



# Citywide Congested Corridors Project

## Woodhaven Boulevard

### From Queens Boulevard to Liberty Avenue



**FINAL REPORT**  
**May 2015**



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## Woodhaven Boulevard (Queens Boulevard to Liberty Avenue) Borough of Queens Final Report

Congestion Mitigation and Air Quality Improvement (CMAQ) Program

PIN X501.70

Contract No.D024673

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## EXECUTIVE SUMMARY

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. The study is consistent with the City's goal of building "Complete Streets" that accommodate all street users including pedestrians, bicyclists, transit users and motorists. It is funded by the federal Congestion Mitigation and Air Quality Improvement program. Woodhaven Boulevard in Queens is selected as one of the congested corridors. This report presents the description and evaluation of recommended improvements for the Woodhaven Boulevard corridor, based on analysis of existing and future conditions presented in *Technical Memorandum #1*.

The study area extends from Queens Boulevard in the north to Liberty Avenue/Rockaway Boulevard in the south, serving Community Boards 4, 5, 6 and 9. This section of Woodhaven Boulevard is mixed use, containing residential and commercial land uses, including the Queens Center Mall located at its intersection with Queens Boulevard.

Problems were identified as a result of data collection and analyses, field observations, and consultation with stakeholders, which includes residents, businesses, transportation providers, community board members, elected officials, local government agencies and assorted interest groups.

The following is a summary of the most pressing issues in the Woodhaven Boulevard study area as was documented in *Technical Memorandum #1*:

- **Localized Traffic Congestion**

Historically, Woodhaven Boulevard has been an attractive alternative route to the Van Wyck Expressway with direct connections to the Long Island Expressway (LIE/I-495) and Queens Boulevard in the north and the Belt (Southern) Parkway in the south due to configuration of main and service roads as well as progressive signal timing during the peak hours. Woodhaven Boulevard is also a local truck route between Queens Boulevard and Liberty Avenue. Congestion is most pronounced in the northern terminus of Woodhaven Boulevard in the vicinity of the Queens Center Mall, at the south end of the corridor at the complex intersection of Rockaway Boulevard, Liberty Avenue and 94<sup>th</sup> Street, and at several intermittent locations including Union Turnpike, Metropolitan Avenue and Myrtle Avenue.

- **Conflicts between Vehicles and Pedestrians**

Heavy traffic turning movements result in severe conflicts between vehicular traffic and pedestrians. One example is pedestrians crossing Eliot Avenue north of the Long Island Railroad (LIRR) overpass at an unsignalized intersection that has a marked crosswalk, in particular, are exposed to a large number of turning vehicles. Pedestrians in the crosswalk are not clearly visible to vehicles making



the northbound right-turn from Woodhaven Boulevard due to sight distance limitations imposed by the railroad overpass.

Similarly, the multi-legged intersection of Woodhaven Boulevard/Rockaway Boulevard/Liberty Avenue/94<sup>th</sup> Street is very complex and problematic for both vehicles and pedestrians, including large numbers of school children. There are major conflicts between turning vehicles, including buses, and pedestrians. In addition, the elevated train columns restrict maneuverability and visibility of pedestrians to drivers. Further, significant jaywalking was observed at this location, especially as people exit the elevated train station.

- **Complex Intersection Geometries**

The presence of the mainline and service roads in both directions along certain sections of Woodhaven Boulevard result in a large number of turning movements and conflict points. In both directions between Union Turnpike and Metropolitan Avenue, the service roads are discontinuous because of the LIRR Montauk Branch tracks, creating loop roads north and south of the tracks.

- **Bottleneck Created by the LIRR Overpass**

Woodhaven Boulevard runs under the elevated LIRR overpass in the vicinity of Dry Harbor Road/Eliot Avenue. Because of the restricted lateral clearance imposed by the bridge structure, there is a lane reduction both north and south of the overpass, from four to three lanes in each direction. Additionally the lanes passing beneath the overpass become narrower due to limited space.

The lane reduction occurs in a very highly trafficked area along the corridor (the LIE/Woodhaven Boulevard interchange is located just north of this location) creates a severe traffic bottleneck with congestion resulting during most periods of the day, weekdays and weekends alike.

- **High Frequency of Vehicle Crashes**

During the three-year period prior to the beginning of the study, there were 495 reportable crashes at the study intersections along Woodhaven Boulevard. Of these, 452 (91%) occurred at intersections while the remaining 43 accidents (9%) occurred at mid-block locations. The highest number of intersection accidents occurred at Union Turnpike (73) followed by Jamaica Avenue (70) and Queens Boulevard (69). Factors contributing to the high incidence of vehicle and pedestrian crashes include complex intersection geometry; lack of exclusive left-turn signal phasing; concurrent vehicle and pedestrian movements; recurring congestion; and lane configuration and alignment, including narrow lanes.

- **Large Number of Local and Express Buses Operating on a Congested Roadway**

Five local, one limited-stop and six express bus routes operate along all or part of the Woodhaven Boulevard corridor. During the busiest times, the 12 bus routes together provide up to 72 buses per hour on weekdays and up to 28 buses per hour on Saturday based on scheduled frequencies. Approximately 42,566 bus riders use the corridor on a typical weekday, while 22,431 use the corridor on a typical Saturday. Buses operate in mixed traffic with no preferential treatment and are therefore subject to recurring congestion-related delays as well as incident- and accident-related delays along the corridor.

- **Lack of Pedestrian Amenities**

Despite the high volume of pedestrians, especially on the north and south ends of the corridor, and the conflicts between vehicles and pedestrians, there are no preferential or priority treatments for pedestrians to cross Woodhaven Boulevard or the intersecting cross streets. The mainline-service road configuration along some sections of Woodhaven Boulevard results in long crossing distances for pedestrians without sufficient mid-crossing refuge islands. In addition, at several intersections, crosswalks are not provided on certain legs of the intersection.

- **Geometric Issues, Signage and Signalization**

At several locations including the service roads between Rockaway Boulevard and Park Lane South, travel lanes are narrow (nine to 10 feet) and although the roadway is striped for two travel lanes, it is being used effectively as a single lane. Narrow travel lanes also exist at several mainline locations including Union Turnpike, Myrtle Avenue, Jamaica Avenue, Rockaway Boulevard and Liberty Avenue. Left-turn bays at several locations (such as southbound at Myrtle Avenue, northbound at Jamaica Avenue) seem to have inadequate storage resulting in spillbacks into the through travel lanes.

Three improvement alternatives were formulated, analyzed and presented to the stakeholders. The best elements of each alternative were identified and were then used to develop a recommended alternative which represents a synergy of the initial improvement alternatives. Some of the short-term improvements of the recommended alternative were implemented between 2010 and 2012. Others will be implemented in 2014. Long-term improvements are planned to be implemented as future capital projects.

The recommended improvements in geographical order from north to south are as follows:

- Between Queens Boulevard and Eliot Avenue, two median refuge islands were installed with truffle paint and vertical delineators in November 2011. Both of these were made permanent with concrete in November 2014.
- Between Queens Boulevard and Eliot Avenue, six curb extensions were installed

with truffle paint and vertical delineators in November 2011. One of these was made permanent with concrete in November 2014. Two will be made permanent with concrete as capital projects at a later date.

- The signal timing at Queens Boulevard and Hoffman Drive was revised in November 2011 to prevent eastbound right-turning vehicles from the Queens Boulevard south service road from encountering a red signal at Hoffman Drive immediately after completing their turn.
- A landscaped median between Queens Boulevard and Eliot Avenue is planned as a capital project to be implemented at an undetermined date.
- A bus lane between Dry harbor Road and Metropolitan Avenue is scheduled to be implemented in May 2015. It will be offset from the curb, meaning parking will be preserved.
- A restriction forcing traffic from the southbound service road approaching Union Turnpike to turn right was impemented in July 2011 to avoid conflict with traffic from the main road.
- The southbound service road from Union Turnpike to 82<sup>nd</sup> Avenue was reduced from two lanes to one in August 2012 because of insufficient roadway width.
- A median refuge island was installed at Forest Park Drive in August 2012.
- The service roads are scheduled to be reduced from two lanes to one for much of their length between Park Lane South and Rockaway Boulevard due to insufficient roadway width in November 2014 and May 2015. The area created from this will be used for pedestrian refuge islands in the northwest and southeast service road medians using truffle paint and vertical delineators.
- A peak period bus lane is scheduled to be implemented in the curb lane on the last few blocks approaching Rockaway Boulevard/Liberty Avenue in both directions in May 2015.
- A complete realignment of the Rockaway Boulevard/Liberty Avenue intersection was implemented in October 2010, with supplemental revisions in April 2012.

Select Bus Service (SBS) for this corridor was also recommended as a longer-term strategy for mitigating congestion by improving mobility for all vehicles, especially for the 30,000 bus riders that use this corridor daily. At the time of this writing, NYCDOT and the Metropolitan Transportation Authority (MTA) are now working with local stakeholders on a plan to bring SBS to the Woodhaven Boulevard/Cross Bay Boulevard corridor.

## 1.0 INTRODUCTION

This Final Report (the “Report”) documents the evaluation of various improvement alternatives under future conditions and the selection of a preferred alternative for the Citywide Congested Corridors Project - Woodhaven Boulevard corridor located in Queens. The study examines a 3.2 mile stretch of Woodhaven Boulevard from Queens Boulevard in the north to Liberty Avenue/Rockaway Boulevard in the south, serving Community Boards 4, 5, 6 and 9. This section of Woodhaven Boulevard is mixed use, containing residential and commercial land uses. Land uses of note on Woodhaven Boulevard are the Queens Center Mall, located at its intersection with Queens Boulevard, the big box retailers at its intersection with Metropolitan Avenue and cemeteries and parkland.

The Report is the conclusion of a planning process which included extensive community outreach, analysis of existing and future without improvements conditions, the development of future conditions with improvement alternatives and the selection of a preferred alternative. Figure 1.1-1 demonstrates the study process and project timeline and Figure 1.1-2 illustrates the project study area.

The project’s community outreach effort was a critical component of the study process. The consultant, AECOM, in conjunction with NYCDOT, held multiple meetings with project advisory committee (PAC) members, as well as the community at-large, to present the extent of the study area, selection of study intersections, collection of operation and safety data, and analysis of the existing and future without improvements conditions; identify safety and operational deficiencies; and obtain feedback from the PAC and the community to fine tune the data analysis. These meetings consisted of various stakeholders including residents, businesses, transportation providers, community board members, elected officials, local government agencies and assorted interest groups. Input from these meetings was incorporated into the development of the various improvement alternatives and the selection of the preferred alternative.

Additionally, the following technical memoranda were prepared as the study process developed:

- *Technical Memorandum #1: Data Summary Report, June 2008*
- *Technical Memorandum #2: Existing and Future Conditions (Without Improvements) Analyses, June 2009*

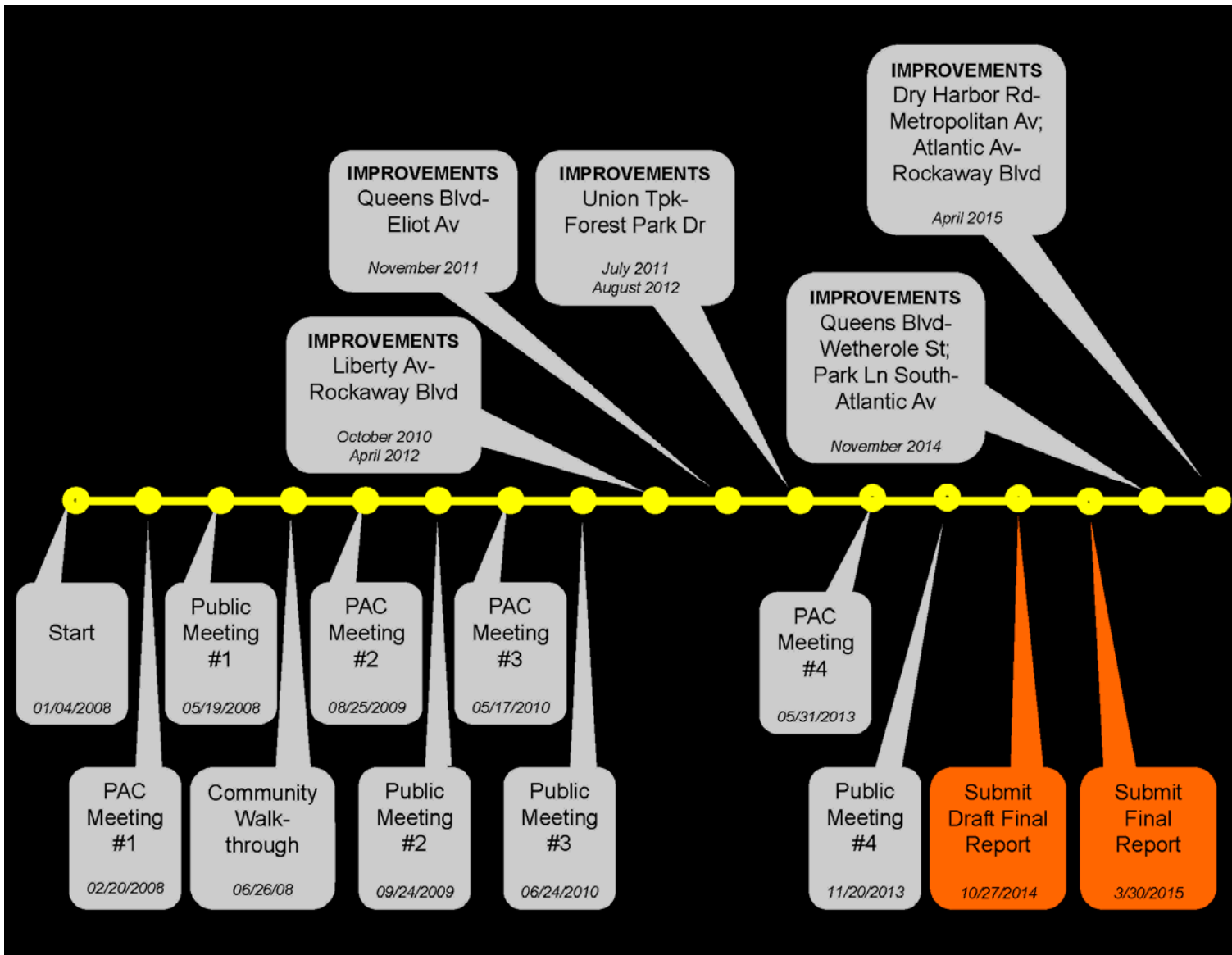


Figure 1.1-1 - Study Process and Project Timeline



Figure 1.1-2 - Project Study Area

## **2.0 ALTERNATIVES STUDIED**

Existing operational and safety needs and deficiencies were identified through data collection and analyses, field observations, and community feedback as documented in the *Technical Memorandum #1: Data Summary Report* and *Technical Memorandum #2: Existing and Future Conditions (Without Improvements) Analyses*. These needs and deficiencies were further discussed and presented to the Project Advisory Committee (PAC) and to the community at public meetings in an attempt to solicit community feedback and input in the development of improvement alternatives for the corridor.

Three future improvement alternatives were developed to address the identified issues in the study area. They were tailored to address the most pressing issues including, but not limited to, complex intersection geometrics, recurring traffic congestion, safety of all street users (i.e., pedestrians, cyclists, transit riders and motorists), and pedestrian mobility on some of the wider intersections where there are currently no pedestrian islands or refuge areas.

The improvement alternatives were developed to fit within the existing curb-to-curb width of Woodhaven Boulevard, which varies from approximately 120 feet between Eliot Avenue and Metropolitan Avenue to about 175 feet at Jamaica Avenue. Alternatives 1, 2 and 3 present different sets of improvements for Woodhaven Boulevard which are described in Sections 2.1, 2.2 and 2.3, respectively.

### **2.1 Improvement Alternative 1**

Alternative 1 consists of location-specific improvements along Woodhaven Boulevard. Typical improvements include extended left-turn bays, turn restrictions, curb extensions, widened medians, pedestrian refuge islands, lane restriping, improved signage, and signal timing modifications to provide sufficient time to cross Woodhaven Boulevard.

### **2.2 Improvement Alternative 2**

Alternative 2 improvements consist of the location-specific treatments described for Alternative 1 (where feasible and applicable) in addition to an exclusive striped bus lane, offset from the curb. The number of general purpose lanes would be reduced to provide for this, and parking would be preserved. Analysis would determine the relative benefits of improved service for buses versus the cost of degradation of traffic operations for different segments of the corridor.

### **2.3 Improvement Alternative 3**

Alternative 3 improvements consist of the location-specific treatments described for Alternative 1 (where feasible and applicable) in addition to a widened median, which would enable extra space for pedestrians for different segments of the corridor. Analysis would determine the relative benefits of median refuge for pedestrians versus the cost of removing traffic lanes

### **3.0 RECOMMENDED IMPROVEMENTS**

The three improvement alternatives were presented to the PAC, Community Board representatives, and elected officials for comment and feedback. Each alternative's unique strengths, limitations, and the issues it addressed were discussed. The best elements of each alternative were identified and were used to develop a recommended alternative which represents a synergy of the three initial improvement alternatives. The recommended improvements were presented at a public meeting on November 20, 2013, the final outreach meeting convened for this project.

The following sections describe the recommended improvements in geographical order from north to south.

#### **3.1 Improvements near Queens Boulevard/Hoffman Drive**

Figure 3.1-1 presents the improvements for the northern end of Woodhaven Boulevard near Queens Boulevard and Hoffman Drive.



## IMPROVEMENTS IMPLEMENTED IN NOV 2011 W/PAINT & DELINEATORS

- 1. CURB EXTENSION – SOUTH CROSSWALK WEST SIDE**
  - 2014: Make Permanent w/Concrete
- 2. MEDIAN REFUGE – SOUTH CROSSWALK**
  - 2014: Make Permanent w/Concrete
- 3. CURB EXTENSION – SOUTH CROSSWALK EAST SIDE**
  - Future Capital Project: Make Permanent w/ Concrete
- 4. WIDENED MEDIAN – QUEENS BLVD TO ELIOT AVE**
  - Future Capital Project: Landscaped Median

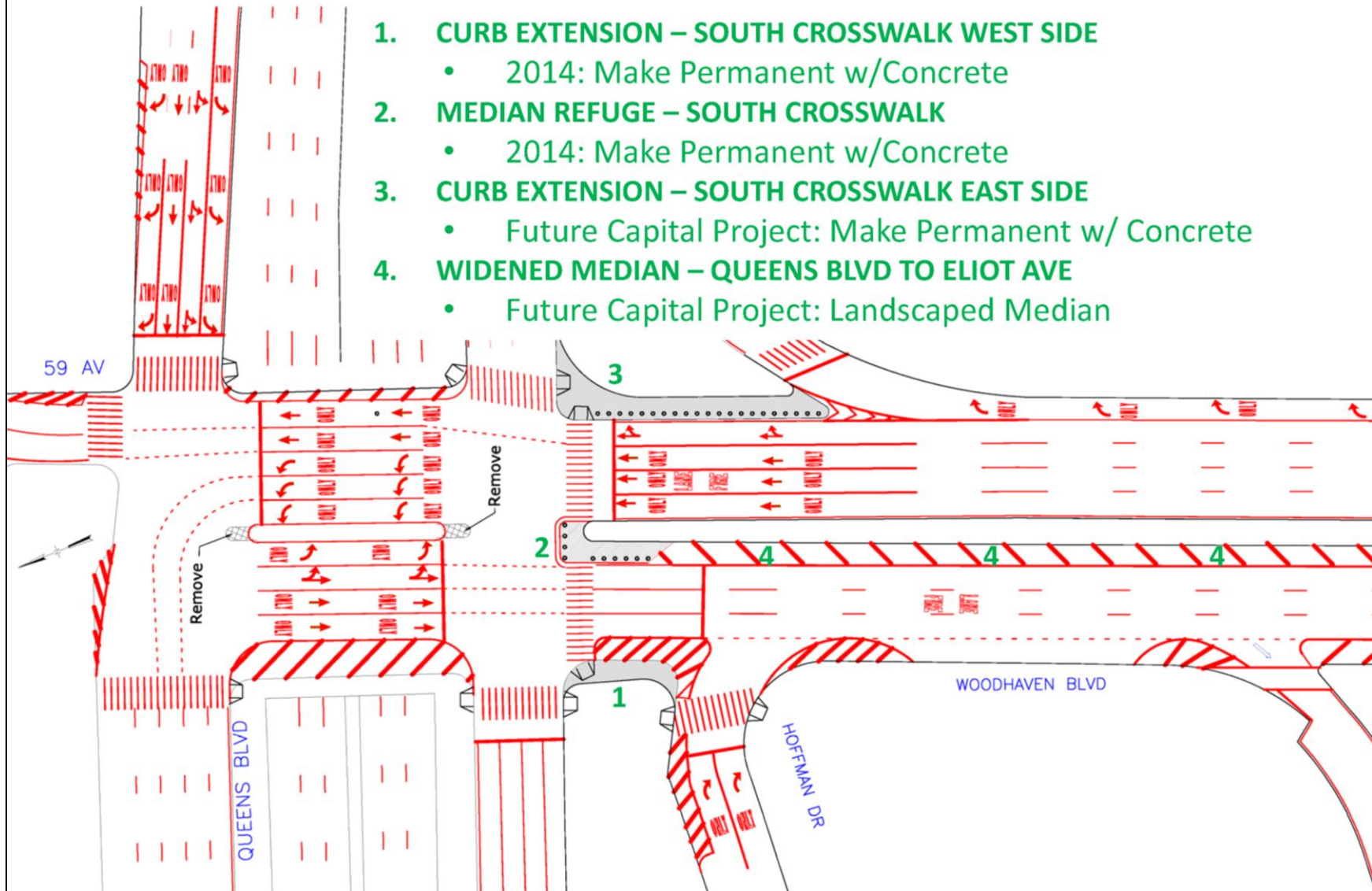


Figure 3.1-1 -Improvements near Queens Boulevard

*Curb Extension, South Crosswalk, West Side:* This is presented as No. 1 in Figure 3.1-1. In November 2011, a curb extension has been added on the west side of Woodhaven Boulevard, between the Queens Boulevard south service road and Hoffman Drive, to reduce the pedestrian crossing distance for the south crosswalk across Woodhaven Boulevard. It is shown in Photo 3.1-1. This temporary improvement was made with truffle paint. It was made permanent in November 2014 with a raised concrete curb extension.



Photo 3.1-1: Curb extension, south crosswalk, west side, at Queens Boulevard

*Widened Median, South Crosswalk:* This is presented as No. 2 in Figure 3.1-1. In November 2011, the median between the northbound and southbound lanes on Woodhaven Boulevard has been widened at the south crosswalk of the Queens Boulevard south service road to provide a pedestrian refuge. It is shown in Photo 3.1-2. This improvement was made with truffle paint and vertical delineators. It was made permanent in November 2014 as a raised concrete median island.



Photo 3.1-2: Widened median, south crosswalk, at Queens Boulevard



*Curb Extension, South Crosswalk, East Side:* This is presented as No. 3 in Figure 3.1-1. In November 2011, a curb extension has been added on the east side of Woodhaven Boulevard, between the on-ramp to the westbound Long Island Expressway and the Queens Boulevard south service road, to further reduce the pedestrian crossing distance for the south crosswalk across Woodhaven Boulevard. It is shown in Photo 3.1-3. This temporary improvement was made with truffle paint and vertical delineators.

This improvement has not been as successful as the previously described improvements that have been made with truffle paint and delineators. Note that the red car in Photo 3.1-3 is illegally using the delineated area that is supposed to be reserved for pedestrians. Unfortunately, making this temporary improvement permanent with concrete, which would eliminate the problem highlighted in the photo, is very complex because of drainage issues, the adjacent subway entrance and underground passageway, and a nearby fire hydrant. As a result, making this temporary improvement permanent with concrete will require a capital project. The capital project was initiated in late 2014. The date of implementation is uncertain at this time.

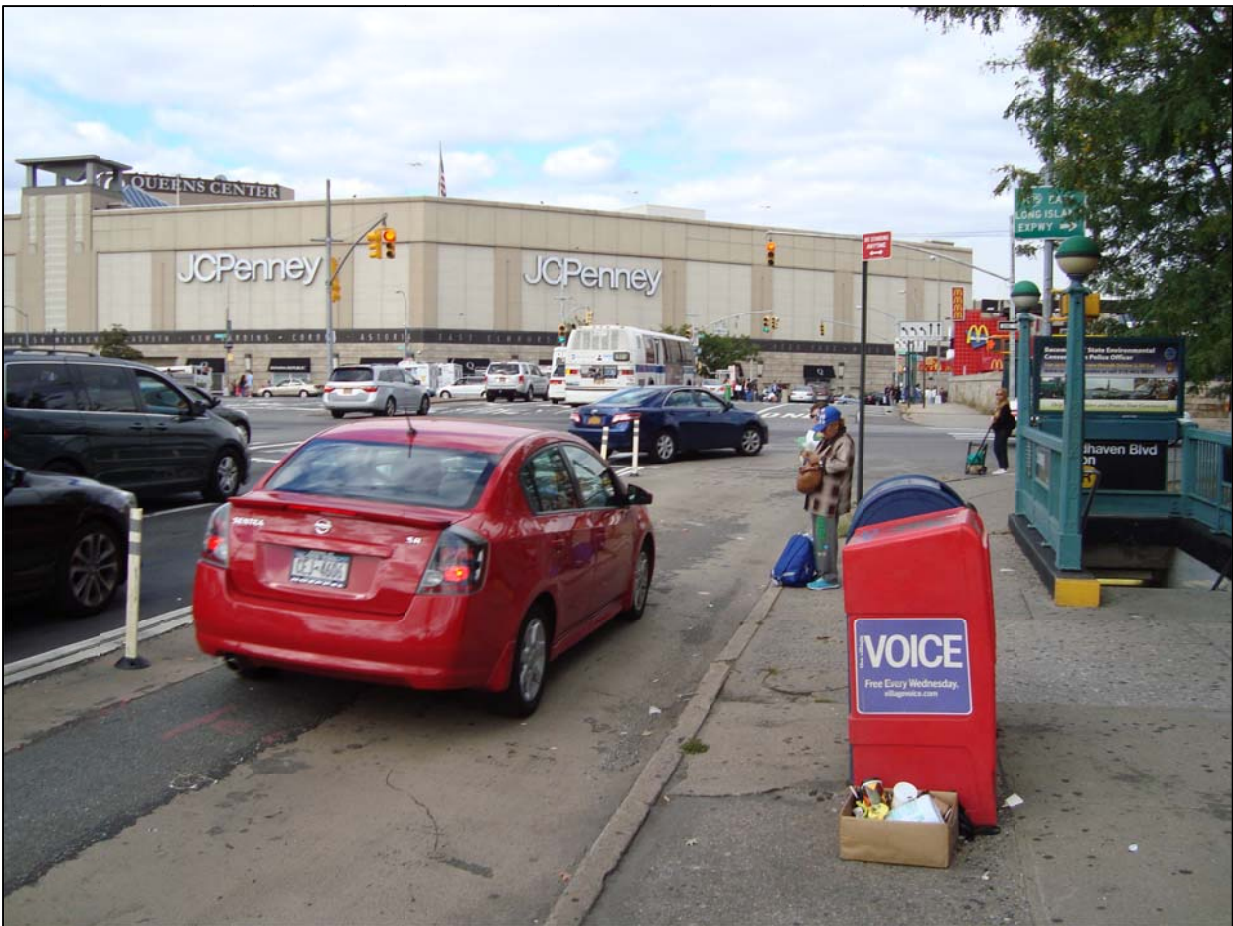


Photo 3.1-3: Curb extension, south crosswalk, east side, at Queens Boulevard

The space occupied by the curb extension of Improvement No. 3 was previously part of the

roadway, utilized as a fifth lane of northbound Woodhaven Boulevard approaching the Queens Boulevard south service road. Removing this part of the roadway allowed for converting the right lane approaching the on-ramp to the westbound Long Island Expressway to be right-turn-only, as shown In Figure 3.1-1. In addition, No Standing Anytime regulations were extended southward, increasing the storage for traffic bound for this ramp, which becomes overloaded during the weekday morning peak period.

*Left Lane Removal, Southbound Woodhaven Boulevard.* This is presented as No. 4 in Figure 3.1-1. Prior to November 2011, southbound Woodhaven Boulevard carried four lanes of traffic from the Queens Boulevard south service road to the LIRR overpass near Eliot Avenue. The four lanes merged to three because of limited horizontal clearance at the overpass. As shown in Figure 3.1-1, this section of roadway is fed by three lanes originating at the Queens Boulevard north service road. Therefore, it was determined that the fourth lane was unnecessary, and this space could be put to better use. In November 2011, the left lane was removed using diagonal striping as shown in Figure 3.1-1 and Photo 3.1-4. It is envisioned that the existing raised concrete median, along with the diagonally striped portion, be transformed into a wide attractive landscaped median as a capital project. The capital project was initiated in late 2014. The date of implementation is uncertain at this time.

