WOODHAVEN-CROSS BAY BICYCLE CORRIDOR STUDY

NYC Department of City Planning
Transportation Division

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Woodhaven – Cross Bay Bicycle Corridor Study

Michael R. Bloomberg, Mayor
City of New York

Amanda M. Burden, FAICP, Director
New York City Department of City Planning

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Executive Summary

The *Woodhaven - Cross Bay Bicycle Corridor Study* recommends a variety of bicycle facilities that would improve bicycle and greenway connections in Southern Queens. The purpose of this study is to develop a series of bicycle routes that would link the various communities in and around the study area and enhance connections to local parks and greenway paths along the Woodhaven - Cross Bay corridor.

New York City has seen remarkable growth in bicycle ridership with a doubling of bicycle commuters in the last seven years and, in June of this year, the City completed an ambitious 3-year project of creating 200 miles of new bicycle facilities. The Mayor's *PlaNYC 2030* has numerous transportation, sustainability and health goals related to bicycling and greenway development. Bicycling contributes to a reduction in traffic congestion and air pollution and whether you are riding for recreation, commutation, or for a quick trip to the store, bicycling promotes a healthy and active lifestyle. However, while the City continues to expand the bicycle network and related infrastructure, there are a number of gaps or connections between facilities that can be improved. The *Woodhaven - Cross Bay Bicycle Corridor Study* addresses these critical issues in Southern Queens.

The objectives of this study are:

- Enhance the bicycle and greenway links between Forest Park Greenway, Shore Parkway Greenway, and Rockaway Greenway and connect the expanding New York City greenway network.

- Improve greenway connections to parkland and open space such as Gateway National Recreation Area, Jamaica Bay Wildlife Refuge, Fort Tilden and Jacob Riis Park, and Rockaway Beach.

- Provide better non-motorized transportation options for residents in Southern Queens.

- Examine and assess existing traffic conditions within the study area including a level of service analysis of a selection of streets along the corridor.

- Recommend a variety of bicycle facilities taking into account safety, suitability of the route, accessibility, and potential conflicts with other modes of transportation.

The report presents detailed analysis of the proposed bicycle routes based on data collected from field visits including street and intersection geometry, bicycle and pedestrian movements, street design and neighborhood context. In addition, this report includes an analysis of existing land use, zoning, demographic and socioeconomic profiles, and a literature search. Vehicle traffic volume counts were also conducted at eight (8) intersections within the study area along the proposed bicycle corridor. The report proposes the following recommendations: fourteen miles of on-street bicycle lanes and signed bicycle routes; innovative street treatments such as pigmented bicycle lanes, advanced stop boxes; pegga-tracked (dashed) markings through certain intersections; and a new, separate greenway path at the Rockaway Peninsula waterfront next to Jacob Riis Park (see a general map of existing and proposed bicycle routes in Figure E-1 on following page).

Study Area - Existing and Proposed Bicycle Routes

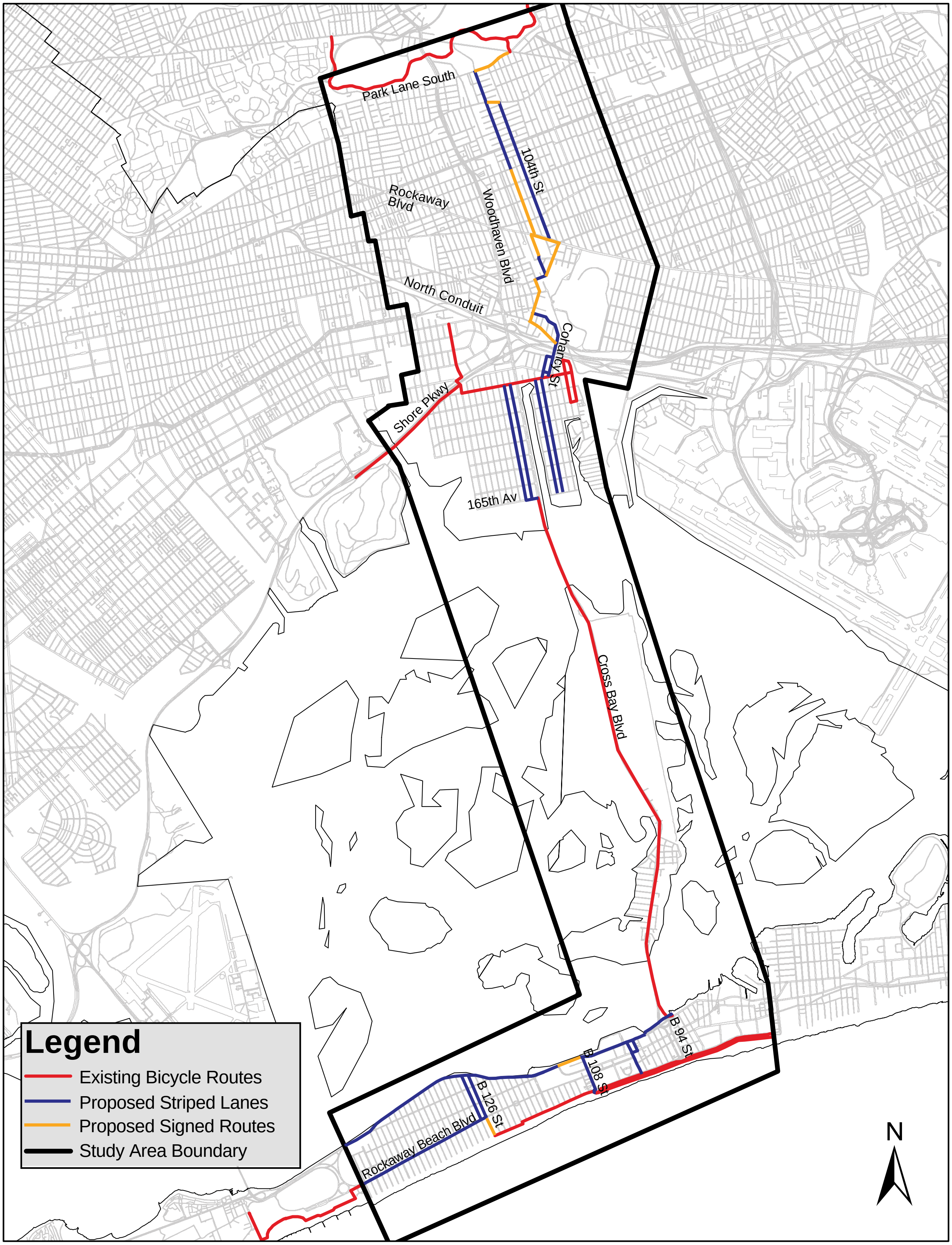


Figure E-1

Introduction

The Woodhaven – Cross Bay Bicycle Corridor is a study undertaken by the Transportation Division of the New York City Department of City Planning to develop a bicycle route from Forest Park to Jamaica Bay in Queens and to encourage cycling in the southern section of Queens by providing a safer and better travel option for cyclists.

The Woodhaven – Cross Bay corridor was identified in the New York City Bicycle Master Plan as a priority corridor and can serve as a recreational route taking cyclists from Forest Park to the Shore Parkway Greenway, and also guiding riders through the Jamaica Bay Wildlife Refuge area to the waterfront and parks of the Rockaway Peninsula.

This large study area in Queens is bordered to the north by Forest Park, to the south by Rockaway Beach, to the west by the borough's boundaries (generally by Eldert Lane) and to the east by Lefferts Boulevard.

The main objective of this study is to develop connections and links to the recreational components of the study area. It is essential for an increase in bicycle usage and to improve access for cyclists to the parklands and waterfront areas in the Woodhaven/ Cross Bay area.

This report is divided into three parts:

- Study Area, which includes a description of the study area; a depiction of its neighborhoods and population; zoning and land uses; the street network; bicycle network; public transportation; and the accidents trends and patterns;

- Evaluation of Selected Corridor and Recommendations, which assesses and proposes a series of recommended bicycle routes along the selected corridor;

- Appendices, which contain additional zoning information in terms of the permitted floor area ratio (FAR) per zoning district; the level of service analysis of typical intersections along the proposed bicycle routes; a description of subway lines and bus routes within the area of study; a literature search on design guidelines and innovative solutions for bicycle facilities.

STUDY AREA

Study Area Location and Neighborhoods

The Woodhaven - Cross Bay Boulevard Bicycle Corridor Study Area is situated in southern Queens. Figures 1 and 2 indicate the study area. This large study area consists of three land segments which are separated by water. The northern segment (the Woodhaven area) is north of Jamaica Bay, the middle segment (Broad Channel area) lies within Jamaica Bay, and the southern segment (Rockaway Peninsula area) is between Jamaica Bay and the Atlantic Ocean. The entire study area lies within portions of Queens Community Districts 9, 10, and 14.

Northern Segment – Woodhaven Area

The Woodhaven area is the largest of the three segments. It includes the communities of Woodhaven, Richmond Hill, Ozone Park, Lindenwood, and Howard Beach. Major land, water and major features, which surround this area are Forest Park on the north; Aqueduct Race Track, John F. Kennedy International (JFK) Airport, and the MTA subway right of way on the southeast; Jamaica Bay, Shellbank Basin, Hawtree Basin, and Spring Creek Park part of the Gateway National Recreational Area (GNRA) on the south; and the boundary between Queens and Brooklyn boroughs on the west.

Middle Segment - Broad Channel Area.

The middle segment of the study area is an island land mass that lies within Jamaica Bay. The Broad Channel residential community is located on the southern end of the island, and a wildlife refuge (part of the Jamaica Bay Unit of GNRA) is located on the northern end of the island. The small geographical area of the Broad Channel community includes a limited number of local streets, most of which intersect Cross Bay Boulevard.

Southern Segment - Rockaway Peninsula Area.

The southern segment comprises a portion of the Rockaway Peninsula. It is bounded by major land and water features, which include Rockaway Inlet/Beach Channel, Rockaway Beach, Atlantic Ocean, and Jacob Riis Park. This segment includes the communities of Seaside, Rockaway Park, Belle Harbor, and Neponsit, all located west of the bridge, and Hammels, located just east of the bridge.

Regional Context ***Figure 1***

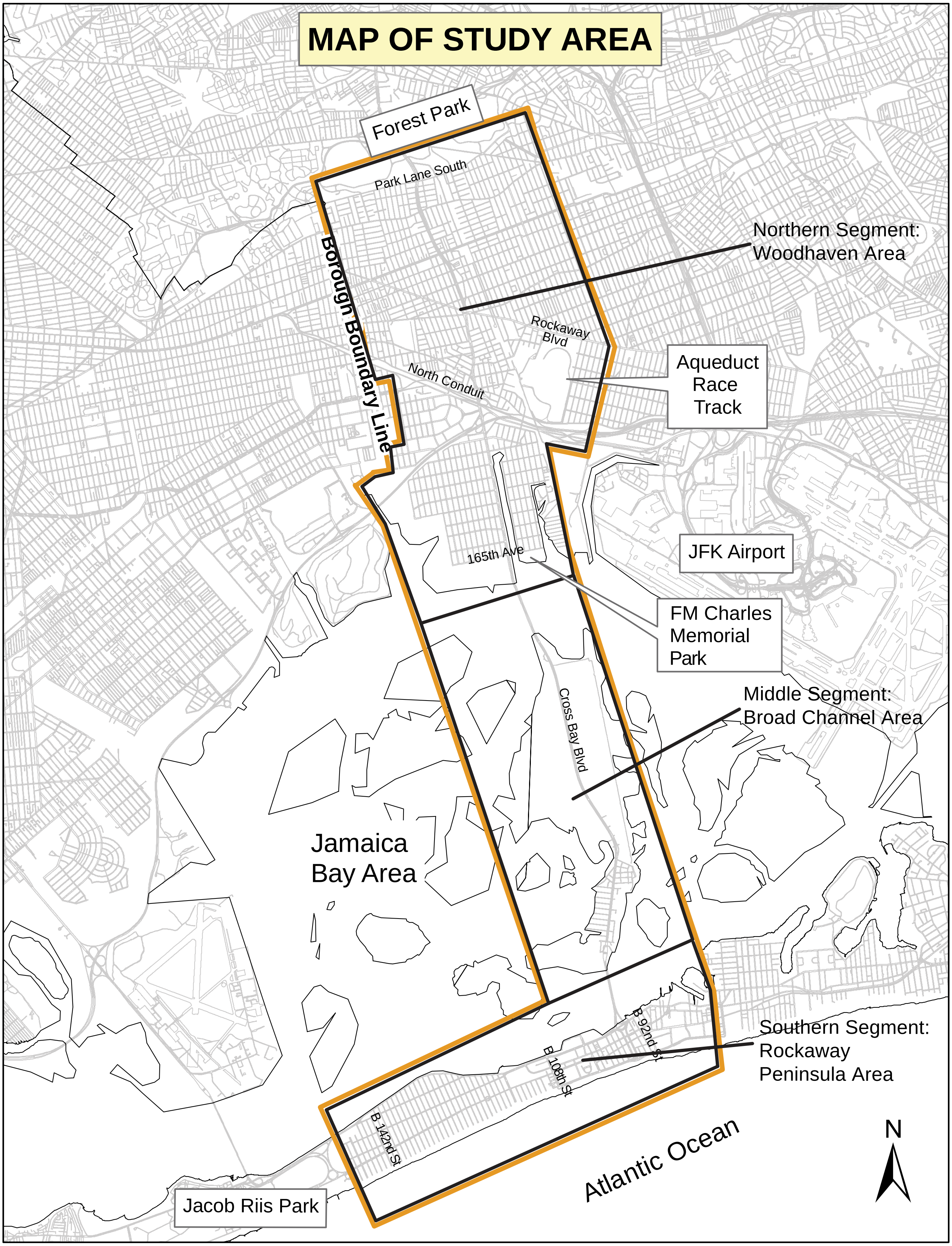

MAP OF STUDY AREA
Forest Park
Park Lane South
Borough Boundary Line
Northern Segment:
Woodhaven Area
Rockaway Blvd
North Conduit
Aqueduct Race Track
JFK Airport
165th Ave
FM Charles Memorial Park
Middle Segment:
Broad Channel Area
Cross Bay Blvd
Jamaica Bay Area
Southern Segment:
Rockaway Peninsula Area
B 92nd St
B 108th St
B 142nd St
Atlantic Ocean
Jacob Riis Park
N

Figure 2

Demographics

Population

According to the Census 2000 data available, the population residing within the limits of the study area consists of 209,954 residents. This population has increased significantly within the last decade largely in the Woodhaven area due to the diversity of the population made up of immigrants. The population has increased by 22 % in the Woodhaven area from 1990 to 2000. The Broad Channel and Rockaway Peninsula areas have also known a population growth, but the increase was of 6% only. The population of these two areas was less affected by the arrival of immigrants.

	1990 Population	2000 Population
Woodhaven Area	148,541	182,005
Broad Channel Area	2,483	2,630
Rockaway Peninsula Area	23,873	25,319

The foreign-born population represents a significant portion of the study area's population. Based on the census data of 1990, an average of 35% of the population in the Woodhaven area was foreign-born. A decade later it increased to an average of 44 %. For the Broad Channel and Rockaway Peninsula areas the foreign-born population (24%) still represents a substantial proportion of the population, even though the increase in total population was less significant.

Journey-to-Work

A journey-to-work modal split analysis was also done for this study using data from the census tracts. This analysis was performed for both the local resident labor force and the people who traveled into the study area to work.

Modal Split for Workers 16 and Older Residing in the Study Area

2000 census data indicates that slightly more than half of the workers residing in the study area use car, truck, or van to commute to work (45,262 of 86,580 or 52.28%). These commuters largely drive alone (78.98%) as compared to carpooling (21.02%). Public transportation users account for 35,705 workers (41.24%). Within this population, most commuters use the subway (74.46%), followed by bus users (21.57%), railroad users (2.69%), taxi users (1.16%) and ferry users (0.12%). People who walk to work account for 3,814 workers (4.4%). Bicyclists represent 0.24% and motorcyclists represent 0.07%.

Place of Work for Workers 16 and Older Who Reside Within the Study Area

The census data indicates that the places of work for workers 16 years and older who reside within the study area are primarily within New York City (91%). The majority of the workers are concentrated in Queens County (34,024 or 45%), followed by New York County (25,956 or 35%), and by Kings County (13,346 or 18%). The other two counties post significantly smaller numbers - Bronx County has 1,217 (2%) and Richmond County has 415 or less than 1%. The remaining workforce work outside of New York City, with close to (7%) in New York State, less than 1% in Connecticut, and 1.62% in New Jersey.

Modal Split for Workers 16 and Older Who Travel into the Study Area

The modal split census data for workers 16 and older who travel into the study area shows that most travel by car, truck, or van 55, 970 (71.81%). These commuters primarily drive alone 46,893 (83.78%) while 9,077 (16.22%) carpool. Those who use public transportation to get to work into the study area represent 15,076 workers (19.34%). Of the 15,076 public transit users, half of them travel by bus (50.79%), 39.15% by subway, 5.17% by taxi, 4.82% by railroad, and finally 0.07% by ferry. Those who walk to work account for 4,051 of the total workers (5.2%). Bicycle commuters represent 0.3% and motorcyclists 0.08%.

Place of Origin for Workers 16 and Older Who Travel Into the Study Area to Work

2000 census data indicates that the place of origin for workers 16 years and older who travel into the study area to work are primarily from New York City counties (24,647 workers or 81%): Queens County has 19,739 (80%) workers traveling to the area of study, followed distantly by Kings County (3,271 workers or 13%). Following these two counties are New York County with 758 workers (3%), Bronx County with 613 workers (2%), and finally Richmond County with 266 workers (1%). The rest of the workers who travel into the study area are from areas outside of New York City: 4,678 workers (16%) of the total workers are from other New York State counties where those arriving from Nassau and Suffolk Counties represent 91% of the commuters, followed by 5% from Westchester County and 4% from other Upstate New York counties. Workers traveling from New Jersey and Connecticut represent a very small group in the study, accounting for 1% each. Many of the out-of-state workers that are not from the tri-state area work at the nearby John F. Kennedy airport. They represent close to 1% of the workers that travel into the study area.

The journey to work analysis was performed for the local resident labor force and for the workers who travel into the study area. It revealed that approximately 0.24 to 0.30% of workers travel to and from the study area by bicycle, which represents less than 1% of the commuters. However the growing population in the area, which includes a growing number of commuters should have the option to get to their destination by bicycle and expanding the network in this part of Queens would provide them with designated bicycle facilities to use. In addition, the recommended bicycle facilities are intended to also attract recreational cyclists of the surrounding neighborhoods in Queens and the rest of the city to the parks and waterfront area of the area of study.

Zoning and Land Use

Zoning and Land Use

The entire study area contains fourteen different residential districts, two commercial districts, and three manufacturing districts, as follows: R1-2, R2, R3-1, R3-2, R3A, R3X, R4, R4-1, R4A, R5, R6, R6A, R6B, R7A, C3, C8-1, M1-1, M1-2, and M2-1. Also, the study area includes three commercial overlay districts: C1-2, C2-2, and C2-4 (see Figures 3 – 12 for a detailed illustration of the zoning and land use). Appendix A in this report contains three tables A1, A2 and A3 which provide a brief description of each zoning district within the area of study and their allowable Floor Areas Ratios (FAR) by permitted uses.

Northern Segment: Woodhaven Area

This part of the study area is mainly residential and contains typically one and two-family residences. The lowest residential densities are generally mapped north of Atlantic Avenue (R1-2, R2, R3-1, and R3X districts) and south of the Belt Parkway (R2, R3-1 and R3-2). Multi-family apartments occupy many of the lots throughout the Woodhaven study area. The slightly higher residential zoning districts R4 and R5 lie between Atlantic Avenue and Belt Parkway. The medium density residential districts (R6A, R6B and R7A) are located near Forest Park along Jamaica Avenue and near Lefferts Boulevard.

There are several C8-1 districts scattered on a few blocks in this part of the study area. Along the major avenues designated as “commercial overlay” are mixed commercial/ residential two to three-story buildings. Many commercial/ office buildings also exist with activities such as medical offices, real estate offices, jewelry stores, banks, furniture stores etc. Cross Bay Boulevard south of the Belt Parkway only has mixed commercial/ office buildings.

Several light manufacturing districts (M1-1, M1-2) exist throughout the area spread out in small pockets with a concentration along 100th Street south of Atlantic Avenue. Along 100th Street there also exists the remnant of an old elevated rail line.

The Aqueduct Racetrack, which lies in a C8-1 district between Rockaway Boulevard and North Conduit Avenue just east of 100th Street is the only racetrack located within the limits of New York City.

The third largest park in Queens, Forest Park, is located in the northern part of the study area. It offers hiking and bridle paths in the eastern portion. To the west it contains softball, baseball, tennis courts etc. and a golf course. It is also a haven for bird watching.

Middle Segment: Broad Channel Area

A small area at the southern end of the Broad Channel Island is primarily residential (R3-2 district). The other zoning districts are commercial overlay districts that occupy four blocks along Cross Bay Boulevard.

The rest of the island is made up of open spaces and marshland which are part of the Gateway National Recreational Park which offer a range of recreational opportunities: hiking, bicycling, bird watching, fishing etc.

Southern Segment: Rockaway Peninsula Area

The Rockaway peninsula is zoned largely residential. The lower density residential zoning districts are located generally west of Beach 116th Street. The slightly higher residential densities (R4-1, R5, R5A, R5D districts) are located roughly south of Rockaway Beach Boulevard, west of Beach 108th Street. The medium density residential zoning districts, R6 are superblocks with large apartment complexes and are concentrated along the Ocean Promenade.

The commercial districts are scattered throughout the Rockaway Peninsula. They are limited to C3 and C8-1 commercial districts. Commercial overlays C1-2, C1-3 and C2-1 are mapped and clustered along Rockaway Beach Boulevard and Beach 116th Street.

Very few locations along the northern waterfront are designated light manufacturing districts. Several large transportation/ utility facilities are located in the western portion of this area between Beach 116th and Beach 103rd Streets: Department of Environmental Protection waste water treatment plant, a Metropolitan Transportation Authority Bus Depot facility, and the LI lighting company.

At the western tip of the peninsula is Jacob Riis Park which is part of the Gateway National Recreation Area. It is a popular destination and provides handball, basketball, volleyball courts, etc. It is also home to various seaside recreation areas: park's ocean beach, landscaped walkways and boardwalks.

Rezonings

Rockaways Neighborhoods Rezoning

The rezoning area encompasses five neighborhoods stretching from the Nassau County border to Beach 129th Street: Far Rockaway, Edgemere, Somerville (eastern end of the peninsula), Rockaway Beach and Rockaway Park (western section of the peninsula, which is also part of the Woodhaven - Cross Bay bicycle corridor study). The proposed rezoning for the 280 blocks of the Rockaway peninsula extends more than six miles. However the area of rezoning under analysis for the bicycle corridor study is generally bounded by Beach 129th Street to the west, Beach 95th Street to the east and by the water to the north and south of the peninsula.

In the last several years neighborhoods of the Rockaways have witnessed a rapid increase in new developments. Much of the developments are inconsistent with the prevailing scale, density and built character of the existing buildings due to the outdated zoning that was largely unchanged from 1961. The proposed contextual rezoning aims to reinforce and protect the special character of the five neighborhoods of the Rockaways: protect the low-scale of the distinctive housing stock, ensure the adequate provision of front and side yards, provide for moderate retail and housing opportunities in select locations near transit and establish new regulations to address parking demand generated by new developments.

The rezoning proposal for the Rockaways Neighborhoods was finally approved and adopted on August 14, 2008.

Woodhaven/ Richmond Hill/ Ozone Park Rezoning

The Woodhaven/ Richmond Hill/ Ozone Park area is under consideration for rezoning by the Department of City Planning. This area is generally bounded by Park Lane South and Jamaica Avenue to the north, 103rd Avenue to the south, 75th Street to the west and Lefferts Boulevard/ 121st Street/ Van Wyck Expressway to the east. The rezoning proposal is to be certified during the winter of 2009/2010.

