APPENDIX B
TRIP GENERATION CHARACTERISTICS

M E M O R A N D U M

To: Project Files

From: PHA

Project: Brooklyn Bridge Park (PHA #0324)

Re: Brooklyn Bridge Park - General Park Trip Generation Characteristics

Date: March 21, 2005

1. Introduction and Summary

The following memorandum describes the forecast methodology for the active and passive park components of the proposed 70-acre Brooklyn Bridge Park. This forecasting was based primarily on surveys of the Brooklyn Heights Promenade as well as from the Hudson River Park EIS. The results of these studies are included in this memorandum. This forecast only considers typical park usage and does not consider special park events that may periodically occur, such as concerts, or a marina, which may generate additional park trips.

As described in the following memorandum, the proposed park is expected to generate approximately 27,000 trips during a typical summer Sunday and 15,000 trips during a typical summer weekday. Brooklyn Heights Promenade park user survey data was utilized to determine the modal split of park users based on distance to the park. As shown, the number of walk trips are expected to decrease as the distance from the park increases, while the number of auto trips are expected to increase as the distance from the park increases. Based on the aggregate modal split for park users, approximately 53% of park trips are expected to be walk oriented, 21% auto/taxi oriented, and 26% transit oriented (subway, bus and water taxi trips).

Parking demand was also determined for the park based on the total number of auto trips generated by the park. By assuming that the Brooklyn Bridge Park will have a destination orientation similar to the Riverbank State Park facility, a 41% parking accumulation rate was assumed for Brooklyn Bridge Park. With consideration for park staff and maintenance workers, the park would require 233 spaces during summer weekdays and 420 spaces during a summer Sunday.

2. Park User Surveys

As part of the Brooklyn Bridge Park data collection effort, selected park user data was collected at the Brooklyn Heights Promenade Park and at Fulton Ferry Landing. The Promenade and

Fulton Ferry Landing locations were chosen due to their proximity to the proposed Brooklyn Bridge Park and due to the unique features of these existing facilities. Both the Promenade and Fulton Ferry Landing have views of the waterfront and the lower Manhattan skyline, which is expected to be one of the draws to the future Brooklyn Bridge Park. Figure 1 shows the locations of these facilities and the locations of the user surveys and gate counts. The Promenade user survey provides a level of guidance for the expected travel patterns for the proposed Brooklyn Bridge Park. The Fulton Ferry Landing visitors were not park oriented uses and the data from that facility is not used herein. Studies at the Riverbank State Park and North Park in Manhattan show similar park user characteristics to those found for the Promenade and Fulton Ferry parks. Therefore, the travel patterns for the proposed park are not expected to be radically different from other urban waterfront parks surveyed in Manhattan.

Park user data was collected on Sunday, August 3, 2003 from 12:00 PM to 2:30 PM. Interviews and gate counts were conducted at the Promenade during this period. Interview questions focused on transportation related topics, including: trip origin, mode of transportation, group size (visiting park), household size and number of children. Summer data was collected in order to better capture the peak usage characteristics of these parks. Appendix A shows the interview form that was used in the survey. A total of 256 interviews were collected at the Promenade. Gate counts were collected concurrently with the park interviews in order to identify the total user population at the park.

In analyzing the interview data, it was assumed that all members of an interviewed group arrived from the same origin and via the same mode of transportation. Group data was therefore used to determine expected origin and mode of transportation statistics for the park. Accounting for group size, a total of 446 individuals were surveyed at the Promenade.
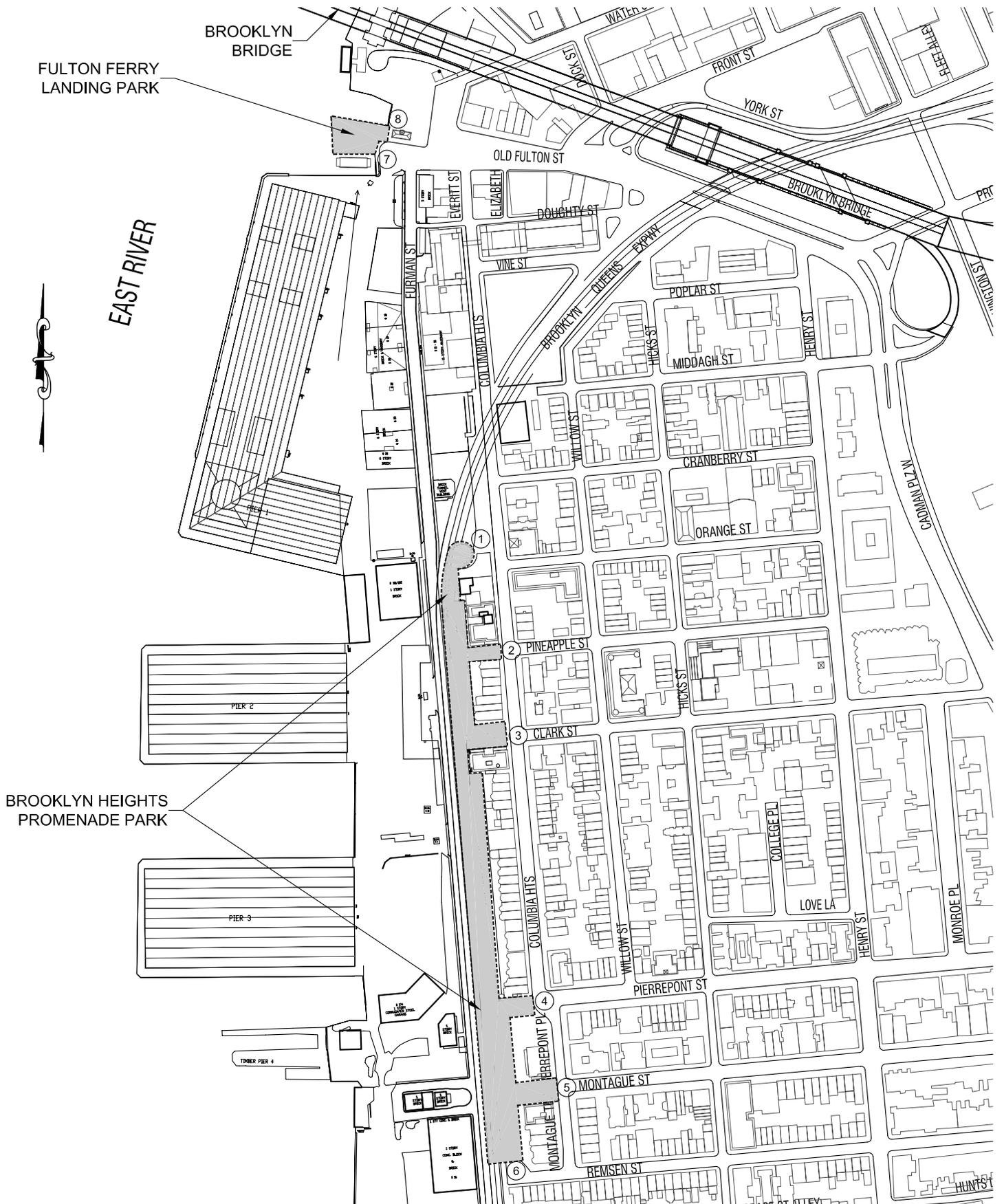
Gate Counts

In addition to the user surveys that were conducted at the Promenade entrances, gate counts were also performed. These counts were performed at the locations identified in Figure 1. At the Promenade, 1,226 individuals were counted entering the park during the data collection period.

Trip Origins

Table 1 shows the trip origin characteristics that were collected in the user study at the Promenade. As shown, the vast majority of trips to these facilities are expected to originate in Brooklyn; 71.3% of the surveyed users came from Brooklyn, while 10.8% came from Manhattan and 17.9% came from other regions.

As part of the planning for the future Hudson River Park in Manhattan, similar surveys were conducted at Riverbank State Park and at North Park in Manhattan. Table 1 also includes the results of these surveys. As shown in Table 1, the principal origin of each park is its borough, however, the closest neighboring borough (Brooklyn for North Park and the Bronx for Riverbank State Park) also contribute to the user population of these major parks.