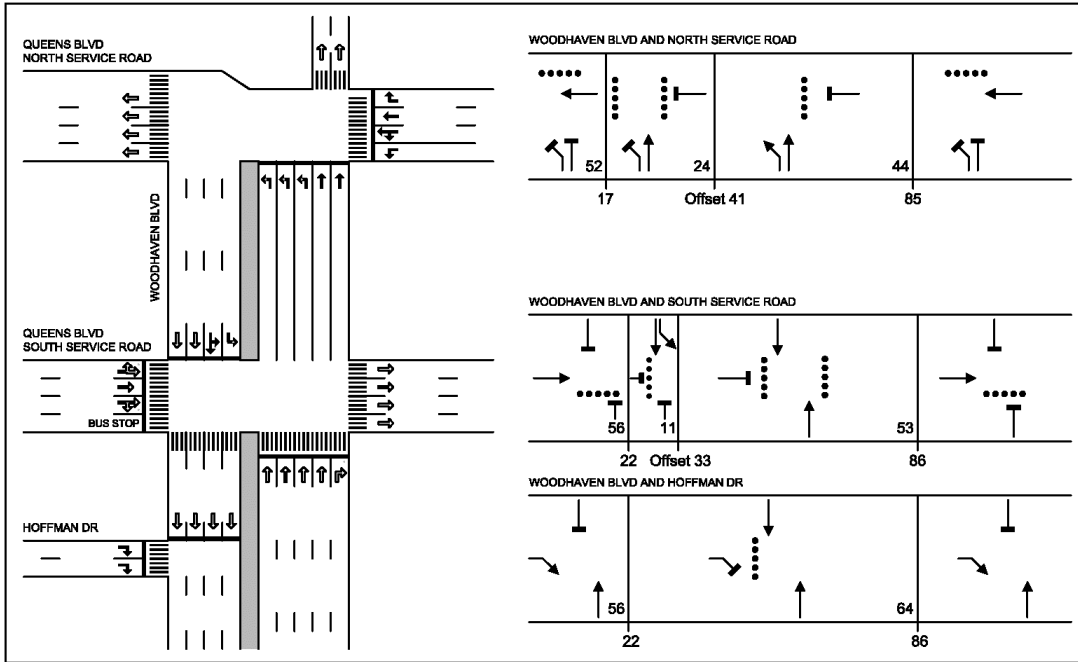


Photo 3.1-4: Left lane of Southbound Woodhaven Boulevard removed with diagonal striping

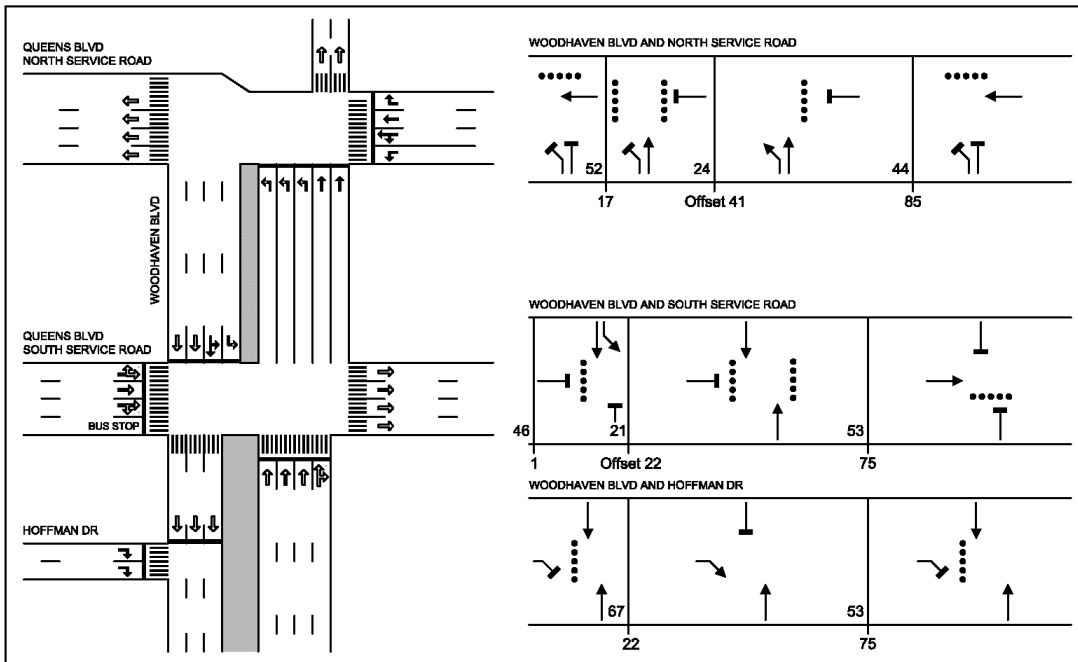
Traffic analysis has confirmed that the above mentioned improvements would not adversely impact traffic operations, except for the short section of southbound Woodhaven Boulevard between the Queens Boulevard south service road and Hoffman Drive. Previously, the signal for these two eastbound roadways received the green indication at the same time. This meant that when vehicles from the Queens Boulevard south service road turned right onto southbound Woodhaven Boulevard, they would always encounter a red signal approaching Hoffman Drive (because the signal for eastbound Hoffman Drive traffic was green). As shown in Figure 3.1-1, there is very little storage to hold these vehicles. As many as 280 vehicles per hour make this turn, and because of the limited storage available when waiting for the signal to turn green approaching Hoffman Drive, vehicles were observed to occupy all four travel lanes, the shoulder, and would still block the intersection attempting to complete the turn without having to wait for the next signal phase. Improvement Nos. 1, 2 and 4 would only exacerbate this situation, because available roadway would be converted to pedestrian space. Therefore, in November 2011 the signal timing was revised so that the signals for the Queens Boulevard south service road and Hoffman Drive are green at different times. That way, when vehicles make the eastbound right turn from the south service road onto Woodhaven Boulevard, they will always encounter a green signal when approaching Hoffman Drive. Figures 3.1-2 through 3.1-4 show the previous and improved timing plans for weekday AM, weekday PM, and all other periods, respectively.

**WOODHAVEN BLVD, QUEENS BLVD AND HOFFMAN DRIVE  
5:00-10:30 AM MON-FRI SIGNAL TIMING**

**PREVIOUS CONDITION**



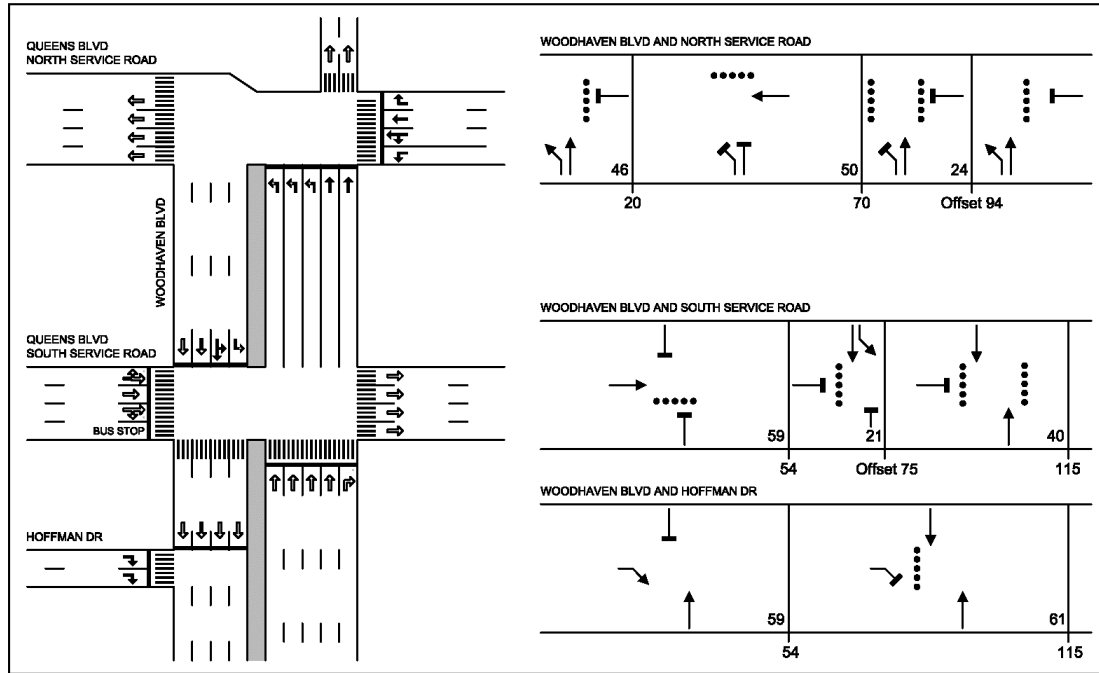
**IMPROVEMENT CONDITION**



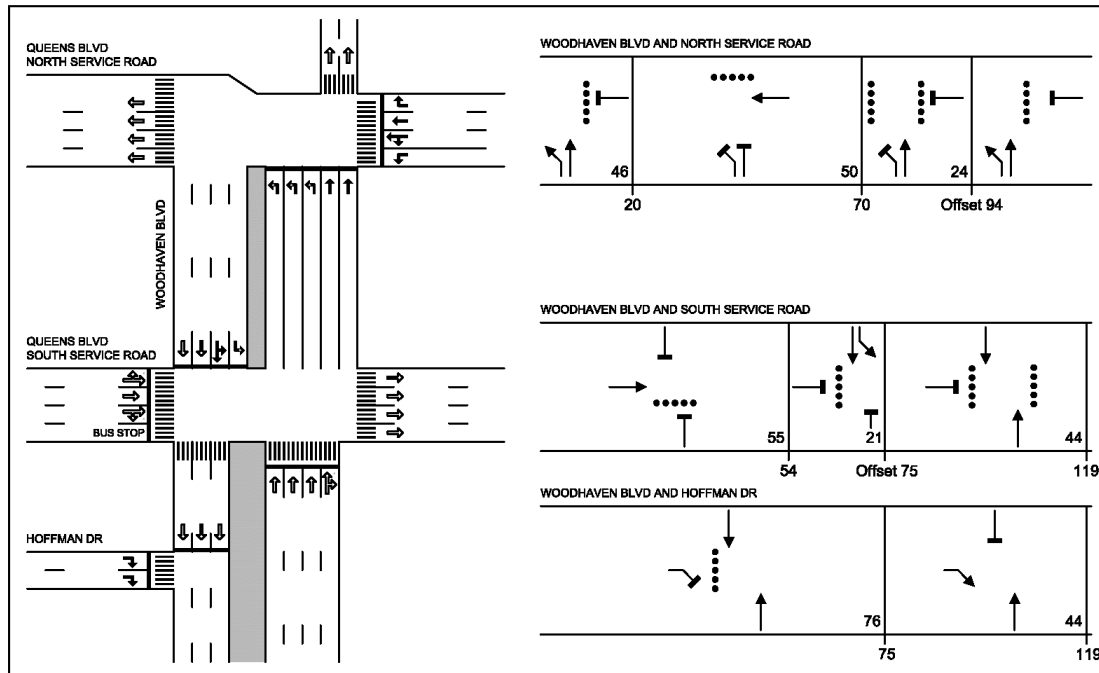
**Figure 3.1-2: Signal timing for weekday AM period at Queens Blvd/Hoffman Dr**

**WOODHAVEN BLVD, QUEENS BLVD AND HOFFMAN DRIVE**  
**1:30-7:30 PM MON-FRI SIGNAL TIMING**

**PREVIOUS CONDITION**



**IMPROVEMENT CONDITION**

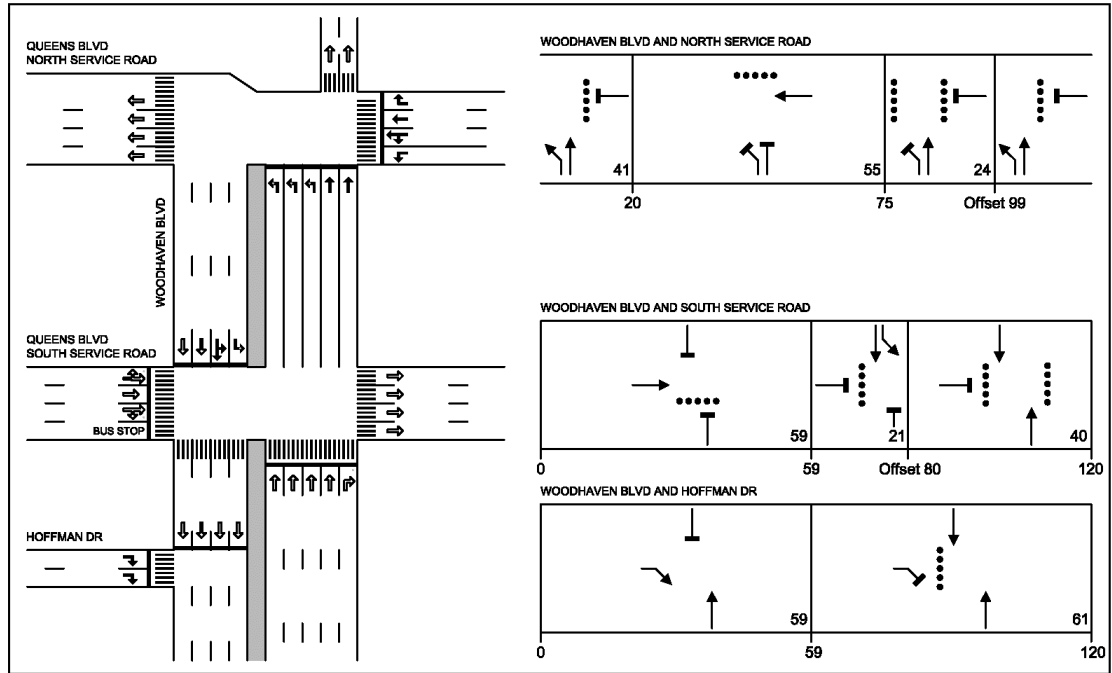


**Figure 3.1-3: Signal timing for weekday PM period at Queens Blvd/Hoffman Dr**

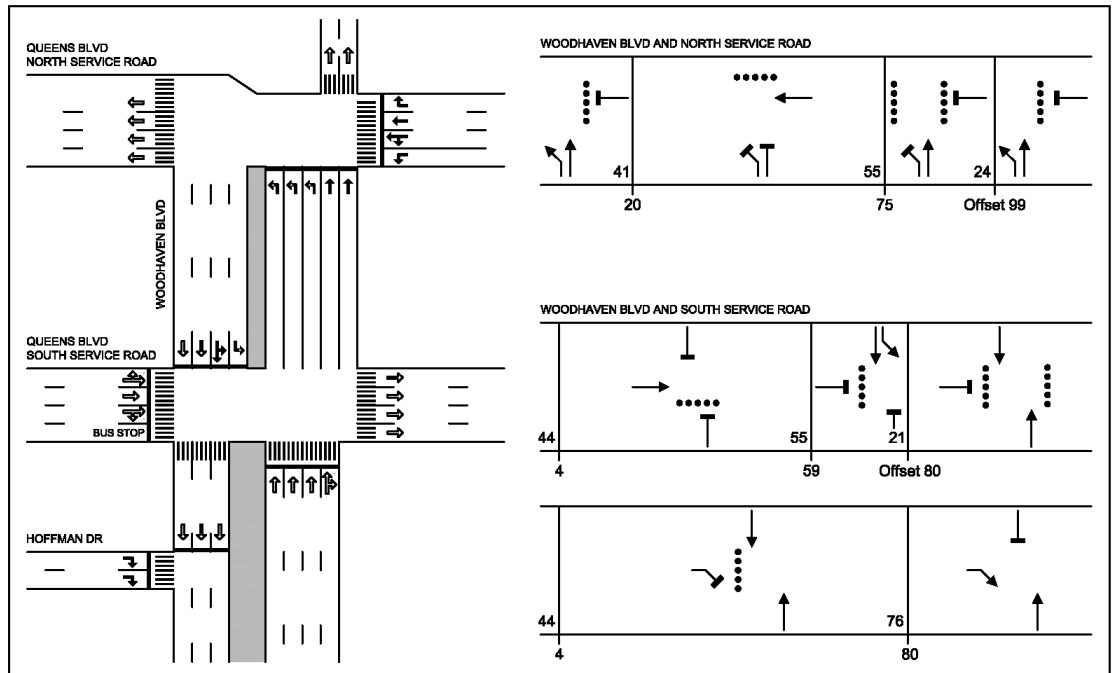


**WOODHAVEN BLVD, QUEENS BLVD AND HOFFMAN DRIVE**  
**10:30AM-1:30PM, 7:30PM-5:00AM MON-FRI; WEEKEND AAT SIGNAL TIMING**

**PREVIOUS CONDITION**



**IMPROVEMENT CONDITION**



**Figure 3.1-4: Signal timing for all other times at Queens Blvd/Hoffman Dr**

### 3.2 Improvements near Wetherole Street

Figure 3.2-1 presents the improvements for Woodhaven Boulevard near Wetherole Street.

*Left Lane Removal, Southbound Woodhaven Boulevard.* This is presented as No. 4 in Figure 3.2-1. This was discussed in the previous section. In November 2011, the left lane was removed and replaced with diagonal striping, leaving three lanes as shown, between the Queens Boulevard south service road and the LIRR overpass near Eliot Avenue. Four lanes were unnecessary because this segment of southbound Woodhaven Boulevard is fed by three lanes at the north service road, and narrows to three lanes at the LIRR overpass. It is envisioned that the existing raised median, along with the diagonally striped portion, be transformed into a wide attractive landscaped median as a capital project. The capital project was initiated in late 2014. The date of implementation is uncertain at this time.

*Widened Median, North Crosswalk:* This is presented as No. 5 in Figure 3.2-1. In November 2011, the median between the northbound and southbound lanes on Woodhaven Boulevard has been widened at the north crosswalk at Wetherole Street to provide a pedestrian refuge. It is shown in the middle of Photo 3.1-2, where a pedestrian is standing waiting for the signal to change. This improvement was made with truffle paint and vertical delineators. As shown in the Figure 3.2-1, the refuge island allowed for the crosswalk to be straightened; previously it had a dogleg shape. It was made permanent in November 2014 with as a raised concrete median island.

*Curb Extension, North Crosswalk, West Side:* This is presented as No. 6 in Figure 3.2-1. In November 2011, a curb extension has been added on the west side of Woodhaven Boulevard, north of Wetherole Street, to reduce the pedestrian crossing distance for the north crosswalk across Woodhaven Boulevard. This is shown in the foreground of Photo 3.2-1. This temporary improvement was made with truffle paint and vertical delineators. Unfortunately, making this temporary improvement permanent with concrete is very complex because of drainage issues. As a result, it will require a capital project. The capital project was initiated in late 2014. The date of implementation is uncertain at this time.

*Curb Extension, West Crosswalk at 60<sup>th</sup> Drive:* This is presented as No. 7 in Figure 3.2-1. In November 2011, a curb extension has been added to the north side of the west crosswalk at the Woodhaven Boulevard/60<sup>th</sup> Drive intersection, to reduce the pedestrian crossing distance for this crosswalk. This improvement was made with truffle paint and vertical delineators. It was determined that making this improvement permanent with concrete would not be cost effective because of drainage issues. Therefore, it will remain in place as is.

## IMPROVEMENTS IMPLEMENTED IN 2011 W/PAINT & DELINEATORS

4. **WIDENED MEDIAN – QUEENS BLVD TO ELIOT AVE**
  - Future Capital Project: Landscaped Median
5. **MEDIAN REFUGE – NORTH CROSSWALK**
  - 2014: Make Permanent w/Concrete
6. **CURB EXTENSION – NORTH CROSSWALK WEST SIDE**
  - Future Capital Project: Make Permanent w/Concrete
7. **CURB EXTENSION – WEST CROSSWALK AT 60 DR**
  - Leave As Is

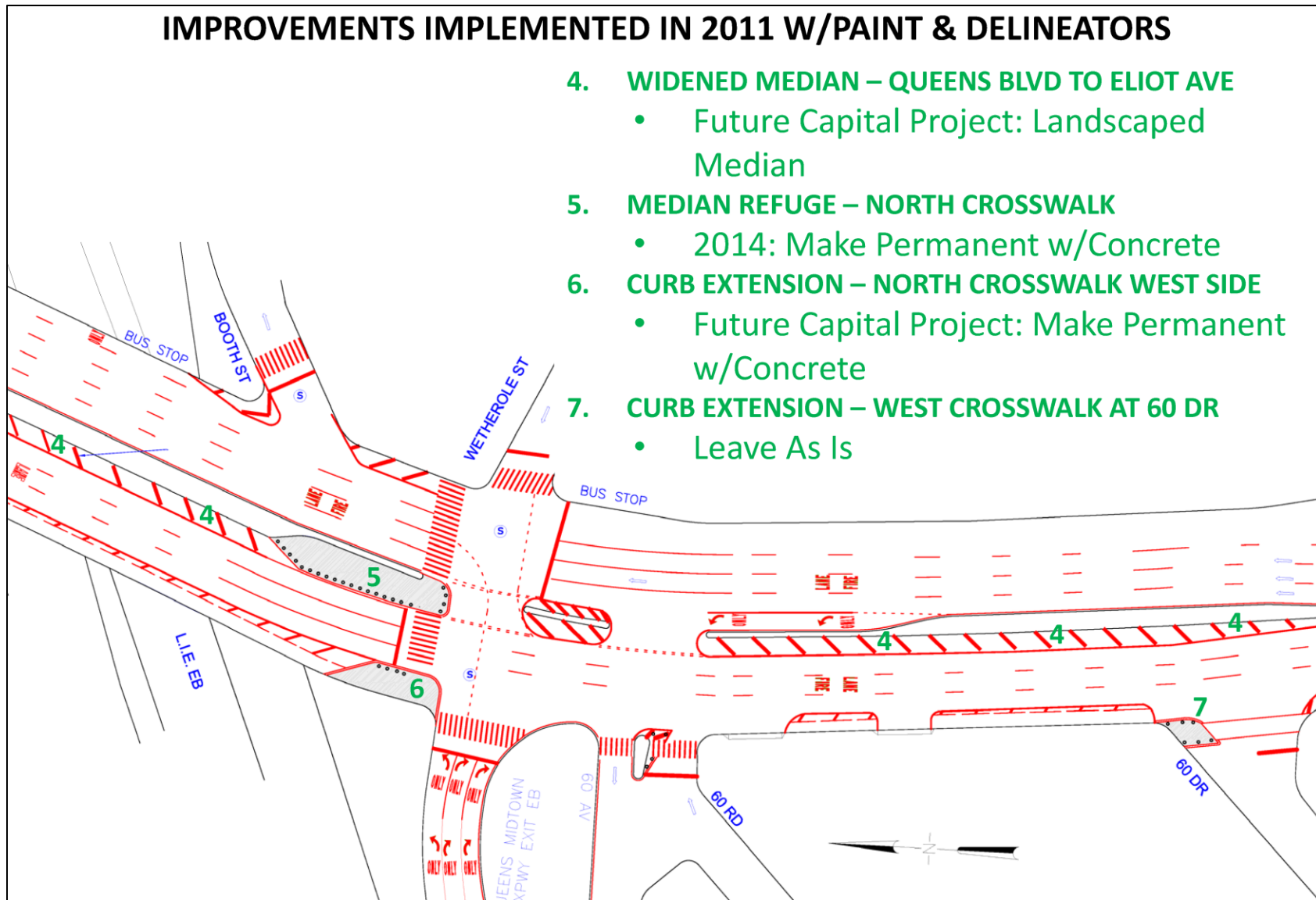


Figure 3.2-1 -Improvements near Wetherole Street



Photo 3.2-1: North crosswalk, median refuge and curb extension, at Wetherole Street

### 3.3 Improvements near Eliot Avenue

*Curb Extensions, Northeast and Southeast Corners of Woodhaven Boulevard/Eliot Avenue:* This is presented as Nos. 8 and 9 in Figure 3.3-1. In November 2011, curb extensions have been added on the northeast and southeast corners of the Woodhaven Boulevard/Eliot Avenue intersection. This improvement provides more positive guidance for motorists making northbound right-turns onto Eliot Avenue, and reduces the conflict area between vehicles and pedestrians crossing Eliot Avenue. These improvements were made with truffle paint and vertical delineators. It was determined that making these improvements permanent with concrete would not be cost effective because of drainage issues. Therefore, they will remain in place as is.

*Proposed advance guide sign south of Alderton Street:* The location and design of this proposed sign is shown in Figure 3.3-1. In the northbound direction along Woodhaven Boulevard, four lanes drop to three lanes near Eliot Avenue because of limited horizontal clearance under the LIRR overpass. Traffic in the right lane upon approaching this bottleneck must eventually merge left. To provide advance guidance to motorists traveling northbound on Woodhaven Boulevard, a guide sign is proposed on the east side of Woodhaven Boulevard, south of Alderton Street, to warn that the right lane is to be used only for right turns onto Alderton Street, or for local access to the businesses on the last block past Alderton Street before the merge.

8. CURB EXTENSION – EAST CROSSWALK NORTH SIDE AT ELIOT AVE
  - Leave As Is
9. CURB EXTENSION – EAST CROSSWALK SOUTH SIDE AT ELIOT AVE
  - Leave As Is

Proposed Sign on NB Woodhaven approaching Alderton Ave to Warn of Lane Drop:

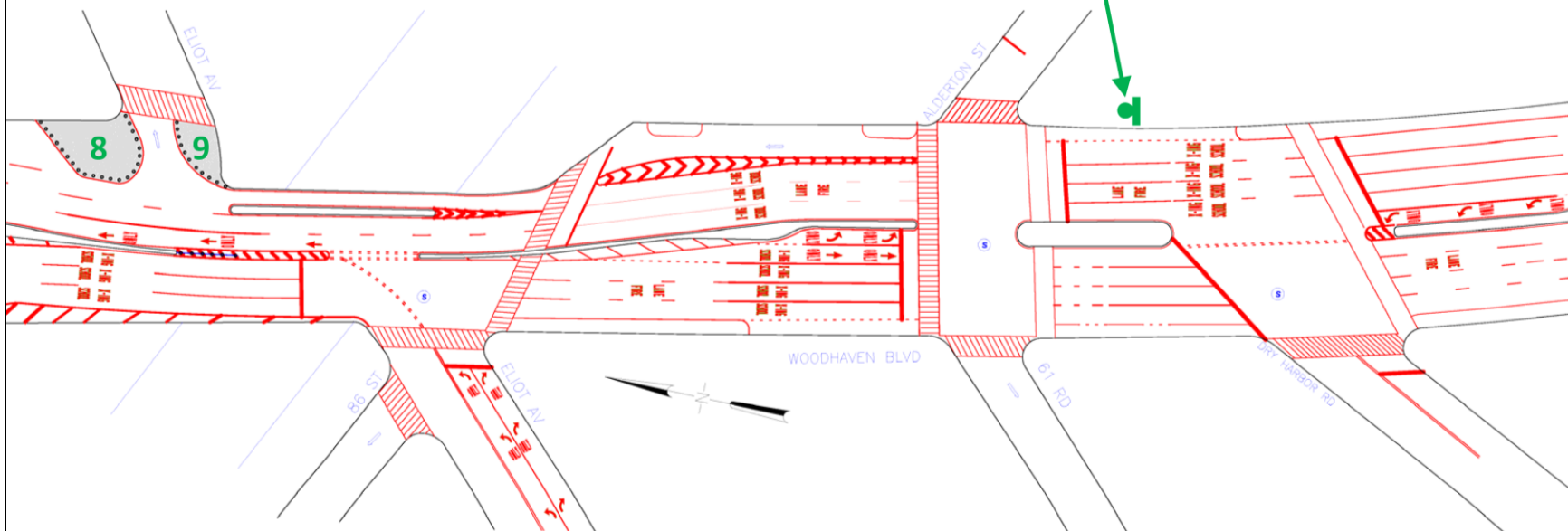


Figure 3.3-1 -Improvements near Eliot Avenue

### 3.4 Improvements between Dry Harbor Road Avenue and Metropolitan Avenue

*Provide exclusive bus lanes northbound and southbound:* Figure 3.4-1 presents the existing and proposed typical cross section of Woodhaven Boulevard between Dry Harbor Road and Metropolitan Avenue. Currently, Woodhaven Boulevard in this section provides four travel lanes in each direction, with left turn bays and parking on both sides. Near the endpoints of this section, the roadway is reduced to three travel lanes. The outside (curbside) lanes, in both directions, are striped as a single 20-foot lane. Each of these lanes accommodates both curbside parking (with provisions for periodic bus stops) as well as one lane of through traffic. The recommended improvement involves restriping the 20-foot outside (curbside) lanes in both the northbound and southbound directions along this segment of Woodhaven Boulevard to accommodate one 12-foot exclusive bus lane and one 8-foot parking lane. Analysis shows that reducing the number of general purpose lanes from four to three will cause minimal degradation to general traffic operations, because it narrows to three lanes anyway at the LIRR overpass to the north near Eliot Avenue, and the LIRR underpass just south of Metropolitan Avenue. The improvement in travel times for the buses is projected to be significant. The bus lanes will be in effect Monday through Friday from 7-10 AM and 4-7 PM. Figure 3.4-2 presents a preliminary detailed marking drawing. Implementation of this improvement is scheduled for May 2015.

Select Bus Service (SBS) for this corridor was also recommended as a longer-term strategy for mitigating congestion by improving mobility for all vehicles, especially for the 30,000 bus riders that use this corridor daily. At the time of this writing, NYCDOT and the Metropolitan Transportation Authority (MTA) are now working with local stakeholders on a plan to bring SBS to the Woodhaven Boulevard/Cross Bay Boulevard corridor.