Zoning Map
Woodhaven Area

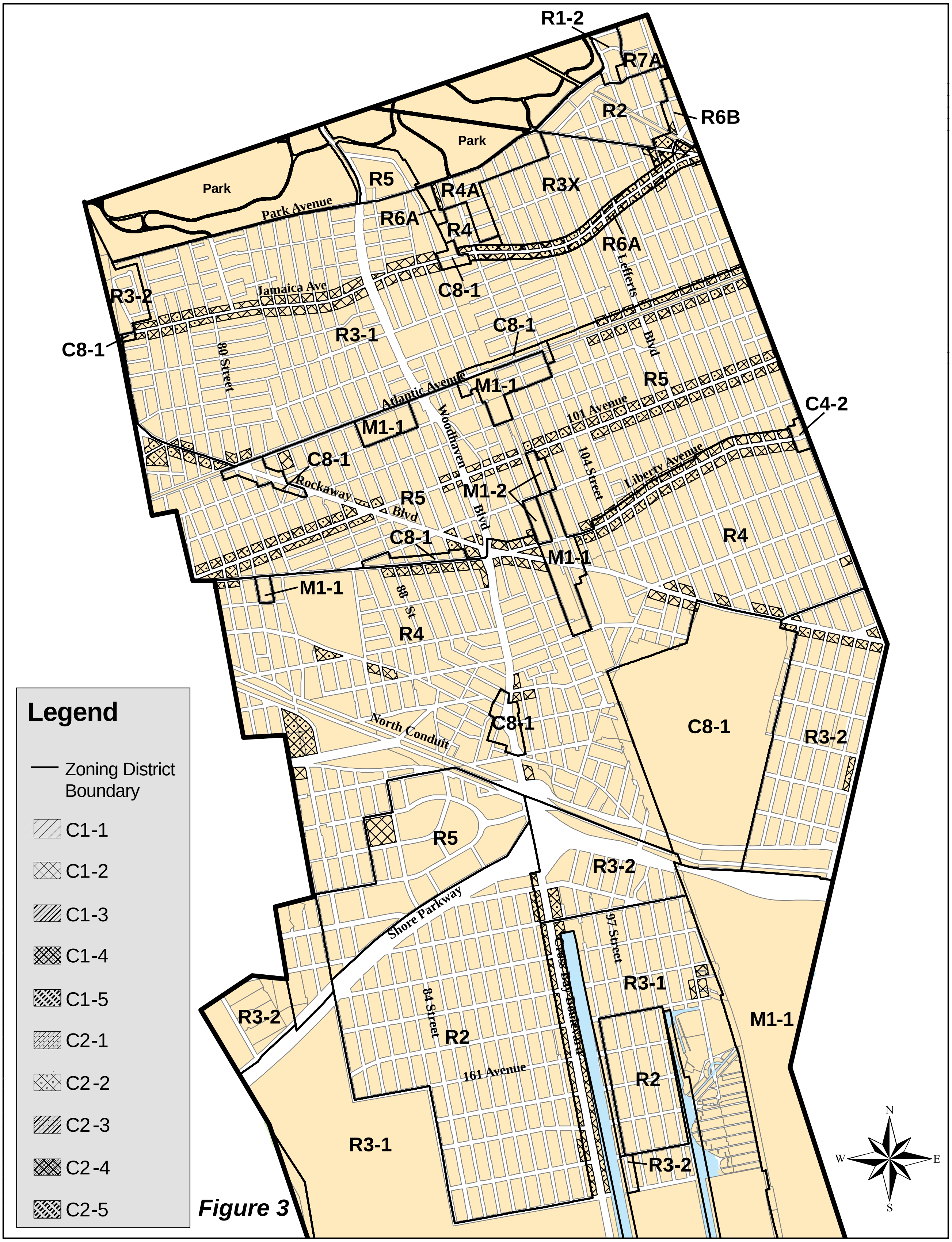


Figure 3

Zoning Map
Broad Channel and Rockaway Peninsula Area

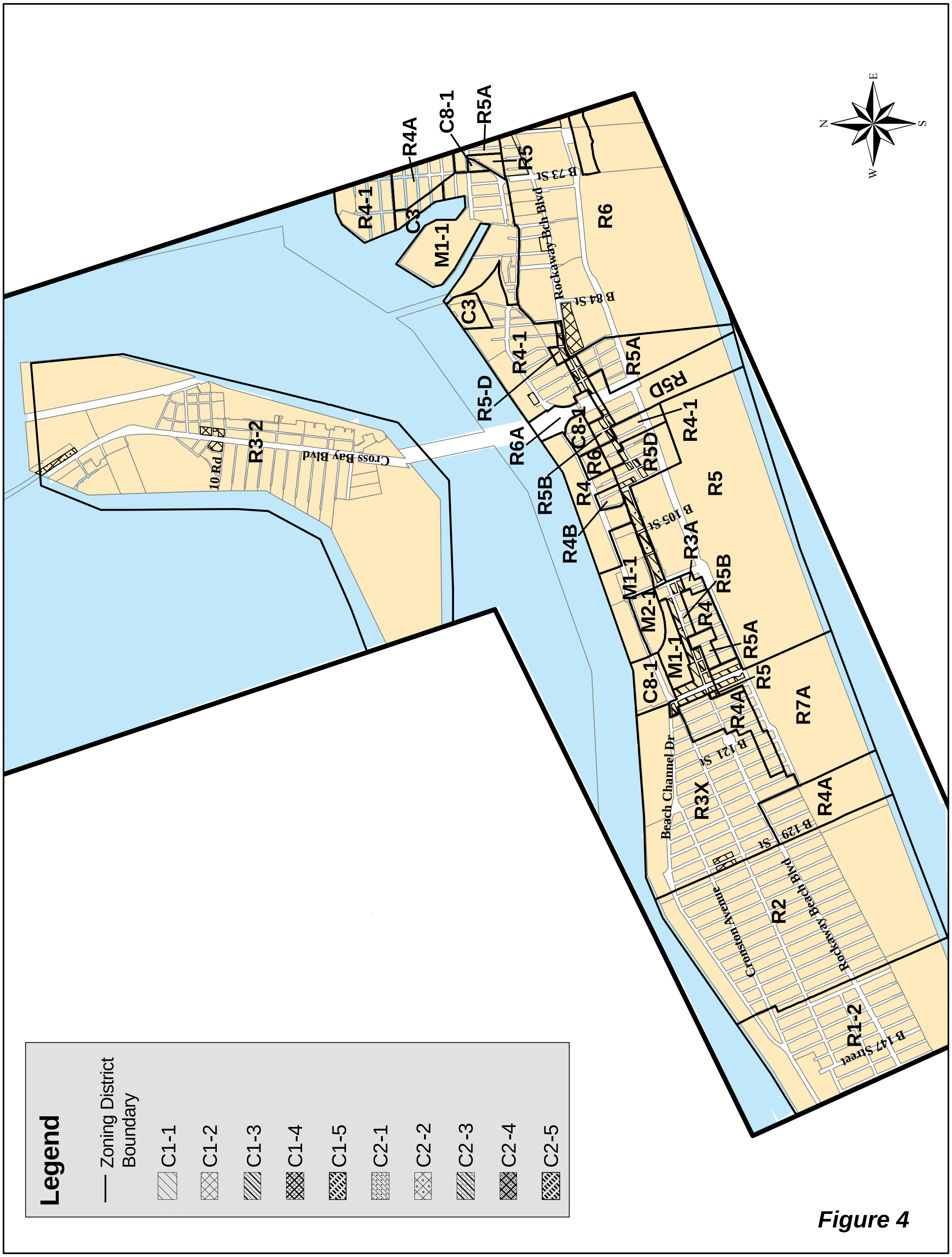


Figure 4

Land Use Map
Woodhaven Area

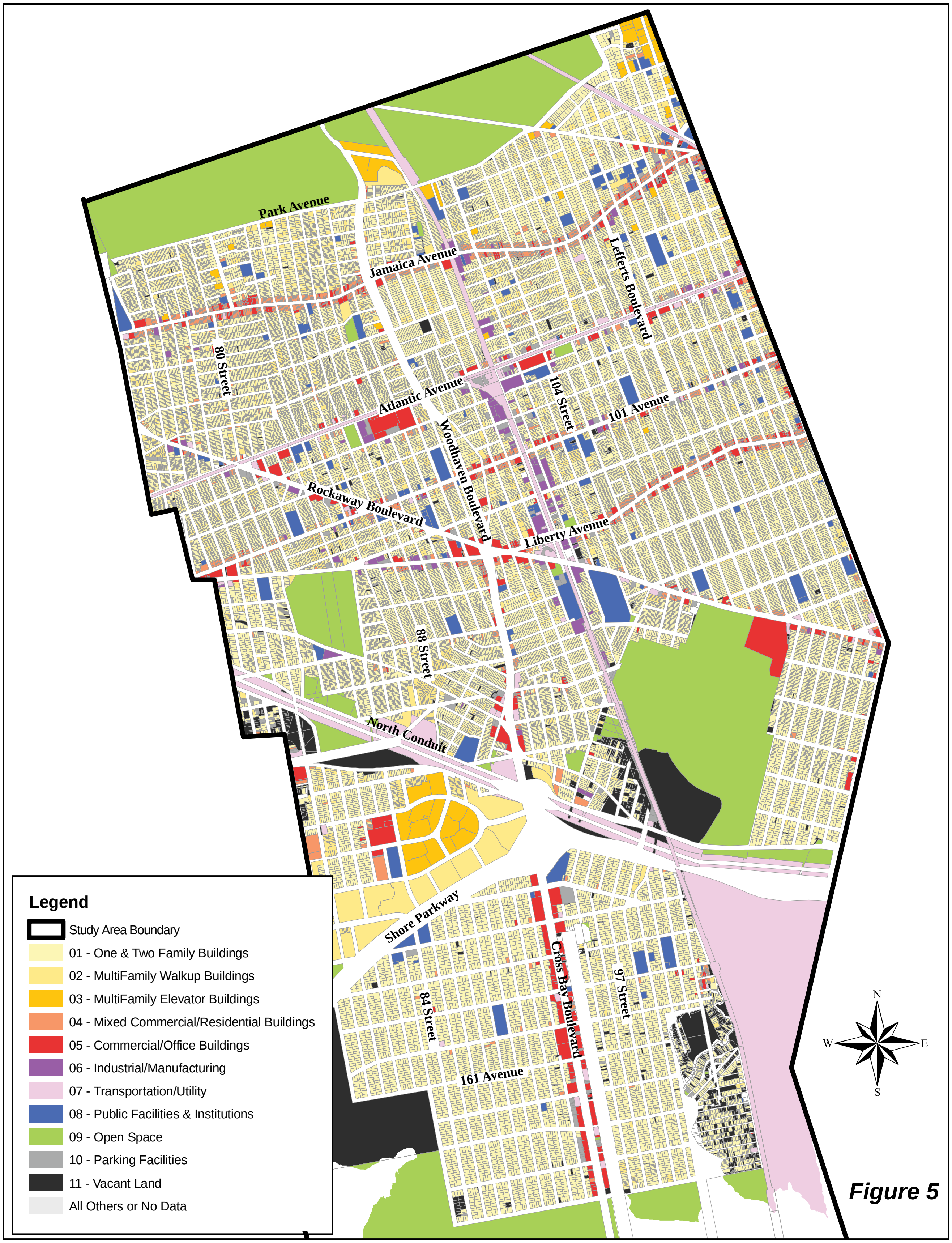


Figure 5

Land Use Map
Broad Channel and Rockaway Peninsula Area

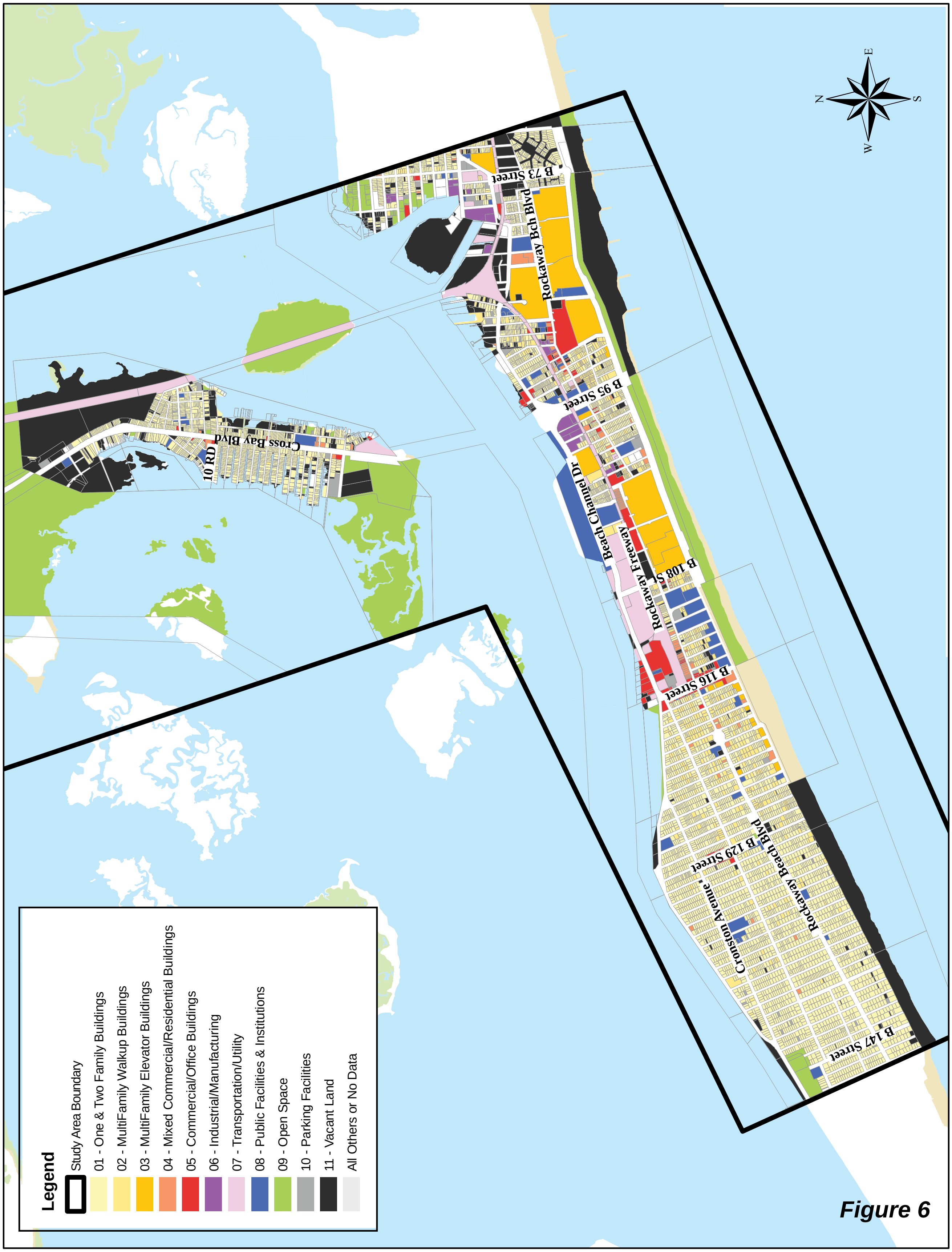


Figure 6

Street Network

Street Network – Major Arterials

Within the study area, there is one highway, the Belt Parkway, and thirteen (13) major collector roadways: Myrtle Avenue, Jamaica Avenue, Atlantic Avenue, Liberty Avenue, Rockaway Boulevard, Linden Boulevard, North Conduit Avenue, South Conduit Avenue, Beach Channel Drive, Rockaway Beach Boulevard, Woodhaven Boulevard, Cross Bay Boulevard, and Lefferts Boulevard that join the study area with the metropolitan region and adjacent communities.

These roadways are described below. The following Figures 13 - 15 map out the location of the highways and major collector roadways in the study area.

East – West Roadways

Belt Parkway is a six-lane, two-directional highway that travels through the study area with the North and South Conduit adjacent and parallel to this highway (North Conduit Avenue running on the north side and South Conduit Avenue running on the south side). It also has a grassy right-of-way on both sides of the highway that includes the Shore Parkway Greenway Path located only on the south side.

Myrtle Avenue is an east to west roadway that serves the study area. It's roadbed is about 35 feet wide with one travel lane and a parking lane in each direction. In the study area it travels through a quiet residential neighborhood in contrast to the stretch west of Forest Park in Glendale and Ridgewood where it is a primary shopping strip.

Jamaica Avenue is a major east-west arterial. This roadway measures approximately 38 – 45 feet wide with a travel and a parking lane per direction of traffic. It is a major commercial strip in the central part of Queens that serves the community of Woodhaven and its surroundings.

Atlantic Avenue is a major arterial that extends across the entire borough of Brooklyn and parts of Queens. It is one of the area's busiest streets carrying many trucks and commercial vehicles, as it is one of the most direct routes to the Van Wyck Expressway. The roadbed is generally 90 feet wide with a 24-foot center median, which includes grates above the Long Island Railroad underground tunnel.

Liberty Avenue is 40 - 50 feet wide with one travel lane and a parking lane per direction of traffic. It is a busy commercial corridor lined with small to medium sized retail stores and businesses.

Rockaway Boulevard's roadbed varies from 60 to 70 feet in width. It has two travel lanes and a parking lane in each direction with limited parking in front of the John Adams High School (near 101st Street). There is a center marked median on Rockaway Boulevard, which becomes a left turn bay at the approach of a few intersections.

Linden Boulevard is generally a very busy through truck route from Brooklyn into Long Island. But the segment within the study area is quiet with a simple two-lane street. This street is 40 – 50 feet wide. It has a travel lane and a parking lane in each direction of traffic.

Beach Channel Drive is a major east-west roadway that travels along the northern shore of the Rockaway Peninsula offering a scenic view of Jamaica Bay. This road generally measures 70 – 80 feet wide between Beach 98th Street to Beach 116th Street. It narrows to 52 feet between Beach 116th and Beach 145th Streets. An open space emerges along the waterfront on the north side of the road at Beach 143rd Street, which includes a paved route for pedestrians.

Rockaway Beach Boulevard runs through most of the Rockaway Peninsula and travels through quiet residential neighborhoods. The roadbed generally measures 40 to 70 feet wide. Beyond Beach 127th Street Rockaway Beach Boulevard width varies between 60 – 70 feet and has an attractive landscaped center median.

North – South Roadways

Woodhaven Boulevard is a wide and busy major arterial that proceeds in the north-south direction often used as alternate route to bypass the Van Wyck Expressway. It consists of a main road and a service road in each direction separated by medians. The total width of the roadway is approximately 130 feet. The main road has six central lanes and each service road has two lanes of traffic.

Cross Bay Boulevard is a continuation of Woodhaven Boulevard starting where Woodhaven Boulevard intersects Rockaway Boulevard and Liberty Avenue. It is the only roadway to Broad Channel and the Rockaway Peninsula from Queens. It is generally 90 – 110 feet wide with a center median and three travel lanes and a parking lane in each direction of traffic.

Lefferts Boulevard is a 40 - 60 feet wide north-to-south roadway that extends to the south of the Belt Parkway within the vicinity of John F. Kennedy Airport.

Truck Routes

There are five designated through truck routes and eight designated local truck routes in the area of study as illustrated in Figures 13, 14 and 15. The five designated through truck routes are Atlantic Avenue, Beach Channel Drive, Linden Boulevard, Myrtle Avenue, and North and South Conduit Avenues. The eight designated local truck routes are Atlantic Avenue, Beach Channel Drive, Cross Bay Boulevard, Linden Boulevard, Myrtle Avenue, North and South Conduit Avenues, Rockaway Boulevard, and Woodhaven Boulevard.

Street Network Map
Woodhaven Area

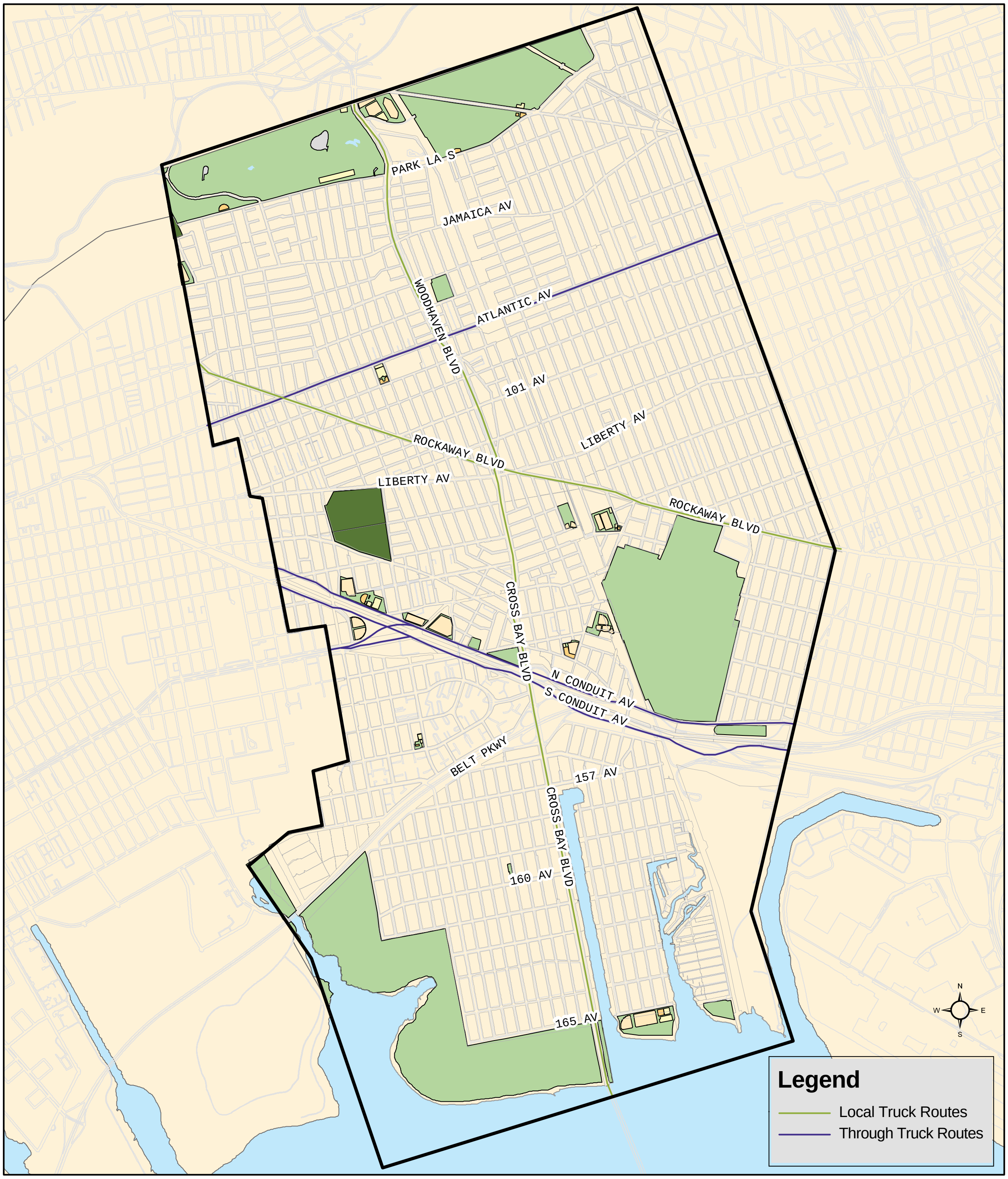


Figure 7

Street Network
Broad Channel Area

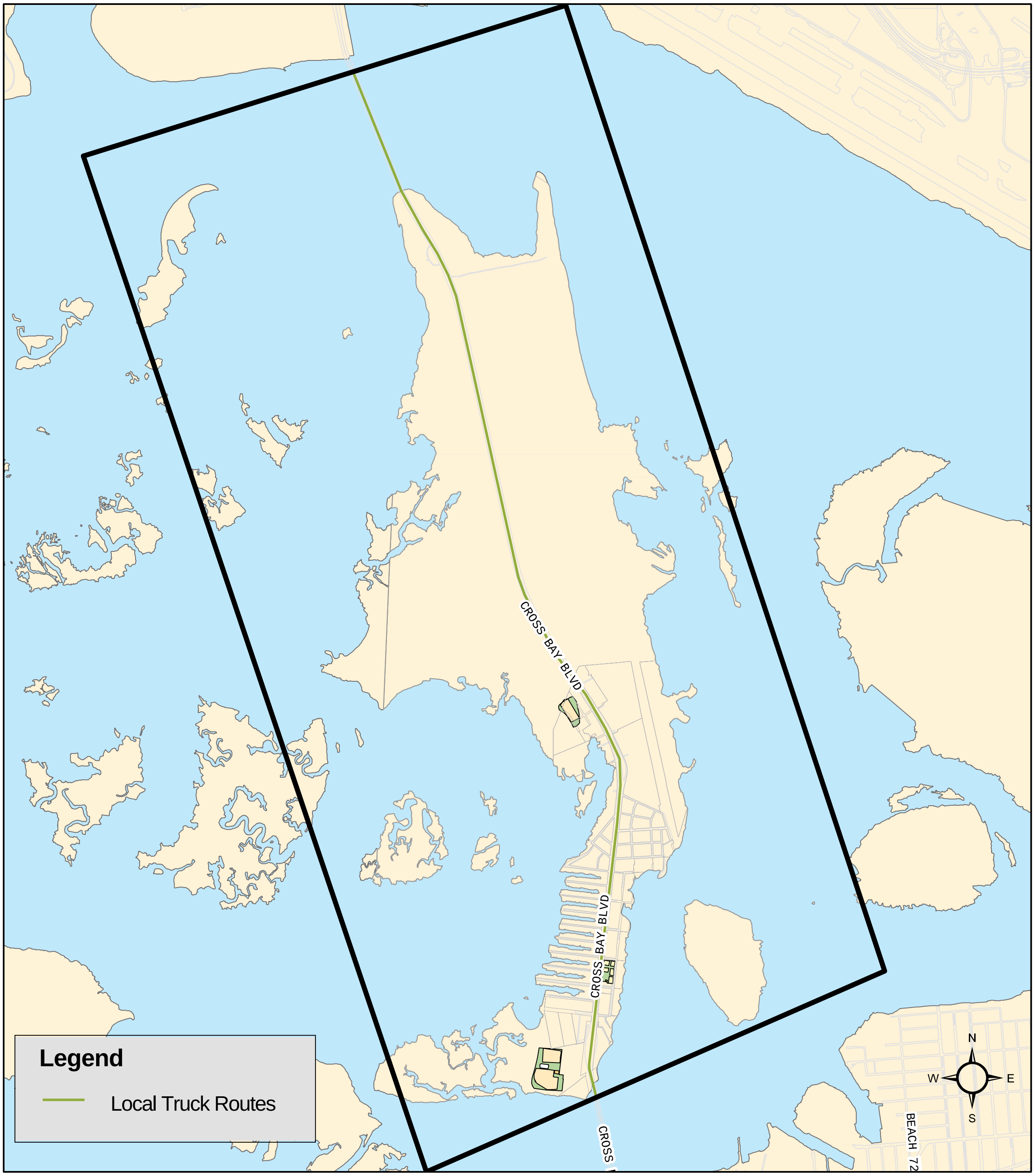


Figure 8

Street Network Map
Rockaway Peninsula Area

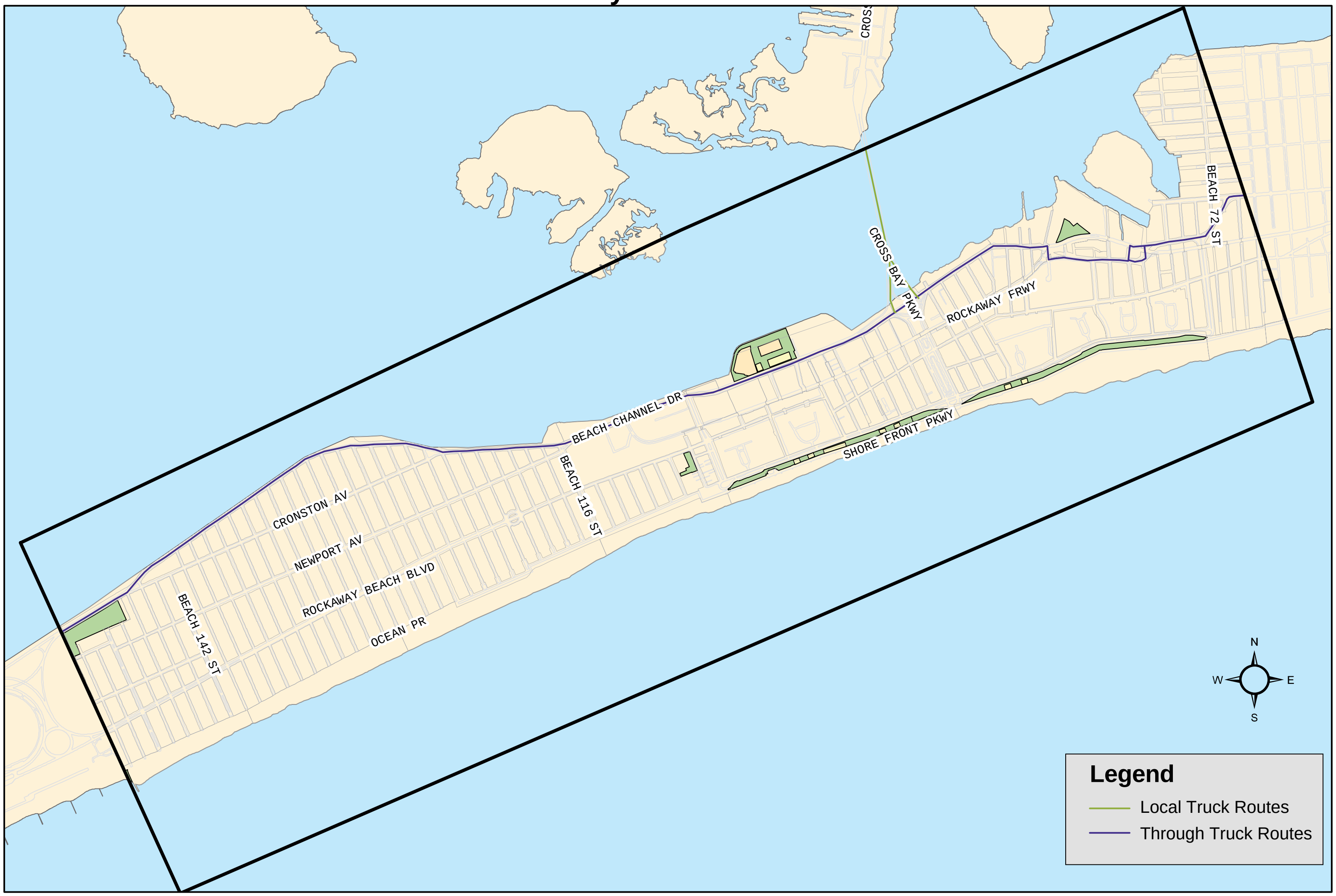


Figure 9

Bicycle Network

Existing Bicycle Network

The New York City Bicycle Master Plan published in 1997 represents the first phase of the Bicycle Network Development program and articulates the city's action plan to encourage cycling as a mode of transportation. In this comprehensive plan, a 900-mile bicycle network has been identified and is gradually being implemented to increase the level of cycling.

The existing network of bicycle routes in New York City has expanded to approximately 530 miles and is distributed throughout the five boroughs. It includes 290 miles of on-street bicycle lanes, 50 miles of on-street signed bicycle routes and 190 miles of off-street bicycle paths[1].

Bicycle use has also been on the rise as new bicycle facilities are installed. Based on the data collected along the bicycle routes in Manhattan by the Transportation Division of NYCDCP, the daily bicycle ridership increased by 30% on-street (bike lanes) from 2001 to 2008 and by 21% off-street (greenways) from 2002 to 2008. The number of greenway users increased by 50%.

To sustain the growing number of cyclists in the city of New York and to encourage cycling as a form of transportation, City Planning recently approved a text amendment to the Zoning Resolution to require indoor, secure, long term bicycle parking in new developments, substantial enlargements, and residential conversions. This applies to multi-family residential, community facility and commercial buildings, including public parking garages, in all zoning districts.

The most critical components that influence the use of bicycle facilities are the continuity of the facilities to the network and the connectivity to major destinations. There is potential to connect neighborhoods and to fill in the gaps in the existing bicycle network citywide. This report will look at one of the priority routes in Queens "Woodhaven/Cross Bay corridor" identified in the master plan with limited connectivity for cyclists and make recommendations that can improve cycling conditions.

The bicycle facilities within the study area are spread out and lack connectivity to the local parks, the Shore Parkway Greenway path, the Rockaway Beach Waterfront area and the rest of the bicycle network as indicated on the following pages in Figures 16 and 17.

The bicycle facilities are discontinuous. There are gaps of at least a mile in between bicycle facilities, and cyclists arriving into this area do not have dedicated lanes or clear signage to get to the major attractions or to connect to the existing bicycle network.

A total of four bicycle lanes and three multi-use paths exist within the study area as indicated in Figures 16 and 17. In the Woodhaven area, there are two on-street striped bicycle lanes: the first on-street bicycle lane exists on 84th Street from 149th Avenue to 157th Avenue; the second lies on 157th Avenue from 84th to 102nd Streets. They both connect to the Shore Parkway Greenway path. However for two miles north of 149th Avenue there are no bicycle facilities that connect to this segment, which would allow cyclists from Woodhaven to access the greenway path along Shore Parkway. In addition the multi-use path located in Forest Park, north of the study area, also lack

1 Source: NYC Department of City Planning (Transportation Division), GIS Bicycle Map of New York.
It should be noted that on-street bike facilities with two lanes of bicycle traffic were measured only once from start to end.

Existing Bicycle Routes (Map 1 of 2)

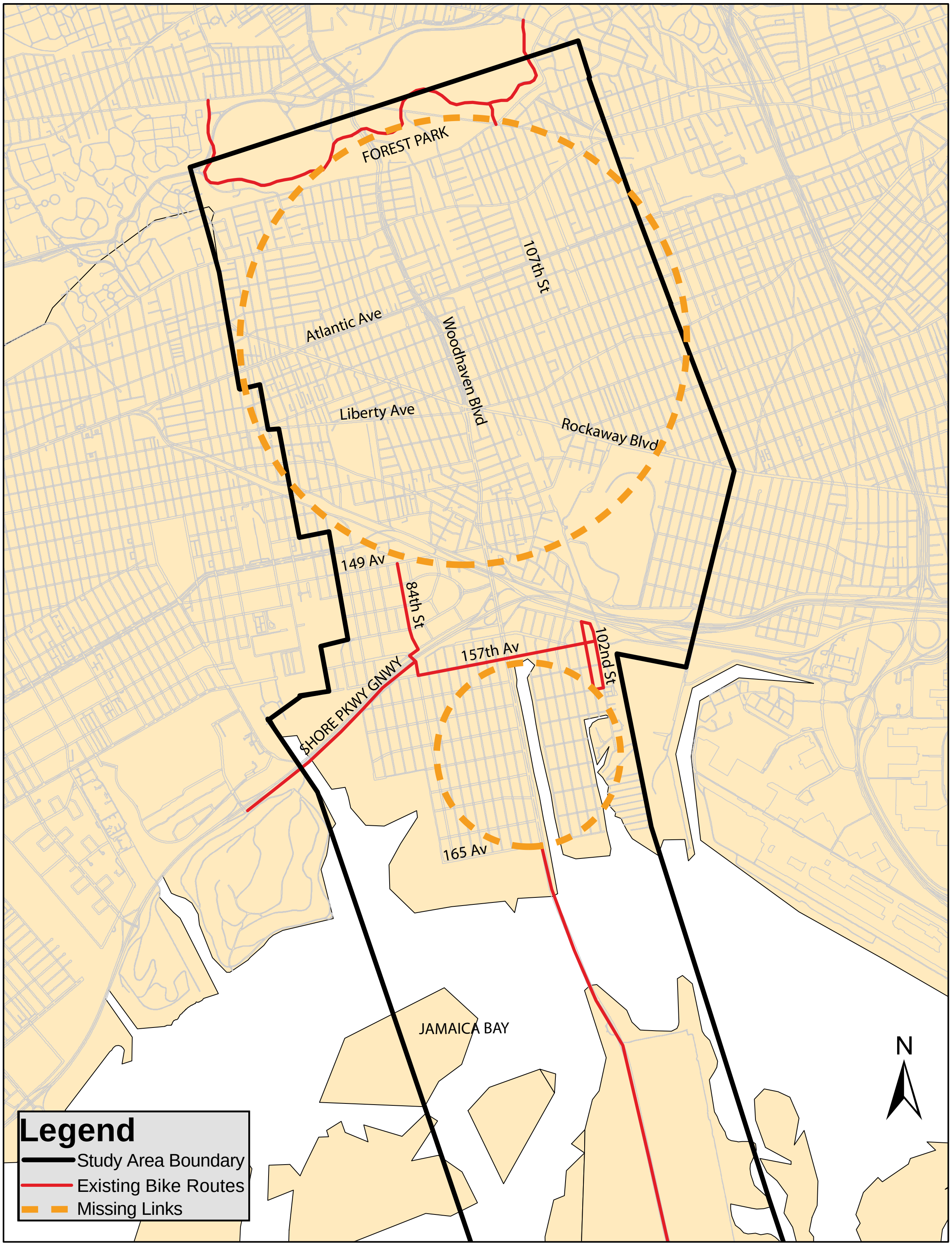


Figure 10

connectivity to the residential neighborhoods situated south of the park (includes Woodhaven).

The third on-street bicycle facility exists along Cross Bay Boulevard from 165th Avenue to the end of the Broad Channel area, leading cyclists across the Joseph P. Addabbo Bridge and the Veterans Memorial Bridge. In addition a two-way greenway path runs parallel to this bicycle lane in the Jamaica Bay wildlife area. The on-street bicycle lane switches from a 4-foot wide bicycle lane with a 2-foot buffer to a 6-foot wide bicycle lane. However there are segments particularly along the Joseph P. Addabbo Bridge, where the buffer disappears and the width of the bicycle lane is reduced to 4 feet which provides cyclists with little protection from motor vehicles along this busy arterial. When cyclists reach the Veterans Memorial Bridge they are forced to dismount and walk their bicycles across the bridge. Currently this bridge is under rehabilitation, including deck rehabilitation. It will have a dedicated bicycle path and a walkway when completed in 2010; this facility on Cross Bay Boulevard does not connect to the rest of the existing bicycle network and provides limited access to cyclists coming from the Rockaways.

The fourth and last on-street bicycle facility is located within the Rockaway Peninsula area on Shore Front Parkway from B 108th St to B 73rd St and extends into Far Rockaway using Beach Channel Drive. However the bicycle facility stops suddenly west of the bridge and does not continue towards the other end of the Rockaways (towards Jacob Riis Park). There is a multi-use path or a boardwalk along the beach that cyclists can use, but bicycle riding is permitted only from 5:00 AM to 10:00 AM.

Furthermore for the area of study there have been several proposals to transform the abandoned Rockaway Beach Branch rail line of the Long Island Railroad to a recreational green space (greenway path). It extends from Rego Park to the Rockaway Peninsula and runs mainly behind the properties on 98th Street in the Woodhaven area. However these proposals have resurfaced over the years, but have never been embraced.

Existing Bicycle Routes (Map 2 of 2)

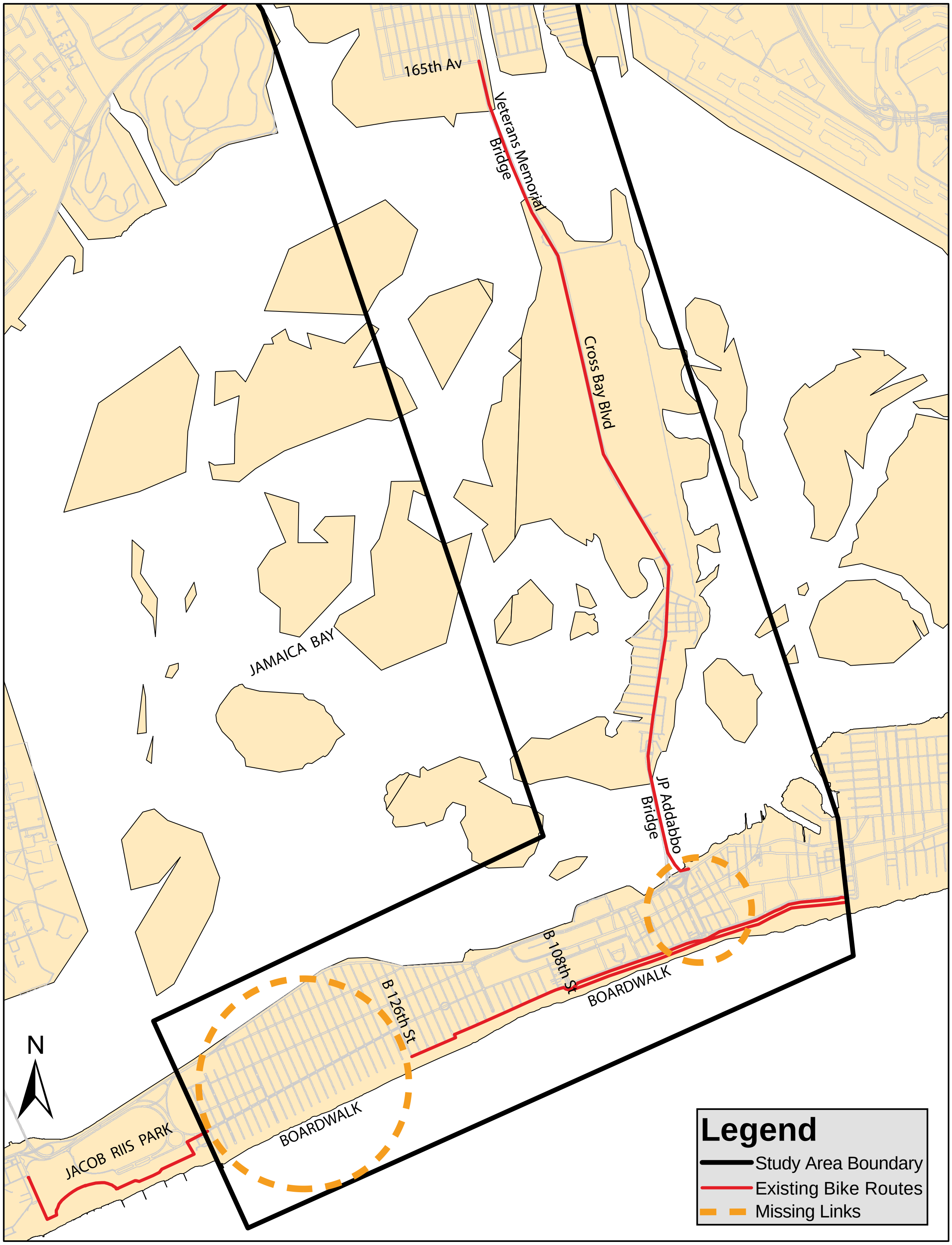


Figure 11

Accident Data Analysis

Bicycle Accident Data Analysis (Years 2005 - 2007)

A detailed analysis of bicycle accidents was conducted for the Woodhaven, Broad Channel and Rockaway Peninsula areas in order to identify and examine the bicycle accident history of the study area and see if there are any patterns. Bicycle, pedestrian and vehicular accident data for a three year period (2005, 2006 and 2007) were obtained from New York State Department of Transportation.

