CITYWIDE FERRY STUDY 2013

Final Report

New York City Economic Development Corporation

Waterfront Vision & Enhancement Strategy

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COMPREHENSIVE CITYWIDE FERRY STUDY 2013

Final Report

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1 Summary of Findings

In 2011, New York City Economic Development Corporation (NYCEDC) completed the Comprehensive Citywide Ferry Study (CFS2011), which provided an overview of potential for passenger ferry transportation throughout New York City. Building on the recommendations of the CFS2011, the City of New York launched several ferry initiatives, including the implementation of the East River Ferry.

Given the success of the East River Ferry's first three years of service and dramatic development changes on New York City's waterfront, NYCEDC commissioned a consultant team to complete an updated and expanded Citywide Ferry Study (CFS2013).

The goals of this effort were to identify new ferry service opportunities, increase understanding of ferries' economic impacts, and evaluate the full potential of this emerging transportation resource in New York City. The main findings of the CFS2013 are as follows:

- The East River Ferry carried over 3,200 average daily riders during weekdays and served 1.2 million total riders in 2013. The service generated considerable user benefits in terms of travel time savings, travel comfort, reliability, and increased accessibility.
- The CFS2013 analyzed over 50 sites—15 more than CFS2011. A resulting short list of most promising commuter and leisure routes includes locations in all five boroughs of the City.
- Fast-growing locations on the Brooklyn and Queens waterfronts are forecast to generate significant ridership, and can potentially operate with modest public funding support.
- Ferry service to LaGuardia Airport holds considerable promise, offering travelers reliable and convenient access, particularly during peak periods.
- Routes serving more distant locations, while providing accessibility benefits, generate higher operating costs requiring greater funding support if they are to maintain fares similar to other transit modes.
- Residential property values within 1/8 mile of East River Ferry stops in Brooklyn and Queens increased 8.0% over comparable property values farther from the stops; for all residential properties within one mile of a ferry stop in Brooklyn and Queens, ferry service increased total property values by $0.5 billion.
- Areas near East River Ferry stops in Brooklyn and Queens realized over 600,000 square feet of additional residential and commercial building space, a 4.9% increase over development rates in comparable areas farther from the stops.
- Given both funding constraints and the demonstrated benefits created by the East River Ferry, the CFS2013 proposes potential value capture mechanisms to generate funding from private sector partners.

- These are the most promising new ferry routes, with their associated costs, based on $5 fares[1]:

Route	Annual Weekday Subsidy Requirement ($ Millions)	Capital Cost Requirements ($ Millions)	Peak Period Vessel Requirements
Route 2B: Astoria, Roosevelt Island, Long Island City North, East 34th St, Pier 11 / Wall St	$2.7	$20	4
Route 3B: Soundview, East 90th St, East 62nd St, Pier 11 / Wall St	$4.3	$17	3
Route 4: East 34th St, East 23rd St, Grand St, Pier 11 / Wall St	$2.3	$12	3
Route 4B: Long Island City North, East 34th St, East 23rd St, Grand St, Pier 11 / Wall St	$1.7	$17	3
Route 5: St George, Pier 79	0[2]	$5	1

[1] See discussion on Revenue Maximizing Fares in Section 6 for an analysis of operating costs with respect to potential fares.

[2] It is assumed that visitation to the upcoming New York Wheel and Empire Outlets development could make an unsubsidized service feasible.

2 Introduction and Project Purpose

In 2011 New York City Economic Development Corporation (NYCEDC) completed the Comprehensive Citywide Ferry Study (CFS2011), which provided an overview of development potential for passenger ferry transportation throughout New York City. That planning study analyzed and prioritized potential routes drawn from a group of over forty waterfront sites in the five boroughs. Building on the recommendations of the CFS2011, the City of New York launched several ferry initiatives, including the implementation of the East River Ferry. The East River Ferry provides rapid and frequent service between several Brooklyn and Queens locations, Downtown Manhattan at Pier 11, and Midtown Manhattan at East 34th Street. Begun in June 2011 as a three-year pilot project, the East River Ferry today carries approximately 3,200 riders on a typical weekday, well above initial expectations.

Following the success of the East River Ferry, and in consideration of continuing and sometimes dramatic development changes on New York City's waterfront, NYCEDC set out to complete an updated and expanded Citywide Ferry Study (CFS2013). The goals of this effort are to identify new ferry service opportunities and to increase understanding of the economic impacts and potential of this emerging transportation resource in New York City**.** The CFS2013 is also intended to develop a planning framework based on several transportation models that can be used on an ongoing basis by public or private sector stakeholders to assess future ferry service opportunities.

Several developments since the CFS2011 provided additional impetus for this follow-up planning work: First, the East River Ferry is now an ongoing service, and as such provides a wealth of information regarding the local ferry market in New York City. A second factor is the recent development of modeling tools specifically designed for passenger ferry transportation in New York City. Finally, the past two years of East River Ferry operations provide a strong data set to quantify the economic value created by ferry service.

The CFS2013 provides detailed analyses to guide the evolution of ferry service in New York over the coming years. Below is a summary of the study's main work products

- Analysis of the potential viability of 58 locations in the five boroughs for commuter and leisure passenger ferry service, including relevant demographic, geographic and physical considerations of each site.
- Estimates of potential ridership for 35 of the most promising locations, analyzed as point-to-point services, using an econometric mode choice model.
- Grouping of 17 of the 35 locations into six potential route configurations:
  - Feasibility of potential passenger ferry service to LaGuardia Airport
  - Estimate of potential revenues, operating and capital costs, and subsidy requirements for commuter and leisure ferry routes and LaGuardia service
  - Review of differential service and fare levels, including an analysis of revenue-maximizing fares and headways

In addition, the CFS2013 addresses several important policy considerations, including:

- Economic value derived from ferry service. A detailed analysis of the real estate and development benefits attributable to the East River Ferry.
- Value capture approaches. Strategic recommendations for capturing some of the considerable value created by new passenger ferry service into potential funding streams to support ferry transit systems.
- Direct and indirect benefits. An economic analysis of both direct user benefits (travel time savings, reliability, safety, comfort) as well as a discussion of likely external benefits attributable to an expanded ferry network.
- Ferries' role in transportation resiliency. An assessment of the role that passenger ferries can play in transportation system redundancy after disruptive events.
- Environmental considerations. An analysis of environmental impacts engendered by service expansion, including current and future emissions impacts of passenger ferries and local wake impacts.
- Fare collection enhancements. Assessment of potential for improved fare collection or increased non-fare revenues, drawing in part on observed "best practices" of other ferry systems.

The report builds on the work contained in the CFS2011, as well as the growing understanding of the regional ferry market, including the inventory of ridership, cost and revenue models designed specifically for New York City.

3 Passenger Ferries in New York Harbor: Past and Present

Historical Context

The 20th Century saw extensive construction of bridges and tunnels to connect Manhattan with the rest of New York City and New Jersey. As a result, the use of passenger ferries declined rapidly in the region. By the early 1980s, all that remained of the once significant network of regularly scheduled waterborne transit was the publicly-run Staten Island Ferry. As the decade progressed, however, there was a revitalization of privately-operated ferry services in the region. These independently financed ferry services generally served several (sometimes overlapping) market niches, including:

- Locations where ferry service provides a clear travel cost advantage over alternative transit (where cost is meant to include travel and wait time, fare and service quality). Services from Monmouth County or Weehawken to Manhattan fall into this category.
- Corridors with significant congestion or crowding. This was especially true for Hudson County PATH commuters, or for motorists using the cross-Hudson bridges and tunnels.
- Areas where the provision of ferry service went hand-in-hand with the development of waterfront residential density, as was the case in Weehawken and Jersey City.

Private operators implemented a variety of services between New Jersey and New York City, with today a relatively stable "core" network in operation which is run for the most part without operating subsidies. Some important service characteristics enable unsubsidized operations, such as:

- Primarily point-to-point routes that serve great densities at the origin and destinations.
- The routes are generally short and cost-effective in terms of fuel usage;
- Significant time savings over otherwise lengthy transit alternatives, and a generally high-income ridership of commuters to Manhattan willing to pay cost-covering fares.

Although these services generally do not utilize direct operating subsidies, these services benefit from indirect capital subsidies provided through public infrastructure, such as ferry landings, located at either end of the service routes.

Current New Jersey to New York City and Cross-Hudson Routes

The current New Jersey to New York City passenger ferry system in the region is detailed in APPENDIX 1. As described and illustrated in earlier reports[3], United States Census data reveals that the core market for the existing inter-state ferry system tends to be commuters living close to the waterfront and pier facilities. Further analysis shows that ferry passenger employment is concentrated in the Lower and Midtown Manhattan Central Business Districts, which are well-served by these routes.

This part of the regional ferry network is discussed extensively in a recent report by the Port Authority of New York and New Jersey (PANYNJ)[4]. The report finds that passenger ridership on these routes has been strongly correlated with employment growth in New York City, particularly in sectors such as finance and business services. Following ridership declines due to the recession of 2007-2008 and recent cost-driven fare increases, this inter-state ferry market is essentially stable today, with growth closely tied to inter-state commutation.

Current New York City Routes

Until recently, the passenger ferry market within New York City was considerably more limited than the inter-state market. Several routes were established serving locations along the East River, but the scale of service and ridership remained modest. Two key constraints to robust ferry ridership in New York City are as follows:

- New York City is served by a widespread, frequent and affordable subway and bus network. To be competitive, passenger ferry service must generally match these characteristics as well. This requirement for success has meant that unsubsidized services have had a difficult time competing, particularly if fares were significantly above the subway fare, or if headways were lengthy.
- Waterfront residential density had been limited as a result of New York City's historic use of the waterfront for industrial purposes.

The last two decades have seen adaptation of waterfront land for residential or mixed uses, including retail, recreation and high tech employment. The attractiveness of these locations has resulted in sometimes significant growth in residential and employment densities (for example, Williamsburg and DUMBO on the Brooklyn waterfront), as well as leisure use at specific locations (notably Governors Island, Brooklyn Bridge Park, DUMBO, Four Freedoms Park on Roosevelt Island and Noguchi Museum / Socrates Sculpture Park on the Queens waterfront).

As discussed below, the policy decision to provide a limited operating subsidy for the East River Ferry combined with these land use changes to create favorable conditions for a robust New York City service. Table 3.1 summarizes the current New York City

[3] Vilain, P., J. Cox and V. Mantero, 2012."Public Policy Objectives and Urban Transit: The Case of Passenger Ferries in the New York City Region", *Transportation Research Record*, No. 2274.