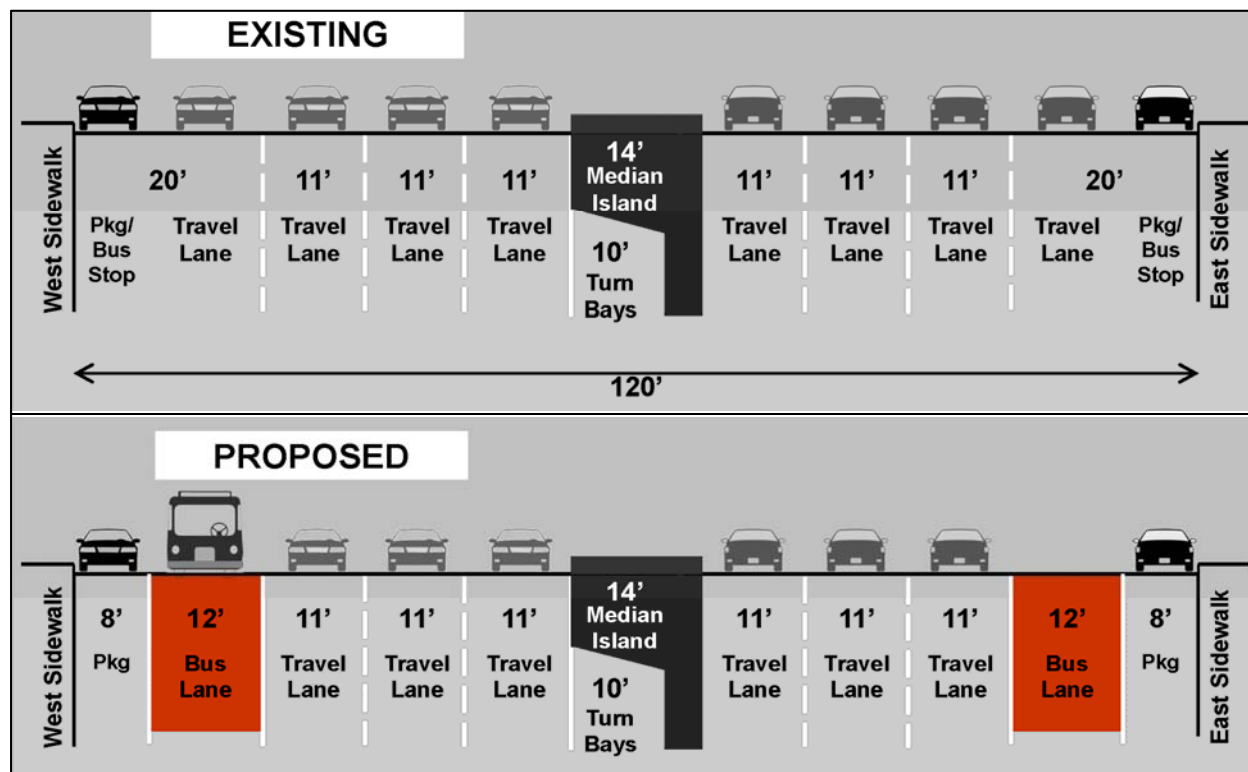
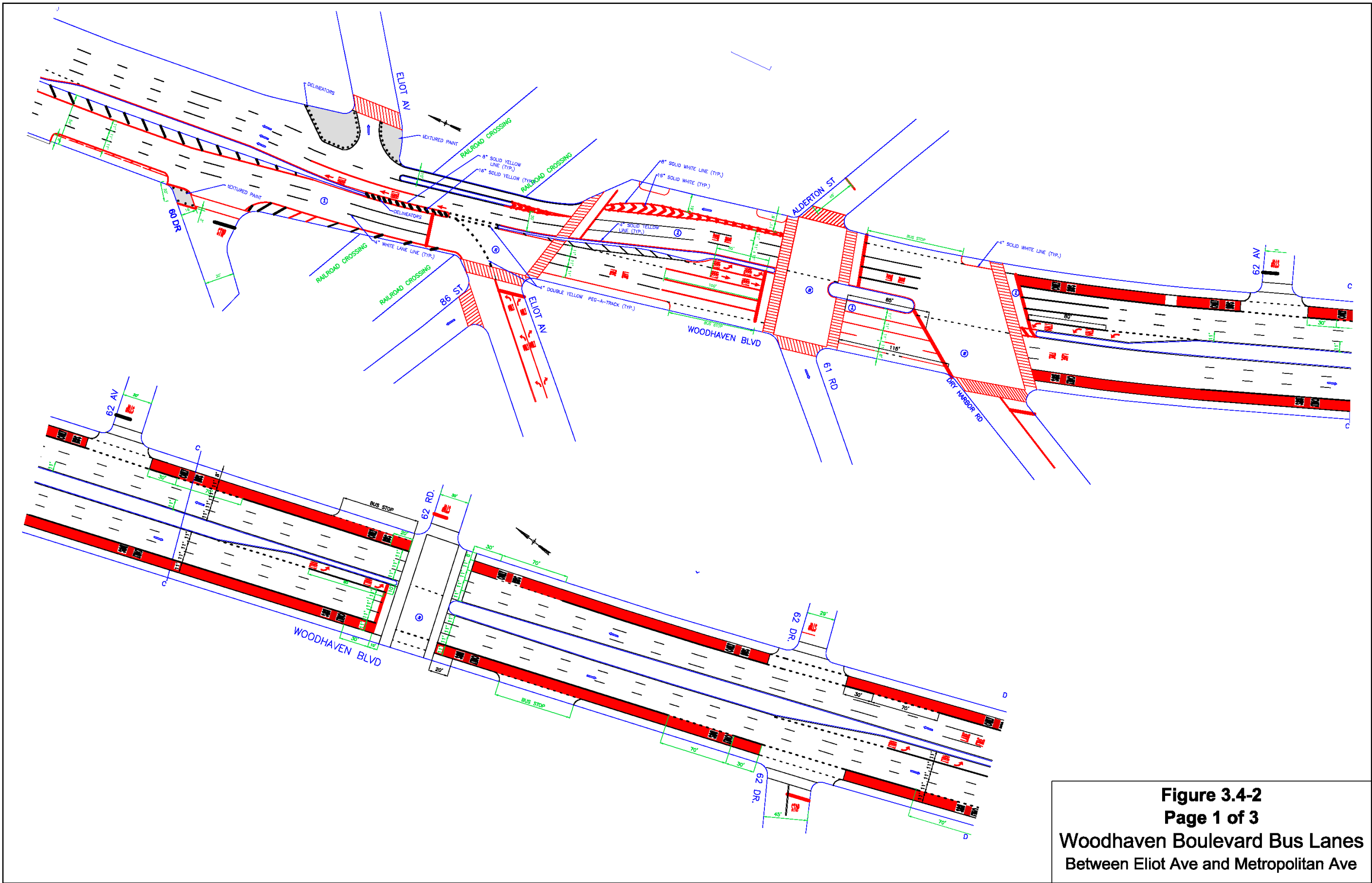


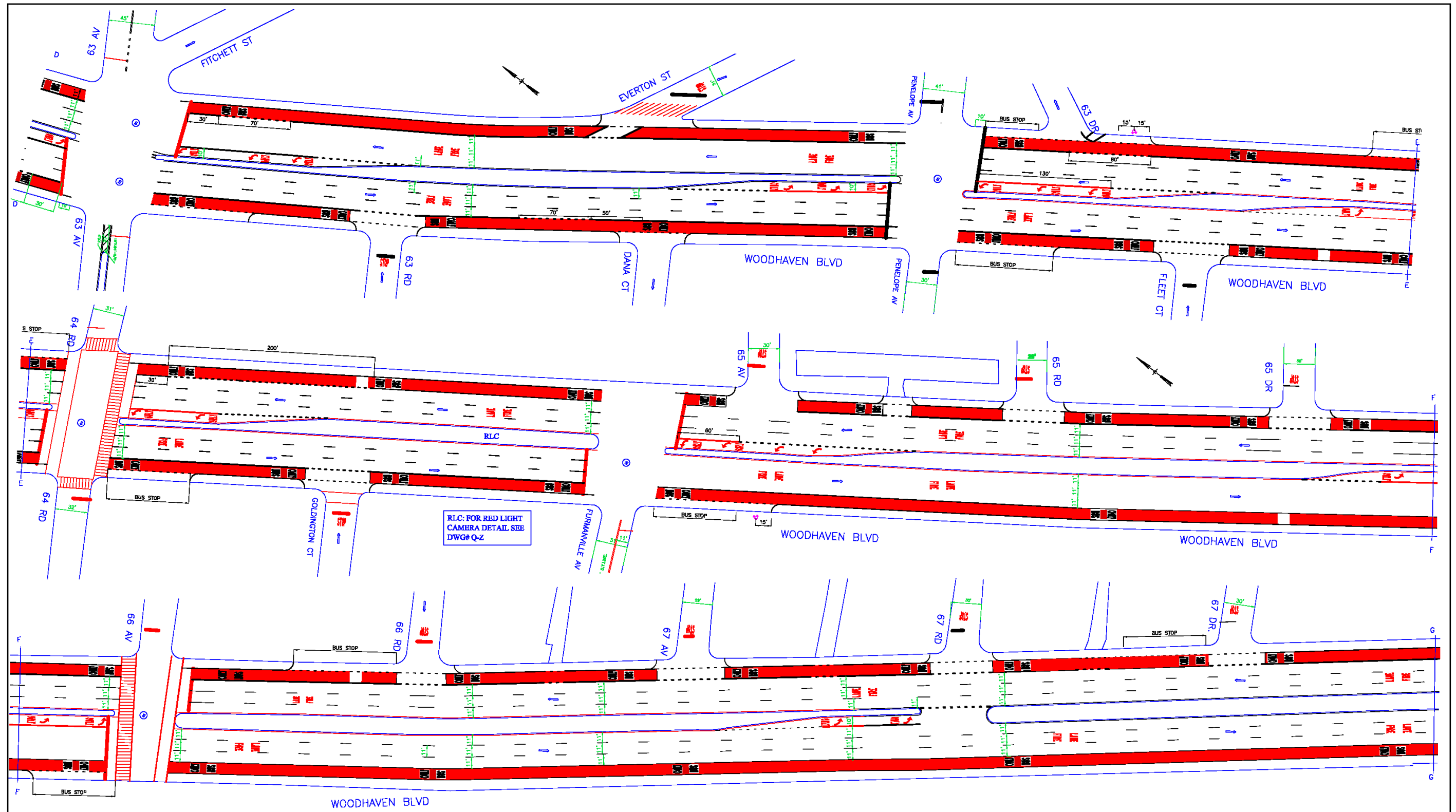
Figure 3.4-1 - Existing & proposed cross-sections between Dry Harbor Rd & Metropolitan Av



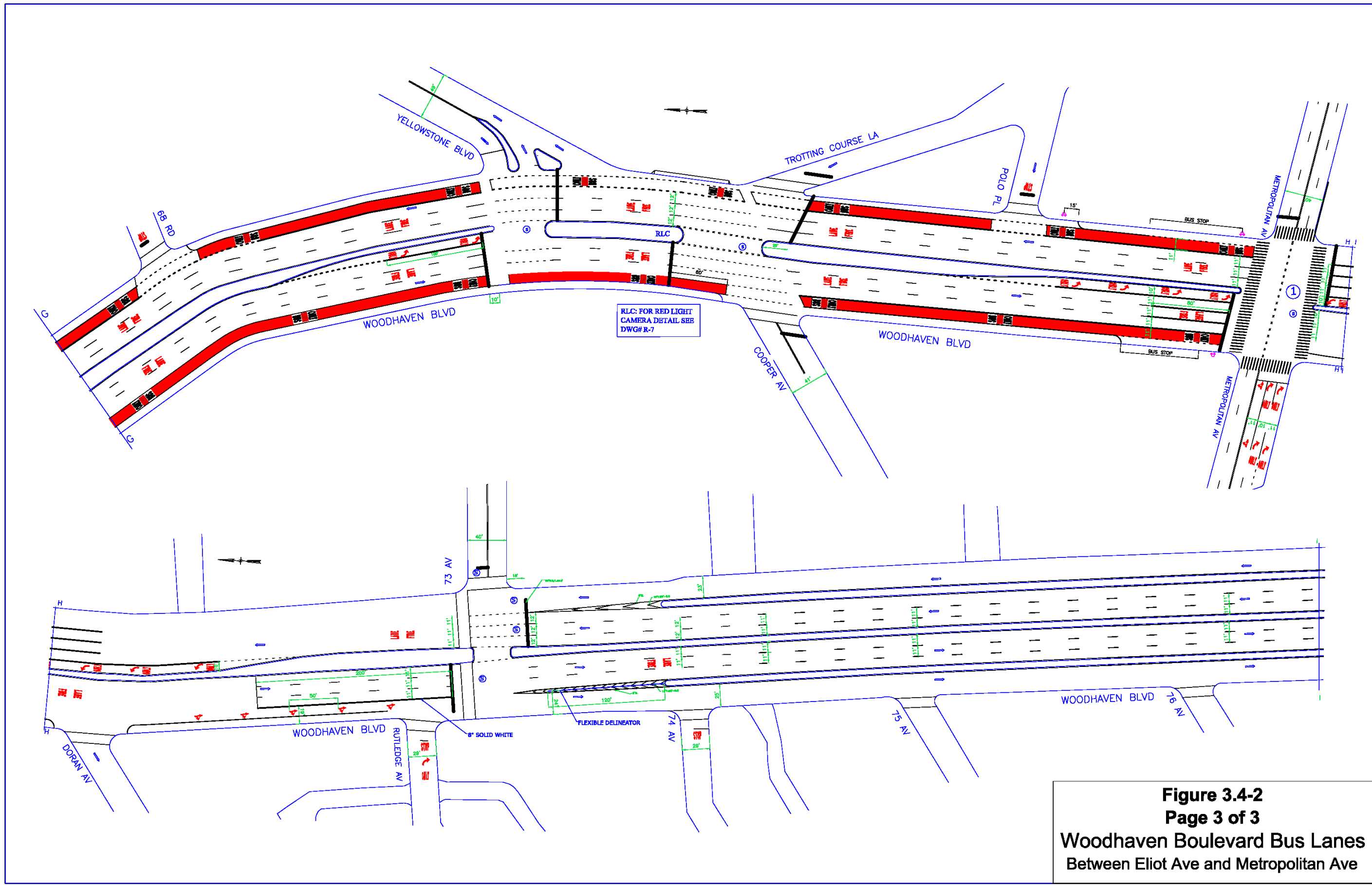


**Figure 3.4-2**  
**Page 1 of 3**  
**Woodhaven Boulevard Bus Lanes**  
**Between Eliot Ave and Metropolitan Ave**





**Figure 3.4-2**  
**Page 2 of 3**  
**Woodhaven Boulevard Bus Lanes**  
**Between Eliot Ave and Metropolitan Ave**



**Figure 3.4-2**  
**Page 3 of 3**  
**Woodhaven Boulevard Bus Lanes**  
**Between Eliot Ave and Metropolitan Ave**

### 3.5 Improvements between Union Turnpike and Myrtle Avenue

*Restripe the southbound service road for right-turns only approaching Union Turnpike, and reduce the service road cross-section from two lanes to one lane south of Union Turnpike:* See Figure 3.5-1. The main road of Woodhaven Boulevard between Union Turnpike and 73<sup>rd</sup> Avenue, which is a viaduct that traverses the LIRR underpass, consists of three lanes in each direction. The service roads in this section are not continuous; they do not traverse LIRR. Northbound from Union Turnpike, the one lane service road leads to the LIRR, loops counterclockwise to the left underneath the viaduct, and becomes the southbound service road. Since these service roads do not provide through traffic, their volume is very small.

South of Union Turnpike, Woodhaven Boulevard provides two main road lanes in each direction, and prior to July 2011 the service roads provided two lanes in each direction with parking. Therefore, southbound Woodhaven Boulevard approaching Union Turnpike provides three main road lanes and one service road lane, but on the far side provides two main road lanes and, prior to July 2011, provided two service road lanes. As a result, in the southbound direction, the two lane service road on the far side was fed by one lane from the main road and one lane from the service road. This was a source of many crashes.

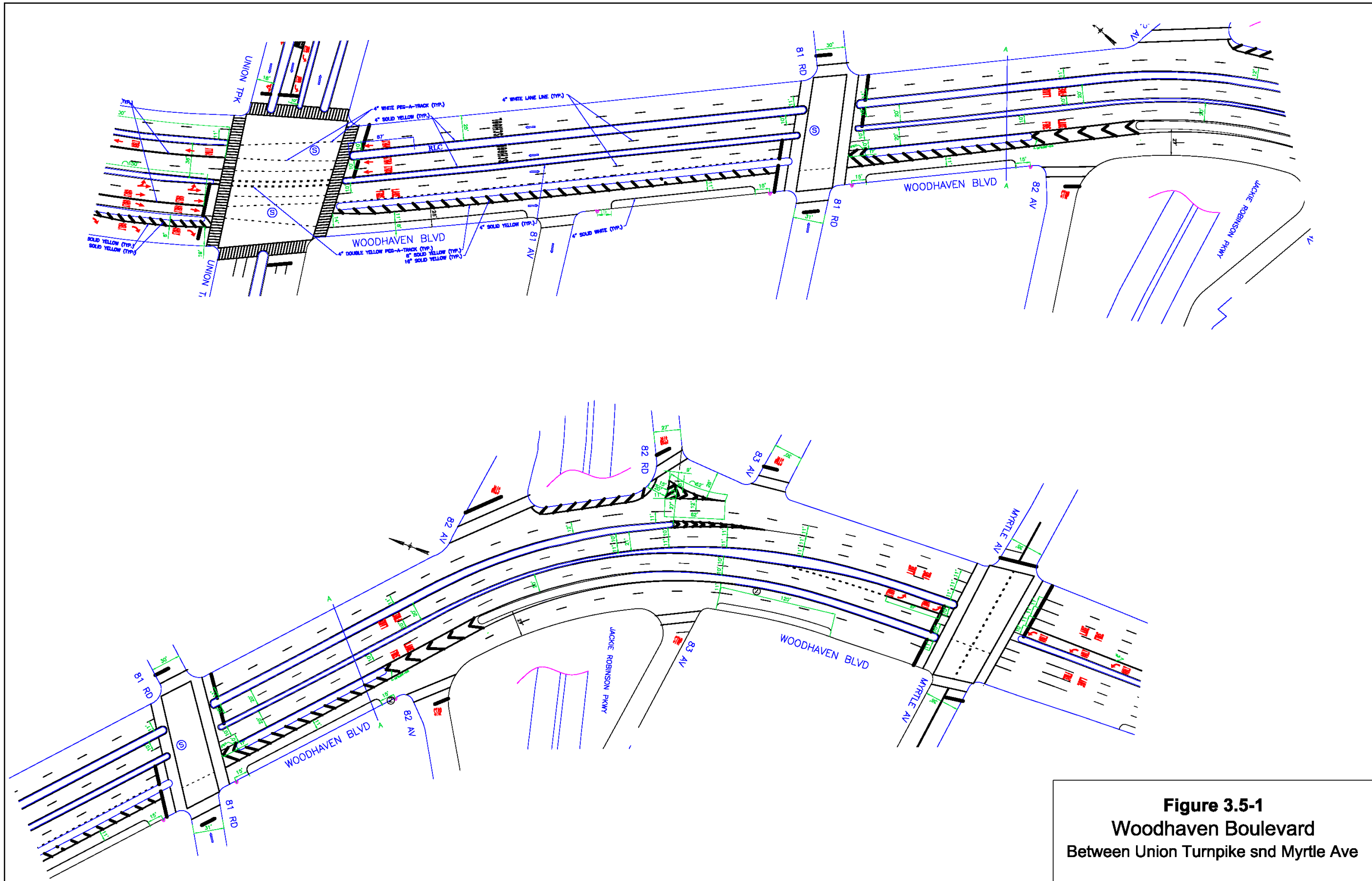
To address this problem, in July 2011 signs and markings on the southbound service road directed all traffic to turn right onto Union Turnpike. This is shown in Photo 3.5-1. The service road on the far side is now fed only by the right lane of the main road. Therefore, this configuration allows the right lane on the southbound mainline to continue straight through the intersection – to the southbound service road – without impedance from through traffic from the service road. This improvement was successful in reducing crashes, but the down side is that it has been inconvenient to motorists who use the northbound service road to drop off at the park near the LIRR, then wish to continue southbound on Woodhaven Boulevard but are forced to turn right onto Union Turnpike. There also remains concern about vehicles illegally turning right onto Union Turnpike from the southbound main road.

A supplemental improvement was implemented in August 2012. The southbound service road from Union Turnpike to 82<sup>nd</sup> Avenue was reduced from two lanes to one. There are two reasons for this. First, because of the previously described improvement, the service road south of Union Turnpike is fed by only one lane. Second, the width of the service road is only 26 feet, not wide enough to safely provide two lanes of traffic and parking. Photo 3.5-2 shows the new markings on the southbound service road at 81<sup>st</sup> Road.

As shown in Figure 3.5-1, the southbound service road continues as one lane to 82<sup>nd</sup> Avenue, and then transitions to two lanes between 82<sup>nd</sup> Avenue and Myrtle Avenue. The service road is wide enough to accommodate two travel lanes in this section. Providing for a two-lane, rather than one-lane, approach on the southbound service road maintains the previous capacity on the service road at the intersection of Woodhaven Boulevard/Myrtle Avenue.

Northbound Woodhaven Boulevard in this section essentially follows the same pattern as southbound in reverse: approaching Union Turnpike, there are two main road lanes and two service road lanes, and on the far side three main road lanes and one service road lane. It was not attempted to reduce the northbound service road to one lane as was done in the southbound direction, because that would have entailed merging two lanes to one (as opposed to expanding

from one lane to two as in the southbound direction at 82<sup>nd</sup> Avenue). Northbound striping improvements included channelization markings to clarify direction in the area of 82<sup>nd</sup> Road.



**Figure 3.5-1**  
**Woodhaven Boulevard**  
 Between Union Turnpike and Myrtle Ave





**Photo 3.5-1: Southbound service road approaching Union Turnpike**



**Photo 3.5-2: Southbound service road approaching 81<sup>st</sup> Road**

### 3.6 Improvements at Forest Park Drive

*Install median refuge island at north crosswalk:* This is presented in Figure 3.6-1. In August 2012, the median between the northbound and southbound lanes on Woodhaven Boulevard has been widened at the north crosswalk at Forest Park Drive to provide a pedestrian refuge. This improvement was made with truffle paint and vertical delineators. This space was previously a left-turn bay, but left-turns are permitted only by authorized Department of Parks and Recreation personnel, and thus have very low volume.

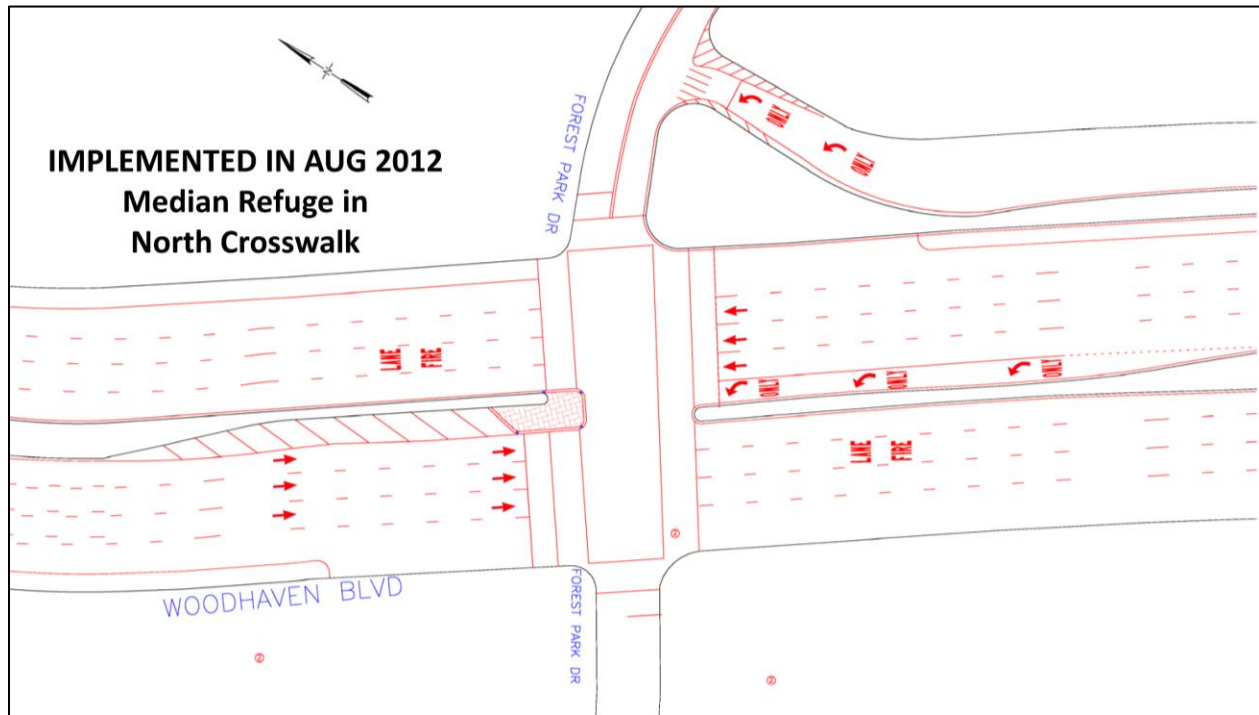


Figure 3.6-1 - Improvements at Forest Park Drive



### 3.7 Improvements on Service Roads between Park Lane South and Rockaway Boulevard

The service roads of Woodhaven Boulevard between Park Lane South and Rockaway Boulevard are generally marked for two travel lanes, with parking and bus stops along the curb. The roadway width of the service roads varies considerably along this stretch. In many sections, the roadway is not wide enough to safely provide for two lanes and parking – in some locations the width is as little as 23 feet, hardly wide enough. Photo 3.7-1 shows the southbound service road between 101<sup>st</sup> Avenue and 103<sup>rd</sup> Avenue where there is clearly not enough room for two lanes and parking. In other sections, however, there is an excess of roadway width.



**Photo 3.7-1: Southbound service road between 101<sup>st</sup> and 103<sup>rd</sup> Avenues**

Figure 3.7.1 presents locations where the service road is not wide enough for two lanes and parking.



**LOCATIONS WHERE SERVICE ROAD NOT WIDE ENOUGH FOR 2 LANES AND PARKING**

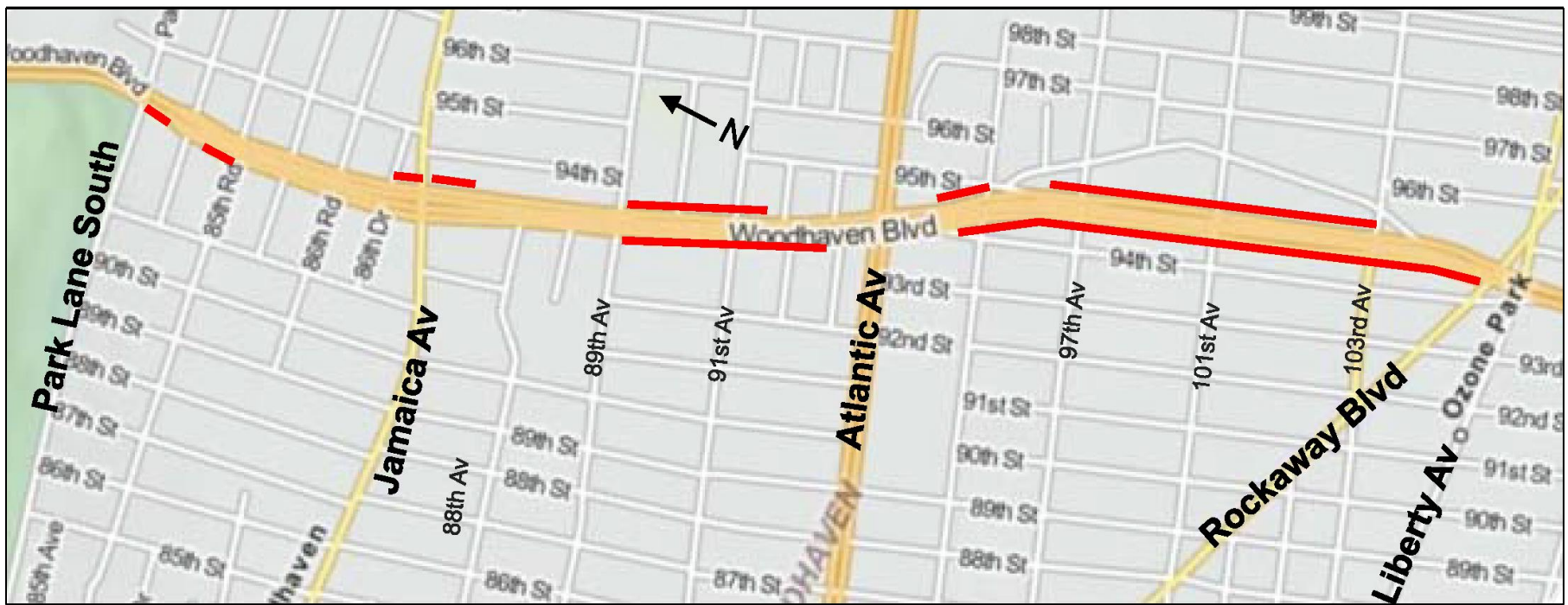


Figure 3.7-1: Woodhaven Boulevard between Park Lane South and Rockaway Boulevard where service road is not wide enough for two lanes and parking.

Analysis shows that the only section where two lanes of traffic on the service road are necessary – that is, where reducing to one lane would cause adverse impacts to traffic operations – is on the southbound approach to Jamaica Avenue. At Jamaica Avenue there is less green time allocated for the northbound/southbound traffic movements compared to most other signalized intersections because of the dual protected left-turn phase, where green arrows are provided to allow protected northbound and southbound left turns. Therefore, the service roads were redesigned to provide one travel lane, except southbound between 85<sup>th</sup> Avenue and 88<sup>th</sup> Avenue where two lanes were maintained so as not to cause additional congestion approaching Jamaica Avenue.

On this section of Woodhaven Boulevard, there is barely sufficient time to cross the entire width of the roadway. In 2012, the signal timing was reallocated to give more green time to the cross streets in order to allow more WALK time for pedestrians to cross Woodhaven Boulevard, but that came at the expense of reducing green time for Woodhaven Boulevard traffic. Further reallocation of green time to allow even more WALK time to cross Woodhven Boulevard would serve to worsen the already congested traffic conditions.

There are existing raised concrete center medians that separate northbound and southbound traffic, and also raised concrete service road medians that separate the main road from the service roads. But these medians generally do not extend into the crosswalks, nor are they wide enough to provide safe refuge for pedestrians who don't make it all the way across the entire roadway. Therefore, some of the extra space created by reducing the number of traffic lanes in the service road will be utilized by widening the service road medians using truffle paint and vertical delineators.