Woodhaven Area

According to the bicycle accident data provided, 138 bicycle accidents occurred in the Woodhaven area from the year 2005 through 2007. This number represents 92% of the total number of bicycle accidents that had taken place over the years within the entire study area.

The locations with the highest number of bicycle accidents over the last three years are situated at cross-streets that lead to one of the several entrances or exits to Forest Park. They are:

- Park Lane South and Woodhaven Boulevard (total = 3 bicycle accidents)
- 85th Road and 86th Street (total = 3 bicycle accidents)

There are no bicycle facilities available in the Woodhaven area and providing cyclists with dedicated on-street bicycle facilities could contribute towards reducing conflicts between motorists and cyclists that lead to accidents on the road.

Broad Channel Area

Based on the accident data available, there were no bicycle accidents in the Broad Channel Area during the period from 2005 through 2007. However one vehicular accident did occur in 2006 at Cross Bay Boulevard and 201st Avenue.

There is an on-street bicycle facility in each direction of traffic and an off-street greenway path on Cross Bay Boulevard. These facilities may have played a role as one of the contributing factors that lead to the low number of bicycle accidents on this stretch of the road.

Rockaway Peninsula Area

A total of 12 bicycle accidents took place from the year 2005 through 2007. Based on the data analyzed during that period close to half of the bicycle accidents occurred on Rockaway Beach Boulevard, which is a direct route to Jacob Riis Park. This supports the need for a bicycle facility on this road as proposed in the NYC Bicycle Master Plan.

An analysis of vehicular and pedestrian accident data was also done for this area from 2005 to 2007. The results revealed that 7 accidents, including 1 pedestrian accident, had occurred for the year 2005. The number of accidents nearly doubled the following year to 13 accidents (included 3 pedestrian accidents). However in 2007, the number of accidents went down dramatically to 2 and involved only vehicles.

See the following maps of study area shown in Figures 18 – 22 for an indication of the accident locations.

Bicycle Accidents Year 2005 - 2007
Woodhaven Area

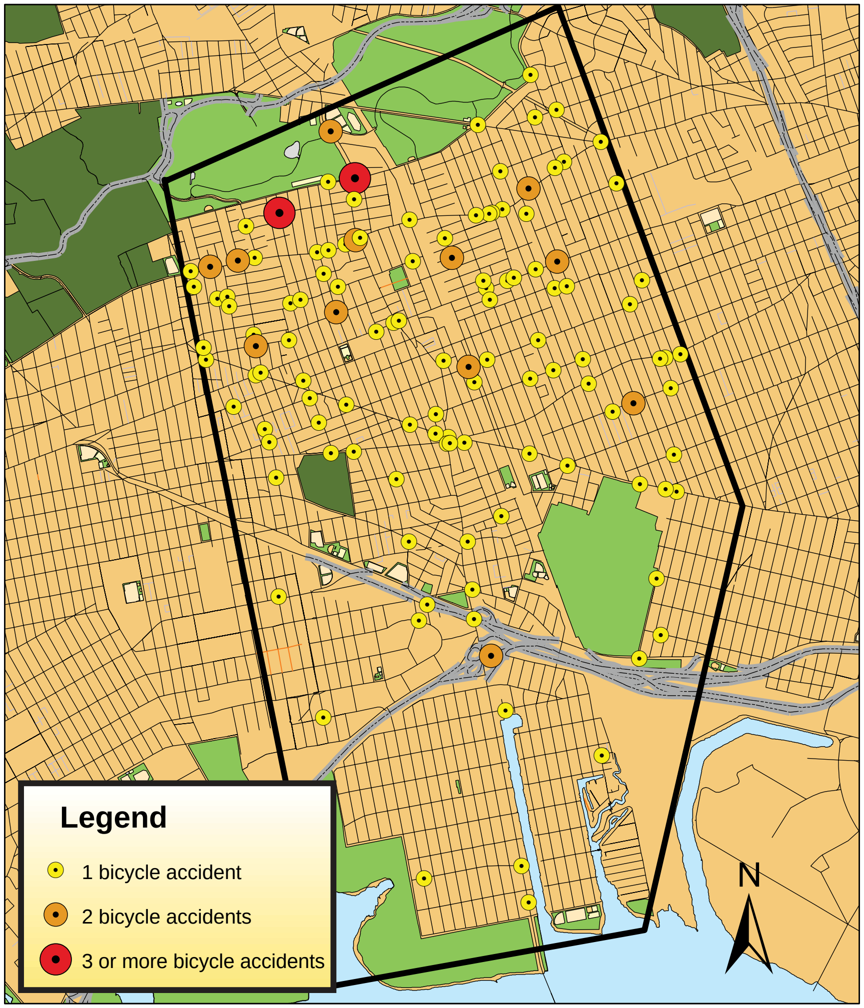


Figure 12

Pedestrian/Vehicle Accidents 2005 - 2007
Woodhaven Area

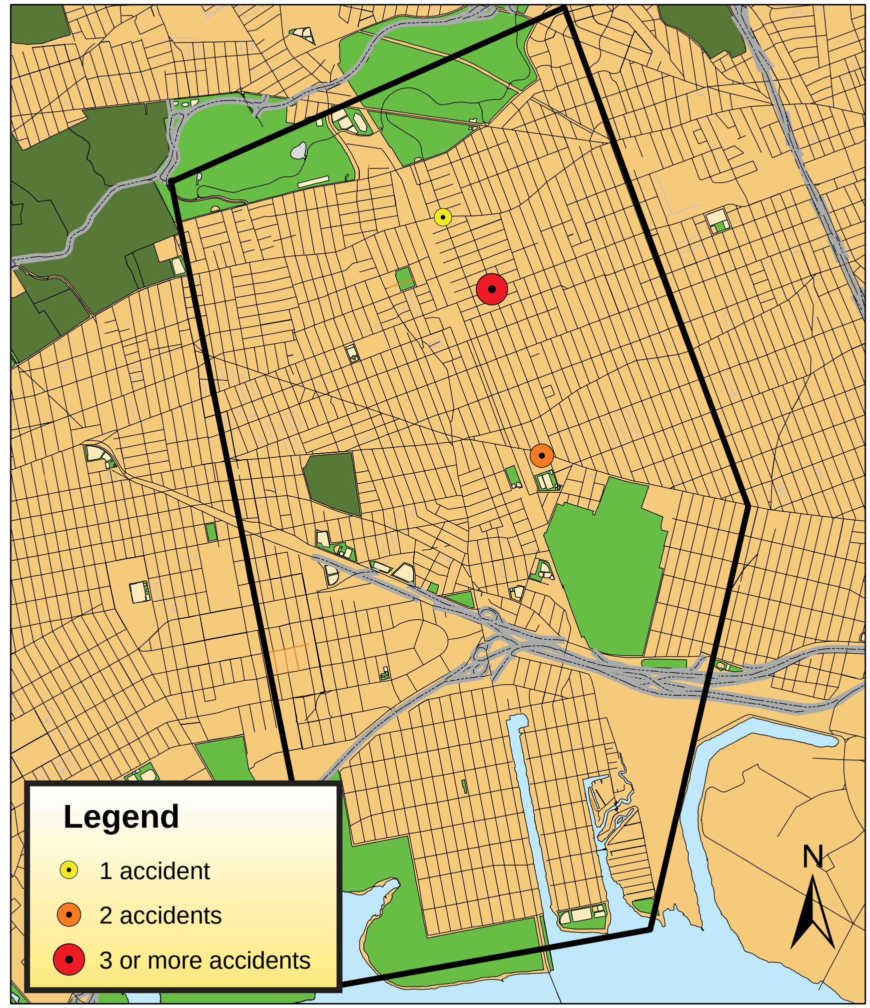


Figure 13

Pedestrian/Vehicle Accidents 2005 - 2007
Broad Channel Area

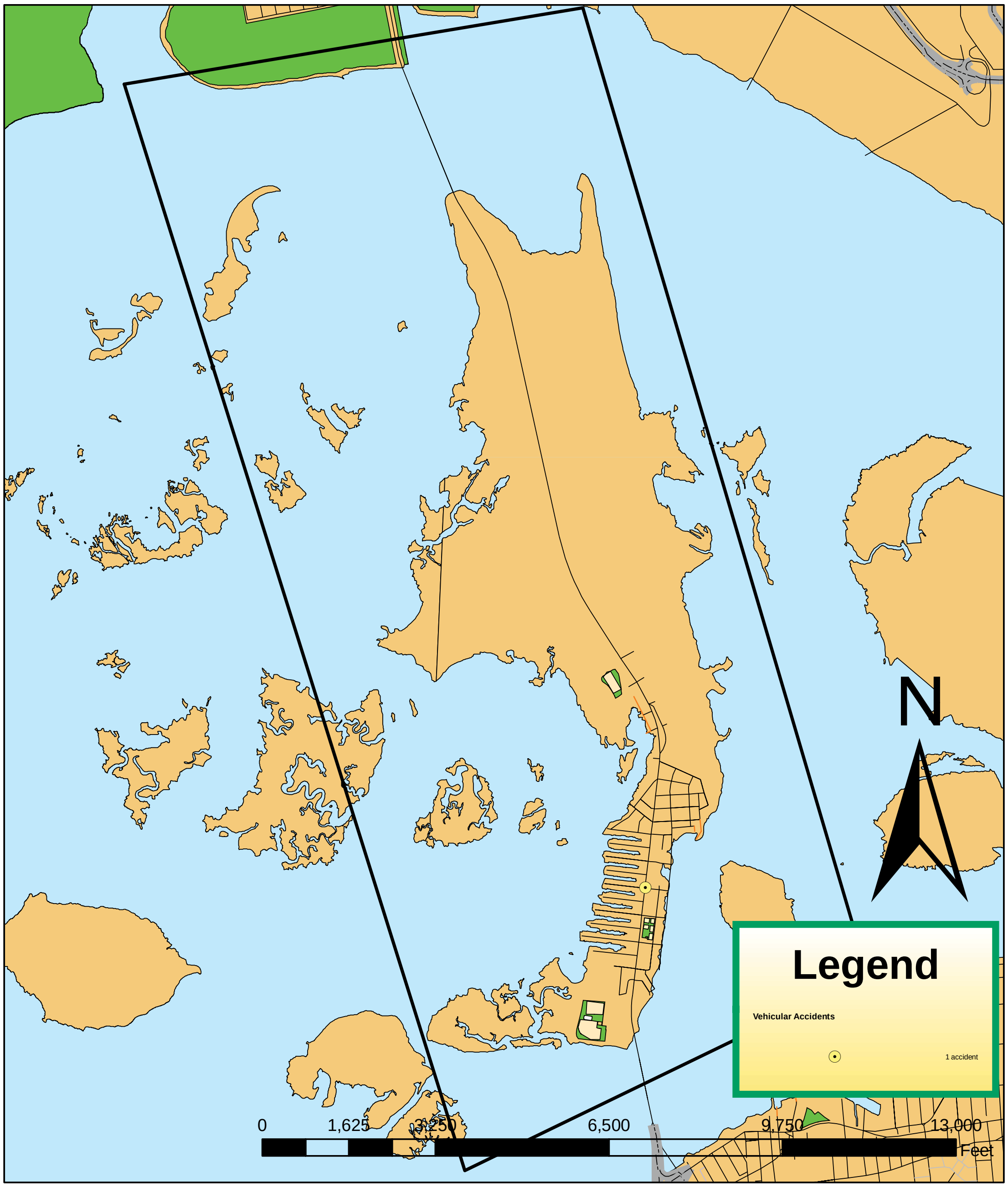


Figure 14

Bicycle Accidents Year 2005 - 2007
Rockaway Peninsula Area

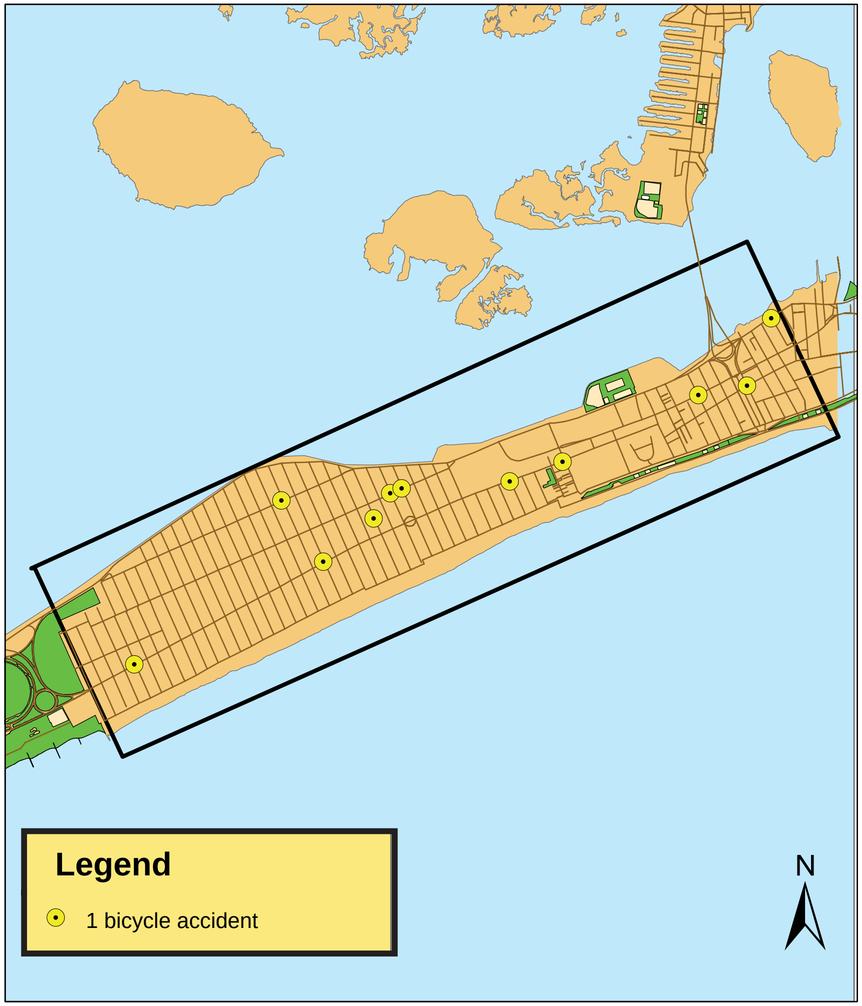


Figure 15

Pedestrian/Vehicle Accidents Years 2005-2007
Rockaway Peninsula Area

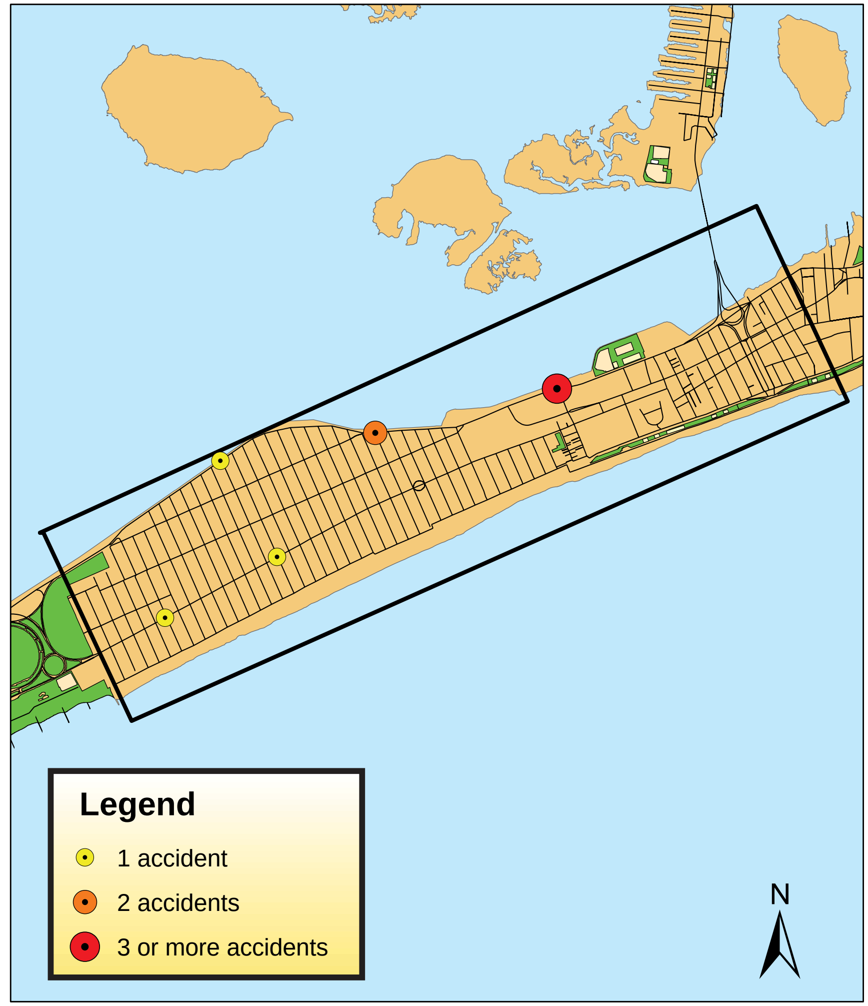


Figure 16

Public Transportation

Subway and Bus Services

Subway Service

The Metropolitan Transportation Authority New York City Transit (MTA) operate four (4) subway lines within the study area which are the "A", "J", "Z" lines and the Rockaway Park Shuttle (see Figures 23 – 25 for the subway lines within the study area).

The daily volumes for each subway station within the study area have been collected by the MTA New York City Transit. The average daily weekday volumes are provided below for 2008:

Subway Station	Average Daily Volume
80th Street ("A" line)	4, 304
88th Street ("A" line)	2,709
Rockaway Boulevard ("A" line)	7,422
104th Street ("A" line)	1,827
111th Street ("A" line)	2,771
Lefferts Boulevard ("A" line)	7,773
Aqueduct Racetrack ("A" line)	60
North Conduit Avenue ("A" line)	890
Howard Beach ("A" line)	2,966
Broad Channel ("A" line)	361
Beach 90th Street ("A" line)	1,114
Beach 98th Street ("A" line)	795
Beach 105th Street ("A" line)	282
Rockaway Park ("A" line)	844
75th Street ("J" line)	3,758
85th Street-Forest Pkwy ("J" line)	3,693
Woodhaven Boulevard ("J" line)	4,174
104th Street ("J" line)	2,509
111th Street ("J" line)	2,637

The Rockaway Boulevard station with 7,422 riders and the Lefferts Boulevard station with 7,773 riders are the busiest stations in the study area and have the highest volumes.

Cyclists at all times have the option to get to the study area by using the subway system. In this case the subway provides bicyclists with an alternate mode of transportation that can reduce the length of a trip for commuters and recreational riders coming from a distant location to the study area.

<u>*Bus Service*</u>
The study area is also served by fourteen local and four express bus routes. The local bus routes are: B15, Q7, Q8, Q10, Q11, Q21, Q22, Q24, Q35, Q37, Q41, Q53, Q56, and Q112. The express bus routes are: QM15, QM16, QM17, and QM23. Here are the average weekday volumes in 2008:

Bus Route	Average Weekday Volume
B15	23,065
Q7	5,672
Q8	7,963
Q10	23,385
Q11	10,415
Q21	1,658
Q22	7,753
Q24	11,387
Q35	4,376
Q37	6,768
Q41	6,968
Q53	10,684
Q56	10,472
Q112	5,765
QM15	1,299
QM16	320
QM17	354
QM23	24

Unlike the subway, bicycles may not be brought onto buses of the MTA and New York City Transit. See the following Figures 26 - 28 for an illustration of the bus routes in the study area. In addition, Appendix C gives a detailed description of the transit system.