[4] Halcrow, Inc., 2010. *Study of Regional Private Passenger Ferry Services in the New York Metropolitan Area: Route and Service Analysis and Public Policy Goals*. Report Submitted to the Port Authority of New York and New Jersey.

services, which include the East River Ferry, a service between Manhattan and the IKEA store in Brooklyn's Red Hook neighborhood[5], and a service between the Rockaway Peninsula in Queens, Brooklyn Army Terminal and Pier 11 in Lower Manhattan.

The Staten Island Ferry, due to its distinct function and market, is seen as distinct and not included here. At nearly 70,000 daily riders it is the largest single ferry system nationally. The privately operated ferry system described in Table 3.1 and APPENDIX 1 serves roughly 34,500 riders on a typical weekday, putting it on par with the ferry system operated by Washington State Ferries.

Of the services currently operating regularly on the East River, the IKEA shuttle has been in existence the longest. The shuttle started soon after the store opened at its Red Hook location in 2008, traveling between Erie Basin and Pier 11. The ferry service to the Rockaways was started as a post-Hurricane Sandy alternative for Rockaway commuters affected by disruption of A-train service. In August 2013, the Rockaway commuter service added a stop at the Brooklyn Army Terminal to serve Sunset Park and Bay Ridge commuters affected by the R-train service modifications caused by Hurricane Sandy tunnel repairs[6]. This service to the Rockaways and Brooklyn Army Terminal includes similarities to a 2008 pilot service to the same areas, but also incorporates significant differences, including fare, travel time, and service frequency.

[5] In addition to the routes outlines in Table 3.1, a temporary route serving Red Hook was established following Hurricane Sandy and the extensive damage to this part of the Brooklyn waterfront as a tool to encourage economic recovery. Through a partnership between the City of New York, NY Water Taxi, Billybey Ferry Company, Fairway Market, IKEA and the O'Connell Organization, a stop at Van Brunt St was added to the IKEA weekend route. The addition of a stop and an additional boat to the route allowed the service to run every 25 minutes from 10am to 9pm during the weekend. The route operated from May 25th 2012 – Sept 2nd 2012.

[6] The IKEA ferry currently runs from 2-8pm on weekdays and 11:20am-9:20pm on weekends with 40 minute headways. New York Waterways operates the service and charges $5 each way during the week. The weekend service remains free and passengers who spend more than $10 in IKEA during the week will have the round trip fare deducted from their store total. The Rockaway service operates from Beach 108th St to Pier 11 with five departures during the morning commute and five return trips in the evening. The fare for one-way trips is $2.

Table 3.1: Existing New York City Ferry Services

Route	Weekday One-Way Fare	Headway (Peak)	2011 Weekday Ridership	2012 Weekday Ridership	2013 Weekday Ridership	2006-2011 Annual Growth	2011-2012 Annual Growth
East River Ferry	$4.00	20	1,235	2,727	3,257	NA	120.9%
IKEA - Pier 11	$5.00	40	475	375	387	NA	-20.9%
Rockaway – Brooklyn Army Terminal - Pier 11	$3.50	35[7]	NA	NA	746	NA	NA

The East River Ferry

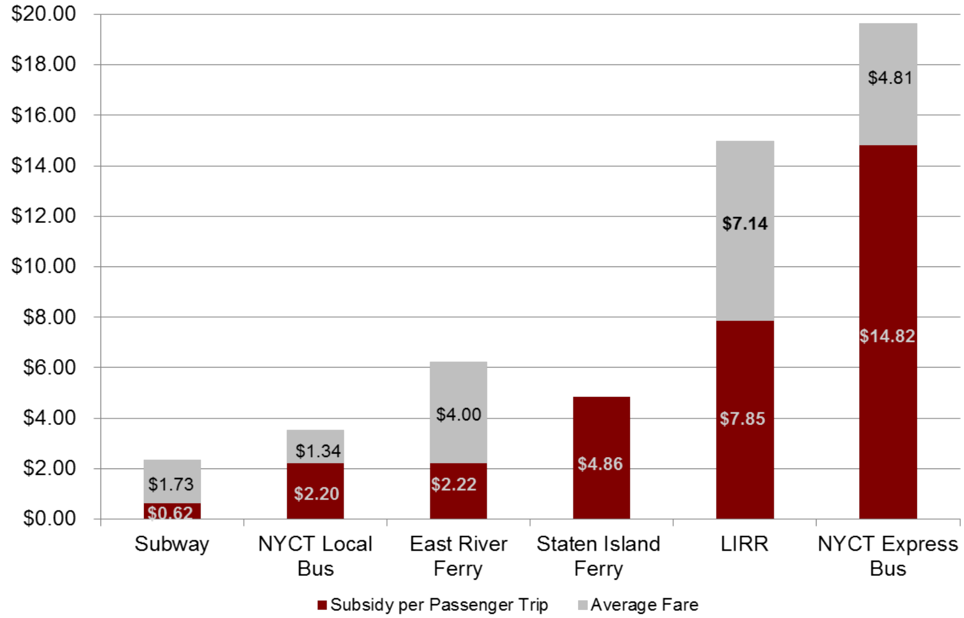
The East River Ferry is the most heavily used of the ferry services operating on the East River. Initiated in June 2011, it currently serves approximately 1.2 million passengers annually. A ladder service, it links Pier 11 at Wall St, then DUMBO, Williamsburg South, Williamsburg North and Greenpoint on the Brooklyn waterfront, Long Island City on the Queens waterfront, and East 34th St in Manhattan.

The service was the primary recommended route in CFS2011, and over the last two years, it has become an integral part of inter and intra-borough transportation along the East River.

The East River Ferry has been successful in attracting a dedicated base of riders, with a current average of over 3,000 daily riders in the 12 month period from July 2012 to June 2013 (or over 3,250 daily). At the current $4 fare the service’s farebox revenue covers 64% of the services operating costs. The $2.22 subsidy per passenger trip is on par with the subsidy levels of the New York City Transit local bus services. Figure 3.1 illustrates the fares and subsidies per passenger trip across the various public transportation modes in New York. When compared to the non-subway transportation options in New York, the East River Ferry is competitive in terms of subsidy levels.

[7] Rockaway-BAT ferry is a schedule-based service with typical headways closer to 50 minutes.

Figure 3.1: Transit Fares and Subsidy per Passenger Trip



Source: Information for Subway, NYCT Local Bus, NYCT Express Bus, and LIRR is based on 2012 data provided to NYCEDC by the Metropolitan Transportation Authority (MTA) in July and October 2013. Information for Staten Island Ferry provided by the NYC Department of Transportation (NYCDOT) in September 2013.

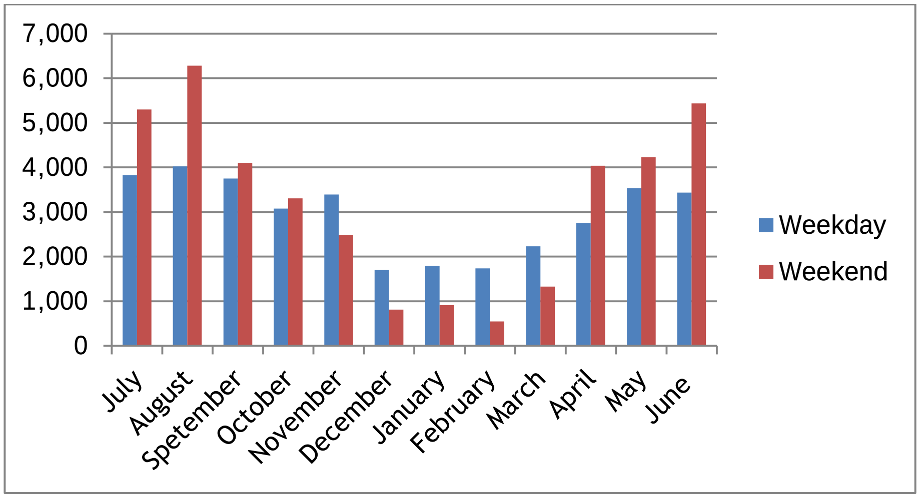
Two markets make up the current East River Ferry ridership: the commuter market, which is made up of users who commute to and from their place of employment, and the recreational market. Recreational riders use the ferry for non-work-related trips. These two markets operate in very different ways: the commuter market makes up a large amount of the weekday ridership, while recreational riders are mostly responsible for weekend ridership.

Weekend and weekday seasonal rider counts confirm the differences between the two groups of ferry users: weekday trips are largely made up of commuters who need to make their trip to work regardless of season. On the other hand, weekend users, primarily recreational in purpose, exhibit far greater seasonal variation; winter weekends see only a fraction of the summer weekend riders. This difference between weekday and weekend trips can be seen in Figure 3.2, which shows the average daily boarding by month for both weekday and weekend trips[8]. The seasonal variations generally illustrate the greater sensitivity to weather conditions than found on alternative modes. This sensitivity is only accentuated for discretionary trips, again due to weather but also to the reduced number of water front activities and events during winter months.

[8] To improve farebox operating coverage efficiencies, weekend and off-peak service frequencies vary by season.

Based on proven demand and resulting impacts over the course of the pilot program, the City recently announced its commitment to extend East River Ferry service into 2019.

Figure 3.2: Average Daily Boardings by Month, July 2012-June 2013



4 Impacts of Passenger Ferries in New York Harbor

Introduction

One expects that transportation generates positive economic impacts. This study developed a systematic assessment of impacts attributable to potential new ferry service, including, when possible, the quantification of these benefits.

The benefit measures which are analyzed in the report include the following:

- Real estate and development benefits
- Direct user benefits
- Wider economic benefits
- Transit system benefits
- System redundancy

It is important to measure these various economic impacts, as the benefits of transit services have been typically shown to be considerably greater than the farebox revenue attributable to them[9]. The current report provides the results of an analysis of real estate impacts attributable to the existing East River Ferry Service. For potential new services considered as part of the CFS2013, direct user benefits are quantified including travel time savings, safety benefits and general comfort accruing to ferry users. Wider economic benefits refer to the impacts on accessibility and productivity attributable to proposed ferry services, while transit system benefits are concerned with the potential for decongesting non-ferry transit services suffering from crowding.