The following guidelines were used to redesign the service roads between Park Lane South and Rockaway Boulevard:

- Maintain an 11 foot curbside lane for parking and bus stops. Parking will be delineated with a 4 inch wide solid white parking stripe to separate the parking lane from the travel lane. Bus stops will be delineated by short skip lines. The reason for the parking lane to be 11 feet wide instead of the more typical 8 feet is because: 1) eleven feet is needed for the bus stops anyway, so maintaining a consistent 11 foot curbside lane will eliminate the occurrence of buses taking up part of the travel lane when making stops, and 2) if in the future, it is deemed appropriate to remove parking to provide peak direction bus lanes, the lane will already be of sufficient width.
- Maintain one 11 foot travel lane (two travel lanes southbound between 85<sup>th</sup> Avenue and 88<sup>th</sup> Avenue so as to provide two lanes approaching Jamaica Avenue) adjacent to the parking lane.
- Mark the excess space with diagonal striping between the left edge of the travel lane and the service road median.
- At all signalized intersections, the excess space described in the previous bullet will be marked with truffle paint and delineators to provide crosswalk refuge at the northwest and southeast service road medians. This refuge will extend out to the full width of the

crosswalks. This treatment will not be done for the southwest or northeast service road medians, because that could preclude safe vehicular turning movements.

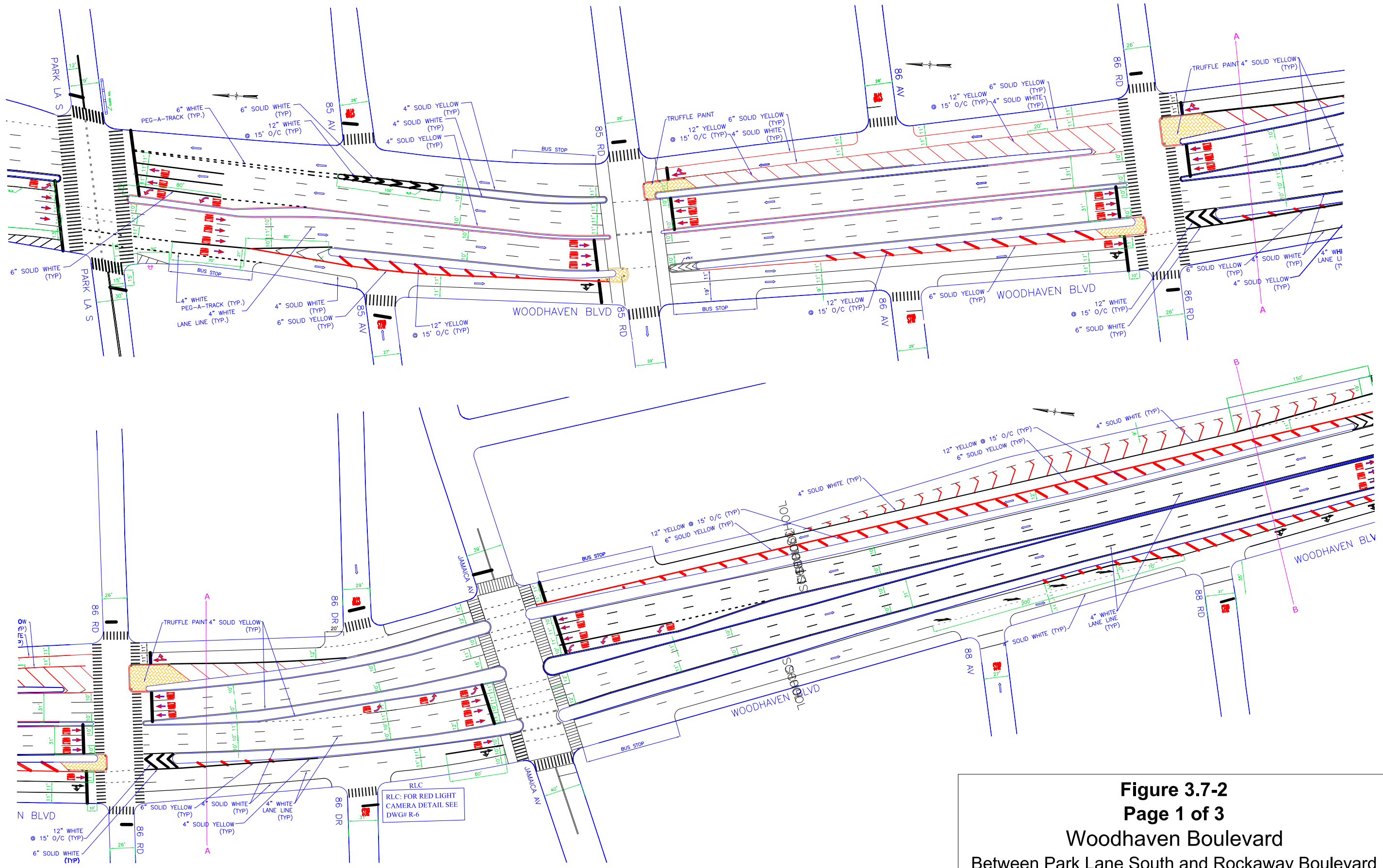
The following are exceptions to the general guidelines:

- At Jamaica Avenue, truffle paint refuge islands are not necessary, because the existing raised concrete center medians and service road medians are already of sufficient width and extend out to the full width of the crosswalk.
- At Atlantic Avenue, where the Woodhaven Boulevard main road is a viaduct and does not intersect at grade, pedestrians only need to cross the service roads. The service roads here are actually two separate intersections, and do not present difficulties for pedestrians to cross.
- The northwest median at 91<sup>st</sup> Avenue, and the southeast median at 97<sup>th</sup> Avenue, will not be treated as described in the general guidelines above, because these are the only locations where traffic from the main road is allowed to move to the service road. The reason is because trucks are not allowed on the main road viaduct over Atlantic Avenue. The former is the last chance for southbound trucks, and the latter is the last chance for northbound trucks to move from the main road to the service road. The truffle paint treatment will preclude trucks to safely complete this movement.

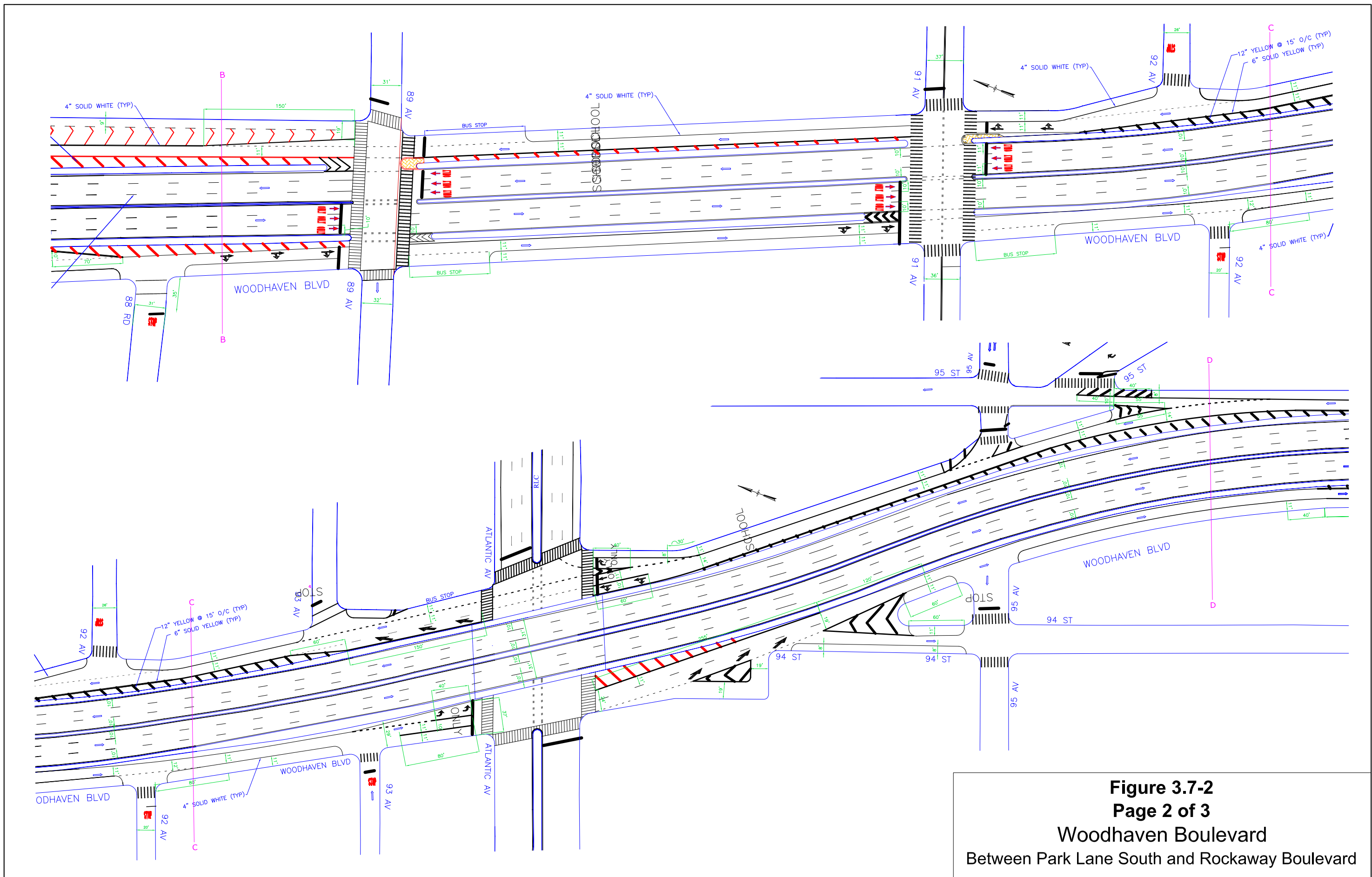
In addition, the curbside lane of the southbound Woodhaven Boulevard service road and northbound Cross Bay Boulevard will be marked and signed as a bus lane at the following blocks approaching Rockaway Boulevard and Liberty Avenue, respectively:

- Southbound between 101<sup>st</sup> Avenue and 103<sup>rd</sup> Avenue, in effect 4-7 PM Monday through Friday. It will not be painted red.
- Southbound between 103<sup>rd</sup> Avenue and Rockaway Boulevard, in effect 7AM-7PM Monday through Friday. It will be painted red.
- Northbound between Plattwood Avenue and 108<sup>th</sup> Avenue, in effect 7-10 AM Monday through Friday. It will not be painted red.
- Northbound between 108<sup>th</sup> Avenue and Liberty Avenue, in effect 7AM-7PM Monday through Friday. It will be painted red.

A preliminary drawing of the Woodhaven Boulevard service roads between Park Lane South and Rockaway Boulevard is presented in Figure 3.7-2. The section between Park Lane South and Atlantic Avenue was implemented in November 2014. The section south of Atlantic Avenue is scheduled to be implemented in May 2015.

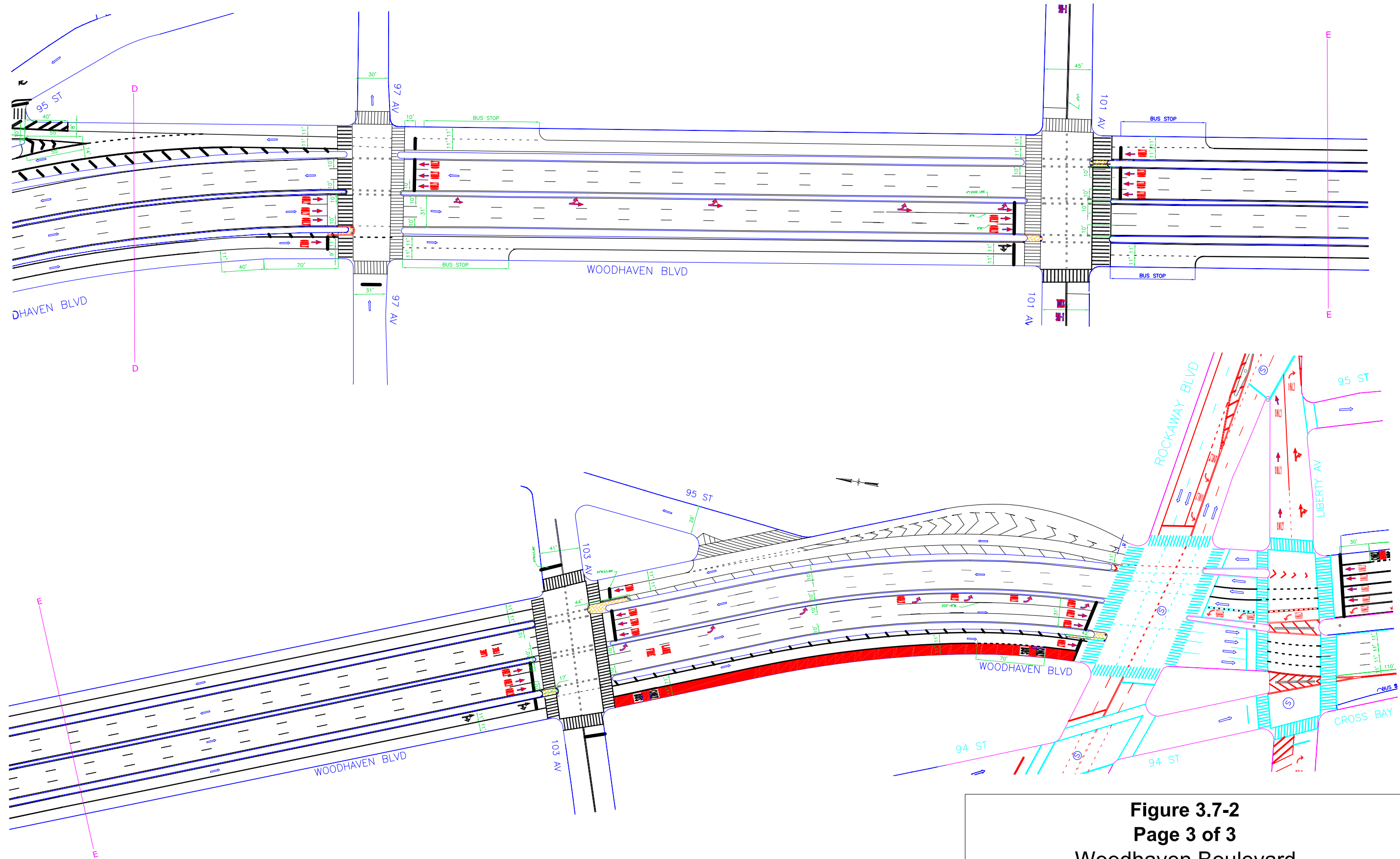


**Figure 3.7-2**  
**Page 1 of 3**  
**Woodhaven Boulevard**  
**Between Park Lane South and Rockaway Boulevard**



**Figure 3.7-2**  
**Page 2 of 3**  
**Woodhaven Boulevard**  
 Between Park Lane South and Rockaway Boulevard





**Figure 3.7-2**  
**Page 3 of 3**  
**Woodhaven Boulevard**  
 Between Park Lane South and Rockaway Boulevard

### 3.8 Improvements at Rockaway Boulevard/Liberty Avenue

At the southern end of the study area is the complex intersection of Woodhaven Boulevard, Cross Bay Boulevard, Rockaway Boulevard, Liberty Avenue and 94<sup>th</sup> Street. There are high traffic volumes, over 2000 vehicles per hour during peak periods, on Woodhaven Boulevard and Cross Bay Boulevard. The busy retail establishments are generators of many pedestrians. The Rockaway Boulevard station for the overhead Liberty Avenue A train is located here, and seven bus lines have stops here. The previous configuration, with some of the major retail establishments, is presented in Figure 3.8-1.

Figure 3.8-2 illustrates some of the issues at this complex intersection. The following are brief descriptions:

- Unsafe movements in and out of the Dunkin Donuts parking lot on the north side of Rockaway Boulevard between Woodhaven Boulevard and 94<sup>th</sup> Street.
- A southbound bus stop in between Rockaway Boulevard and Liberty Avenue causes congestion and sudden lane changing within a constricted space.
- A long, unsafe crosswalk along the south side of Liberty Avenue across Crossbay Boulevard.
- Unsafe merge for southbound traffic from the Woodhaven Boulevard main road, service road, and 94<sup>th</sup> Street.
- The capacity of the left-turn movement from northbound Crossbay Boulevard to westbound Rockaway Boulevard was not enough to meet the demand. The protected northbound and southbound left-turn phase at Rockaway Boulevard occurred when the signal for northbound and southbound through traffic at Liberty Avenue and Rockaway Boulevard was red. Therefore, the effective capacity for the northbound left-turn was restricted to the four cars per cycle that could be stored between Liberty Avenue and Rockaway Boulevard, no matter how long the duration of the left-turn arrow.
- Vehicular and pedestrian congestion on the southeast corner of Crossbay Boulevard and Liberty Avenue, where pedestrians jaywalking across Liberty Avenue conflict with eastbound drivers.
- The intersection of Rockaway Boulevard and Liberty Avenue was complex and confusing for drivers.
- There were no crosswalks along the south side of Rockaway Boulevard across Liberty Avenue, or along the west side of 96<sup>th</sup> Street across Rockaway Boulevard and Liberty Avenue.
- The crosswalk along the east side of 96<sup>th</sup> Street across Rockaway Boulevard and Liberty Avenue was skewed.

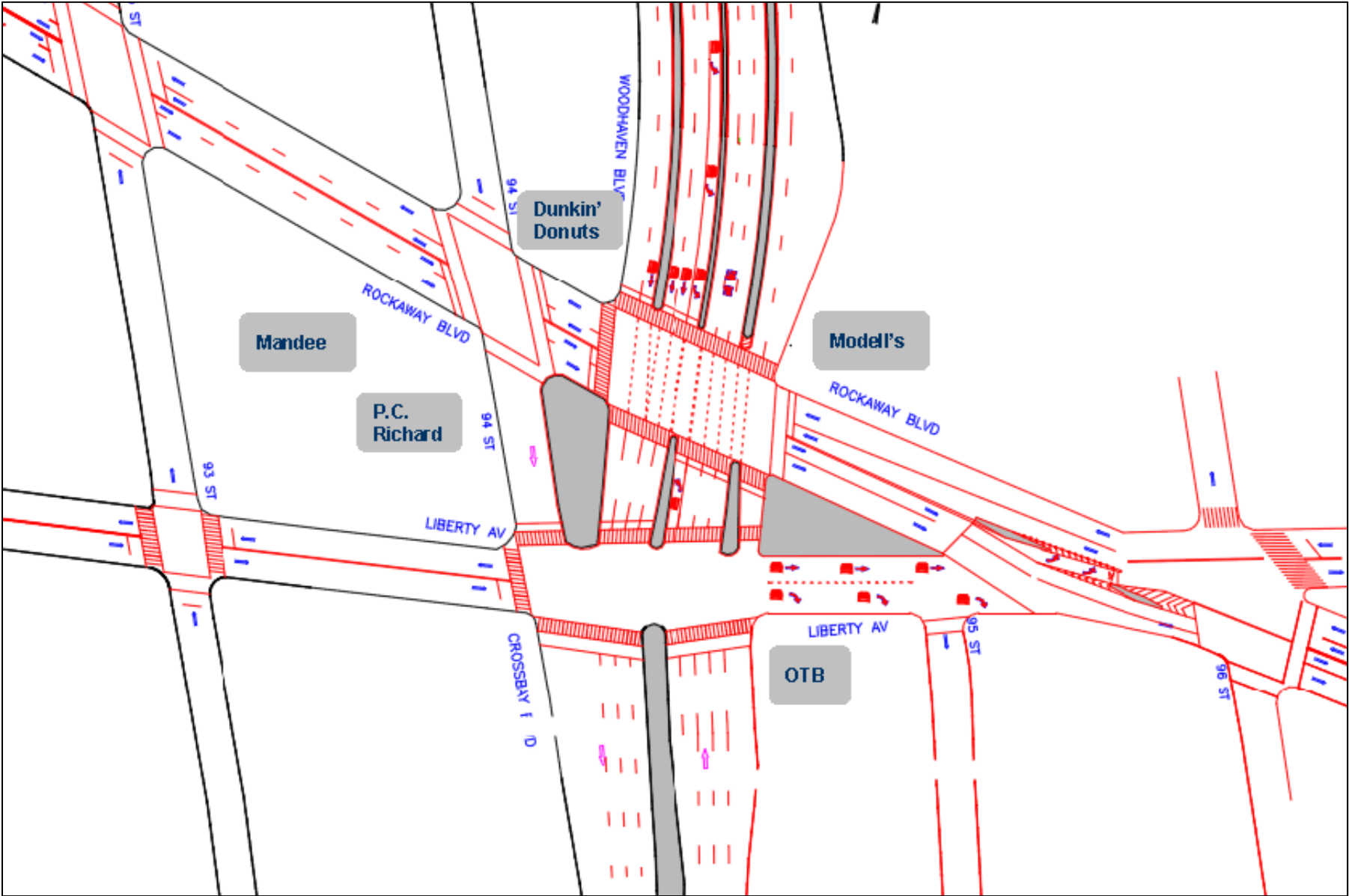


Figure 3.8-1: Previous Layout at Rockaway Boulevard/Liberty Avenue



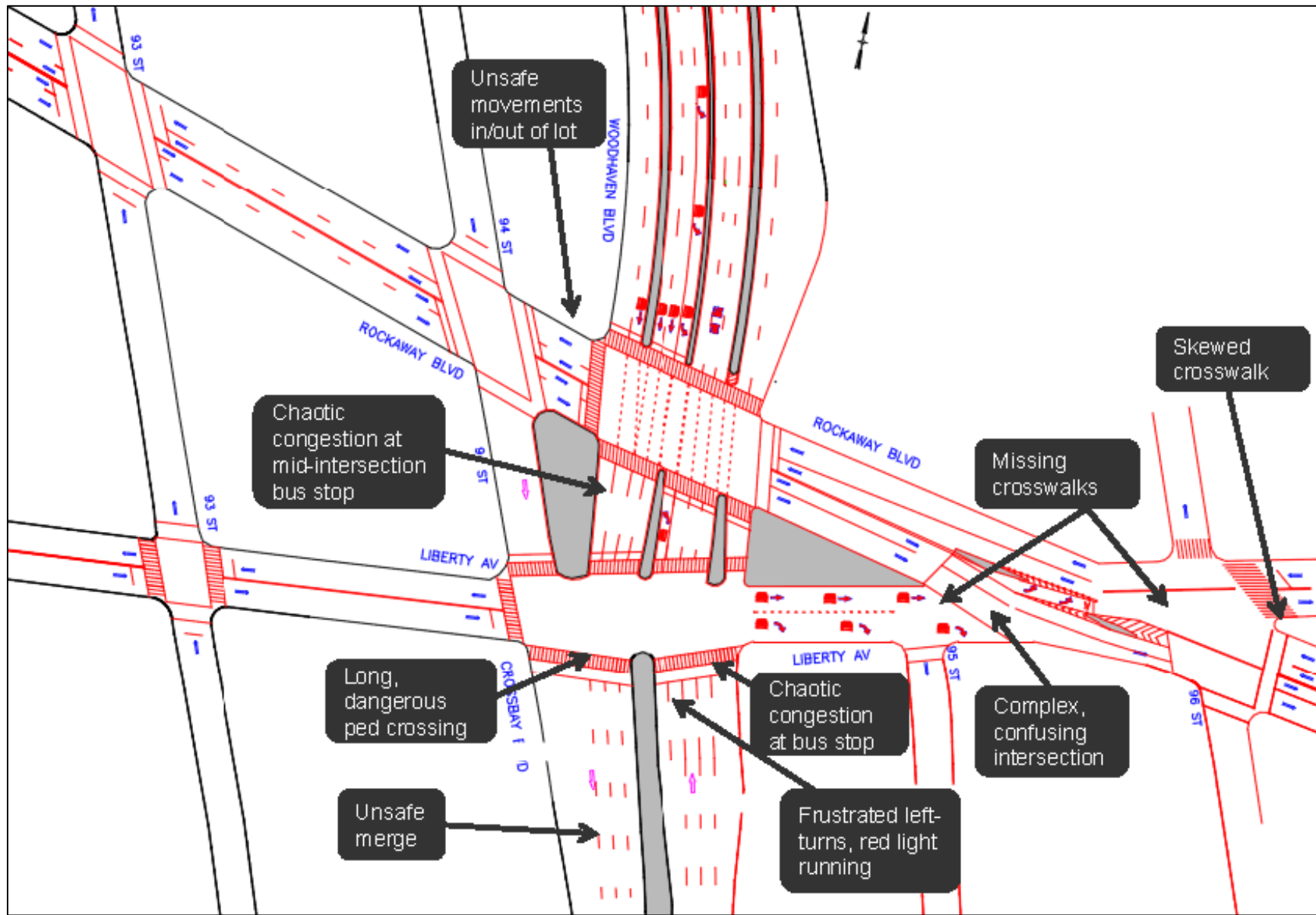


Figure 3.8-2: Issues at Rockaway Boulevard/Liberty Avenue

In October 2010, improvements were made to address these issues. There were some modifications made in April 2012 as a result of community input. The resulting layout is presented in Figure 3.8-3.

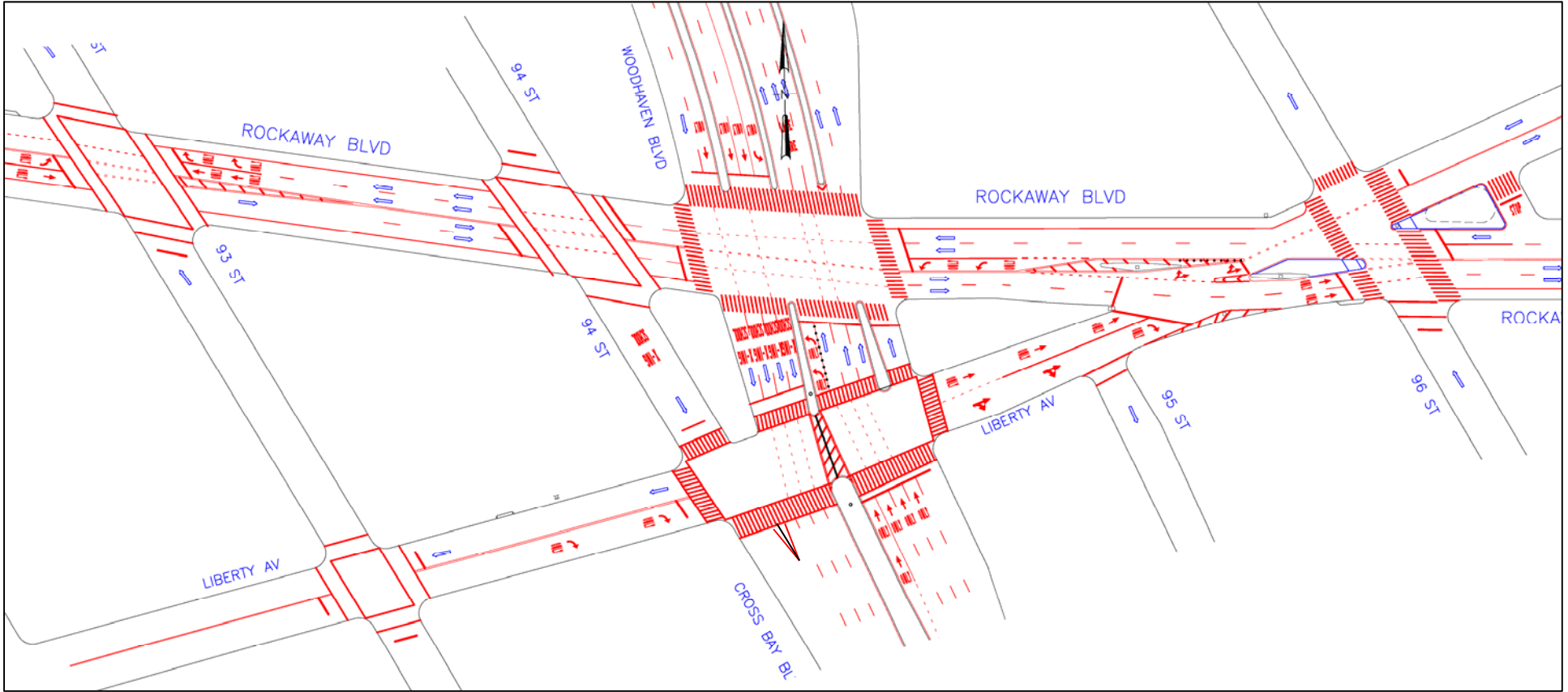


Figure 3.8-3: Improved layout at Rockaway Boulevard/Liberty Avenue

The following are descriptions of the improvements:

A jersey barrier was installed in the median of Crossbay Boulevard in the middle of its intersection with Liberty Avenue. This physically prevents any eastbound left-turns and through movements from Liberty Avenue. The eastbound approach has been restriped as right-turn only. Reduced traffic volume at this approach reduces potential conflicts with pedestrians in the north crosswalk. More importantly, the eastbound through movement prohibition eliminates conflicts with jaywalking pedestrians in the east crosswalk. The only vehicular traffic on Liberty Avenue between Crossbay Boulevard and Rockaway Boulevard is that which originated from the right-turn from northbound Crossbay Boulevard.

Because of the jersey barrier, there is no cut in the median along Crossbay Boulevard at Liberty Avenue, which has the effect of extending the left-turn bay for northbound traffic to westbound Rockaway Boulevard. Delineators have been installed to separate the left-turn lane from the through lanes, enabling separate signal heads at the northbound approach to Liberty Avenue. This allows the signal for the left-turn lane (for traffic bound for westbound Rockaway Boulevard) to display the green arrow back at Liberty Avenue at the same time that the signal for the through traffic displays the red. The result is that the intersection can more easily process the demand for the northbound left-turn onto Rockaway Boulevard. Photo 3.8-1 illustrates these improvements.