Subway Lines Map
Woodhaven Area

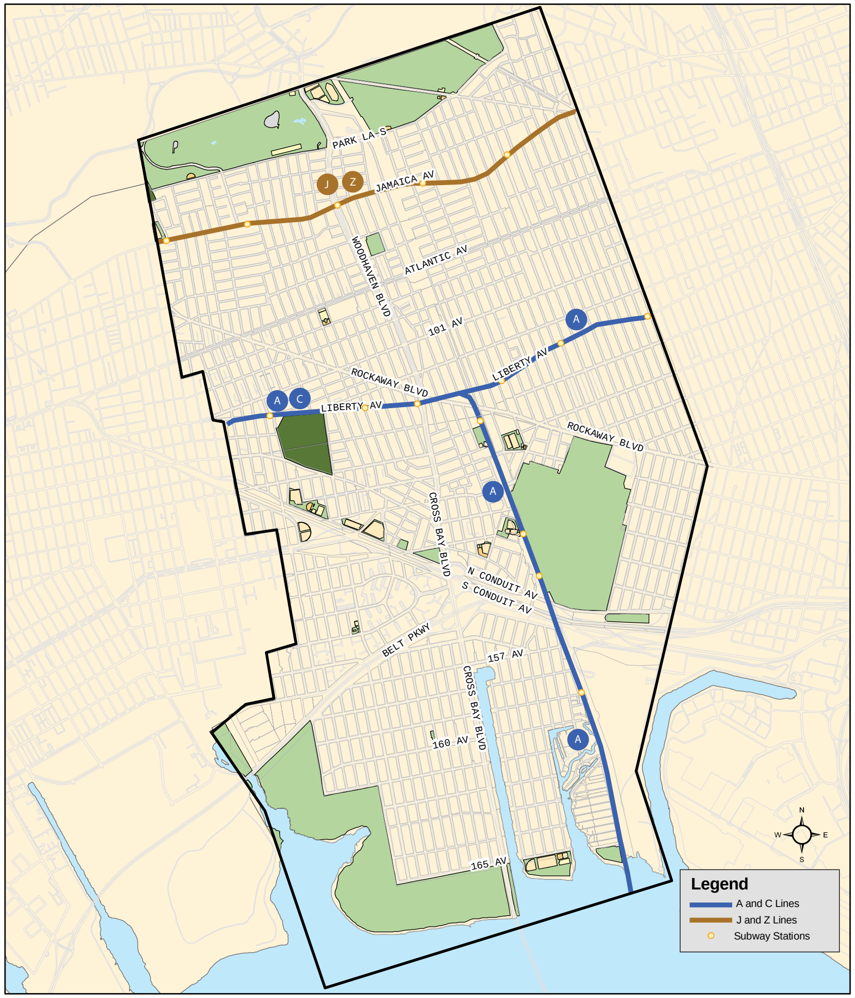


Figure 17

Subway Lines Map
Broad Channel Area

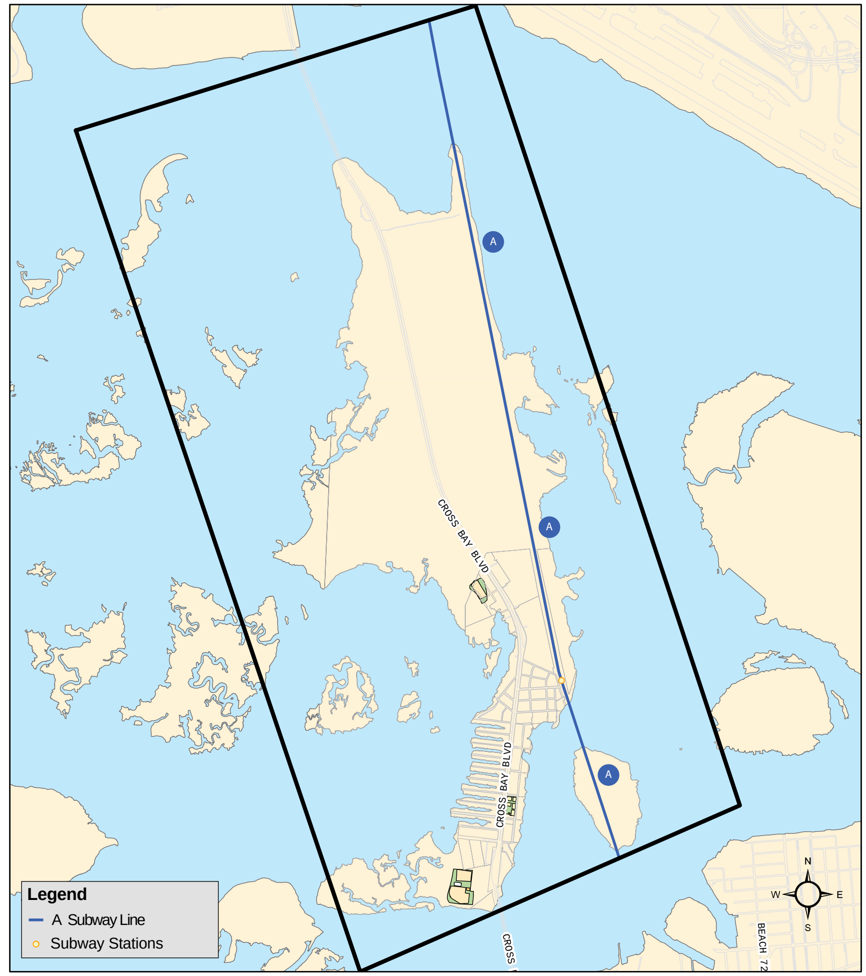


Figure 18

Subway Lines Map
Rockaway Peninsula Area

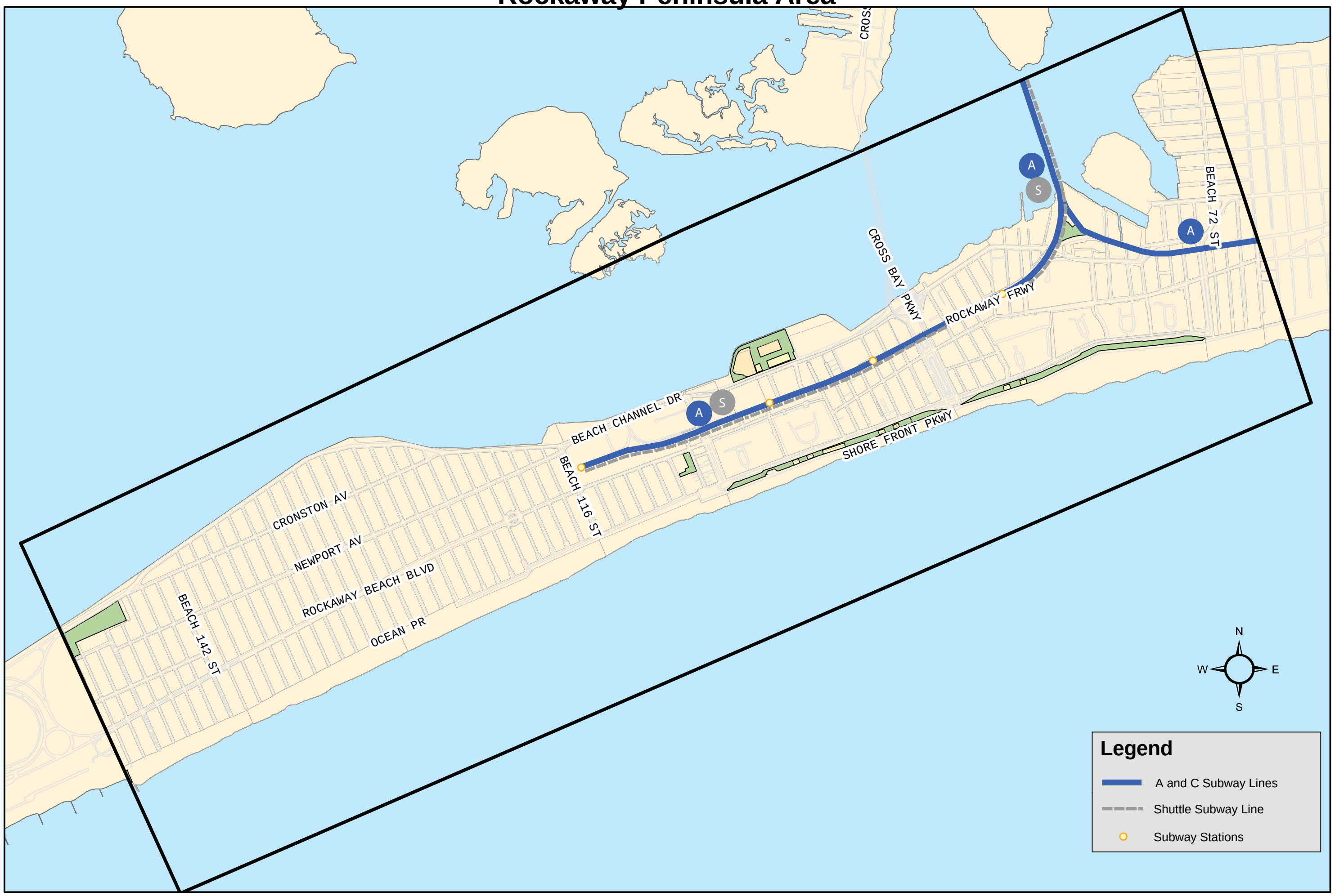


Figure 19

Bus Routes Map
Woodhaven Area

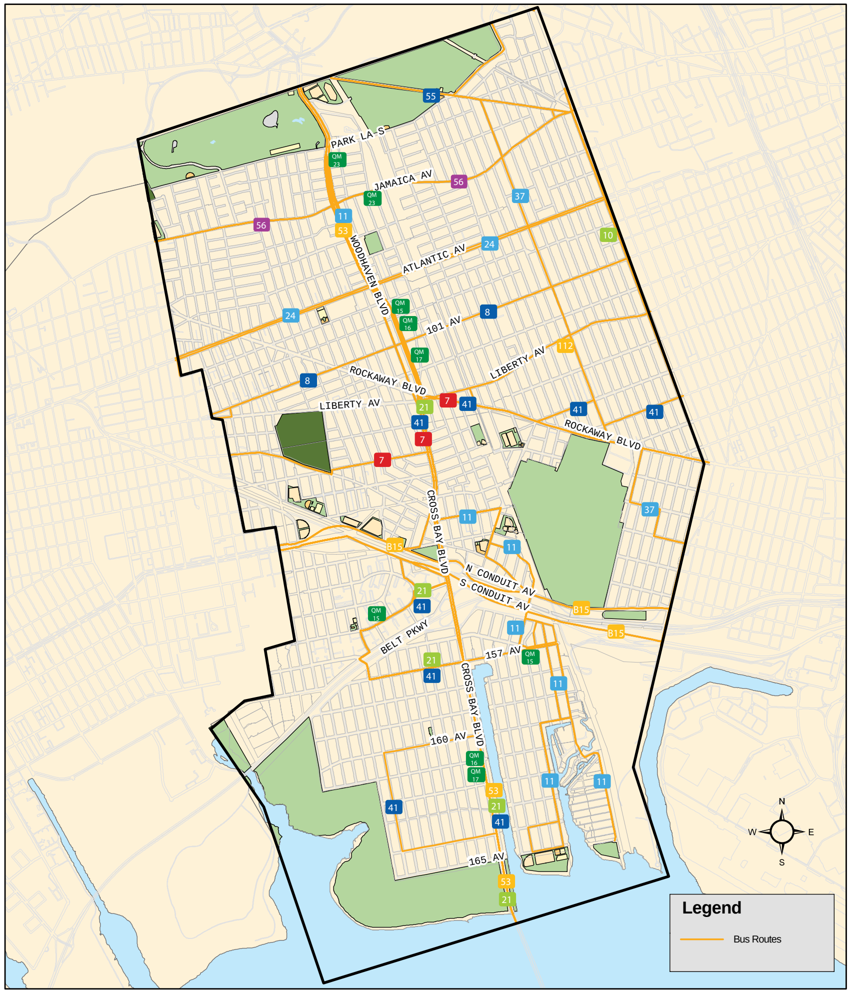


Figure 20

Bus Routes Map
Broad Channel Area

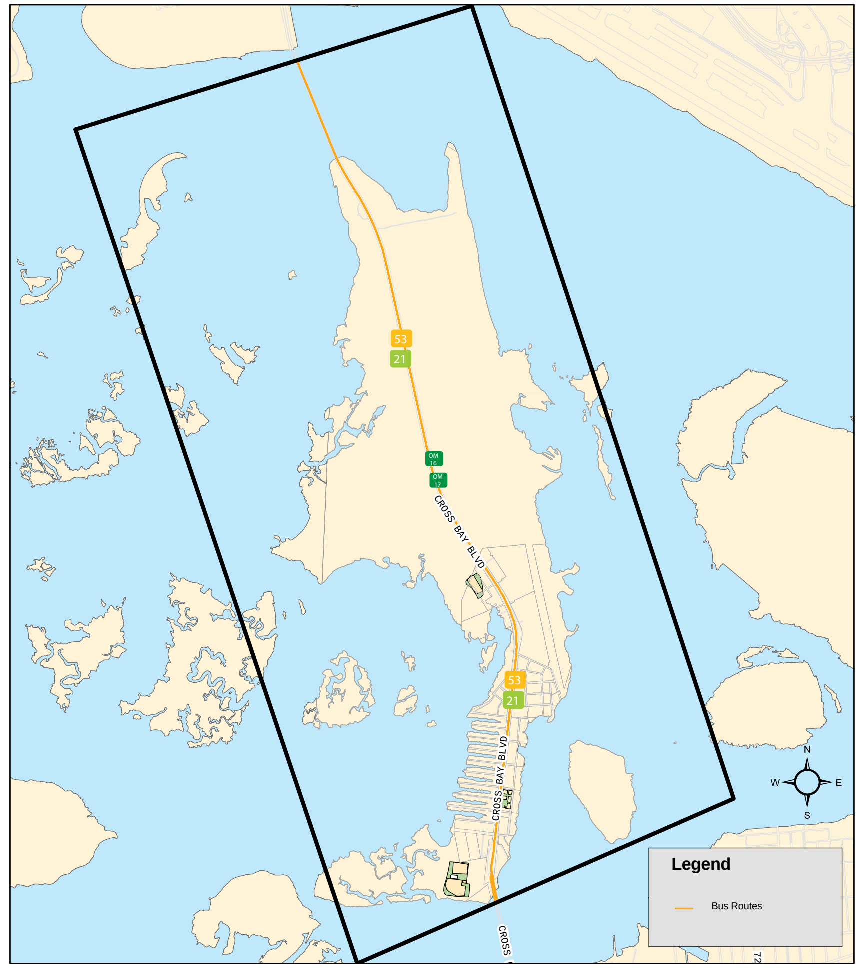


Figure 21

Bus Routes Map
Rockaway Peninsula Area

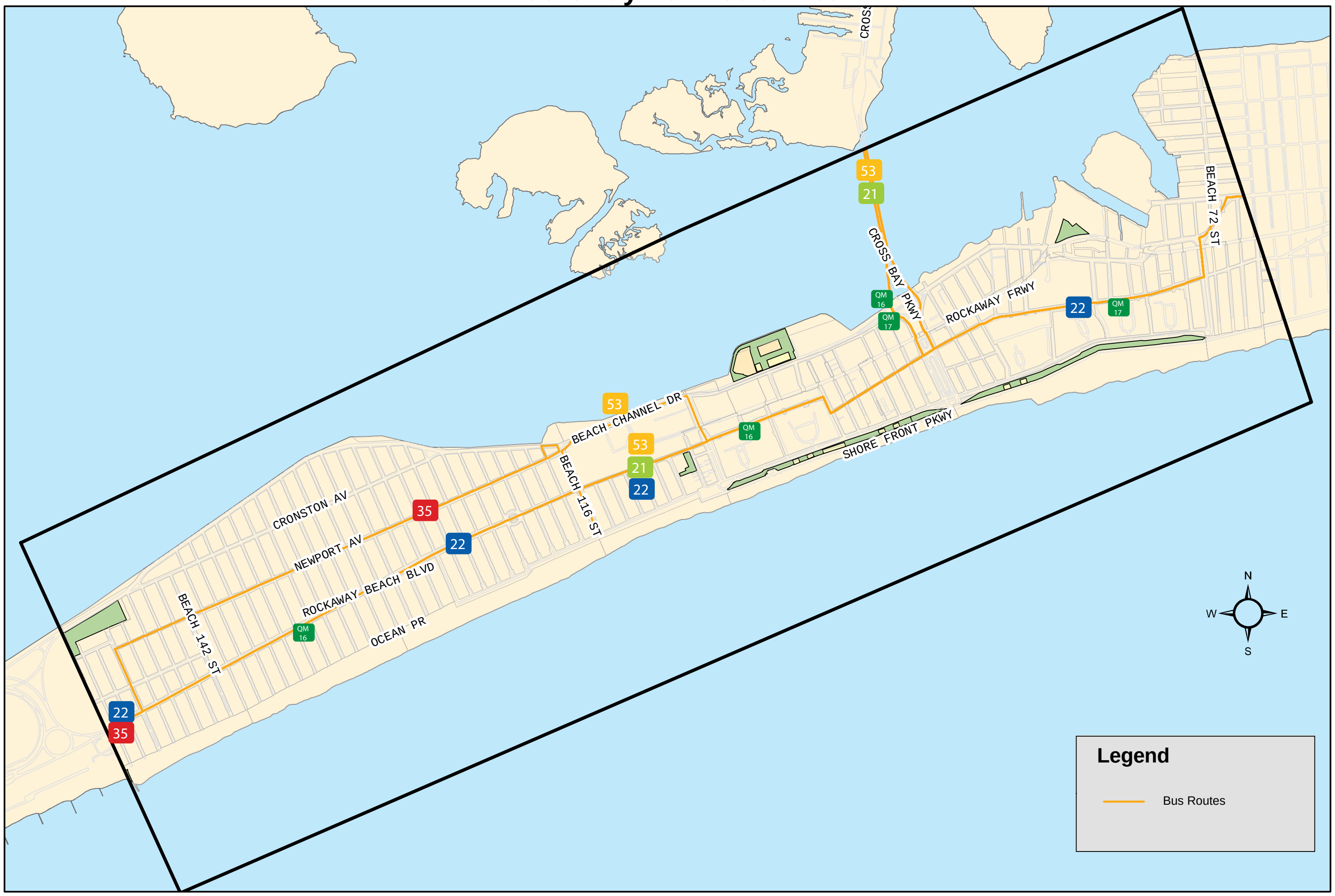


Figure 22

EVALUATION OF SELECTED CORRIDOR AND RECOMMENDATIONS

Corridor Selected for a Proposed Bicycle Route

The New York City Bicycle Master Plan is used as a starting point in developing connections for the bicycle travel corridor of the Woodhaven / Cross Bay Boulevard area in this chapter. The proposed bicycle corridor would potentially link those who travel by bicycle from the residential neighborhoods of Woodhaven, Howard Beach, Rockaway Park and Belle Harbor to the major attractions and open spaces of the area such as Shore Parkway Greenway, Forest Park, Jamaica Bay Wildlife Refuge, Rockaway Beach and Jacob Riis Park.

As illustrated in Figures 30 through 34, it travels generally in a north-south direction through 102^{nd}, 104^{th} and 101^{st} Streets, Centreville Street, Hawtree Street, Cohancy Street, 91^{st} and 92^{nd} Streets, 96^{th} and 97^{th} Streets, Cross Bay Boulevard. Then it continues in an east-west direction through Beach Channel Drive, Shore Front Parkway and Rockaway Beach Boulevard.

The travel corridor identified for cyclists within this southern portion of Queens represents the most direct route that cyclists would follow from Forest Park to Rockaway Beach and Jacob Riis Park. The bicycle corridor was determined based on the following criteria:

- Accessibility and directness to major destinations
- Connection with existing bicycle routes
- Attractiveness of the route for cyclists
- Low conflict with other modes of transportation
- Potential feasibility for implementation
- Safety to cyclists

Study Area Bicycle Corridor

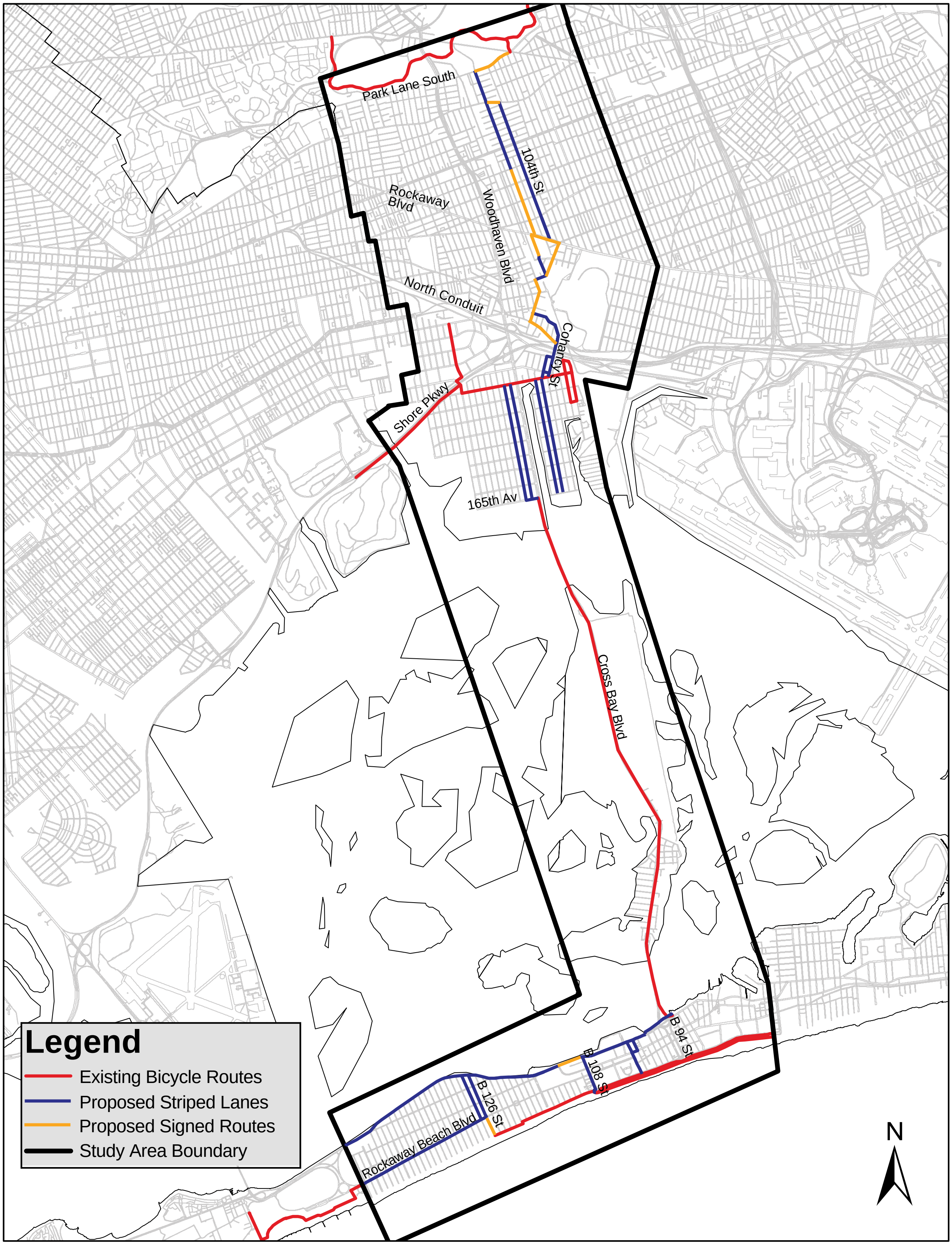


Figure 23

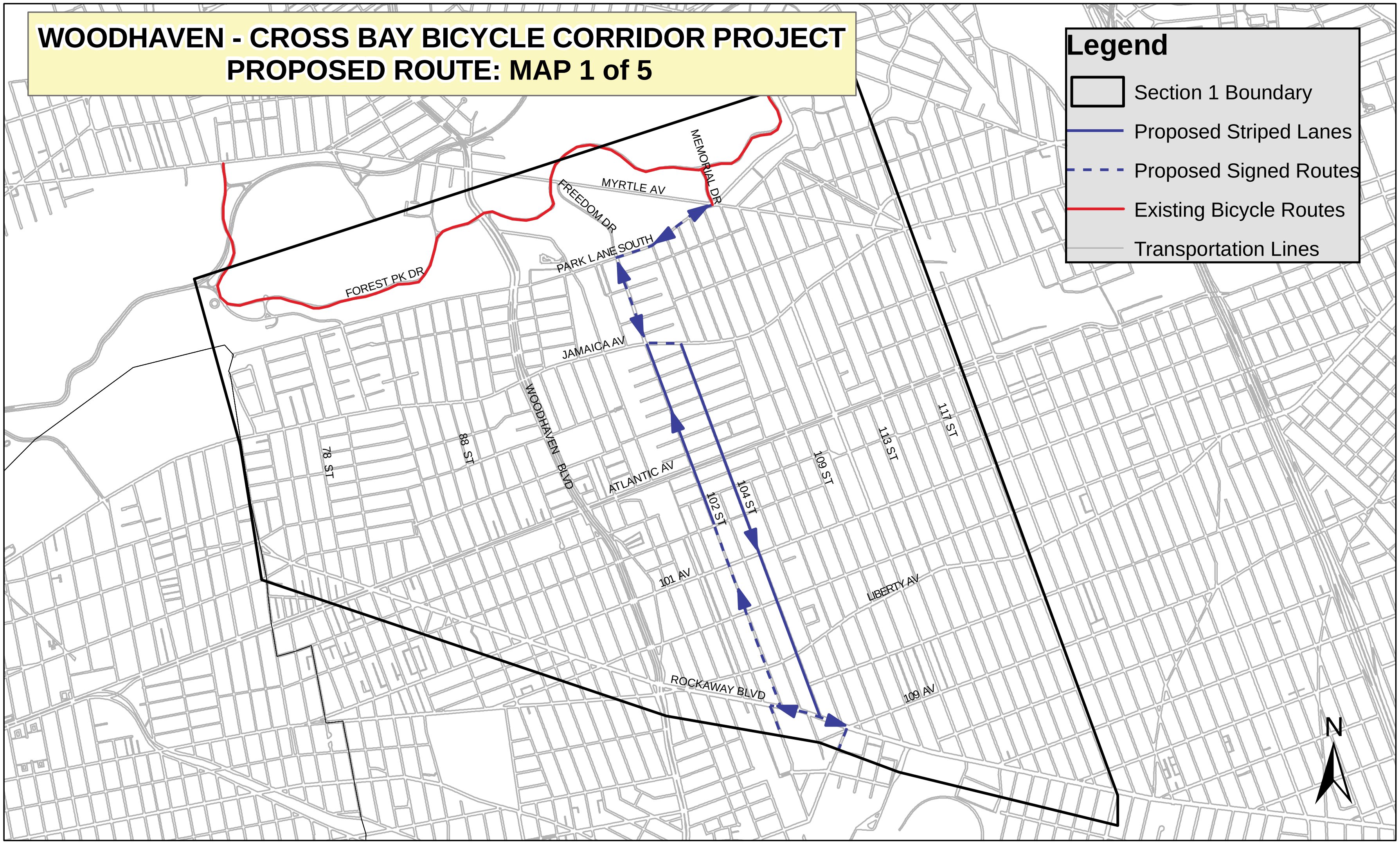
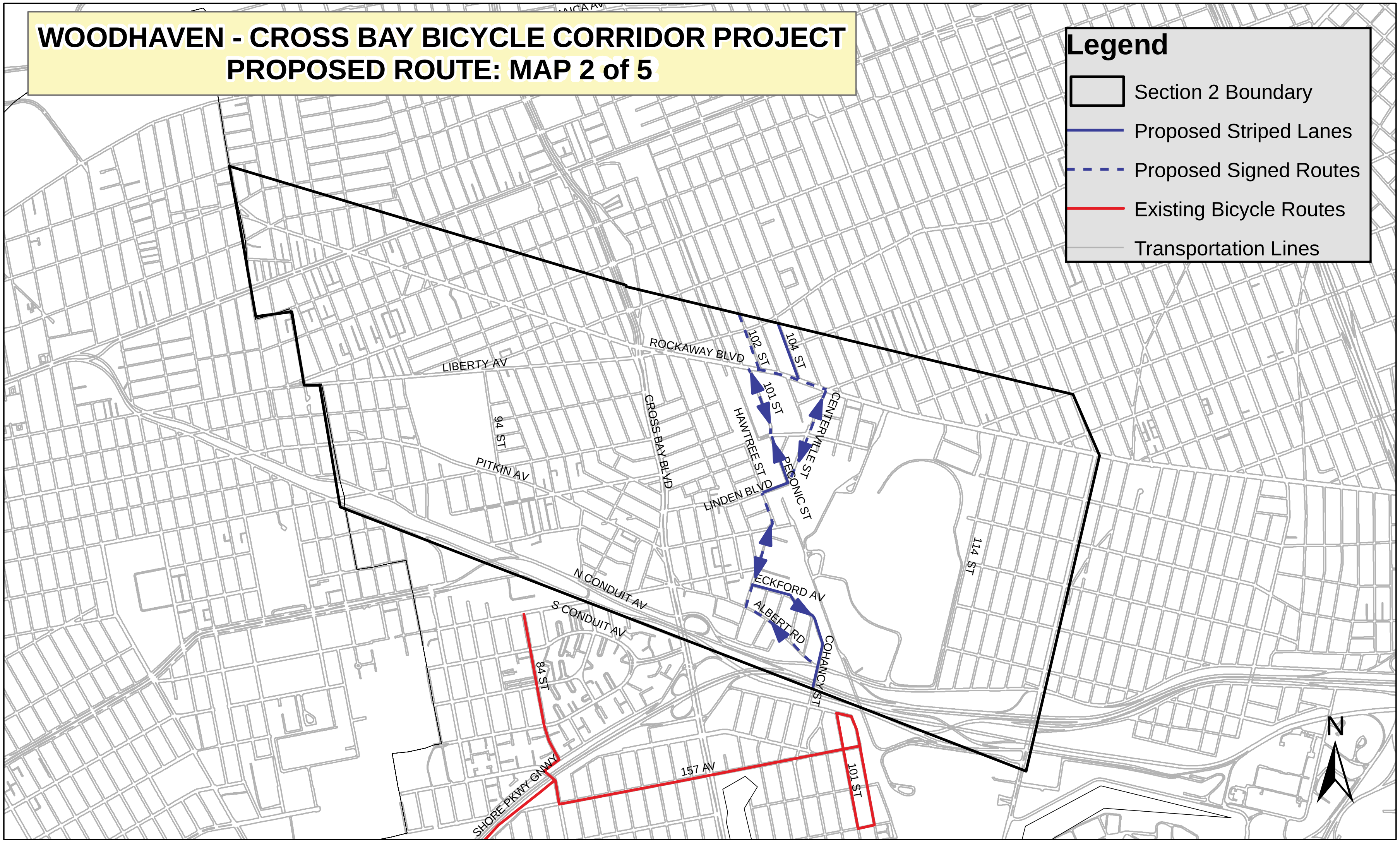

WOODHAVEN - CROSS BAY BICYCLE CORRIDOR PROJECT
PROPOSED ROUTE: MAP 1 of 5
Legend
Section 1 Boundary
Proposed Striped Lanes
Proposed Signed Routes
Existing Bicycle Routes
Transportation Lines
MYRTLE AV
MEMORIAL DR
FREEDOM DR
PARK LANE SOUTH
FOREST PK DR
JAMAICA AV
WOODHAVEN BLVD
88 ST
78 ST
ATLANTIC AV
102 ST
104 ST
109 ST
113 ST
117 ST
101 AV
LIBERTY AV
ROCKAWAY BLVD
109 AV
N

Figure 24



WOODHAVEN - CROSS BAY BICYCLE CORRIDOR PROJECT
PROPOSED ROUTE: MAP 2 of 5
Legend
Section 2 Boundary
Proposed Striped Lanes
Proposed Signed Routes
Existing Bicycle Routes
Transportation Lines
ROCKAWAY BLVD
LIBERTY AV
102 ST
104 ST
101 ST
CENTERVILLE ST
HAWTREE ST
PECONIC ST
94 ST
PITKIN AV
CROSS BAY BLVD
LINDEN BLVD
114 ST
N CONDUIT AV
S CONDUIT AV
ECKFORD AV
ALBERT RD
COHANCY ST
84 ST
157 AV
101 ST
SHORE PKWY GNWY
N

Figure 25

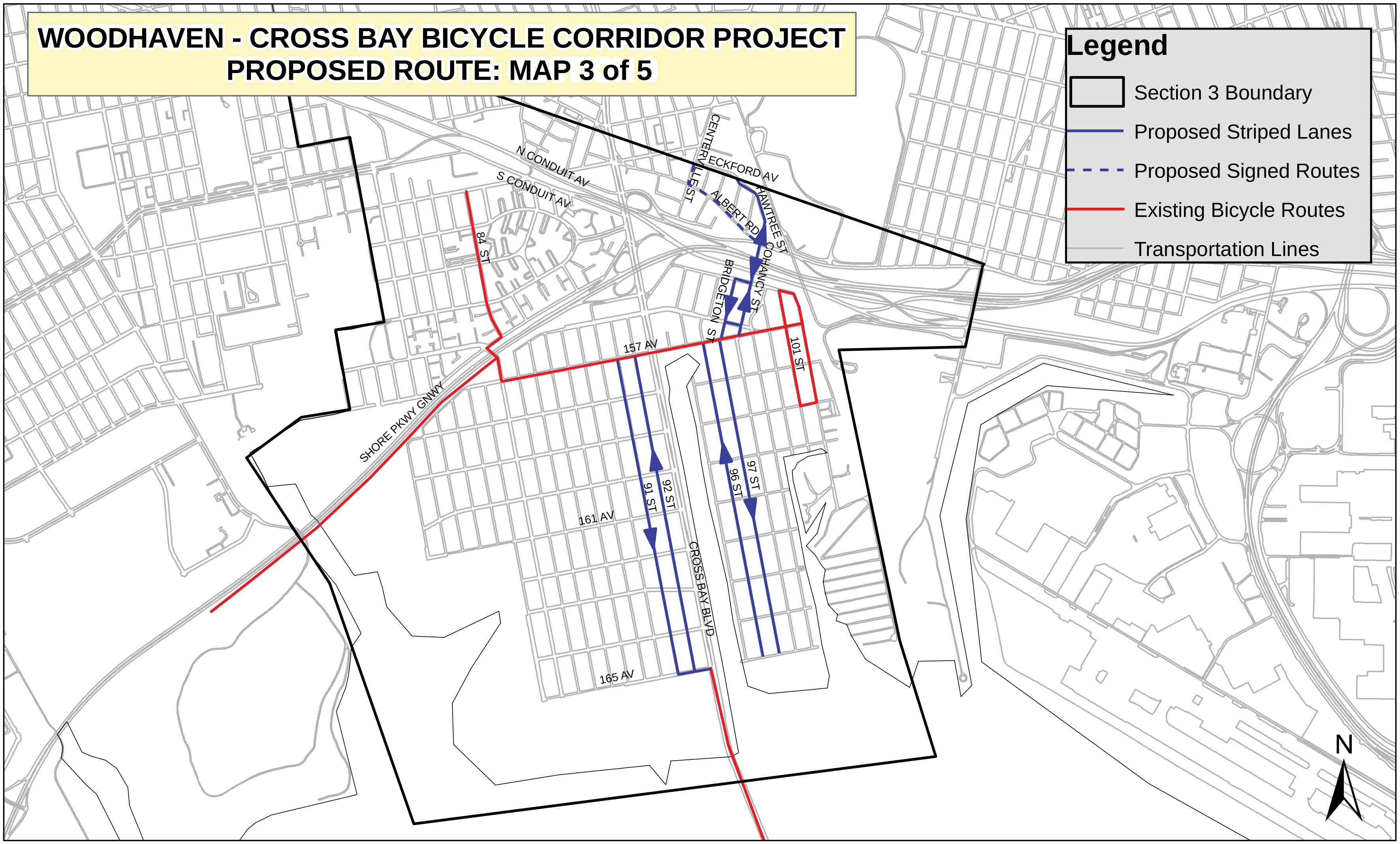

WOODHAVEN - CROSS BAY BICYCLE CORRIDOR PROJECT
PROPOSED ROUTE: MAP 3 of 5
Legend
Section 3 Boundary
Proposed Striped Lanes
Proposed Signed Routes
Existing Bicycle Routes
Transportation Lines
N CONDUIT AV
S CONDUIT AV
CENTERVILLE ST
ECKFORD AV
ALBERT RD
HAWTREE ST
BRIDGETON ST
COHANCY ST
84 ST
157 AV
101 ST
SHORE PKWY GNWY
161 AV
91 ST
92 ST
96 ST
97 ST
CROSS BAY BLVD
165 AV
N

Figure 26

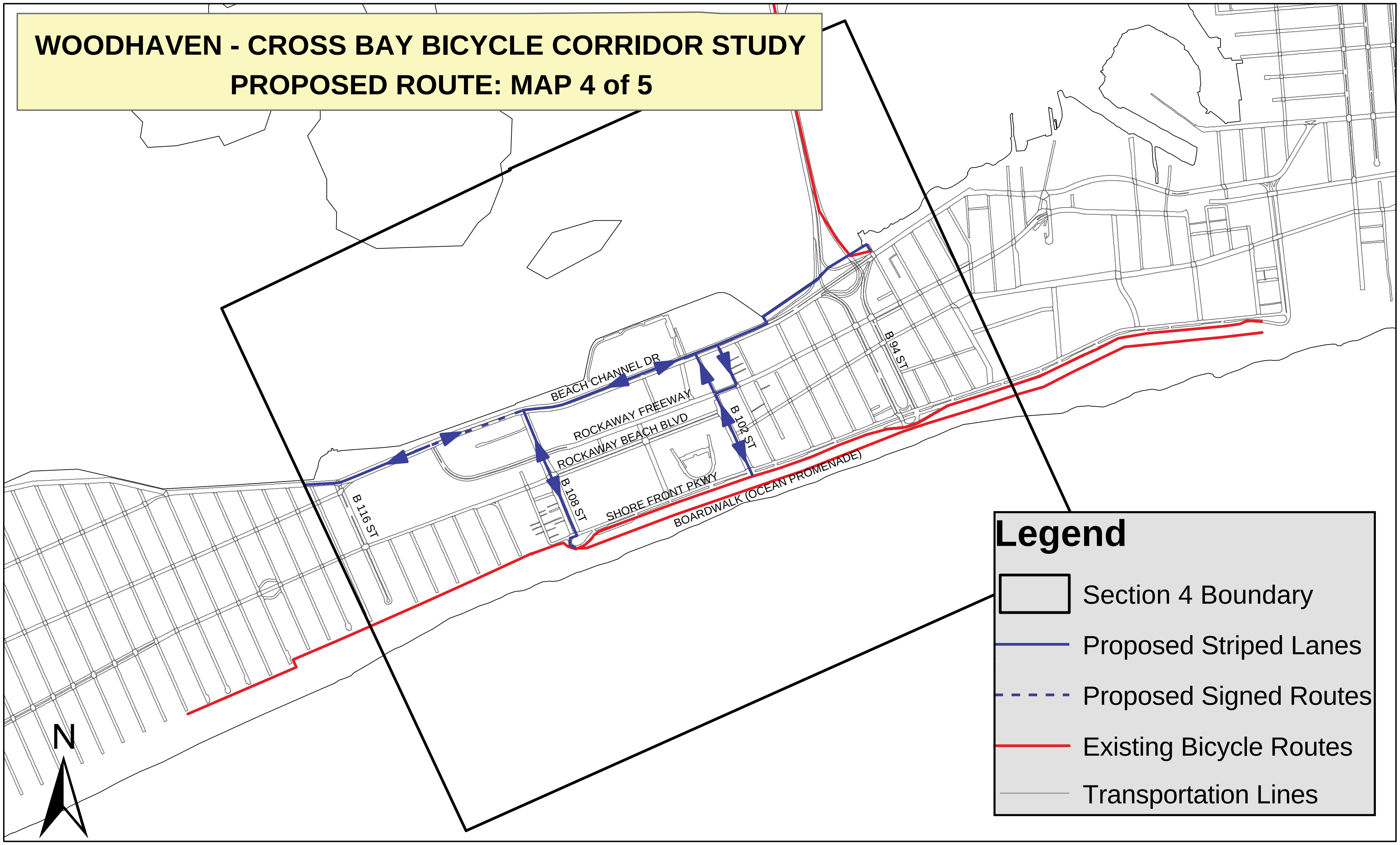
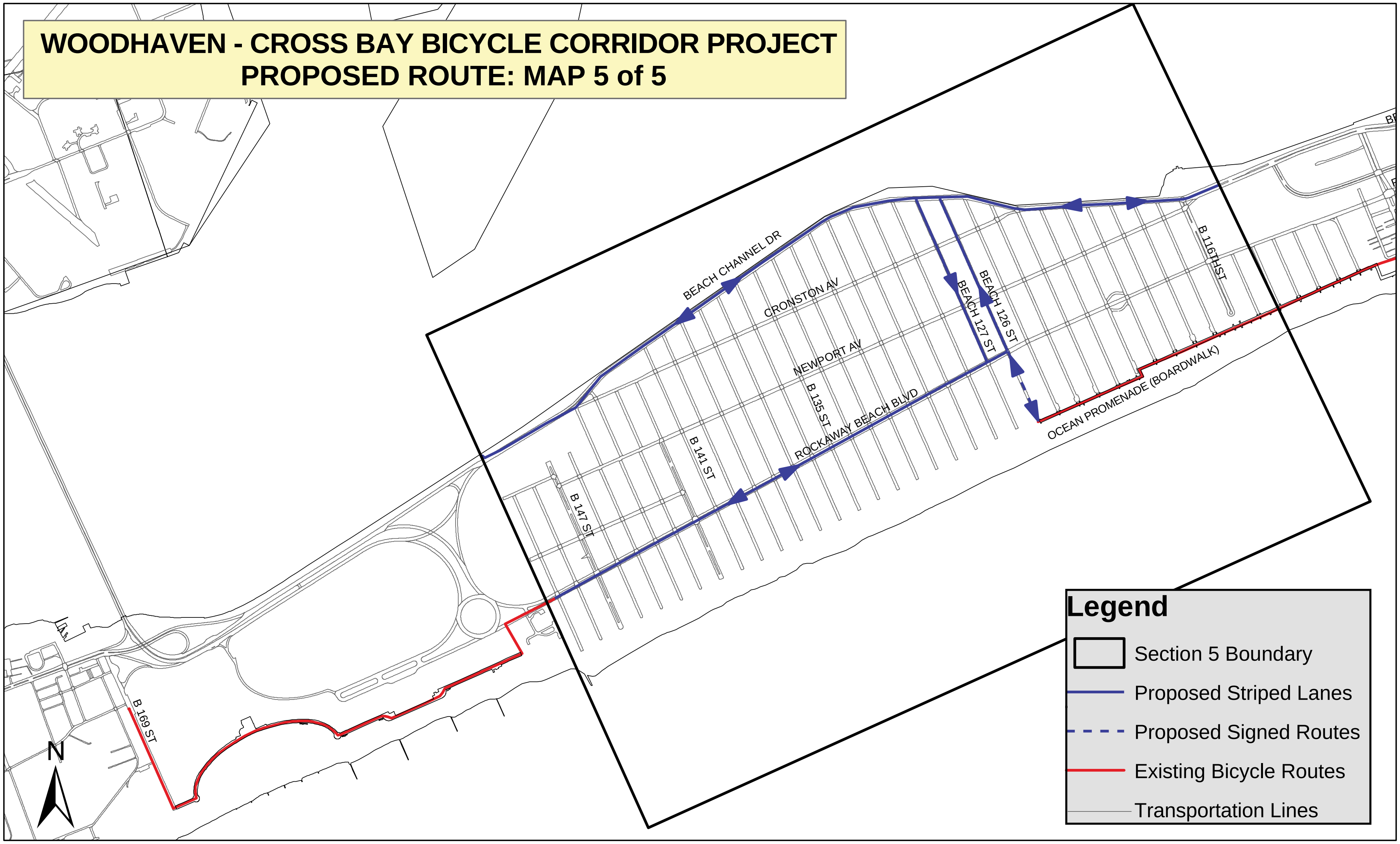

WOODHAVEN - CROSS BAY BICYCLE CORRIDOR STUDY
PROPOSED ROUTE: MAP 4 of 5
BEACH CHANNEL DR
ROCKAWAY FREEWAY
ROCKAWAY BEACH BLVD
SHORE FRONT PKWY
BOARDWALK (OCEAN PROMENADE)
B 116 ST
B 108 ST
B 102 ST
B 94 ST
N
Legend
Section 4 Boundary
Proposed Striped Lanes
Proposed Signed Routes
Existing Bicycle Routes
Transportation Lines

Figure 27



WOODHAVEN - CROSS BAY BICYCLE CORRIDOR PROJECT
PROPOSED ROUTE: MAP 5 of 5
BEACH CHANNEL DR
CRONSTON AV
NEWPORT AV
ROCKAWAY BEACH BLVD
OCEAN PROMENADE (BOARDWALK)
BEACH 127 ST
BEACH 126 ST
B 116TH ST
B 135 ST
B 141 ST
B 147 ST
B 169 ST
N
Legend
Section 5 Boundary
Proposed Striped Lanes
Proposed Signed Routes
Existing Bicycle Routes
Transportation Lines

Figure 28

Evaluation of Selected Corridor and Recommendations

Cyclists generally prefer the safety of a dedicated bicycle facility while riding on-street. This study explores and evaluates the potential bicycle facilities under consideration for the study area and provides recommendations for on-street bicycle routes that can best connect neighborhoods to the sites of attractions.

Existing conditions information pertinent to the study area such as street width, number of travel lanes, traffic direction etc. are summarized and tabulated in this repot in Appendix B: Street Network.

Forest Park (Memorial Drive and/or Freedom Drive)

Memorial Drive travels into the park from the Myrtle Avenue/ Park Lane South intersection. It is a quiet roadway, closed to traffic that leads to Forest Park's greenway path. It is the easiest access point for cyclists to get to and from Forest Park (refer to following picture of road).

Freedom Drive was considered as another option to begin the bicycle route from Forest Park, but because of the changing width of Freedom Drive and its curved configuration the bicycle route would have to be a shared use path on the east sidewalk instead of an on-street bicycle lane. There is another disadvantage in having Freedom Drive as a recommended bicycle route: cyclists would have to dismount his or her bicycle as they reach Forest Park. The path of Forest Park becomes an overpass at this location and the only access point is through a steep staircase about 100 feet west of the intersection of Myrtle Avenue and Freedom Drive (staircase on south side of Myrtle Avenue). Refer to the picture below showing the stairs.