BROOKLYN
BRIDGE

FULTON FERRY
LANDING PARK

EAST RIVER

OLD FULTON ST

EVERIT ST

ELIZABETH

DOUGHTY ST

VINE ST

FURMAN ST

COLUMBIA HTS

POPLAR ST

BROOKLYN QUEENS EXPWY

HICKS ST

MIDDAGH ST

HENRY ST

WILLOW ST

CRANBERRY ST

CADMAN PLZ W

ORANGE ST

PIER 1

PINEAPPLE ST

HICKS ST

CLARK ST

BROOKLYN HEIGHTS
PROMENADE PARK

PIER 2

COLLEGE PL

PIER 3

LOVE LA

HENRY ST

MONROE PL

WILLOW ST

COLUMBIA HTS

PIERREPONT ST

TIMBER PIER 4

PIERREPONT PL

MONTAGUE ST

MONTAGUE ST

REMSEN ST

Legend:

SURVEYED PARK   (X) INTERVIEW/COUNT LOCATION

Table 1:
Trip Origin

Origin	Promenade[1]	Riverbank[2]	North Park[2]
Brooklyn	71.3%	2%	7%
Manhattan	10.8%	77%	84%
Bronx	0%	15%	1%
Queens	2.5%	5%	3%
Staten Island	0%	0%	0%
New Jersey	2.9%	0%	4%
Other*	12.6%	1%	1%
TOTAL	100%	100%	100%

Notes:
* Other includes tourist population and visitors from Long Island, Connecticut
and Westchester for Promenade user survey.
Source:
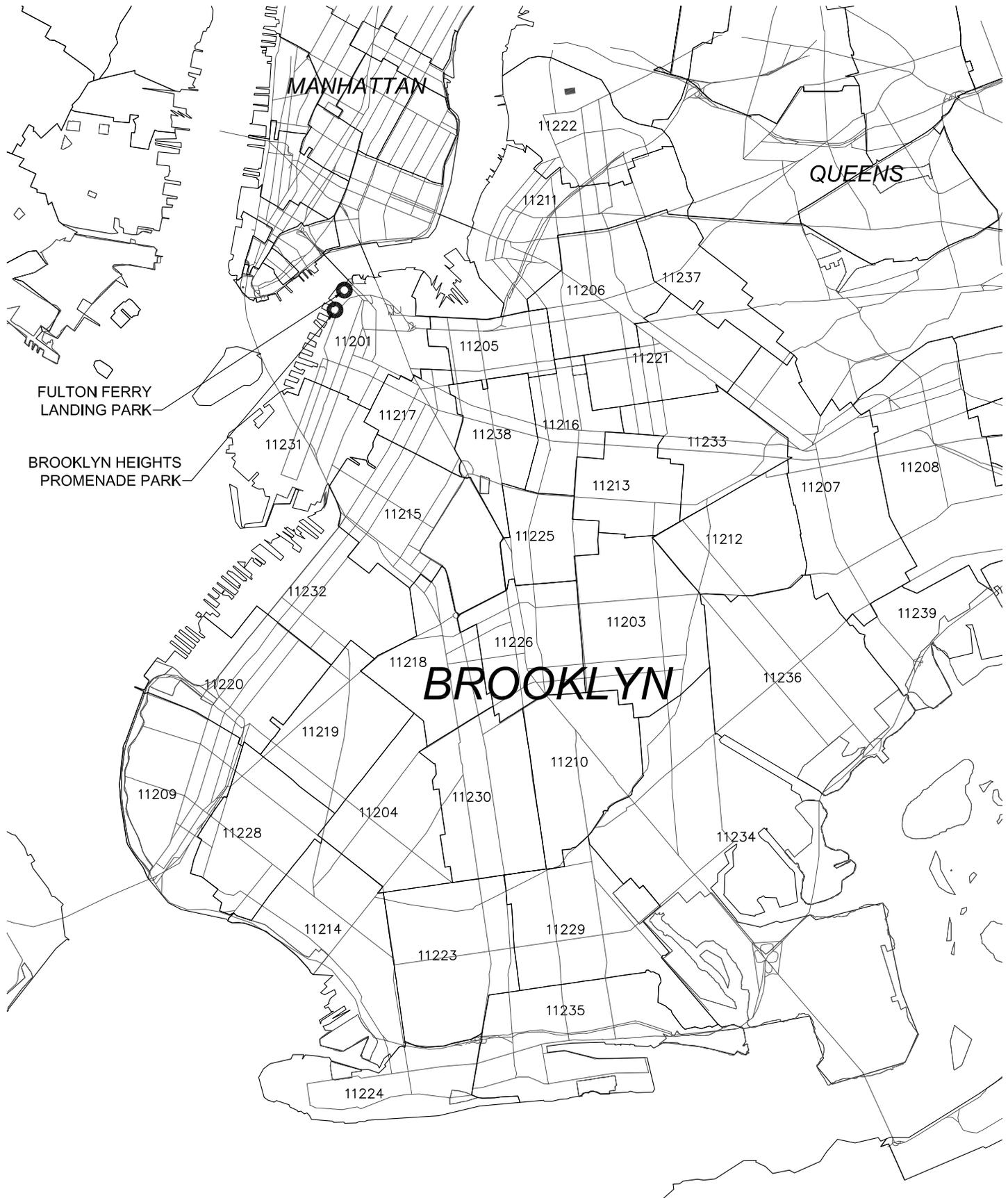1. Park User Survey, PHA, 2003
2. Hudson River Park EIS

Brooklyn Trip Origins

In order to better correlate the expected relationship between park users and proximity to the park, interviewees who began their trip in Brooklyn were also asked to identify the nearest street intersection to their trip origin. The corresponding zip code was then determined for each interviewee. Figure 2 shows the Brooklyn zip codes in relation to the surveyed parks.

Table 2 shows the breakdown in zip code origins for the surveyed park. The zip codes were then arranged based on proximity to the surveyed park. As expected from studies of regional parks, the majority of Brooklyn based trips originated within the zip codes closest to the surveyed parks. At the Promenade, 49.8% of the surveyed park users originated within the 11201 zip code, which includes the Promenade facility and is mostly within walking distance. In addition, approximately 8.7% of park users began their trips within the surrounding 11217, 11205 and 11231 zip codes (located within 2 miles of the surveyed park). Therefore, approximately 58.5% of the total 70.9% Brooklyn based trips originated within 2 miles of the surveyed park.

Figures 3 and 4 show the percentage of park users based on proximity to the park that were found at the Riverbank and North Parks, respectively. As shown, the greatest percentage of park users was found in those areas closest to these parks. Based on the Promenade survey data, it is expected that similar user patterns will be present for the Brooklyn Bridge Park.

MANHATTAN

QUEENS

BROOKLYN

FULTON FERRY
LANDING PARK

BROOKLYN HEIGHTS
PROMENADE PARK

11222
11211
11206
11237
11201
11205
11221
11217
11238
11216
11233
11208
11231
11215
11213
11207
11225
11212
11232
11203
11239
11226
11218
11236
11220
11210
11219
11209
11230
11204
11234
11228
11214
11229
11223
11235
11224

Table 2:
Brooklyn Trip Origins

| Zip Code	Distance from Zip Code to Park (Miles)	PROMENADE
11201	0.2	49.8%
11217	1.5	2.9%
11205	1.7	1.8%
11231	1.8	4.0%
11238	2.2	0.9%
11211	2.4	0.7%
11215	2.5	1.3%
11216	2.8	0.0%
11222	3.1	1.1%
11225	3.3	1.3%
11221	3.5	0.7%
11237	3.6	0.4%
11213	3.6	0.9%
11220	4.1	0.0%
11218	4.1	0.2%
11204	5.5	0.2%
11230	5.5	1.1%
11209	5.6	0.7%
11207	5.7	0.0%
11208	6.5	0.2%
11214	6.8	1.3%
11229	7.1	0.2%
11239	7.2	0.7%
11234	7.4	0.2%
	Total	70.9%

SOURCE: BROOKLYN HEIGHTS PROMENADE,

PARK USER SURVEY, PHA, 2003.