Photo 3.8-1: Crossbay Boulevard looking north towards Liberty Avenue



As mentioned earlier, a jersey barrier prevents through movements on eastbound Liberty Avenue across Crossbay Boulevard. Motorists wishing to proceed eastbound on Liberty Avenue or Rockaway Boulevard must now proceed northbound on 93<sup>rd</sup> Street, and turn right onto Rockaway Boulevard. Signs have been placed on the eastbound and northbound approaches of the 93<sup>rd</sup> Street/Liberty Avenue intersection to advise drivers of this, as shown in Photo 3.8-2.



**Photo 3.8-2: Sign on eastbound Liberty Avenue approaching 93<sup>rd</sup> Street**

To facilitate the increased traffic diverted onto 93<sup>rd</sup> Street making the acute northbound right-turn onto Rockaway Boulevard, especially for trucks, two parking spaces were removed from the west curb.

To facilitate the increased traffic diverted onto eastbound Rockaway Boulevard, the left-turn

onto northbound Woodhaven Boulevard has been banned. Volume for this move was very low, less than 50 vehicles per hour at any time, and using 103<sup>rd</sup> Avenue is an easy alternate route.

To facilitate westbound traffic, a left-turn bay was marked on Rockaway Boulevard approaching Woodhaven Boulevard. Previously, left turners blocked through traffic since their turns were made from a shared left-through lane.

On the west side of 96<sup>th</sup> Street at the Liberty Avenue/Rockaway Boulevard junction, the pedestrian island was expanded, and a new crosswalk was marked. On the east side of 96<sup>th</sup> Street at the same junction, a new pedestrian island was constructed, shown in Photo 3.8-3. The existing crosswalk was realigned to provide a straight path through this refuge island.



**Photo 3.8-3: New pedestrian refuge island along the east side of 96<sup>th</sup> Street at the Liberty Avenue/Rockaway Boulevard junction**

## 4.0 ANALYSIS OF THE RECOMMENDED IMPROVEMENTS

The recommended improvements were analyzed using Synchro software. For analysis purposes, the future horizon year for this study has been established as 2017. The following sections provide an assessment of 2017 conditions that are likely to occur in the study area with the recommended improvements as compared to conditions in 2017 without any improvements.

### 4.1 Traffic

Under the recommended improvements, it was assumed that traffic operates under different signal timing as compared to the Future without Improvements scenario, namely that traffic signals operate on a 135-second cycle length as compared to a 120-second cycle length and that pedestrians have adequate time to cross at all crosswalks in the study area. Before implementing the 135 second cycle, however, further analysis must be conducted to ensure proper progression on some of the major cross street, especially Queens Boulevard, Metropolitan Avenue, Jamaica Avenue and Rockaway Boulevard.

Detailed level of service analysis was performed for the preferred alternative using Synchro software. The results are presented in Tables 4.1-1 to 4.1-4 which compare level of service (LOS) and other measures of effectiveness between the recommended improvements and the Future without Improvements condition for the weekday AM, midday, PM and Saturday midday peak hours, respectively. In general, the recommended improvements is projected to have slightly more intersection lane groups operating at mid-LOS D or worse during the Saturday midday peak hour, while the weekday AM, midday and PM peak hours will experience slightly fewer intersection lane groups operating at mid-LOS D or worse (Figures 4.1-1 through 4.1-4).

The analysis considers traffic delay per vehicle. The delay per person would be projected to improve more than delay per vehicle because the bus lanes will improve travel times of buses, which carry many more persons per vehicle than autos. Also, the analysis is conservative in that same mode split is assumed, but in reality the improved bus service is expected to be accompanied by a slight mode shift away from autos to buses.

| Table 4.1-1: Year 2017 Traffic Conditions - Future with and without Improvements |                 |            |                              |                 |          |                          |             |          |
|--|-----------------|------------|------------------------------|-----------------|----------|--------------------------|-------------|----------|
| Intersection   | Approach        | Lane Group | Weekday AM (7:45 to 8:45 AM) |                 |          |                          |             |          |
|  |                 |            | Future without Improvements  |                 |          | Future with Improvements |             |          |
|  |                 |            | v/c                          | Delay (sec/veh) | LOS      | Preferred Alternative    |             |          |
| v/c  | Delay (sec/veh) | LOS        | v/c                          | Delay (sec/veh) | LOS      |                          |             |          |
| <b>SIGNALIZED INTERSECTIONS</b>  |                 |            |                              |                 |          |                          |             |          |
| Woodhaven Blvd at Queens Blvd North Service Road                                 | WB              | L          | 0.70                         | 63.4            | E        | 0.82                     | 69.3        | E        |
|  |                 | LT         | 0.61                         | 32.4            | C        | 0.72                     | 44.4        | D        |
|  |                 | R          | 0.30                         | 27.4            | C        | 0.39                     | 39.2        | D        |
|  | NB              | L          | 0.78                         | 39.1            | D        | 0.81                     | 39.1        | D        |
|  |                 | T          | 0.27                         | 2.3             | A        | 0.24                     | 16.5        | B        |
| <b>Overall</b>   |                 |            | *                            | <b>33.9</b>     | <b>C</b> | *                        | <b>40.4</b> | <b>D</b> |
| Woodhaven Blvd at Queens Blvd South Service Road                                 | EB              | L          | 0.16                         | 27.3            | C        | 0.17                     | 32.3        | C        |
|  |                 | T          | 0.76                         | 39.3            | D        | 0.77                     | 44.0        | D        |
|  |                 | R          | 0.23                         | 28.7            | C        | 0.23                     | 32.4        | C        |
|  | NB              | TR         | 0.69                         | 30.2            | C        | 0.69                     | 22.5        | C        |
|  | SB              | L          | 0.24                         | 22.9            | C        | 0.22                     | 62.0        | E        |
|  |                 | LT         | 0.29                         | 79.1            | E        | 0.28                     | 70.5        | E        |
| <b>Overall</b>   |                 |            | *                            | <b>38.5</b>     | <b>D</b> | *                        | <b>35.5</b> | <b>D</b> |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                               | EB              | L          | 0.39                         | 42.8            | D        | 0.33                     | 41.5        | D        |
|  |                 | R          | 0.80                         | 49.5            | D        | 0.70                     | 46.1        | D        |
|  | WB              | LTR        | 0.41                         | 41.0            | D        | 0.36                     | 40.4        | D        |
|  | NB              | T          | 0.79                         | 4.6             | A        | 0.82                     | 5.8         | A        |
|  | SB              | T          | 0.30                         | 6.6             | A        | 0.40                     | 13.9        | B        |
| <b>Overall</b>   |                 |            | *                            | <b>11.2</b>     | <b>B</b> | *                        | <b>13.2</b> | <b>B</b> |
| Woodhaven Blvd at Eliot Ave/ 86 St   | EB              | LR         | 0.75                         | 45.8            | D        | --                       | --          | --       |
|  |                 | L          | --                           | --              | --       | 0.57                     | 40.8        | D        |
|  |                 | R          | --                           | --              | --       | 0.16                     | 32.8        | C        |
|  | NB              | T          | 1.05                         | 63.1            | E        | 1.04                     | 56.3        | E        |
|  | SB              | TR         | 0.65                         | 9.6             | A        | 0.67                     | 12.8        | B        |
| <b>Overall</b>   |                 |            | *                            | <b>44.6</b>     | <b>D</b> | *                        | <b>40.9</b> | <b>D</b> |
| Woodhaven Blvd at Dry Harbor Rd  | EB              | LR         | 0.45                         | 35.0            | C        | 0.41                     | 34.4        | C        |
|  | NB              | L          | 0.23                         | 38.8            | D        | 0.32                     | 40.6        | D        |
|  |                 | T          | 1.00                         | 58.3            | E        | 0.64                     | 40.0        | D        |
|  | SB              | TR         | 0.50                         | 13.9            | B        | 0.61                     | 6.6         | A        |
| <b>Overall</b>   |                 |            | *                            | <b>43.2</b>     | <b>D</b> | *                        | <b>73.8</b> | <b>E</b> |
| Woodhaven Blvd at Yellowstone Blvd   | WB              | LR         | 0.64                         | 48.2            | D        | 0.41                     | 34.2        | C        |
|  | NB              | TR         | 0.89                         | 5.6             | A        | 0.68                     | 10.2        | B        |
|  | SB              | L          | 0.15                         | 11.4            | B        | 0.34                     | 41.5        | D        |
|  |                 | T          | 0.33                         | 1.2             | A        | 0.58                     | 30.0        | C        |
| <b>Overall</b>   |                 |            | *                            | <b>6.9</b>      | <b>A</b> | *                        | <b>82.1</b> | <b>F</b> |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln                                 | EB              | LTR        | 0.64                         | 48.9            | D        | 0.41                     | 32.5        | C        |
|  | WB              | R          | 0.14                         | 37.4            | D        | 0.09                     | 29.2        | C        |
|  | NB              | T          | 0.79                         | 3.9             | A        | 0.56                     | 3.9         | A        |
|  | SB              | T          | 0.40                         | 4.2             | A        | --                       | --          | --       |
|  |                 | R          | 0.17                         | 0.3             | A        | --                       | --          | --       |
|  |                 | TR         | --                           | --              | --       | 0.68                     | 10.6        | B        |
| <b>Overall</b>   |                 |            | *                            | <b>6.7</b>      | <b>A</b> | *                        | <b>36.8</b> | <b>D</b> |
| Woodhaven Blvd at Metropolitan Ave   | EB              | LT         | 0.47                         | 40.6            | D        | 0.36                     | 35.9        | D        |
|  |                 | R          | 0.45                         | 42.5            | D        | 0.34                     | 36.9        | D        |
|  | WB              | LTR        | 0.75                         | 49.8            | D        | 0.55                     | 40.1        | D        |
|  |                 | L          | 0.95                         | 55.9            | E        | 0.52                     | 42.4        | D        |
|  | NB              | T          | 0.86                         | 6.0             | A        | 1.16                     | 89.1        | F        |
|  |                 | R          | --                           | --              | --       | 0.13                     | 5.9         | F        |
|  | SB              | L          | 0.63                         | 39.9            | D        | 0.71                     | 42.1        | D        |
|  |                 | TR         | 0.49                         | 14.4            | B        | 0.65                     | 14.1        | B        |
| <b>Overall</b>   |                 |            | *                            | <b>17.6</b>     | <b>B</b> | *                        | <b>58.4</b> | <b>E</b> |
| Woodhaven Blvd at Union Tpke   | EB              | LTR        | 0.64                         | 42.0            | D        | 0.49                     | 34.7        | C        |
|  | WB (main)       | L          | 0.81                         | 47.3            | D        | 0.71                     | 37.5        | D        |
|  |                 | TR         | 0.38                         | 27.4            | C        | 0.33                     | 24.7        | C        |
|  | WB (service)    | R          | 0.08                         | 22.9            | C        | 0.07                     | 20.8        | C        |
|  | NB (main)       | T          | 1.34                         | 174.8           | F        | 1.45                     | 226.3       | F        |
|  | NB (service)    | TR         | 0.81                         | 13.8            | B        | 0.88                     | 18.1        | B        |
|  | SB (main)       | LT         | 0.87                         | 26.2            | C        | 0.98                     | 40.6        | D        |
|  | SB (service)    | TR         | 0.10                         | 13.6            | B        | --                       | --          | --       |
|  |                 | R          | --                           | --              | --       | 0.18                     | 29.6        | C        |
| <b>Overall</b>   |                 |            | *                            | <b>77.0</b>     | <b>E</b> | *                        | <b>98.7</b> | <b>F</b> |
| Woodhaven Blvd at Myrtle Ave   | EB              | LTR        | 0.54                         | 42.1            | D        | 0.33                     | 31.6        | C        |
|  | WB              | LTR        | 0.91                         | 60.0            | E        | 0.63                     | 38.1        | D        |
|  | NB              | L          | 1.04                         | 113.7           | F        | 1.07                     | 119.6       | F        |
|  |                 | TR         | 0.85                         | 5.2             | A        | 1.04                     | 35.2        | D        |
|  | SB (main)       | L          | 0.94                         | 84.5            | F        | 0.97                     | 96.7        | F        |
|  |                 | T          | 0.47                         | 20.6            | C        | 0.57                     | 36.9        | D        |
|  | SB (service)    | TR         | 0.45                         | 20.8            | C        | 0.54                     | 37.0        | D        |
| <b>Overall</b>   |                 |            | *                            | <b>22.5</b>     | <b>C</b> | *                        | <b>39.9</b> | <b>D</b> |
| Woodhaven Blvd at Jamaica Ave  | EB              | LTR        | 1.06                         | 110.1           | F        | --                       | --          | --       |
|  |                 | TR         | --                           | --              | --       | 0.59                     | 46.9        | D        |
|  | WB              | LTR        | 0.66                         | 51.2            | D        | 0.62                     | 50.5        | D        |
|  | NB (main)       | L          | 0.42                         | 51.5            | D        | 0.47                     | 48.6        | D        |
|  |                 | T          | 0.84                         | 12.5            | B        | 0.85                     | 14.8        | B        |
|  | NB (service)    | TR         | 0.82                         | 28.3            | C        | 0.84                     | 34.0        | C        |
|  | SB (main)       | L          | 0.22                         | 33.4            | C        | 0.25                     | 51.4        | D        |
|  |                 | T          | 0.42                         | 20.4            | C        | 0.43                     | 3.9         | A        |
|  | SB (service)    | TR         | 0.49                         | 24.5            | C        | 0.50                     | 6.5         | A        |
| <b>Overall</b>   |                 |            | *                            | <b>26.8</b>     | <b>C</b> | *                        | <b>19.8</b> | <b>B</b> |
| Woodhaven Blvd SB Service Road at Atlantic Ave                                   | EB              | TR         | 0.32                         | 15.2            | B        | 0.51                     | 36.1        | D        |
|  | WB              | L          | 0.42                         | 9.7             | A        | 0.40                     | 20.9        | C        |
|  |                 | T          | 0.41                         | 4.0             | A        | 0.50                     | 8.4         | A        |
|  | SB (service)    | LTR        | 0.60                         | 23.5            | C        | --                       | --          | --       |
|  |                 | L          | --                           | --              | --       | 0.15                     | 35.3        | D        |
|  |                 | T          | --                           | --              | --       | 0.49                     | 45.0        | D        |
|  |                 | R          | --                           | --              | --       | 0.21                     | 37.5        | D        |
| <b>Overall</b>   |                 |            | *                            | <b>12.2</b>     | <b>B</b> | *                        | <b>25.7</b> | <b>C</b> |
| Woodhaven Blvd NB Service Road at Atlantic Ave                                   | EB              | L          | 0.57                         | 18.0            | B        | 0.45                     | 14.3        | B        |
|  |                 | T          | 0.33                         | 3.4             | A        | 0.40                     | 6.7         | A        |
|  | WB              | TR         | 0.40                         | 16.1            | B        | 0.71                     | 26.5        | C        |
|  | NB (service)    | LTR        | 0.53                         | 40.3            | D        | --                       | --          | --       |
|  |                 | L          | --                           | --              | --       | 0.12                     | 8.3         | A        |
|  |                 | TR         | --                           | --              | --       | 0.62                     | 11.4        | B        |
| <b>Overall</b>   |                 |            | *                            | <b>17.4</b>     | <b>B</b> | *                        | <b>16.8</b> | <b>B</b> |



| Table 4.1-1: Year 2017 Traffic Conditions - Future with and without Improvements |                |            |                              |                 |             |                          |                 |             |
|--|----------------|------------|------------------------------|-----------------|-------------|--------------------------|-----------------|-------------|
| Intersection   | Approach       | Lane Group | Weekday AM (7:45 to 8:45 AM) |                 |             |                          |                 |             |
|  |                |            | Future without Improvements  |                 |             | Future with Improvements |                 |             |
|  |                |            | Preferred Alternative        |                 |             | v/c                      | Delay (sec/veh) | LOS         |
|  |                |            | v/c                          | Delay (sec/veh) | LOS         | v/c                      | Delay (sec/veh) | LOS         |
| Woodhaven Blvd at Rockaway Blvd  | EB             | LTR        | 0.40                         | 4.2             | A           | --                       | --              | --          |
|  |                | TR         | --                           | --              | --          | 0.40                     | 90.8            | F           |
|  | WB             | L          | 1.05                         | 92.1            | F           | --                       | --              | --          |
|  |                | TR         | --                           | --              | --          | 0.51                     | 43.1            | D           |
|  | NB             | L          | 0.59                         | 141.5           | F           | 0.59                     | 127.0           | F           |
|  |                | TR         | 0.74                         | 5.2             | A           | 0.75                     | 16.0            | B           |
|  | SB (main)      | L          | 0.57                         | 81.7            | F           | 0.59                     | 48.6            | D           |
|  |                | T          | 0.65                         | 38.4            | D           | 0.70                     | 51.3            | D           |
|  | SB (service)   | TR         | 0.28                         | 18.4            | B           | 0.31                     | 24.9            | C           |
| <b>Overall</b>   |                |            | *                            | <b>33.6</b>     | <b>C</b>    | *                        | <b>47.4</b>     | <b>D</b>    |
| Woodhaven Blvd at Liberty Ave/ 94 St   | EB             | LTR        | 0.63                         | 83.6            | F           | --                       | --              | --          |
|  |                | R          | --                           | --              | --          | 0.17                     | 35.0            | C           |
|  | NB             | TR         | 0.65                         | 27.1            | C           | 0.53                     | 19.5            | B           |
|  | SB (main)      | T          | 0.43                         | 4.2             | A           | 0.41                     | 5.0             | A           |
|  | SB (94 St)     | TR         | 0.26                         | 12.9            | B           | 0.24                     | 14.9            | B           |
| <b>Overall</b>   |                |            | *                            | <b>22.4</b>     | <b>C</b>    | *                        | <b>13.9</b>     | <b>B</b>    |
| Rockaway Blvd at 94 St   | EB             | TR         | 0.41                         | 23.6            | C           | 0.53                     | 34.9            | C           |
|  | WB             | LT         | 0.62                         | 10.8            | B           | 0.63                     | 76.6            | E           |
|  | SB             | LTR        | 0.18                         | 19.9            | B           | 0.18                     | 19.9            | B           |
|  | <b>Overall</b> |            |                              | *               | <b>16.6</b> | <b>B</b>                 | *               | <b>52.9</b> |
| Rockaway Blvd at 93 St   | EB             | LT         | 0.23                         | 11.5            | B           | --                       | --              | --          |
|  |                | L          | --                           | --              | --          | 0.05                     | 10.4            | B           |
|  |                | T          | --                           | --              | --          | 0.39                     | 14.0            | B           |
|  | WB             | TR         | 0.32                         | 2.5             | A           | --                       | --              | --          |
|  |                | T          | --                           | --              | --          | 0.53                     | 7.2             | A           |
|  |                | R          | --                           | --              | --          | 0.10                     | 1.2             | A           |
|  | NB             | LTR        | 0.28                         | 28.2            | C           | 0.68                     | 48.8            | D           |
| <b>Overall</b>   |                |            | *                            | <b>9.6</b>      | <b>A</b>    | *                        | <b>21.0</b>     | <b>C</b>    |
| Liberty Ave at 93 St   | EB             | LT         | 0.37                         | 9.9             | A           | 0.55                     | 14.2            | B           |
|  | WB             | TR         | 0.08                         | 2.2             | A           | 0.08                     | 7.2             | A           |
|  | NB             | LTR        | 0.29                         | 14.9            | B           | 0.29                     | 15.1            | B           |
|  | <b>Overall</b> |            |                              | *               | <b>10.5</b> | <b>B</b>                 | *               | <b>13.7</b> |
| Rockaway Blvd at Liberty Ave   | EB             | T          | 0.39                         | 6.7             | A           | 0.51                     | 42.6            | D           |
|  | WB             | T          | 0.24                         | 0.1             | A           | 0.24                     | 0.1             | A           |
|  | NEB            | T          | 0.34                         | 24.0            | C           | 0.12                     | 29.1            | C           |
|  | <b>Overall</b> |            |                              | *               | <b>5.8</b>  | <b>A</b>                 | --              | <b>19.1</b> |
| Rockaway Blvd at Liberty Ave & 96 St   | EB             | L          | 0.87                         | 125.5           | F           | 0.87                     | 143.4           | F           |
|  |                | T          | 0.21                         | 0.7             | A           | 0.21                     | 0.7             | A           |
|  | WB             | TR         | 0.58                         | 35.0            | C           | 0.58                     | 35.0            | C           |
|  | NB             | LTR        | 0.35                         | 39.6            | D           | 0.35                     | 39.6            | D           |
|  | SWB            | TR         | 0.73                         | 48.1            | D           | 0.73                     | 48.1            | D           |
|  | <b>Overall</b> |            |                              | *               | <b>36.5</b> | <b>D</b>                 | *               | <b>38.3</b> |
| <b>UNSIGNALIZED INTERSECTIONS</b>  |                |            |                              |                 |             |                          |                 |             |
| Liberty Ave at 95 St   | EB             | T          | 0.14                         | 0.0             | A           | 0.05                     | 0.0             | A           |
|  |                | R          | 0.01                         | 0.0             | A           | 0.01                     | 0.0             | A           |
|  | <b>Overall</b> |            |                              | *               | *           | *                        | --              | --          |

NB = northbound, SB = southbound, EB = eastbound, WB = westbound, NEB = northeastbound, SWB = southwestbound  
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn  
v/c = volume-to-capacity ratio, LOS = Level-of-Service  
All Intersection Lane Groups: Delay >=45.0 (mid-LOS D or worse)

| Table 4.1-2: Year 2017 Traffic Conditions - Future with and without Improvements |              |            |                              |                 |          |                          |             |          |
|--|--------------|------------|------------------------------|-----------------|----------|--------------------------|-------------|----------|
| Intersection   | Approach     | Lane Group | Weekday MD (1:00 to 2:00 PM) |                 |          |                          |             |          |
|  |              |            | Future without Improvements  |                 |          | Future with Improvements |             |          |
|  |              |            | v/c                          | Delay (sec/veh) | LOS      | Preferred Alternative    |             |          |
|  |              |            | v/c                          | Delay (sec/veh) | LOS      |                          |             |          |
| <b>SIGNALIZED INTERSECTIONS</b>  |              |            |                              |                 |          |                          |             |          |
| Woodhaven Blvd at Queens Blvd North Service Road                                 | WB           | L          | 0.49                         | 28.1            | C        | 0.50                     | 32.6        | C        |
|  |              | LT         | 0.65                         | 29.9            | C        | 0.67                     | 34.8        | C        |
|  |              | R          | 0.26                         | 23.9            | C        | 0.27                     | 27.9        | C        |
|  | NB           | L          | 0.48                         | 17.9            | B        | 0.45                     | 15.4        | B        |
|  |              | T          | 0.18                         | 1.7             | A        | 0.18                     | 1.8         | A        |
| <b>Overall</b>   |              |            | *                            | <b>21.7</b>     | <b>C</b> | *                        | <b>23.6</b> | <b>C</b> |
| Woodhaven Blvd at Queens Blvd South Service Road                                 | EB           | L          | 0.12                         | 21.0            | C        | 0.11                     | 20.8        | C        |
|  |              | T          | 0.72                         | 31.7            | C        | 0.67                     | 30.7        | C        |
|  |              | R          | 0.14                         | 21.6            | C        | 0.13                     | 21.4        | C        |
|  | NB           | TR         | 0.49                         | 48.4            | D        | 0.52                     | 23.5        | C        |
|  | SB           | L          | 0.38                         | 35.1            | D        | 0.39                     | 44.2        | D        |
| LT   |              | 0.20       | 26.4                         | C               | 0.21     | 32.5                     | C           |          |
| <b>Overall</b>   |              |            | *                            | <b>37.4</b>     | <b>D</b> | *                        | <b>27.8</b> | <b>C</b> |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                               | EB           | L          | 0.37                         | 38.5            | D        | 0.35                     | 41.2        | D        |
|  |              | R          | 0.68                         | 29.0            | C        | 0.66                     | 30.9        | C        |
|  | WB           | LTR        | 0.17                         | 34.5            | C        | 0.16                     | 37.1        | D        |
|  | NB           | T          | 0.47                         | 1.6             | A        | 0.48                     | 3.2         | A        |
|  | SB           | T          | 0.19                         | 9.3             | A        | 0.25                     | 7.4         | A        |
| <b>Overall</b>   |              |            | *                            | <b>10.2</b>     | <b>B</b> | *                        | <b>11.1</b> | <b>B</b> |
| Woodhaven Blvd at Eliot Ave/ 86 St   | EB           | LR         | 0.54                         | 38.1            | D        | --                       | --          | --       |
|  |              | L          | --                           | --              | --       | 0.35                     | 32.4        | C        |
|  |              | R          | --                           | --              | --       | 0.12                     | 28.8        | C        |
|  | NB           | T          | 0.61                         | 7.1             | A        | 0.65                     | 2.6         | A        |
|  | SB           | TR         | 0.48                         | 15.5            | B        | 0.53                     | 8.9         | A        |
| <b>Overall</b>   |              |            | *                            | <b>13.3</b>     | <b>B</b> | *                        | <b>7.8</b>  | <b>A</b> |
| Woodhaven Blvd at Dry Harbor Rd  | EB           | LR         | 0.29                         | 32.0            | C        | 0.22                     | 25.3        | C        |
|  | NB           | L          | 0.24                         | 71.0            | E        | 0.34                     | 50.5        | D        |
|  |              | T          | 0.56                         | 46.9            | D        | 0.80                     | 7.0         | A        |
|  | SB           | TR         | 0.41                         | 8.1             | A        | 0.58                     | 14.8        | B        |
| <b>Overall</b>   |              |            | *                            | <b>31.5</b>     | <b>C</b> | *                        | <b>11.3</b> | <b>B</b> |
| Woodhaven Blvd at Yellowstone Blvd   | WB           | LR         | 0.49                         | 38.1            | D        | 0.37                     | 31.3        | C        |
|  | NB           | TR         | 0.66                         | 5.7             | A        | 0.86                     | 13.5        | B        |
|  | SB           | L          | 0.21                         | 24.8            | C        | 0.34                     | 40.4        | D        |
|  |              | T          | 0.34                         | 14.9            | B        | 0.57                     | 18.7        | B        |
| <b>Overall</b>   |              |            | *                            | <b>12.2</b>     | <b>B</b> | *                        | <b>17.3</b> | <b>B</b> |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln                                 | EB           | LTR        | 0.54                         | 40.3            | D        | 0.41                     | 32.9        | C        |
|  | WB           | R          | 0.13                         | 32.1            | C        | 0.10                     | 27.1        | C        |
|  | NB           | T          | 0.54                         | 3.9             | A        | 0.71                     | 5.2         | A        |
|  | SB           | T          | 0.38                         | 9.1             | A        | --                       | --          | --       |
|  |              | R          | 0.19                         | 0.3             | A        | --                       | --          | --       |
| TR   |              | --         | --                           | --              | 0.65     | 9.8                      | A           |          |
| <b>Overall</b>   |              |            | *                            | <b>8.8</b>      | <b>A</b> | *                        | <b>9.7</b>  | <b>A</b> |
| Woodhaven Blvd at Metropolitan Ave   | EB           | LT         | 0.30                         | 22.4            | C        | 0.33                     | 28.4        | C        |
|  |              | R          | 0.25                         | 22.4            | C        | 0.28                     | 28.4        | C        |
|  | WB           | LTR        | 0.51                         | 26.2            | C        | 0.56                     | 33.4        | C        |
|  |              | L          | 0.61                         | 52.7            | D        | 0.52                     | 42.4        | D        |
|  | NB           | T          | 0.75                         | 19.5            | B        | 0.80                     | 12.1        | B        |
|  |              | R          | --                           | --              | --       | 0.25                     | 9.0         | C        |
|  | SB           | L          | 0.83                         | 78.6            | E        | 0.70                     | 43.4        | D        |
| TR   |              | 0.71       | 22.8                         | C               | 0.82     | 15.3                     | B           |          |
| <b>Overall</b>   |              |            | *                            | <b>25.1</b>     | <b>C</b> | *                        | <b>19.8</b> | <b>B</b> |
| Woodhaven Blvd at Union Tpke   | EB           | LTR        | 0.37                         | 34.6            | C        | 0.30                     | 31.1        | C        |
|  | WB (main)    | L          | 0.54                         | 26.4            | C        | 0.48                     | 23.3        | C        |
|  |              | TR         | 0.27                         | 23.1            | C        | 0.24                     | 20.9        | C        |
|  | WB (service) | R          | 0.14                         | 21.5            | C        | 0.13                     | 19.5        | B        |
|  | NB (main)    | T          | 0.89                         | 30.1            | C        | 0.98                     | 30.3        | C        |
|  | NB (service) | TR         | 0.55                         | 14.5            | B        | 0.60                     | 13.9        | B        |
|  | SB (main)    | LT         | 0.79                         | 16.7            | B        | 0.87                     | 32.3        | C        |
|  |              | TR         | 0.05                         | 15.7            | B        | --                       | --          | --       |
|  | SB (service) | R          | --                           | --              | --       | 0.10                     | 28.5        | A        |
| <b>Overall</b>   |              |            | *                            | <b>22.2</b>     | <b>C</b> | *                        | <b>27.4</b> | <b>C</b> |
| Woodhaven Blvd at Myrtle Ave   | EB           | LTR        | 0.49                         | 35.8            | D        | 0.32                     | 23.6        | C        |
|  | WB           | LTR        | 0.69                         | 39.7            | D        | 0.48                     | 26.2        | C        |
|  | NB           | L          | 0.65                         | 86.4            | F        | 0.73                     | 48.9        | D        |
|  |              | TR         | 0.61                         | 33.2            | C        | 0.82                     | 16.0        | B        |
|  | SB (main)    | L          | 0.76                         | 61.3            | E        | 0.85                     | 72.1        | E        |
|  |              | T          | 0.61                         | 49.4            | D        | 0.83                     | 55.9        | E        |
|  | SB (service) | TR         | 0.51                         | 48.8            | D        | 0.69                     | 53.5        | D        |
| <b>Overall</b>   |              |            | *                            | <b>42.8</b>     | <b>D</b> | *                        | <b>34.9</b> | <b>C</b> |
| Woodhaven Blvd at Jamaica Ave  | EB           | LTR        | 0.44                         | 32.4            | C        | --                       | --          | --       |
|  |              | TR         | --                           | --              | --       | 0.34                     | 34.2        | C        |
|  | WB           | LTR        | 0.61                         | 38.0            | D        | 0.65                     | 44.5        | D        |
|  | NB (main)    | L          | 0.37                         | 33.9            | C        | 0.39                     | 42.5        | D        |
|  |              | T          | 0.71                         | 43.4            | D        | 0.66                     | 52.4        | D        |
|  | NB (service) | TR         | 0.45                         | 29.5            | C        | 0.42                     | 25.2        | C        |
|  | SB (main)    | L          | 0.35                         | 53.4            | D        | 0.37                     | 51.4        | D        |
|  |              | T          | 0.51                         | 58.7            | E        | 0.47                     | 6.5         | A        |
| SB (service)   | TR           | 0.61       | 61.8                         | E               | 0.57     | 8.1                      | A           |          |
| <b>Overall</b>   |              |            | *                            | <b>46.9</b>     | <b>D</b> | *                        | <b>30.5</b> | <b>C</b> |
| Woodhaven Blvd SB Service Road at Atlantic Ave                                   | EB           | TR         | 0.40                         | 18.2            | B        | 0.40                     | 26.0        | C        |
|  | WB           | L          | 0.46                         | 14.3            | B        | 0.49                     | 19.9        | B        |
|  |              | T          | 0.30                         | 4.8             | A        | 0.24                     | 5.3         | A        |
|  | SB (service) | LTR        | 0.46                         | 23.3            | C        | --                       | --          | --       |
|  |              | L          | --                           | --              | --       | 0.25                     | 13.2        | B        |
|  |              | T          | --                           | --              | --       | 0.68                     | 23.4        | C        |
|  | R            | --         | --                           | --              | 0.39     | 15.5                     | B           |          |
| <b>Overall</b>   |              |            | *                            | <b>15.2</b>     | <b>B</b> | *                        | <b>17.8</b> | <b>B</b> |
| Woodhaven Blvd NB Service Road at Atlantic Ave                                   | EB           | L          | 0.49                         | 12.1            | B        | 0.49                     | 20.9        | C        |
|  |              | T          | 0.36                         | 3.7             | A        | 0.29                     | 4.3         | A        |
|  | WB           | TR         | 0.34                         | 16.9            | B        | 0.34                     | 12.5        | B        |
|  |              | LTR        | 0.20                         | 20.1            | C        | --                       | --          | --       |
|  | NB (service) | L          | --                           | --              | --       | 0.19                     | 35.8        | D        |
|  | TR           | --         | --                           | --              | 0.39     | 40.9                     | D           |          |
| <b>Overall</b>   |              |            | *                            | <b>12.0</b>     | <b>B</b> | *                        | <b>13.7</b> | <b>B</b> |