Therefore the best starting point for cyclists from Forest Park to the Woodhaven area is from Memorial Drive.

Memorial Drive looking north from Park Lane South

Stairs to Forest Park's greenway path, west of intersection of Myrtle Ave. and Freedom Dr.

Park Lane South

It is recommended to continue the route with Park Lane South as a signed bicycle route due to the restricted width of the road and the parking observed on the south side of the street.

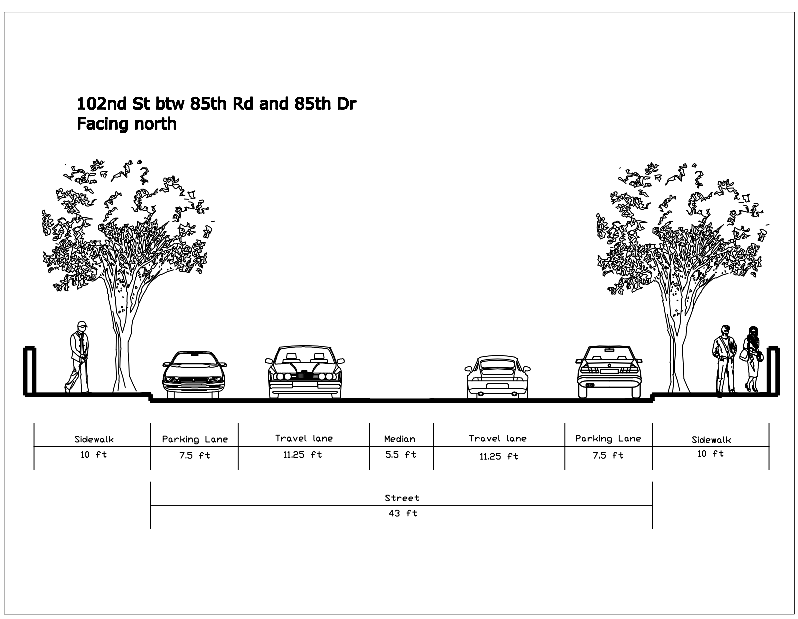
Shared use arrows or "sharrows" may be used in this portion of the bike route, alerting drivers to the presence of bicyclists on the road. In addition, an advanced stop box (bike box) would be useful on Park Lane South at the intersection of Myrtle Avenue and Memorial Drive for eastbound cyclists heading towards Forest Park.

102nd Street

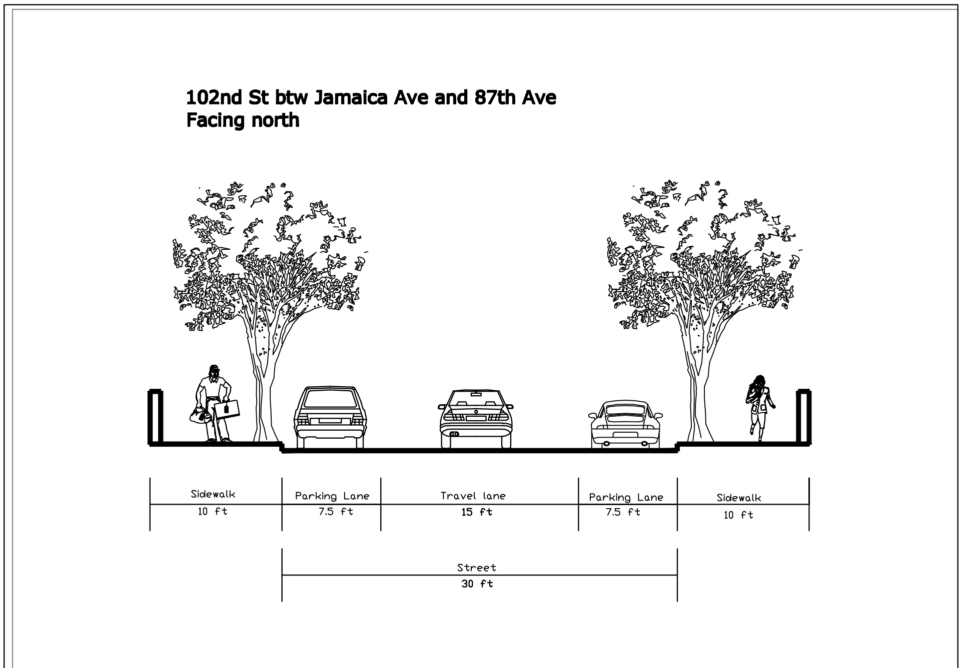
102nd Street due to its variation in width and traffic direction will have two types of proposed bicycle facilities: a signed bicycle route (Class 3) and a striped bicycle lane (Class 2). A continuation of the signed bicycle route from Park Lane South is recommended for 102nd Street until Jamaica Avenue. Then a striped bicycle lane is to be installed on 102nd Street from Jamaica Avenue to 97th Avenue. South of 97th Avenue 102nd Street narrows, therefore the signed bicycle route would resume until Rockaway Boulevard. Figures 35 through 37 represent typical cross sections of 102nd Street for existing and recommended conditions.

At the intersection of 102nd St and Jamaica Avenue, it may be useful to put in a “bike box” (advanced stop box) allowing southbound bicyclists to move ahead of motorists in order to make the left turn onto Jamaica Avenue safely when the traffic signal changes to green.

An alternative to this proposal would be to remove one of the parking lanes on the one-way segment of 102nd Street and replace it with a bicycle lane and a buffer. This would create a continuous dedicated lane for cyclists on 102nd Street from Jamaica Avenue to Rockaway Boulevard. However an assessment of the demand on-street parking and its capacity would be necessary to determine if there would be any adverse impact (see following Figure 38 for more detail). This alternate proposal would also require involvement of local community for approval.

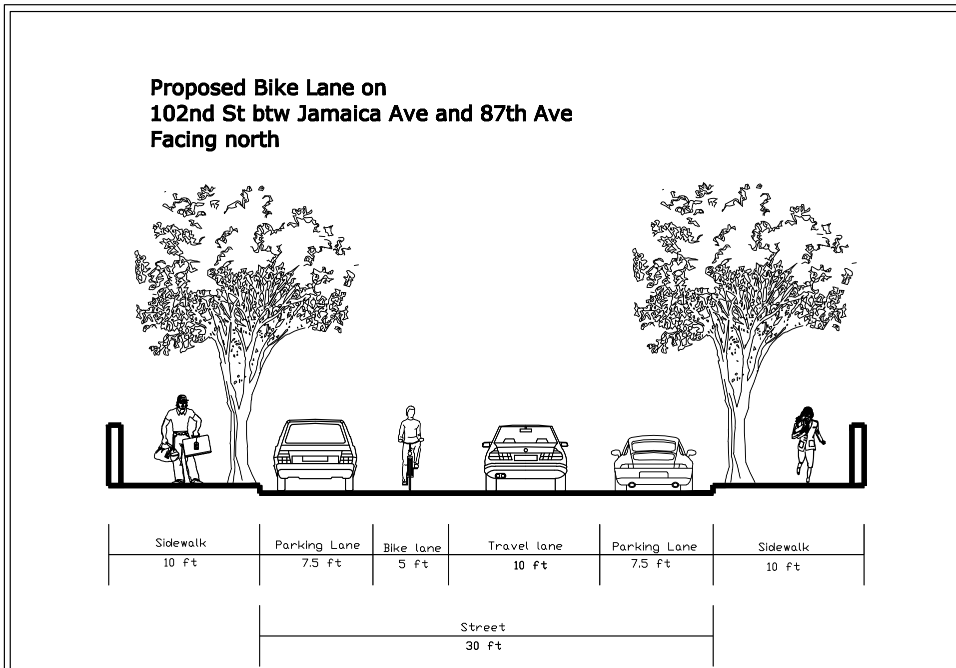


Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study
Figure 29



Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 30



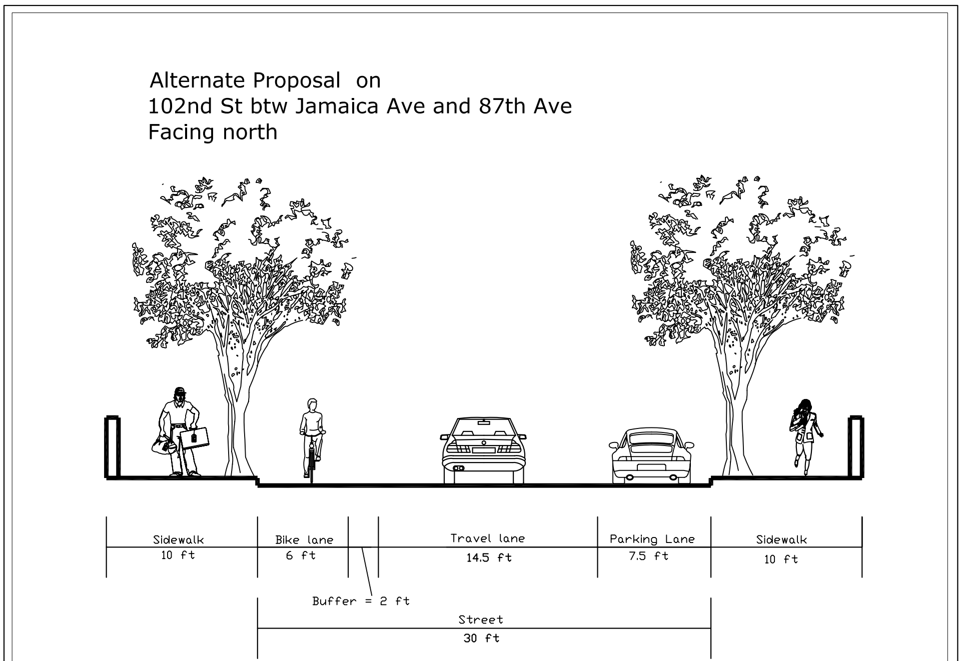
Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 31

104th St

104th Street being 30 feet wide can accommodate a 5-foot wide striped bicycle lane (refer to Figure 37). Traffic is southbound from Jamaica Avenue to Rockaway Boulevard. It is recommended for southbound cyclists, arriving from Park Lane South, to make use of 102nd Street first then transfer to 104th Street after Jamaica Avenue.

The alternate proposal for 104th Street is to remove one parking lane and replace it with a striped bicycle lane and a buffer (see Figure 38 for an example of this proposal).



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study
Figure 32

Jamaica Avenue

A transition route for cyclists is proposed on Jamaica Avenue as they travel from 102nd Street to 104th Street. A proposal to have a striped bike lane adjacent to the south curb was considered for this block but the presence of a bus stop and metered parking made it not feasible. A practical solution would be to install a signed bicycle route with appropriate signage and pavement markings “sharrows” informing motorists and cyclists to share the road on Jamaica Avenue.

Rockaway Boulevard

Rockaway Boulevard has also been recommended to include a signed bicycle route with “sharrows” that would link cyclists from 104th and 102nd Streets to 101st and Centerville Streets due to the variation in roadway and median widths.

Woodhaven Boulevard

Woodhaven Boulevard was considered and evaluated as a possible bicycle corridor in the study area, however to make recommendations for this route would require further analysis as a separate report which was beyond the scope of this study.

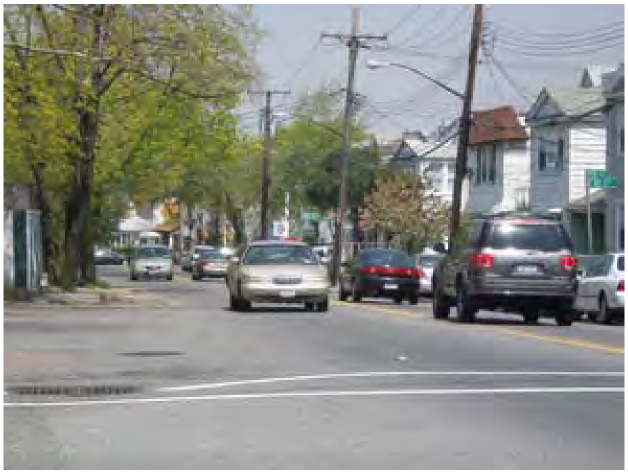
New York City Department of Transportation (NYCDOT) has undertaken a congested corridor study of Woodhaven Boulevard (part of the Citywide Congested Corridors Programs). An analysis of bicycle users and bicycle traffic will be included in NYCDOT’s study of Woodhaven Boulevard.

101st Street and Peconic Street

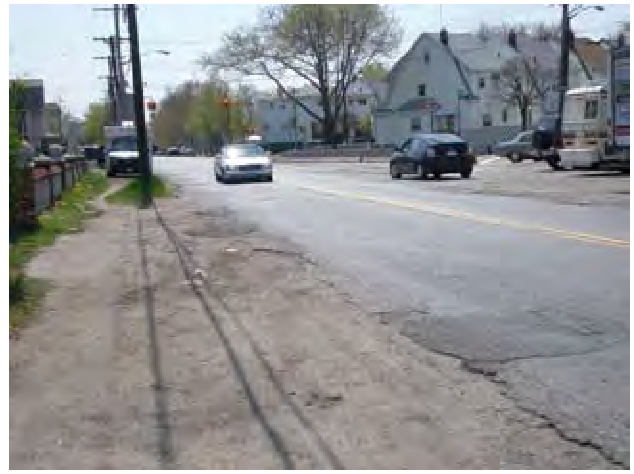
A signed bicycle route is proposed for 101st Street since it is less than 40 feet wide. South of 133rd Avenue 101st Street becomes a one-way street and is called Peconic Street. With this change there is room for a 5-foot wide Class 2 bicycle lane. See cross section drawing of 102nd Street, figure 37 as a reference for this recommendation.

Centerville Street

Centerville Street varies in width (30 – 40 feet wide) and is a two-way street. The current street geometry will only allow for a signed bicycle route. Currently there is space on both sides of the road at the edge to put in striped bicycle lanes. But this space will most likely be used for the construction of sidewalks in the future if the community or the city decides to have them installed (see following pictures of road).



Centerville Street north of Linden Boulevard

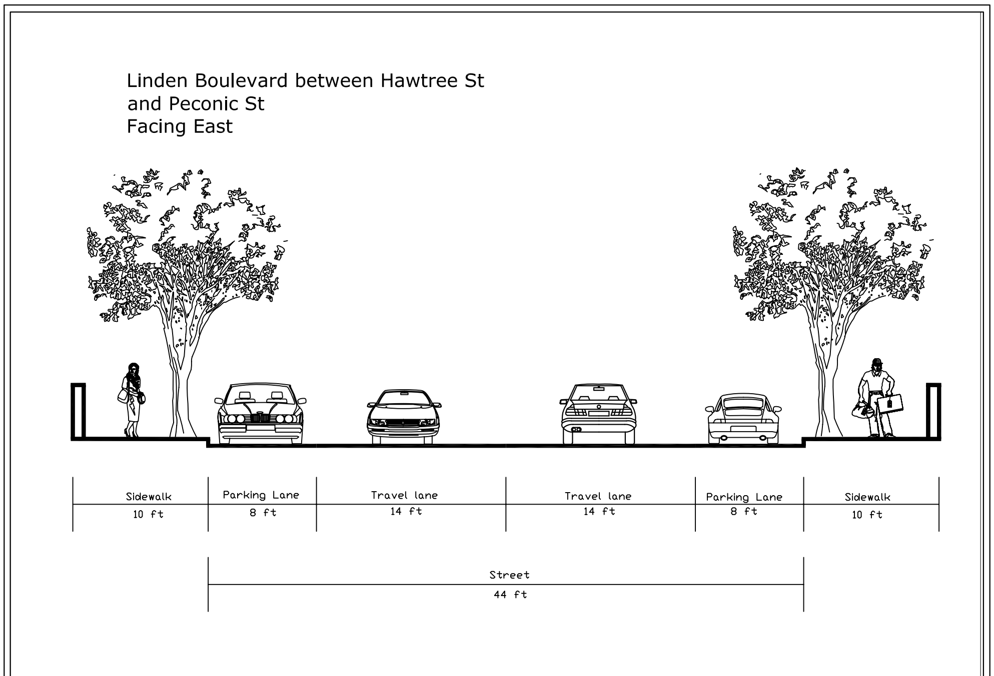


Centerville Street south of Pitkin Avenue

Linden Boulevard

A striped bicycle lane is recommended for one block on Linden Boulevard between Hawtree Street and Centerville/ Peconic Streets. It would connect the bicycle facilities proposed for Centreville and Hawtree Streets.

This block of Linden Boulevard is adjacent to the Aqueduct Racetrack where there are currently no signs indicating parking and vehicles usually do not park at this location. It is also at a certain distance from the residential area (1 - 2 blocks). It is proposed to restrict parking at all times on this block and to have a bicycle lane and a buffer along the curb for cyclists. See Figures 39 and 40 for existing and recommended conditions.



Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 33

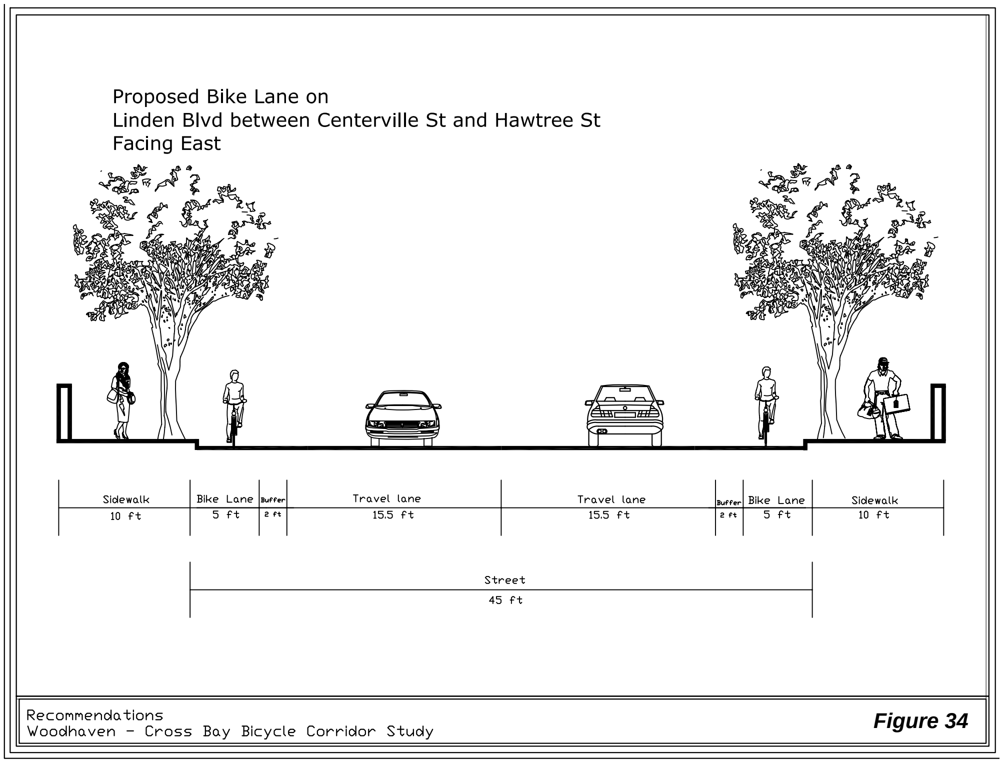


Figure 34

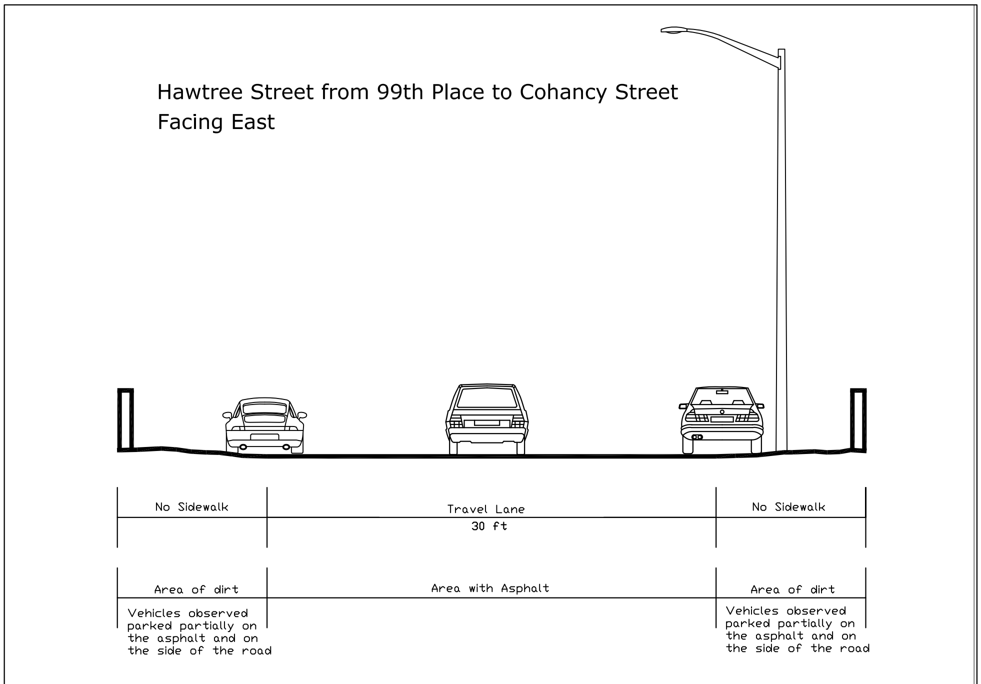
Hawtree Street

Hawtree Street exists in two segments along this corridor. For the northern section of Hawtree Street (south of Linden Boulevard) a signed bicycle route is recommended for cyclists since it is only 38 feet wide. Shared use pavement markings can be added to get motorists' attention to share the roadway.

The southern section of Hawtree Street (continuation of Eckford Avenue) is a one-way street that varies from 30 to 55 feet. There is sufficient space to install a striped bicycle lane. A buffer can be added on the widest block which is between Huron Street and 99th Place. See Figures 41 and 42 for existing and recommended conditions.

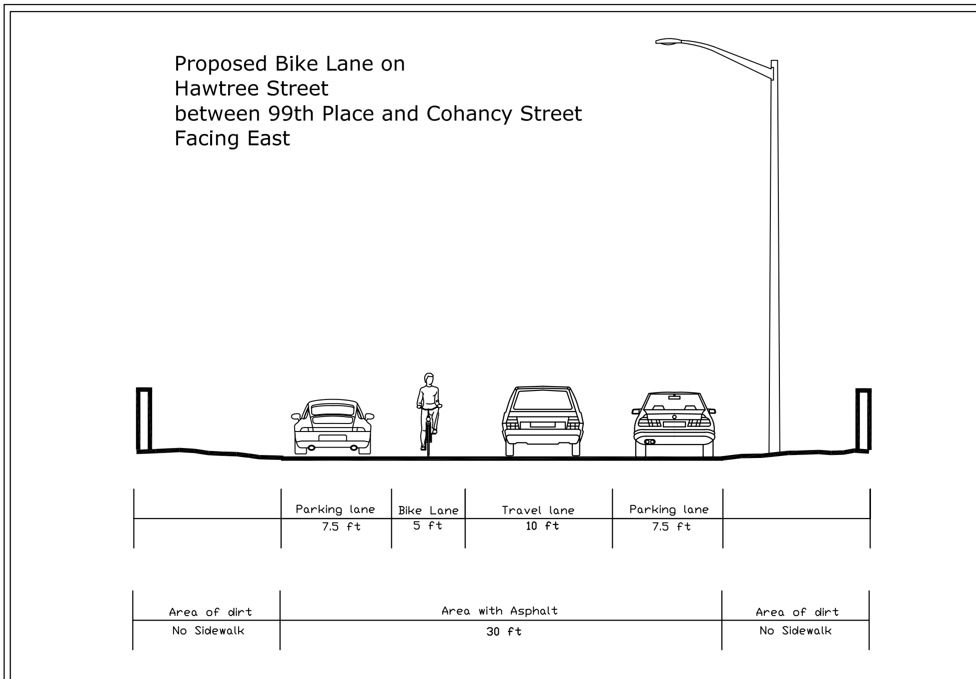
Eckford Avenue

Eckford Avenue (30 ft wide) can easily accommodate a bicycle lane and is recommended for a designated Class 2 bicycle facility (similar to 102nd St – refer to Figure 37).



Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 35



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 36

Hawtree Street looking north, between Huron St and 99th Pl - Width close to 55 ft

Hawtree Street looking south at west shoulder of road

Albert Road

Albert Road is barely 30 feet wide (variation 24 – 28 feet). It can only be recommended for a signed bicycle route. This road can include signs and marked sharrows on the pavement to inform users to share the road.

Cohancy Street

The recommendation for Cohancy Street is to have two types of bicycle facilities: a shared bicycle-pedestrian path and a striped bicycle lane.

The shared use path is proposed for both sidewalks on Cohancy Street at the overpass located over the South Conduit (between North Conduit Avenue and 155th Ave.). Due to vehicular traffic volumes, traffic conditions and the limited space available on-street at this location, there is insufficient room to accommodate a dedicated on-street bicycle facility for cyclists. Shared-use sidewalks would be appropriate for this block of Cohancy Street where cyclists and pedestrians can share the sidewalk (see Figure 43 for existing conditions). The width of each sidewalk is 10 feet and the volume of pedestrians is very light on both sidewalks. A sample count of users was conducted on December 9, 2008 from 2:00 – 2:30 PM. The number of pedestrians counted was low: six (6) on the west sidewalk and three (3) on the east sidewalk. However one cyclist was observed riding on the east sidewalk during that time period. Therefore pedestrians and cyclists would most likely be able to share the sidewalk.

A striped bicycle lane is recommended for the rest of Cohancy Street, where the direction of traffic changes a few times. Between 155th and 156th Avenues a striped bicycle lane is proposed for northbound Cohancy Street, which would take cyclists to the northern portion of the study area. Bridgeton Street an adjacent southbound street can have a Class 2 bicycle lane for cyclists heading south.

The last blocks of Cohancy and Bridgeton Streets between 156th and 157th Avenues are also recommended for dedicated bicycle lanes, but the traffic direction changes again (Cohancy Street becomes southbound while Bridgeton Street becomes northbound). Refer to Figure 32 at the beginning of the recommendations section of the report for traffic direction.

Installation of directional signage would be necessary to guide cyclists as they travel through this area.

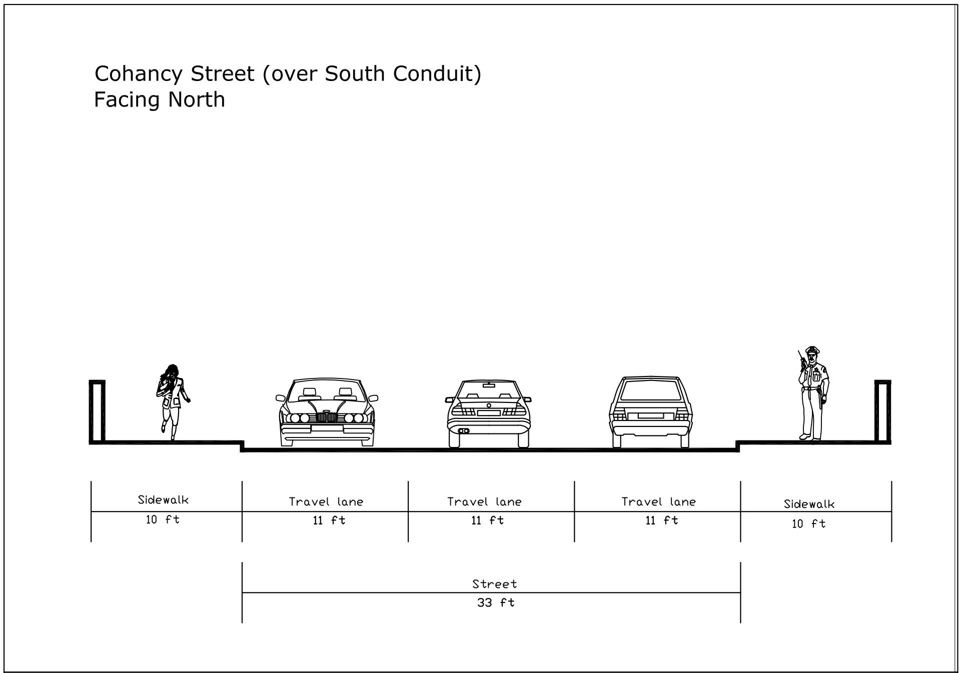


Figure 37

155th Avenue and 156th Avenue

Both of these avenues can connect cyclists to Cohancy and Bridgeton Streets as they transfer from one street to the other. These avenues measuring 50 – 51 feet in width can each accommodate two on-street bicycle lanes, one for each direction of traffic, similar to the existing bicycle lanes on 157th Avenue. Refer to the picture below of the 157th Avenue bicycle lanes as an example.

Existing Bicycle Lanes on 157th Avenue

91st and 92nd Streets

The proposal was to stripe a bicycle lane on 91st and 92nd Streets that would link residents of Howard Beach to the Woodhaven and Cross Bay areas. Since this study launched New York City Department of Transportation has installed 5-foot wide bicycle lanes on these streets, as shown in picture below of 91st Street.

96th and 97th Streets

On-street bicycle lanes are being proposed for 96th and 97th Streets which can take cyclists directly to the waterfront, a fishing and recreational spot called the F.M. Charles Memorial Park. These streets are similar to 91st and 92nd Streets in traffic volume, traffic condition and street geometry; therefore a bicycle lane can be installed without a buffer. Use as a reference following picture of the 91st Street bicycle lane.

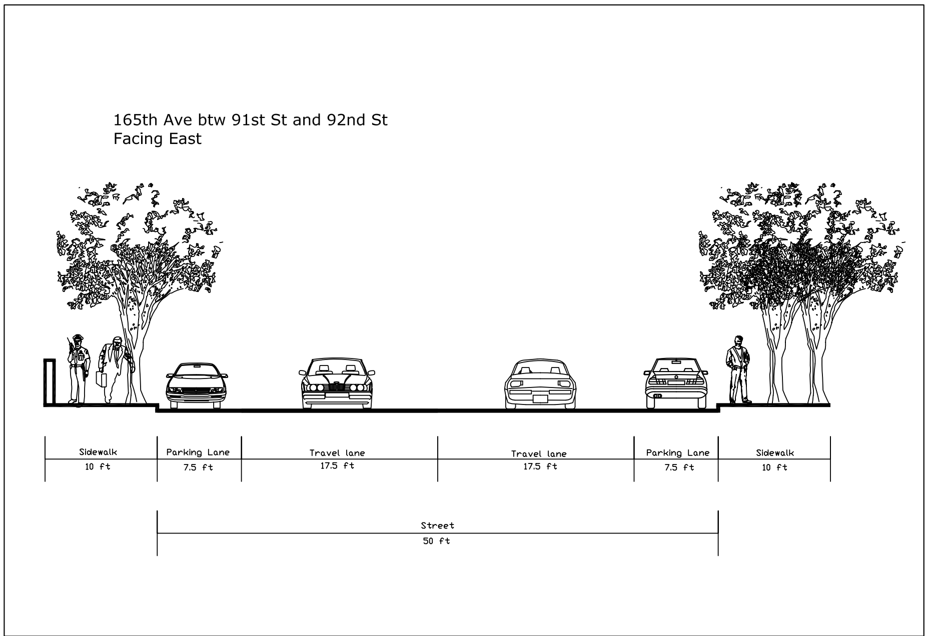
Existing Bicycle Lane on 91st Street

FM Charles Memorial Park - recreational spot with baseball field, sitting and fishing area

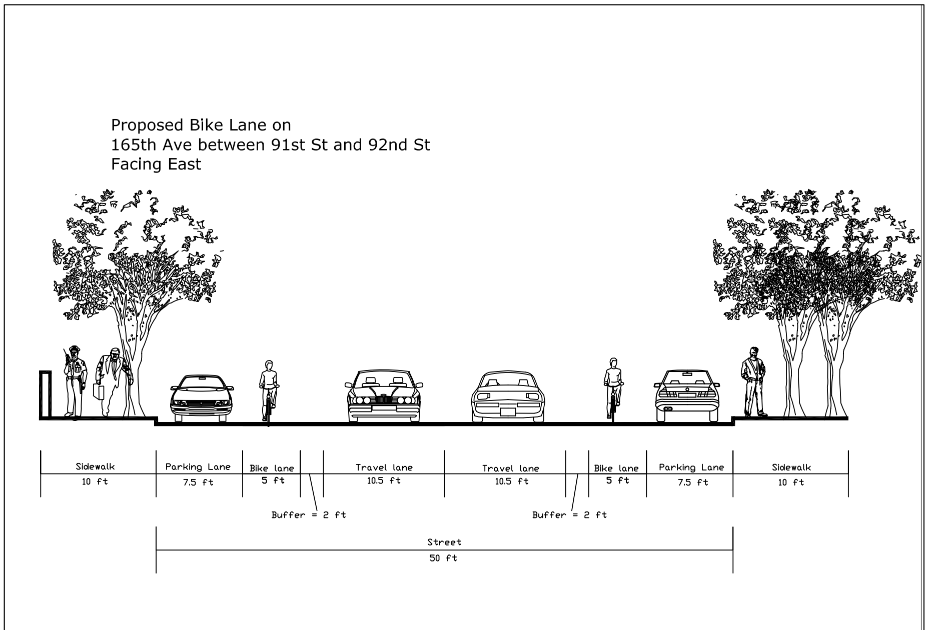
165th Avenue

165th Avenue has also been selected in this study for a proposed striped bicycle lane, one in each direction of traffic that will lead cyclists directly from/to 91st, 92nd, 96th and 97th Streets to the bicycle lane on Cross Bay Boulevard.