System redundancy provided by passenger ferries has proven to be an extremely important issue for the New York City region. In several very notable instances the passenger ferry fleet in New York Harbor has played a crucial role in providing emergency support. As the potential value of future system redundancy is difficult to quantify, the CFS2013 provides a qualitative discussion of the aspect of passenger ferry service.

Real Estate Benefits

The CFS2013 provides the first estimate of the impact of the East River Ferry service on residential property values and real estate development. The research draws on experience modeling the impacts of public transit on real estate outcomes. The

[9] See Parry, W. H. and K. A. Small, 2009. "Should Urban Transit Subsidies be Reduced?" *American Economic Review*, Vol. 99 (3), 700-724.; Guerra, E., 2011. "Valuing Rail transit: comparing Capital and Operating Costs with Consumer Benefits." *Transportation Research Record*, No. 2219, 50-58; Halcrow, Inc., 2010. *Study of Regional Private Passenger Ferry Services in the New York Metropolitan Area: Route and Service Analysis and Public Policy Goals*. Report Submitted to the Port Authority of New York and New Jersey.

following summarizes the key results of the East River Ferry's measured impacts (with a detailed discussion contained in APPENDIX 2):

- Residential property values within 1/8 mile of the closest ferry stop increased by 8.0%.
- For all residential properties within one mile of a ferry stop, the ferry service increased total property values by $0.5 billion.
- Higher real estate values also coincided with an increase in residential and commercial building space of over 600,000 square feet, a 4.9% increase of space within 1/4 mile. This includes:
  - An increase in the nearby supply of residential housing by 487,238 square feet, or over 7%; and
  - An increase in the supply of retail space within 1/4 mile by over 20,000 square feet, or 4.2%.

East River Ferry ridership, described above, has exceeded expectations since the service commenced in June 2011. The popularity of the ferry illustrates a strong demand for this service and suggests the high value that users place on it. Urban economic theory predicts that this higher demand for ferry service should lead to higher residential prices and rents as homes with access to ferry stops now come bundled with access to the ferry network. In addition, the increase in real estate prices should spur new residential development by increasing the value of building new properties relative to development costs, which on the margin should spur new residential development.

The CFS2013 focuses on residential real estate prices rather than the prices of commercial real estate leases. This is because the long-term nature of commercial leases would yield relatively sparse data and slower price changes that would be difficult to measure. Using publically available data on housing transactions and following well-established methods for determining the real estate impacts of transit services, the CFS2013 estimated the impact of the new ferry services on house prices and rates of real estate development in locations benefitting most from proximity to East River Ferry service.

Based on a comparison of trends in real estate prices for locations benefitting from the East River Service and similar properties that did not enjoy this access, analysis shows that the ferry service has a positive and statistically significant impact on house prices. The regression analysis shows that, after controlling for pre-existing conditions and building quality, including differences in proximity to the waterfront, the value of being close to a ferry stop increased real estate values.

Specifically, the ferry service increased the value of homes that were within a band extending to 1/8 mile away by 8.0%, and 2.5% for all homes within a 1/8 of a mile to 1/4 mile band away. The impact falls to less than 1% for homes a mile or more away[10].

[10] Impacts within this walking distance area are consistent with a survey performed on over 1,300 East River Ferry riders, in which over 75% of ferry riders reported that they walk to and from the ferry at either end of the trip.

These results imply that the ferry service has increased the average home value within one mile of the ferry by over 1.2%, and has increased residential value by roughly one half billion dollars in aggregate. The average impact of 8.0% within 1/8 mile is consistent with the results found in the wider literature on the impact of public transit on house prices. Overall, the East River Ferry increased house values by nearly half a billion dollars in the Brooklyn and Queens areas of New York City.

Table 4.1: Property value impact by distance from ferry stop

Distance from ferry stop (in miles)		Total value ($m)	Relative impact (%)	Absolute impact ($m)	Cumulative impact ($m)
Lower bound	Upper bound				
0.000	0.125	1,298	8.0%	92	92
0.125	0.250	2,872	2.5%	74	166
0.250	0.375	6,249	1.6%	98	264
0.375	0.500	5,557	1.1%	63	327
0.500	0.625	5,117	0.9%	47	374
0.625	0.750	7,897	0.7%	56	431
0.750	0.875	5,204	0.6%	32	463
0.875	1.000	5,468	0.5%	29	492

The analysis also confirms that the ferry service has a positive impact on the pace of development. The results from the construction impact analysis are consistent with the impact on prices: for most measures, there was a statistically and economically significant impact on development in the immediate area, and a declining impact at farther distances. The analysis controls for other factors that may affect development by looking at changes in the pace of development at the block level prior to the ferry service compared to the pace of development in those same blocks after the ferry service. This makes the results more robust by accounting for pre-existing differences between areas near the ferry and those farther away. Table 4.2 below shows the amount of new developments within 1/4 mile that can be attributed to the East River Ferry service. The largest impact was on residential development, which increased by nearly 350 additional residential units and 487,238 residential square feet.

Table 4.2: Change in construction with East River Ferry stop within a quarter mile

Development Type	Stock in 2009	New construction	Percent increase
Buildings	732	9	1.2%
Residential Units	6,051	350	5.8%
Building Area	12,300,000	608,615	4.9%
Commercial Area	5,466,094	183,963	3.4%
Office Area	953,887	948	0.1%
Retail Area	485,488	20,284	4.2%
Residential Area	6,745,500	487,238	7.2%

User Benefits

User benefits include a wide range of changes in travel characteristics, including travel time and cost, as well as convenience and comfort. The established approach to calculating user benefits is to convert these characteristics into monetary equivalents, or the *generalized cost* of the trip. One can then compare the generalized costs for a given journey under different scenarios and the change in cost is the benefit to the traveler.

It is important to measure user benefits in cases where prices or fares are not a good reflection of the total benefits users are deriving from using a particular mode or service. For many subsidized transportation services this is clearly the case, and fare revenue may not be a good measure of the total benefits generated by the service. This is particularly true when there are benefits to those beyond the direct users of the service, as occurs when a transit service reduces congestion on the rest of the transportation system[11].

The typical user benefits analyzed in the context of an economic cost-benefit analysis (CBA) include improved travel time, increased safety, reduced vehicle operating costs, reduced wait time, reduced access time. These user benefits can be measured in various ways, but here the approach used is an increasingly common one in CBA practice, involving reliance on the ridership models described in Chapter 6[12].

[11] As shown in Halcrow, Inc., 2010 (op. cit) passenger ferry service in new York city generates modest external benefits, as diversion from auto use (the standard source of transit external benefits) is minimal within New York City.

[12] How a ridership model can be used to measure user benefits is not immediately intuitive, but the logic is the following: As described in Chapter 6 the ridership model measures quite precisely the total costs attributable to various travel options in forecasting ridership. These precise measures then form the basis of the user benefit calculations. For details see Small, K.A. and H.A. Rosen, 1981. "Applied Welfare Economics with Discrete Choice Models" *Econometrica*, Vol. 49, No. 1, pp. 105-130.

The CFS2013 developed estimates of total user benefits attributable to each of the routes that were considered most promising, with those various routes described in detail below. For several of the highest ridership routes considered user benefits are considerable and as expected outweigh, in monetary terms, the fare revenue.

In several cases the total user benefits are greater than total operating costs, meaning that the subsidy is basically less than the total net benefit for users after paying the fare.

In short, an analysis of user benefits attributable to passenger ferry services in New York City confirms that user benefits are greater than fare revenue and reinforces the view that the positive effects of ferry service outweigh farebox revenues.

Wider Economic Benefits

Recent research in transportation economics has identified the existence of economic gains from improving connectivity beyond those captured by user benefits. The most significant of these is *agglomeration economies*.

Agglomeration economies are productivity gains enjoyed by firms that are located in areas of dense economic activity. These gains arise because such locations offer a high level of interaction between firms and workers, access to large and diverse labor markets and access to large and diverse suppliers and customers. Agglomeration economies are the principal reason for the existence of big cities – otherwise why would companies be willing to pay premium rents, wages and transport costs for city locations?

One frequently used method for approximating the wider economic benefits of transportation projects is to develop an indicator of the agglomeration benefits based on measures of connectivity. This entails identifying for each proposed ferry route the number of workers and jobs falling within the ferry stop catchment areas and then calculating each catchment area's *accessibility*, essentially connectivity between workers and employment. The CFS2013 then compares the accessibility with and without the ferry extensions to identify the routes which deliver the greatest impact. Those with a greater increase in worker accessibility are likely to generate larger wider economic benefits.

This suggests that several promising routes would be expected to deliver an impact on worker accessibility and generate wider economic benefits to New York City.

Transit System Benefits

Ferries can close gaps in the transit network, making transit more convenient for many users. The improved service may divert drivers to transit or allow people to make trips they would not have otherwise made. When these additional travelers connect from the ferry to other transit systems, they boost the other system's ridership and revenue. If the other transit system is severely congested, however, these additional trips may incur costly expansion investments.

In addition to connecting new riders to other transit systems, ferries can divert ridership from other transit lines. If the alternative transit lines, or the stations that serve them, are overcrowded, then the marginal cost of accommodating travelers is high and may exceed the marginal revenue. The ferry creates a benefit by easing the load on the alternative system. Those who remain on the alternative mode will have more space, and there will be less congestion to interrupt service. If the alternative transit system is not crowded, however, the ferry will be diverting fares and ridership from the alternative system.

The transit system in New York City is extensive, and often overcrowded. There are few gaps for ferries to close, so ferries are unlikely to create significant benefits by inducing transit trips. However, they are likely to create significant benefits by easing congestion at overcrowded subway stations. Because this is a benefit of ferry service that does not accrue to ferry users themselves it can be described as an *external benefit*. In a recent study of passenger ferries in the New York City region, it was found that reducing crowding on the Port Authority Trans Hudson (PATH) service was the major external benefit attributable to cross-Hudson ferry services[13].

A simple assessment of the impact of potential ferry service expansion on other transit services was completed for the CFS2013. The analysis relied on the ridership modeling, which is described in detail below. The modeling assumes that all ferry riders divert from transit[14], and each route modeled generates estimates of ferry riders diverted from specific competing transit services. The CFS2013 was then able to compare the transit trips diverted to ferry by station with MTA station boarding data to generate a general impression of the effect on crowding relief at specific subway stations.

