Southern Brooklyn Transportation Investment Study
Kings County, New York
P.I.N. X804.00; D007406

Technical Memorandum #3
Technical Investigations

DRAFT

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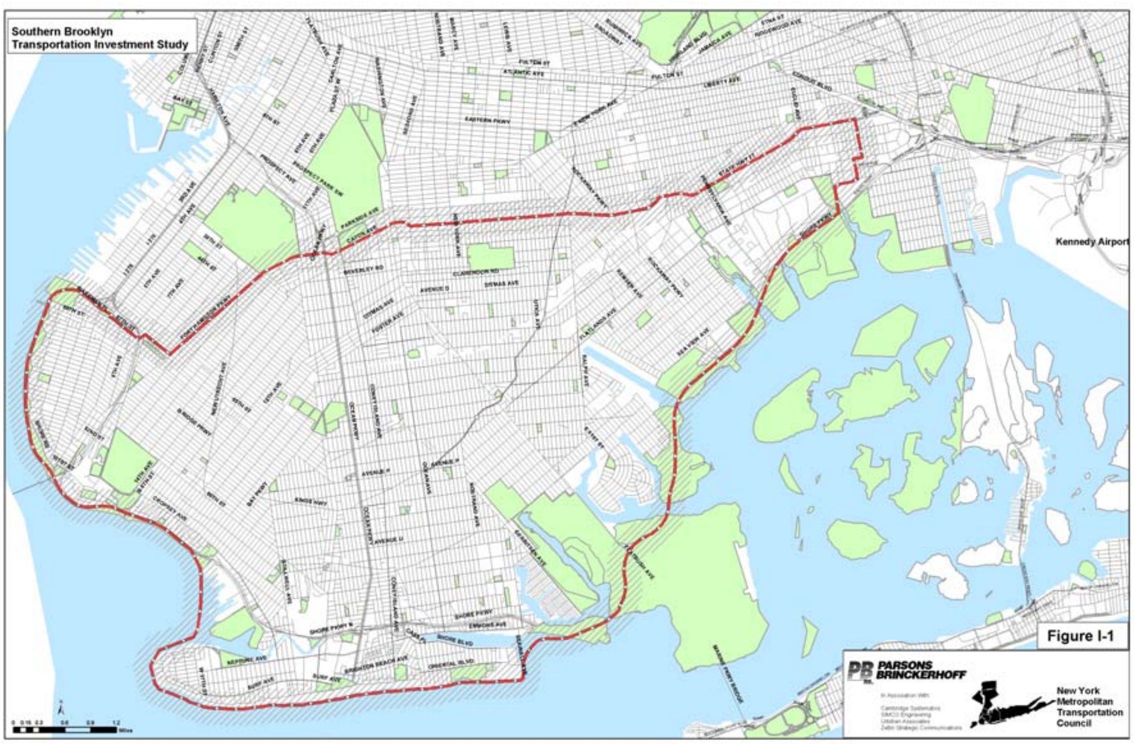
Chapter I: Introduction

This Technical Memorandum presents the results of the analyses of existing operational characteristics of the transportation systems serving the study area and an assessment of safety and accident problems. The purposes of these efforts were to provide overall evaluations of the transportation system modes, describe travel patterns and identify system deficiencies.

A. PROJECT OVERVIEW

The TIS is a three-year, multimodal transportation planning study being undertaken by the New York Metropolitan Transportation Council (NYMTC). The purpose of the study is to assess current and future travel conditions and deficiencies and develop multimodal transportation improvement solutions that address the movement of people and goods within and through the study area. The study area boundaries are Linden Boulevard, Caton Avenue, Fort Hamilton Parkway, and 66th Street at Owls Head Park on the north; Belt Parkway/Coney Island on the west and south; and the Brooklyn/Queens Line on the east (see Figure I-1, Study Area). All or portions of Brooklyn Community Boards 5, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18 are included in the study area.

FIGURE I-1
STUDY AREA



Chapter II: Public Transportation

A. BUS ROUTE RANKINGS

1. Introduction

An analysis of performance indicators was performed for all of MTA New York City Transit (NYCT) and NYCDOT franchise bus routes that navigate through the Southern Brooklyn study area. Data is taken primarily from the NYCT 2000 Subway & Bus Ridership Report. The performance indicators include:

- Passenger Trips per Vehicle Hour
- Passenger Trips per Vehicle Mile
- Miles per Hour
- Annual Passengers per Peak Vehicle
- Service Capacity Rating
- Passengers per Vehicle Trip

The main performance standards used to measure productivity include passengers trips per vehicle hour and passengers trips per vehicle mile. Passengers trips per vehicle hour refer to the number of unlinked passenger trips for each revenue and non-revenue vehicle hour. Passenger trips per vehicle mile refer to the number of unlinked passenger trips per vehicle mile. (Note - Unlinked Passenger Trips refer to the number of passengers who board public transportation vehicles. Passengers are counted each time they board vehicles no matter how many vehicles they use to travel from their origin to their destination).

Miles per hour measures the speed of each bus route. Low operating speeds may indicate the necessity of utilizing dedicated bus lanes or other strategies that seek to improve on-time performance and address route inefficiencies.

Annual passengers per peak vehicle measures vehicle utilization by determining the average number of passengers carried on the number of peak vehicles utilized for each route. Total annual ridership is used determine this performance indicator.

The service capacity rating measures crowding by measuring the passenger load at maximum load points for each route. Frequency of service is also factored into the service capacity rating. For example, NYCT standards permit higher loads on routes that have more service and higher frequencies. Routes that have less service are considered crowded at a lower load level. This performance measure is only available for NYCT routes.

Passengers per trip measures the volume of passengers per one-way vehicle trip. It is calculated by dividing weekday number of vehicle trips into weekday ridership.

2. Indicator Rankings

a. Passenger Trips per Vehicle Hour

Table II-1 displays the passenger trips per vehicle hour for local and limited stop bus routes. Limited stop bus service is similar to local service, with the exception that buses stop at only predefined high-demand locations. Typically, limited stop routes operate along local routes, bypassing many local bus stops and therefore offering convenience and some travel time savings.

The routes with the highest passengers per hour include the B74, B35, B36, B46, B6 and B44. All are either east-west or north-south routes serving major corridors (B46, B44, B6 and B35) or routes that serve Coney Island, which is characterized by major transit generators and high-density residential development (B74 and B36).

The local routes with the lowest passengers per hour include the S79, B31, B16, B100 B37, B23 and B103. The B103 has the lowest rank of all local/limited stop routes in the study area. With 10.09 passengers per hour it has similar productivity as the express routes which have between 12.82 and 8.13 passengers per hour. Although it is considered a limited stop route, it should be noted that the B103 runs express for a significant portion of its route.

Three of these low performing routes (B16, B23 and B37) operate in the southwestern portion of the study area. They travel through Borough Park, Sunset Park, Dyker Heights, and Bay Ridge.

The B100 and B31, two routes that rank near the bottom of the passengers per hour rankings, both act as short, subway feeders in the south central portion of the study area. These two routes operate in Mill Basin, Marine Park and Gerritsen Beach, which are communities with relatively lower levels of transit use as compared with other communities in the study area.

Table II-2 illustrates passenger trips per vehicle hour for the express routes. The best performers according to this measure are the X27 and X28, which serve Bay Ridge and Bensonhurst. These routes averaged between 12 and 13 passengers per hour. The express routes with the lowest passengers per hour rankings include the BM3, BM4, BQM1 and X29.

TABLE II-1
PASSENGER TRIPS PER VEHICLE HOUR (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Passenger Trips per Vehicle Hour
1	B74	73.59
2	B35	69.81
3	B36	63.79
4	B46	61.21
5	B6	61.18
6	B44	60.77
7	B3	58.35
8	B83	58.21
9	B17	56.86
10	B82	55.93
11	B41	55.60
12	B68	53.57
13	B1	51.85
14	B42	49.78
15	B8	48.32
16	B15	48.11
17	B60	47.61
18	B78	47.19
19	B64	45.47
20	B2	44.56
21	S53	44.54
22	B49	44.24
23	B11	44.05
24	B63	42.65
25	Q35	42.57
26	B20	41.78
27	B9	41.65
28	B7	40.61
29	B70	37.63
30	B4	36.22
31	B67	35.12
32	B13	32.94
33	S79	32.80
34	B31	32.54
35	B16	32.54
36	B100	31.73
37	B37	28.62
38	B23	27.26
39	B103	10.09
	Study Area Average	**45.93**

Source: MTA New York City Transit

TABLE II-2
PASSENGER TRIPS PER VEHICLE HOUR (EXPRESS ROUTES)

Rank	Route Number	Passenger Trips per Vehicle Hour
1	X27	12.82
2	X28	12.50
3	BM1	9.40
4	BM2	8.84
5	BQM1	8.73
6	X29	8.60
7	BM4	8.14
8	BM3	8.13
	Study Area Average	**9.64**

Source: MTA New York City Transit

b. Passenger Trips per Vehicle Mile

Tables II-3 and II-4 display the passenger trips per vehicle mile for local/limited and express bus routes, respectively.

The local/limited routes with the highest passengers per mile include the B35, B74, B46, B41, B83, B44 and B6. Most of these are routes that serve major corridors. One route, the B74, provides service to Coney Island and Sea Gate.

The local and limited stop routes with the lowest passengers per hour include the B23, B31, B37, B100, Q35, S79 and B103.

The express routes with the highest passengers per mile include the X27 and X28, both carrying close to 1.00 passengers per vehicle mile. The express routes with the lowest passengers per mile rankings include the BM3, BM4, BQM1 and X29. All of these routes have rankings below the study area average for express routes of 0.78 passengers per mile.

TABLE II-3
PASSENGER TRIPS PER VEHICLE MILE (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Passenger Trips per Vehicle Mile
1	B35	11.52
2	B74	9.80
3	B46	8.99
4	B41	8.92
5	B83	8.60
6	B44	8.37
7	B6	8.00
8	B3	7.89
9	B36	7.79
10	B17	7.15
11	B11	6.94
12	B63	6.91
13	B42	6.77
14	B82	6.68
15	B60	6.66

TABLE II-3 (CONTINUED)
PASSENGER TRIPS PER VEHICLE MILE (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Passenger Trips per Vehicle Mile
16	B78	6.57
17	B8	6.50
18	B68	6.49
19	B1	6.34
20	B2	6.30
21	B20	5.75
22	B49	5.67
23	B64	5.58
24	B15	5.50
25	B7	5.47
26	B67	5.09
27	B70	5.09
28	B9	5.04
29	B13	4.36
30	S53	4.24
31	B16	4.12
32	B4	4.11
33	B23	4.07
34	B31	3.91
35	B37	3.88
36	B100	3.39
37	Q35	3.08
38	S79	2.72
39	B103	1.06
	Study Area Average	**6.03**

Source: MTA New York City Transit

TABLE II-4
PASSENGER TRIPS PER VEHICLE MILE (EXPRESS ROUTES)

Rank	Route Number	Passenger Trips per Vehicle Mile
1	X27	1.00
2	X28	0.97
3	BM2	0.78
4	BM1	0.77
5	X29	0.71
6	BQM1	0.71
7	BM4	0.68
8	BM3	0.66
	Study Area Average	**0.78**

Source: MTA New York City Transit

c. Miles per Hour

The routes with the highest miles per hour (over 10 miles per hour) are all express routes with the exception of the S53, S79 and Q35 local routes (Table II-5).

TABLE II-5
MILES PER HOUR (LOCAL, LIMITED & EXPRESS ROUTES)

Rank	Route Number	Miles Per Hour
1	Q35	13.82
2	X28	12.93
3	X27	12.86
4	BQM1	12.34
5	BM3	12.32
6	BM1	12.28
7	S79	12.08
8	X29	12.04
9	BM4	11.93
10	BM2	11.26
11	S53	10.52
12	B103	9.48
13	B100	9.35
14	B4	8.82
15	B15	8.74
16	B82	8.38
17	B31	8.33
18	B9	8.26
19	B68	8.26
20	B36	8.19
21	B1	8.18
22	B64	8.16
23	B17	7.95
24	B16	7.90
25	B49	7.80
26	B6	7.65
27	B13	7.56
28	B74	7.51
29	B8	7.43
30	B7	7.42
31	B70	7.39
32	B3	7.39
33	B37	7.37
34	B42	7.35
35	B20	7.27
36	B44	7.26
37	B78	7.19
38	B60	7.14
39	B2	7.07
40	B67	6.90
41	B46	6.81
42	B83	6.77
43	B23	6.71
44	B11	6.35
45	B41	6.23
46	B63	6.17
47	B35	6.06
Study Area Average		**8.66**

Source: MTA New York City Transit

The slowest bus routes include the B35, B63, B41, B11, B23, B83, B46 and B67. Most of these routes serve major corridors, such as the B35 along Church Avenue, the B63 along Fifth Avenue, the B41 along Nostrand Avenue, and the B46 along Utica Avenue. These routes tend to have high ridership rankings and tend to rank high in terms of passengers per hour and passengers per mile. These major corridor routes are highly productive, which tends to slow down operating speeds. In addition, the very nature of the operating environment, with high-density development and narrow rights-of-ways, contributes to very slow operating speeds. The one exception is the B23, which ranks low in productivity (in terms of passengers per hour and passengers per mile) and also low in terms of miles per hour.

d. Annual Passengers per Peak Vehicle

Local/limited stop routes with the highest passengers per peak vehicle include the B35, B74, B15, B6, B46 and B68 (see Table II-6). All of these routes have more than 250,000 annual passengers per peak vehicle. With the exception of the B68 and B15, all of these routes rank very high in terms of passengers per hour and passengers per mile.

The local/limited stop routes with the lowest annual passengers per peak vehicle include the B100, B103, B20, B16, B13, B37, B67, B31 and B23. All of these routes have about 130,000 annual passengers per peak vehicle or less. Most of these routes also have low passengers per hour and passengers per mile. These routes are the B103, B100, B31, B23, B16, B37 and B13.

Table II-7 illustrates annual passengers per peak for the express routes. Routes ranked highest are the X27 and X28. The express routes with the lowest passengers per peak vehicle rankings include the X29, BQM1, BM3, and BM4. All of these routes have rankings below the study area average for express routes of 20,726 passengers per peak vehicle.