165th Avenue is the last street at the end of the northern portion of the study area just before the Joseph P. Addabbo Bridge (see Figures 44 and 45).



Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study
Figure 38



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study
Figure 39

Path along Esplanade

As bicyclists exit the Cross Bay Veterans Memorial Bridge, they have no guidance to find a route to the parks and waterfront area on the Rockaway Peninsula. It is proposed to transform the pedestrian esplanade located between the bridge and the high school's property into a shared use path for pedestrians and cyclists by adding an 8-foot wide two-way bike path south of the existing sidewalk on the esplanade (see picture below).

The esplanade ends at the high school's property. From there the path would be extended across the open space onto the sidewalk where the cyclists would access the street to ride on Beach Channel Drive. At that point bicyclists would also have the option to proceed towards Beach 101st Street to head to the bicycle route on Shore Front Parkway.

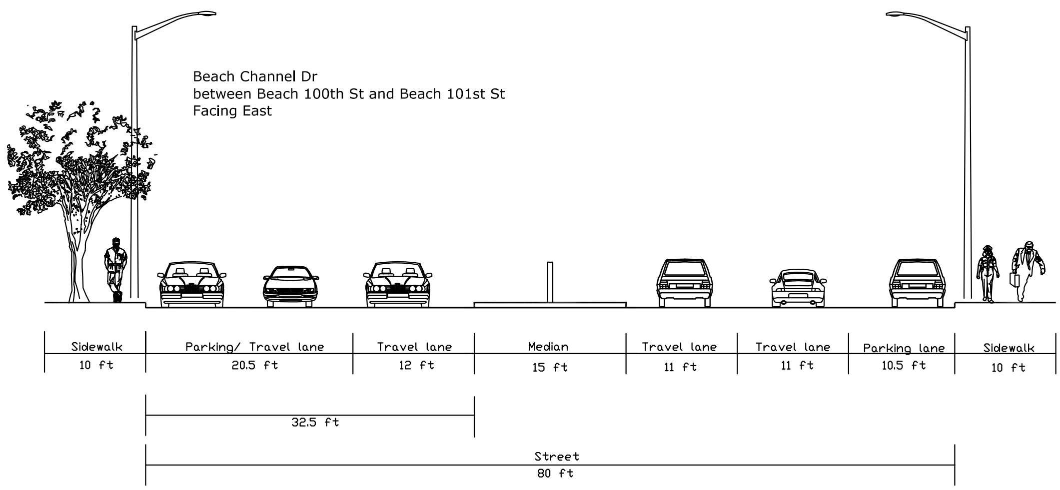
This proposal after several field visits and observations appears to be the best solution. An alternate route from the bridge to the Shore Front Parkway using Beach 94th and Beach 95th Streets was examined, but a high level of conflicts with vehicles exiting and entering the ramps to/from the bridge was observed and created an unsafe transition point for cyclists.

Accessible esplanade located under ramps of Veterans Memorial Bridge

Beach Channel Drive (from Beach 98th Street to Beach 116th Street)

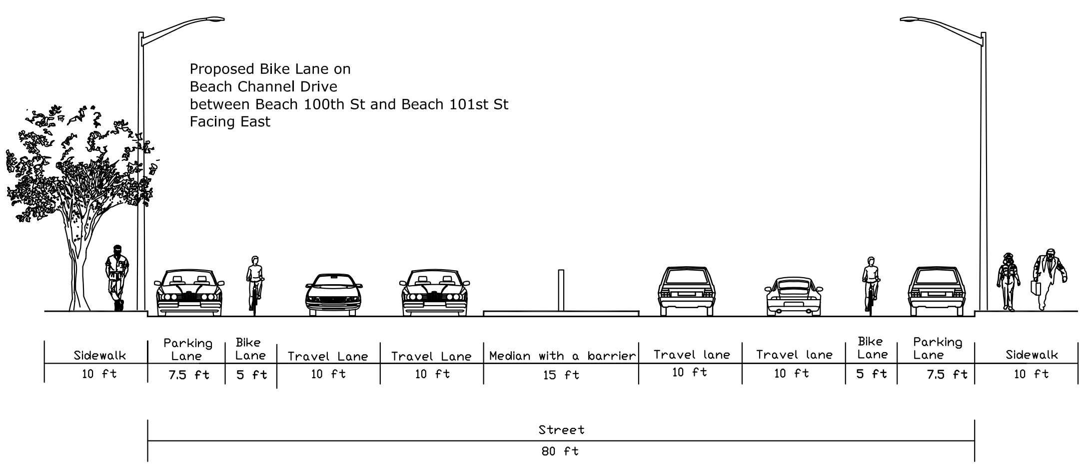
Beach Channel Drive travels along the northern shore of the Rockaway Peninsula from the Cross Bay Veterans Memorial Bridge to Jacob Riis Park. It provides great views of the Jamaica Bay Area and of Brooklyn.

This part of Beach Channel Drive, without the segment between Beach 108th Street and Rockaway Freeway, can be striped with a 5-foot wide bicycle lane in each direction of traffic if the travel lanes are reduced to a width of 10 feet each. Signs and sharrows (pavement markings) would be necessary to inform motorists to share the road with bicyclists. For the segment between Beach 108th Street and Rockaway Freeway, only a signed bicycle route is possible due to the street width (70 - 75 ft) and the median (6 - 12.5 ft). Only 4 feet can be captured, which is below the standards of the 1999 AASHTO (American Association of State Highway and Transportation Officials) Guidelines for bicycle lanes.



Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study

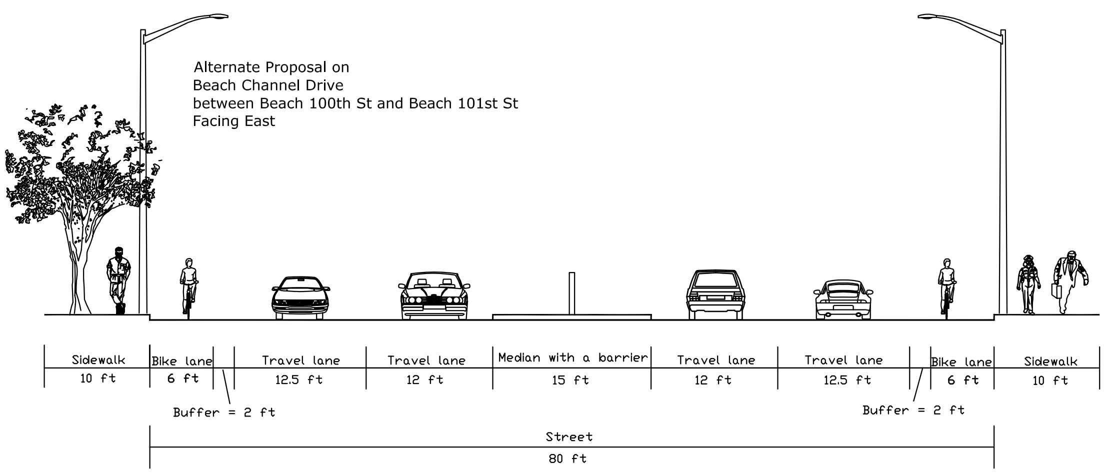
Figure 40



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 41

Having a buffer would give cyclists additional protection from vehicles. An alternate proposal for Beach Channel Drive between Beach 98th and Beach 116th Streets (about 20 blocks) would be to make space for a bicycle lane and a buffer by removing the parking lane on both sides of the road. Currently there are some restrictions in terms of parking, but an assessment of the on-street parking would be necessary to determine if there would be any adverse impact on the capacity especially for the north side between Beach 116th and Rockaway Freeway where metered parking and many businesses are located (refer to Figures 46 - 48 for details). Consultation with the local community would also be essential for their approval of this recommendation.



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

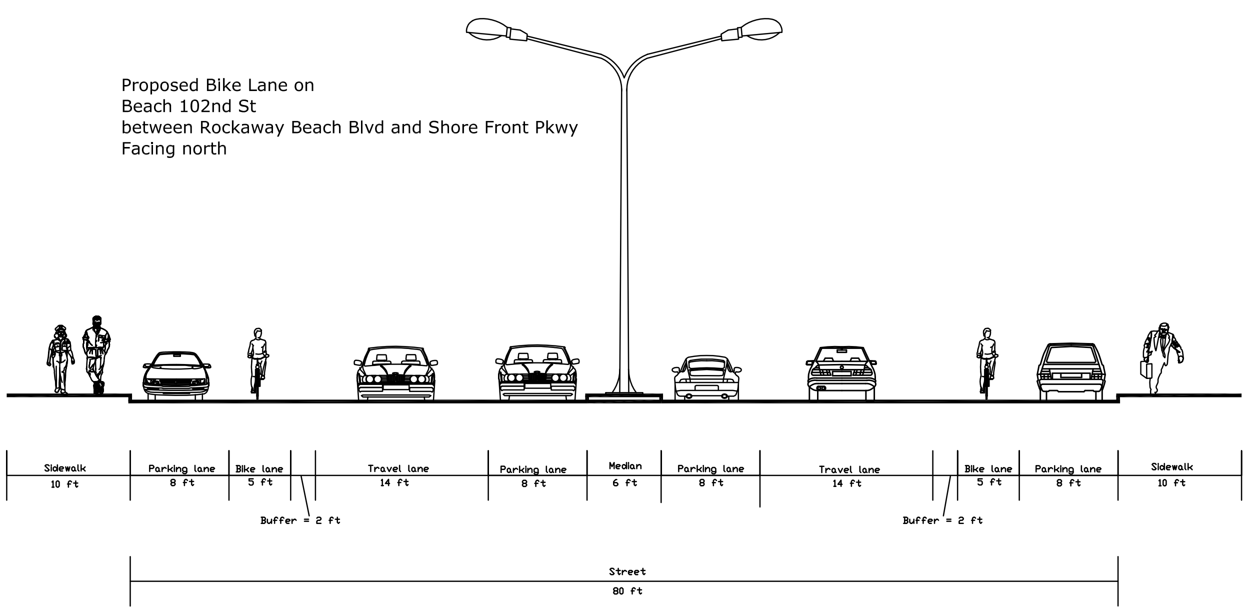
Figure 42

Beach 101st Street and Beach 102nd Street

Beach 101st Street and Beach 102nd Street were selected to provide a connection from the proposed route on Beach Channel Drive to the bicycle lane on Shore Front Parkway. The proposal for these streets is similar to the other one-way streets in the study area with a recommended 5-foot wide bicycle lane to be placed between the parking lane and the travel lane. This new bicycle facility would give bicyclists the option to link from the north side to the south side of the Rockaway Peninsula (refer to Figures 37 - 38 provided in this report as an example).

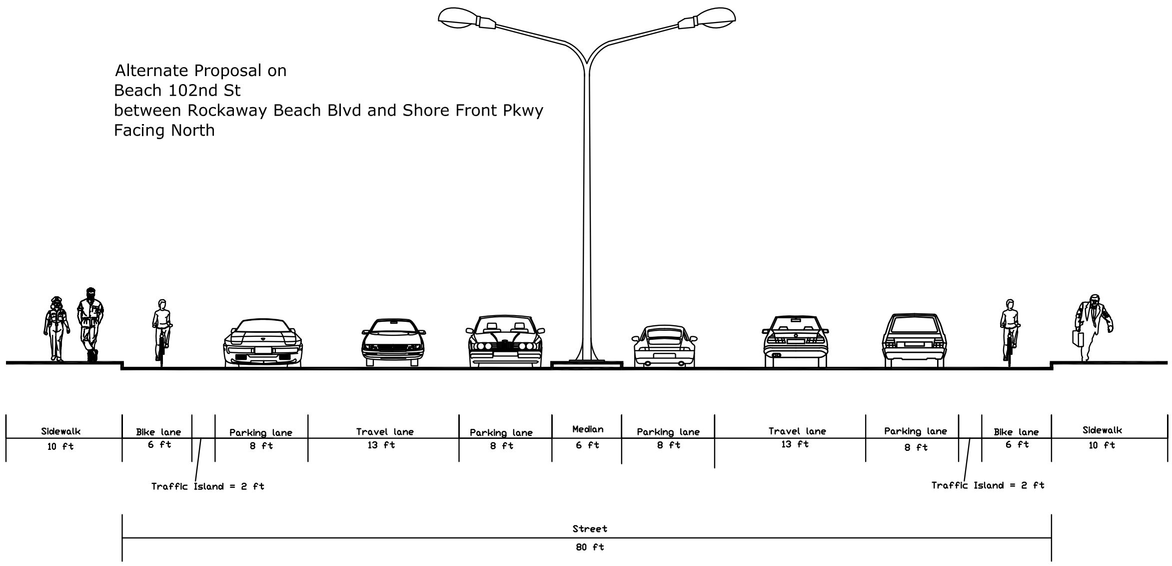
Beach 102nd Street, south of Rockaway Freeway, changes to a wide two-way street. A bicycle lane for each direction of traffic is recommended (see Figure 49). An alternate proposal for this two-way portion of B. 102nd Street is to install a bicycle lane along the curb on both sides of the road and move the parking lane in between the bike lane and the travel lanes. The parking lane would become a buffer for cyclists and eliminate conflicts between motorists and cyclists as they travel on this segment. See Figure 50 for details. This design treatment would provide cyclists with a separate and protected lane from motorists along this north-south route

To make the transition safer and easier for northbound cyclists traveling from the two-way segment to the one-way segment of B. 102nd St, a bike box can be added at the intersection of Rockaway Freeway and B. 102nd St.



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 43



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 44

Rockaway Freeway

This roadway was considered for a bicycle lane. The road is 45 feet wide and one travel lane exists in each direction of traffic close to the curb, away from the columns. It has an elevated subway line that runs above it for many blocks. This street is usually deserted due to the structural steel columns that hold up the rail lines and separate Rockaway Freeway from the rest of the neighborhood. The back of buildings, walls and fences generally line this street. In addition, sidewalks provided are narrow or do not exist. Pedestrians often walk down the middle of the street along the columns where the marked traffic islands are located.

This roadway in terms of space available, low traffic volume and limited left turns permitted would be great for a Class 2 bicycle lane, but its lack of attractiveness compared to the other streets in the area is found not to be the best corridor for a bicycle route.

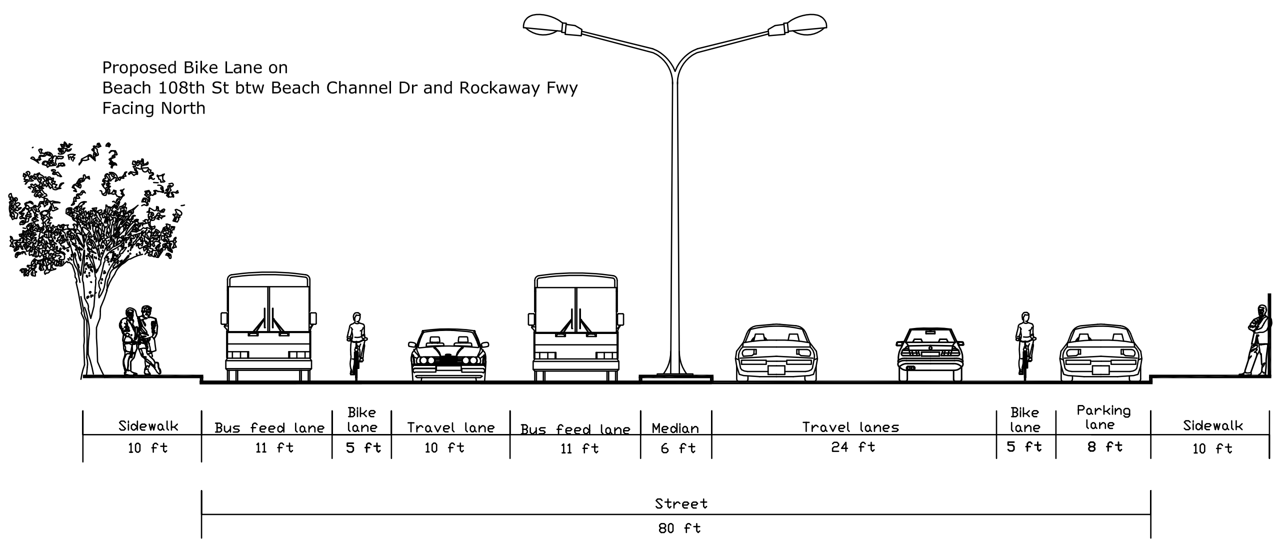
However for one block between Beach 101^{st} and Beach 102^{nd} Streets, information signs are necessary to direct cyclists transferring from the proposed bike lanes on Beach 101^{st} and Beach 102^{nd} Streets.

Beach 108th Street

For Beach 108th Street, the installation of a north-south connection is recommended. A bicycle lane per direction of traffic can easily be added to create dedicated facilities for cyclists between the parking lane and the travel lane. See Figures 51 and 52.

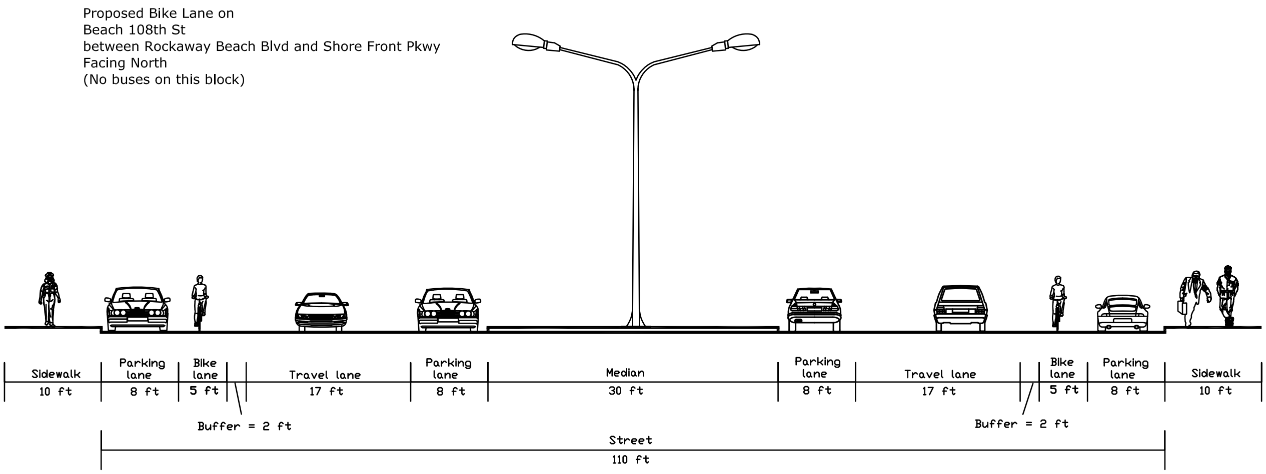
An alternate design treatment for B. 108th St between Rockaway Beach Blvd and Shore Front Parkway is to have a separate bicycle lane adjacent to the curb where the parking lane is used as a buffer from motorists.

In addition a bike box for northbound and southbound cyclists at the intersection of Rockaway Beach Blvd and B. 108th St can be useful in order to allow cyclists to move ahead of traffic when the light turns green.



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 45



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 46

Beach Channel Drive (from Beach 116th Street to Jacob Riis Park)

The second half of Beach Channel Drive from Beach 116th Street to Beach 143rd Street is also recommended for the installation of a bicycle lane, but it is to be striped in the lane adjacent to the curb. Generally vehicles do not park along this segment. In addition, the few signs that are up indicate "No Parking Anytime". Motorists as they drive on this street remain in the two travel lanes closest to the middle of the road. This practice by motorists leaves the curb lanes on Beach Channel Drive empty and makes it possible to capture 6 feet on each side of the road for the proposed bicycle lanes. See Figure 53.

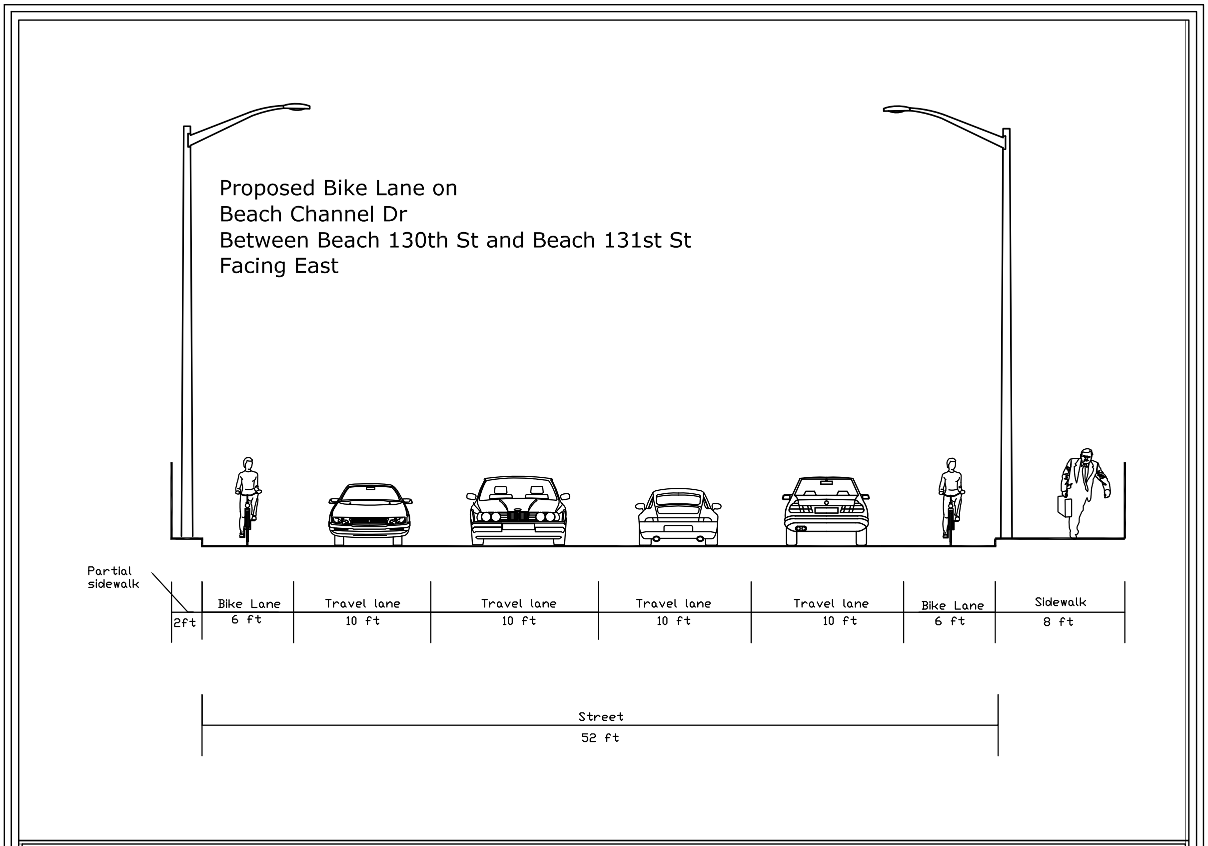
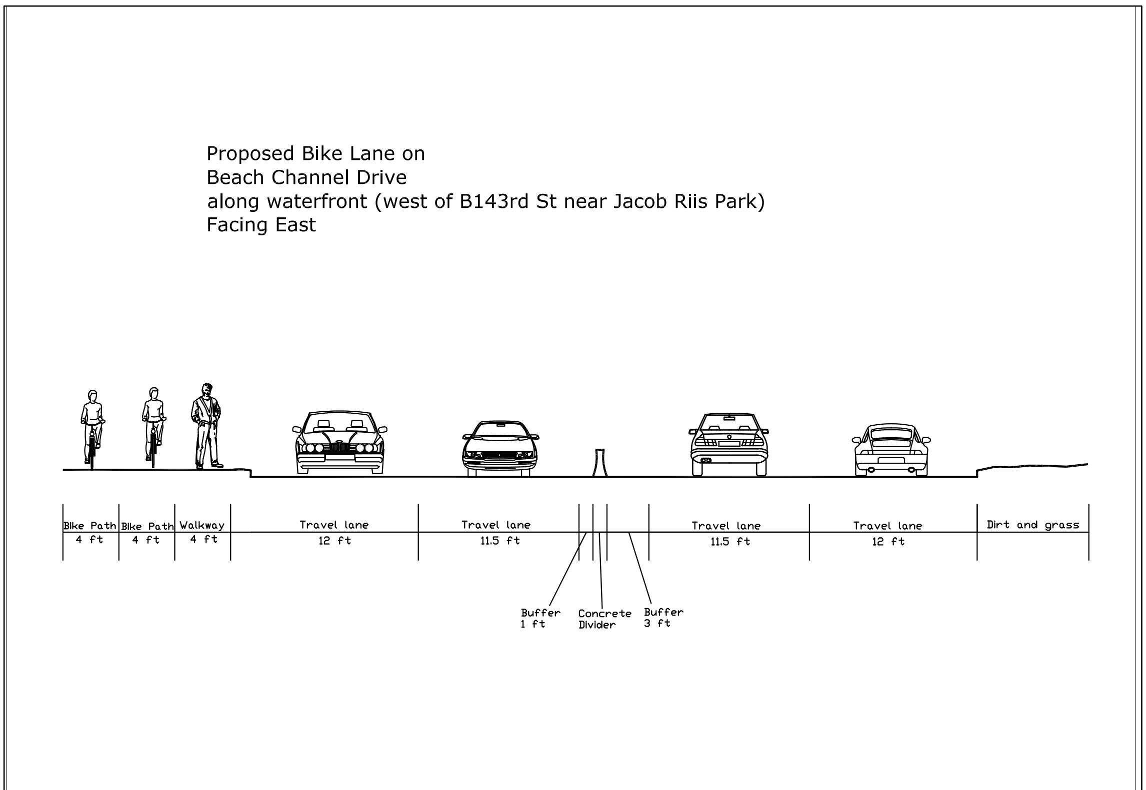


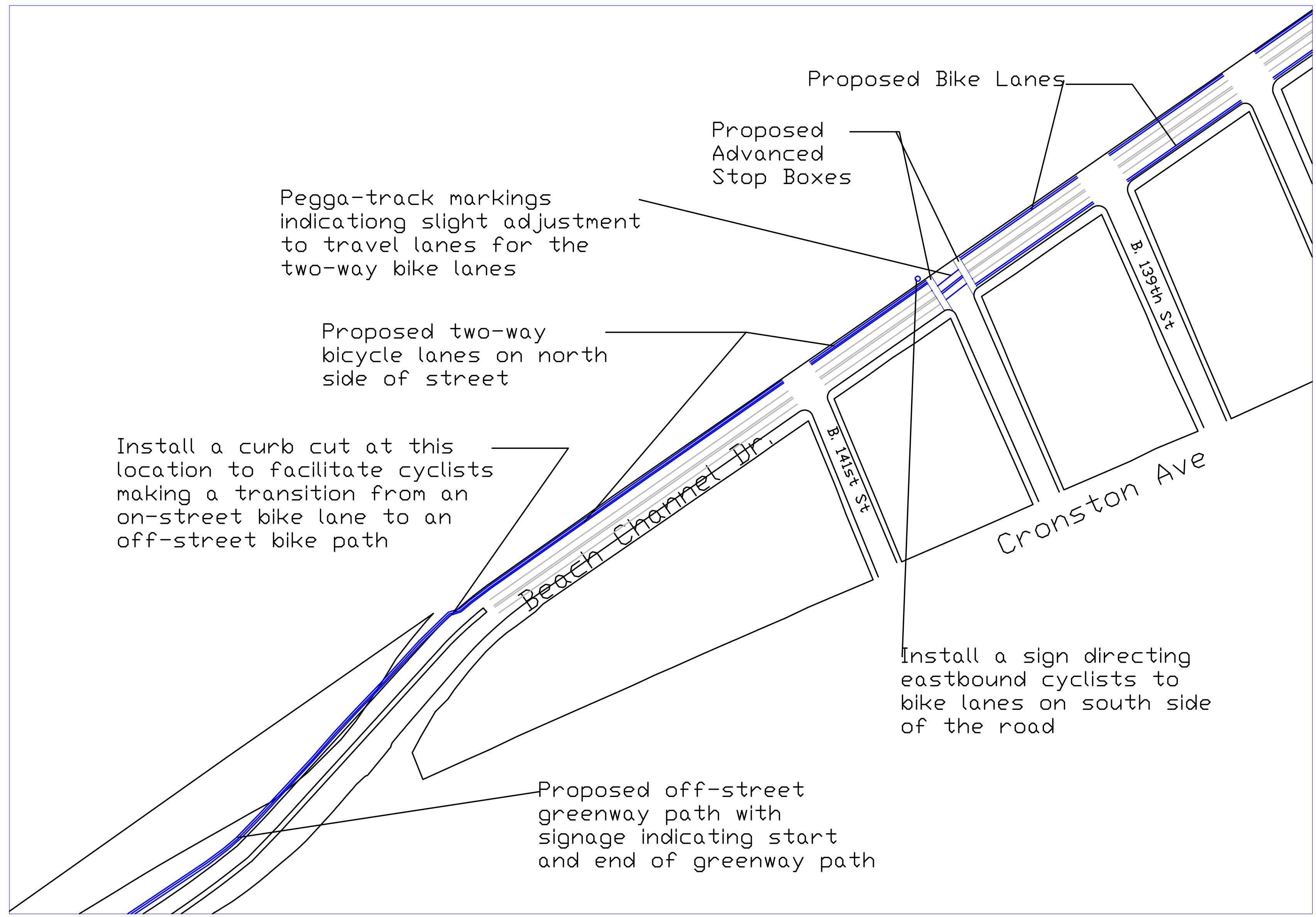
Figure 47

On Beach Channel Drive at B. 140th Street, it is recommended to have the on-street bicycle lanes converge towards the waterfront area on one side of the road (north side). Then a path for bicyclists can be added to the existing pedestrian walkway which starts between Beach 143rd Street and Beach 144th Street. It would be developed as a greenway path with a two-way bicycle path 8 feet wide and a pedestrian path (4 feet wide). See Figure 54 for a sectional drawing of the road. This path would then continue along the waterfront north of Jacob Riis Park, and go through an underpass under the Marine Parkway Bridge before connecting to the paths of Jacob Riis Park at Beach 169th Street. Pegga-tracked pavement markings and signage are recommended at the intersection of State Road and Beach 169th Street to make motorists aware of cyclists crossing at this intersection. This is the most direct route to the park without having to cross the travel lanes of the roadway connecting to the bridge (refer to Figures 55 and 56 - plan drawings of area for details).



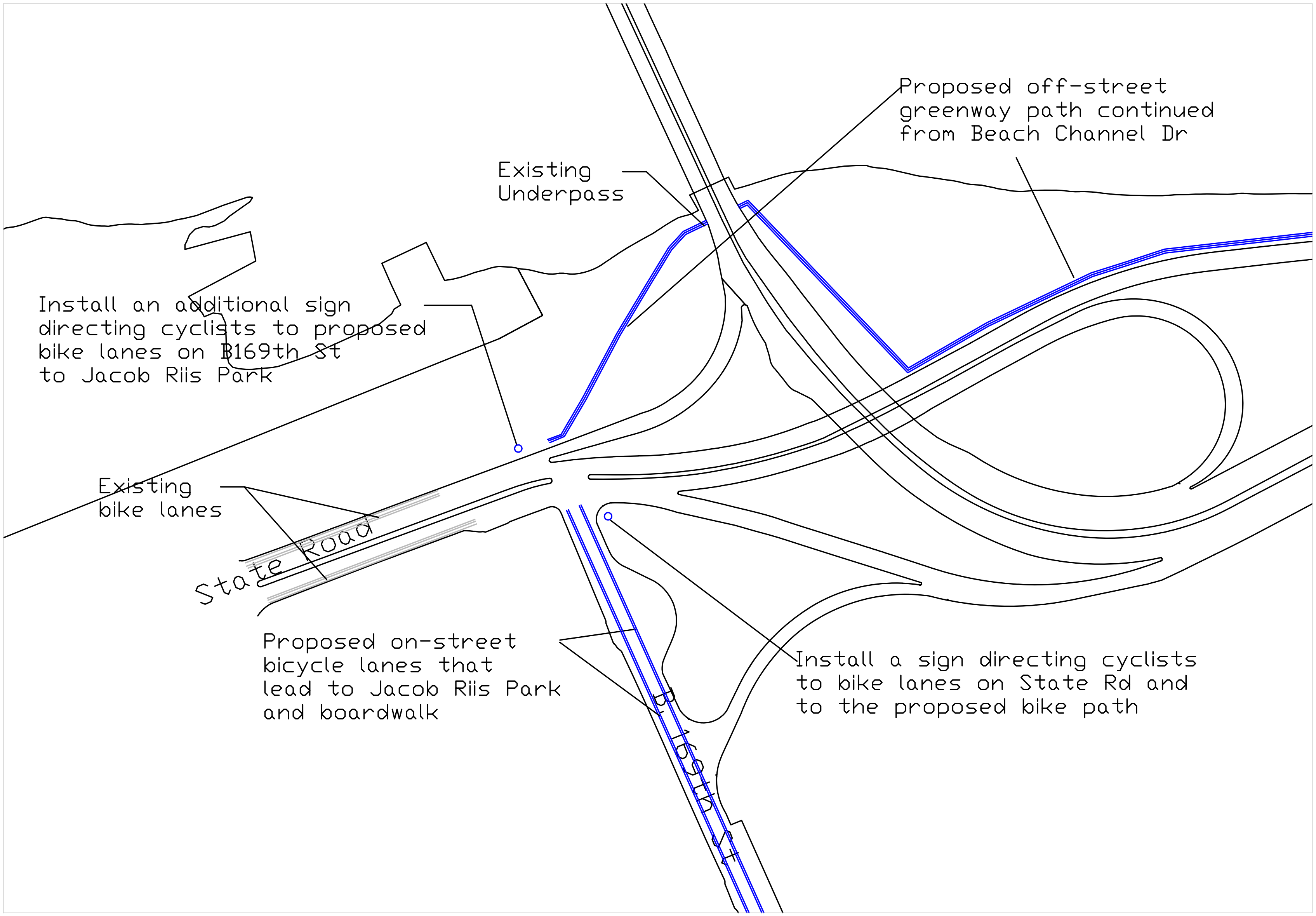
Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 48



Recommendations - Beach Channel Dr between B. 138th St and B. 145th St
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 49



Recommendations - Intersection of State Road and B. 169th Street
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 50

Beach 126th Street and Beach 127th Street

These streets are similar to each other and are proposed as the north-south links between Beach Channel Drive and Rockaway Beach Boulevard for this area. A Class 2 bicycle lane can be added on Beach 126th St and Beach 127th St between the parking lane and the travel lane.