FIGURE 3: Riverbank Park
Percent of Users by Distance
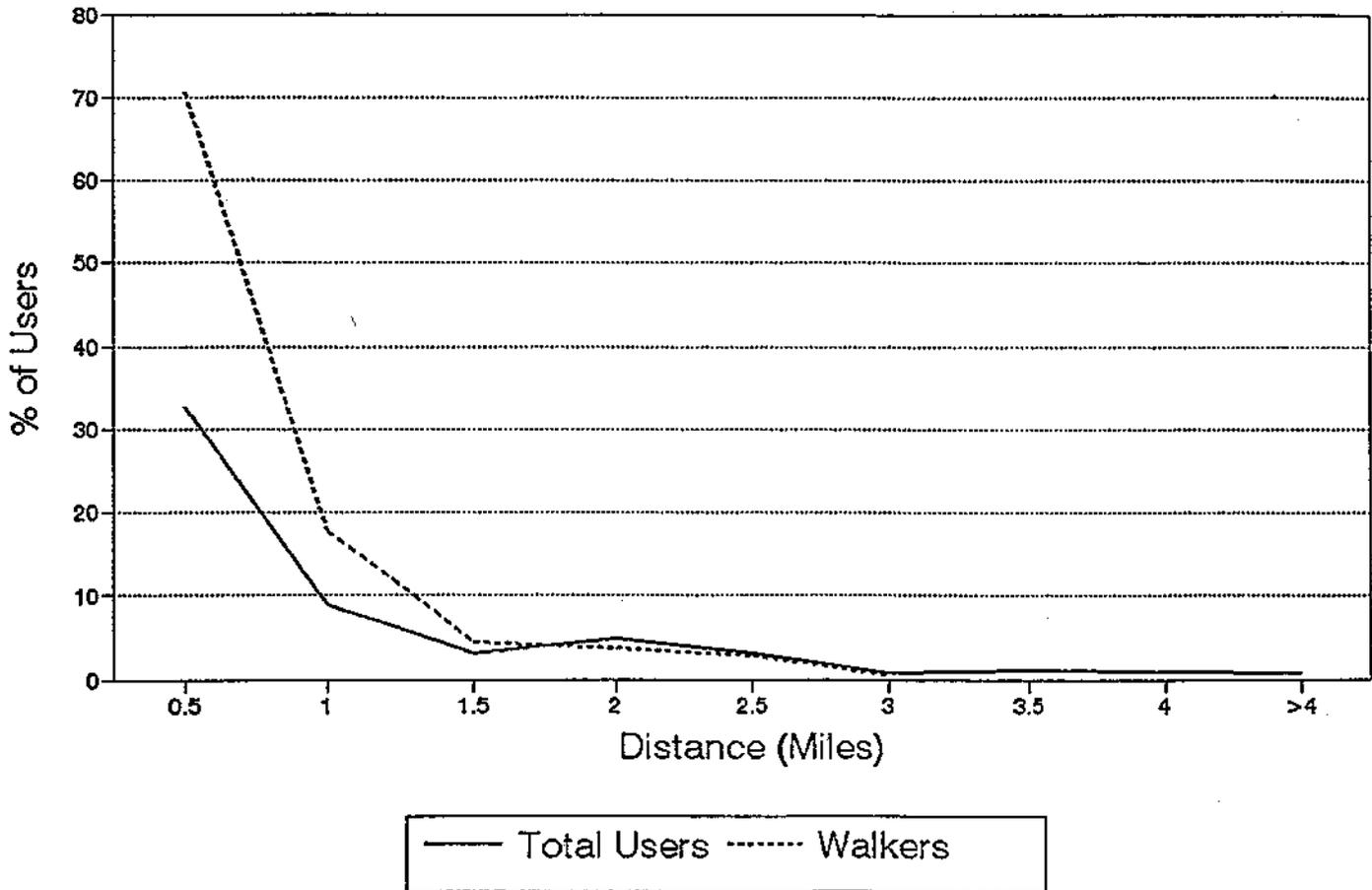
FIGURE 4: North Park
Percent of Users by Distance

Legend: —— Total Users ······· Walkers
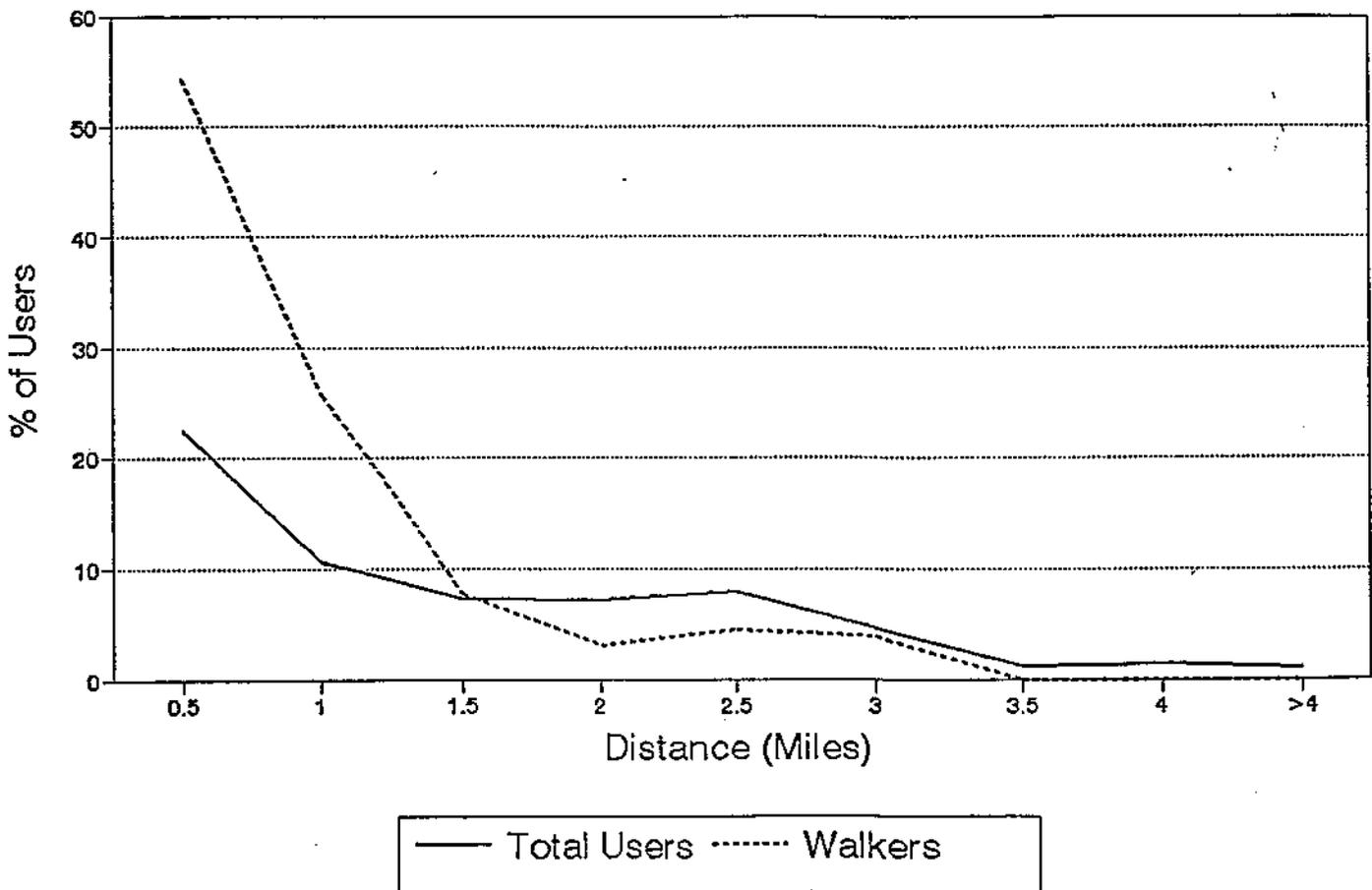
Source: Hudson River
Park EIS

Modal Split

As part of the user survey, park interviewees were asked about their means of transportation to the park. This data was broken down into the following categories: walk, run/jog, bike, skate, bus, subway, auto, taxi, and water taxi. Table 3 shows the modal splits for the Promenade, as well as the Riverbank and North Park facilities.

As shown in Table 3, at the Promenade, 58.8% of interviewees walked/ran/jogged to the park, 1.6% biked/skated to the park, 16.0% came by bus/subway/water taxi to the park and 23.5% drove/came by taxi to the park.

Table 3:
Mode of Transportation

| Origin	Promenade[1]	Riverbank[2]	North Park[2]
Walk/Run/Jog	58.8%	50%	39%
Bike	1.4%	4%	3%
Skate	0.2%	1%	6%
Bus	2.7%	11%	2%
Subway	13.3%	8%	17%
Auto	21.5%	24%	23%
Taxi	2.0%	2%	8%
Water Taxi (Ferry)	0.0%	0%	3%
TOTAL	100%	100%	100%

Source:
1. Park User Survey, PHA, 2003
2. Hudson River Park EIS

Modal Split by Distance

Modal split data from the Brooklyn Heights Promenade park user survey was grouped by distance from the park in order to provide a distribution of modal split consistent with the trip generation model, which is discussed in the following sections of the memorandum. Figure 5 shows a graph of modal split values based on distance from the proposed park. As shown, the number of walk trips are expected to decrease as the distance from the park increases, while the number of auto trips are expected to increase as the distance from the park increases. For example, at a 1/4 mile distance from the park, 100% of park trips are expected to be walk oriented (including run, bike/skate trips), while at 1-1/2 miles from the park, 54% of park trips are expected to be walk oriented, 18% auto and 28% transit (bus and subway).