TABLE II-6

ANNUAL PASSENGERS PER PEAK VEHICLE (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Annual Passengers per Peak Vehicle
1	B35	291,237
2	B74	287,666
3	B15	273,136
4	B6	266,703
5	B46	252,758
6	B68	252,483
7	B82	245,167
8	B44	239,763
9	B3	233,178
10	B83	233,067
11	B64	232,814
12	B41	223,199
13	B1	215,378
14	B17	210,160
15	B36	205,776
16	Q35	205,550

TABLE II-6 (CONTINUED)
ANNUAL PASSENGERS PER PEAK VEHICLE (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Annual Passengers per Peak Vehicle
17	B8	202,066
18	B60	197,596
19	B63	196,264
20	B11	187,759
21	S53	180,239
22	B70	178,352
23	B78	173,664
24	B9	170,639
25	B4	169,203
26	B49	157,800
27	B2	156,633
28	S79	155,530
29	B42	154,969
30	B7	139,939
31	B23	132,676
32	B31	130,977
33	B67	130,055
34	B37	123,977
35	B13	122,597
36	B16	117,190
37	B20	105,891
38	B100	80,320
39	B103	16,353
	Study Area Average	**185,865**

Source: MTA New York City Transit

TABLE II-7
ANNUAL PASSENGERS PER PEAK VEHICLE (EXPRESS ROUTES)

Rank	Route Number	Annual Passengers per Peak Vehicle
1	X27	29,421
2	X28	25,173
3	BM1	24,355
4	BM2	21,411
5	BM3	19,803
6	BM4	19,140
7	BQM1	13,897
8	X29	12,607
	Study Area Average	**20,726**

Source: MTA New York City Transit

e. Service Capacity Rating

NYCT develops service capacity ratings based on how the average load of a route at the maximum load point in the peak direction corresponds to a loading standard. A 100 percent rating would indicate that any additional passenger demand would cause the bus route to exceed its guideline capacity, while lower percentage ratings indicate the presence of some overall excess capacity. Thus, routes with higher percentage ratings tend to be more crowded. A rating below 100 percent does not indicate a lack of crowding problems on individual bus trips, as some trips may exceed NYCT guidelines and bus bunching will exacerbate crowding. However, this measure indicates that capacity is being met by the frequency of service provided, notwithstanding individual cases of overcrowding and crowding caused by operational problems.

Table II-8 presents the service capacity ratings for bus routes in the study area. The following routes had higher service capacity ratings and were thus relatively more crowded: B17, B1, X27, B20, X28, S79, B3, B11, B6, B4 and B15.

The following routes had the lowest capacity ratings in the study area and thus were relatively less crowded: B70, B23, S53, B74, B13, X29 and B9.

TABLE II-8
SERVICE CAPACITY RATINGS (LOCAL, LIMITED STOP, & EXPRESS ROUTES)

Rank	Route Number	Service Capacity Rating
1	B17	86 percent
2	B1	86 percent
3	X27	84 percent
4	B20	84 percent
5	X28	83 percent
6	S79	83 percent
7	B3	83 percent
8	B11	81 percent
9	B6	80 percent
10	B4	80 percent
11	B15	80 percent
12	B67	79 percent
13	B35	79 percent
14	B82	78 percent
15	B64	78 percent
16	B63	78 percent
17	B60	78 percent
18	B36	78 percent
19	B16	78 percent
20	B46	77 percent
21	B49	76 percent
22	B41	76 percent
23	B44	75 percent
24	B83	74 percent
25	B78	74 percent
26	B31	72 percent
27	B68	68 percent
28	B8	67 percent
29	B7	67 percent
30	B2	67 percent

TABLE II-8 (CONTINUED)
SERVICE CAPACITY RATINGS (LOCAL, LIMITED STOP, & EXPRESS ROUTES)

Rank	Route Number	Service Capacity Rating
31	B37	66 percent
32	B70	64 percent
33	B23	63 percent
34	S53	62 percent
35	B74	62 percent
36	B13	61 percent
37	X29	60 percent
38	B9	53 percent
	Study Area Average	**74 percent**

Source: MTA New York City Transit

f. Passengers per Vehicle Trip

The local/limited stop routes with the highest average passengers per vehicle trip include the B82, B44, B6, B35, B8, B41 and B46 (Table II-9). These routes all serve major corridors in the study area such as Flatbush Avenue, Nostrand Avenue, Bay Parkway and Kings Highway.

The routes with the fewest passengers per trip include the B31, S53, B67, B42, Q35, B103 and B100.

TABLE II-9
PASSENGERS PER VEHICLE TRIP (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Passengers per Vehicle Trip
1	B82	174.56
2	B44	159.18
3	B6	158.41
4	B35	152.50
5	B8	140.99
6	B41	140.56
7	B46	131.21
8	B63	128.23
9	B1	126.55
10	B49	118.80
11	B68	115.00
12	B36	112.62
13	B4	111.69
14	B3	106.72
15	B11	102.42
16	B9	99.25
17	B7	95.55
18	B17	94.03
19	B16	84.60
20	B20	82.11
21	B37	75.18
22	B83	72.11
23	B70	69.69

TABLE II-9 (CONTINUED)
PASSENGERS PER VEHICLE TRIP (LOCAL/LIMITED STOP ROUTES)

Rank	Route Number	Passengers per Vehicle Trip
24	B78	69.07
25	B15	66.77
26	B60	66.53
27	B64	66.32
28	B13	64.68
29	S79	43.82
30	B2	40.62
31	B23	39.93
32	B74	38.15
33	B31	37.44
34	S53	37.04
35	B67	33.20
36	B42	31.71
37	Q35	NA
38	B103	NA
39	B100	NA
	Study Area Average	**91.31**

Source: MTA New York City Transit

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Table II-10 shows the passengers per vehicle trip for the express routes that travel in the study area. The X28 and X27 are ranked highest, with about 31 passengers per trip. Data in this category for Command express routes were not available.

TABLE II-10
PASSENGERS PER VEHICLE TRIP (EXPRESS ROUTES)

Rank	Route Number	Passengers per Vehicle Trip
1	X28	30.92
2	X27	30.77
3	X29	23.84
4	BQM1	NA
5	BM4	NA
6	BM3	NA
7	BM2	NA
8	BM1	NA
Study Area Average		**28.51**

Source: MTA New York City Transit

g. Summary of Rankings

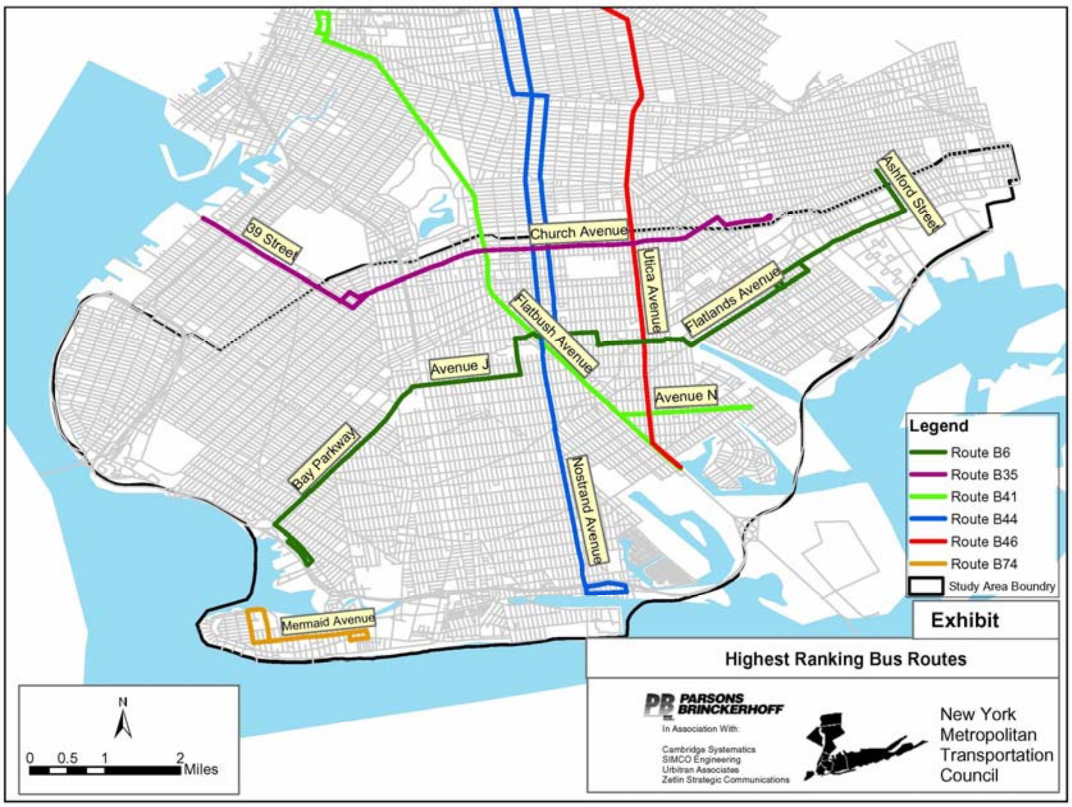
This section evaluates how well routes ranked according to the six performance indicators employed. Local routes that consistently rank highest include the following:

- B35
- B41
- B44

- B46
- B74
- B6

With the exception of the B74, all of the routes listed above serve major, lengthy corridors within the study area, see Figure II-1. Church Avenue, Nostrand Avenue, Flatbush Avenue, Utica Avenue, and Bay Parkway are all corridors served by these routes. Furthermore, all of the routes listed above rank very high and near the top of the citywide and borough ridership rankings.

FIGURE II-1
HIGHEST RANKING BUS ROUTES



The B74 runs along Mermaid Avenue in Coney Island and provides subway feeder service for the residents of Sea Gate and Coney Island. It does not rank particularly high in terms of ridership (citywide and in Brooklyn). However, as the performance indicators discussed in this chapter signify, it is one of the most productive local routes found in the study area.

Based on a review of the six performance indicators, there are certain local/limited stop routes that consistently appear near the bottom in the rankings. They include the following local routes:

- B103
- B31
- B100
- B23
- B16
- B37
- B13

The B31 and B100 are two local routes that provide subway feeder service in Mill Basin, Gerritsen Beach, Marine Park and Sheepshead Bay. They rank near the bottom in terms of ridership (citywide and Brooklyn rankings) as well as the performance indicators presented previously.

A general statement about the rankings of express routes can also be made. The X27 and X28 serving Bay Ridge and Bensonhurst consistently ranked first and second, generally very close to one another and well ahead of the X29 and Command express bus routes.

B. SUBWAY SERVICE CAPACITY ISSUES

1. Introduction

Issues which have a direct impact on the passenger capacity of the subway lines serving the study area are discussed below. First, a review of capacity improvement measures currently underway details the efforts of NYCT to make repairs and upgrades to the network. In particular, the completion of the repairs to the Manhattan Bridge has greatly improved transit capacity in the study area. However, the section on specific infrastructure constraints in the network illustrates existing limitations to subway throughput. Opportunities to increase capacity are also discussed, including those that would require modest capital expenditures and those that would require sizable capital expenditures.

2. Existing Capacity Improvement Measures

The following sections summarize the ongoing and recently completed efforts of NYCT to increase capacity which affect the study area.

3. Manhattan Bridge Repairs

Construction was completed on the structure on the north side of the Manhattan Bridge on February 22, 2004. Consequently, all four subway tracks on the Manhattan Bridge are now available for use by trains between Manhattan and Brooklyn. As a result of this change, frequencies on some lines have increased, as shown in Table II-11. In addition, the N train has been shifted from the Montague Tunnel to the Manhattan Bridge. The D train replaces the W train as the West End express with comparable frequencies. It appears, therefore, that NYCT has taken advantage of most of the additional capacity created by the opening of both sides of the Manhattan Bridge.

TABLE II-11

SERVICE CHANGES AFTER COMPLETION OF MANHATTAN BRIDGE REPAIRS

Subway Line	Old Service	New Service	Pre-Feb. 22, 2004 Avg. Peak Headway (min:sec)*	Post- Feb. 22, 2004 Avg. Peak Headway (min:sec)*	Notes
Brighton Express and Local	Q, Q diamond	B, Q	3:15	3:15	3:00 as of November 2004
West End/Fourth Ave Express	W	D	6:30	6:30	6:00 as of November 2004
West End/Fourth Ave Local**	M	M	8:30	10:00	
Sea Beach/Fourth Ave	N	N	8:30	6:30	N now operates express in Man., 6:00 as of November 2004
Fourth Ave Local	R	R	8:00	6:00	

* *NYCT Subway Timetables – Based on number peak period peak direction trains, rounded to the closest half minute*

** *M operates in Southern Brooklyn from 7 to 9 AM only during the morning peak*

Since the N was shifted from the Montague Tunnel to the Manhattan Bridge, the trains per peak hour traveling through the Montague Tunnel have decreased from about 20 trains per hour to about 14 (M and R train frequencies have remained close to the same). This means that there is currently available capacity in the Montague Tunnel, which may allow for future peak hour service increases to the Southern Brooklyn subway network.

4. Upgraded Signal System on Canarsie (L) line

NYCT is in the process of installing a Communications Based Train Control (CBTC) system along the full length of the L line. This new signaling system, to be functional by 2005, allows for closer spacing of trains than conventional wayside signaling allows.

5. Replacement of Bergen Street interlocking on Culver (F) line

North of the Bergen Street station on the F line, the interlocking system controlling the connection between the lower (express) and upper (local) tracks at Bergen Street was damaged by fire in the 1990s. This interlocking must be replaced in order for express service to safely operate alongside local service on this line. NYCT intends to complete the reconstruction efforts by 2006 and reconstruct the Culver viaduct. After these improvements conclude, it would be possible to consider reestablishing express service along the Culver Line to provide greater passenger capacity.

6. Capacity Limitations

This section provides descriptions of the major infrastructure limitations to enhancing passenger capacity in the study area. Significant capital investments would be required to ameliorate these capacity limitations.

a. Rogers Avenue Junction

As part of the IRT Dual Contracts of 1913, the City of New York built extensions into Brooklyn along where the 2, 3, 4, 5, B and Q trains now operate. The 2, 3, 4 and 5 trains serve Flatbush Avenue, turning onto Eastern Parkway at the northwest corner of Prospect Park. The 3 and 4 lines continue along Eastern Parkway, with the 4 Line terminating at Utica Avenue and the 3 Line terminating at New Lots Avenue. The 2 and 5 Lines, however, veer off Eastern Parkway at Nostrand Avenue. The only track connection at Nostrand Avenue funnels both directions of Nostrand Avenue service onto the local track of the Eastern Parkway line. Thus, subway service on the Eastern Parkway Local (3 Line) and both local and express services on Nostrand Avenue (2 and 5 Lines) share the same local track for a brief stretch east of the Franklin Avenue station. This bottleneck leads to regular delays during peak period service.

b. Eight-Car Platform Lengths on Jamaica (J, M,Z) and Canarsie (L) Lines

Station platforms serving Division B subway cars typically accommodate either eight or ten 60-foot long subway cars. The shorter configuration is found on the platforms for the full length of the Canarsie line and the portions of the Broadway lines not sharing track with other lines. This arrangement prevents these lines from being able to operate ten-car train sets in order to increase capacity. Furthermore, should NYCT endeavor in the future to operate trains that also serve other lines along the Broadway and Canarsie lines (e.g., extend the V train to Canarsie via the Broadway and Canarsie lines), those services would necessarily have to operate with eight-car trains, thereby reducing person capacity for the length of the route. These lines are restricted to 60 foot cars due to clearance restrictions that do not allow for 75 foot cars.