Table 4.3 below summarizes the diversion impact at specific stations if the three most promising proposed ferry routes were implemented. The routes link various locations on the Brooklyn, Queens and Bronx waterfront to Midtown and Lower Manhattan. In order to assess the potential system impacts when ferry ridership would be at its "steady state" level 2018 ridership forecasts were used, since they take into account demand from new developments at proposed ferry sites[15].

[13]Halcrow, Inc., 2010. *Study of Regional Private Passenger Ferry Services in the New York Metropolitan Area: Route and Service Analysis and Public Policy Goals*. Report Submitted to the Port Authority of New York and New Jersey.

[14]This assumption is based on previous work carried out by Steer Davies Gleave. In the PANYNJ study referred to previously, analysis using the two regional travel demand models available for the New York City region modeling results confirmed that ferry services in New York City with Manhattan destinations draw the near-totality of ridership from other transit modes (see Halcrow, Inc., 2010. *Study of Regional Private Passenger Ferry Services in the New York Metropolitan Area: Market Modeling of Ferry Routes West and East of the Hudson – Analysis Using Regional Models*. Report Submitted to the Port Authority of New York and New Jersey).

[15] The trip demand from these developments was added to the projected MTA station boardings data.

Table 4.3: Diversion of Station Boardings due to Ferry Service

Station (Train Lines)	Total station boardings	Daily station boardings diverted by new ferry service		Percent of station boardings diverted by ferry	
		Assumed Ferry Fare: $2.75	Assumed Ferry Fare: $5.00	Assumed Ferry Fare: $2.75	Assumed Ferry Fare: $5.00
23 St (6)	32,189	829	334	3%	1%
59 St (N,R)	13,100	514	201	4%	2%
Broad St (J,M,Z)	5,011	348	147	7%	3%
Roosevelt Island (F)	7,703	405	171	5%	2%
Vernon Blvd (7)	36,429	3,206	1,294	9%	4%
Wall St (4,5)	46,208	6,268	2,495	14%	5%

As shown in Table 4.3, Broad Street, Vernon Boulevard and Wall Street subway stations would all experience decrease in station boardings of over 5% thanks to the ferry. While a precise quantification of the value of this crowding relief is not included here, this diversion would improve comfort and on-time-performance for subway users.

New services to Staten Island, such as route 5 between St George to Pier 79 at W 38th St modeled in this study, could benefit the heavily utilized Staten Island Ferry similarly without draining revenue since the Staten Island Ferry does not charge a fare.

System Redundancy

Passenger ferry service offers redundancy to the New York City transportation system, which has proven to be critical during several recent crisis situations. During the terrorist attacks of September 11, 2001, the Northeast blackout of August 14, 2003, or the emergency Hudson River landing of US Airways Flight 1549 on January 15, 2009, the passenger ferry fleet played an invaluable role in providing emergency assistance. Following the destruction caused by Hurricane Sandy, passenger ferry services to Staten Island, Red Hook and the Rockaways was set up in a matter of days, demonstrating the manner in which ferry service can be established relatively easily and flexibly to respond to transit service disruptions.

The future potential value of ferry service in terms of system redundancy or emergency preparedness is difficult to quantify: The events referred to previously are thankfully rare and impossible to predict, as are the total extent of the potential ferry system response. In general, in keeping with other recent assessments of the value of system redundancy, the CFS2013 concludes that the denser the ferry vessel and service network, the greater the potential ability to respond to emergency situations.

5 Opportunities for Ferry Service Expansion

2010 Citywide Ferry Study Site Assessments

The CFS2011 evaluated 43 sites for potential ferry service. The ridership analysis contained in that study was not able to benefit from models, nor data sources that are now available. In addition to several mode choice models[16] recently developed in the context of separate studies for the PANYNJ, the last several years have also seen the release of the 2010 Census and the American Community Survey (ACS), providing socio-demographic information down to the census tract level.

The timely availability of these models and data allowed the CFS2013 to update the work done in the CFS2011 as well as consider 15 entirely new sites.

Sites Assessed in the 2013 Citywide Ferry Study

The CFS2013 assessed a total of 58 sites, including the 43 sites considered in the 2010 study. These sites are described in extensive detail in APPENDIX 3A, APPENDIX 3B, APPENDIX 3C and APPENDIX 3D. These appendices detail socio-demographic conditions, physical characteristics, and development trends for each site, as well as specific large-scale developments, leisure visitation and suitability to accommodate emergency ferry service for selected sites.

The potential of a site for ferry service depends on a variety of factors including but not limited to, the number of residents commuting to Midtown or Lower Manhattan, existing transportation options, potential travel time savings, future development plans and the physical viability of the site. In order to assess the feasibility of ferry service from the study sites the CFS2013 team first produced a comprehensive site profiles for each of the 58 study locations. The sites studied by the CFS2013 can be seen in Figure 5.1: CFS2013 Study Sites.

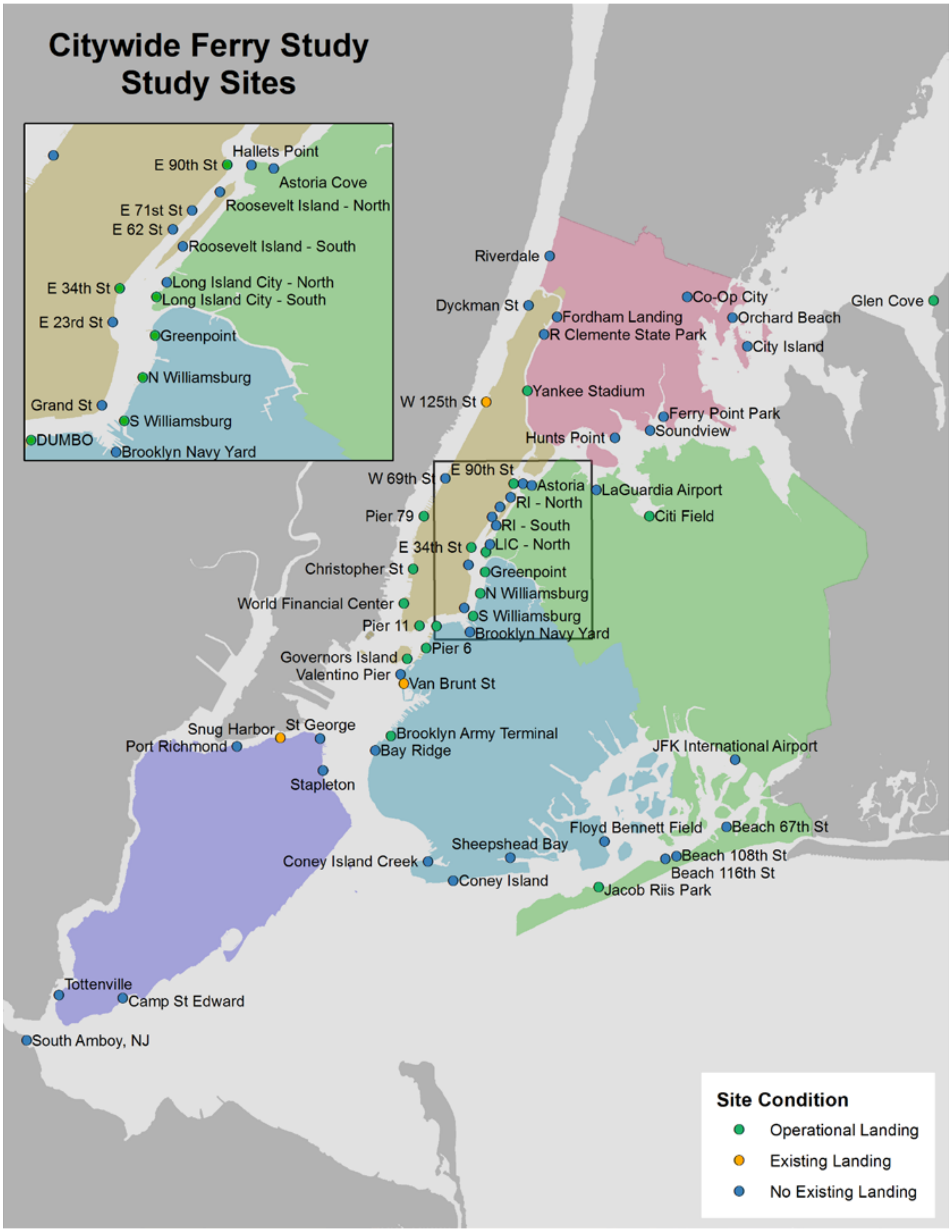
The profiles were compiled from a variety of sources to understand each site's demographic make-up, market size, transportation options, future development plans and physical characteristics. By compiling this information for all 58 sites, the CFS2013 was able to consistently evaluate the sites against similar criteria. Each profile contains the following information from the following sources:

- Population - 2000 and 2010 Census
- Employment Characteristics – 2000 Census & 2007-2011 5 year American Community Survey
- Journey-to-work – 2000 Census
- Planned Developments – NYC Department of City Planning
- Travel Time comparison – Google Maps
- Transit Access – Google Maps and MTA

[16] Mode choice models predict a market capture rate for a specific mode based on its characteristics (such as fare, travel time and frequency) compared to those same characteristics for competing modes.

- Water Depths – NOAA navigation charts[17]
- The site's suitability for emergency use – site visits

Figure 5.1: CFS2013 Study Sites



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17 NOAA navigation charts provide a useful approximation of navigation conditions in the context of a screening exercise. Further analysis, such as surveys, would be required for individual locations considered for ferry service.

By comparing each site's current population and employment characteristics, the CFS2013 was able to identify areas experiencing high levels of growth. Growth trends were highly varied by location, with some locations exhibiting slow growth while other locations (for example Long Island City North and North Williamsburg) saw nearly a doubling of their residential populations in a decade.

In addition to the sites from the 2010 study that were revisited, a number of new sites were taken into consideration. These added sites are listed in Table 5.1.