An alternate solution is to have a bicycle lane and a buffer against the curb in place of the parking lane. Since parking is not permitted on these streets from May 15 – September 30 on Saturdays, Sundays and holidays (peak period usage with the nearby beach attraction), it is proposed to make it a year-round regulation for one side of the street since most houses in this residential area have garages and driveways to park their vehicles (see Figures 38 of 102nd Street as an example). This alternate proposal would require the involvement of the local community and the community board prior to implementation.

On the other hand bicyclists on Beach 126th Street between Rockaway Beach Boulevard and the boardwalk can ride in both directions with the "No Parking Anytime" signs posted on both sides of the street. Five-foot wide bicycle lanes can be striped against the curb in each direction and sufficient space would be left for vehicular traffic (See Figure 57 below).

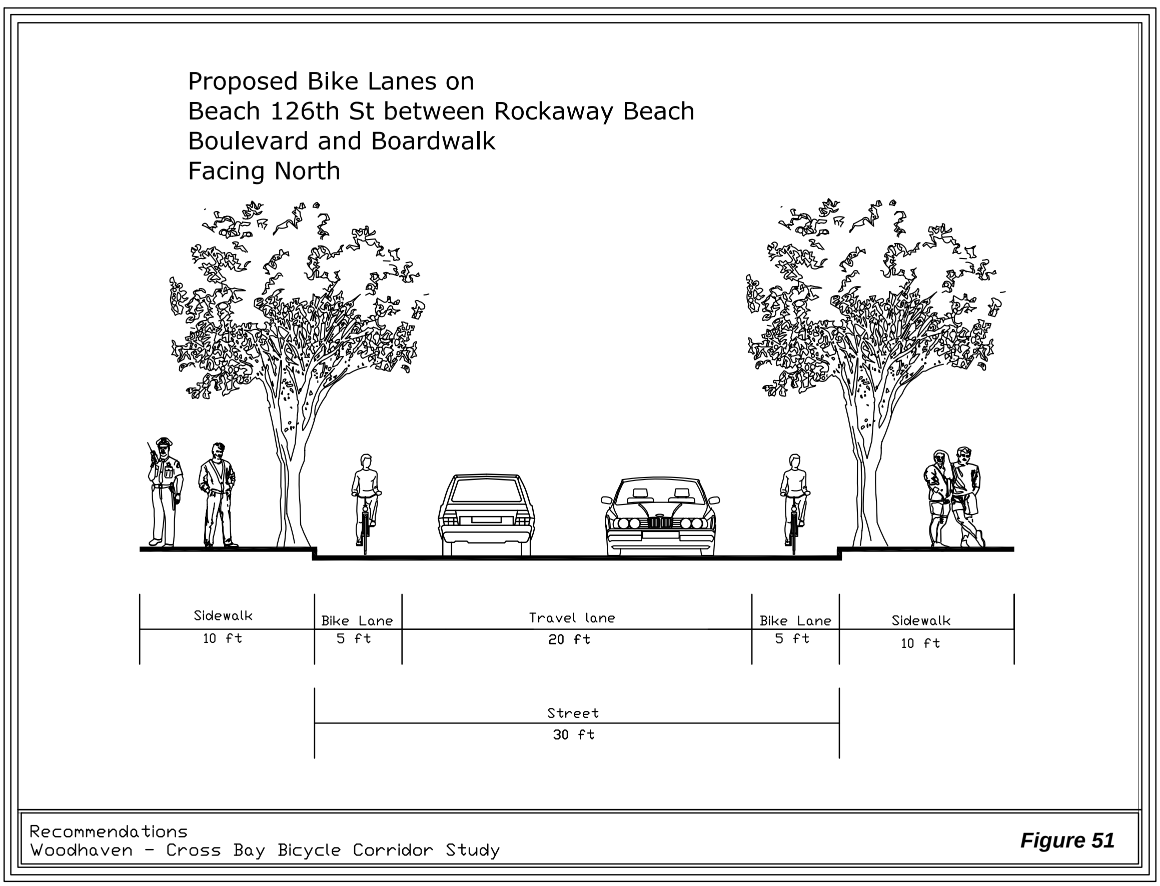
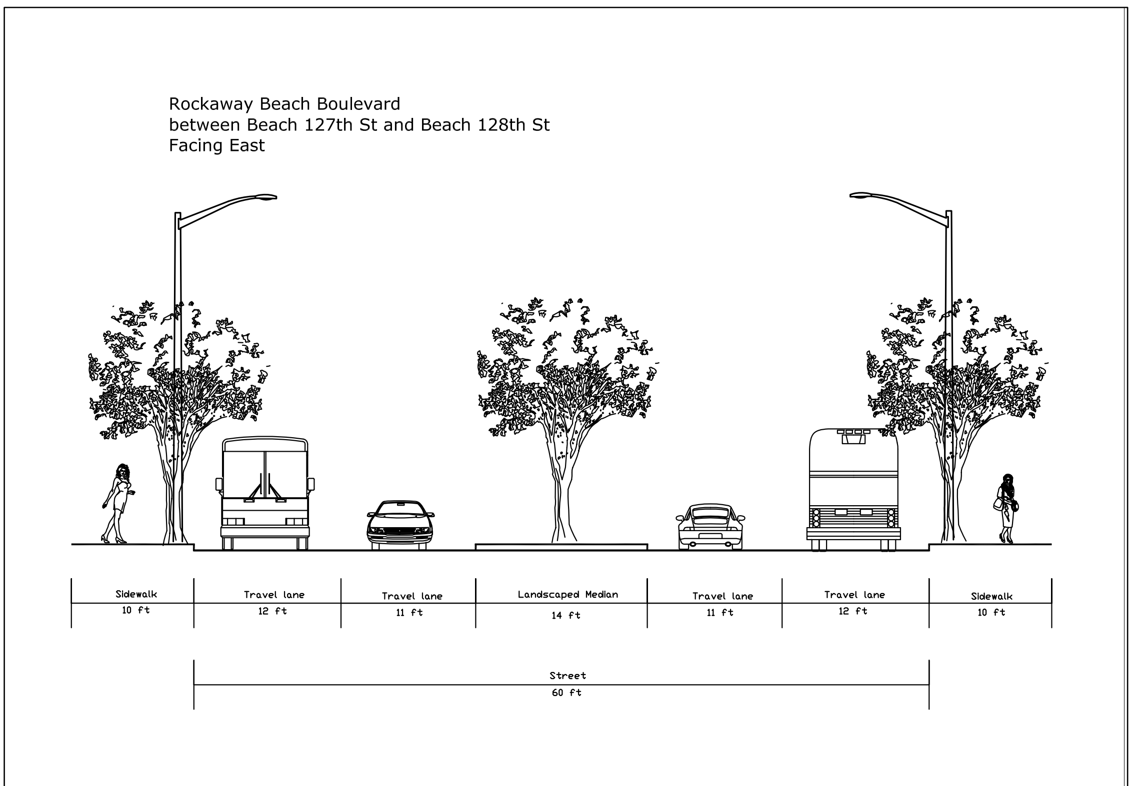


Figure 51

Rockaway Beach Boulevard

A proposal for Rockaway Beach Boulevard from Beach 126th Street to Beach 149th Street is to have a two-way striped bicycle facility and to place each bicycle lane between the bus/ parking lane and the travel lane (see Figure 58 and 59 for existing and recommended conditions).

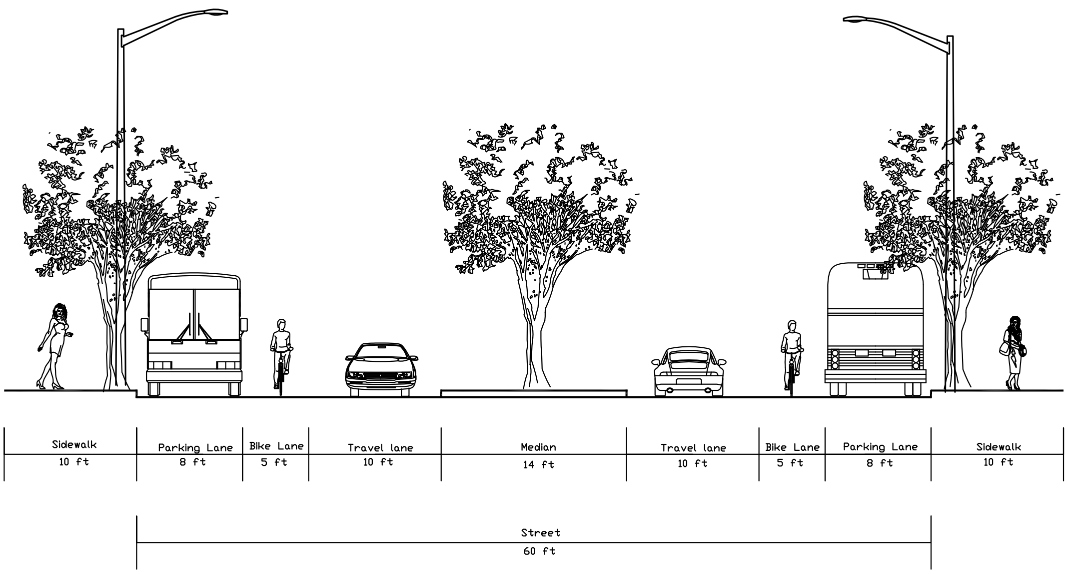
As an alternate solution, it is recommended for this segment of Rockaway Beach Boulevard to stripe a bicycle lane in each direction of traffic and to place them adjacent to the landscaped center median. This would eliminate conflicts between cyclists and buses pulling in and out along this roadway to drop off or pick up passengers. It is highly recommended in this situation to put in pigmented bicycle lanes along this route to visually define the bicycle facility for motorists and cyclists (see Figure 60).



Existing Conditions
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 52

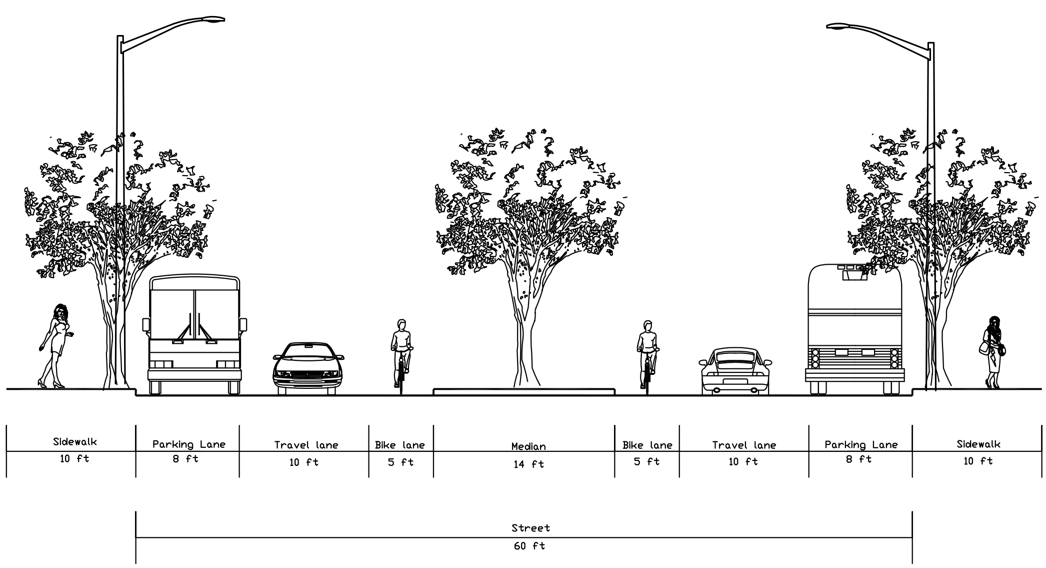
Proposed Bike Lane on
Rockaway Beach Boulevard
between Beach 127th St and Beach 128th St
Facing East



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 53

Alternate Proposal on
Rockaway Beach Blvd
between Beach 127th St and Beach 128th St
Facing east



Recommendations
Woodhaven - Cross Bay Bicycle Corridor Study

Figure 54

Conclusion

The Woodhaven – Cross Bay Bicycle Corridor Study is a first step towards the implementation of a series of bicycle routes for cyclists within the area of study and to link the residents of Woodhaven to the Cross Bay area with connections to local parks, the Shore Parkway Greenway path and the Rockaway Beach area.

This study analyzed the existing conditions of the roadways considered for a bicycle facility including a level of service analysis, bicycle accidents analysis etc. Problems were identified within the area of study in terms of accessibility and connectivity to the bicycle network. Recommendations were made to build on the existing network and create links for cyclists wanting to travel to the different and many attractions of the study area.

As a next step, further assessment is necessary to determine the feasibility of the proposed bicycle facilities. New York City Department of Transportation and the New York City Department of Parks and Recreation which are the implementing agencies will review and further evaluate the recommendations of this study. In addition, the New York City Department of City Planning will work in coordination with the community and any relevant agencies towards the implementation of the proposed bicycle routes. Funding will be required and sought for the execution of this project.

APPENDICES

Appendix A - Zoning and Land Use

Appendix B - Street Network
a)Definitions
b)Level of Service Analysis
c)Street Widths and Traffic Direction

Appendix C - Public Transportation

Appendix D - Literature Search

Appendix A :

Zoning and Land Use

Zoning and Land Use

In accordance with the Zoning Resolution of the City of New York, there are three basic zoning designations within New York City: residential (R), commercial (C), and manufacturing (M). There are ten residential, eight commercial, and three manufacturing zoning districts of varying densities (lower, medium and higher densities). Manufacturing zoning districts are further classified into performance zones which establish limits on the amount and type of nuisances permitted. Development within these districts is regulated by use, building size and parking regulations.

Table A1
Residential Zoning Districts Within the Study Area

Residential Zoning District*	Maximum Residential FAR	Maximum Community Facility FAR	Maximum Commercial Overlay FAR	General Permitted Housing Types
R1-2	0.5	0.5	1.0	Single-family detached residences
R2	0.5	0.5	1.0	Single-family detached residences
R3-1	0.5	1.0	1.0	Single and two-family detached and semi-detached residences
R3-2	0.5	1.6	1.0	Low density general residence district: a variety of housing types
R3A	0.5	1.0	1.0	Single and two-family detached residences
R3X	0.5	1.0	1.0	Single and two-family detached residences
R4	0.75	2.0	1.0	Low density general residence district: a variety of housing types
R4-1	0.75	2.0	1.0	Single and two-family detached and semi-detached residences
R4A	0.75	2.0	1.0	Single and two-family detached residences
R5	1.25	2.0	1.0	Low density general residence districts: a variety of housing types
R6	0.78-2.43	4.8	2.0	R6 height factor regulations; R6 Quality Housing Option
R6A	3.0	3.0	2.0	R6A general residence district: a variety of housing types; Quality Housing is mandatory
R6B	2.0	2.0	2.0	R6B general residence district: a variety of housing types; Quality Housing is mandatory
R7A	4.0	4.0	2.0	R7A general residence district: a variety of housing types; Quality Housing is mandatory

Note that in the R1 and R2 districts listed above, regulations may differ in a Lower Density Growth Management Plan. Also, in the R3 and R4 districts listed above, the FAR may be increased up to 20 percent for an attic allowance.

Table A2

Commercial Zoning Districts Within the Study Area

Commercial Zoning District	Maximum Commercial FAR	Maximum Community Facility FAR	Maximum Residential FAR	Residential District Equivalent
C3	0.50	1.0	0.5[1]	R3-2
C8-1	1.0	2.4	N/A	N/A

[1] The FAR may be increased up to 20 percent for an attic allowance.

Table A3

Manufacturing Zoning Districts Within the Study Area

Manufacturing Zoning District	Maximum Manufacturing FAR	Maximum Commercial FAR	Maximum Community Facility FAR[1]
M1-1	1.0	1.0	2.4
M1-2	2.0	2.0	4.8
M2-1	2.0	2.0	N/A

[1] Only community facilities in Use Group 4 are permitted.

Appendix B :

Street Network

Street Network

a) Definitions

Arterial Roadway. An arterial roadway is a high-speed divided highway, serving through traffic with access partially or fully controlled. It is a main, direct roadway that connects communities throughout the city.

Major Collector Roadway. A major collector roadway caries a significant amount of vehicular traffic within a study area. It generally runs through a study area and beyond to adjacent outlying peripheral areas, sometimes via bridges over waterways. A major collector roadway tends to be a long street which may provide linkage to a highway. It is likely to be two-directional and wider than a minor collector street. The major collector roadways may also serve as a designated truck route, a bus route, and/or the location for a subway station and may contain commercial stores.

Truck Routes. There are two major truck route designations: a through truck route is designated for trucks having neither an origin nor a destination within the local area and a local truck route is designated for trucks with origins or destinations within an area for the purpose of delivery, loading, or providing services.

b) Level of Service Analysis and Methodology – Vehicular Traffic

The operation of the intersections within the study area was analyzed applying the methodologies presented in the 2000 Highway Capacity Manual (HCM2000). These procedures evaluate intersections for average delay per vehicle and level of service (LOS).

Signalized Intersections

The capacity analysis methodology separates an intersection approach into lane groups on the basis of the movements occurring during each signal phase. The lane groups are then analyzed to determine the specific vehicular capacity and LOS. This analysis requires the following input parameters: intersection geometry, lane utilization, number of travel lanes, width of travel lanes, on-street parking conditions, locations of bus stops, number of buses stopping per hour, vehicle turning movements, vehicle classification, conflicting pedestrian movements, traffic signal cycle length, and allocation of green time.

The operating characteristics of signalized intersections can be estimated and evaluated by analyzing capacity and performance. The capacity of an intersection represents the throughput of a facility (i.e., the maximum number of vehicles that can be served in one hour). Capacity analysis results in the volume-to-capacity ratio (v/c ratio) which presents the proportion of capacity (supply) utilized by the existing traffic volume (demand). High v/c ratios (>0.85) indicate some traffic congestion, and low v/c ratios (<0.60) indicate a smooth traffic flow.

The performance of an intersection is based on the estimated average delay time (i.e., the average stopped time per vehicle) for each vehicle utilizing a roadway segment. Delay time is determined by the capacity of a lane group, the amount of green time allotted to a lane group, and the signal cycle length. Delay time is a factor which determines the LOS for a lane group. Short delays receive a good LOS while long delays receive a poor LOS.

Unsignalized Intersections

The capacity analysis is based on the use of “gaps” in a major traffic stream by vehicles crossing through or turning into that stream. At unsignalized intersections, “Stop” or “Yield” signs are used to assign the right-of-way to one street while controlling the movements from the other street(s). The methodology assumes that major street traffic is not affected by minor street flows. Left turns from the major street are assumed to be affected by the opposing, oncoming, major street flow. Minor street traffic is obviously affected by all conflicting movements, vehicular and pedestrian. Table B1 describes the LOS definitions for signalized intersections and Table B2 describes the LOS definitions for unsignalized intersections.

Table B1 – Level of Service Definitions for Signalized Intersections

Flow Quality	Description
Level A	Describes operation with very low delay, i.e., less than or equal to 10 seconds per vehicle. This occurs when progression is extremely favorable and most vehicles arrive during the green phase.
Level B	Describes operation with delay in the range of >10-20 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths.
Level C	Describes operation with delay in the range of >20-35 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths.
Level D	Describes operation with delay in the range of >35 -55 seconds per vehicle. At level D, the influence of congestion becomes more noticeable.
Level E	Describes operation with delay in the range of >55 – 80 seconds per vehicle. This is considered to be the limit of acceptable delay.
Level F	Describes operation with delay in excess of 80.0 seconds per vehicle. This is considered to be unacceptable to most drivers.

Source: Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C., 2000.

Table B2 – Level of Service Definitions for Unsignalized Intersections

Level of Service	Control Delay (s/veh)
A	0 – 10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Data Collection

Traffic volumes including vehicle classification and turning movement volumes were collected for a total of eight (8) intersections of which 6 are signalized and 2 are unsignalized. These counts were conducted for a typical weekday (Tuesday, Wednesday or Thursday) in 15-minute intervals during the AM (7:00 – 9:00AM), MD (12:00 – 2:00 PM), PM (4:00 – 6:00 PM) and Saturday Midday (1:00 – 3:00 PM) peak periods. The following is a list of the signalized intersections:

- Jamaica Avenue and 102nd Street
- Atlantic Avenue and 104th Street
- Rockaway Boulevard and 102nd Street
- Beach Channel Drive and Beach 134th Street
- Beach Channel Drive and Beach 122nd Street
- Beach Channel Drive and Beach 108th Street

The following is a list of the unsignalized intersections:

- Rockaway Beach Boulevard and Beach 133rd Street
- Rockaway Beach Boulevard and Beach 143rd Street

Automatic Traffic Recorders (ATR) were also used to conduct automatic 24-hour traffic counts for one full week including weekends (7 days) at the following locations:

- On Freedom Drive between Myrtle Avenue and Park Lane South
- On Centreville Street between 133rd Avenue and Linden Blvd
- On Centreville Street between 149th Avenue and Eckford Avenue
- On 92nd Street between 162nd and 163rd Avenues
- On 165th Avenue between 91st and 92nd Streets

<u>Network Traffic Volumes</u>

The traffic volume, including turning movement volumes, data analysis revealed the following for a typical weekday:

102nd Street (bet Jamaica Av and Rockaway Blvd)	**AM – NB**	**AM – SB**	**MD – NB**	***MD – SB***	**PM – NB**	**PM - SB**
Average 15-min Volumes	351	104	214	95	242	158

104th Street at Atlantic Avenue	**AM – SB**	**MD – SB**	**PM - SB**
Average 15-min Volumes	245	210	297

Jamaica Avenue at 102nd Street	**AM – EB**	**AM – WB**	**MD – EB**	**MD – WB**	**PM – EB**	**PM - WB**
Average 15-min Volumes	247	219	224	198	279	237

Rockaway Blvd at 102nd Street	**AM – EB**	**AM – WB**	**MD – EB**	**MD – WB**	**PM – EB**	**PM - WB**
Average 15-min Volumes	686	1,034	490	491	780	654

Beach Channel Dr at Beach 108th St	**AM – EB**	**AM – WB**	**MD – EB**	**MD – WB**	**PM – EB**	**PM - WB**
Average 15-min Volumes	569	624	419	437	531	698

Beach Channel Dr at Beach 122nd St	AM – EB	AM – WB	MD – EB	MD – WB	PM – EB	PM - WB
Average 15-min Volumes	498	678	408	422	590	606

Beach Channel Dr at Beach 134th St	AM – EB	AM – WB	MD – EB	MD – WB	PM – EB	PM - WB
Average 15-min Volumes	373	725	334	378	559	494

Rockaway Beach Blvd at B133rd St	AM – EB	AM – WB	MD – EB	MD – WB	PM – EB	PM - WB
Average 15-min Volumes	224	344	154	167	223	207

Rockaway Beach Blvd at B143rd St	AM – EB	AM – WB	MD – EB	MD – WB	PM – EB	PM - WB
Average 15-min Volumes	116	319	160	167	259	206

The results of the Automatic Traffic Recorder (ATR) volumes are presented in the tables below. They represent the volumes during the peak hour where traffic operation is at its most critical on a typical weekday for these locations:

Table B3 – Automatic Traffic Recorder Volumes (1 of 2)

Locations	AM Peak Hour Volume (NB)	PM Peak Hour Volume (NB)	AM Peak Hour Volume (SB)	PM Peak Hour Volume (SB)
Freedom Dr between Myrtle Av and Park Lane South	232	139	82	169
Centerville St between 133rd Av and Linden Blvd	238	199	260	326
Centerville St between 149th Av and Eckford Av	205	175	254	449
92nd St between 162nd and 163rd Aves	98	96	n/a	n/a

Table B3 – Automatic Traffic Recorder Volumes (2 of 2)

Locations	AM Peak Hour Volume (EB)	PM Peak Hour Volume (EB)	AM Peak Hour Volume (WB)	PM Peak Hour Volume (WB)
165th Av between 91st and 92nd Sts	46	56	24	53

Intersection Analysis

Typical intersections were identified and analyzed for roadway capacity using the 2000 Highway Capacity Manual (HCM) methodology. Volume-to-capacity (v/c) ratios, vehicular delay, and the level of service (LOS) were determined for the respective peak hours.

The analysis shows that most intersections operate at an acceptable level of service LOS C or better during the AM, MD, PM and Saturday midday peak hours. However the 102nd Street and Jamaica Avenue intersection experienced LOS D, E or F for some of the lane groups during the weekday peak hours. (see Tables B4 and B5 on the following pages for details).

The approaches or lane groups with mid-LOS D (equal to 45 sec/ veh) or worse are:

- Northbound on 102nd Street (AM)
- Southbound on 102nd Street (AM, MD, and PM)

Table B4 - Traffic Capacity Analysis of Signalized Intersections

		2008 Existing Conditions - Signalized Intersections											
Jamaica Avenue & 102nd Street		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
EB	LT	0.35	8.6	A	0.30	8.0	A	0.28	7.7	A	0.29	7.9	A
WB	TR	0.27	7.7	A	0.21	7.2	A	0.23	7.3	A	0.23	7.4	A
NB	LTR	0.97	71.1	E	0.74	42.0	D	0.73	41.6	D	0.46	32.8	C
SB	LR	1.00	111.4	F	0.73	55.9	E	0.99	97.2	F	0.60	41.2	D
	Intersection:		44.3	D		25.7	C		34.3	C		18.8	B
Atlantic Avenue & 104th Street		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
EB	TR	0.50	15.7	B	0.58	18.4	B	0.63	18.0	B	0.62	19.2	B
WB	L	0.68	32.7	C	0.50	24.7	C	0.69	43.1	D	0.48	26.8	C
	T	0.49	9.3	A	0.39	9.4	A	0.41	8.5	A	0.29	8.6	A
SB	LTR	0.56	44.7	D	0.31	27.6	C	0.54	44.0	D	0.29	26.4	C
	Intersection:		18.8	B		16.8	B		20.3	C		17.6	B
Rockaway Blvd. & 102nd Street		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
EB	LT	0.33	0.3	A	0.21	0.2	A	0.29	0.2	A	0.23	0.2	A
WB	TR	0.37	0.3	A	0.17	0.1	A	0.23	0.2	A	0.21	0.1	A
	Intersection:		0.3	A		0.1	A		0.2	A		0.2	A
Beach Channel Drive & 134th Street		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
EB	T	0.24	7.9	A	0.23	7.8	A	0.34	8.6	A	0.25	8.0	A
WB	T	0.50	10.0-	A	0.25	7.9	A	0.36	8.7	A	0.27	8.1	A
NB	LR	0.23	15.5	B	0.11	14.3	B	0.06	14.0	B	0.04	13.8	B
	Intersection:		9.8	A		8.3	A		8.8	A		8.2	A
Beach Channel Drive & 122nd Street		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
EB	T	0.35	8.7	A	0.28	8.2	A	0.36	8.7	A	0.28	8.2	A
WB	T	0.46	9.6	A	0.26	8.0	A	0.36	8.7	A	0.31	8.4	A
NB	LR	0.13	14.5	B	0.05	13.8	B	0.08	14.1	B	0.05	13.9	B
	Intersection:		9.5	A		8.2	A		8.9	A		13.9	A
Beach Channel Drive & 108th Street		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
EB	TR	0.28	9.4	A	0.19	8.7	A	0.27	9.3	A	0.17	8.5	A
WB	LT	0.55	12.7	B	0.30	9.7	A	0.55	12.4	B	0.30	9.6	A
NB	L	0.17	24.6	C	0.17	24.6	C	0.11	23.9	C	0.18	24.7	C
	R	0.11	24.0	C	0.08	23.6	C	0.06	23.4	C	0.07	23.5	C
	Intersection:		12.1	B		10.7	A		11.7	B		10.8	B

Table B5 - Traffic Capacity Analysis of Unsignalized Intersections

		2008 Existing Conditions - UnSignalized Intersections											
Rockaway Beach Blvd & B133rd St		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
WB	LT	0.00	8.2	A	0.00	7.8	A	0.00	7.9	A	0.00	7.7	A
NB	LR	0.05	12.9	B	0.02	11.0	B	0.01	9.1	A	0.02	8.9	A
SB	LTR	0.15	13.7	B	0.06	10.0+	B	0.05	11.1	B	0.04	10.1	B
Rockaway Beach Blvd & B143rd St		AM			Midday			PM			Saturday		
Approach	Lane Group	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
WB	LT	0.00	7.6	A	0.00	7.7	A	0.00	8.0	A	0.00	7.5	A
NB	LR	0.02	10.4	B	0.01	8.9	A	0.02	12.3	B	0.02	9.8	A
SB	LTR	0.03	10.9	B	0.02	10.3	B	0.01	8.9	A	0.02	10.1	B

c) Street Widths and Traffic Direction

Table B6 – Street Widths, Traffic Direction, Travel Lanes

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Memorial Drive - small street that leads into Forest Park path	Greenway path to intersection of Myrtle Avenue and Park Lane South	40 ft	2-way	1	
Park Lane South	Myrtle Avenue to 102nd Street	30 ft	2way	1	
102nd St	Park Lane South to 85th Avenue	43 ft	2 -way	1	1 - 5.5 ft
102nd St	85th Avenue and 85th Road	43 ft	2 -way	1	5.5 ft
102nd St	85th Road and 85th Drive	43 ft	2 -way	1	5.5 ft
102nd St	85th Drive and 86th Avenue	43 ft	2 -way	1	5.5 ft
102nd St	86th Avenue and 86th Road	43 ft	2 -way	1	1 - 5.5 ft
102nd St	86th Road and Jamaica Avenue	43 ft	2 -way	1	
Jamaica Avenue	102nd St to 104th St	39 ft	2-way	1	
102nd St	Jamaica Avenue to 87th Avenue	30 ft	1-way (NB)	1	
102nd St	87th Avenue to 88th Avenue	30 ft	1-way (NB)	1	
102nd St	88th Avenue to 89th Avenue	30 ft	1-way (NB)	1	
102nd St	89th Avenue to 90th Avenue	30 ft	1-way (NB)	1	
102nd St	89th Avenue to 90th Avenue	30 ft	1-way (NB)	1	
102nd St	90th Avenue to 91st Avenue	30 ft	1-way (NB)	1	
102nd St	91st Avenue to 92nd Avenue	30 ft	1-way (NB)	1	
102nd St	92nd Avenuet to 93rd Avenue	30 ft	1-way (NB)	1	
102nd St	93rd Avenue to Atlantic Avenue	30 ft	1-way (NB)	1	
102nd St	Atlantic Avenue to 94th Avenue	30 ft	1-way (NB)	1	
102nd St	94th Avenue to 95th Avenue	30 ft	1-way (NB)	1	
102nd St	95th Avenue to 97th Avenue	30 ft	1-way (NB)	1	
102nd St	97th Avenue to 101st Avenue	27.5 ft	1-way (NB)	1	
102nd St	101st Avenue to 103rd Avenue	27.5 ft	1-way (NB)	1	
102nd St	103rd Avenue to Liberty Avenue	28 ft	1-way (NB)	1	
102nd St	Liberty Avenue to Rockaway Boulevard	28 ft	1-way (NB)	1	

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
104th St	Jamaica Avenue to 87th Avenue	30 ft	1-way (SB)	1	
104th St	87th Avenue to 88th Avenue	30 ft	1-way (SB)	1	
104th St	88th Avenue to 89th Avenue	30 ft	1-way (SB)	1	
104th St	89th Avenue to 90th Avenue	30 ft	1-way (SB)	1	
104th St	90th Avenue to 91st Avenue	30 ft	1-way (SB)	1	
104th St	91st Avenue to 92nd Avenue	30 ft	1-way (SB)	1	
104th St	92nd Avenue to 93rd Avenue	30 ft	1-way (SB)	1	
104th St	93rd Avenue to Atlantic Avenue	30 ft	1-way (SB)	1	
104th St	Atlantic Avenue to 94th Avenue	30 ft	1-way (SB)	1	
104th St	94th Avenue to 95th Avenue	30 ft	1-way (SB)	1	
104th St	95th Avenue to 97th Avenue	30 ft	1-way (SB)	1	
104th St	97th Avenue to 101st Avenue	30 ft	1-way (SB)	1	
104th St	101st Avenue to 103rd Avenue	30 ft	1-way (SB)	1	
104th St	103rd Avenue to Liberty Avenue	30 ft	1-way (SB)	1	
104th St	Liberty Avenue to 107th Avenue	30 ft	1-way (SB)	1	
104th St	107th Avenue to Rockaway Boulevard	30 ft	1-way (SB)	1	
Rockaway Boulevard	101st Street to 102nd Street	60 ft	2-way	2	
Rockaway Boulevard	102nd Street to 103rd Street (where 103rd St south of Rockaway Blvd starts)	60 ft	2-way	2	
Rockaway Boulevard	103rd Street (where 103rd St south of Rockaway Blvd starts) to 104th Street	Varies from 64.5 ft to 66 ft (from west to east)	2-way	2	Varies from 1.5 ft to 7.5 ft (from west to east)