C. FERRY SERVICES

Immediately after the destruction of the World Trade Center in September 2001, ferryboat service was initiated in Brooklyn between the Brooklyn Army Terminal and Whitehall Terminal in Manhattan to compensate for the elimination of certain subway services. Free service was offered, through FEMA funding, during weekday peak periods on a 30-minute frequency ferry route. Ridership peaked immediately after implementation and leveled off at about 8,000 riders per week by early 2002. In May 2003, New York Water Taxi replaced NY Waterway as the operator of this service, sustaining a similar schedule without public funds and charging a base fare of $5.00.

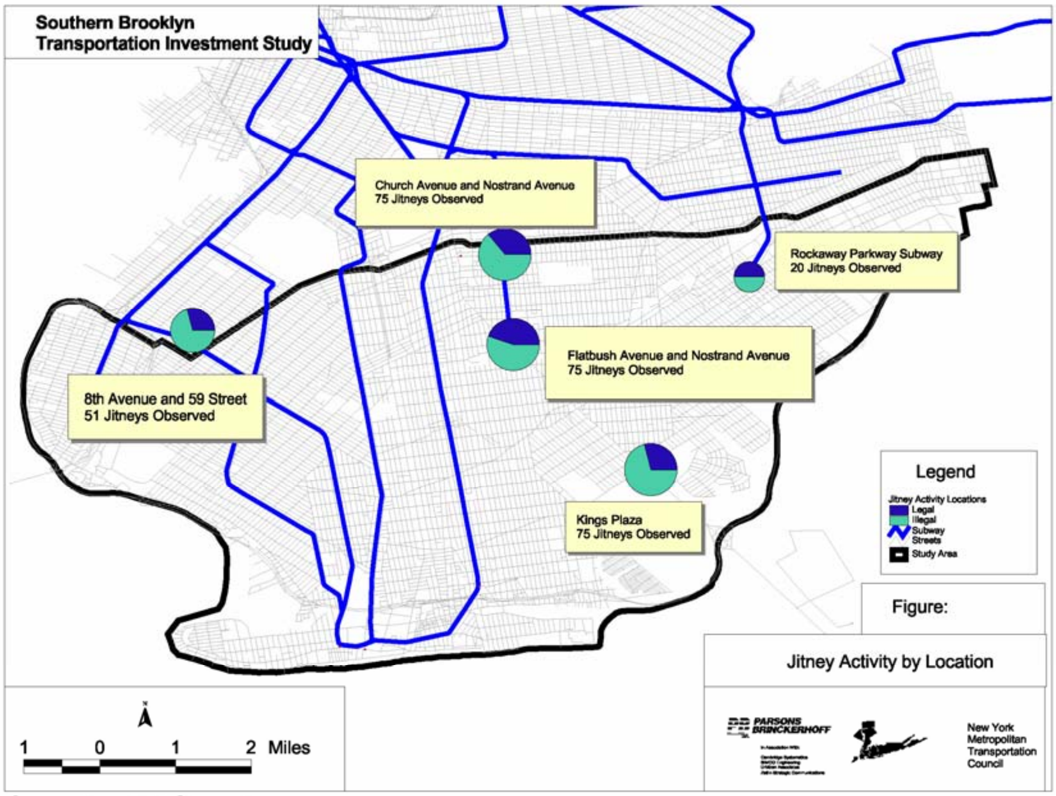
Based on comments from members of the public and evaluation by the consultant team, new Southern Brooklyn ferryboat alternatives should be considered. Due to long subway travel times to Manhattan from Southern Brooklyn, a market could exist for ferryboat service to Manhattan as well as to other boroughs and New Jersey. Existing infrastructure and ferry services at the Brooklyn Army Terminal could be upgraded and expanded. A Southern Brooklyn-Manhattan commuter ferry service could incorporate stations at the 57th Street Pier, Coney Island/Aquarium (new landing required), Sheepshead Bay at Emmons Avenue Piers, Jacob Riis Park, Floyd Bennett Field, and Dead Horse Bay. Manhattan connections could include Pier 11/Wall Street and East 34th Street. Weekend and event-based Manhattan to Coney Island service providing ferry access to the Brooklyn Aquarium and Coney Island could be an important component as well.

Additionally, improvements to bus, pedestrian, and bicycle connections should be considered to improve ferry connections and the total trip experience for ferry passengers. For example, the B11 could be extended west of 1st Avenue to turn around at the Brooklyn Army Terminal Ferry Landing. In addition, the B9 could operate into the Brooklyn Army Terminal Ferry Landing and extend along Shore Road. Other minor modifications could be explored with MTA-NYCT to provide direct connections to ferry terminals. Furthermore, improvements to parking capacity, especially in Sheepshead Bay, would have to be addressed prior to ferry service initiation.

D. JITNEY ISSUES

Since jitneys are typically owned by private individuals or firms, and are in many cases, unlicensed, data is limited. As part of the data collection element of this project, the consultant team made observations of jitney activity at multiple locations. Results are presented in SBTIS Technical Memorandum #2. Figure II-2 shows locations and the number of total and illegal vans per 3-hour peak period. Jitney vans clearly fulfill a need by providing transportation to its users at a cost lower than transit fares, often acting as a shuttle to subway stations, or to other activity locations such as major commercial/employment/health care centers. However, there are negative implications associated with the proliferation of these services in Southern Brooklyn. Jitney operations often compete with bus routes, a more efficient form of transportation from an air quality and congestion standpoint. Another issue is illegal operations, such as operating along bus routes, stopping at bus stops, blocking bus stops when picking up or dropping off passengers, and operating without insurance or a TLC license. Enforcement of city regulations is needed as has been pointed out, more effective regulation of jitney vans is needed on a citywide basis to reduce these negative impacts.

FIGURE II-2
JITNEY ACTIVITY BY LOCATION



Source: Jitney Field Observation

Chapter III: Goods Movement

A. OVERVIEW

This chapter describes the current and projected future deficiencies of the transportation system supporting freight movement in the Southern Brooklyn study area including a safety assessment of goods movement, an analysis of goods movement travel patterns, and a discussion of future trends affecting freight transportation.

B. SAFETY ASSESSMENT

Safety considerations are critical to multi-modal planning activities, especially in dense urban areas such as Brooklyn where goods movement activities occur in close proximity with residential and commercial activities. The most critical safety issue affecting goods movement is truck safety. Within the study area, accidents involving trucks comprised approximately 3 percent (418) of the total highway accidents (13,826) between 1997 and 1999. Certain intersections and highway segments were especially hazardous for trucks. With 35 incidents reported from 1997 to 1999, the highest truck accident location was the eastbound 92nd Street exit off the Gowanus Expressway, followed by the intersection of Linden Boulevard and Pennsylvania Avenue, with 18 accidents. The following table shows the 15 locations with the highest number of truck accidents. Many of the highest accident locations are located along busy truck route corridors, including I-278 (Gowanus Expressway), Linden Boulevard, and Flatbush Avenue. Thus, the high level of truck accidents at these locations is largely a function of high total traffic levels but may also be related to geometry and other physical deficiencies.

TABLE III-1
HIGH TRUCK ACCIDENT LOCATIONS (1997 TO 1999)

Location	Number of Accidents
Gowanus Expressway Eastbound off ramp to 92nd Street	35
Linden Boulevard and Pennsylvania Avenue	18
Flatbush Avenue and Caton Avenue	17
Linden Boulevard and Fountain Avenue	17
Gowanus Expressway Eastbound on ramp from 92nd St./Ft. Hamilton Pkwy	15
Gowanus Expressway Eastbound off ramp to 65th Street	12
Gowanus Expressway Eastbound 6th Avenue Underpass	12
Stanley Avenue and Pennsylvania Avenue	11
6th Avenue and 65th Street	10
Flatbush Avenue and Church Street	10
Linden Boulevard and Utica Avenue	10
7th Avenue and 65th Street	8
Linden Boulevard and Kings Highway	8
Church Avenue and Kings Highway	8
Flatlands Avenue and Remsen Avenue	8

Source: SBTIS Technical Memorandum #2

In the future, the issue of dependence on trucks in Southern Brooklyn and Long Island translates into greater truck vehicle-miles traveled, which raises the likelihood of traffic accidents involving trucks and increased community exposure to diesel emissions and hazardous cargo movement. The region therefore seeks greater use of rail and waterborne modes to reduce truck exposure.

Freight rail safety is another important issue in the study area, but not of the same magnitude as truck safety because of the relatively low level of freight rail activity compared to truck movements. The Southern Brooklyn study area also benefits from the grade separation of the Long Island Rail Road right-of-way through most of the study area. Thus, the principal concerns of freight rail safety in the study area are related to the security of the freight rail right-of-way through the study area, including the prevention of trespassing, and not necessarily highway-rail crossings.

Overall, railroads today have lower employee injury rates than other modes of transportation and most other major industry groups, including agriculture, construction, and manufacturing. Railroads are far safer than trucks, incurring an estimated one-fifth of the fatalities that intercity motor carriers do per billion ton-miles of freight moved. Thus, future diversion of freight from trucks to rail through the study area should improve the overall safety of freight movement in Southern Brooklyn.

Finally, for highway, rail, and waterborne transportation of goods, there are continuing general concerns over hazardous materials haulage. Training, regulations, and safety inspections/enforcement of all freight modes will continue to improve the safety of hazardous materials transportation through the study area.

C. ANALYSIS OF TRAVEL PATTERNS

This section of describes the travel patterns of goods movement within the study area. The focus of this section is principally truck movements at the traffic analysis zone (TAZ) level and includes:

- **origin patterns** of total tonnage and percentage trucks;
- **destination patterns** of total tonnage and percentage trucks;
- **internal patterns** of total tonnage and percentage trucks (highest TAZ-to-TAZ flows within the study area); and
- **external patterns** of total tonnage and percentage trucks (highest TAZ-to-TAZ flows where one TAZ is located outside the study area but within the NYMTC Best Practices Model region).

This section also includes a description of the travel patterns of air cargo truck drayage and brief synopses of the patterns of waterborne and rail movements.

1. Summary of Travel Patterns

The following graphs summarize the overall travel patterns. These two graphs show the distribution of tonnage by direction (outbound, inbound, internal, and through) and by mode (truck, rail, water, and air cargo drayage) based on the TRANSEARCH commodity flow analysis for Kings County.

FIGURE III-1
DIRECTION OF TONNAGE (ALL MODES) FOR BROOKLYN
(SOURCE: TRANSEARCH)

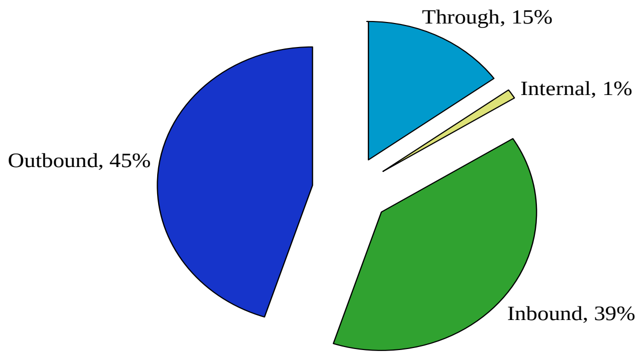
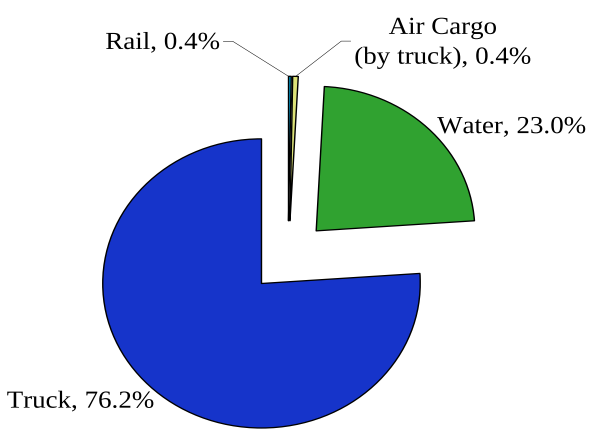


FIGURE III-2
TONNAGE BY MODE FOR BROOKLYN
(SOURCE: TRANSEARCH)



2. Truck Trip Table Methodology

The study team developed a series of trip tables from the NYMTC Best Practices model describing truck trips originating in the study area, terminating in the study area, and moving internally within the study area. The truck trip tables describe origin, destination, and internal truck moves for the 250 transportation analysis zones (TAZs) within the Southern Brooklyn study area boundaries. The estimated tonnage for each of these moves is also included in the tables. Also, additional fields have been calculated for the total tonnage (origin and destination) and the percentage of truck trips for each TAZ. The data was used to identify the highest tonnage TAZs and highest TAZs by truck percentage. The data were also linked to a GIS map showing the TAZs in the study area to depict the locations of freight activity within Southern Brooklyn.

3. Origin Patterns

The Best Practices Model estimates total tonnage originating within the Southern Brooklyn study area at 24,510 daily tons. However, the pattern of origination tonnage across the study area TAZs varies widely. The following table presents the estimated tonnage originating in the top 10 TAZs, representing over 17 percent of all tonnage originating within the study area.