Table 5.1: New Sites Analyzed in the CFS2013

Locations		
Brooklyn Navy Yard, Brooklyn	Coney Island Creek, Brooklyn	Long Island City North, Queens
Valentino Pier, Red Hook, Brooklyn	Christopher St, Manhattan	Grand St, Manhattan
Astoria Cove, Queens	Beach 67th St, Queens	Beach 108th St, Queens
Beach 116th St, Queens	Port Richmond, Staten Island	St George, Staten Island
Glen Cove, Long Island	South Amboy, New Jersey	

Site Prioritization

The site profiles were used to guide the selection of sites for the first phase of ridership modeling. Information gained from various site visits was used to supplement the information contained in each site profile. The site visits yielded invaluable information in terms of understanding the physical area around the study sites. The visits and the site profiles allowed the study to assess several important factors for sites, including:

- **Ridership potential:** The study developed detailed assessments of both current commutation potential (using the various data described previously) as well as leisure ridership potential for sites. Leisure potential was determined for various waterfront attractions, including Four Freedoms Park on Roosevelt Island, Brooklyn Bridge Park and the proposed New York Wheel on Staten Island, based on existing visitation data or projections.
- **Proximity to competing existing transit service:** Several sites, such as Fordham Landing, are very near Metro North commuter rail stops. An analysis of comparative travel times and frequency in these instances revealed that passenger ferry service to Midtown or Lower Manhattan would not be expected to be competitive.
- **Physical limitations of the sites:** Physical limitations assessed included shallow water at the bulkhead that would require dredging. While these limitations can be overcome, the capital and environmental mitigation costs required to do so may be prohibitively high. Other physical considerations included passenger accessibility to the waterfront, navigational obstacles, and parking availability in areas with reliance on personal vehicles to reach a ferry landing.

- **Limited potential for network connectivity:** Glen Cove, Long Island and South Amboy, New Jersey have often been discussed as potential origins for ferry service to Manhattan. Both locations have had prior service and, in the case of Glen Cove, are currently completing extensive capital investments in ferry facilities. These sites are included because of the potential to leverage these sites to support longer distance ferry routes. However, both these locations would serve primarily non-New York City residents, even if the services could be combined with stops at New York City locations on the way to Midtown or Lower Manhattan. There would be limited incentive for the operators of these services to consider stops within New York City given the additional travel time and operating costs involved in doing so.

Based on this multi-level assessment, the extensive list of 58 sites was reduced to 35 potential sites that were carried through to the first phase of ridership modeling. A list of the sites used in the first phase of modeling is shown in Figure 5.2.

The first phase of ridership modeling consisted of modeling the potential ridership between each of the selected sites to the key employment centers of Midtown and Lower Manhattan focusing on the weekday peak period. The ferry landings at Pier 11 and the World Financial Center (WFC) were used as lower Manhattan destinations, while Pier 79 and E 34th St were used at midtown destinations (east and west). These point-to-point forecasts helped the CFS2013 to identify the locations with the greatest potential to be combined into possible routes for the next phase of modeling.

Route Identification

The point-to-point ridership forecasts allowed the CFS2013 to rank the site pairs by the competitiveness of the ferry alternative, number of overall commuters to the destination and forecasted ferry ridership. The results of the point-to-point ridership forecasts were the basis for the definition of six routes, each incorporating several locations into a service to Midtown and/or Lower Manhattan[18].

In addition to weekday ridership projections, the CFS2013 also developed detailed estimates of vessel operating costs for each route. The ridership and operating costs were then used to develop revenue and subsidy estimates for each route under various fare and service frequency scenarios. Besides operating costs, the CFS2013 produced order-of-magnitude capital costs needs for each location included in a route that requires new ferry landing infrastructure.

[18] The CFS2013 developed a model for each of the six routes taking into account the effects of linking multiple sites together in a single route. When sites are combined in a route there are two distinct effects: First, operating costs per passenger will tend to be reduced as one vessel is serving multiple stops each with its own ridership base. On the other hand, the addition of stops along a route translates into increased time spent maneuvering into and away from the dock as well as time spent waiting for passengers to board or depart the ferry. The increase in travel time for users from most locations results in an inevitable decrease in ridership.

Figure 5.2: Summary of Ridership Modeling Process

Site Prioritization:
Site profiles

Sites:

City Island
Co-Op City
Ferry Point Park
Fordham Landing
Hunts Point
Orchard Beach
Riverdale
Roberto Clemente State Park
Soundview
Yankee Stadium
Bay Ridge
Brooklyn Army Terminal
Brooklyn Navy Yard
Coney Island Beach
Coney Island Creek
DUMBO/Fulton Ferry
Floyd Bennett Field
Greenpoint
North Williamsburg
Pier 6 - Brooklyn Bridge Park
Sheepshead Bay
South Williamsburg
Valentino Pier - Red Hook
Van Brunt St - Red Hook
Christopher St
Dyckman St
E 23rd St
E 34th St
E 62 St
E 71st St
E 90th St
Grand St
Pier 11/Wall Street
Pier 79
Roosevelt Island - North
Roosevelt Island - South
W 69th St
W 125th St
World Financial Center
Astoria Cove
Beach 67th St
Beach 108th St
Beach 116th St
Citi Field
Hallets Point
Jacob Riis Park
JFK International Airport
Long Island City - North
Long Island City - South
Camp St Edward
Port Richmond
Snug Harbor
St George
Stapleton
Tottenville
Governors Island
Glen Cove
South Amboy, NJ

⇨

Modeling Phase 1: Point-to-Point ridership forecasts produced

Sites:

Ferry Point Park
Soundview
Bay Ridge
Brooklyn Army Terminal
Brooklyn Navy Yard
Coney Island Beach
Coney Island Creek
Pier 6 – Brooklyn Bridge Park
Valentino Pier - Red Hook
Van Brunt St – Red Hook
Christopher St
Dyckman St
E 23rd St
E 34th St
E 62 St
E 90th St
Grand St
Pier 11/Wall Street
Pier 79
Roosevelt Island – North
Roosevelt Island – South
W 69th St
W 125th St
World Financial Center
Astoria Cove
Beach 67th St
Beach 108th St
Beach 116th St
Hallets Point
Long Island City – North
Camp St Edward
Port Richmond
St George
Stapleton
Governors Island

⇨

Modeling Phase 2: Route ridership forecasts produced and capital costs were developed

Sites:

Soundview
Bay Ridge
Brooklyn Army Terminal
Pier 6 – Brooklyn Bridge Park
Van Brunt St – Red Hook
E 23rd St
E 34th St
E 62 St
E 90th St
Grand St
Pier 11/Wall Street
Pier 79
Roosevelt Island – South
Astoria Cove
Beach 116th St
Long Island City – North
St George

Color Key:
Bronx – Red
Brooklyn – Blue
Manhattan – Orange
Queens – Green
Staten Island – Purple
Other - Black

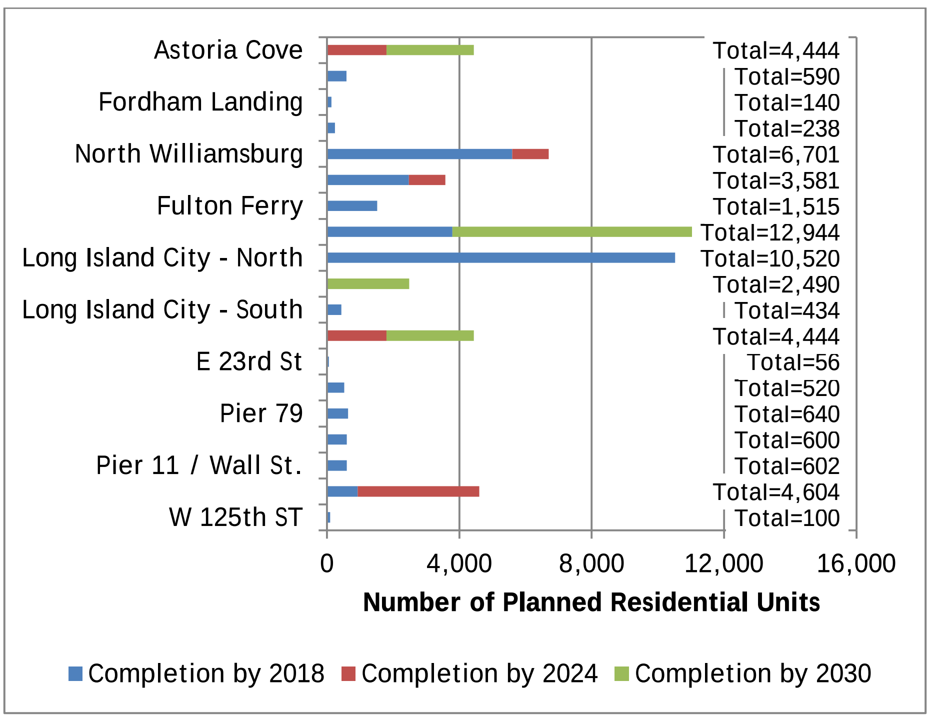
Potential Future Waterfront Developments

The experience of the East River Ferry illustrates the degree to which waterfront residential and employment growth has increased the value of waterborne transit options[19]. New York City is currently seeing an unprecedented amount of waterfront growth and rebuilding in and around its numerous waterfront communities, aided in part by a widespread rezoning initiative by the City.

Given dynamic and fast-changing conditions on the waterfront, it was imperative to have precise and up-to-date data and forecasts of residential development to develop ridership forecasts. For many locations, such as Long Island City North or Astoria Cove, rapid growth meant that 2010 Census data was essentially obsolete and even misleading as a basis for ridership forecasting.

To address these shortcomings, the CFS2013 obtained development data compiled by the New York City Department of City Planning. These data outline all known recent, current and future developments within the catchment areas for each study site[20]. Figure 5.3 summarizes the planned residential development project within the catchment area of a study site.

Figure 5.3: Planned Residential Units



[19] See New York City Economic Development Corporation, 2013, Ferry Policy and Planning in New York City: Considerations for a Five-Borough Ferry System. December, 2013.

[20] The CFS2013 produced ridership forecasts for two years, 2013 and 2018. The 2018 forecasts accounted for the number of residential units that projected to be built by 2018.

Stakeholder Outreach

Similar to the CFS2011, the current study included an extensive stakeholder outreach component. As part of the current update, the CFS2013 conducted targeted briefings and interviews with the following stakeholders:

- City Council district members and staff
- Ferry operators

Motivations for the outreach were twofold: First, a public sector transportation initiative such as an expansion of passenger ferry service needs to elicit input from elected officials to best understand local needs and constituent concerns. Second, outreach to ferry operators is important to better understand opportunities and challenges stemming from factors such as operating costs, technology and evolving market conditions.

City Council Districts

Outreach briefings were hosted by borough for City Council Members and their representatives on October 29th and 30th, 2013. All council members whose districts include (or will include with the new 2014 district boundaries) ferry study sites and passenger catchment areas were invited.