| Table 4.1-2: Year 2017 Traffic Conditions - Future with and without Improvements |                |            |                              |             |             |                          |                 |             |
|--|----------------|------------|------------------------------|-------------|-------------|--------------------------|-----------------|-------------|
| Intersection   | Approach       | Lane Group | Weekday MD (1:00 to 2:00 PM) |             |             |                          |                 |             |
|  |                |            | Future without Improvements  |             |             | Future with Improvements |                 |             |
|  |                |            | Preferred Alternative        |             |             | v/c                      | Delay (sec/veh) | LOS         |
| Woodhaven Blvd at Rockaway Blvd  | EB             | LTR        | 0.29                         | 6.3         | A           | --                       | --              | --          |
|  |                | TR         | --                           | --          | --          | 0.29                     | 87.5            | F           |
|  | WB             | LTR        | 0.63                         | 26.0        | C           | --                       | --              | --          |
|  |                | L          | --                           | --          | --          | 0.32                     | 32.2            | C           |
|  | NB             | L          | 0.74                         | 146.2       | F           | 0.78                     | 140.2           | F           |
|  |                | TR         | 0.44                         | 3.7         | A           | 0.43                     | 8.1             | A           |
|  | SB (main)      | L          | 0.69                         | 42.1        | D           | 0.76                     | 62.5            | E           |
|  |                | T          | 0.82                         | 63.7        | E           | 0.84                     | 17.7            | B           |
|  | SB (service)   | TR         | 0.28                         | 24.6        | C           | 0.28                     | 23.8            | C           |
| <b>Overall</b>   |                |            | *                            | <b>34.8</b> | <b>C</b>    | *                        | <b>32.3</b>     | <b>C</b>    |
| Woodhaven Blvd at Liberty Ave/ 94 St   | EB             | LTR        | 0.48                         | 40.0        | D           | --                       | --              | --          |
|  |                | R          | --                           | --          | --          | 0.12                     | 28.8            | C           |
|  | NB             | TR         | 0.53                         | 27.9        | C           | 0.45                     | 23.1            | C           |
|  | SB (main)      | T          | 0.52                         | 5.4         | A           | 0.51                     | 6.0             | A           |
|  | SB (94 St)     | TR         | 0.31                         | 21.0        | C           | 0.31                     | 21.0            | C           |
| <b>Overall</b>   |                |            | *                            | <b>17.9</b> | <b>B</b>    | *                        | <b>14.7</b>     | <b>B</b>    |
| Rockaway Blvd at 94 St   | EB             | TR         | 0.29                         | 23.8        | C           | 0.36                     | 21.4            | C           |
|  | WB             | LT         | 0.34                         | 2.7         | A           | 0.34                     | 32.2            | C           |
|  | SB             | LTR        | 0.27                         | 33.3        | C           | 0.27                     | 33.2            | C           |
|  | <b>Overall</b> |            |                              | *           | <b>14.8</b> | <b>B</b>                 | *               | <b>27.7</b> |
| Rockaway Blvd at 93 St   | EB             | LT         | 0.17                         | 10.9        | B           | --                       | --              | --          |
|  |                | L          | --                           | --          | --          | 0.10                     | 10.9            | B           |
|  |                | T          | --                           | --          | --          | 0.27                     | 12.2            | B           |
|  | WB             | TR         | 0.22                         | 17.5        | B           | --                       | --              | --          |
|  |                | T          | --                           | --          | --          | 0.38                     | 64.7            | E           |
|  |                | R          | --                           | --          | --          | 0.06                     | 25.0            | C           |
|  | NB             | LTR        | 0.27                         | 32.7        | C           | 0.58                     | 35.5            | D           |
| <b>Overall</b>   |                |            | *                            | <b>17.8</b> | <b>B</b>    | *                        | <b>38.9</b>     | <b>D</b>    |
| Liberty Ave at 93 St   | EB             | LT         | 0.28                         | 8.7         | A           | 0.43                     | 11.0            | B           |
|  | WB             | TR         | 0.09                         | 2.1         | A           | 0.09                     | 7.2             | A           |
|  | NB             | LTR        | 0.25                         | 14.5        | B           | 0.25                     | 14.6            | B           |
|  | <b>Overall</b> |            |                              | *           | <b>9.4</b>  | <b>A</b>                 | *               | <b>11.5</b> |
| Rockaway Blvd at Liberty Ave   | EB             | T          | 0.31                         | 13.6        | B           | 0.41                     | 34.2            | C           |
|  | WB             | T          | 0.17                         | 0.1         | A           | 0.17                     | 0.1             | A           |
|  | NEB            | T          | 0.36                         | 21.8        | C           | 0.18                     | 30.0            | C           |
|  | <b>Overall</b> |            |                              | *           | <b>9.0</b>  | <b>A</b>                 | --              | <b>17.8</b> |
| Rockaway Blvd at Liberty Ave & 96 St   | EB             | L          | 0.76                         | 100.7       | F           | 0.76                     | 126.2           | F           |
|  |                | T          | 0.18                         | 0.8         | A           | 0.18                     | 0.7             | A           |
|  | WB             | TR         | 0.37                         | 30.9        | C           | 0.37                     | 30.9            | C           |
|  | NB             | LTR        | 0.29                         | 38.2        | D           | 0.29                     | 38.2            | D           |
|  | SWB            | TR         | 0.47                         | 37.2        | D           | 0.47                     | 37.2            | D           |
|  | <b>Overall</b> |            |                              | *           | <b>31.8</b> | <b>C</b>                 | *               | <b>35.3</b> |
| <b>UNSIGNALIZED INTERSECTIONS</b>  |                |            |                              |             |             |                          |                 |             |
| Liberty Ave at 95 St   | EB             | T          | 0.15                         | 0.0         | A           | 0.08                     | 0.0             | A           |
|  |                | R          | 0.01                         | 0.0         | A           | 0.01                     | 0.0             | A           |
|  | <b>Overall</b> |            |                              | *           | *           | *                        | --              | --          |

NB = northbound, SB = southbound, EB = eastbound, WB = westbound, NEB = northeastbound, SWB = southwestbound  
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn  
v/c = volume-to-capacity ratio, LOS = Level-of-Service  
All Intersection Lane Groups: Delay >=45.0 (mid-LOS D or worse)

| Table 4.1-3: Year 2017 Traffic Conditions - Future with and without Improvements |              |            |                              |                 |          |                          |                 |          |
|--|--------------|------------|------------------------------|-----------------|----------|--------------------------|-----------------|----------|
| Intersection   | Approach     | Lane Group | Weekday PM (4:30 to 5:30 PM) |                 |          |                          |                 |          |
|  |              |            | Future without Improvements  |                 |          | Future with Improvements |                 |          |
|  |              |            | Preferred Alternative        |                 |          | v/c                      | Delay (sec/veh) | LOS      |
|  |              |            | v/c                          | Delay (sec/veh) | LOS      | v/c                      | Delay (sec/veh) | LOS      |
| <b>SIGNALIZED INTERSECTIONS</b>  |              |            |                              |                 |          |                          |                 |          |
| Woodhaven Blvd at Queens Blvd North Service Road                                 | WB           | L          | 0.54                         | 32.6            | C        | 0.54                     | 38.8            | D        |
|  |              | LT         | 0.70                         | 34.8            | C        | 0.72                     | 41.4            | D        |
|  |              | R          | 0.35                         | 29.4            | C        | 0.37                     | 33.8            | C        |
|  | NB           | L          | 0.46                         | 61.2            | E        | 0.43                     | 9.8             | A        |
|  |              | T          | 0.20                         | 2.4             | A        | 0.20                     | 3.3             | A        |
| <b>Overall</b>   |              |            | *                            | <b>37.4</b>     | <b>D</b> | *                        | <b>24.9</b>     | <b>C</b> |
| Woodhaven Blvd at Queens Blvd South Service Road                                 | EB           | L          | 0.16                         | 21.5            | C        | 0.17                     | 25.1            | C        |
|  |              | T          | 0.86                         | 38.3            | D        | 0.89                     | 44.9            | D        |
|  |              | R          | 0.57                         | 30.8            | C        | 0.59                     | 36.0            | D        |
|  | NB           | TR         | 0.96                         | 36.0            | D        | 1.11                     | 43.6            | D        |
|  | SB           | L          | 0.31                         | 26.5            | C        | 0.21                     | 36.6            | D        |
|  |              | LT         | 0.17                         | 23.7            | C        | 0.15                     | 42.9            | D        |
| <b>Overall</b>   |              |            | *                            | <b>34.7</b>     | <b>C</b> | *                        | <b>42.6</b>     | <b>D</b> |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                               | EB           | L          | 1.14                         | 124.2           | F        | 0.81                     | 44.7            | D        |
|  |              | R          | 1.05                         | 85.0            | F        | 0.75                     | 36.7            | D        |
|  | WB           | LTR        | 0.09                         | 30.9            | C        | 0.06                     | 23.6            | C        |
|  | NB           | T          | 0.50                         | 11.8            | B        | 0.61                     | 11.0            | B        |
|  | SB           | T          | 0.51                         | 14.3            | B        | 0.78                     | 29.5            | C        |
| <b>Overall</b>   |              |            | *                            | <b>35.9</b>     | <b>D</b> | *                        | <b>25.3</b>     | <b>C</b> |
| Woodhaven Blvd at Eliot Ave/ 86 St   | EB           | LR         | 0.66                         | 41.8            | D        | --                       | --              | --       |
|  |              | L          | --                           | --              | --       | 0.46                     | 38.7            | D        |
|  |              | R          | --                           | --              | --       | 0.21                     | 34.2            | C        |
|  | NB           | T          | 0.68                         | 5.4             | A        | 0.67                     | 5.0             | A        |
|  | SB           | TR         | 0.97                         | 37.0            | D        | 0.99                     | 66.7            | E        |
| <b>Overall</b>   |              |            | *                            | <b>25.6</b>     | <b>C</b> | *                        | <b>41.7</b>     | <b>D</b> |
| Woodhaven Blvd at Dry Harbor Rd  | EB           | LR         | 0.39                         | 33.7            | C        | 0.35                     | 33.3            | C        |
|  | NB           | L          | 0.53                         | 47.5            | D        | 0.59                     | 87.8            | F        |
|  |              | T          | 0.56                         | 1.9             | A        | 0.71                     | 29.1            | C        |
|  | SB           | TR         | 0.83                         | 18.3            | B        | 0.95                     | 65.9            | E        |
| <b>Overall</b>   |              |            | *                            | <b>13.1</b>     | <b>B</b> | *                        | <b>47.9</b>     | <b>D</b> |
| Woodhaven Blvd at Yellowstone Blvd   | WB           | LR         | 0.89                         | 64.6            | E        | 0.57                     | 93.5            | F        |
|  | NB           | TR         | 0.67                         | 5.2             | A        | 0.92                     | 15.8            | B        |
|  | SB           | L          | 0.22                         | 17.0            | B        | 0.38                     | 15.1            | B        |
|  |              | T          | 0.56                         | 1.6             | A        | 0.97                     | 42.3            | D        |
| <b>Overall</b>   |              |            | *                            | <b>8.0</b>      | <b>A</b> | *                        | <b>35.3</b>     | <b>D</b> |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln                                 | EB           | LTR        | 0.72                         | 52.5            | D        | 0.46                     | 36.3            | D        |
|  | WB           | R          | 0.18                         | 38.1            | D        | 0.12                     | 29.2            | C        |
|  | NB           | T          | 0.54                         | 3.6             | A        | 0.75                     | 3.8             | A        |
|  | SB           | T          | 0.70                         | 5.4             | A        | --                       | --              | --       |
|  |              | R          | 0.22                         | 0.6             | A        | --                       | --              | --       |
|  |              | TR         | --                           | --              | --       | 1.15                     | 82.4            | F        |
| <b>Overall</b>   |              |            | *                            | <b>7.7</b>      | <b>A</b> | *                        | <b>52.3</b>     | <b>D</b> |
| Woodhaven Blvd at Metropolitan Ave   | EB           | LT         | 0.55                         | 42.0            | D        | 0.42                     | 37.0            | D        |
|  |              | R          | 0.74                         | 55.2            | E        | 0.56                     | 43.0            | D        |
|  | WB           | LTR        | 0.62                         | 45.4            | D        | 0.45                     | 38.0            | D        |
|  |              | L          | 0.73                         | 68.8            | E        | 0.82                     | 80.7            | F        |
|  | NB           | T          | 0.60                         | 15.7            | B        | 0.83                     | 28.9            | C        |
|  |              | R          | --                           | --              | --       | 0.02                     | 10.3            | C        |
|  | SB           | L          | 0.79                         | 55.8            | E        | 0.89                     | 36.5            | D        |
|  |              | TR         | 0.93                         | 14.8            | B        | 1.25                     | 142.7           | F        |
| <b>Overall</b>   |              |            | *                            | <b>23.7</b>     | <b>C</b> | *                        | <b>84.9</b>     | <b>F</b> |
| Woodhaven Blvd at Union Tpke   | EB           | LTR        | 0.66                         | 42.5            | D        | 0.52                     | 35.3            | D        |
|  | WB (main)    | L          | 1.03                         | 87.5            | F        | 1.01                     | 83.3            | F        |
|  |              | TR         | 0.43                         | 29.0            | C        | 0.37                     | 26.0            | C        |
|  | WB (service) | R          | 0.12                         | 23.9            | C        | 0.10                     | 21.7            | C        |
|  | NB (main)    | T          | 1.04                         | 82.2            | F        | 1.12                     | 80.4            | F        |
|  | NB (service) | TR         | 0.71                         | 52.8            | D        | 0.76                     | 12.1            | B        |
|  | SB (main)    | LT         | 1.27                         | 143.1           | F        | 1.42                     | 206.9           | F        |
|  | SB (service) | TR         | 0.08                         | 13.5            | B        | --                       | --              | --       |
|  |              | R          | --                           | --              | --       | 0.17                     | 29.7            | C        |
| <b>Overall</b>   |              |            | *                            | <b>97.2</b>     | <b>F</b> | *                        | <b>118.0</b>    | <b>F</b> |
| Woodhaven Blvd at Myrtle Ave   | EB           | LTR        | 0.81                         | 55.3            | E        | 0.57                     | 40.7            | D        |
|  | WB           | LTR        | 0.88                         | 56.8            | E        | 0.68                     | 42.9            | D        |
|  | NB           | L          | 0.55                         | 43.9            | D        | 0.62                     | 65.1            | E        |
|  |              | TR         | 0.71                         | 7.1             | A        | 0.78                     | 17.9            | B        |
|  | SB (main)    | L          | 1.03                         | 83.7            | F        | 1.16                     | 121.7           | F        |
|  |              | T          | 1.15                         | 91.9            | F        | 1.27                     | 159.6           | F        |
|  | SB (service) | TR         | 1.16                         | 98.9            | F        | 1.30                     | 171.4           | F        |
| <b>Overall</b>   |              |            | *                            | <b>62.5</b>     | <b>E</b> | *                        | <b>100.8</b>    | <b>F</b> |
| Woodhaven Blvd at Jamaica Ave  | EB           | LTR        | 0.60                         | 43.0            | D        | --                       | --              | --       |
|  |              | TR         | --                           | --              | --       | 0.43                     | 40.1            | D        |
|  | WB           | LTR        | 0.66                         | 45.7            | D        | 0.64                     | 47.9            | D        |
|  | NB (main)    | L          | 0.32                         | 73.0            | E        | 0.36                     | 80.8            | F        |
|  |              | T          | 0.68                         | 35.4            | D        | 0.65                     | 32.9            | C        |
|  | NB (service) | TR         | 0.40                         | 27.2            | C        | 0.39                     | 23.7            | C        |
|  | SB (main)    | L          | 0.35                         | 33.2            | C        | 0.40                     | 34.7            | C        |
|  |              | T          | 0.77                         | 7.0             | A        | 0.74                     | 7.7             | A        |
| SB (service)   | TR           | 1.01       | 26.7                         | C               | 1.00     | 24.5                     | C               |          |
| <b>Overall</b>   |              |            | *                            | <b>25.2</b>     | <b>C</b> | *                        | <b>24.1</b>     | <b>C</b> |
| Woodhaven Blvd SB Service Road at Atlantic Ave                                   | EB           | TR         | 0.38                         | 15.8            | B        | 0.56                     | 35.4            | D        |
|  | WB           | L          | 0.53                         | 18.2            | B        | 0.87                     | 66.3            | E        |
|  |              | T          | 0.37                         | 4.6             | A        | 0.39                     | 6.3             | A        |
|  | SB (service) | LTR        | 0.88                         | 72.9            | E        | --                       | --              | --       |
|  |              | L          | --                           | --              | --       | 0.30                     | 10.8            | B        |
|  |              | T          | --                           | --              | --       | 0.97                     | 39.6            | D        |
|  | R            | --         | --                           | --              | 0.22     | 9.3                      | A               |          |
| <b>Overall</b>   |              |            | *                            | <b>29.5</b>     | <b>C</b> | *                        | <b>27.1</b>     | <b>C</b> |
| Woodhaven Blvd NB Service Road at Atlantic Ave                                   | EB           | L          | 0.39                         | 9.0             | A        | 0.92                     | 130.3           | F        |
|  |              | T          | 0.44                         | 5.9             | A        | 0.48                     | 10.1            | B        |
|  | WB           | TR         | 0.34                         | 15.4            | B        | 0.43                     | 27.1            | C        |
|  |              | LTR        | 0.42                         | 27.8            | C        | --                       | --              | --       |
|  | NB (service) | L          | --                           | --              | --       | 0.20                     | 8.2             | A        |
|  |              | TR         | --                           | --              | --       | 0.50                     | 10.9            | B        |
| <b>Overall</b>   |              |            | *                            | <b>13.1</b>     | <b>B</b> | *                        | <b>23.4</b>     | <b>C</b> |

| Table 4.1-3: Year 2017 Traffic Conditions - Future with and without Improvements |                |                |                              |                 |             |                          |                 |             |
|--|----------------|----------------|------------------------------|-----------------|-------------|--------------------------|-----------------|-------------|
| Intersection   | Approach       | Lane Group     | Weekday PM (4:30 to 5:30 PM) |                 |             |                          |                 |             |
|  |                |                | Future without Improvements  |                 |             | Future with Improvements |                 |             |
|  |                |                | Preferred Alternative        |                 |             |                          |                 |             |
|  |                |                | v/c                          | Delay (sec/veh) | LOS         | v/c                      | Delay (sec/veh) | LOS         |
| Woodhaven Blvd at Rockaway Blvd  | EB             | LTR            | 0.63                         | 18.8            | B           | --                       | --              | --          |
|  |                | TR             | --                           | --              | --          | 0.49                     | 92.9            | F           |
|  | WB             | LTR            | 0.88                         | 89.8            | F           | --                       | --              | --          |
|  |                | L              | --                           | --              | --          | 0.60                     | 53.6            | D           |
|  | NB             | TR             | --                           | --              | --          | 0.44                     | 42.5            | D           |
|  |                | L              | 0.93                         | 145.6           | F           | 0.94                     | 128.8           | F           |
|  | SB (main)      | TR             | 0.62                         | 3.1             | A           | 0.65                     | 13.8            | B           |
|  |                | L              | 0.99                         | 79.0            | E           | 1.05                     | 118.4           | F           |
|  | SB (service)   | T              | 0.95                         | 20.9            | C           | 1.01                     | 58.4            | E           |
|  | TR             | 0.55           | 33.8                         | C               | 0.58        | 19.4                     | B               |             |
|  | <b>Overall</b> |                | *                            | <b>32.7</b>     | <b>C</b>    | *                        | <b>48.1</b>     | <b>D</b>    |
| Woodhaven Blvd at Liberty Ave/ 94 St   | EB             | LTR            | 0.72                         | 44.0            | D           | --                       | --              | --          |
|  |                | R              | --                           | --              | --          | 0.18                     | 35.8            | D           |
|  | NB             | TR             | 0.80                         | 35.0            | C           | 0.63                     | 21.0            | C           |
|  | SB (main)      | T              | 0.65                         | 5.6             | A           | 0.63                     | 7.4             | A           |
|  | SB (94 St)     | TR             | 0.32                         | 22.4            | C           | 0.31                     | 16.6            | B           |
|  | <b>Overall</b> |                | *                            | <b>22.3</b>     | <b>C</b>    | *                        | <b>14.9</b>     | <b>B</b>    |
| Rockaway Blvd at 94 St   | EB             | TR             | 0.50                         | 63.8            | E           | 0.63                     | 54.9            | D           |
|  | WB             | LT             | 0.76                         | 81.2            | F           | 0.85                     | 82.0            | F           |
|  | SB             | LTR            | 0.18                         | 20.2            | C           | 0.18                     | 20.1            | C           |
|  |                | <b>Overall</b> |                              | *               | <b>68.0</b> | <b>E</b>                 | *               | <b>63.7</b> |
| Rockaway Blvd at 93 St   | EB             | LT             | 0.29                         | 17.6            | B           | --                       | --              | --          |
|  |                | L              | --                           | --              | --          | 0.27                     | 20.6            | C           |
|  |                | T              | --                           | --              | --          | 0.46                     | 20.8            | C           |
|  | WB             | TR             | 0.34                         | 49.7            | D           | --                       | --              | --          |
|  |                | T              | --                           | --              | --          | 0.58                     | 111.6           | F           |
|  |                | R              | --                           | --              | --          | 0.10                     | 39.5            | D           |
|  | NB             | LTR            | 0.22                         | 24.8            | C           | 0.56                     | 27.5            | C           |
|  | <b>Overall</b> |                | *                            | <b>33.7</b>     | <b>C</b>    | *                        | <b>56.2</b>     | <b>E</b>    |
| Liberty Ave at 93 St   | EB             | LT             | 0.33                         | 9.1             | A           | 0.49                     | 12.0            | B           |
|  | WB             | TR             | 0.10                         | 8.1             | A           | 0.10                     | 7.3             | A           |
|  | NB             | LTR            | 0.28                         | 14.8            | B           | 0.28                     | 14.9            | B           |
|  |                | <b>Overall</b> |                              | *               | <b>10.6</b> | <b>B</b>                 | *               | <b>12.1</b> |
| Rockaway Blvd at Liberty Ave   | EB             | T              | 0.54                         | 11.2            | B           | 0.71                     | 89.0            | F           |
|  | WB             | T              | 0.18                         | 0.1             | A           | 0.18                     | 0.1             | A           |
|  | NEB            | T              | 0.69                         | 30.0            | C           | 0.41                     | 34.5            | C           |
|  |                | <b>Overall</b> |                              | *               | <b>12.5</b> | <b>B</b>                 | --              | <b>48.4</b> |
| Rockaway Blvd at Liberty Ave & 96 St   | EB             | L              | 0.90                         | 115.5           | F           | 0.90                     | 123.0           | F           |
|  |                | T              | 0.37                         | 1.1             | A           | 0.37                     | 1.0             | A           |
|  | WB             | TR             | 0.44                         | 32.0            | C           | 0.44                     | 32.0            | C           |
|  | NB             | LTR            | 0.26                         | 37.5            | D           | 0.26                     | 37.5            | D           |
|  | SWB            | TR             | 0.54                         | 39.3            | D           | 0.54                     | 39.3            | D           |
|  |                | <b>Overall</b> |                              | *               | <b>26.9</b> | <b>C</b>                 | *               | <b>27.6</b> |
| <b>UNSIGNALIZED INTERSECTIONS</b>  |                |                |                              |                 |             |                          |                 |             |
| Liberty Ave at 95 St   | EB             | T              | 0.31                         | 0.0             | A           | 0.18                     | 0.0             | A           |
|  |                | R              | 0.02                         | 0.0             | A           | 0.02                     | 0.0             | A           |
|  |                | <b>Overall</b> |                              | *               | *           | *                        | --              | --          |

NB = northbound, SB = southbound, EB = eastbound, WB = westbound, NEB = northeastbound, SWB = southwestbound  
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn  
v/c = volume-to-capacity ratio, LOS = Level-of-Service  
All Intersection Lane Groups: Delay >=45.0 (mid-LOS D or worse)