TABLE III-2
HIGHEST TONNAGE ORIGINS FOR SBTIS TAZS (DAILY TONS)

Rank	TAZ	Description	Estimated Origin Tonnage (daily tons)	Percentage of Total Origin Tonnage in SBTIS
1	1499	**Kings Plaza Shopping Center** (bounded by Mill Basin [N]; Ave. U [W]; Rockaway Inset [E]; and Flatbush Ave. [S])	1143.49	4.7 percent
2	1179	**Starrett City** (bounded by Flatlands Ave. [N]; Belt Pkwy.; Fresh Creek [W]; Hendrix Creek [E]; and Jamaica Bay [S])	549.64	2.2 percent
3	1345	**East Bensonhurst** (bounded by Bay Pkwy. and 65th St. [N]; by Ave. P on the [S]; and between 9th and 5th Streets [W & E]).	383.55	1.6 percent
4	1428	**Manhattan Beach** (Coney Island east of Corbin Pl.)	346.18	1.4 percent
5	1453	**Sheepshead Bay** (bounded by Ave. Z [N]; 7th St. [W]; and 29th St. [E] Belt Pkwy. [S])	339.14	1.4 percent
6	1448	**North Homecrest** (bounded by Ave. P [N]; Coney Island Ave. on the west---jogging to the east on 19th St. and then south to Ave. T; and bounded on the east by 23rd St.)	323.05	1.3 percent
7	1424	**Flatbush-Brooklyn College** (bounded by Farragut Rd. [N]; Ocean Ave. on the [W]; Amersfort Pl. [E]; and Ave. I [S])	303.68	1.2 percent
8	1394	**Brighton Beach/Coney Island Hospital** (bounded by Ave. X [N]; Ocean Pkwy. [W]; Coney Island Ave. [E]	294.25	1.2 percent

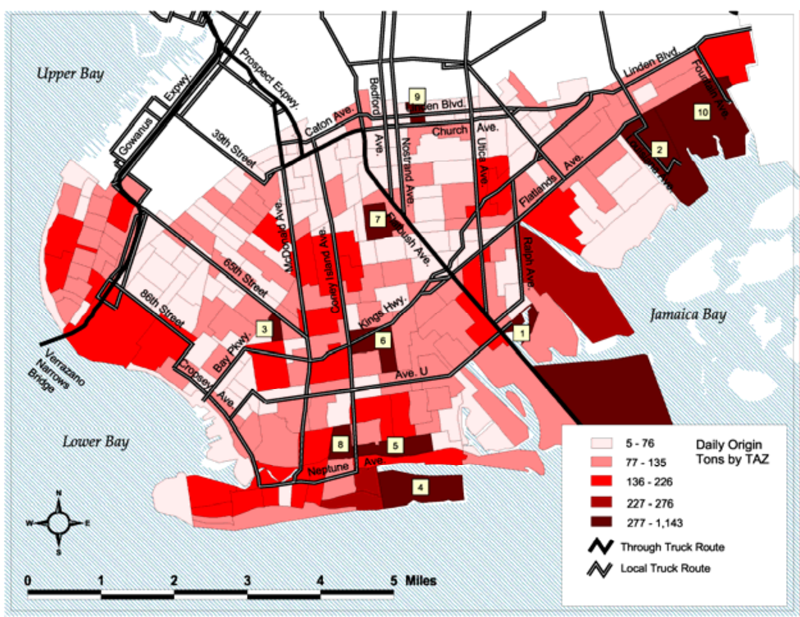
TABLE III-2 (CONTINUED)
HIGHEST TONNAGE ORIGINS FOR SBTIS TAZS (DAILY TONS)

Rank	TAZ	Description	Estimated Origin Tonnage (daily tons)	Percentage of Total Origin Tonnage in SBTIS
9	1472	**Kings County Hospital** (bounded by Clarkson Ave. [N]; New York Ave. [W]; 38th St. [E]; and Church Ave. [S])	283.01	1.2 percent
10	1178	**Spring Creek-Brooklyn Dev. Center** (bounded by Flatlands Ave. [N]; Hendrix Creek [W]; Sheridan Ave. [E]; and Jamaica Bay [S])	276.54	1.1 percent

Source: NYMTC Best Practices Model – SBTIS Truck Tables

Several of the TAZs with the highest origin tonnages are anchored by commercial, industrial or institutional land uses. Figure III-3 shows the location of the top ten TAZs by origin tonnage. The pattern of tonnage is similar to the pattern TAZs with the highest percentage of commercial truck originations. For example, nine of the TAZs listed in the table above are among the top twenty TAZs for originations of commercial trucks. The TAZ with the single highest commercial truck origination percentage is the zone containing Kings Plaza Shopping Center. However, the percentage of commercial vehicles originating in this and other zones with high truck percentages is still relatively low. Specifically, the aforementioned zone containing Kings Plaza has a commercial vehicle trip origination percentage of only 1.8 percent, or approximately 84 daily commercial truck origins out of 4,649 total trips (auto + non-commercial truck + commercial truck).

FIGURE III-3
HIGHEST TONNAGE ORIGINS FOR SBTIS TAZS (DAILY TONS)



Source: NYMTC Best Practices Model – SBTIS Truck Tables

4. Destination Patterns

The Best Practices Model estimates total tonnage terminating within the Southern Brooklyn study area at 22,350 daily tons. Like origination tonnage, destination tonnage varies by TAZ across the study area. Table III-3 presents the estimated tonnage terminating in the top 10 TAZs, representing nearly 14 percent of all tonnage terminating within the study area.

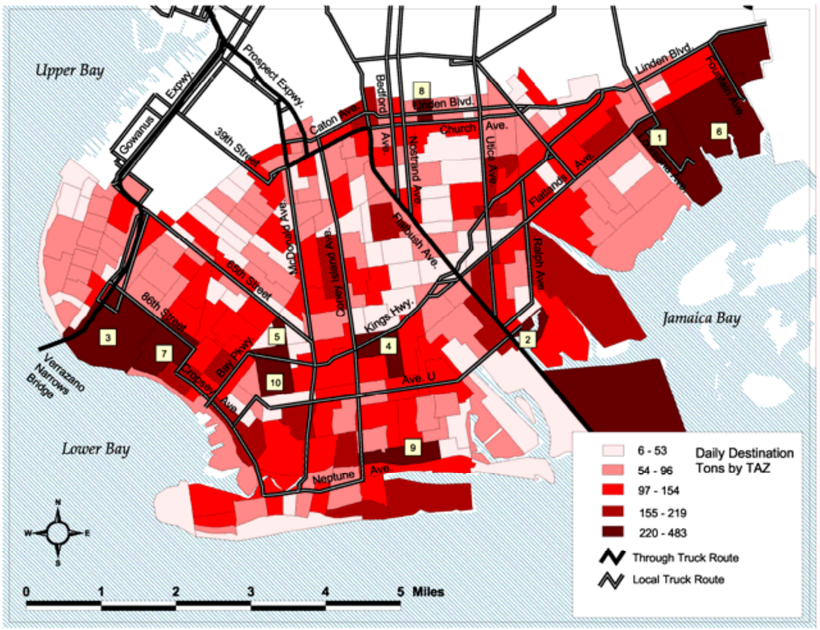
TABLE III-3
HIGHEST TONNAGE DESTINATIONS FOR SBTIS TAZS (DAILY TONS)

Rank	TAZ	Description	Estimated Origin Tonnage (daily tons)	Percentage of Total Origin Tonnage in SBTIS
1	1179	**Starrett City** (bounded by Flatlands Ave. [N]; Belt Pkwy.; Fresh Creek [W]; Hendrix Creek [E]; and Jamaica Bay [S])	482.74	2.2 percent
2	1499	**Kings Plaza Shopping Center** (bounded by Mill Basin [N]; Ave. U [W]; Rockaway Inset [E]; and Flatbush Ave. [S])	402.97	1.8 percent
3	1291	**Fort Hamilton-VA Hospital** (bounded by 86th St. [N]; I-278 [W]; 14th St [E]; and Gravesend Bay [S])	358.7	1.6 percent
4	1448	**North Homecrest** (bounded by Ave. P [N]; Coney Island Ave. on the west---jogging to the east on 19th St. and then south to Ave. T; and bounded on the east by 23rd St.)	353.71	1.6 percent
5	1345	**East Bensonhurst** (bounded by Bay Pkwy. and 65th St. [N]; by Ave. P on the [S]; and between 9th and 5th Streets [W & E]).	265.84	1.2 percent
6	1178	**Spring Creek-Brooklyn Dev. Center** (bounded by Flatlands Ave. [N]; Hendrix Creek [W]; Sheridan Ave. [E]; and Jamaica Bay [S])	253.52	1.1 percent
7	1323	**Bath Beach** (bounded by 85th St. [N]; 14th St. [W]; 18th Ave. [E]; and Gravesend Bay [S])	251.1	1.1 percent
8	1472	**Kings County Hospital** (bounded by Clarkson Ave. [N]; New York Ave. [W]; 38th St. [E]; and Church Ave. [S])	245.62	1.1 percent
9	1453	**Sheepshead Bay** (bounded by Ave. Z [N]; 7th St. [W]; and 29th St. [E] Belt Pkwy. [S])	226.34	1.0 percent
10	1347	**Southeast Bensonhurst** (bounded by Ave. P [N]; Stillwell Ave. [W]; 5th St. [E]; and Ave. T [S])	222.95	1.0 percent

Source: NYMTC Best Practices Model – SBTIS Truck Tables

Like the origin tonnage TAZs, several of the TAZs with the highest destination tonnages are anchored by commercial, industrial or institutional land uses. Figure III-4 shows the location of the top ten TAZs by destination tonnage. The pattern of zones with the highest percentage of destination commercial truck trips follows a similar pattern to tonnage. The TAZ with the highest commercial truck percentage is the Spring Creek area zone, containing the Brooklyn Developmental Center. The TAZ with the second highest percentage of truck destinations is the zone containing the Kings Plaza Shopping Center. Like the origin pattern described above, the percentage of commercial trucks terminating trips in any given TAZ is relatively low. Within the study area, the Spring Creek TAZ is the only zone with a commercial truck percentage higher than 1 percent. In both the case of the origin and destination patterns, it should be noted that the truck percentages in this technical memorandum include only commercial vehicles that carry commercial freight.

FIGURE III-4
HIGHEST TONNAGE DESTINATIONS FOR SBTIS TAZS (DAILY TONS)



Source: NYMTC Best Practices Model – SBTIS Truck Tables

5. <u>Internal Patterns</u>

The Best Practices Model also accounts for internal goods movement within the study area. The model estimates total tonnage originating *and* terminating within the Southern Brooklyn study area at 5,080 daily tons. However, there are no TAZ pairs with significant daily exchanges of freight. For example, the highest single tonnage trading pair is between TAZs is the Kings Plaza area zone and the North Homecrest area zone, with just over 6.5 tons exchanged daily. This tonnage, which is much less than the capacity of one tractor-trailer, is relatively insignificant when compared to the origin and destination totals. The resulting truck percentage for internal movements is inconsequential. Thus, internal TAZ-to-TAZ tonnage flows within the study area do not impact infrastructure as much as through movements and trips originating or terminating within the study area but linked to an external location.

6. External Patterns

According to the Best Practices Model, the West of Hudson region dominates external trade with specific TAZs within the study area. For example, the highest tonnage exchange occurs between the Kings Plaza area TAZ and "West of Hudson" destinations. This means that 1,280 daily tons are transported between New Jersey and the Kings Plaza area in Southern Brooklyn each day, generating approximately 11 truck trips. Similarly, other high tonnage TAZs within the study area, such as the Fort Hamilton area TAZ and the Starrett City area TAZ also trade most heavily with New Jersey "West of Hudson" origins and destinations. This analysis shows that other external trading regions, including the remaining "North Brooklyn" portion of Kings County, represent a much lower tonnage exchange than the external moves to and from New Jersey and specific TAZs within the study area.

In addition to the truck trip tables developed for this study, the recently completed *New York City Arterial Freight Study* offers some additional details of external freight flow patterns. The study, sponsored by NYSDOT, asserts that truck movements have the greatest geographical reach of any of the freight modes operating in region. For example, water, rail and air cargo (including air cargo drayage) tend to "provide direct service only to a few locations and customers." The consequence of this pattern is that the first and last legs of trips tend to be completed by truck. The study claims that Brooklyn is the destination of 50 percent of all inbound trucks to New York City -- higher than any other borough -- and that Brooklyn is second only to Queens in origination tonnage (32 percent originate in Queens and 28 percent originate in Brooklyn, with the other three borough accounting for the remaining 40 percent).

7. Summary of Truck Patterns

In summary, the truck trip tables developed for this study reveal that a majority of truck trips (and tonnage) have an origin or destination outside the study area. This pattern suggests that commercial vehicle traffic, much of which originates or terminates in high-tonnage TAZs in the eastern portions of the study area, must often traverse significant portions of the study area to reach major interstate and intrastate truck facilities, such as I-278.

8. Air Cargo Drayage Patterns

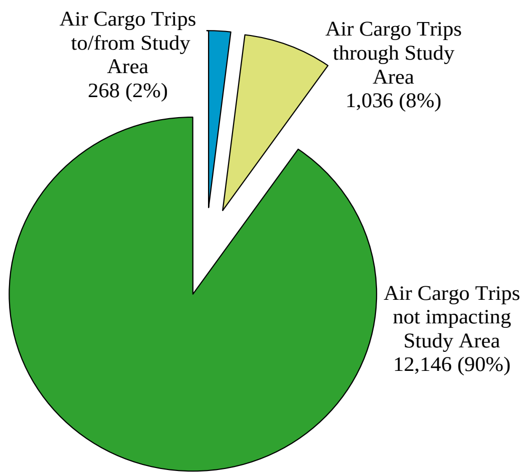
An important part of goods movement in the study area is the through truck drayage of air cargo originating or terminating at John F. Kennedy International Airport (JFKIA) in the neighboring borough of Queens. While the total tonnage of the through air cargo drayage is relatively modest compared to the other totals for through modes, the value of air cargo is high. Specifically, the TRANSEARCH commodity flow database shows that air cargo drayage constitutes 0.4 percent of the total through tonnage while truck through tonnage, waterborne through tonnage, and rail through tonnage constitute 76.2 percent, 23 percent, and 0.4 percent, respectively. Thus, JFKIA generates approximately 0.4 percent of the truck tonnage that moves through the study area.

More recently, the Port Authority of New York and New Jersey (PANYNJ) completed its *Air Cargo Truck Movement Study* for JFKIA. The PANYNJ study estimates that JFKIA generates 13,450 one-way cargo related vehicle moves per day. The vehicle classification of those cargo related moves shows that the vehicle types consist of:

- 40 percent autos & mini-vans;
- 25 percent pickup trucks;
- 25 percent single-unit (small) trucks;
- 4 percent 3 & 4-axle trucks; and
- 6 percent 5 & 6-axle trucks.

The PANYNJ study also shows that the Southern Brooklyn study area accommodates approximately 10 percent of all JFKIA cargo related trips. The following figure graphically depicts the estimated routing of JFKIA trips, including those trips traveling to/from/and through the study area.

FIGURE III-5
DISTRIBUTION OF JFKIA AIR CARGO TRIPS PER DAY
(CARS, VANS, PICKUP TRUCKS, SINGLE-UNIT TRUCKS, COMBINATION TRUCKS)



Source: Adapted from PANYNJ JFKIA Air Cargo Truck Movement Study

The PANYNJ study describes the specific routing of JFKIA air cargo trips, derived from survey information obtained from truck operators. The data show that a majority of JFKIA related air cargo trips use the Van Wyck Expressway to points northeast and northwest and do not use routes through the study area. The routes affecting the study area are listed in Table III-4.