The briefings included a discussion of findings from the prior study and lessons learned from the East River Ferry pilot. The goal of the briefings, however, was to collect information to inform the CFS2013. Specifically, the CFS2013 sought information on the following:

- Any density changes in the district?
- Any proposed or planned land use changes, e.g. industrial to residential?
- Any new commercial, residential or recreational projects that will impact demand?
- Any proposed or planned changes in nearby transit modes that will impact ferry ridership? For example, are there any new bus lines, increased service frequency or temporary station closures due to subway reconstruction projects in the district?

Feedback from City Council members and staff included:

- Information on new upcoming residential developments in various districts
- Connectivity needs between transit and ferry sites
- Need to evaluate uniform payment method, i.e., use of MetroCard for ferry rides
- New and/or expanded recreational opportunities that may enhance recreational ridership in areas such as the Bronx and Staten Island

Additional information from this process directly related to potential ridership modeling is included in the individual site profiles in APPENDIX 3A.

Ferry Operators

To provide updated operator information for the City, interviews were conducted with all current private providers of ferry service in New York Harbor. The providers interviewed include:

- Port Imperial Ferry Corporation
- Billybey Ferry Company
- New York Water Taxi
- Seastreak
- T.W.F.M. Ferry Company
- Statue Cruises, A Hornblower Company

To encourage candor, the operators' comments are not directly attributed, and are therefore confidential. Operators were asked for their perspectives on the following topics:

- State of current service
- Opportunities for new services
- Emergency response and disaster recovery - lessons learned from Sandy
- Amenities to increase ridership
- Potential funding and/or management ideas
- General feedback for the City

The main issues identified are the following:

- The ferry industry needs a dedicated forum to discuss issues with public agencies and waterfront organizations. Current venues are ineffective for addressing operator concerns. For example, meetings with ferry operators are often combined with non-motorized boating groups.
- Multiple agencies with jurisdiction over ferry operations and multiple landing owners are inefficient.
- Fuel costs are a major concern, and operators are interested in solutions to refuel within New York (rather than New Jersey) without significant fuel tax implications. In addition to costs, there are concerns with the lack of refueling locations within New York City.
- Under many current ferry service structures, operators feel that they take on the majority of risk while property owners benefit from the majority of rewards.
- Longer-term contract opportunities are necessary to allow operators to finance the construction of new boats that may be required for expansion of service. In addition, public assistance to purchase vessels could be helpful.
- Sometimes public financial support of ferries weakens the private industry, and the City should minimize subsidies in order to maintain the strength and sustainability of unsubsidized services. However, in other instances, a subsidy is needed when ferries are competing with other modes of transportation which are also subsidized
- Intermodal connections are important; opportunities to improve ferry service connectivity with buses should be pursued.
- Amenities with potential to increase ridership include: improved weather protection through shelters, fare integration (MetroCard), and strong cellular networks to support operation.

- Parking is an important consideration in certain areas where potential riders rely on personal vehicles and do not live within walking distance of a landing.

6 Ridership Modeling and Analysis

Commuter and Leisure Models

Background

The ridership modeling for the CFS2013 relied extensively on an existing set of models developed recently for the PANYNJ[21]. The models are described in detail in APPENDIX 4, and the key features of the models are the following:

- The models are forecasting tools that generate estimates of transit market capture for passenger ferry services at specific locations. The capture rate is based on the ferry service characteristics (such as fare, travel time and frequency) and the resulting attractiveness of the ferry option relative to the transit alternatives at that location.
- The models have been developed separately for subway users or express bus users. As mentioned previously, earlier research on ferry use in New York City suggests that ferry service to Midtown or downtown Manhattan will draw overwhelmingly from existing transit, hence the appropriateness of focusing exclusively on capture from transit in the modeling.
- Forecasts generated by the PANYNJ models are for weekday peak-period users, primarily commuters. Weekday off-peak usage is forecast separately using observed relationships for the East River Ferry, and weekend ridership can be forecast using a separate econometric model developed by the CFS2013 which ties weekend usage to weekday usage as well as a measure of the site's attractiveness as a weekend destination.
- The PANYNJ mode choice models are shown to predict ferry demand very well. A calibration exercise using East River Ferry data is described in APPENDIX 4.

Model Development

Until the PANYNJ models were developed, there was a lack of understanding of the ferry passenger market in New York City. For this reason, a comprehensive stated preference (SP) survey was completed in 2010 to better understand the travel preferences of potential ferry riders originating in the New York City's five boroughs and to serve as the empirical basis for a predictive passenger ferry demand model.

The estimation of the two mode choice models is described in detail in the PANYNJ report, but the most salient facts are the following:

- The estimation was based on a large number of responses and produced a model with strong statistical significance.

[21] Halcrow, Inc., 2010. *Study of Regional Private Passenger Ferry Services in the New York Metropolitan Area: Interim Report 7 Stated Preference Survey and Ridership Forecasts for Potential Routes*. Report Submitted to the Port Authority of New York and New Jersey.

- As expected, the models predict that ferry ridership would decline with increases in fare, in-vessel time, wait time and access time. The model estimation also revealed a lower probability of choosing ferries for female respondents[22].
- Respondents also exhibited an inherent preference for the ferry mode over their current subway or express bus option. The preference for ferry is a measure of how much respondents would be willing to pay for a ferry option if all characteristics were equal to the current option. For subway users (who face a generally shorter commute) the willingness-to-pay for a ferry option was equal to $1.15; for express bus users (who typically face a longer commute) the valuation of the ferry option was $1.92)[23].

The model coefficients have expected signs. For example, increasing ferry travel time relative to subway decreases the probability that patrons would adopt ferry as a mode of choice. Similarly, increases in fare or headway decreases the probability that ferry would be adopted as a mode of choice. The mode choice constant is positive, implying that ferries are preferred by users as a mode of travel compared to subway.In initial applications, the Subway/Ferry Mode Choice Model was used to test demand for a then hypothetical ferry service between several locations (notably Williamsburg) and Pier 11 or 34th Street in Manhattan. The assumed characteristics were not identical to the current East River Ferry, but resulting ridership forecasts were comparable to current East River Ferry ridership, suggesting that the model would be a robust tool for forecasting ridership of proposed passenger ferry services in New York Harbor. A more complete validation exercise was carried out in the context of the current project based on actual East River Ferry characteristics and ridership results.

LaGuardia Airport Model

Background

A privately-operated ferry service to LaGuardia Airport operated from 1988 to 2000. This service, connecting ferry terminals at Pier 11 and East 34th Street in Manhattan with the Marine Air Terminal at LaGuardia Airport, was sponsored by Delta Airlines and was marketed as the “Delta Water Shuttle” to provide a connection to Delta’s flights to Washington D.C. and Boston. Since the service was sponsored solely to support flights leaving from the Marine Air Terminal (Terminal A), connections to other terminals were not marketed. In interviews with ferry operators familiar with the service, it was described as a “nice service”, “consistent” for customers, but one that “lost money” for the operator as well as for Delta, which provided a fuel subsidy for their sponsorship.

[22] An alternative formulation of the mode choice models also revealed that high-income users (with income over $100,000) were more likely to choose the ferry *all other factors being equal*, and respondents also were more likely to choose the ferry option if it were part of an integrated fare structure. These model formulations proved to have lower predictive power and were therefore abandoned in favor of model formulations incorporating only fare, headway, access time, and gender.

[23] Note that this preference is for a ferry service, which, as presented to respondents in the SP survey, is a premium service such as the East River Ferry.

There was no public subsidy for this service. Fares at one point in time were $15 one way and $25 round trip and were reported to be up to $19 one way when the service was operated most recently by New York Waterway. Data from four years of ridership indicate the following patterns:

- Average daily ridership was 130 passenger trips per day
- January was consistently the lowest month for ridership
- June usually has the highest ridership
- Daily highs were reported anecdotally as up to 200 per day

In looking at what it may take to reactivate this service, it is worth examining what has changed to make the service a more attractive option since the prior ferry service ceased operations. There have been numerous developments to both ferry services as well as at LaGuardia Airport that may support the viability of a revived ferry service.

Model Development

The potential for ferry service to and from LaGuardia Airport from Manhattan's East Side was studied in 2006, and a mode choice model was developed by the PANYNJ for this purpose[24]. This model, which was made available to the CFS2013, relied heavily on customer satisfaction data provided by the PANYNJ that included additional information on how passengers accessed the airport. For the CFS2013, the econometric model from that prior study was updated with 2011 customer satisfaction survey data, and no stated preference surveys were conducted as part of this effort.

To develop a mode choice model, a probability model was developed whereby riders are presented choices from their origin to LaGuardia Airport based on time and cost combinations. Cost, access fares and distances were estimated using zip code-level trip origins, which were then used to supplement the data set.

Total market size of LaGuardia Airport is 25.7 million passengers/year. Of that, 50% of LaGuardia Airport users are destined to Manhattan, 10% are destined to Brooklyn, and the remainder of LaGuardia Airport users are dispersed throughout the region.

Ferry market potential was limited to LaGuardia Airport users who currently access the airport by taxis, car services, shared-van service (e.g. Super Shuttle), or public transit such as the MTA bus. All users that drive their own vehicles or are dropped-off by a non-commercial vehicle were excluded. All users carrying two or more bags are ruled out from potential ridership pool because of inconvenience of moving luggage to and from a ferry. A flow chart summarizes this process in Figure 1.4. More details on the modelling methodology are provided in the APPENDIX 4.

Citywide Ridership Modeling Results: Point-to-Point Service Potential for Commuter and Leisure Services

Compared to the robust network of Hudson River ferry crossings between New York and New Jersey, point-to-point ferry service is unlikely to be viable within New York

[24] See The Louis Berger Group, 2006. *Ridership projections for Proposed LaGuardia - Manhattan Ferry Service.* Report submitted to the Port Authority of New York and New Jersey.

City. New York City has a comparatively extensive network of transit alternatives across water bodies with high service frequency and relatively low fares. As discussed in APPENDIX 4, this transit competition will tend to restrict the market size (and demand high service frequencies) for any single ferry site, reducing the viability of most locations for point-to-point service.

The CFS2013 therefore forecasted point-to-point ridership primarily to identify station pairs that could potentially be served by a multiple stop ferry route. The analysis demonstrated significant variability in ridership demand between station pairs, and this preliminary ridership demand was the primary input in the design of routes.