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FIGURE 5: PROMENADE USER SURVEY DATA-MODE SPLIT DISTRIBUTION

SOURCE: BROOKLYN HEIGHTS PROMENADE, PARK USER SURVEY, PHA, 2003
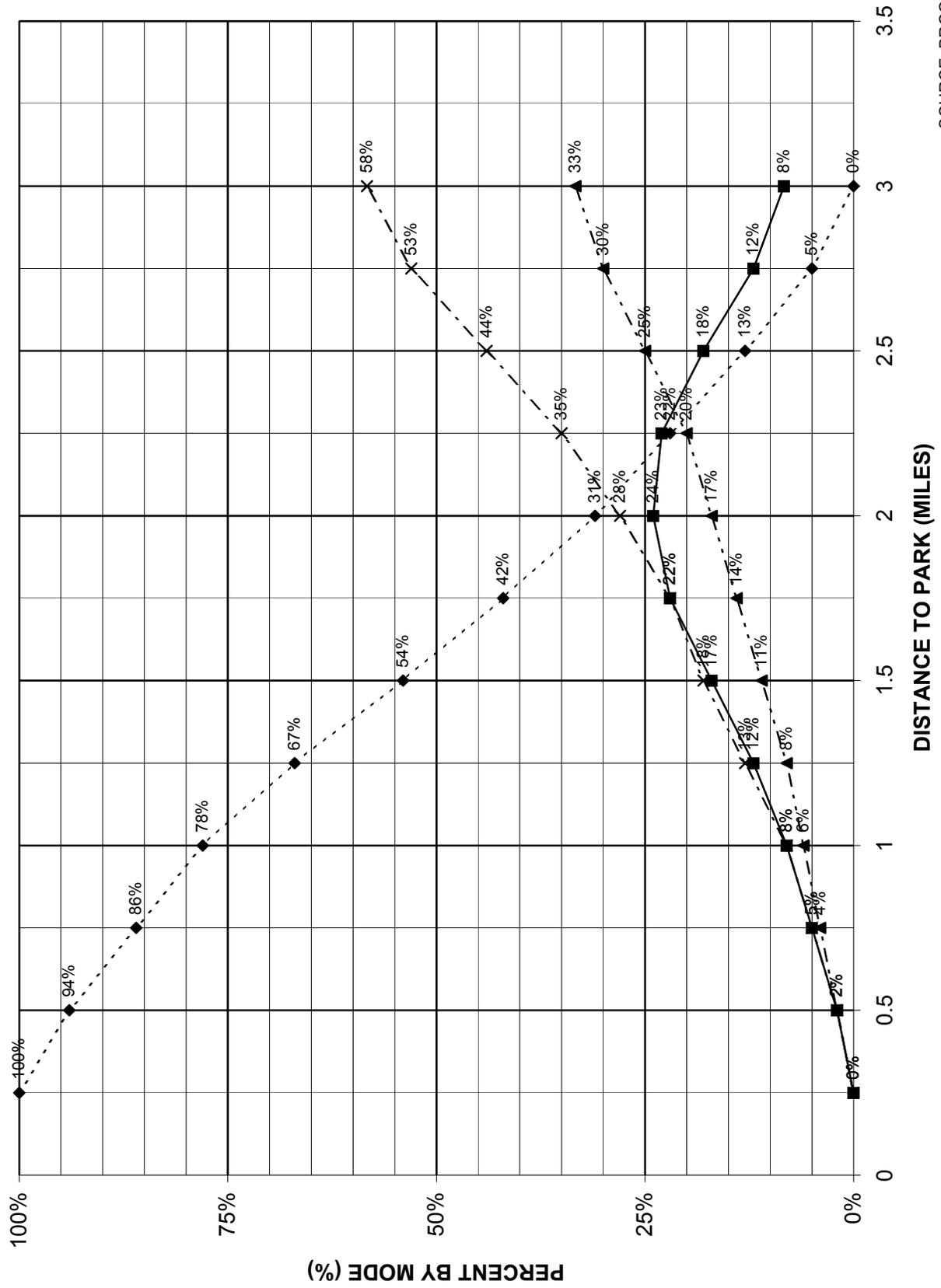
Auto Occupancy

Based on park user data collected at the Brooklyn Heights Promenade, it was determined that the existing auto occupancy at this park was 2.9 persons per vehicle for auto trips and 3.0 persons per vehicle for taxi trips.

3. Trip Generation

Trip generation for the proposed park component of the project differs from the various other trip generation components of the park. This is due to the fact that the park component is assumed to be an unconstrained trip generator. Typical trip generation involves a calculation of total trips based on the size of the proposed facility and the use of the proposed facility. However, as discussed in the Hudson River Park EIS (see Appendix B: Technical Memorandum #2), the expected trips generated by a regional park, such as the proposed Brooklyn Bridge Park, are based instead on the distance to the park and the population densities surrounding the park. Please note that these park trip forecasts only consider typical (i.e., regular) park usage and do not consider unique park events (concerts, etc.) that may generate additional concentrations of park trips. Using the Hudson River Park methodology, the following model was utilized for determining the number of park users expected to use Brooklyn Bridge Park:

Equation 1:

$$Ui = 0.23 + 20.63 \times \frac{1}{D_i^{1.15}}$$

where: *U_i=daily Sunday (10 AM - 6 PM) park users per 1,000 population in census tract i.*
   *D_i=distance (miles) from park entrance to centroid of census tract.*

Figure 6 shows the plot of the calculated distribution of park trips generated by the proposed project based on this model. As shown, the number of park users decreases as distance from the park increases. For example, at a 1/4 mile distance from the park, 102 users per 1000 (approximately 10%) are expected to utilize the proposed park, while at a 3 mile distance from the park, 6 users per 1000 (approximately 0.6%) are expected to utilize the proposed park. After 3 miles, the number of additional trips generated by the park are assumed to be minor contributors to the total number of park trips. To account for this population, it was assumed that an additional 5% of the total park trips would originate beyond the 3 mile boundary.

Please note the similarities between Figure 6 and Figures 3 and 4, which show the percent of park users by distance at the Riverbank and North River parks, respectively. The model developed for the Hudson River Park was based on data collected at these facilities and all three figures show a similar decrease in park users with increased distance to the facility.

4. Trip Distribution

Using 2000 census tract information for Brooklyn and lower Manhattan, a population distribution surrounding Brooklyn Bridge Park was determined based on 1/4 mile increments

FIGURE 6: BROOKLYN BRIDGE PARK TRIP GENERATION

DISTANCE TO PARK (MILES)