TABLE III-4
JFKIA AIR CARGO TRIPS IMPACTING SOUTHERN BROOKLYN (DAILY TRIPS)

Route	Auto, Mini-Van	Pickup, Single Unit	Combo Truck, 3-4 and 5-6 Axle	Total
VNB/Gowanus/BQE/LIE to Van Wyck or Woodhaven	225	64	70 / 148	507
VNB/Manhattan Bridge to Atlantic and Conduit Blvd	182	143	82 / 116	523
Atlantic Ave with unspecified route	0	16	66 / 0	82
Linden Blvd with unspecified route	66	32	39 / 49	186
VNB to Belt Parkway	0	0	6 / 0	6
Total, all routes	473	255	263 / 313	1304

Source: Adapted from PANYNJ JFKIA Air Cargo Truck Movement Study

In summary, the relevance of PANYNJ study's truck traffic counts to this study is fourfold:

- The travel patterns highlight the fact that JFKIA freight access is not just a truck issue -- over half of trips are car or pickup;
- About 80 percent of trips impacting the study area are through trips (to/from Verrazano Narrows Bridge);
- Atlantic/Conduit Avenues and Linden Boulevard have been identified as key access routes; and
- There is a need to address air cargo access at the regional level.

9. Marine and Rail Cargo Patterns

There are no public (e.g., facilities that serve multiple freight shippers and carriers) marine cargo terminals in the SBTIS study area. However, there are three public marine cargo facilities elsewhere in Brooklyn that impact, to a limited extent, the SBTIS study area. These facilities include the Red Hook Marine Terminal and the South Brooklyn Marine Terminal. The impacts of these two facilities on the study area, however, are negligible: approximately 85 percent of containers terminating at Red Hook arrive via barge from New Jersey and the South Brooklyn Marine Terminal has very low truck throughput. Consequently, the remaining 15 percent of the containers inbound to Red Hook presumably travel through the study area via I-278 (Gowanus Expressway) and other surface routes.

Similarly, freight rail comprises a very low percentage (0.4 percent) of total tonnage moving in the study area. The New York and Atlantic Railway, which operates on the Bay Ridge Branch, runs several trains each week through the study area.

D. FUTURE TRENDS

This section analyzes the future operational characteristics of goods movement facilities in the Southern Brooklyn study area and the Greater New York City region. Much of the information presented in this section was adapted from NYMTC's "Regional Freight Plan" and the USDOT's "Regional Freight Transportation Case Study for the New York City Metropolitan Area," both by Cambridge Systematics.

1. Analysis of Future Operational Characteristics

A combination of factors in the study area (and the entire New York metropolitan region) have created a situation that impedes goods movement and causes other undesirable impacts, including: higher costs for shippers, receivers, and consumers; constrained economic growth; increased congestion for motorists; diminished air quality; and other community impacts. Some of the most critical issues, as identified in recent and ongoing regional analyses, are highlighted below.

- Capacity. The region's truck freight network is severely congested. Automobiles account for most of the volume, yet the congestion is a major problem for freight movement because of the travel delays it causes. It also erodes the ability of the trucking to provide reliable and predictable freight service. Travel time and cost are increasing, service reliability is decreasing, and the ability of the system to recover from emergencies and disruptions of service is severely taxed. The capacity and congestion problems are most apparent on the major freight routes through the study area, including the Brooklyn-Queens Expressway and the Gowanus Expressway sections of I-278. The current and future challenges associated with truck congestion include:
  - Chronic congestion on the main highways and river crossings will continue to reduce the reliability and consistency of travel times, which negatively affects trucking operations.
  - A limited number of alternative truck routes due in part to vertical clearance issues and vehicle dimension restrictions at major river crossings or along major truck routes will continue to limit the choices for larger trucks.
  - The peak hours will lengthen and the options for alternative delivery periods will decrease (these delivery periods are determined by when shippers and receivers are open for business, not when there is capacity available on the highways). This means that shippers and carriers will increase their costs by having longer work hours to get into the study area early or late to avoid congestion.
  - The current toll structure (eastbound on all major crossings except the Verrazano-Narrows Bridge) often causes trucks to cross to Long Island via the Verrazano-Narrows Bridge and exit via the George Washington Bridge, in order to save more than $40 in the process. This toll structure causes truck congestion on the inbound Verrazano-Narrows Bridge to Brooklyn and the outbound George Washington Bridge to New Jersey.

- — Increasing the capacity and performance of all elements of the region's goods movement system is the most critical concern, and is the focus of many of the ongoing initiatives. Generally, the strategies under consideration fall into one of the following areas:
- — Construction of physical improvements to terminals (ports, intermodal rail, warehouse/distribution centers), networks (highway improvements and bottleneck reduction, new rail links and mainline improvements, deeper navigation channels), and intermodal transfer facilities;
- — Implementation of operational improvements via information systems that would allow for better scheduling and coordination of freight activities, and possibly support some shifting of daytime freight activity to nighttime hours when highway and rail capacity is generally more readily available (work zones permitting);
- — Improved management and utilization of available infrastructure by the public sector and by private freight carriers;
- — Public encouragement of freight to shift from more congested modes to less congested modes;
- — New technology solutions on the visible horizon, such as short-haul rail, short-sea shipping, and advanced train controls; and
- — Continuing and improved cooperation among the various public-sector agencies charged with addressing some part of the "freight problem," as well as continuing and improved cooperation between the public and private sectors.

- Dependence on Trucking. One of the concerns most often raised about goods movement in Southern Brooklyn and the "East of Hudson" portion of the New York City region is the high dependence on trucking. The high density of freight tonnage moving by truck is a matter of concern, because it leads to increased highway congestion, reduced air quality, and (in many cases) higher producer and consumer costs. Improvement measures are being pursued by the railroads and public agencies to shift freight movement to rail to reduce the dependence on trucking. The most promising measures to improve rail freight service include the following:
  - — Elimination of height and weight restrictions for freight on the overland route from Albany to Queens, and beyond to Brooklyn and Long Island;
  - — Improvements in car float service between New Jersey and Brooklyn;
  - — Development and expansion of rail facilities and freight yards East of Hudson to accommodate increased rail traffic (e.g., LIRR third track and double track); and
  - — Exploration and development of policies to provide an economic impetus to use non-highway freight modes.

  In the longer term, strategies to reduce the imbalance between rail and truck freight mode share could include improved rail connections between the East of Hudson and the national freight rail network, along with improved mainline and terminal capacity on both sides of the Hudson River as necessary to support the expanded rail traffic.

- Bridges and Tunnels. The natural port and waterways that originally made the New York metropolitan area America's most populous region now pose interesting institutional, engineering, and planning challenges for transportation policy-makers. With so many natural barriers, such as the Hudson River, the East River, Long Island Sound, and New York Harbor, creating a seamless interconnected transportation system is challenging.

  The study area is connected to Staten Island and Manhattan by several bridges and tunnels, some with great historic value and beauty. However, most of these facilities cannot accommodate the current dimensions of truck and rail equipment, and many of the major highways within New York City do not meet current AASHTO design standards. Most of these highway and rail bridges and tunnels are too small to accommodate standard truck and rail equipment, meaning that freight must be broken down in the region to smaller vehicles to complete the logistics chain. Regional cooperation is required for planning, financing, and maintaining these essential transportation linkages while preserving their historic value.

- Growth. Even as the population of the study area and the greater New York City region continues to grow at a steady pace, consumer demand for goods will outpace population growth, both regionally and nationally. The consequence of this trend is increasing stress on the study area's already overburdened transportation system to accommodate not only increased internal demand but demand for "through" movement of goods destined for other East of Hudson destinations on Long Island. One estimate predicts an increase of 27 percent in freight volumes for the New York City region by 2020, to more than 600 million annual tons.[1] As the region has evolved, the East of Hudson region has become more of a consuming region, while the West of Hudson area has become more of a goods-handling region. There are many factors underlying this evolution; in brief, these include:
  - Modern logistics patterns have increasingly emphasized the role of warehousing and distribution centers. These centers accomplish a variety of purposes, including allowing for large-lot shipments to be broken into smaller lots, allowing oversize/overweight shipments to be transferred into small trucks, and allowing for value-added intermediate processing. These functions require large areas of affordable land with good highway and rail access. Suitable land has been and continues to be more available West of Hudson, resulting in a growing concentration of the region's warehouse and distribution capacity. The effect of this land use pattern on the study area is increased truck traffic through Southern Brooklyn from New Jersey warehousing and distribution zones to consumers on Long Island.
  - The national rail freight system effectively terminates in North Jersey – the nearest direct connection is at Albany, several hours north, and coming south

[1] Cross Hudson MIS Final Report, New York City Economic Development Corporation, 2000.

from Albany freight trains operate with passenger traffic over a rail line with design constraints.

— The highway system provides substantially greater capacity and more modern facilities in the West of Hudson region. Highways and local streets in the study area and throughout New York City are restricted as to the size and routing of truck traffic; and there are a limited number of truck routes (which are significantly congested and constrained) traversing the Hudson.

This creates, in essence, three different "freight problems" to be addressed: the problems characterizing the West of Hudson, the problems characterizing the East of Hudson, and the problems associated with the connectivity (or lack thereof) between the two subregions.

2. Future Highway Operational Characteristics

Trucking in the region is expected to increase substantially through the year 2025, with growth varying between 50 percent and 150 percent depending on location, based on different studies. The combination of growing truck traffic, growing background traffic, and limited opportunities for new capacity will result in further degradation of levels of service.

The region's major truck corridors – the Northern Tier (New Jersey Turnpike/George Washington Bridge/Cross Bronx Expressway/I-95) and the Southern Tier (New Jersey Turnpike/Goethals Bridge/Staten Island Expressway/Verrazano Narrows Bridge/Brooklyn-Queens Expressway) – will be significantly impacted. Truck movements between East and West of Hudson portions of the region number more than 30,000 crossings each day on the George Washington Bridge and Verrazano-Narrows Bridge. These trans-Hudson moves are expected to increase by 70 percent in 2025.

These problems of current and anticipated congestion are exacerbated by limitations on the highway system within New York City itself. Much of the City is not immediately accessible by major arterials, much of the City's roadway network is off limits to larger trucks, and local parking for pickup and delivery is highly restricted. Additionally, some of the primary truck routes – like the Brooklyn-Queens Expressway – have height restrictions.

The highway challenges facing the region are huge. Principal among them is the need to find more capacity – by increasing supply (through bottleneck elimination and new construction where practical), by managing mode choice (expanding the use of alternative modes for both passengers and freight), by managing time-of-day utilization of the system (off-hours pickup and delivery, where practical), and by deploying advanced information systems for network management and driver operations.

3. Future Rail Operational Characteristics

Northern New Jersey is one of the nation's preeminent rail freight centers. It handles a broad mix of containerized and non-containerized commodities, along with a mix of domestic and international cargo. Around half of the international containerized cargo moving to and from the region is actually handled by rail, via "mini-landbridge" to/from marine terminals on the U.S. west coast. The West of Hudson rail system is a major success story by any reasonable measure. Nationally, the average rail share for a given region is around 11 percent[2]; for the West of Hudson, this figure is 15 percent.

East of the Hudson River, the rail system handles just three percent of freight tonnage. By contrast, the rail system in Northern New Jersey handles 15 percent of freight. Part of this disparity is because of the circuitous connection between the continental rail network and Queens (and Brooklyn/Long Island). Specifically, the nearest direct connection to the national rail freight system is the Hudson River crossing at Albany; coming south out of Albany, freight must share a height and weight-constrained line with heavy passenger traffic. Upon reaching New York City, it must navigate a variety of physical and operational constraints. Historically, this barrier was addressed through an extensive railcar-float operation; a float operation still exists between Jersey City and Brooklyn, but handles very little traffic.

Various studies have identified significant problems with the rail system, including:

- Numerous physical chokepoints – inadequate vertical and weight clearances, insufficient mainline capacity, missing connections, aging bridges and infrastructure, and at grade rail-rail crossings.
- Capacity constraints associated with shared use of rail infrastructure immediately east of the study area on the Long Island Rail Road tracks shared with the New York and Atlantic Railroad.
- Inadequate intermodal and classification yard capacity.
- The lack of an efficient, direct rail freight connection between the West of Hudson and East of Hudson subregions, limiting the possibility of handling a higher share of East of Hudson freight by rail in lieu of truck.

The Pilgrim Intermodal Center EIS (NYSDOT), Cross-Harbor Freight Movement EIS (NYCEDC) and LIRR propose improvements that would, if implemented, dramatically improve rail capacity to the East of Hudson region, and would have major implications on the study area. The Cross-Harbor Freight tunnel would tie existing railroad systems in Brooklyn to the continental Class I rail freight network in New Jersey. The Pilgrim proposal would add intermodal rail capacity in Suffolk County on Long Island and would affect the study area by increasing through rail traffic in the study area.

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[2] Cross Hudson MIS Final Report, New York City Economic Development Corporation, 2000. U.S. DOT National Transportation Statistics, 1999 Table 1-43, Page 68.

4. Future Waterborne Operational Characteristics

Rapid growth in the region's port facilities has brought to light some significant problems, which have been assessed through a variety of studies over the past decade. The key issues that have been identified include:

- Need for additional terminal capacity, through some combination of physical expansion, productivity gains, and information/technology advances;
- Need for deeper navigation channels to accommodate next-generation vessels;
- Need for improved landside access to improve efficiency and reduce impacts on the local highway system; and
- Perceived underutilization of marine terminal sites in Brooklyn.

5. Future Air Cargo Operational Characteristics

Although air freight accounts for a relatively small portion of total freight moving through the study area, it is growing rapidly on a national and international basis. Access to efficient air freight service is crucial to the many high-end service industries located in the New York metropolitan region that depend on fast and reliable air freight service. Critical issues facing the region's airports include a shortage of land for expanding air cargo operations (transfer, storage, etc.), and continuing deterioration of truck access, particularly for JFK.

Addressing these problems in the coming decade will require a willingness to plan and fund transportation system improvements across boundaries – across the jurisdictional boundaries between states and cities, across the interest boundaries between the public agencies and private firms, and across the financial boundaries between the highway and rail systems.

Chapter IV: Traffic

A. ANALYSIS OF TRAVEL PATTERNS

A search was made of the available Origin-Destination (O-D) survey databases from secondary data sources. Brief descriptions of the travel patterns based on an overview of the available data are provided below.

1. Gowanus Expressway I-278 Travel Survey Report (Revised January 2001)

A comprehensive travel survey was sponsored by NYSDOT in connection with the DEIS preparation for the 5.7-mile Gowanus Expressway Project corridor in May and June of 1999. The Gowanus travel survey area encompassed essentially one-third of the western portion of the Southern Brooklyn study area. The significant findings and results of the Gowanus Expressway O-D survey are listed below.