In forecasting point-to-point ridership the CFS2013 developed input assumptions that would permit a balanced comparison between sites: the CFS2013 assumed 20-minute headways and $5 fare for ferry service between all station pairs.

As mentioned above the mode choice models are weekday peak-period models. Analysis of the East River Ferry ridership data revealed that AM peak ridership accounts for 30% of overall ridership, a relationship that is quite stable irrespective of the origin pier. Building off of this insight, the model divides AM peak ridership by 0.3 to produce a daily ridership estimate that takes into account intra-borough and return trips. In this way, the model does not require modeling of intra-borough station pairs, but rather only station pairs for which the destination is one of the four major Manhattan sites: East 34th St, Pier 11/Wall St, World Financial Center, and Pier 79/W 39th St.

For each station pair a calculation of potential demand was developed, which was based on an estimate of the existing journey-to-work movements between the origin and destination pairs. For the origin location, the ridership potential was usually drawn from relatively circumscribed market areas: a Primary Market Area (PMA) defined by a 1/4 mile radius from the ferry pier, and a Secondary Market Area (SMA) described by a radius extending from the 1/4 mile to a 1/2 mile boundary. On the destination side a similar "market" definition was used. For less dense locations, for example several on Staten Island, an Extended Market Area (EMA) was also incorporated to reflect the observed patterns of commutation involving private vehicles and feeder bus routes.

For each station pair the relevant costs (fare, travel time, headway, and access time) for both the proposed ferry service and the competing subway or express bus service were carefully calculated from a series of data and mapping sources. The mode choice models were then applied to calculate the market capture rate for ferries based on the relative attractiveness of the ferry option.

Table 6.1 shows the station pairs with at least 120 daily forecasted passenger trips, a benchmark minimum in previous studies, ranked by forecasted ridership. As mentioned, it is the relative attractiveness of the ferry option that determines the capture rate, and hence the capture rate will not necessarily decline with route distance. Further, a high capture rate will not necessarily ensure high forecasted ridership, and a low capture rate will not necessarily generate low ridership: It is the combination of capture rate and its application to various journey-to-work markets that together determine ridership.

To illustrate, Long Island City North to Pier 11 at Wall Street generates a capture rate of less than 9% despite the rapid travel time offered by the hypothetical service. The relatively low capture rate reflects the fact that Long Island City North has good subway connections, and even a two-seat ride to Lower Manhattan can be accomplished fairly quickly. However, the tremendous growth at Long Island City North mentioned previously means that the estimated daily commutation base to Lower Manhattan in 2018 will be well over 5,000 in the Primary Market Area and Secondary Market Area: Applying a 9% capture rate to this volume generates the highest peak period and daily ridership of any station pair.

Likewise, St George to East 34th St produces a high projected capture rate for the ferry as the alternative transit option to Midtown requires a two-seat ride involving the Staten Island Ferry and local subway. However, applying this high capture rate to the smaller observed commutation base yields ridership estimates that are far below those generated for Long Island City North.

Table 6.1: Forecasted Ridership by Station Pair

Origin	Destination	2018 Daily Trip Potential	Capture Rate	2018 Daily Forecasted Trips
Long Island City North	Pier 11 / Wall St	17,266	9%	1,542
Stapleton	Pier 11 / Wall St	4,750	29%	1,374
Port Richmond	Pier 11 / Wall St	7,806	9%	702
Soundview	Pier 11 / Wall St	2,638	22%	577
Brooklyn Army Terminal	Pier 11 / Wall St	15,086	4%	540
Coney Island Creek	Pier 11 / Wall St	1,313	34%	444
E 90th St	Pier 11 / Wall St	6,798	6%	424
St George	East 34th St	489	81%	397
E 23rd St	Pier 11 / Wall St	5,703	7%	386
Stapleton	East 34th St	611	58%	356
East 34th St	Pier 11 / Wall St	6,290	6%	348
Port Richmond	World Financial Center	2,477	14%	347
Beach 108th/116th St	Pier 11 / Wall St	2,048	17%	344
Stapleton	World Financial Center	1,403	23%	330
St George	Pier 11 / Wall St	2,870	11%	305
E 62nd St	Pier 11 / Wall St	4,686	6%	266
Coney Island Creek	World Financial Center	669	39%	263
Long Island City North	East 34th St	3,394	7%	244
Brooklyn Army Terminal	World Financial Center	5,931	4%	237
E 90th St	East 34th St	2,864	8%	216
Bay Ridge (69th St)	Pier 11 / Wall St	1,287	16%	208
E 62nd St	East 34th St	3,034	7%	199
E 23rd St	East 34th St	5,596	3%	185
Pier 6	Pier 11 / Wall St	3,042	6%	184
Port Richmond	East 34th St	793	23%	180
Roosevelt Island	Pier 11 / Wall St	1,125	13%	150
Brooklyn Army Terminal	East 34th St	3,111	5%	147
Beach 108th/116th St	East 34th St	701	20%	138

Several ferry sites stand out in their potential to attract significant ridership. Pier 11/Wall St is the most attractive destination, with East 34^{th} St also attracting significant ridership. Among the origins, Long Island City North produces the most demand, as mentioned, due in part to the ambitious development projects to be completed there by 2018. Otherwise, there are promising ferry sites in all five boroughs with no particularly dominant region.

Ridership Results: Potential Commuter Service Corridors

Based on the point-to-point ridership results, and with the stated interest in the most promising routes incorporating all five boroughs, the CFS2013 developed six ferry routes. Also instrumental in the definition of the routes were important policy considerations:

- It was decided that ferry service that directly competed with the Staten Island Ferry would produce an inefficient and duplicative use of limited transit funding for commuter service. This meant that ferry service between St George and Lower Manhattan was eliminated from consideration.
- Similarly, ferry service from Stapleton to Lower Manhattan would also draw ridership heavily from the Staten Island Ferry and therefore would not be considered in the context of the CFS2013 (though such a route could be considered at a later date with the realization of planned residential developments).
- Although Port Richmond resulted in relatively high point-to-point ridership estimates, these levels are insufficient to sustain a stand-alone service given the distances involved. As Port Richmond is difficult to link with other sites to add ridership and reduce per passenger operating costs, it is also not considered further in the CFS2013.
- There was a concerted attempt to match some routes with lower overall ridership potential with others showing much higher potential. This is meant to permit the extension of ferry service as widely as possible, while maintaining the anticipated subsidy levels of any single route at sustainable levels. Higher ridership locations essentially support service to lower ridership locations, often at minimal added cost, and support opportunities for growth and accessibility in lower demand areas.

The CFS2013 modeled the proposed routes for 2013 and 2018, with low and high frequency schedules, at a $5.00 and revenue-maximizing (RevMax) fare (with the process for estimating the fare described below)[25]. Table 6.2 summarizes the scenarios modeled for 2018 to best reflect the effects of ongoing and planned residential and employment growth at the various sites.

Note for the routes described in Tables 6.3 and 6.4, Route 5 ridership projections are predicated on expected visitation to the planned New York Wheel and Empire Outlets development (see Note 1 on Table 6.4).

[25] The choice of a $5 base fare reflected a desire for consistency with CFS2010.

Table 6.2: Summary of Modeled Ferry Services

Route	Stops	Low Frequency Headway	High Frequency Headway
1	Bay Ridge, Red Hook, Pier 6 - Brooklyn Bridge Park, Pier 11- Wall St	30 min (2 boats)	20 min (3 boats)
1b	Red Hook, Pier 6 – Brooklyn Bridge Park, Pier 11 – Wall St	35 min headway (1 boat)	NA
2	Astoria, Roosevelt Island, Long Island City North, East 34th St	24 min (2 boats)	16 min (3 boats)
2B	Astoria, Roosevelt Island, Long Island City North, East 34th St, and Pier 11	41 min (2 boats)	20 min (4 boats)
3	E 90th St, E 62nd St, Pier 11- Wall St	26 min (2 boats)	17 min (3 boats)
3B	Soundview, E 90th St, E 62nd St, Pier 11	44 min (2 boats)	29 min (3 boats)
3B - Select	Soundview, E 90th St, E 62nd St, Pier 11 – Wall St	89 min (Soundview)/19min (E 90th)	44 min (Soundview)/22min (E 90th)
4	East 34th St, East 23rd St, Grand St, Pier 11 – Wall St	27 min (2 boats)	18 min (3 boats)
4B	Long Island City North, East 34th St, East 23rd St, Grand St, Pier 11 – Wall St	34 min (2 boats)	22 min (3 boats)
5	St George, Pier 79	53 min (1 boat)	27 min (2 boats)
6	Rockaway Mid-Peninsula, Brooklyn Army Terminal, Pier 11 – Wall St	60 min (2 boats)	40 min (3 boats)

Ridership modeling clearly revealed that shorter headway scenarios resulted in higher ridership and revenues that more than compensated for the higher operating costs associated with operating more boats, requiring lower subsidies in all cases other than the LaGuardia Airport service. As a result, forecast results of the longer headway scenarios are omitted from discussion since they are always less preferable in terms of cost. Table 6.3 contains journey-to-work (referred to as JTW), capture rate and forecasted daily ridership for all routes at a $5.00 fare.

Table 6.3: 2018 Forecasted Ridership with $5.00 Fares

Route	Stops	Headway (min)	Daily JTW potential	Capture rate	Daily trips
1	Bay Ridge, Red Hook, Pier 6 - Brooklyn Bridge Park, Pier 11- Wall St	20	6,717	9%	388
1b	Red Hook, Pier 6 – Brooklyn Bridge Park, Pier 11 – Wall St	35	5,430	1%	67[26]
2	Astoria, Roosevelt Island, Long Island City – North, East 34th St	16	4,669	16%	496
2B	Astoria, Roosevelt Island, Long Island City – North, East 34th St, and Pier 11	20	30,065	10%	1,902
3	E 90th St, E 62nd St, Pier 11	17	11,484	11%	857
3B	Soundview, E 90th St, E 62nd St, Pier 11	29	14,122	7%	658
3B - Select	Soundview E 90th St, E 62nd St, Pier 11	44 Soundview /22 other	14,122	8%	742
4	East 34th St, East 23rd S., Grand St, Pier 11	18	20,326	5%	963
4B	Long Island City – North, East 34th St, East 23rd St, Grand St, Pier 11	22	40,986	4%	1,483
5[1]	St George, Pier 79	27	88	91%	75
6	Rockaway Mid-peninsula, Brooklyn Army Terminal, Pier 11	40	3,111	2%	146

Table 6.4 contains the capture rates and ridership forecasts with RevMax fares.