USERS PER 1000 POPULATION

PARK USERS
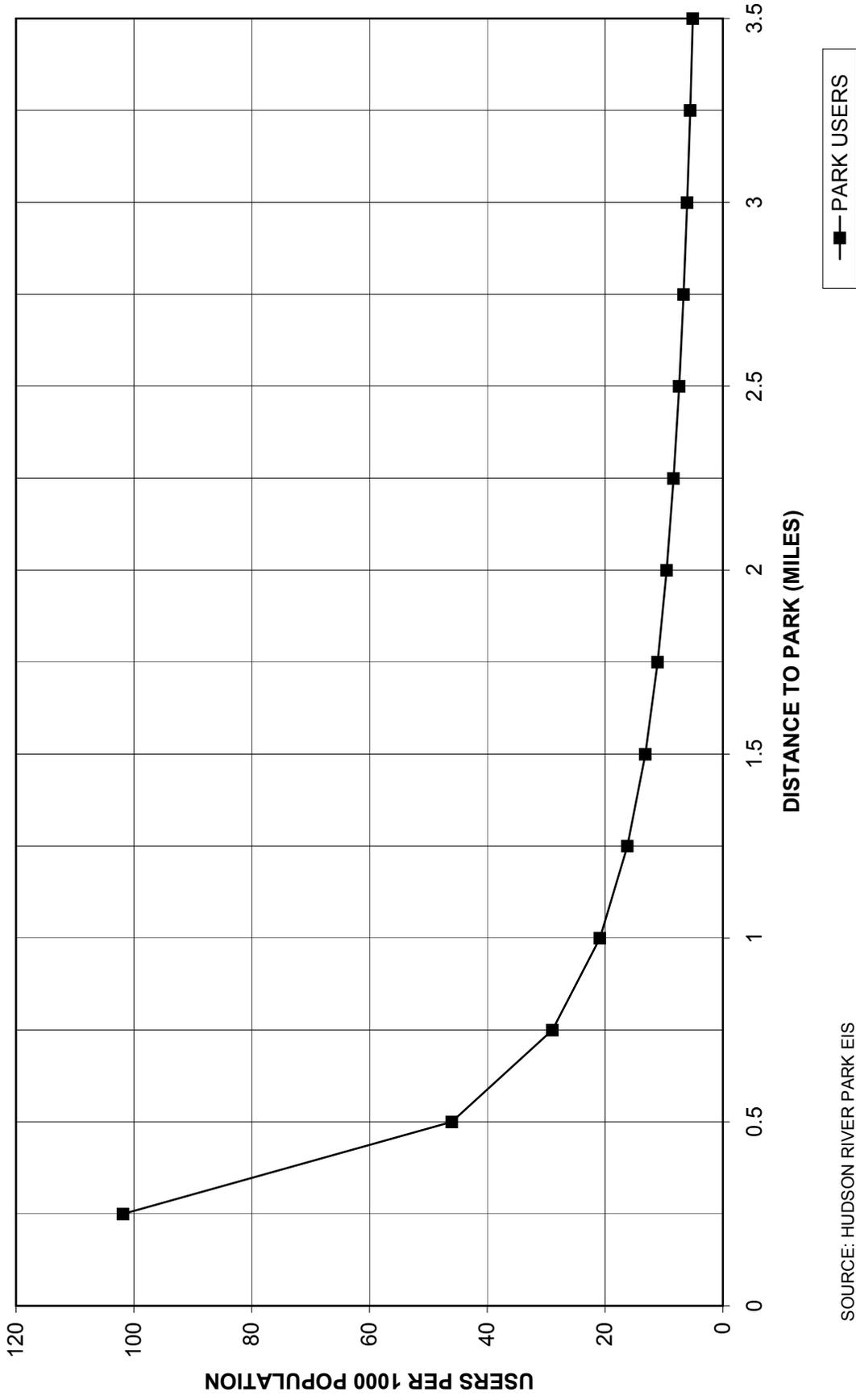
SOURCE: HUDSON RIVER PARK EIS

from the park. These populations were then grown by 0.5% per year to 2012 to determine future population densities surrounding the project site. Table 4 shows the estimated future populations surrounding Brooklyn Bridge Park. The above park user model was then applied to this population distribution to determine the expected number of park trips based on proximity to the park. Please note that the modal split for the population beyond the 3 mile boundary was assumed to be the same as that for the 3 mile population (see Figure 5).

Based on the park user survey data that was collected at the Brooklyn Heights Promenade, over 70% of park trips are expected to originate in Brooklyn. Based on this survey and surveys performed for the Hudson River Park, it is expected that approximately 75% of Brooklyn Bridge Park trips will originate in Brooklyn. In order to be consistent with this distribution, a factor was applied to the Manhattan population densities to reduce the overall number of trips expected to originate from these Manhattan census tracts. It should be noted that for the purposes of trip forecasting, these Manhattan populations also represent the various other non-Brooklyn trip origins for the future park.

The distribution of populations surrounding the project site (see Table 4) were then applied to the trip generation model shown in Figure 6. This provided a total number of daily Sunday park users (10 AM to 6 PM) generated by the proposed park during a typical summer Sunday. The total number of trips generated by the park is twice this number to account for both inbound and outbound trips generated by the proposed facility. This number was also adjusted to reflect the total 24 hour trips generated by the park (i.e., not only the 10 AM to 6 PM period). Based on this forecasting, it is expected that the proposed park will generate approximately 27,000 daily trips on a summer Sunday. Based on the Hudson River Park EIS, it was determined that summer weekday users generated about 56% of summer Sunday demand, while summer Saturday users generated approximately 68% of summer Sunday demand.

5. Travel Demand Forecast

The modal split distribution shown in Figure 5 was then applied to the park user model described in Equation 1 to determine the overall modal split characteristics of the proposed park. This surveyed modal split was then slightly adjusted to account for the limited taxi and water taxi trips generated by the proposed park in the future (approximately 1% and 3% of the total trips, respectively).

Table 5 shows the forecasting assumptions that were applied to Brooklyn Bridge Park. This table also shows the aggregate modal split distribution for the park. As shown, the proposed park is expected to generate approximately 27,000 trips during a typical summer Sunday and 15,000 trips during a typical summer weekday. During a typical summer Sunday, approximately 14,300 (53%) of these trips are expected to be walk oriented, while approximately 5,400 (20%) are expected to be auto oriented. Based on the auto occupancy data collected during the Promenade user survey (2.9 persons per auto), 1,034 autos would be generated by the park on a summer weekday, while 1,862 autos would be generated by the park on a summer Sunday (24 hour total).

Table 6 shows the expected peak hour park trips generated by the Brooklyn Bridge Park using

TABLE 4:
POPULATION TABLE

	ESTIMATED FUTURE POPULATIONS[1]	
DISTANCE TO PARK[2]	**BROOKLYN**	**MANHATTAN[3]**
0.00 - 0.25 MILES	16029	0
0.25 - 0.50 MILES	15255	21411
0.50 - 0.75 MILES	14665	34264
0.75 - 1.00 MILES	26765	44659
1.00 - 1.25 MILES	36106	33709
1.25 - 1.50 MILES	44003	29826
1.50 - 1.75 MILES	42643	37132
1.75 - 2.00 MILES	68468	38798
2.00 - 2.25 MILES	60526	32205
2.25 - 2.50 MILES	57178	32522
2.50 - 2.75 MILES	97580	31239
2.75 - 3.00 MILES	56767	19417

NOTES:

1. Estimated future populations are based on 2000 Census Tract data grown by 0.5% per year to 2012.

2. Census Tract populations were grouped based on distance to the park for estimating park trip generation.

3. Manhattan 'Estimated Future Populations' were adjusted (unadjusted populations are shown above) based on 2003 PHA Park User Survey data collected.
This adjustment assumed that 75% of the park user trips would originate in Brooklyn.

TABLE 5:
BROOKLYN BRIDGE PARK
TRAVEL DEMAND FORECAST ASSUMPTIONS

GENERAL PARK USE

		WEEKDAY		SUNDAY	
DAILY PARK VISITORS:		15,000		27,000	
HOURLY DISTRIBUTION (1):					
	MD:	17%		15%	
	PM:	14%			
DIRECTIONAL SPLIT (IN/OUT) (1):					
	MD:	50% /	50%	55% /	45%
	PM:	45% /	55%		
VEHICLE OCCUPANCY (2):					
	AUTO:	2.9		2.9	
	TAXI:	3.0		3.0	
MODAL SPLIT:		*VARIES BY DISTANCE (SEE FIGURE 5)*			

		WEEKDAY		SUNDAY	
TOTAL PERSON TRIPS BY MODE:					
	Walk:	7950	*53%*	14310	*53%*
	Bus:	1650	*11%*	2970	*11%*
	Subway:	1800	*12%*	3240	*12%*
	Auto:	3000	*20%*	5400	*20%*
	Taxi:	150	*1%*	270	*1%*
	Water Taxi:	450	*3%*	810	*3%*
TOTAL VEHICLES TRIPS:					
	Auto:	1034		1862	
	Taxi:	50		90	

NOTES:

(1) Hudson River Park EIS

(2) Brooklyn Heights Promenade, Park User Survey, PHA, 2003

TABLE 6:
BROOKLYN BRIDGE PARK
TRIP GENERATION

PEAK HOUR TRIPS:

WALK:		IN	OUT	TOTAL
	MD:	676	676	1352
	PM:	501	612	1113
	SUN MD:	1181	966	2147
BUS:				
	MD:	140	140	281
	PM:	104	127	231
	SUN MD:	245	200	446
SUBWAY:				
	MD:	153	153	306
	PM:	113	139	252
	SUN MD:	267	219	486
AUTO VEHICLE TRIPS:				
	MD:	88	88	176
	PM:	65	80	145
	SUN MD:	154	126	279
TAXI VEHICLE TRIPS:				
	MD:	4	4	9
	PM:	3	4	7
	SUN MD:	7	6	14
WATER TAXI:				
	MD:	38	38	77
	PM:	28	35	63
	SUN MD:	67	55	122

TABLE 7:
BROOKLYN BRIDGE PARK
PARKING FORECAST ASSUMPTIONS

	GENERAL PARK USE	
	WEEKDAY	**SUNDAY**
DAILY AUTO TRIPS:	1,034	1,862
INBOUND AUTO TRIPS: (ASSUME 50% INBOUND)	517	931
ACCUMULATION FACTOR (1):	0.41	0.41
REQUIRED PARKING SPACES:	**212**	**382**
STAFF/MAINTENANCE WORKER ADJUSTMENT: (FOR PLANNING, ASSUME 10% OF USER DEMAND)	21	38
TOTAL	**233**	**420**

Source:
(1) Hudson River Park EIS

the assumptions provided in Table 5. As shown, during the weekday midday peak period, the proposed park is expected to generate a total of 1,352 walk trips, 281 bus trips, 306 subway trips, 176 autos, 9 taxis and 77 water taxi trips. During the weekday PM peak period, the proposed park is expected to generate a total of 1,113 walk trips, 231 bus trips, 252 subway trips, 145 autos, 7 taxis and 63 water taxi trips. During the Sunday midday peak period, the proposed park is expected to generate a total of 2,147 walk trips, 446 bus trips, 486 subway trips, 279 autos, 14 taxis and 122 water taxi trips.