- Over 80 percent of the Gowanus Expressway users originated from Brooklyn and Staten Island in the AM peak period.
- The majority of the Gowanus Expressway users (50 percent) are destined for Manhattan, 30 percent for downtown Brooklyn, and over 10 percent for the Long Island City area in Queens.
- Over 40 percent of the Gowanus Expressway users incurred a one-way travel time between 41 to 60 minutes.
- More than 75 percent of the users made the trip by passenger cars.
- Work-related trips accounted for over 85 percent of the Gowanus Expressway inbound trips during the AM peak period.
- The Verrazano-Narrows Bridge entrance ramp was used by more than 33 percent of the Gowanus Expressway users, and approximately 20 percent of the users used each of the Shore Parkway, the Prospect Expressway and the ramps between 92nd and 65th Streets.
- More than half of the users exited onto the BQE and nearly one third used the Brooklyn Battery Tunnel exit ramp.
- Over 60 percent of the Gowanus Expressway users are single occupant vehicles, and 28 percent traveled in 2-person vehicles.
- Nearly 75 percent of the users exiting the Fort Hamilton Parkway exit ramp are destined for the southern Brooklyn (Bay Ridge) area.
- Almost 60 percent of the users exiting at 7th Avenue/65th Street exit ramp are destined for the Sunset Park neighborhood, while more than 22 percent of the users are bound for the Bay Ridge area.

2. MTA Bridges and Tunnels Origin-Destination Survey (April 1999)

A comprehensive O-D survey of passenger and commercial vehicles was sponsored by the MTA at all nine bridge and tunnel facilities on a mid-week day and a weekend day (Saturday or Sunday) in June 1997. The O-D questionnaire survey was conducted over a full 24-hour period at the following MTA facilities:

- Verrazano-Narrows Bridge
- Triborough Bridge (Manhattan and Bronx Plaza)
- Throgs Neck Bridge
- Bronx-Whitestone Bridge
- Henry Hudson Bridge
- Marine Parkway-Gil Hodges Memorial Bridge
- Cross Bay Veterans Memorial Bridge
- Brooklyn-Battery Tunnel
- Queens-Midtown Tunnel

The significant findings and results of the MTA Bridges and Tunnels O-D survey are listed below:

- Nearly 70 percent of auto trips using the manual toll lanes at all TBTA facilities originated in New York City (i.e., Manhattan, Queens, Bronx, Brooklyn and Staten Island).
- Trips using manual toll lanes originating in New York City represented 58 percent of all Saturday trips and 60 percent of all Sunday trips.
- New York City accounted for 66 percent of all weekday auto trip destinations, 57 percent of all Saturday auto trips, and 59 percent of all Sunday trip destinations at manual toll lanes.
- Over a 24-hour period, 27 percent of weekday auto trips were Home-to-Work, 20 percent were Work-to-Home, and 19 percent were other Work-related trips at manual toll lanes.
- The majority of autos on a weekday using the manual toll lanes were single occupant vehicles (58 percent), followed by 2-occupant vehicles (29 percent), and three-occupant vehicles (9 percent).

More detailed O-D travel patterns were reviewed for the three MTA Bridge and Tunnel facilities that provide essential connections to adjoining boroughs of New York City along the SBTIS study area boundaries. The three MTA facilities are the Brooklyn-Battery Tunnel, Verrazano-Narrows Bridge and Marine Parkway-Gil Hodges Memorial Bridge. Brief descriptions of significant O-D travel patterns at these facilities are provided below.

- Brooklyn-Battery Tunnel: Approximately 75 percent of the Manhattan-bound non-E-ZPass auto users originate in Brooklyn and 14 percent originate in Staten Island. Most of the non-E-ZPass auto user trips (85 percent) end in Manhattan. The higher percentage of E-ZPass auto users (28 percent) originate in Staten Island. Of the total daily Manhattan-bound trips, 65 percent are E-ZPass users. The predominant weekday home-to-work Manhattan-bound trips and work-to-home Brooklyn-bound trips account for approximately 50 percent of total daily trips. The majority of auto users on a weekday using the Cash and E-ZPass toll lanes were single occupant vehicles (53 percent) and 2-occupant vehicles (33 percent). Over 72 percent of the Manhattan-bound non-E-ZPass trucks originate in Brooklyn and end in Manhattan.

Approximately 71 percent of the Brooklyn-bound auto trips originating in Manhattan are non-E-ZPass users. About 79 percent of the E-ZPass auto users originate in Manhattan. Most of the non-E-ZPass auto trips (72 percent) end in Brooklyn, whereas only 42 percent of the E-ZPass auto trips end in Brooklyn and 43 percent in Staten Island. Most of the auto users for the Brooklyn-bound Cash and E-ZPass toll lanes are single occupant vehicles (54 percent-57 percent) and 2-occupant vehicles (32 percent).

- Verrazano-Narrows Bridge: Due to one-way toll collection on the Staten Island-toll plaza, the MTA O-D survey was conducted only at toll booths designated for the Staten Island-bound direction. The reverse O-D travel pattern of Brooklyn-bound users was estimated based upon origins and destinations of E-ZPass users surveyed in the Staten Island-bound direction. Approximately 45 percent of the non-E-ZPass auto trips originate in Long Island via Shore Parkway, followed by 32 percent from Brooklyn, and 18 percent from Queens. Approximately 59 percent of all Staten Island-bound auto users had destinations in Staten Island, and 33 percent in New Jersey. Nearly 65 percent of the total daily Staten Island-bound autos are E-ZPass users. The higher percentage of Staten Island-bound E-ZPass users (60 percent) originate in Long Island. Approximately 88 percent of all automobile users had single or 2 occupants. A slightly higher percentage of non-E-ZPass truck trips (36 percent) end in New Jersey, as compared to 33 percent for autos. Approximately 74 percent of the Brooklyn-bound auto E-ZPass users originate in Staten Island, and 22 percent originate in New Jersey.
- Marine Parkway Bridge: The majority of the Brooklyn-bound non-E-ZPass auto users originate along the Rockaway Beach Boulevard area of Queens (89 percent) and 11 percent originate in Long Island. Similarly, 85 percent of the Brooklyn-bound E-ZPass auto users originate along the Rockaway Beach Boulevard area of Queens and 15 percent originate in Long Island. Most of the non-E-ZPass auto trips end in Brooklyn (81 percent), followed by Manhattan (9 percent). Most of the E-ZPass auto trips end in Brooklyn (79 percent), followed by Manhattan (8 percent). Nearly 80 percent of the Rockaway-bound non-E-ZPass auto users originate in Brooklyn, whereas 62 percent of the E-ZPass auto trips originate in Brooklyn and 15 percent originate in Manhattan. Approximately 70 percent of the daily auto trips are E-ZPass users.

3. Port Authority Hudson River Crossings Origin-Destination Survey (November 1991)

The automobile surveys were conducted at the trans-Hudson facilities (George Washington Bridge, Lincoln Tunnel and Holland Tunnel) for 18 hours on a weekday and for 17 hours on Saturday and Sunday in November 1991. Results of O-D travel patterns for the combined three Port Authority facilities indicated that only 5 percent and 8 percent of the eastbound auto trips end in Brooklyn during the 6:00 – 10:00 AM and 4:00 – 7:00 PM weekday peak periods, respectively. The eastbound auto usage of the Port Authority trans-Hudson facilities destined for Brooklyn throughout the weekday, Saturday and Sunday varied from 6 percent to 8 percent. In general, the higher percentage of eastbound auto users at the Port Authority facilities had residence in Brooklyn in the 4:00 – 7:00 PM peak period (6.7 percent), whereas only 0.2 percent had residence in Brooklyn in the 6:00 -10:00 AM peak period. For instance, at the George Washington Bridge less than 0.5 percent and 4.0 percent of the eastbound auto users had destinations in Brooklyn during the AM and PM peak periods, respectively. However, over 20 percent of the eastbound auto users at the Holland Tunnel had destinations in Brooklyn during the PM peak period.

4. Manhattan-Oriented Trip Generation and Origin-Destination Auto Study (May 1986)

The NYCDOT conducted automobile O-D surveys at 11 of the 17 East and Harlem River crossings during the 6:00 -10:00 AM peak period in the summer of 1986. These crossings consisted of 4 toll facilities operate by TBTA and 7 free facilities operated by NYCDOT. Most of the home-to-work trips in Manhattan during the weekday morning peak period originate in Brooklyn (28.5 percent), followed by Queens (27.8 percent), Bronx (12.4 percent), Long Island (12.2 percent), Westchester County (11.4 percent), Staten Island (5.4 percent), and others (2.3 percent). The Brooklyn and Manhattan Bridges primarily served Brooklyn and Staten Island residents destined for lower Manhattan area. Single occupancy autos accounted for more than 50 percent of all autos crossing the East and Harlem River facilities during the morning peak period. Two-occupant autos constituted 32 percent of all autos.

B. TRAFFIC DATA

A summary of 24-hour traffic volumes and AM and PM peak hour volumes on selected major study area roadways is presented in Table IV-1. As expected, the Shore Parkway carried the highest 24-hour traffic flow volume of over 86,000 vehicles in the peak direction on a typical weekday. The weekday peak hour traffic volume was recorded as 5,200 vehicles in the westbound direction during the PM peak hour on this six-lane, divided facility.

Control-station ATR counts were conducted from August 16 to September 9, 2002 on Shore Parkway, Flatbush Avenue, Kings Highway and Ocean Parkway. The counts were repeated at these four locations plus at another location on Linden Boulevard from November 16 to November 28, 2002, and from May 11 to May 20, 2003. The control-station ATR count locations are listed below.

- Shore Parkway west of Flatbush Avenue
- Flatbush Avenue south of Avenue H
- Kings Highway south of Avenue N
- Ocean Parkway south of Ditmas Avenue
- Linden Boulevard east of Brooklyn Avenue

TABLE IV-1
AVAILABLE ATR COUNT DATA

Location		Count Date	Direction	24-Hour Volume	AM Peak Hour	PM Peak Hour
Linden Blvd	E of Rockaway Pkwy	11/26/2002	WB	21,100	1,890	1,180
			EB	22,000	1,030	1,520
Avenue U	E of Coney Island Ave	7/22/2000	EB	5,500	310	390
			WB	5,600	300	350
Bay Pkwy	N of 86th Street	7/22/2000	NB	12,300	650	780
			SB	12,100	690	750
Coney Island Ave	S of Avenue J	7/22/2000	NB	14,000	920	870
			SB	11,600	570	860
Flatbush Ave	S of Nostrand Ave	7/29/2000	SB	12,000	530	810
Rockaway Pkwy	N of Flatlands Ave	8/21/2000	NB	7,300	480	370
			SB	9,800	410	620
Utica Ave	S of Flatland Ave	2/22/1999	NB	9,100	680	650
		9/30/2000	SB	8,700	470	710
Shore Pkwy	E of Cropsey Ave	6/26/2001	WB	86,300	4,760	5,180
			EB	83,500	4,650	4,840
Shore Pkwy	W of Flatbush Ave	7/10/2001	WB	71,500	4,160	4,330
			EB	71,600	4,200	4,600
Kings Hwy	S of Linden Blvd	8/6/2001	SB	12,600	690	990
Parkside Ave	E of Bedford Ave	7/23/2001	EB	8,400	510	590
			WB	10,200	590	640
Ralph Ave	S of Flatland Ave	7/9/2001	NB	14,600	720	1,010
			SB	11,800	600	920
Ocean Pkwy	S of Kings Hwy	5/25/1999	NB	24,500	1,720	1,460
			SB	25,100	1,180	1,750
Ft Hamilton Pkwy	N of 61st St	5/10/1999	NB	9,900	800	600
			SB	10,400	620	730
18th Avenue	N of 65th St	8/2/1999	EB	6,600	410	400
			WB	6,200	350	430
Pennsylvania Ave	N of Shore Pkwy	5/15/1999	NB	17,900	1,450	930
			SB	13,100	580	1,080
Gowanus Expwy	Before 92nd St	5/25/1999	NB	60,500	5,280	2,870

The hourly traffic variation pattern at these ATR count locations for a typical weekday exhibit the pattern of a typical commuter-oriented roadway with two distinct peak periods, generally occurring from 7:00 to 10:00 AM and from 4:00 to 7:00 PM (see Appendix A Figures 1 through 6). Essentially all of the major access roadways located at the control ATR stations exhibited the peak traffic flow pattern in the inbound Manhattan direction during the morning peak period and in the outbound Manhattan direction during the afternoon peak period. The weekday morning and afternoon peak hours on the east-west Shore Parkway occurred from 8:00 to 9:00 AM and from 3:00 to 4:00 PM. The major north-south roadways such as Ocean Parkway and Flatbush Avenue showed the morning 8:00 – 9:00 AM peak hour and the afternoon 5:00 – 6:00 PM peak hour.

A review of daily traffic volumes also reveals that weekend (i.e., Saturday and Sunday) traffic volumes are generally similar to weekday volumes on major arterial routes, except on Kings Highway. The Kings Highway weekend traffic volumes were substantially lower than the weekday traffic volumes. Daily traffic volumes are shown in Table IV-2.

TABLE IV-2
AVERAGE DAILY TRAFFIC VOLUMES

TIME	Ocean Parkway (Mainline)		Linden Boulevard		Flatbush Avenue		Kings Highway		Shore Parkway	
	NB	SB	EB	WB	NB	SB	EB	WB	EB	WB
Sunday	28,710	31,930	11,940	10,430	17,010	13,100	6,540	6,310	72,440	72,230
Monday	29,980	31,360	12,340	11,470	17,210	12,730	10,490	10,140	75,350	74,360
Tuesday	30,730	33,250	12,160	11,590	18,550	12,960	10,770	10,350	75,550	73,790
Wednesday	29,950	30,500	12,310	11,630	18,830	13,120	10,740	10,360	75,220	73,320
Thursday	31,680	31,900	12,090	11,540	18,520	13,200	10,820	10,290	79,030	60,400
Friday	30,790	33,490	12,970	12,000	18,490	12,590	10,820	10,140	80,210	78,270
Saturday	27,050	28,360	13,260	11,750	19,690	15,120	7,480	7,020	78,420	78,970

Source: SIMCO Engineering, P.C. ATR traffic data from 05/11/03 to 05/20/03.

C. CRITICAL LANE ANALYSIS

For the purpose of a planning level analysis, the "critical lane analysis" procedure was applied to determine the approximate operating conditions occurring at the selected 25 major intersections in the study area during the morning and afternoon peak hours on a typical weekday in 2002. This approximate level of service (LOS) analysis procedure is primarily based on two parameters: peak hour demand volumes and number of moving lanes on the intersection approaches. For the sake of a conservative analysis, the highest peak hour volumes at each intersection in lieu of the overall peak hour volumes throughout the study area were selected for the morning and afternoon peak periods. Results of LOS for the selected major intersections are summarized in Table IV-3. The detailed procedure is presented in Appendix B. In general, all of the analyzed intersections operate at LOS "C" or better during the present weekday AM and PM peak hours, except for the LOS "F" during both peak hours at the following intersections:

- Pennsylvania Avenue at Linden Boulevard
- Flatlands Avenue at Ralph Avenue
- Flatbush Avenue at Avenue U
- Bay Parkway at Cropsey Avenue
- Shore Parkway Westbound Service Road at Cropsey Avenue

In addition, Rockaway Avenue at Linden Boulevard currently operates at LOS "E" during the weekday AM peak hour and Utica Avenue at Church Avenue currently operates at LOS "D" during the weekday PM peak hour.