Table 4.1-4: Year 2017 Traffic Conditions - Future with and without Improvements

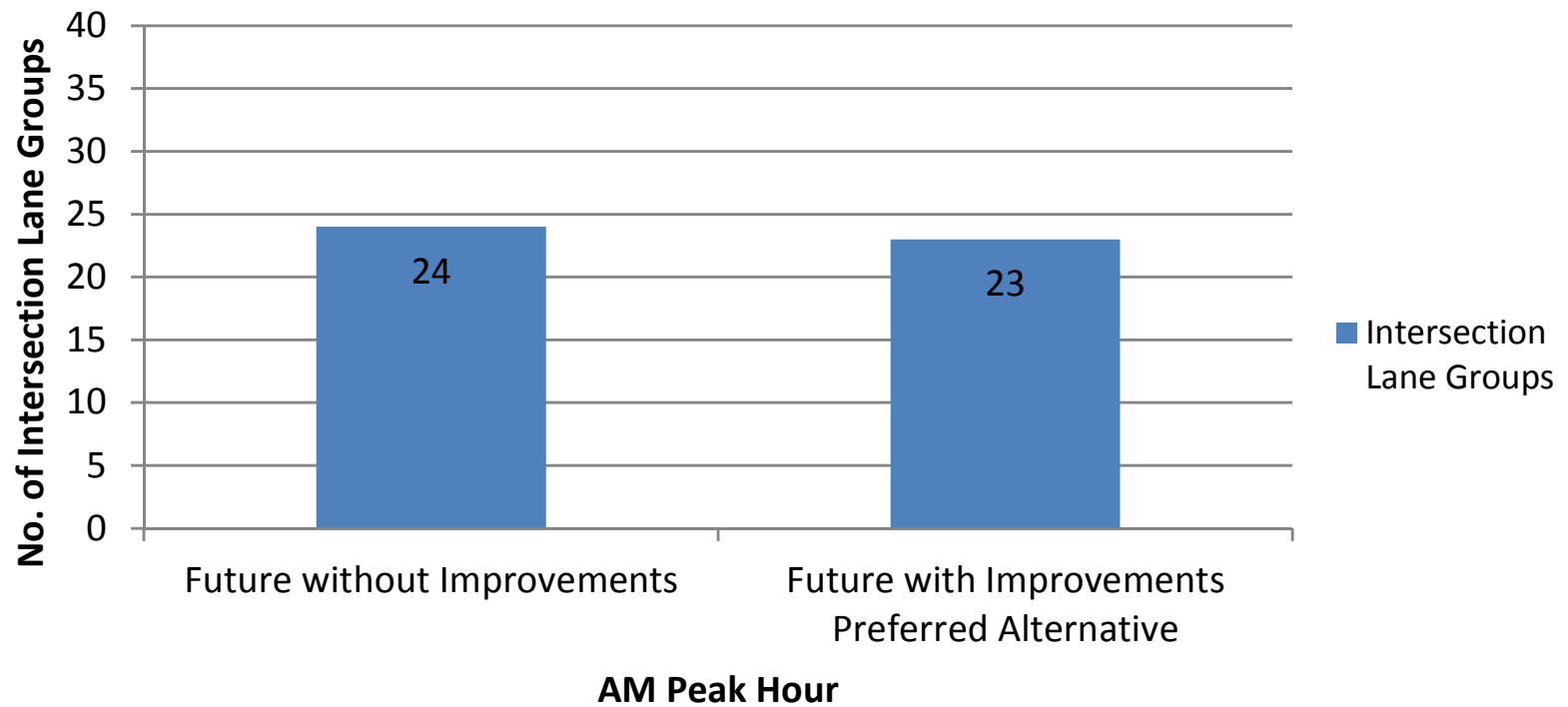
| Intersection                                       | Approach        | Lane Group | Weekday SAT (12:45 to 1:45 PM) |                 |          |                          |             |          |
|--|-----------------|------------|--------------------------------|-----------------|----------|--------------------------|-------------|----------|
|  |                 |            | Future without Improvements    |                 |          | Future with Improvements |             |          |
|  |                 |            | v/c                            | Delay (sec/veh) | LOS      | Preferred Alternative    |             |          |
| v/c  | Delay (sec/veh) | LOS        | v/c                            | Delay (sec/veh) | LOS      |                          |             |          |
| <b>SIGNALIZED INTERSECTIONS</b>                    |                 |            |                                |                 |          |                          |             |          |
| Woodhaven Blvd at Queens Blvd North Service Road   | WB              | L          | 0.37                           | 25.0            | C        | 0.37                     | 27.7        | C        |
|  |                 | LT         | 0.97                           | 57.4            | E        | 0.96                     | 70.8        | E        |
|  |                 | R          | 0.51                           | 29.2            | C        | 0.51                     | 31.9        | C        |
|  | NB              | L          | 0.91                           | 69.7            | E        | 0.89                     | 72.0        | E        |
|  |                 | T          | 0.32                           | 7.2             | A        | 0.31                     | 17.5        | B        |
| <b>Overall</b>                                     |                 |            | *                              | <b>50.4</b>     | <b>D</b> | *                        | <b>57.9</b> | <b>E</b> |
| Woodhaven Blvd at Queens Blvd South Service Road   | EB              | L          | 0.39                           | 25.2            | C        | 0.42                     | 33.2        | C        |
|  |                 | T          | 0.80                           | 34.8            | C        | 0.87                     | 45.5        | D        |
|  |                 | R          | 0.47                           | 27.8            | C        | 0.52                     | 35.1        | D        |
|  | NB              | TR         | 1.04                           | 100.4           | F        | 0.90                     | 31.6        | C        |
|  | SB              | L          | 0.31                           | 32.8            | C        | 0.35                     | 74.8        | E        |
| LT   |                 | 0.13       | 25.5                           | C               | 0.13     | 25.8                     | C           |          |
| <b>Overall</b>                                     |                 |            | *                              | <b>67.0</b>     | <b>E</b> | *                        | <b>37.9</b> | <b>D</b> |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St | EB              | L          | 0.63                           | 46.4            | D        | 0.63                     | 51.5        | D        |
|  |                 | R          | 0.59                           | 37.6            | D        | 0.59                     | 41.8        | D        |
|  | WB              | LTR        | 0.24                           | 35.2            | D        | 0.24                     | 39.5        | D        |
|  | NB              | T          | 0.49                           | 4.0             | A        | 0.48                     | 3.3         | A        |
|  | SB              | T          | 0.30                           | 9.7             | A        | 0.37                     | 13.5        | B        |
| <b>Overall</b>                                     |                 |            | *                              | <b>12.9</b>     | <b>B</b> | *                        | <b>14.6</b> | <b>B</b> |
| Woodhaven Blvd at Eliot Ave/ 86 St                 | EB              | LR         | 0.88                           | 55.1            | E        | --                       | --          | --       |
|  |                 | L          | --                             | --              | --       | 0.67                     | 43.7        | D        |
|  |                 | R          | --                             | --              | --       | 0.19                     | 33.2        | C        |
|  | NB              | T          | 0.55                           | 3.4             | A        | 0.55                     | 1.7         | A        |
|  | SB              | TR         | 0.61                           | 17.2            | B        | 0.63                     | 9.1         | A        |
| <b>Overall</b>                                     |                 |            | *                              | <b>16.5</b>     | <b>B</b> | *                        | <b>10.4</b> | <b>B</b> |
| Woodhaven Blvd at Dry Harbor Rd                    | EB              | LR         | 0.33                           | 32.6            | C        | 0.30                     | 32.2        | C        |
|  | NB              | L          | 0.46                           | 41.8            | D        | 0.21                     | 47.7        | D        |
|  |                 | T          | 0.50                           | 0.4             | A        | 0.81                     | 11.1        | B        |
|  | SB              | TR         | 0.53                           | 10.0            | A        | 0.86                     | 42.0        | D        |
| <b>Overall</b>                                     |                 |            | *                              | <b>7.4</b>      | <b>A</b> | *                        | <b>27.4</b> | <b>C</b> |
| Woodhaven Blvd at Yellowstone Blvd                 | WB              | LR         | 0.62                           | 41.7            | D        | 0.47                     | 33.4        | C        |
|  | NB              | TR         | 0.74                           | 10.5            | B        | 0.87                     | 15.6        | B        |
|  | SB              | L          | 0.45                           | 33.2            | C        | 0.48                     | 43.9        | D        |
|  |                 | T          | 0.32                           | 1.8             | A        | 0.53                     | 12.5        | B        |
| <b>Overall</b>                                     |                 |            | *                              | <b>10.7</b>     | <b>B</b> | *                        | <b>44.2</b> | <b>D</b> |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln   | EB              | LTR        | 0.45                           | 37.5            | D        | 0.34                     | 31.9        | C        |
|  | WB              | R          | 0.10                           | 31.8            | C        | 0.08                     | 26.9        | C        |
|  | NB              | T          | 0.63                           | 4.7             | A        | 5.70                     | 6.2         | A        |
|  | SB              | T          | 0.42                           | 5.8             | A        | --                       | --          | --       |
|  |                 | R          | 0.10                           | 0.1             | A        | --                       | --          | --       |
| TR   |                 | --         | --                             | --              | 0.66     | 12.9                     | B           |          |
| <b>Overall</b>                                     |                 |            | *                              | <b>7.2</b>      | <b>A</b> | *                        | <b>30.8</b> | <b>C</b> |
| Woodhaven Blvd at Metropolitan Ave                 | EB              | LT         | 0.28                           | 22.0            | C        | 0.28                     | 25.1        | C        |
|  |                 | R          | 0.21                           | 21.8            | C        | 0.21                     | 24.8        | C        |
|  | WB              | LTR        | 0.51                           | 26.0            | C        | 0.52                     | 29.8        | C        |
|  |                 | L          | 1.01                           | 116.9           | F        | 1.00                     | 90.3        | F        |
|  |                 | T          | 0.92                           | 48.9            | D        | 0.82                     | 20.9        | C        |
|  | NB              | R          | --                             | --              | --       | 0.22                     | 10.9        | D        |
|  |                 | L          | 0.97                           | 84.1            | F        | 0.96                     | 74.0        | E        |
| SB   | TR              | 0.73       | 16.2                           | B               | 0.86     | 19.0                     | B           |          |
| <b>Overall</b>                                     |                 |            | *                              | <b>38.0</b>     | <b>D</b> | *                        | <b>36.4</b> | <b>D</b> |
| Woodhaven Blvd at Union Tpke                       | EB              | LTR        | 0.47                           | 37.8            | D        | 0.36                     | 32.1        | C        |
|  | WB (main)       | L          | 0.58                           | 31.2            | C        | 0.51                     | 27.4        | C        |
|  |                 | TR         | 0.28                           | 26.1            | C        | 0.24                     | 23.7        | C        |
|  | WB (service)    | R          | 0.17                           | 24.6            | C        | 0.15                     | 22.3        | C        |
|  | NB (main)       | T          | 1.08                           | 89.6            | F        | 1.16                     | 123.3       | F        |
|  | NB (service)    | TR         | 0.66                           | 41.5            | D        | 0.71                     | 46.3        | D        |
|  | SB (main)       | LT         | 0.74                           | 35.4            | D        | 0.83                     | 17.9        | B        |
|  | SB (service)    | TR         | 0.47                           | 18.5            | B        | --                       | --          | --       |
| R  |                 | --         | --                             | --              | 0.53     | 21.9                     | C           |          |
| <b>Overall</b>                                     |                 |            | *                              | <b>48.6</b>     | <b>D</b> | *                        | <b>56.3</b> | <b>E</b> |
| Woodhaven Blvd at Myrtle Ave                       | EB              | LTR        | 0.50                           | 35.7            | D        | 0.43                     | 33.8        | C        |
|  | WB              | LTR        | 0.63                           | 37.7            | D        | 0.56                     | 35.9        | D        |
|  | NB              | L          | 0.61                           | 84.6            | F        | 0.62                     | 54.4        | D        |
|  |                 | TR         | 0.57                           | 32.1            | C        | 0.61                     | 5.3         | A        |
|  | SB (main)       | L          | 0.68                           | 82.9            | F        | 0.68                     | 81.5        | F        |
|  |                 | T          | 0.53                           | 28.5            | C        | 0.58                     | 31.8        | C        |
|  | SB (service)    | TR         | 0.49                           | 27.9            | C        | 0.53                     | 31.0        | C        |
| <b>Overall</b>                                     |                 |            | *                              | <b>35.8</b>     | <b>D</b> | *                        | <b>25.4</b> | <b>C</b> |
| Woodhaven Blvd at Jamaica Ave                      | EB              | LTR        | 0.42                           | 31.4            | C        | --                       | --          | --       |
|  |                 | TR         | --                             | --              | --       | 0.34                     | 32.5        | C        |
|  | WB              | LTR        | 0.44                           | 31.7            | C        | 0.43                     | 34.9        | C        |
|  | NB (main)       | L          | 0.34                           | 27.1            | C        | 0.29                     | 31.9        | C        |
|  |                 | T          | 0.64                           | 44.5            | D        | 0.67                     | 35.4        | D        |
|  | NB (service)    | TR         | 0.37                           | 27.8            | C        | 0.39                     | 31.0        | C        |
|  | SB (main)       | L          | 0.36                           | 50.5            | D        | 0.32                     | 49.5        | D        |
|  |                 | T          | 0.71                           | 57.8            | E        | 0.73                     | 17.7        | B        |
| SB (service)                                       | TR              | 0.73       | 60.5                           | E               | 0.76     | 21.8                     | C           |          |
| <b>Overall</b>                                     |                 |            | *                              | <b>47.7</b>     | <b>D</b> | *                        | <b>27.4</b> | <b>C</b> |
| Woodhaven Blvd SB Service Road at Atlantic Ave     | EB              | TR         | 0.43                           | 18.4            | B        | 0.34                     | 17.8        | B        |
|  | WB              | L          | 0.40                           | 13.8            | B        | 0.44                     | 79.3        | E        |
|  |                 | T          | 0.37                           | 5.8             | A        | 0.30                     | 7.0         | A        |
|  | SB (service)    | LTR        | 0.33                           | 21.4            | C        | --                       | --          | --       |
|  |                 | L          | --                             | --              | --       | 0.15                     | 8.5         | A        |
|  |                 | T          | --                             | --              | --       | 0.46                     | 11.1        | B        |
| <b>Overall</b>                                     |                 |            | *                              | <b>14.5</b>     | <b>B</b> | *                        | <b>16.4</b> | <b>B</b> |
| Woodhaven Blvd NB Service Road at Atlantic Ave     | EB              | L          | 0.57                           | 17.5            | B        | 0.64                     | 26.8        | C        |
|  |                 | T          | 0.32                           | 2.5             | A        | 0.26                     | 2.4         | A        |
|  | WB              | TR         | 0.37                           | 17.2            | B        | 0.56                     | 22.3        | C        |
|  | NB (service)    | LTR        | 0.23                           | 20.3            | C        | --                       | --          | --       |
|  |                 | L          | --                             | --              | --       | 0.27                     | 44.1        | D        |
| <b>Overall</b>                                     |                 |            | *                              | <b>12.8</b>     | <b>B</b> | *                        | <b>20.3</b> | <b>C</b> |

Table 4.1-4: Year 2017 Traffic Conditions - Future with and without Improvements

| Weekday SAT (12:45 to 1:45 PM)       |                |                |                             |                 |             |                          |                 |             |
|--------------------------------------|----------------|----------------|-----------------------------|-----------------|-------------|--------------------------|-----------------|-------------|
| Intersection                         | Approach       | Lane Group     | Future without Improvements |                 |             | Future with Improvements |                 |             |
|                                      |                |                |                             |                 |             | Preferred Alternative    |                 |             |
|                                      |                |                | v/c                         | Delay (sec/veh) | LOS         | v/c                      | Delay (sec/veh) | LOS         |
| Woodhaven Blvd at Rockaway Blvd      | EB             | LTR            | 0.43                        | 5.3             | A           | --                       | --              | --          |
|                                      |                | TR             | --                          | --              | --          | 0.44                     | 85.5            | F           |
|                                      | WB             | LTR            | 0.99                        | 87.6            | F           | --                       | --              | --          |
|                                      |                | L              | --                          | --              | --          | 0.92                     | 132.0           | F           |
|                                      | NB             | TR             | --                          | --              | --          | 0.45                     | 42.6            | D           |
|                                      |                | L              | 0.59                        | 138.7           | F           | 0.66                     | 156.7           | F           |
|                                      | SB (main)      | TR             | 0.51                        | 4.1             | A           | 0.49                     | 6.4             | A           |
|                                      |                | L              | 0.85                        | 60.9            | E           | 0.99                     | 76.2            | E           |
|                                      | SB (service)   | T              | 0.83                        | 70.6            | E           | 0.86                     | 49.2            | D           |
|                                      | TR             | 0.26           | 24.2                        | C               | 0.27        | 34.0                     | C               |             |
|                                      | <b>Overall</b> |                | *                           | <b>45.0</b>     | <b>D</b>    | *                        | <b>48.4</b>     | <b>D</b>    |
| Woodhaven Blvd at Liberty Ave/ 94 St | EB             | LTR            | 1.07                        | 112.3           | F           | --                       | --              | --          |
|                                      |                | R              | --                          | --              | --          | 0.29                     | 30.9            | C           |
|                                      | NB             | TR             | 0.61                        | 29.3            | C           | 0.53                     | 26.4            | C           |
|                                      | SB (main)      | T              | 0.53                        | 6.7             | A           | 0.55                     | 5.1             | A           |
|                                      | SB (94 St)     | TR             | 0.27                        | 18.9            | B           | 0.28                     | 21.5            | C           |
|                                      | <b>Overall</b> |                | *                           | <b>30.3</b>     | <b>C</b>    | *                        | <b>16.5</b>     | <b>B</b>    |
| Rockaway Blvd at 94 St               | EB             | TR             | 0.37                        | 25.3            | C           | 0.56                     | 25.5            | C           |
|                                      | WB             | LT             | 0.42                        | 5.7             | A           | 0.47                     | 20.1            | C           |
|                                      | SB             | LTR            | 0.20                        | 32.0            | C           | 0.20                     | 31.9            | C           |
|                                      |                | <b>Overall</b> |                             | *               | <b>15.9</b> | <b>B</b>                 | *               | <b>37.9</b> |
| Rockaway Blvd at 93 St               | EB             | LT             | 0.22                        | 11.4            | B           | --                       | --              | --          |
|                                      |                | L              | --                          | --              | --          | 0.11                     | 11.2            | B           |
|                                      |                | T              | --                          | --              | --          | 0.36                     | 13.3            | B           |
|                                      | WB             | TR             | 0.25                        | 16.8            | B           | --                       | --              | --          |
|                                      |                | T              | --                          | --              | --          | 0.43                     | 92.0            | F           |
|                                      |                | R              | --                          | --              | --          | 0.07                     | 25.8            | C           |
|                                      | NB             | LTR            | 0.25                        | 32.2            | C           | 0.86                     | 86.9            | F           |
|                                      | <b>Overall</b> |                | *                           | <b>16.9</b>     | <b>B</b>    | *                        | <b>64.6</b>     | <b>E</b>    |
| Liberty Ave at 93 St                 | EB             | LT             | 0.54                        | 47.7            | D           | 0.71                     | 19.6            | B           |
|                                      | WB             | TR             | 0.05                        | 1.4             | A           | 0.05                     | 7.0             | A           |
|                                      | NB             | LTR            | 0.25                        | 14.6            | B           | 0.25                     | 15.7            | B           |
|                                      |                | <b>Overall</b> |                             | *               | <b>37.2</b> | <b>D</b>                 | *               | <b>17.9</b> |
| Rockaway Blvd at Liberty Ave         | EB             | T              | 0.45                        | 19.3            | B           | 0.68                     | 40.2            | D           |
|                                      | WB             | T              | 0.23                        | 0.1             | A           | 0.23                     | 0.1             | A           |
|                                      | NEB            | T              | 0.61                        | 24.0            | C           | 0.30                     | 31.5            | C           |
|                                      |                | <b>Overall</b> |                             | *               | <b>12.5</b> | <b>B</b>                 | --              | <b>42.4</b> |
| Rockaway Blvd at Liberty Ave & 96 St | EB             | L              | 0.79                        | 80.8            | F           | 0.79                     | 118.8           | F           |
|                                      |                | T              | 0.36                        | 0.9             | A           | 0.36                     | 0.9             | A           |
|                                      | WB             | TR             | 0.53                        | 33.7            | C           | 0.53                     | 33.7            | C           |
|                                      | NB             | LTR            | 0.43                        | 40.8            | D           | 0.43                     | 40.8            | D           |
|                                      | SWB            | TR             | 0.26                        | 31.3            | C           | 0.26                     | 31.3            | C           |
|                                      | <b>Overall</b> |                | *                           | <b>23.9</b>     | <b>C</b>    | *                        | <b>27.2</b>     | <b>C</b>    |
| <b>UNSIGNALIZED INTERSECTIONS</b>    |                |                |                             |                 |             |                          |                 |             |
| Liberty Ave at 95 St                 | EB             | T              | 0.34                        | 0.0             | A           | 0.17                     | 0.0             | A           |
|                                      |                | R              | 0.00                        | 0.0             | A           | 0.00                     | 0.0             | A           |
|                                      |                | <b>Overall</b> |                             | *               | *           | *                        | --              | --          |

NB = northbound, SB = southbound, EB = eastbound, WB = westbound, NEB = northeastbound, SWB = southwestbound  
 L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn  
 v/c = volume-to-capacity ratio, LOS = Level-of-Service  
 All Intersection Lane Groups: Delay >=45.0 (mid-LOS D or worse)

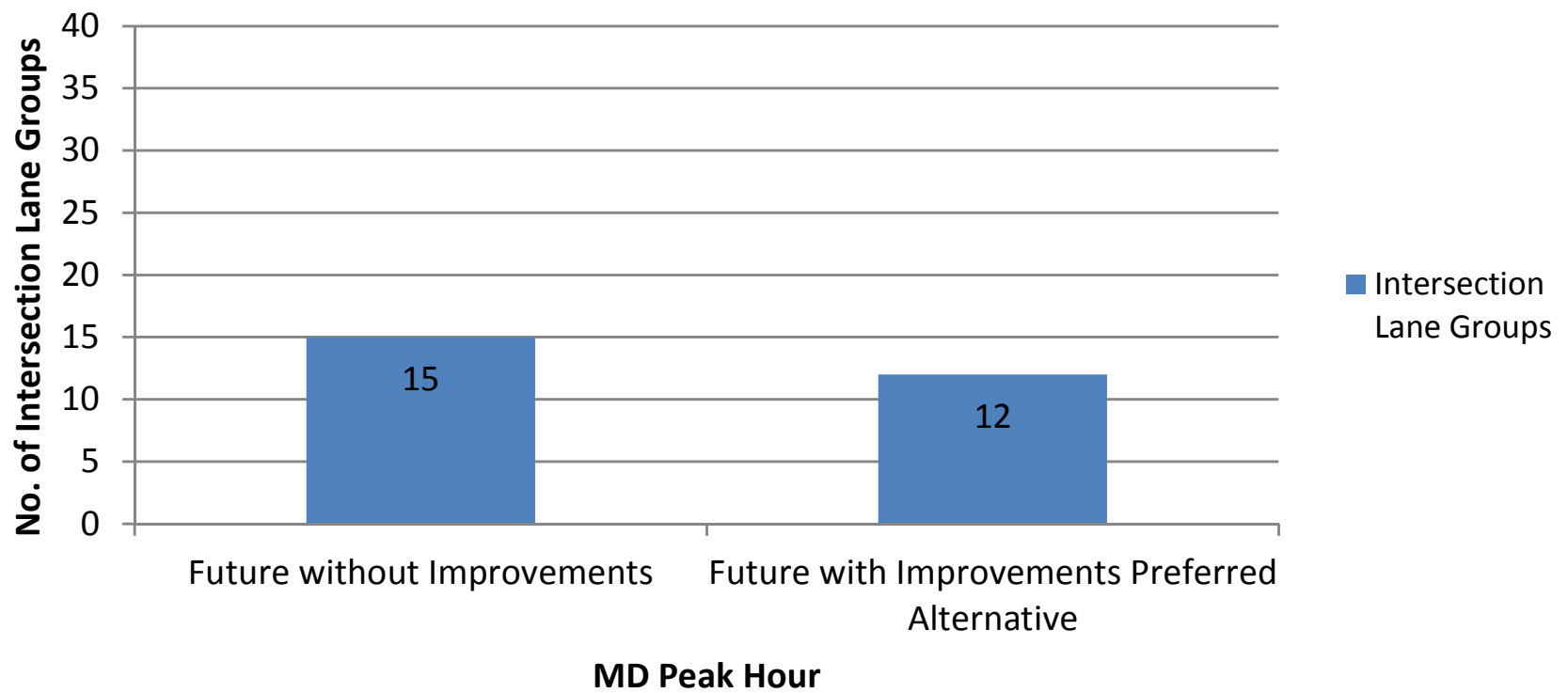
**Figure 4.1-1**  
**Intersection Lane Groups Operating at Mid-LOS "D" or Worse\***



\*Mid-LOS "D": Vehicle Delay >45 seconds

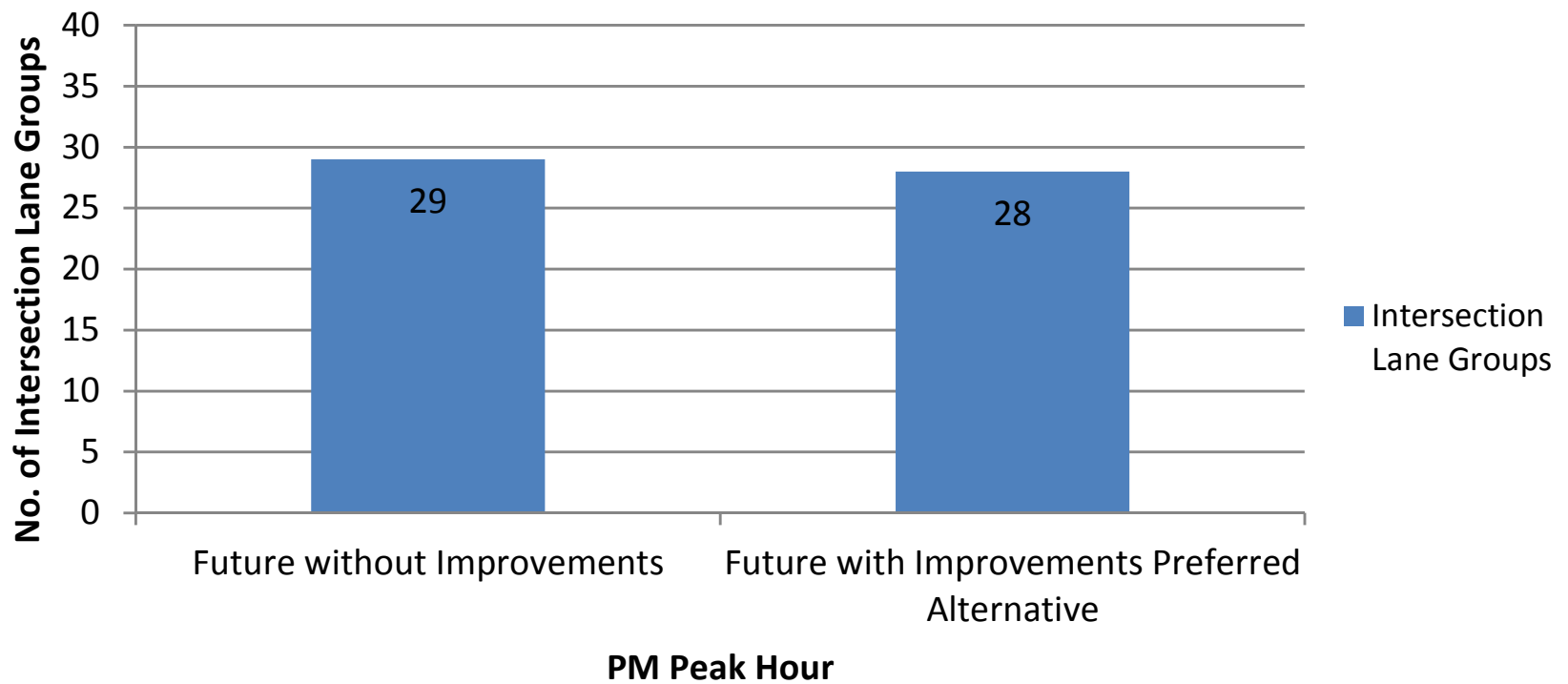


**Figure 4.1-2**  
**Intersection Lane Groups Operating at Mid-LOS "D" or Worse\***



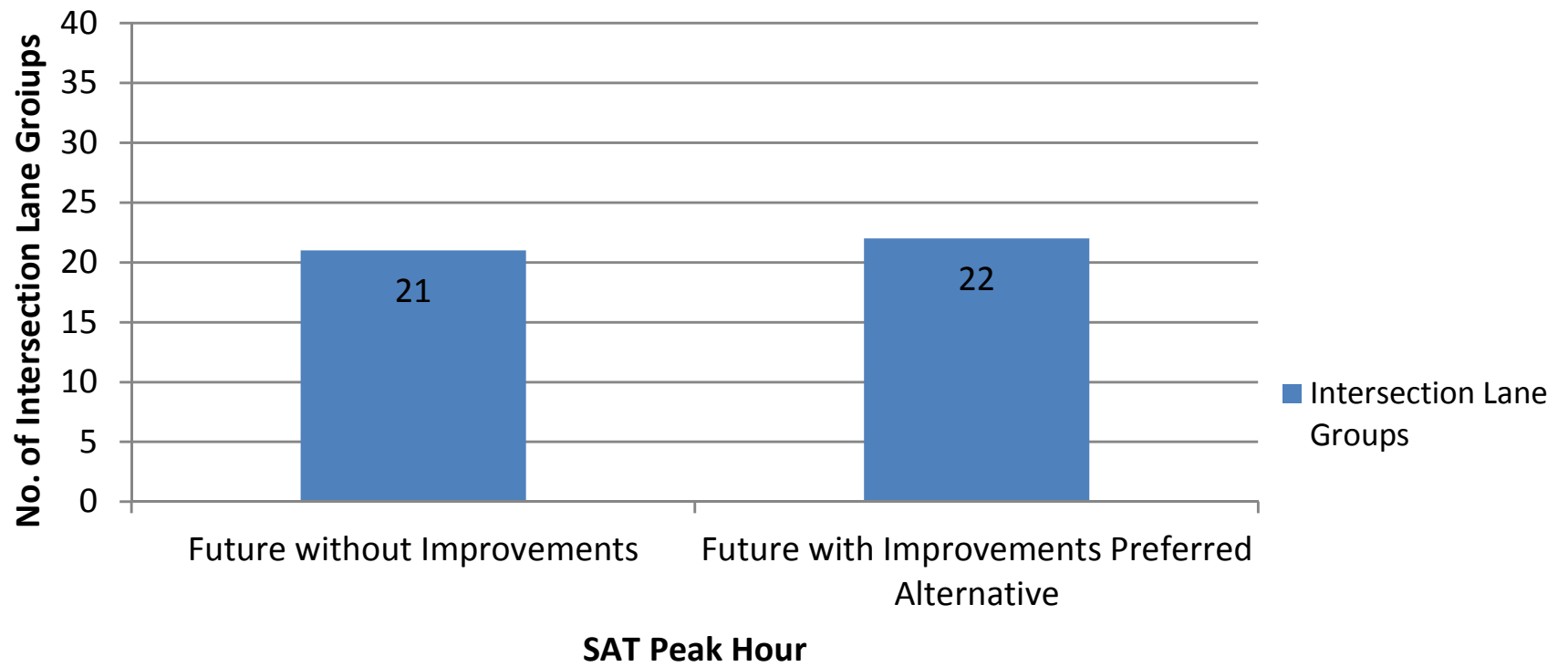
\*Mid-LOS "D": Vehicle Delay >45 seconds

**Figure 4.1-3**  
**Intersection Lane Groups Operating at Mid-LOS "D" or Worse\***



\*Mid-LOS "D": Vehicle Delay >45 seconds

**Figure 4.1-4**  
**Intersection Lane Groups Operating at Mid-LOS "D" or Worse\***



\*Mid-LOS "D": Vehicle Delay >45 seconds

## 4.2 Emissions

An emissions analysis was conducted using the Synchro software for the Woodhaven Boulevard corridor from Queens Boulevard north service road to Liberty Avenue, and also for the broader network which included nearby affected roadways, such as intersections along Rockaway Boulevard and Liberty Avenue between 93<sup>rd</sup> Street and 96<sup>th</sup> Street. The results are presented in Table 4.2-1. Emissions for Carbon Monoxide (CO), Nitrogen Oxide (NOX) and Volatile Oxygen Compounds (VOC) are projected for the future without improvements and the future with the recommended improvements. For the network, the recommended improvements is projected to produce more of all three emissions than the Future without Improvements scenario for the weekday AM and PM peak hours. The weekday midday and Saturday peak hour are projected to experience an improvement in all three emissions. The analysis conservatively does not account for a possible mode shift from auto to bus that is expected from the improved bus travel times due to the bus lanes.