6. Parking Demand

The auto trips generated by the park would not all be present at the proposed park during a single time. Instead, this traffic would arrive and depart from the park throughout the day. The total number of vehicles located at the park during any given time is referred to as the parking accumulation. This accumulation is expected to peak in the early to mid Sunday afternoon.

Parking accumulation patterns vary depending on the type of facility that is being serviced. Park user arrival and departure information was surveyed at Riverbank State Park and North Park as part of the Hudson River Park EIS. These surveys found that Riverbank State Park had a parking accumulation rate of 41% of daily trips, while North Park had a parking accumulation rate of 20%. Riverbank State Park was found to have a higher accumulation rate due to the destination orientation of this facility, with North Park being more transitory. It is assumed that Brooklyn Bridge park will have a destination orientation similar to the Riverbank State Park facility. Therefore, for planning purposes, a 41% parking accumulation rate is assumed for Brooklyn Bridge Park. This results in a parking demand of 212 spaces during the weekday and 382 spaces during Sunday.

In order to provide adequate parking for parks staff and maintenance workers, it is proposed to increase the overall parking supply by 10%. Table 7 shows the total number of parking spaces needed for the normal park component of the project. As shown, for planning purposes, the park would require 233 spaces during the weekday and 420 spaces during Sunday, peaking at midday.

7. Conclusion

The trip generation characteristics for the proposed Brooklyn Bridge Park were developed based on surveys collected at the Brooklyn Heights Promenade and on previous park user data collected for Hudson River Park. As indicated, trip generation for the proposed park (general park use only) is assumed to be an unconstrained trip generator. The expected trips generated by a regional park, such as the proposed Brooklyn Bridge Park, are based instead on the population densities surrounding the park and the distances of these populations to the park. Based on the generic park trip generation model developed for Hudson River Park, the number of expected Brooklyn Bridge Park users was estimated. As shown above, the proposed park is expected to generate approximately 27,000 trips during a typical summer Sunday and 15,000 trips during a typical summer weekday.

Brooklyn Heights Promenade park user survey data was utilized to assist in determining the modal split of park users based on distance to the park. As shown, the number of walk trips are expected to decrease as the distance from the park increases, while the number of auto trips are expected to increase as the distance from the park increases. Based on the aggregate modal split for park users generated by the project, approximately 53% of park trips are expected to be walk oriented, 21% auto/taxi oriented and 26% transit oriented (subway, bus and water taxi trips).

Parking demand was also determined for the park. With consideration for park staff and maintenance workers, the park would require 233 spaces during summer weekdays and 420 spaces during a summer Sunday to accommodate the normal park user demand for each day.

Appendix A: Park User Survey

<center>

Brooklyn Bridge Park (PHA #0324)
Park User Interview

</center>

Name:_____   Date:_____

Location:_____   Time: From_____ to _____

A. User Category

    1. Male adult alone   4. Adult Couple   7.Child / Teen group of friends   2.

Female adult alone   5. Adult / Family with Children   8. Other (Specify)

    3. Child / Teen alone   6. Adult group of Friends

B. If group, record number in group

C. How did you come to the park today?

    1. Walk   4. Skate   7. Auto (See section D)

    2. Run, Jog   5. Bus   8. Taxi (See section D)

    3. Bike   6. Subway   9. Water Taxi

D. If by Auto or Taxi, please specify number of people in vehicle.

E. Did you begin your trip in Brooklyn or from another borough or state?

    1. Brooklyn   4. Queens   7. Other (Specify)

    2. Manhattan   5. Staten Island

    3. Bronx   6. New Jersey

F. If in Brooklyn, what are the nearest cross-streets?

G. Did you begin your trip from home? (Yes or No)

H. How many people live in your household?

I. How many children under age 12 are living in your household?

	A	B	C	D	E	F	G	H	I
	User	**# in Group**	**Trans.**	**# in car**	**Location**	**Origin in Brooklyn**	**Home Origin**	**People in HSHLD**	**Child in HSHLD**
1									
2									
3									
4									
6									
7									
8									
9									
10									

Appendix B:

Hudson River Park

Technical Memorandum #2

HUDSON RIVER PARK

Technical Memorandum #2

Travel Forecast Methodology
for Park Component of
Hudson River Park

March 24, 1997

Prepared for
Hudson River Park Conservancy

Prepared by
Philip Habib & Associates

Technical Memorandum #2

Travel Forecast Methodology for Park Component of Hudson River Park

The forecast methodology for the park component of Hudson River Park is based primarily on the findings of the PHA user surveys at Riverbank State Park and Nelson Rockefeller (North) Park, as well as the findings of the Ukeles Associates, Inc. (UAI) study, "The Users of Riverside Park". Combined, these three resources provided a substantive basis in forecasting the proposed new regional facility on the west side of Manhattan's waterfront from West 59th Street to Battery Place.

Trip Generation

The surveys conducted at North Park and Riverbank Park were coded for census tract origin zones and regression analysis was prepared for the surrounding tracts at each park. Technical Memorandum #1 (Figures 1-3 and 1-4) demonstrate a strong relationship between distance to and usage of each park. Further, the Ukeles study found that approximately 85% of Riverside Park users walked, jogged, or bicycled to that facility, a reliable indicator of user proximity. Several census tract variables were considered in the regression analysis, including tract population, persons per household, children per household and other demographics. Park size was also considered as part of the regression analysis. The results of the analysis yielded two variables affecting unconstrained park usage: census tract population and distance to the park. The following equation was derived from consideration of the variables at both Riverbank Park and North Park:

$$U_i = 0.23 + 20.63 \times \frac{1}{D_i^{1.15}} \qquad\qquad R^2 = 0.59$$

where: U_i = daily Sunday (10 AM - 6 PM) park users per 1,000 population in census tract I.

D_i = distance (miles) from park entrance to the centroid of the census tract.

R^2 = measure of correlation between the variables, expressed on a scale of -1 to +1. The closer to +1 the R^2 is, the better the correlation between the variables.

Using the above equation, Figure 2-1 shows a plot of actual versus the calculated distribution for Riverbank State Park and Figure 2-2 shows the comparison for North Park. Figure 2-3 shows the comparison for both surveyed park samples. Park size was not a factor in determining the resultant equation, presumably because both parks were considerable in size, and neither had any user capacity constraints. Persons per household and children per household also did not show any distinct patterns of the surveyed park users. Economic variables were not considered as they were not included in the park surveys.
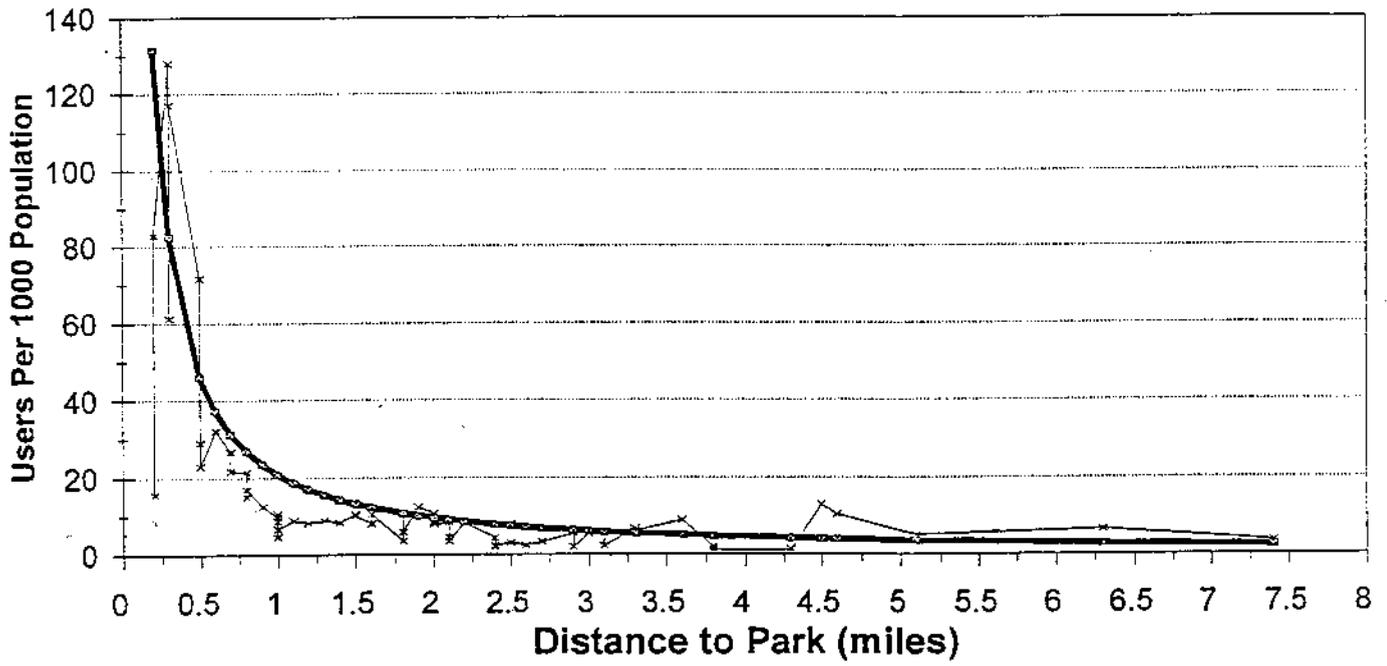
Trip Distribution