TABLE IV-3
CRITICAL LANE ANALYSIS SUMMARY

Intersection	Level of Service AM Peak Hour	Level of Service PM Peak Hour
Pennsylvania Ave. @ Linden Blvd	F	F
Rockaway Pkwy @ Seaview Ave.	A	A
Rockaway Pkwy @ Flatlands Ave.	A	A
Flatlands Ave. @ Ralph Ave.	F	F
Utica Ave. @ Church Ave.	A	D
Flatbush Ave. @ Avenue U	F	F
Flatbush Ave. @ Nostrand Ave.	A	A
Flatbush Ave. @ Church Ave.	B	A
Flatbush Ave. @ Caton Ave.	B	A
Ocean Pkwy @ Shore Pkwy WB	B	B
Ocean Pkwy @ Shore Pkwy EB	C	C
Ocean Pkwy @ Church Ave.	A	B
Rockaway Ave. @ Linden Blvd	E	A
Fort Hamilton Pkwy @ 65th Street	C	C
Bay Parkway @ 65th Street	C	C
Bay Parkway @ Cropsey Ave.	F	F
Shore Pkwy WB Service Road @ Cropsey Ave.	F	F
Shore Pkwy EB Service Road @ Cropsey Ave.	A	A
Gowanus Expwy WB Service Road @ 92nd Street	A	A
Gowanus Expwy EB Service Road @ 92nd Street	A	A
Avenue U @ Mill Ave.	C	C
Ocean Ave. @ Avenue P	A	A
Ocean Ave. @ Kings Highway	A	A
Ocean Ave. @ Avenue J	A	A

Note: Analysis based on November 2002 traffic counts

Chapter V: Assessment of Safety and Accident Problems

A. SUMMARY

The top 120 high accident locations in Southern Brooklyn were listed in Technical Memorandum #2. The list was based on accident data obtained from the New York State Department of Transportation (NYSDOT) for the three-year period from January 1997 to December 1999. The majority of the high accident locations are located along major roadways, including Shore Parkway, Linden Boulevard, Coney Island Avenue, Flatbush Avenue, Church Avenue, Gowanus Expressway, 65th Street, and Kings Highway. While most of these roadways are also truck routes, approximately 87 percent of the total vehicles involved in the reportable accidents were passenger vehicles.

Although a higher total number of accidents occurred at intersections, as compared to ramps and mainlines, 70 percent of the top 20 accident locations occurred on expressways or expressway ramps, most notably Shore Parkway. The high number of accident locations along Shore Parkway may, in part, be due to substandard features that exist along this arterial such as substandard deceleration and acceleration lanes.

The most frequent accident type in the study area was rear-end collision. Rear-end collisions accounted for the majority of mainline, expressway ramp, and intersection accidents. Rear-end collisions are commonly due to slippery surface, large number of turning vehicles, poor visibility of signals, inadequate signal timing, inadequate roadway lighting, crossing pedestrians, insufficient signal clearance time and congestion.

Pedestrian accidents accounted for 7.7 percent of the total accidents and bicycle accidents accounted for 2.3 percent of the total accidents. The top pedestrian accident location was the intersection of Flatbush Avenue and Church Avenue.

B. PEDESTRIAN AND BICYCLIST SAFETY

According to the NYSDOT accident data, 515 pedestrians and 153 bicyclists were struck and injured during the three-year period of 1997-1999 within the Southern Brooklyn Study area. While these numbers represent only 10 percent of all reportable collisions during this period, pedestrians and cyclists make up 41 percent of fatal collisions in Southern Brooklyn.

Pedestrian accidents occurred most frequently along Flatbush Avenue, Nostrand Avenue, Church Avenue, Flatlands Avenue, Bay Parkway, and Linden Blvd. The intersection of two of these high pedestrian locations, Flatbush Avenue and Church Avenue, tops the list of the most accident prone intersections for pedestrians (Table V-1). Many locations in the top twenty pedestrian accident locations are associated with important transit nodes or retail corridors.

TABLE V-1
TOP 20 PEDESTRIAN ACCIDENT LOCATIONS BY FREQUENCY (1997-1999)

	Location Description	Injury Accidents	PDO* Accidents	Bicyclist Accidents	Pedestrian Accidents
1	Flatbush Ave. and Church Ave.	76	5	4	22
2	Utica Ave. and Church Ave.	45	6	2	18
3	Ave. U and Flatbush Ave.	91	20	4	18
4	Church Ave. and Ocean Ave.	36	1	2	16
5	Flatlands Ave. and Paerdegat Ave. S	71	9	2	15
6	Flatlands Ave. and Rockaway Pkwy	42	4	2	14
7	Flatlands Ave. and E. 80th St	35	3	1	13
8	Bay Pkwy and 86th St	36	1	0	13
9	4th Ave. and 86th St	25	1	0	12
10	Nostrand Ave. and Church Ave.	34	3	1	12
11	Nostrand Ave. and Flatbush Ave.	41	2	4	12
12	Bay Pkwy and 65th St	48	11	1	12
13	Nostrand Ave. and Kings Hwy	58	5	3	12
14	Mc Donald Ave. and Church Ave.	28	11	0	11
15	Ocean Ave. and Kings Hwy	34	2	2	11
16	Emmons Ave. and Coney Island Ave.	50	5	1	11
17	Coney Island Ave. and Kings Hwy	28	3	2	10
18	8th Ave. and 65th St	30	3	1	10
19	Glenwood Rd. and E. 29th St.	40	2	3	10
20	Flatbush Ave. and Caton Ave.	42	4	0	9

* *Property Damage Only*

Five of the top 10 most accident prone locations for bicyclists were on major streets that feed the Shore Parkway Greenway (Table V-2). One of the top ten bicycle accident locations, the intersection of Caton Avenue and Bedford Avenue, is associated with a bicycle lane and a truck route. Linden Boulevard, the major east-west route in the study area, and Flatbush Avenue are the main accident prone corridors for cyclists.

TABLE V-2
TOP 10 BICYCLE ACCIDENT LOCATIONS BY FREQUENCY (1997-1999)

Location Description	Injury Accidents	PDO* Accidents	Pedestrian Accidents	Bicyclist Accidents
Linden Blvd. and Van Siclen Ave.	60	3	6	5
Cropsey Ave. and Bay Pkwy.	42	6	4	5
Linden Blvd. and Rockaway Ave.	79	12	2	5
Nostrand Ave. and Flatbush Ave.	41	2	12	4
Flatbush Ave. and Church Ave.	76	5	22	4
Linden Blvd. and Rogers Ave.	39	2	8	4
Avenue U and Flatbush Ave.	91	20	18	4
Caton Ave. and Bedford Ave.	38	5	5	4
Glenwood Rd. and E. 29th St.	40	2	10	3
Nostrand Ave. and Kings Hwy.	58	5	12	3

* *Property Damage Only*

C. SOUTHERN BROOKLYN ACCIDENT RATES

Vehicles traveling on high-volume roadways are typically exposed to more conflicts than vehicles traveling on low-volume roadways. Consequently, accident rates are typically calculated to allow for a direct comparison of accident histories between high-volume and low-volume locations. In addition to the frequency of accidents occurring at a particular location, the accident rate calculations also require additional data, such as traffic volumes. The Average Annual Daily Traffic (AADT) volume is typically used for accident rate calculations.

Three types of data were collected for the study, including ATR counts, turning movement counts and vehicle classification counts. Based on AADT estimation methods related to ATR counts and turning movement counts, accident rates for 9 of the 120 high accident locations were estimated. These locations are as follows.

- Bay Parkway @ 65th Street
- Flatbush Avenue @ Church Avenue
- Flatbush Avenue @ Caton Avenue
- Fort Hamilton Parkway @ 65th Street
- Fountain Avenue @ Linden Boulevard
- Ocean Avenue @ Kings Highway
- Rockaway Parkway @ Flatlands Avenue
- Rockaway Parkway @ Seaview Avenue
- Utica Avenue @ Church Avenue

Estimating the accident rates at the other high accident locations could not be performed due to lack of traffic volume data. Table V-3 shows the accident rates at the nine intersections, for which data were available, compared to New York State statewide average accident rates for similar intersection. As shown in Figure V-1, all nine intersections have much higher accident rates than the statewide average. Figure V-2 shows the locations and rates for the nine intersections.

TABLE V-3
SUMMARY OF ACCIDENT RATES BY INTERSECTION

Intersection	Number of Accidents	AADT	Accidents per MEV	Statewide Average*	Percent Difference
Bay Parkway @ 65th Street	117	50,886	2.10	0.42	400%
Flatbush Avenue @ Church Avenue	162	31,734	4.66	0.42	1010%
Flatbush Avenue @ Caton Avenue	121	36,475	3.03	0.42	621%
Fort Hamilton Parkway @ 65th Street	108	49,797	1.98	0.58	241%
Fountain Avenue @ Linden Boulevard	101	91,874	1.00	0.58	73%
Ocean Avenue @ Kings Highway	69	28,347	2.22	0.58	283%
Rockaway Parkway @ Flatlands Avenue	99	40,237	2.25	0.58	287%
Rockaway Parkway @ Seaview Avenue	71	31,872	2.03	0.58	251%
Utica Avenue @ Church Avenue	131	45,479	2.63	0.42	526%

Accidents per MEV (Million Entering Vehicles) = (No. of Accidents x 1,000,000)/No of Years X 365 days x AADT)

** Source: Average Accident Rates of State Highways 1997-1999, Traffic Engineering and Safety Division, NYSDOT*

FIGURE V-1
COMPARISON OF ACCIDENT RATES BY INTERSECTION

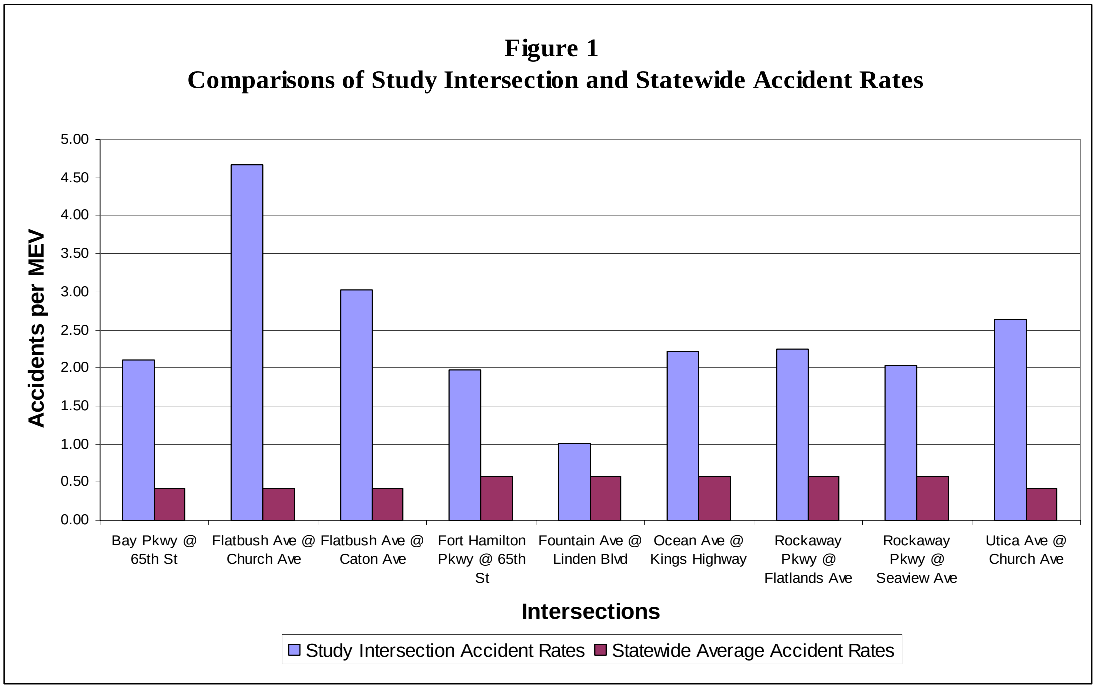
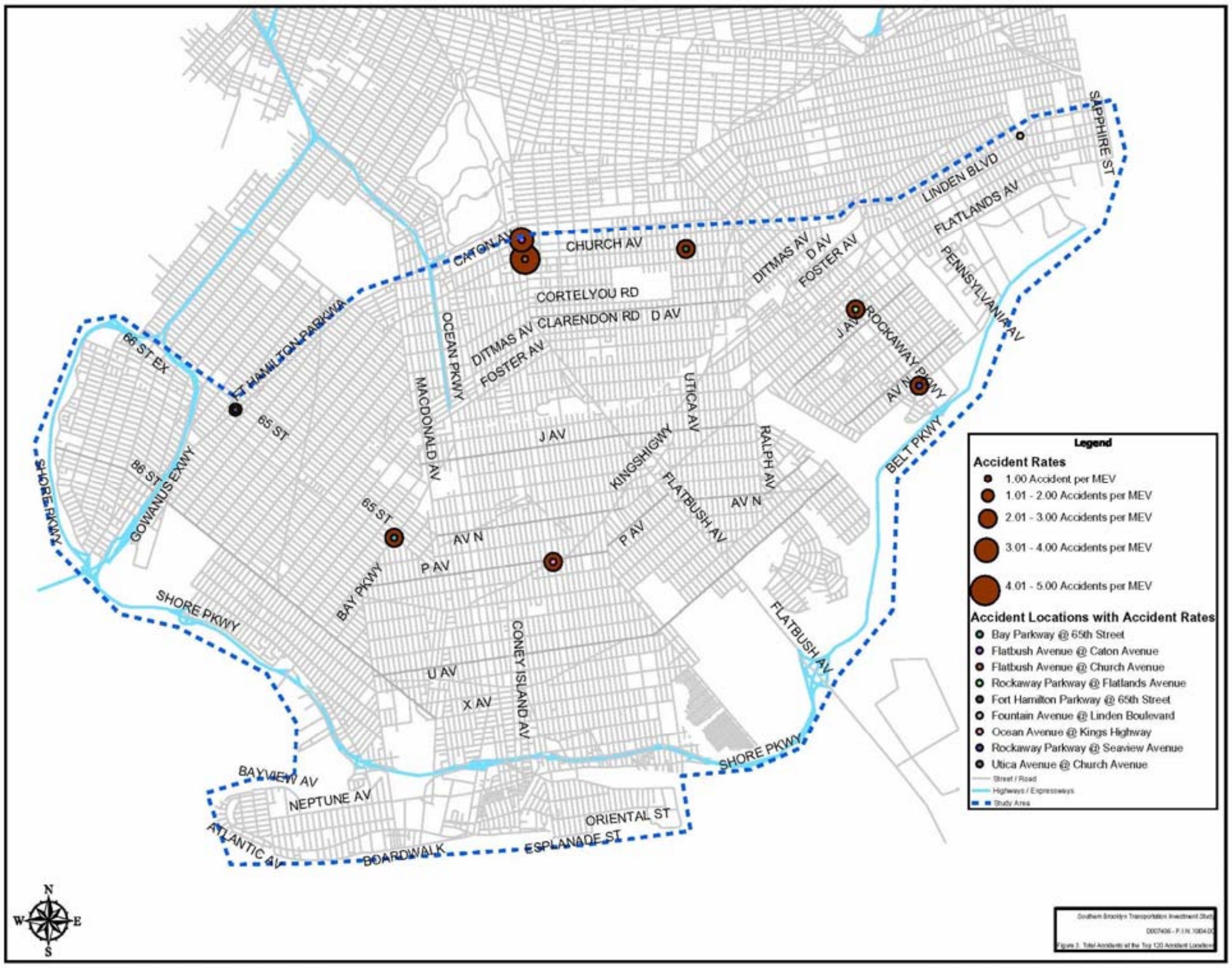


FIGURE V-2
INTERSECTION LOCATIONS AND ACCIDENT RATES



Although the accident rates for these locations are much higher than statewide averages, there are a few caveats. First, the lack of traffic volume data at many locations in Southern Brooklyn means that there may be other locations with higher accident rates than those shown above. Second, it should be kept in mind that NYCDOT and NYSDOT must determine priorities among many high accident locations in all five boroughs, not only the SBTIS study area.