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Rockaway Boulevard	104th Street to 105th Street	70 ft	2-way	2 travel lanes and a left turn lane for EB traffic	Varies from 11ft to 2 ft (from west to east)
Rockaway Boulevard	105th Street to Centreville Street/ Plattwood Avenue	70 ft	2-way	2 travel lanes and a left turn lane for EB traffic	
Centerville Street (north of Linden Blvd)	Rockaway Blvd to Rosita Road	30 ft	2-way	1	
Centerville Street (north of Linden Blvd)	Rosita Rd to Sutter Ave/ 133rd Ave	30 ft; 52 ft where there is no sidewalk	2-way	1	
Centerville Street (north of Linden Blvd)	Sutter Ave/ 133rd Ave to Peconic St/ Linden Blvd	40 ft; street width widens to 50 ft near intersection where there is a dirt sidewalk	2-way	1	
101st Street	Rockaway Blvd to 133rd Ave	36 ft	2-way	1	
Peconic Street	133rd Ave to Boss St	30 ft	1 way (NB)	1	
Peconic Street	Boss St to Linden Blvd/ Centreville St	30 ft	1 way (NB)	1	
Linden Boulevard	Hawtree St to Peconic St/ Centerville St	45ft west of the elevated rail line; 50 ft east of the elevated rail line	2-way	1	
Hawtree Street	Linden Blvd to 135th Rd	38 ft	2-way	1	
Hawtree Street	135th Rd to Pitkin Ave	38 ft	2-way	1	
Hawtree Street	At intersection of Hawtree St and Pitkin Ave, near corner	Curbed section of road widens from 38ft to 140 ft	2-way	1	
Centerville Street (south of Pitkin Ave)	Pitkin Ave to 135th Dr	23ft to 21ft (narrows from north intersection to south intersection)	2-way	1	
Centerville Street (south of Pitkin Ave)	135th Dr to 149th Ave/ Bristol Ave	Varies from 21 to 25 ft in width due to dirt sidewalk - east side of road	2-way	1	

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Centerville Street (south of Pitkin Ave)	149th Ave/ Bristol Ave to Eckford Ave	40 ft	2-way	1	
Centerville Street (south of Pitkin Ave)	Eckford Ave to Albert Road	38 ft	2-way	1	
Albert Road	Centerville St to Tahoe St (where Tahoe St ends north of Albert Rd)	33 ft	1-way (WB)	1	
Albert Road	Tahoe St-north (where Tahoe St ends north of Albert Rd) to Tahoe St-south (where Tahoe St starts south of Albert Rd)	Varies from 33 to 30 ft in width (west to east) due to dirt sidewalk on south side of road	1-way (WB)	1	
Albert Road	Tahoe Street - south (where Tahoe St starts south of Albert Rd) to Raleigh Street	Varies from 28 to 30 ft in width (west to east) due to sections of an uneven curb on south side of road	1-way (WB)	1	
Albert Road	Raleigh Street to Huron Street	33 ft	1-way (WB)	1	
Albert Road	Huron Street to 99th Place	24 - 25 ft	1-way (WB)	1	
Albert Road	99th Place to Cohancy Street	24 - 25 ft	1-way (WB)	1	
Eckford Avenue	Centerville St to Tahoe St	30 ft	1-way (EB)	1	
Eckford Avenue	Tahoe Street to Raleigh Street	30 ft	1 way (EB)	1	
Hawtree Street	Raleigh Street to Huron Street	30 ft wide with sidewalks on both sides of the street; Varies from 35 to 32 ft in width (from west to east) where there are no sidewalks	1 way (EB)	1	

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Hawtree Street	Huron Street to 99th Place	Varies from 55 to 45 ft in width (from west to east) due to sections of roadway with no sidewalks	1 way (EB)	1	
Hawtree Street	99th Place to Cohancy Street	Width is 30 ft with dirt both sides of the road; no sidewalks on both sides of the road	1 way (EB)	1	
Cohancy Street	Hawtree Street to 155th Avenue	33 ft	2-way	1 SB travel lane and 2 NB travel lanes (total = 3 travel lanes)	
Cohancy Street	155th Avenue to 156th Avenue	33 ft	1-way (NB)	1	
Cohancy Street	156th Avenue to 157th Avenue	33 ft	1-way (SB)	1	
155th Avenue	Bridgeton Street to Cohancy Street	50 ft	2-way	1	
156th Avenue	Bridgeton Street to Cohancy Street	51 ft	2-way	1	
Bridgeton Street	156th Avenue to 157th Avenue	30 ft	1-way (SB)	1	
91st Street	157th Avenue to 165th Avenue	30 ft	1-way (SB)	1	
92nd Street	157th Avenue to 165th Avenue	30 ft	1-way (NB)	1	
96th Street	157th Avenue to 165th Avenue	30 ft	1-way (SB)	1	
97th Street	157th Avenue to 165th Avenue	30 ft	1-way (NB)	1	
165th Avenue	91st Street and Cross Bay Boulevard	50 ft	2-way	1	
Esplanade under ramps of Veteran’s Memorial Bridge		16 - 18 ft			
Beach 94th Street	Beach Channel Drive to Rockaway Freeway	26 ft	1-way (NB)	1	

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Beach 94th Street	Rockaway Freeway to Shore Front Parkway	65 ft total, 32 ft main road, 25 ft service road	1-way (NB)	Room for 3 on main road, 1 on service road	8 ft (grass median), 125 ft (parking area in between B94 and B95 Sts)
Beach 95th Street	Beach Channel Drive to Rockaway Freeway	26 ft	1-way (SB)	1	
Beach 95th Street	Rockaway Freeway to Shore Front Parkway	65 ft total, 32 ft main road, 25 ft service road	1-way (SB)	Room for 3 on main road, 1 on service road	8 ft (grass median), 125 ft (parking area in between B94 and B95 Sts)
Beach 96th Street	Beach Channel Drive to Rockaway Freeway	28 ft	1-way (NB)	1	
Beach 101st Street	Beach Channel Drive to Rockaway Freeway	30 ft	1-way (SB)	1	
Beach 102nd Street	Beach Channel Drive to Rockaway Freeway	30 ft	1-way (NB)	1	
Beach 102nd Street	Rockaway Freeway to Rockaway Beach Blvd	70 ft, narrows to 40 ft near Rockaway Freeway intersection	2-way	1 per direction, room for more lanes	
Beach 102nd Street	Rockaway Beach Blvd to Shore Front Parkway	80 ft total, 37 ft each way	2-way	1	6 ft
Beach 108th Street	Beach Channel Drive to Rockaway Freeway	80 ft total, 37 ft each way	2-way	2 NB, 1 SB	6 ft
Beach 108th Street	Rockaway Freeway to Rockaway Beach Blvd	92 - 110 ft total, 40 ft each way	2-way	2	12 - 30 ft
Beach 108th Street	Rockaway Beach Blvd to Shore Front Parkway	110 ft total, 40 ft each way	2-way	2	30 ft
Beach 121st Street	Beach Channel Drive to Ocean Promenade (bdwlk)	30 ft	1-way (SB)	1	
Beach 122nd Street	Beach Channel Drive to Ocean Promenade (bdwlk)	30 ft	1-way (NB)	1	
Beach Channel Drive	Beach 90th Street to Beach 92nd Street	52 ft	2-way	2 WB, 1 EB	
Beach Channel Drive	Beach 92nd Street to Beach 96th Street	52 ft	2-way	2 WB, 1 EB	6 ft
Beach Channel Drive	Beach 96th Street to Beach 97th Street	70 ft	2-way	2 WB, 3 EB	6 ft

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Beach Channel Drive	Beach 97th Street to Beach 98th Street	68 ft	2-way	2 WB, 3 EB	6 ft
Beach Channel Drive	Beach 98th Street to Beach 99th Street	80 ft	2-way	2 WB, 2EB	6 - 10ft gradually, then merges with the 17ft median
Beach Channel Drive	Beach 99th Street to Beach 100th Street	80 ft	2-way	3 WB, 3EB	17 ft
Beach Channel Drive	Beach 100th Street to Beach 101st Street	80 ft	2-way	2 WB, 2 EB, plus 1 left turn bay for WB traffic at B 101st St	6 ft
Beach Channel Drive	Beach 101st Street to Beach 102nd Street	80 ft	2-way	2 (WB), 2 (EB)	17 ft
Beach Channel Drive	Beach 102nd Street to Seaside Avenue	80 ft	2-way	2 (WB), 2 (EB), plus 1 left turn bay for WB traffic at Seaside Av	6 ft
Beach Channel Drive	Seaside Avenue to Beach 104th Street	80 ft	2-way	2 (WB), 2 (EB), 1 left turn bay for EB traffic at Seaside Av	6 - 10ft gradually, then merges with the 17ft median
Beach Channel Drive	Beach 104th Street to Beach 108th Street	80 ft, narrows to 73.5 ft near B 108th St	2-way	2 (WB), 2 (EB)	17 ft, narrows gradually to 6 ft near B 108th St
Beach Channel Drive	Beach 108th Street to Rockaway Freeway	70 ft, widens to 75 ft near Rockaway Freeway	2-way	2 (WB), 2 (EB)	6 ft, widens to 12.5 ft near Rockaway Freeway
Beach Channel Drive	Rockaway Freeway to Beach 116th Street	80 ft	2-way	2 (WB), 2 (EB), 1 left turn bay for WB traffic at parking lot entrance across shopping strip	17ft median narrows to 6 ft at or near intersections
Beach Channel Drive	Beach 116th Street to Beach 129th Street	52 ft	2-way	2	No medians, ends at B116th
Beach Channel Drive	Beach 129th Street to Beach 145th Street	52 ft	2-way	2	No medians

Street	Block (From/To Street)	Width	Traffic Direction	Number of Travel Lanes per Direction of Traffic	Width of Median or Traffic Island, if any
Rockaway Freeway	Beach 101st Street to Beach 102nd Street	45 ft total, 11 ft each way	2-way	1	Traffic island markings underneath elevated structure = 23 ft wide
Rockaway Beach Blvd	Beach 108th Street to Beach 109th Street	46 - 48 ft	2-way	1	
Rockaway Beach Blvd	Beach 109th Street to Beach 110th Steet	39 -43 ft	2-way	1	
Rockaway Beach Blvd	Beach 110th Street to Beach 111th Street	45 ft	2-way	1	
Rockaway Beach Blvd	Beach 111th Street to Beach 116th Street	33 ft	2-way	1	
Rockaway Beach Blvd	Beach 116th Street to Beach 117th Street	31 ft	2-way	1	
Rockaway Beach Blvd	Beach 117th Street to Beach 118th Street	30 ft	2-way	1	
Rockaway Beach Blvd	Beach 118th Street to Beach 120th Street	31 ft	2-way	1	
Rockaway Beach Blvd	Beach 120th Street to Beach 124th Street	40 ft	2-way	1	
Rockaway Beach Blvd	Beach 124th Street to Beach 125th Street	40 - 45 ft	2-way	1	
Rockaway Beach Blvd	Beach 125th Street to Beach 126th Street	45 - 50 ft	2-way	1	
Rockaway Beach Blvd	Beach 126th Street to Beach 127th Street	55 - 60 ft	2-way	2	8 -14 ft
Rockaway Beach Blvd	Beach 127th Street to Beach 140th Street	60 ft	2-way	2	14 ft
Rockaway Beach Blvd	Beach 140th Street to Beach 141st Street	65 ft	2-way	2	16 ft
Rockaway Beach Blvd	Beach 141st Street to Beach 149th Street	70 ft	2-way	2	20 ft

Appendix C :

Public Transportation

Subway Lines Information

A Line

The A Line, known as the 8th Avenue Express, runs between Inwood/207th Street in Manhattan and Ozone Park/Lefferts Boulevard or Far Rockaway and sometimes Rockaway Park (during rush hours), Queens.

It makes stops within the study area at 104th Street station, 111th street station, and Ozone Park/Lefferts Boulevard stations.

The line which also runs to the Rockaways, makes stops within the study area at Aqueduct/North Conduit Avenue (southbound) /Aqueduct Racetrack (northbound), Howard Beach/JFK Airport (connection with Airtrain to JFK Airport), and Broad Channel subway stations.

After the Broad Channel station, the A train route splits into two routes: to Far Rockaway and to Rockaway Park. The A train route proceeding to Far Rockaway does not stop within the area of study. The A train proceeding to Rockaway Park terminus station makes stops during the weekday rush hours in the peak direction at Beach 90th Street, Beach 98th Street, Beach 105th Street and Rockaway Park/ Beach 116th Street stations within the study area.

J and Z Lines

The J and Z subway lines travel along the same subway line and through the same subway stations. The J and Z routes, called Nassau Street Express, run between Jamaica Center, Queens, and Broad Street, Manhattan, during weekday rush hours in the peak direction. On evenings, weekends, and late nights, the J runs run between Jamaica Center and either Broad Street or Chambers Street in Manhattan, making all local stops. The Z line does not operate outside of weekday rush hours.

The J and Z trains make stops within the study area at the 75th Street station, 85th Street-Forest Parkway station, Woodhaven Boulevard station, 104th Street station, 111th Street station, and 121st Street station. These station stops are all located along Jamaica Avenue. The subway line is elevated within the study area.

S Shuttle

Known as the Rockaway Park Shuttle runs between Broad Channel and Rockaway Park in Queens. While the A route operates between Broad Channel station and Rockaway Park/Beach 116th Street station during the rush hours, at other times, passengers must transfer from the A train at Broad Channel station for the S shuttle train which makes all A train stops between Broad Channel station and Rockaway Park/Beach 116th Street station. The stops are: Broad Channel station, Beach 90th Street station, Beach 98th Street station, Beach 105th Street station, and Rockaway Park-Beach 116th Street station.

Bus Information

1) Q56: Jamaica Avenue

This bus route operates between 171st Street/Jamaica Avenue, Jamaica, and Broadway Junction/East New York.

The Q56 route utilizes Jamaica Avenue when traveling within the study area.

2) Q24: Atlantic Avenue/ Broadway
The bus route extends between Archer Avenue/168th Street, Jamaica, and Lafayette/Patchen Avenues, Brooklyn.

Within the study area, the Q24 travels along Atlantic Avenue.

3) Q8: 101st Avenue
The Q8 bus route operates between Euclid Avenue, East New York, and 165th Street Bus Terminal, Jamaica.

Within the study area, the Q8 route runs entirely along 101st Avenue.

4) Q112: Liberty Avenue
The bus route operates between Parsons Boulevard, Jamaica, and Rockaway Boulevard, Ozone Park.

Within the study area, the bus route travels along Liberty Avenue, 100th Street, and Rockaway Boulevard.

5) Q41: 127th Street/111th Avenue
The bus route operates between 164th Avenue/Cross Bay Boulevard, Lindenwood, and 165th Street Bus Terminal, Jamaica.

6) Q7: Rockaway Boulevard/ Pitkin Avenue
The bus route operates between Euclid Avenue, East New York (at the borough boundary) and 148th Street/South Cargo Road, JFK Airport.

7) B15: Marcus Garvey Boulevard/New Lots Avenue/JFK Airport
This bus route provides service between Broadway/Marcus Garvey Boulevard, Brooklyn, and either JFK Airport, Queens, or Brooklyn General Mail Facility, Brooklyn (Spring Creek area).

8) Q11: Woodhaven Boulevard
The route operates between Woodhaven Boulevard, Elmhurst, and either 164th /99th Streets, Howard Beach, or 164th Avenue/104th Street, Hamilton Beach, daily. Additional service is provided between Woodhaven Boulevard, Elmhurst, and Rockaway Boulevard, Ozone Park.

9) Q53: Woodside/ Rockaway Park Limited
The Q53 bus route runs between Woodside - 61st Street and Rockaway Park/Beach 116th Street, Rockaway Park.

10) Q21: Cross Bay Boulevard
The bus route travels between Rockaway Boulevard, Ozone Park, and Beach 116th Street/Ocean Promenade, Rockaway Park.

11) Q37: 111th Street/ 135th Avenue
This bus route operates between Kew Gardens - Union Turnpike, Kew Gardens and 131st Street/135th Avenue, South Ozone Park.

12) Q10: Lefferts Boulevard/ JFK Airport
Overall, the Q10 bus route operates between Union Turnpike, Kew Gardens and Central Terminal Area, JFK Airport. Additional service operates between Union Turnpike and Lefferts Boulevard/Rockaway Boulevard or 150th Avenue/130th Street, South Ozone Park.

13) Q22: Rockaway Beach Boulevard/Beach Channel Drive
The Q22 bus route operates between Far Rockaway - Mott Avenue, Far Rockaway and Beach 169th Street/Rockaway Point Boulevard, Roxbury.

14) Q35: Rockaway Park/ Brooklyn College
The Q35 bus route runs between Beach 116th Street/Newport Avenue, Rockaway Park and Flatbush Avenue - Brooklyn College, Midwood.

15) QM15: Lindenwood/ Midtown (Queens Express Bus Service)
The QM15 bus route operates between 157th Avenue/ 92nd Street, Lindenwood and East 57th Street/ Third Avenue, Manhattan.

16) QM16: Neponsit/ Midtown (Queens Express Bus Service)
The QM16 bus route operates between Rockaway Beach Boulevard/ Beach 147th Street, Neponsit and East 57th Street/ Third Avenue, Manhattan.

17) QM17: Far Rockaway/ Midtown (Queens Express Bus Service)
The QM17 bus route operates between Beach 21st Street/ Mott Avenue, Far Rockaway and East 57th Street/ Third Avenue, Manhattan.

18) QM23: Brooklyn Manor/ Midtown (Queens Express Bus Service)
The QM23 bus route operates between Jamaica Avenue/ 102nd Street, Brooklyn Manor and 33rd Street/ Seventh Avenue, Manhattan.

Appendix D :

Literature Search

Information on design guidelines and standards for bicycle facilities has been gathered for the literature search section of the Woodhaven – Cross Bay Bicycle Corridor Study. Innovative solutions from other cities of the Unites States such as San Francisco, Seattle, and Portland etc. were also researched and incorporated into the report.

New York City Bicycle Master Plan Document

The guidelines of the 1997 Bicycle Master Plan were developed to create a framework for roadway designers and planners. The guidelines are based on national guidelines and examples of existing or proposed facilities in the city with particular attention paid to the national standards as defined by the American Association of State Highway and Transportation Officials (AASHTO) Guide to the Development of Bicycle Facilities, by the Manual on Uniform Traffic Control Devices (MUTCD), by the Federal Highway Administration, by the Guidelines for Greenways (Greenway Collaborative), by the Design and Maintenance Manual for Multi-Use Trails (Rails-to-Trails Conservancy), and by the Guidelines for Establishing In-Line Skate Trails in Park and Recreation Areas (International In-Line Skating Association).

AASHTO requires that the minimum bicycle lane width be 4 feet. In the case of curbed streets with a parking lane, bicycle lanes should never be located between the curb and parking lane so that visibility could be preserved and so that left turns would still be permitted. It is also recommended that the bicycle lane is 5’. Where parking is permitted but there is no lane for it, a combination lane for cycling and parking should be at least 12’. There must also be a 4’ clearance between the edge of gutter pavement and the motor vehicle lane. On highways without a curb or gutter, bicycle lanes should be located between the travel lane and shoulder with a minimum width of 4’, though 5’ is preferable.

In New York City, the 1978 Bikeway Planning and Policy Guidelines for New York City document recommended a minimum bicycle lane width of 3 feet 6 inches though 4 feet was preferable. Newer on-street lanes have surpassed these recommendations allowing variable bicycle lane widths of 5 to 6 feet and a buffer to separate the bike lanes from the travel lane.

The Bicycle Master Plan identifies two kinds of signed bicycle routes: short routes that connect dispersed bicycle facilities and longer routes which are also called touring routes. Signed routes are indicated with MUTCD signage. Signs from the city’s greenway system developed by city planning are also often used. Roadways with wide curb lanes are acceptable for signed routes. AASHTO recommends a minimum 12 feet though 14 feet is ideal. However, where vehicles travel faster, there should also be a larger separation between the travel and bicycle lanes.

As far as markings are concerned, the MUTCD has provided national standards for the three sign categories that affect motorists, pedestrians and cyclists: Regulatory, Warning, and Guidance Signs. Regulatory signs should convey traffic laws or regulations. Designated bicycle lane signs should be visible before the beginning of the bicycle lanes in order to indicate to motorists of the presence of cyclists. Warning signs serve the purpose of warning cyclists of the potentially hazardous conditions ahead. These signs should be limited to areas where the hazard is not immediately obvious to avoid overuse of the sign. Guidance signs provide cyclists with information such as route identification and direction. Most states conform to the MUTCD standards.

AASHTO Guide to the Development of Bicycle Facilities Document

<u>Shared Roadways</u>

AASHTO recommends that bicycle-safe design practices should be considered for implementation when developing new roadways, though it acknowledges that many roads were nonetheless designed without any consideration for bicycles. In order to make roadways compatible with bicycle travel, they recommend including “bicycle-safe drainage gates and bridge expansion joints, improved railroad crossings, smooth pavements, adequate sight distances, and signal timing detector systems that respond to bicycles” (page 16). AASHTO acknowledges that width is the “most important variable” in the compatibility between roadways and bicycle traffic. It delineates the following recommendations:

- Paved Shoulders

AASHTO recommends a useable width of 4 feet where possible, though any width of shoulder is better than having none. Further, it is recommended that the shoulder should be 5 feet from the face of a guardrail and that additional width should be provided where vehicles travel in excess of 50 mph, where there is a high percentage of trucks, buses, and recreational vehicles, and where there are static obstructions. Rumble strips and raised pavement markers are not recommended on shoulders for cyclists’ use unless there is a clear path of 1 foot from the rumble strip to travel lane, 4 feet from the rumble strip to the edge of the paved shoulder, or 5 feet to the guardrail.

- Increased Lane Width

Wide curb lanes are preferable where paved shoulders are not available. An outside curb lane of 12 feet can support both vehicle traffic and cyclists while providing enough room for vehicles to pass cyclists without having to change lanes. 14 feet of usable lane width is recommended, though it should be extended to 15 feet where there are steep inclines for cyclist maneuvering space. However, wide lanes in excess of 14 feet may encourage more than one vehicle to occupy the same lane, which can detract from bicycle space. Where more than 15 feet is provided, bicycle lane striping should be considered.

- On-Street Parking

In urban settings, many cyclists use the space between the parking lane and travel lanes, which expose them to moving vehicles and such dangers as opening car doors and vehicles entering or exiting parking spaces. AASHTO recommends a minimum of 12 feet combined parking and bicycle travel lane width.

- Pavement Surface Quality

Pavement surfaces should be smooth and uniform in width in order to provide the maximum comfort, safety, and speed for cyclists.

- Drainage Inlet Grates

Bicycle-safe drainage inlets should be used and should not be placed with grates parallel to the roadway in order to prevent trapping of bicycle wheels.

- Signed Shared Roadways

Prior to signing a route for bicycle usage, AASHTO recommends that the route can provide direct travel in bicycle-demand corridors, that it connects discontinuous segments of other paths, that traffic control devices give priority to cyclists, that street parking has been removed or reduced, that the surface is smooth, that the road will be maintained regularly, that wider curb lanes are provided than along parallel roads, and that these curb lanes meet the recommendations of 14 to 15 feet of usable space.

- Designating Sidewalks as Shared Bikeways

AASHTO acknowledges that it is not optimal for cyclists and pedestrians to share the sidewalk. This option should only be considered if the bikeway provides bikeway continuity between high speed or high traffic roadways and is uninterrupted by driveways or intersections for long distances. It can also be considered for long, narrow bridges. All unnecessary obstacles should be removed from the sidewalk. Curb cuts should be flush with the street and should be wide enough to accommodate adult tricycles or two-wheeled bicycle trailers.

- Signing of Shared Roadways

In order to make signs of a signed bicycle route more effective, it is recommended that they also point in the direction of high demand destinations such as “To Downtown.” It can also be used to direct cyclists toward the next logical destination or away from certain sections of a highway. In urban settings, signs are typically spaced out every ¼ mile.

- Bicycle Lanes

Bicycle lanes provide cyclists with a preferable traveling space while making both cyclist and motor vehicle behavior more predictable. For most circumstances, these should be single lane and should carry cyclists in the same direction as motor vehicles in the adjacent travel lane. These should generally be placed on the right side of the street as placing them on the left side can be unfamiliar and unexpected for motorists. Left side bike lanes should only be used where it reduces the number of traffic conflicts or where there are a significant number of left-turning cyclists.

- Bicycle Lane Widths

Bicycle lanes should be 4 feet where there is no curb and/or gutter. Where there is a parking lane, the bicycle lane should be between the parking lane and travel lane and should be a minimum 5 feet in width. Where parking is permitted but there are no parking stripes or stalls, the shared use area should be at least 11 feet without a curb face or 12 feet with, and an additional 1 – 2 feet is recommended where there is high volume or turnover. The bike lane should never be placed between the parking lane and curb.

Bicycle lanes should be free of structures and should be 5 feet’ in width where there is a curb face or guardrail. They should have a minimum rideable surface width of 3 feet in order to accommodate for gutter pans. They can be 4 feet where the area beyond the paved shoulder can provide additional maneuvering width. 5 feet is preferable where there is substantial truck traffic or where vehicles travel in excess of 50 mph. There should be a 6-inch white line separating the bicycle lane from the travel lane, though some jurisdictions require 8 inches for better distinction. A 4-foot white line can be used to separate the parking lane from the bike lane, which can encourage parking closer to the curb. There should be adequate drainage in order to prevent flooding in bicycle lanes.

Innovative Designs

Portland, Oregon : Colored Bicycle Lanes

In 1999, the City of Portland's Office of Transportation initiated a study using colored pavement markings -specifically, solid-blue-colored bike lanes - in order to determine whether it could reduce the number of bicyclist-motorist conflicts at certain crossing areas. It focused specifically on exit ramps, right-turn lanes, and entrance ramps.

The study concluded that most behavior changes amongst cyclists and motorists were positive. There was an increased use by cyclists of the colored path recommended path which the Office of Transportation found encouraging. However, they also noticed that the use of colored paths created a false sense of security. While it did improve cyclist confidence, it also contributed to a decline in cyclist caution - the study counted fewer cyclists turning their heads to make sure there was no oncoming traffic or using hand signals to notify motorists that they were turning.

These results were similar to what had been found by the City of Montreal in 1996.

The entire study can be found at: http://www.portlandonline.com/shared/cfm/image.cfm?id=58842

California Department of Transportation

Source: http://www.dot.ca.gov/hq/traffops/survey/pedestrian/TR_MAY0405.pdf

- Bicycle Lane-Parking Lane Conflicts

As noted above, conflicts may arise between the bicycle lane and parking lane. Motorists opening their doors or vehicles entering or exiting the parking lane may be hazardous to cyclists. As a result, some cyclists will ride in the travel lane just outside the bicycle lane in order to avoid such hazards from parked cars.

The California Department of Transportation has proposed several solutions to this problem:

a- Minimize the parking lane width to 7 feet and/or widen the bike lane width to 6.5 feet based on research showing that narrower parking lanes is correlated with vehicles parking closer to the curb.

b- Mark parking spaces with cross hatches to denote parking lane limits and to guide drivers closer to the curb.

c- Place bicycle route stencils where there is a parking lane that can be used to inform drivers in the travel lane that they have to share the road with cyclists.

d- Angled parking should be avoided where there is high bike traffic. However, one option is to have reverse angled parking, requiring drivers to back into the parking space, which allows greater visibility of bicyclists as drivers enter or leave.

- Shared-Use Arrows

On shared-use roads, cyclists trying to avoid vehicles in the parking lane often ride closer to the center of the travel lane. Vehicles may become a hazard as a result of drivers that are unaware of this allowed use. A study conducted by the San Francisco Department of Parking and Traffic found that using shared-use arrows, or "sharrows," to notify both drivers and cyclists of the allowed shared use has found that it improved both drivers' and cyclists' positions on the roadway and reduced sidewalk or wrong-way riding.

Oregon Bicycle and Pedestrian Plan

Source: http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/bp_plan_2_ii.pdf

- Bicycle Boulevards

Bicycle boulevards allow cyclists and drivers to share the same road while giving priority to through bicycle movement. They can act as traffic calming devices, slowing down motor vehicle traffic. They can also improve travel conditions for pedestrians by reducing traffic and improved crossings. However, there are downsides to the boulevard. They can cause traffic to build up on other streets and are often located on streets that do not provide direct access to cyclist destinations. Recommendations for successful bicycle boulevards include turning stop signs toward intersecting streets so that bicycle through traffic is mostly uninterrupted and using directional signs to point cyclists toward nearby destinations and alerting motorists of cyclist presence.

- Raised Bicycle Lanes

A raised bicycle lane is separated from the travel lane with a slight incline. The separation provides more safety to cyclists and it lets drivers know when they have strayed from the travel lane as they feel the bump from the raised lane. Being that it is mountable, it also allows cyclists to enter and exit as necessary, and novice cyclists become more likely to stay in the bike lane rather than the sidewalk. The downside of the raised bike lane, however, is that it is expensive to construct. On the other hand, it is subjected to much less wear and tear than a normal road and is much easier to maintain than the travel lane. Where there is parking, it is still recommended that the raised bike lane goes between the travel lane and parking lane.

- Bicycle Lanes and Bus Lanes

While bicycles and buses can normally share the same road space, areas where there is higher bus and bicycle traffic it should be considered to separate the two with lanes. Bus lanes should be located closest to the curb, extending to the face, while the bike lane remains between the bus lane and travel lane.

City of Toronto Bicycle Plan – Shifting Gears

Source: http://www.toronto.ca/cycling/bikeplan/pdf/chapter04.pdf

- Bicycle Actuated Signals

In 1995, the former Metro Transportation Department began adjusting the sensitivity of the sensors so that bicycles would also be able to actuate the signal. In order to alert cyclists as to which signals could be actuated, three white dots were stenciled as pavement markers. However, it turned out that many cyclists did not even know what the purpose of those dots was, nor did they know how to use them properly. Other solutions for traffic signals that have been proposed include using video detectors or push buttons located close to the bike lane so cyclists do not need to dismount to actuate a green light.

- Bicycle Exemption

Another innovative option Toronto has considered is the exemption of bicycles from certain traffic regulations. While the Highway Traffic Act states that bicycles are required to follow the same regulations as motor vehicles, there are some circumstances in which the rules do not make sense for bicycles. The example brought up in Shifting Gears is that of restricting through traffic from quiet residential neighborhoods - a regulation that shouldn't apply to bicycles, which do not make as much noise as motor vehicles. For this to be implemented, however, there would need to be an exhaustive review of each law in order to determine which ones should apply to bicycles and which should not.

Seattle Bicycle Master Plan

Source: http://www.seattle.gov/transportation/docs/bmp/final/AppendixE.pdf

- Climbing Lanes

Not all topography is equally level. One solution that Seattle has looked into is using climbing lanes, where there is a 5-foot bike lane on one side of the incline and a designated shared-use lane on the other. This is designed so that uphill bicyclists moving at a slower pace in their separated, uphill bike lane can easily be passed by drivers. Meanwhile, fast-moving downhill bicyclists can share the road with cars in order to avoid the hazards posed by parked vehicles.

- Bikes on Buses

In order to improve multimodal transit, several agencies have equipped buses with front-mounted bicycle racks able to hold two bicycles at a time. However, these have often been limited only to a select few routes rather than all. These bikes can be loaded and unloaded without much delay and specially-designed racks prevent the bikes from obstructing the bus's headlights. In most instances, bikes are not allowed inside the bus itself.

Cities that have used this method include Sacramento (California), Portland (Oregon), and Washington, D.C.

Links to each specific program can be found at: http://www.bicyclinginfo.org/transit/solutions-buses.cfm

REFERENCES

New York City Department of City Planning and New York City Department of Transportation (1997) *New York City Bicycle Master Plan*

New York City Department of City Planning (2004) *The Newest New Yorkers 2000, Immigrant New York in the New Millennium*

New York City Department of City Planning (1996) *The Newest New Yorkers 1990-1994*

New York City Department of City Planning (2006) *Community District Needs, Fiscal Year 2008*

New York City Department of City Planning, *Community District Profiles*
[Available at: http://www.nyc.gov/html/dcp/html/lucds/cdstart.shtml]

Metropolitan Transportation Authority, *Subway and Bus Maps*
[Available at: http://www.mta.nyc.ny.us/mta/maps.htm]

Credits

New York City Department of City Planning
Amanda M. Burden, AICP, Director
Richard Barth, Executive Director
Sandy Hornick, Deputy Executive Director for Strategic Planning
Elizabeth Mackintosh, Director of Planning Coordination

Transportation Division
Jack Schmidt, Director
Kevin Olinger, Deputy Director
Stratos Prassas, Team Leader
Lise Dorestant, Project Manager
Dekka Michael, City Planner
Andrea Malester, Associate City Planner
Alan Ripps, City Planner
Kenneth Laidlow, Highway Transportation Specialist
Emilio Feliz, Highway Transportation Specialist
Jeffrey Leyco, Intern