Applying the proposed model to forecast peak user demand for Hudson River Park established an estimate for the daily (10AM - 6PM) Hudson River Park visitors on a typical summer Sunday. In order to estimate the forecasting model parameters, a background growth factor was applied to the 1990 population census as well as additional population growth from future developments to establish the future 2003 census tract populations in Manhattan. The distance from the centroid of each origin census tract to the nearest Hudson River Park entrance was then calculated. Utilizing these two census tract parameters, the model equation calculated the projected daily visitors to Hudson River Park form the various origin tracts in Manhattan.

Hudson River Park users from outside of Manhattan were also considered as the surveys indicate that a portion of Sunday Riverbank Park and North Park users came from the Bronx, Queens, Brooklyn and New Jersey. The 1990 census district populations for these origin zones were forecasted for the future and their respective distance to the Hudson River Park was used to estimate the daily Sunday users from outside of Manhattan. Table 2-1 summarizes the number of expected daily Sunday Hudson River Park users from the various origins. As can be seen from this table, the park would attract approximately 25,700 visitors on a peak summer Sunday from 10AM to 6PM, with 21,600 (84%) users from Manhattan. Over a Sunday 24-hour period, approximately 32,000 users would visit Hudson River Park.
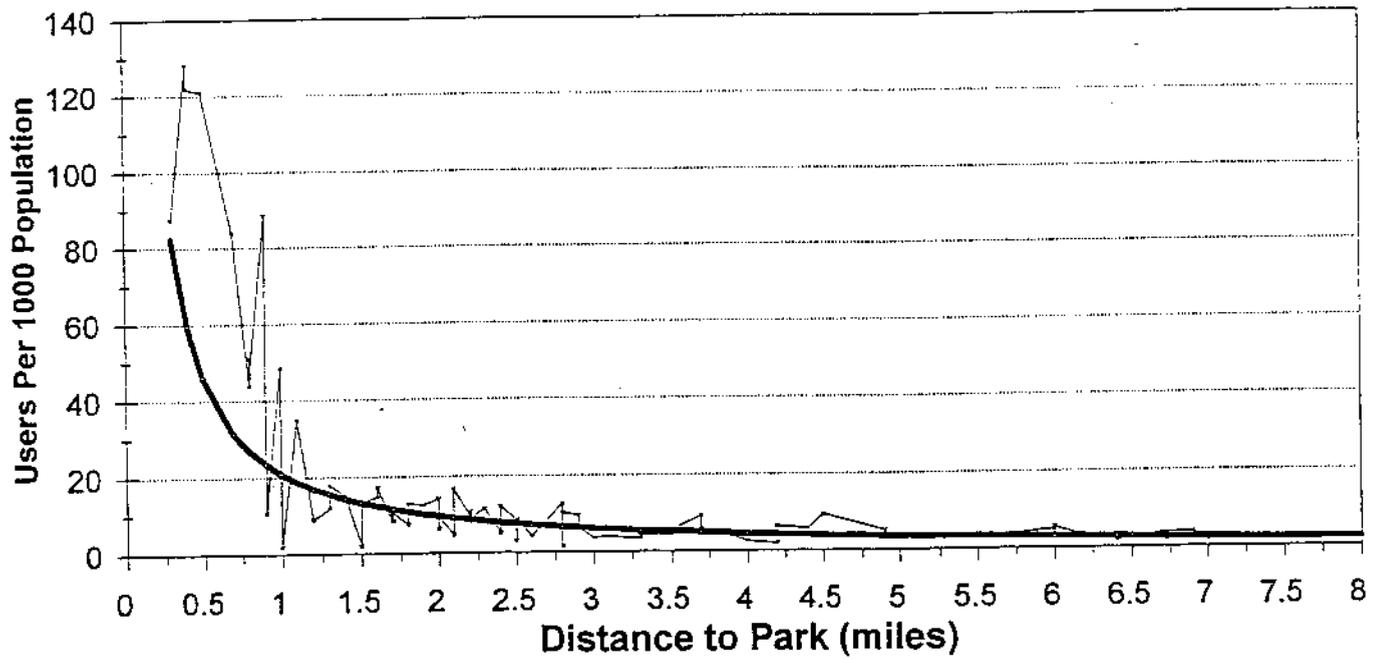
The Ukeles study of Riverside Park provided the basis for estimating weekday demand in the Summer. The study found that Summer weekday users (clement weather) were about 56% of a

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FIGURE 2-1
RIVERBANK PARK DISTRIBUTION

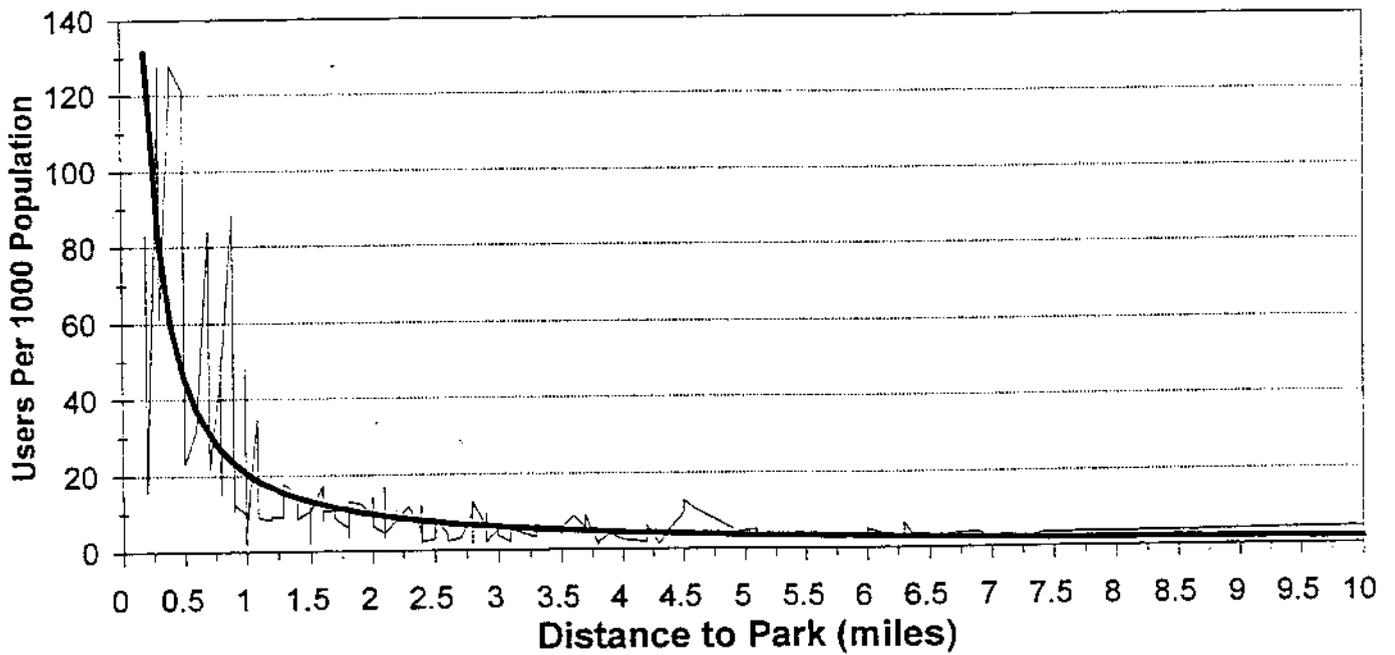Chart showing Users Per 1000 Population (y-axis, 0 to 140) versus Distance to Park (miles) (x-axis, 0 to 8), with legend: Actual Distribution, Computed Distribution.