| <b>Table 4.2-1: Emissions/Air Quality Analysis - Woodhaven Boulevard (AM Peak Hour)</b> |                                    |                           |                           |  |                           |                           |
|---|------------------------------------|---------------------------|---------------------------|--|---------------------------|---------------------------|
| <b>Scenario</b>   |                                    |                           |                           |  |                           |                           |
|   | <b>Future without Improvements</b> |                           |                           | <b>Future with Improvements: Preferred Alternative</b> |                           |                           |
|   | <b>CO Emissions (kg)</b>           | <b>NOx Emissions (kg)</b> | <b>VOC Emissions (kg)</b> | <b>CO Emissions (kg)</b>                               | <b>NOx Emissions (kg)</b> | <b>VOC Emissions (kg)</b> |
| <b>Intersections</b>  |                                    |                           |                           |  |                           |                           |
| Woodhaven Blvd at Queens Blvd North Service Rd  | 2.70                               | 0.53                      | 0.63                      | 2.70   | 0.53                      | 0.63                      |
| Woodhaven Blvd at Queens Blvd South Service Rd  | 3.87                               | 0.75                      | 0.90                      | 3.73   | 0.73                      | 0.87                      |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                                      | 3.86                               | 0.75                      | 0.89                      | 3.62   | 0.71                      | 0.84                      |
| Woodhaven Blvd at Eliot Ave/86 St   | 7.05                               | 1.37                      | 1.63                      | 5.39   | 1.05                      | 1.25                      |
| Woodhaven Blvd at Dry Harbor Rd   | 14.85                              | 2.89                      | 3.44                      | 13.06  | 2.54                      | 3.03                      |
| Woodhaven Blvd at Yellowstone Blvd  | 7.12                               | 1.38                      | 1.65                      | 10.42  | 2.02                      | 2.42                      |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln  | 2.53                               | 0.49                      | 0.59                      | 3.99   | 0.78                      | 0.93                      |
| Woodhaven Blvd at Metropolitan Ave  | 7.09                               | 1.38                      | 1.64                      | 8.73   | 1.70                      | 2.02                      |
| Woodhaven Blvd at Union Tpke  | 9.95                               | 1.94                      | 2.31                      | 11.69  | 2.27                      | 2.71                      |
| Woodhaven Blvd at Myrtle Ave  | 7.93                               | 1.54                      | 1.84                      | 9.94   | 1.93                      | 2.30                      |
| Woodhaven Blvd at Jamaica Ave   | 5.72                               | 1.11                      | 1.33                      | 4.39   | 0.85                      | 1.02                      |
| Woodhaven Blvd SB Service Road at Atlantic Ave  | 1.79                               | 0.35                      | 0.42                      | 2.55   | 0.50                      | 0.59                      |
| Woodhaven Blvd NB Service Road at Atlantic Ave  | 2.22                               | 0.43                      | 0.52                      | 2.32   | 0.45                      | 0.54                      |
| Woodhaven Blvd at Rockaway Blvd   | 4.49                               | 0.87                      | 1.04                      | 4.90   | 0.95                      | 1.14                      |
| Woodhaven Blvd at Liberty Ave/ 94 St  | 4.01                               | 0.78                      | 0.93                      | 2.37   | 0.46                      | 0.55                      |
| Rockaway Blvd at 94 St  | 0.69                               | 0.13                      | 0.16                      | 1.33   | 0.26                      | 0.31                      |
| Rockaway Blvd at 93 St  | 0.57                               | 0.11                      | 0.13                      | 0.90   | 0.18                      | 0.21                      |
| Liberty Ave at 93 St  | 0.39                               | 0.08                      | 0.09                      | 0.36   | 0.07                      | 0.08                      |
| Rockaway Blvd at Liberty Ave  | 0.43                               | 0.08                      | 0.10                      | 0.66   | 0.13                      | 0.15                      |
| Rockaway Blvd at Liberty Ave & 96 St  | 1.77                               | 0.34                      | 0.41                      | 1.46   | 0.28                      | 0.34                      |
| Liberty Ave at 95 St  | 0.02                               | 0.00                      | 0.00                      | 0.01   | 0.00                      | 0.00                      |
| <b>Total: Network</b>   | <b>89.05</b>                       | <b>17.30</b>              | <b>20.65</b>              | <b>94.51</b>   | <b>18.39</b>              | <b>21.93</b>              |

| Table 4.2-2: Emissions/Air Quality Analysis - Woodhaven Boulevard (MD Peak Hour) |                             |                    |                    |   |                    |                    |
|--|-----------------------------|--------------------|--------------------|---|--------------------|--------------------|
| Scenario   |                             |                    |                    |   |                    |                    |
| Intersections  | Future without Improvements |                    |                    | Future with Improvements: Preferred Alternative |                    |                    |
|  | CO Emissions (kg)           | NOx Emissions (kg) | VOC Emissions (kg) | CO Emissions (kg)                               | NOx Emissions (kg) | VOC Emissions (kg) |
| Woodhaven Blvd at Queens Blvd North Service Rd                                   | 1.77                        | 0.34               | 0.41               | 1.79  | 0.35               | 0.41               |
| Woodhaven Blvd at Queens Blvd South Service Rd                                   | 2.97                        | 0.58               | 0.69               | 2.39  | 0.47               | 0.55               |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                               | 2.16                        | 0.42               | 0.50               | 2.23  | 0.43               | 0.52               |
| Woodhaven Blvd at Eliot Ave/86 St  | 2.26                        | 0.44               | 0.52               | 1.43  | 0.28               | 0.33               |
| Woodhaven Blvd at Dry Harbor Rd  | 8.37                        | 1.63               | 1.94               | 7.27  | 1.42               | 1.69               |
| Woodhaven Blvd at Yellowstone Blvd   | 6.99                        | 1.36               | 1.62               | 7.54  | 1.47               | 1.75               |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln                                 | 1.85                        | 0.36               | 0.43               | 2.09  | 0.41               | 0.48               |
| Woodhaven Blvd at Metropolitan Ave   | 6.13                        | 1.19               | 1.42               | 5.03  | 0.98               | 1.17               |
| Woodhaven Blvd at Union Tpke   | 3.82                        | 0.74               | 0.88               | 3.67  | 0.71               | 0.85               |
| Woodhaven Blvd at Myrtle Ave   | 7.55                        | 1.47               | 1.75               | 6.24  | 1.21               | 1.45               |
| Woodhaven Blvd at Jamaica Ave  | 5.28                        | 1.03               | 1.22               | 4.12  | 0.80               | 0.95               |
| Woodhaven Blvd SB Service Road at Atlantic Ave                                   | 1.76                        | 0.34               | 0.41               | 1.90  | 0.37               | 0.44               |
| Woodhaven Blvd NB Service Road at Atlantic Ave                                   | 1.31                        | 0.25               | 0.30               | 1.50  | 0.29               | 0.35               |
| Woodhaven Blvd at Rockaway Blvd  | 3.69                        | 0.72               | 0.85               | 3.43  | 0.67               | 0.79               |
| Woodhaven Blvd at Liberty Ave/ 94 St   | 3.04                        | 0.59               | 0.70               | 2.49  | 0.48               | 0.58               |
| Rockaway Blvd at 94 St   | 0.50                        | 0.10               | 0.11               | 0.86  | 0.17               | 0.20               |
| Rockaway Blvd at 93 St   | 0.79                        | 0.15               | 0.18               | 1.31  | 0.25               | 0.30               |
| Liberty Ave at 93 St   | 0.31                        | 0.06               | 0.07               | 0.35  | 0.07               | 0.08               |
| Rockaway Blvd at Liberty Ave   | 0.44                        | 0.09               | 0.10               | 0.65  | 0.13               | 0.15               |
| Rockaway Blvd at Liberty Ave & 96 St   | 1.17                        | 0.23               | 0.27               | 1.24  | 0.24               | 0.29               |
| Liberty Ave at 95 St   | 0.02                        | 0.00               | 0.01               | 0.01  | 0.00               | 0.00               |
| <b>Total: Network</b>  | <b>62.18</b>                | <b>12.09</b>       | <b>14.38</b>       | <b>57.54</b>                                    | <b>11.20</b>       | <b>13.33</b>       |

| Table 4.2-3: Emissions/Air Quality Analysis - Woodhaven Boulevard (PM Peak Hour) |                             |                    |                    |   |                    |                    |
|--|-----------------------------|--------------------|--------------------|---|--------------------|--------------------|
| Scenario   |                             |                    |                    |   |                    |                    |
| Intersections  | Future without Improvements |                    |                    | Future with Improvements: Preferred Alternative |                    |                    |
|  | CO Emissions (kg)           | NOx Emissions (kg) | VOC Emissions (kg) | CO Emissions (kg)                               | NOx Emissions (kg) | VOC Emissions (kg) |
| Woodhaven Blvd at Queens Blvd North Service Rd                                   | 2.39                        | 0.46               | 0.55               | 1.77  | 0.34               | 0.41               |
| Woodhaven Blvd at Queens Blvd South Service Rd                                   | 4.13                        | 0.80               | 0.96               | 4.62  | 0.90               | 1.07               |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                               | 6.40                        | 1.25               | 1.48               | 5.76  | 1.12               | 1.33               |
| Woodhaven Blvd at Eliot Ave/86 St  | 4.66                        | 0.91               | 1.08               | 5.16  | 1.00               | 1.20               |
| Woodhaven Blvd at Dry Harbor Rd  | 8.44                        | 1.64               | 1.96               | 9.55  | 1.86               | 2.22               |
| Woodhaven Blvd at Yellowstone Blvd   | 11.23                       | 2.18               | 2.60               | 10.90   | 2.12               | 2.53               |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln                                 | 2.89                        | 0.56               | 0.67               | 5.39  | 1.05               | 1.25               |
| Woodhaven Blvd at Metropolitan Ave   | 8.35                        | 1.62               | 1.94               | 11.01   | 2.14               | 2.55               |
| Woodhaven Blvd at Union Tpke   | 11.81                       | 2.30               | 2.74               | 13.46   | 2.62               | 3.12               |
| Woodhaven Blvd at Myrtle Ave   | 12.87                       | 2.50               | 2.98               | 17.21   | 3.35               | 3.99               |
| Woodhaven Blvd at Jamaica Ave  | 5.00                        | 0.97               | 1.16               | 4.76  | 0.93               | 1.10               |
| Woodhaven Blvd SB Service Road at Atlantic Ave                                   | 3.17                        | 0.62               | 0.74               | 3.20  | 0.62               | 0.74               |
| Woodhaven Blvd NB Service Road at Atlantic Ave                                   | 1.96                        | 0.38               | 0.45               | 2.59  | 0.50               | 0.60               |
| Woodhaven Blvd at Rockaway Blvd  | 5.47                        | 1.06               | 1.27               | 6.11  | 1.19               | 1.42               |
| Woodhaven Blvd at Liberty Ave/ 94 St   | 5.52                        | 1.07               | 1.28               | 3.64  | 0.70               | 0.84               |
| Rockaway Blvd at 94 St   | 2.00                        | 0.39               | 0.46               | 1.71  | 0.34               | 0.40               |
| Rockaway Blvd at 93 St   | 1.40                        | 0.27               | 0.32               | 1.74  | 0.34               | 0.41               |
| Liberty Ave at 93 St   | 0.42                        | 0.08               | 0.10               | 0.34  | 0.06               | 0.08               |
| Rockaway Blvd at Liberty Ave   | 0.86                        | 0.17               | 0.20               | 1.53  | 0.30               | 0.35               |
| Rockaway Blvd at Liberty Ave & 96 St   | 1.47                        | 0.29               | 0.34               | 1.19  | 0.23               | 0.28               |
| Liberty Ave at 95 St   | 0.04                        | 0.01               | 0.01               | 0.02  | 0.01               | 0.01               |
| <b>Total: Network</b>  | <b>100.48</b>               | <b>19.53</b>       | <b>23.29</b>       | <b>111.67</b>                                   | <b>21.72</b>       | <b>25.89</b>       |



| Table 4.2-4: Emissions/Air Quality Analysis - Woodhaven Boulevard (SAT Peak Hour) |                             |                    |                    |   |                    |                    |
|---|-----------------------------|--------------------|--------------------|---|--------------------|--------------------|
| Scenario  |                             |                    |                    |   |                    |                    |
| Intersections   | Future without Improvements |                    |                    | Future with Improvements: Preferred Alternative |                    |                    |
|   | CO Emissions (kg)           | NOx Emissions (kg) | VOC Emissions (kg) | CO Emissions (kg)                               | NOx Emissions (kg) | VOC Emissions (kg) |
| Woodhaven Blvd at Queens Blvd North Service Rd                                    | 4.59                        | 0.89               | 1.06               | 4.89  | 0.95               | 1.13               |
| Woodhaven Blvd at Queens Blvd South Service Rd                                    | 6.80                        | 1.32               | 1.58               | 4.95  | 0.96               | 1.15               |
| Woodhaven Blvd at L.I.E. EB Off-ramp/ Wetherole St                                | 3.10                        | 0.60               | 0.72               | 3.17  | 0.62               | 0.73               |
| Woodhaven Blvd at Eliot Ave/86 St   | 2.87                        | 0.56               | 0.67               | 1.98  | 0.39               | 0.46               |
| Woodhaven Blvd at Dry Harbor Rd   | 6.48                        | 1.26               | 1.50               | 6.98  | 1.36               | 1.62               |
| Woodhaven Blvd at Yellowstone Blvd  | 7.19                        | 1.40               | 1.67               | 8.07  | 1.57               | 1.87               |
| Woodhaven Blvd at Cooper Ave/ Trotting Course Ln                                  | 1.91                        | 0.37               | 0.44               | 3.26  | 0.63               | 0.76               |
| Woodhaven Blvd at Metropolitan Ave  | 8.39                        | 1.63               | 1.94               | 6.32  | 1.23               | 1.46               |
| Woodhaven Blvd at Union Tpke  | 6.88                        | 1.34               | 1.59               | 7.67  | 1.49               | 1.78               |
| Woodhaven Blvd at Myrtle Ave  | 7.12                        | 1.38               | 1.65               | 5.84  | 1.14               | 1.35               |
| Woodhaven Blvd at Jamaica Ave   | 6.00                        | 1.17               | 1.39               | 4.60  | 0.89               | 1.07               |
| Woodhaven Blvd SB Service Road at Atlantic Ave                                    | 1.78                        | 0.35               | 0.41               | 1.83  | 0.36               | 0.42               |
| Woodhaven Blvd NB Service Road at Atlantic Ave                                    | 1.54                        | 0.30               | 0.36               | 1.93  | 0.38               | 0.45               |
| Woodhaven Blvd at Rockaway Blvd   | 4.98                        | 0.97               | 1.15               | 4.52  | 0.88               | 1.05               |
| Woodhaven Blvd at Liberty Ave/ 94 St  | 4.56                        | 0.89               | 1.06               | 2.43  | 0.47               | 0.56               |
| Rockaway Blvd at 94 St  | 0.60                        | 0.12               | 0.14               | 1.08  | 0.21               | 0.25               |
| Rockaway Blvd at 93 St  | 0.88                        | 0.17               | 0.20               | 1.87  | 0.36               | 0.43               |
| Liberty Ave at 93 St  | 0.84                        | 0.16               | 0.19               | 0.53  | 0.10               | 0.12               |
| Rockaway Blvd at Liberty Ave  | 0.87                        | 0.17               | 0.20               | 1.44  | 0.28               | 0.34               |
| Rockaway Blvd at Liberty Ave & 96 St  | 1.55                        | 0.30               | 0.36               | 1.32  | 0.26               | 0.30               |
| Liberty Ave at 95 St  | 0.05                        | 0.01               | 0.01               | 0.02  | 0.00               | 0.01               |
| <b>Total: Network</b>   | <b>78.98</b>                | <b>15.36</b>       | <b>18.29</b>       | <b>74.71</b>                                    | <b>14.53</b>       | <b>17.31</b>       |

| 0.80

| Table 4.2-5: Emissions/Air Quality Analysis - Woodhaven Boulevard Network Totals |           |                             |                    |                    |   |                    |                    |
|--|-----------|-----------------------------|--------------------|--------------------|---|--------------------|--------------------|
|  |           | Scenario                    |                    |                    |   |                    |                    |
|  |           | Future without Improvements |                    |                    | Future with Improvements: Preferred Alternative |                    |                    |
|  |           | CO Emissions (kg)           | NOx Emissions (kg) | VOC Emissions (kg) | CO Emissions (kg)                               | NOx Emissions (kg) | VOC Emissions (kg) |
| Intersections  | Peak Hour |                             |                    |                    |   |                    |                    |
| Network  | AM        | 89.05                       | 17.30              | 20.65              | 94.51   | 18.39              | 21.93              |
|  | Midday    | 62.18                       | 12.09              | 14.38              | 57.54   | 11.20              | 13.33              |
|  | PM        | 100.48                      | 19.53              | 23.29              | 111.67  | 21.72              | 25.89              |
|  | Saturday  | 78.98                       | 15.36              | 18.29              | 74.71   | 14.53              | 17.31              |

The preferred alternative includes several improvements specifically developed to enhance pedestrian comfort, safety and convenience. Such improvements include curb extensions at/near Queens Boulevard, Wetherhole Street, Eliot Avenue and 60<sup>th</sup> Drive; widened center medians for pedestrian at/near Queens Boulevard, Wetherhole Street and Forest Park Drive; and widened service road medians that extend into the crosswalks at signalized intersections from Park Lane South to Rockaway Boulevard. Curb extensions provide additional pedestrian holding area space and would improve corner LOS and reduce crossing distances. Widened medians would provide safer refuge areas for pedestrians who cannot complete their crossing in one cycle by providing greater separation between vehicular traffic and pedestrians.

#### 4.4 Safety

Safety for all street users (i.e., pedestrians, cyclists, transit riders and motorists) was a key consideration in the process of developing improvement alternatives for the Woodhaven Boulevard corridor. Specifically, measures aimed at reducing the exposure of pedestrians to vehicular traffic, providing pedestrian amenities and separating vehicles from pedestrians to the extent possible served as guiding principles. The preferred alternative contains several safety-related elements that are expected to improve safety for all street users, including:

- Curb extensions at a number of locations as described in previous sections. Curb extensions will reduce crossing distance and also provide for more sidewalk space.
- A widened median between Queens Boulevard and Eliot Avenue, and wider center medians at a number of locations as described earlier.
- Wider service road medians at most signalized intersections between Park Lane South and Rockaway Boulevard.
- Improved intersection geometrics at:
  - Liberty Avenue/Rockaway Boulevard to simplify a very complex junction; eliminate conflicts between vehicles and pedestrians; and provide additional left-turn storage and capacity for the northbound left-turn movement from Cross Bay Boulevard.
- Improved signage on:
  - Northbound Woodhaven Boulevard approaching Alderton Avenue warning motorists of the lane drop at this location.
- Roadway restriping on:

- Woodhaven Boulevard southbound service road at Union Turnpike to provide a right-turn-only, thereby allowing the right lane from the southbound mainline to proceed onto the service road without conflicting with the southbound through movement from the service road.
  - Service roads between Park Lane South and Rockaway Boulevard to provide sufficient travel lane, parking lane and bus stop width.
  - Eastbound Liberty Avenue at Cross Bay Boulevard to eliminate through movement and provide a right-turn-only lane.
- Extension of left-turn lanes on:
    - Northbound Cross Bay Boulevard at Rockaway Boulevard to provide additional storage and better signal coordination.
  - Roadway Edge Line Markings to better delineate parking and travel lanes on:
    - Woodhaven Boulevard northbound and southbound service roads between Atlantic Avenue and Rockaway Boulevard.
    - Northbound Woodhaven Boulevard between 86<sup>th</sup> Drive and Forest Park Drive.

#### 4.5 Transit

Improving transit (bus) operations was a major consideration during the development of the recommended alternative. It also had to be balanced with other improvements being recommended for the corridor as well as varying roadway geometrics along different segments on Woodhaven Boulevard. The recommended alternative includes an offset bus lane in both directions on Woodhaven Boulevard between Dry Harbor road and Metropolitan Avenue, and also curbside peak direction bus lanes on Woodhaven Boulevard on the last few blocks approaching Rockaway Boulevard/Liberty Avenue. These dedicated bus lanes will improve bus travel times along Woodhaven Boulevard, during the weekday AM and PM peak periods, and will reduce conflicts between buses and other vehicles. It is expected that the improved service would result in mode shift from cars to buses in the long run, which would justify increased bus frequency.

Improving bus transit is a high priority as a result of this study. A followup study for implementing Select Bus Service (SBS) has commenced. SBS for this corridor has been recommended as a longer-term strategy for mitigating congestion by improving mobility for all vehicles, especially for the 30,000 bus riders that use this corridor daily. At the time of this writing, NYCDOT and the Metropolitan Transportation Authority (MTA) are now working with local stakeholders on a plan to bring SBS to the Woodhaven Boulevard/Cross Bay Boulevard corridor.

## 5.0 OPTIONS CONSIDERED BUT NOT RECOMMENDED

There were several improvements that were suggested, considered and tested, but ultimately not recommended. The following sections describe these proposals.

### 5.1 Options Considered at Union Turnpike

There is a major bottleneck for southbound Woodhaven Boulevard at Union Turnpike, especially during the weekday PM period. This is one of the few locations where there are no left turn bays, but left turns are permitted. It is perhaps the single biggest cause of congestion in the study area. It has been suggested to ban the southbound left-turn, which would have an enormous benefit in relieving congestion. For an alternate route, southbound drivers could turn left at Metropolitan Avenue, less than a half mile upstream, which angles into Union Turnpike. It would inconvenience only a select few drivers whose destination is very localized.

MTA buses need to turn left here to access a layover facility on Union Turnpike just east of Woodhaven Boulevard. Attempts to find alternate routes to this facility, and to find alternate facilities, were unsuccessful. Therefore, the southbound left turn remains permitted, and attempts to alleviate this bottleneck are ongoing.

### 5.2 Options Considered at Park Lane South

Park Lane South has been identified as a location with safety problems. The layout is shown in Figure 5.1-1. The northbound main road and service road merge just before approaching Park Lane South. Drivers from the main road must merge into the service road if they are destined to either turn right at onto eastbound Park Lane South, or bear right to the service road toward the Forest Park Co-op. This movement has proved to cause many crashes. Another dangerous movement that is possible with this configuration is for traffic from the service road to cut across the main road lanes to turn left onto Park Lane South. Two options have been tested, and both were determined to be infeasible:

- Extend the northbound service road median all the way up to the STOP bar at Park Lane South, and provide separate phases for the main road and service road. This would eliminate conflicts between the main road and service road. However, splitting the green time would severely impact traffic operations. Currently, the northbound/southbound green time varies between 45 and 57 seconds, depending on time of day, out of a 120 second cycle. No matter how it is split, there would not be enough green time for the main road or service road, or both, to process the demand. Green time from the eastbound/westbound movement cannot be reduced, because that would cut into the time for pedestrians to cross Woodhaven Boulevard, which is already insufficient.

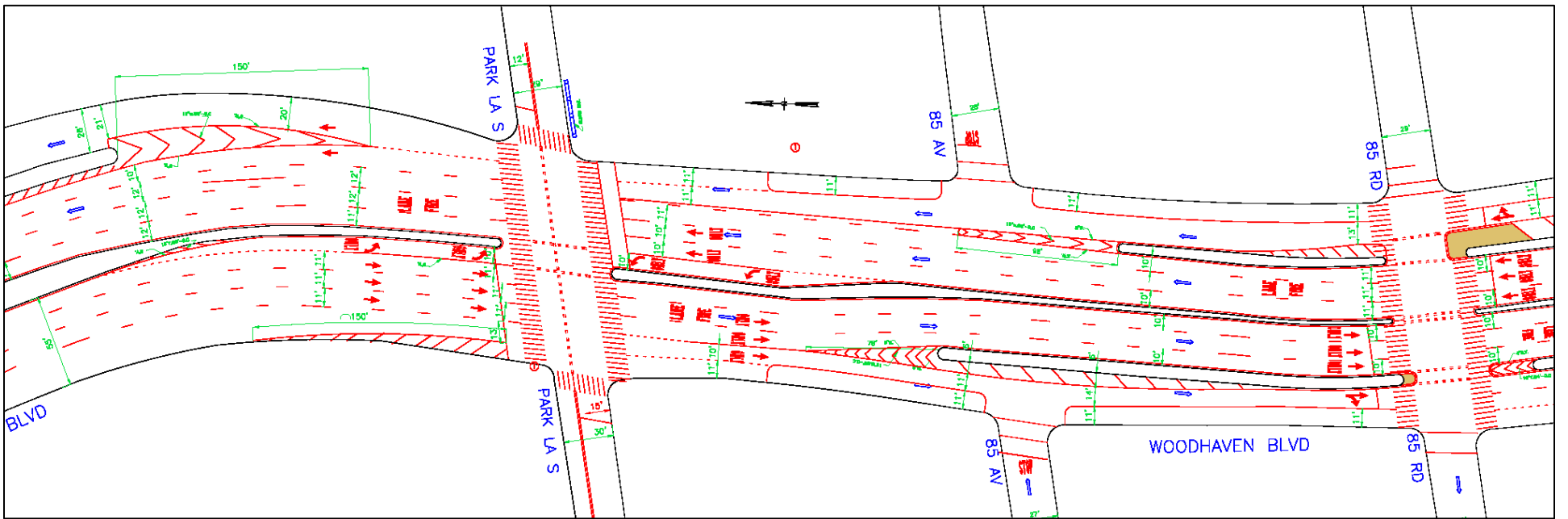


Figure 5.2-1: Woodhaven Boulevard and Park Lane South

- Provide a new signal for northbound traffic at the merge point, near 85<sup>th</sup> Avenue, and split the green time between main road and service road traffic. This too would severely impact traffic operations, though not as badly as the previous option. The problem with this option is progression. If progression is favored for the main road, that is, if the signal for the northbound main road is green approaching 85<sup>th</sup> Road, the proposed signal at the merge, and Park Lane South at approximately the same time, then there would be poor progression on the service road. The signal for the service road would be red at the merge during the time it is green at 85<sup>th</sup> Avenue, and vice versa. The length of the service road between 85<sup>th</sup> Avenue and the merge would not be enough to store the vehicles that encounter the green at the former and the red at the latter, causing spillback. If the offsets were adjusted to “split the pain” between the main road and service road, both would suffer.

Attempts to address the unsafe condition of this location are ongoing.

### **5.3 Options Considered at Jamaica Avenue**

The wide center medians and service road medians on Woodhaven Boulevard at Jamaica Avenue that extend into the crosswalk are beneficial for providing refuge for pedestrians who do not make it all the way across the street. However, they present problems for vehicles making left turns from Jamaica Avenue. More than at other locations, the left turns overlap each other. A possible solution is to ban the turns from one direction. The eastbound left-turn has better alternative routes than the westbound, so banning the eastbound left turns would be preferable between the two. However, the alternative routes would involve diverting traffic onto quiet residential streets. While this option has not been permanently rejected, there are no plans to implement at this time.

### **5.4 Options Considered at 101<sup>st</sup> Avenue**

One of the problems with the Woodhaven Boulevard main road between Park Lane South and Rockaway Boulevard is that there are no left-turn bays, except at these endpoints and at Jamaica Avenue. Therefore, left turns are banned at all locations, except southbound at 101<sup>st</sup> Avenue. This is one of the few locations on the entire Woodhaven Boulevard corridor where left turns are permitted from a shared lane (the other is at previously mentioned Union Turnpike). This has become a safety problem, as through vehicles traveling southbound in the left lane are often forced to suddenly stop and merge right to go around left-turning vehicles waiting for a gap. It has been suggested to mark and sign the left lane as a left-turn-only lane. This could make the problem worse, especially during off-peak hours, because then *all* vehicles would be forced to merge right, even if there are no left-turners ahead of them. Instead, increased signage has been installed to warn vehicles that the left lane is designated as shared for left and through vehicles. The monitoring of this location is ongoing.



## 6.0 SUMMARY AND CONCLUSION

In the development of a recommended alternative, every attempt was made to address as many specific and corridor-wide issues to the extent possible and practical. Three future improvement alternatives were developed to address the identified issues in the study area. They were tailored to address the most pressing issues including, but not limited to, complex intersection geometrics, recurring traffic congestion, safety of all street users (i.e., pedestrians, cyclists, transit riders and motorists), and pedestrian mobility on some of the wider intersections where there are currently no pedestrian islands or refuge areas.

The preferred alternative consists of a hybrid of improvements some of which will be (or have been) implemented at specific locations along the corridor, as well as segment-specific treatments such as the proposed bus lane between Eliot Avenue and Metropolitan Avenue, and the narrowed service roads/widened median between the mainline and service roads between Atlantic Avenue and Rockaway Boulevard.

Select Bus Service (SBS) for this corridor was also recommended as a longer-term strategy for mitigating congestion by improving mobility for all vehicles, especially for the 30,000 bus riders that use this corridor daily. At the time of this writing, NYCDOT and the Metropolitan Transportation Authority (MTA) are now working with local stakeholders on a plan to bring SBS to the Woodhaven Boulevard/Cross Bay Boulevard corridor.

For the recommended improvements to yield optimal benefits, stepped-up enforcement of traffic laws and regulations along the Woodhaven Boulevard corridor may be required. While traffic enforcement is not under the jurisdiction of NYCDOT, agency coordination and cooperation involving NYCDOT, NYPD, MTA and other key agencies will be critical to ensure that maximum benefits are achieved from implementation of the recommended alternative for the Woodhaven Boulevard congested corridor. The corridor will be monitored to assess the improvements beginning in 2015.