Chapter VI: Pedestrian and Bicycle Issues

A. INTRODUCTION

Issues and concerns relating to pedestrian and bicycle mobility were raised by the public at community meetings held throughout the Southern Brooklyn study area and by members of the study's Local Circulation Subcommittee. Suggested means to address the issues were discussed at meetings of the subcommittee with appropriate issues forwarded and received from other subcommittees. The following sections summarize the results of the work of the subcommittee and the study team.

B. PEDESTRIAN ACCESS TO TRANSIT

There is a need for safer conditions for pedestrians near bus stops and subway stations in the study area. In particular, elevated subway lines present obstacles to pedestrians. Table VI-1 lists pedestrian accidents near subway stations in the study area. Based on the locations listed in the table, pedestrian routes to the following subway stations and intermodal hubs should be considered priority locations for improvement:

- Church Avenue on the Q Line
- Canarsie on the L line
- Bay Parkway on the M, D Lines
- Church Avenue on the 2, 5 Lines
- 86th Street on the R Line

The issue of subway access is being addressed by the joint NYC DOT/DCP Subway/Sidewalk Interface project at two subway stations within the study area on the Brighton Line – the Sheepshead Bay and Kings Highway stations. Proposed interventions in the context of the SBTIS include the recommendations that emerge from that study as well as expanding the Subway/Sidewalk study to include additional Southern Brooklyn subway stations and to include major bus stops, reflecting much of the area's dependency on bus travel. Access to transit should consider wider sidewalks and medians, bus neckdowns under elevated stations, changes to street directions or curbside parking regulations, signal timing adjustments, lighting, streetscape enhancements, and improved wayfinding markers and signs. Potential transit improvements or services that emerge from this and other studies should incorporate pedestrian access plans from the outset.

TABLE VI-1
PEDESTRIAN ACCIDENTS NEAR SUBWAY STATIONS IN SOUTHERN BROOKLYN*

Number of Pedestrian Accidents	Intersection		Closest Subway Station	Bus Routes	2000 Annual Subway Station Ridership	
22	Flatbush Ave.	Church Ave.	Church Ave (B,Q)	B41, B35	4,930,357	Busiest in study area
16	Ocean Ave.	Church Ave.	Church Ave (B,Q)	B35	4,930,357	Busiest in study area
14	Flatlands Ave.	Rockaway Parkway	Rockaway Pkwy-Canarsie(L)	B42, B6, B60, B82, B103	2,873,821	Busiest on line
13	Bay Parkway	86th St.	Bay Pkwy (M, W)	B1, B6, B82	n/a	
12	Nostrand Ave.	Church Ave.	Church Ave (2,5)	B35, B44	2,999,614	2nd busiest on line
12	4th Ave.	86th Street	86 Street (R)	B16, B64, B79, S93, S53, S79	2,435,039	Busiest on line
12	Bay Parkway	65th Street	Bay Pkwy (N)	B6	1,156,255	Busiest on line
12	Flatbush Ave.	Nostrand Ave.	Flatbush Ave.-Bklyn College (2,5)	Q35, B103, B41, B6, B11, B44	5,499,297	Busiest on line
11	16th Street	Kings Highway	Kings Highway (B,Q),	B7, B82, B100, X29	4,891,156	
11	McDonald Ave.	Church Ave.	Church Ave (F)	B67, B35	2,435,039	Busiest on line
10	Nostrand Ave.	Glenwood Ave.	Flatbush Av-Bklyn College (2,5)	Q35, B103, B41, B6, B11, B44	5,499,297	Busiest on line
10	8th Ave.	65th Street	8th Ave (N)	B70	1,146,251	2nd busiest on line
9	Flatbush Ave.	Caton Ave.	Church Ave (B,Q)	B41	4,930,357	Busiest in study area

**Source: List of top 120 all-mode accident locations, NYSDOT 1997-1999*

1. <u>Safety & Mobility for Pedestrians and Bicyclists On Major Arterials</u>

Pedestrian and bicycle accidents are concentrated along Southern Brooklyn's arterial streets and major collectors, see Tables VI-2 and VI-3. To reduce accident frequency, a number of measures could be employed. Where possible, signal progression could be used to manage the speed of traffic. Expanding the red light camera program on arterials would also address pedestrian safety, though it would require state authorizing legislation. Where excessive street width encourages speeding or presents a barrier to pedestrians, medians could be considered. Other measures to increase pedestrian safety include turn prohibitions, neckdowns at intersections, and Leading Pedestrian Intervals following green signals. Finally, streetscape improvements to areas of pedestrian concentration enhance pedestrian environment and signal to drivers that they are sharing the area with pedestrians.

TABLE VI-2
TOP 20 PEDESTRIAN CRASH LOCATIONS BY FREQUENCY*

Rank	Location	Injury Accidents	PDO** Accidents	Bicyclist Accidents	Pedestrian Accidents
1	Flatbush Ave. & Church Ave.	76	5	4	22
2	Utica Ave. & Church Ave.	45	6	2	18
3	Avenue U & Flatbush Ave.	91	20	4	18
4	Church Ave. & Ocean Ave.	36	1	2	16
5	Flatlands Ave. & Paerdegat Ave.	71	9	2	15
6	Flatlands Ave. & Rockaway Pkwy	42	4	2	14
7	Flatlands Ave. & East 80th Street	35	3	1	13
8	Bay Parkway & 86th Street	36	1	0	13
9	4th Ave. & 86th Street	25	1	0	12
10	Nostrand Ave. & Church Ave.	34	3	1	12
11	Nostrand Ave. & Flatbush Ave.	41	2	4	12
12	Bay Parkway & 65th Street	48	11	1	12
13	Nostrand Ave. & Kings Hwy	58	5	3	12
14	McDonald Ave. & Church Ave.	28	11	0	11
15	Ocean Ave. & Kings Hwy	34	2	2	11
16	Emmons Ave. & Coney Island Ave.	50	5	1	11
17	Coney Island Ave. & Kings Hwy	28	3	2	10
18	8th Ave. & 65th Street	30	3	1	10
19	Glenwood Rd. & East 29th Street	40	2	3	10
20	Flatbush Ave. & Caton Ave.	42	4	0	9

**Source: List of top 120 all-mode accident locations, NYSDOT 1997-1999*
*** Property Damage Only*

TABLE VI-3
TOP 10 BICYCLE CRASH LOCATIONS BY FREQUENCY*

Location	Injury Accidents	PDO** Accidents	Pedestrian Accidents	Bicyclist Accidents
Linden Blvd. & Van Siclen Ave.	60	3	6	5
Cropsey Ave. & Bay Parkway	42	6	4	5
Linden Blvd. & Rockaway Ave.	79	12	2	5
Nostrand Ave. & Flatbush Ave.	41	2	12	4
FLATBUSH AVE. & CHURCH AVE.	76	5	22	4
Linden Blvd. & Rogers Ave.	39	2	8	4
Avenue U & Flatbush Ave.	91	20	18	4
Caton Ave. & Bedford Ave.	38	5	5	4
Glenwood Rd. & East29th Street	40	2	10	3
Nostrand Ave. & Kings Hwy	58	5	12	3

**Source: List of top 120 all-mode accident locations, NYSDOT 1997-1999*
*** Property Damage Only*

2. Safety Issues Relating to Speeding and Through Traffic on Neighborhood Streets

At community meetings, concerns were expressed about speeding and through traffic in residential neighborhoods. Traffic concerns around schools were felt to warrant extra attention. Potential alternatives to address these concerns that could be investigated are the establishment of pilot traffic calming programs and reviewing and updating Safe Routes to School programs in Southern Brooklyn neighborhoods.

A first step would be to identify neighborhoods where traffic is a concern and traffic calming would be welcome. In those areas, one needs to apply a neighborhood-wide approach to reduce speeds and mitigate negative impacts of traffic and reduce spillover from street to street. Residents should participate in developing and evaluating their options to achieve consensus on benefits and trade offs.

The Safe Routes to School program applies a neighborhood traffic calming approach to improve the safety of the streets along walking routes to school. Specifically, schools may be prioritized for treatments depending on crash history, existing deficiencies and community concerns. Parents and teachers should participate in developing and evaluating options to achieve consensus on benefits and trade offs.

3. Truck Impacts on Residents Living on and off of Truck Routes

Southern Brooklyn residents living along or close to designated truck routes report elevated levels of noise, pollution, vibration and traffic safety concerns. Residents living on streets that are not designated by truck routes, but whose streets are routinely used by trucks as short cuts, share these concerns. This is a city-wide issue, and partly to address this, the New York City Department of Transportation is currently studying its truck route network throughout the city. This study will study such issues as truck route enforcement and truck route changes which should reduce the conflict between trucks and neighborhoods, which includes bicycles and pedestrians.

4. Bicycle Parking at Transit

NYC Transit allows bicycles aboard subway cars as long as the cars are not too crowded. However, there appears to a demand for secure bicycle parking at transit stations in Southern Brooklyn. It is easier for many cyclists to ride to the station and park than it is to bring bikes on a crowded train. Bicyclists are uncomfortable leaving their bikes unattended at transit stations all day because they are afraid they will be stolen. Linking cycling and transit can improve the utility and accessibility of both modes, especially as much of Southern Brooklyn is too far from New York City’s major centers of employment for most potential cyclists.

This issue could be addressed by providing secure bicycle parking near transit. Appropriately designed lockers can provide secure bike parking where there are a variety of potential users. Where potential users are expected to be a limited and regular set, or where there are specific design or aesthetic considerations, bicycle lock-ups are another solution. These offer bicycle racks inside secure enclosures, usually designed and built for the site. The following locations for bicycle facilities were suggested at community and subcommittee meetings:

- Flatbush Avenue/ Brooklyn College station on the 2 Line
- Sheepshead Bay station on the Q Line
- Coney Island/Stillwell Avenue terminal
- Bay Ridge Avenue on the R Line

5. Bicycle & Pedestrian Access to Shore Parkway Path and Other Recreational Facilities

Residents of many neighborhoods adjacent to the Shore Parkway have a hard time accessing the path and beaches by transit, foot or bicycle because conditions along the way are unsafe or inhospitable or because the access points are too far apart. Five of the top ten most accident prone locations for bicyclists were on major streets that feed the Shore Parkway Greenway.

A possible solution to address these gaps and safety concerns would be to connect local streets in neighborhoods such as Canarsie, Bergen Beach and East New York to the greenway and its amenities with short connector paths on Parkway land adjacent to inlets. On-street connections to Shore Parkway Path could also be improved by addressing route and intersection safety for cyclists and pedestrians. These include areas where the following streets approach the greenway: Rockaway Avenue, Pennsylvania Avenue, Bay Parkway, Ocean Parkway south, Neptune Avenue, and Flatbush Avenue south.

Another issue is the inadequacy of on-street connections between east and west segments of Shore Parkway Path and between Ocean Parkway and Shore Parkway. These routes are insufficient and feel dangerous. A permanent off street or low traffic connector between the east and west segments of Shore Parkway Path could address this issue.

6. East-West Connections for Cyclists

There are some excellent on-street and off-street bicycle facilities in the study area. However, there is a deficit of east-west routes for cyclists in the middle of study area, and the eastern portion of study area is generally underserved by the bicycle network. A potential alternative is to upgrade existing recommended bicycle routes, such as the Farragut Road and Cozine Avenue corridors, by striping bike lanes or wide curb lanes. Additional bike routes in eastern portion of study area may need to be identified for possible inclusion in the NYC Cycling map and subsequent implementation.

7. Gaps in the Pedestrian and Bicycle Network

Southern Brooklyn has a number of excellent dual use recreation/transportation facilities. However, their utility is limited by their lack of connectivity. Large gaps exist between Southern Brooklyn’s off-street bicycle and pedestrian networks, and transitions between paths and streets are confusing and can be dangerous.

Several major gaps were identified at community and subcommittee meetings. East and west portions of Shore Parkway Path are disconnected from each other, the beaches and other recreational destinations. Ocean Parkway Paths are disconnected from Shore Parkway Path. Finally, there is no access for cyclists and pedestrians between Brooklyn and Staten Island. The Verrazano-Narrows Bridge lacks access for pedestrians and bicyclists.

A short term measure to address gaps is to improve wayfinding for bike routes, including wayfinding markers for major Southern Brooklyn destinations such as Keyspan Park, beaches, Cyclone, boardwalk and Brighton Beach shopping district. In the longer term, the gaps discussed above could be addressed as follows:

- Connect East and West Shore Parkway Paths with upgraded facilities. Wherever possible, find off-street accommodation for pedestrians and bicyclists.
- Reconstruct the southern end of Ocean Parkway and minimize conflict with Shore Parkway ramps.
- Consider plans for bicycle and pedestrian access to the Verrazano-Narrows Bridge in future major rehabilitation work.