FIGURE 2-2
NORTH PARK DISTRIBUTION

FIGURE 2-3
DISTRIBUTION FOR BOTH SURVEYED PARKS

TABLE 2-1

HUDSON RIVER PARK

DISTRIBUTION OF SUNDAY VISITORS BY ORIGIN

ORIGIN	PARK VISITORS	% OF TOTAL
MANHATTAN	21,600	84%
BRONX	700	3%
QUEENS	1,300	5%
BROOKLYN	1,600	6%
NEW JERSEY	500	2%
DAILY (10AM - 6PM) TOTAL	25,700	100%

DAILY (24-HOUR) TOTAL	32,000

summer Sunday (clement weather), whereas a Summer Saturday generated approximately 68% of summer Sunday visitors. In addition, the Spring, Fall and Winter seasons attracted a substantially lower number of park visitors than the Summer season.

Mode Choice

The mode choice assumptions used to estimate travel behavior of Hudson River Park users were also drawn from the surveys at Riverbank and North Parks. These surveys show that mode choice varied by trip origin (see Tables 1-3 and 1-4). Further research into the intra-Manhattan trips showed that, as expected, there was a high walk (walk, jog, bicycle, roller blade, etc.) percentage by users in close proximity to the parks and increasing non-walk modes (bus, subway, auto, taxi) as distance to the park increased. Table 2-2 summarizes the mode choice assumptions for each origin and calculates the expected overall mode choice of travelers to Hudson River Park. As shown on Table 2-2, approximately 57% of users from Manhattan would travel to the park via walking, and 17% of Manhattan users would travel to the park via auto. The overall mode choice represents the weighted average of all (Manhattan, Bronx, Queens, Brooklyn and New Jersey) Sunday park visitors. This indicates that 21% of all Sunday park users would travel by auto and approximately 48% of all Sunday users would walk to the park.

Trip Assignment

The trip assignment forecast was based on characteristics of park travelers surveyed at Riverbank State Park and North Park. As demonstrated on Table 1-1 in Technical Appendix #1, the two parks attracted users of various origins based on their location. Riverbank Park, located in Harlem, attracted a greater percentage of users from the Bronx (15%) than North Park (1%), which is located in Battery Park City. Likewise, North Park attracted a greater percentage of users from Brooklyn (7%) than Riverbank Park (2%).

For purposes of assignment, the park was divided into six destination zones: Clinton, Hell's Kitchen/No. Chelsea, Chelsea, Greenwich Village, Tribeca and Lower Manhattan. Table 2-3

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TABLE 2 - 2

HUDSON RIVER PARK

MODE CHOICE ASSUMPTIONS BY ORIGIN

ORIGIN	AUTO	TAXI	SUBWAY	BUS	FERRY	WALK*	TOTAL
MANHATTAN	17%	12%	6%	8%	0%	57%	100%
BRONX	50%	5%	30%	15%	0%	0%	100%
QUEENS	40%	5%	40%	15%	0%	0%	100%
BROOKLYN	45%	5%	40%	10%	0%	0%	100%
NEW JERSEY	15%	0%	30%	10%	45%	0%	100%
OVERALL (SUNDAY)	21%	11%	11%	8%	1%	48%	100%

* WALK INCLUDES WALKING, BICYCLING, ROLLERBLADING, JOGGING, ETC.

TABLE 2 - 3

HUDSON RIVER PARK

ORIGIN-DESTINATION ASSIGNMENT PATTERN

ORIGIN	PARK DESTINATION ZONE						
	CLINTON	HELL'S KITCHEN / NO. CHELSEA	CHELSEA	GREENWICH VILLAGE	TRIBECA	LOWER MANHATTAN	TOTAL
MANHATTAN	29%	19%	23%	15%	9%	5%	100%
BRONX	30%	25%	20%	10%	10%	5%	100%
QUEENS	25%	30%	20%	10%	10%	5%	100%
BROOKLYN	5%	10%	10%	20%	25%	30%	100%
NEW JERSEY	2%	35%	3%	15%	5%	40%	100%
OVERALL (SUNDAY)	26%	20%	22%	15%	10%	7%	100%

summarizes the origin-destination assignment, and shows the percentage of origin trips to each park destination zone. As observed through the Riverbank and North Park surveys, the trip assignment was based on the distance and accessibility between the origins and destinations. Table 2-3 shows that the Clinton area would attract approximately 30% of Bronx trips, whereas the Lower Manhattan area would only attract 5% of Bronx trips. The Lower Manhattan area would attract 30% of Brooklyn trips and the Clinton area would only attract 5% of Brooklyn trips. Park users from New Jersey have limited access to Manhattan's west side, therefore, the trip assignment reflected probable zones of destination for these travelers. The low percentage of intra-Manhattan trips to the Tribeca (9%) and Lower Manhattan (5%) areas reflects the relatively low nearby populations of these zones compared to the adjacent populations of other park zones. In addition, park users from northern parts of Manhattan would be more inclined to enter the park in the northern-most park zones (Clinton and Hell's Kitchen/No. Chelsea). It is assumed that Hudson River Park would attract users almost entirely from origins in Manhattan on weekdays. Therefore, the Manhattan distribution pattern shown on Table 2-3 would apply for weekday conditions. On a typical Saturday (not analyzed in the EIS), it is expected that the overall Sunday pattern would apply.

Table 2-4 summarizes the expected peak hour trips to each park destination zone based on the various trip generation, trip distribution, modal split and trip assignment forecasts. The weekday AM peak hour would generate a total of 2,340 Hudson River Park trips, with approximately 5,995, 4,795 and 9,240 trips expected during the weekday midday, PM and Sunday midday peak hour, respectively. Collectively, this data was used to determine the effects of Hudson River Park to the transportation system within the project's study area.

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TABLE 2 - 4

HUDSON RIVER PARK

PEAK HOUR TRIPS TO PARK DESTINATION ZONES

		CLINTON	HELL'S KITCHEN/ NO. CHELSEA	CHELSEA	GREENWICH VILLAGE	TRIBECA	LOWER MANHATTAN	TOTAL
	TOTAL PERSON TRIPS							
	AM	673	460	565	369	228	103	2,398
	MD	1,684	1,149	1,413	922	570	257	5,995
	PM	1,347	919	1,130	738	456	205	4,795
	SU	2,407	1,816	2,035	1,411	961	610	9,240
AM	AUTOS *	27	34	26	33	17	6	143
	TAXIS *	23	22	21	21	11	5	103
	SUBWAY	45	39	31	17	16	8	156
	BUS	27	41	32	50	23	8	181
	FERRY	0	0	0	1	0	0	1
	WALK **	464	221	369	149	111	57	1,371
MD	AUTOS *	67	85	66	82	42	16	358
	TAXIS *	56	56	53	54	28	11	258
	SUBWAY	113	97	78	43	39	20	390
	BUS	67	104	80	125	57	19	452
	FERRY	0	0	0	0	0	0	0
	WALK **	1,160	553	922	372	277	143	3,427
PM	AUTOS *	53	68	53	65	34	13	286
	TAXIS *	45	45	42	43	23	9	207
	SUBWAY	90	78	62	35	31	16	312
	BUS	54	84	64	100	45	15	362
	FERRY	0	0	0	0	0	0	0
	WALK **	928	442	739	298	221	114	2,742
SU	AUTOS *	122	153	118	138	91	55	677
	TAXIS *	77	77	72	73	41	18	358
	SUBWAY	227	224	175	155	134	134	1,049
	BUS	119	190	131	183	99	47	769
	FERRY	0	41	0	0	0	41	82
	WALK **	1,504	716	1,196	482	359	185	4,442

* IN TERMS OF VEHICLE TRIPS. NOTE: TAXI VOLUMES SHOWN NOT BALANCED.

** WALK INCLUDES WALKING, BICYCLING, ROLLERBLADING, JOGGING, ETC.