[26] Ridership estimate assumes that no off-peak service is provided.

Table 6.4: 2018 Forecasted Ridership with RevMax Fares

Route	Stops	Headway (min)	Daily JTW potential	Fare (USD 2013)	Capture rate	Daily trips
1	Bay Ridge, Red Hook, Pier 6 - Brooklyn Bridge Park, Pier 11-Wall St	20	6,717	$2.75	14%	939
1b	Red Hook, Pier 6 – Brooklyn Bridge Park, Pier 11 – Wall St	35	5,430	$2.50	4%	194[27]
2	Astoria, Roosevelt Island, Long Island City – North, East 34th St	16	4,669	$2.75	25%	1,146
2B	Astoria, Roosevelt Island, Long Island City – North, East 34th St, and Pier 11	20	30,065	$2.75	16%	4,699
3	E 90th St, E 62nd St, Pier 11	17	11,484	$2.75	18%	2,073
3B	Soundview, E 90th St, E 62nd St, Pier 11	29	14,122	$2.75	11%	1,590
3B - Select	Soundview E 90th St, E 62nd St, Pier 11	44/22	14,122	$2.75	13%	1,855
4	East 34th St, East 23rd St, Grand St, Pier 11	18	20,326	$2.75	12%	2,415
4B	Long Island City – North, East 34th St, East 23rd St, Grand St, Pier 11	22	40,986	$2.50	10%	4,191
5[1]	St George, Pier 79	27	88	$5.50	6%[28]	843
6	Rockaway Mid-peninsula, Brooklyn Army Terminal, Pier 11	56	3,111	$2.50	31%	959

(1) Route 5 ridership results detailed above are mostly developed outside the mode choice models. Table 6.3 details commutation estimates only, but Route 5 is seen as primarily serving leisure purposes, namely visitors to the planned and approved New York Wheel and Empire State Outlets, and the reported ridership and capture reflect the ridership required (along with the commuter ridership) to ensure operating cost coverage from the farebox.

[27] Ridership estimate assumes that no off-peak service is provided.

[28] 6% capture rate assumed for projected 2.4 million annual visitors traveling from Manhattan to St George.

The results of the route-based ridership forecasts eliminated a majority of scenarios from consideration. Routes 1, 1b, 2, 3, and 3B–Select proved to require increased subsidies over the other routes in Table 5.4, so they are not recommended. Route 5 ridership reported here is not a forecast of future commutation ridership alone. Rather, the route is primarily anticipated to serve visitation to the future New York Wheel and associated shopping destinations while reducing strains on the existing Staten Island Ferry service schedule. Forecasting this demand is extremely challenging given the preliminary nature of the visitation estimates and the inapplicability of the mode choice models to this very specific market. Given this constraint, the ridership for Route 5 is essentially an estimate of required ridership and New York Wheel visitation capture required to ensure service at financial break-even levels.

Route 3B was preferred over Route 3 even though the latter performs well in terms of required subsidies. The difference in the routes is the extension to Soundview, and it is felt that creating wider accessibility to the Bronx waterfront is an important policy consideration. Route 3B, as shown in Figure 6.1, serves areas of the Bronx, via Soundview, and Manhattan, via East 90th St and East 62nd St, that suffer from low connectivity. The Second Avenue Subway, currently under construction, will eventually provide superior connectivity for eastern Manhattan, but Soundview would likely benefit from ferry service for a longer period. Additionally, there is opportunity for connecting Bronx residents to hospital and other job centers in the Upper East Side. This route would require construction of two new ferry landings, approximately valued at $16.6 million in capital expenditures.

Figure 6.1: Route 3B

Table 6.5: Route 3B Detailed Ridership Forecast at $2.75 with 29-Minute Headways

Origin	Destination	Daily JTW potential	Capture rate	Daily forecasted trips
E 90th St	Pier 11 / Wall St	6,798	9%	606
E 62nd St	Pier 11 / Wall St	4,686	11%	514
Soundview	Pier 11 / Wall St	2,638	18%	470

Three new routes exhibit significant ridership and would require relatively little public support to operate: 2B, 4 and 4B. Route 4B, as shown in Figure 6.2, which connects Pier 11/Wall St to Long Island City North via Grand St, East 23rd St and East 34th St, is estimated to attract over 4,100 daily trips. With an unremarkable capture rate of 10%, the higher ridership forecast is mainly due to the addition of commuters in new developments in Long Island City North and their demand to reach Pier 11, making Route 4B an attractive option. This route would require construction of three new ferry landings, approximately valued at $17.5 million in capital expenditures.

Figure 6.2: Route 4B

Table 6.6: Route 4B Detailed Ridership Forecast at $2.50 with 22 Minute Headways

Origin	Destination	Daily JTW potential	Capture rate	Daily forecasted trips
E 23rd St	East 34th St	5,596	9%	497
Grand St	East 34th St	679	16%	109
Pier 11 / Wall St	East 34th St	431	6%	27
Long Island City North	East 34th St	3,394	19%	645
Long Island City North	Pier 11 / Wall St	17,266	8%	1,385
East 34th St	Pier 11 / Wall St	6,290	7%	470
E 23rd St	Pier 11 / Wall St	5,703	13%	744
Grand St	Pier 11 / Wall St	1,627	19%	314

Route 4, shown in Figure 6.3, does not serve Long Island City North, but has roughly half the journey-to-work potential as Route 4B. With the same capture rate, the model therefore forecasts half the ridership. Both Routes 4B and 2B provide access from Long Island City North to Pier 11. If only one route were to serve Long Island City North (preventing service overlap), Route 4B is more viable without Long Island City North than Route 2B. One benefit of Route 4 is that ridership, shown in Table 6.7, is distributed relatively evenly amongst station pairs, so the service is less likely to be limited by capacity. Route 4 would require construction of two new ferry landings, approximately valued at $11.9 million in capital expenditures.

Figure 6.3: Route 4

Table 6.7: Route 4 Detailed Ridership Forecast at $2.75 with 18 Minute Headways

Origin	Destination	Daily JTW potential	Capture rate	Daily forecasted trips
E 23rd St	East 34th St	5,596	10%	558
Grand St	East 34th St	679	18%	121
Pier 11 / Wall St	East 34th St	431	7%	31
East 34th St	Pier 11 / Wall St	6,290	8%	528
E 23rd St	Pier 11 / Wall St	5,703	15%	829
Grand St	Pier 11 / Wall St	1,627	21%	348

Route 2B, shown in Figure 6.4, serves Astoria, Roosevelt Island, Long Island City North, East 34th St, and Pier 11/Wall St, thereby connecting three rapidly growing sites with the two most attractive commuter destinations. Astoria and Long Island City North will gain tens of thousands of commuters by 2018 as a result of planned developments currently underway. Roosevelt Island will become both a destination and generator of commuter trips as Cornell University develops its applied science campus. This route would require construction of three new ferry landings, approximately valued at $19.9 million in capital expenditures.

Figure 6.4: Route 2B

As shown in Table 6.8, both Astoria and Roosevelt Island produce less ridership than Long Island City North despite robust capture rates, reflecting a lower base of potential riders[29].

[29] A downside to impressive ridership is the risk of reaching capacity on boats in operation, which would limit revenue and create costly delays for passengers. The CFS2013 analyzed recent East River Ferry ridership data, and discovered that ridership is far from evenly distributed throughout the peak period. The most crowded boat left at 8:20 AM and served 16.8% of all AM peak trips, compared to the 7:00 AM departure that served just 5.3% of all AM peak trips. Distributing the AM-peak ridership forecast according to this same boarding pattern revealed that both routes 2B and 4B would reach capacity after 7:40 AM with 149-passenger

Table 6.8: Route 2B Detailed Ridership Forecast at $2.75 with 20 Minute Headways

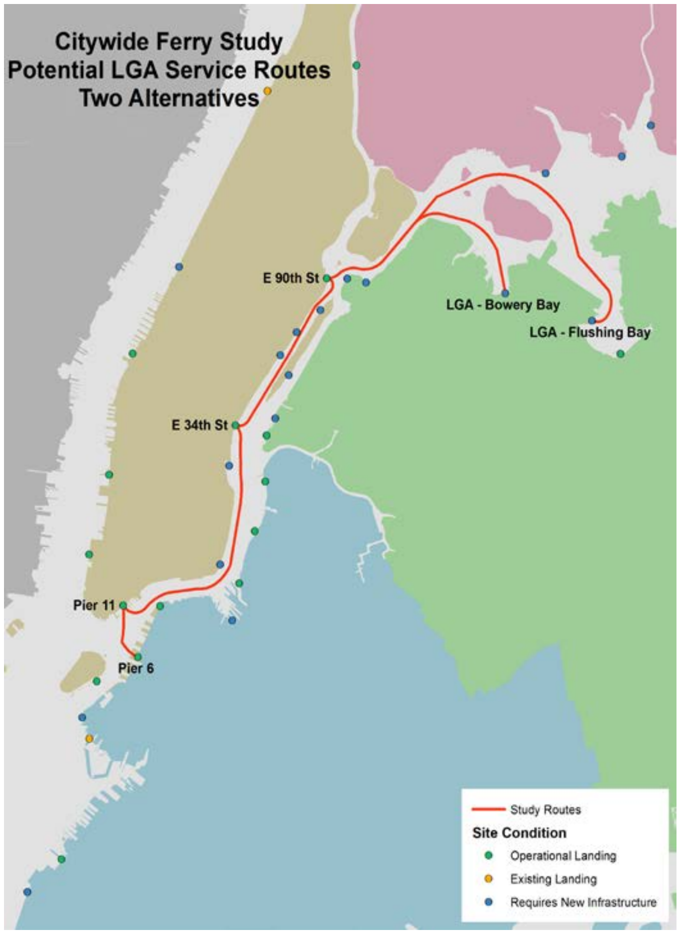
Origin	Destination	Daily JTW potential	Capture rate	Daily forecasted trips
Astoria	East 34th St	427	21%	90
Roosevelt Island	East 34th St	848	25%	214
Long Island City North	East 34th St	3,394	19%	649
Astoria	Pier 11 / Wall St	714	18%	128
Roosevelt Island	Pier 11 / Wall St	1,125	17%	192
Long Island City North	Pier 11 / Wall St	17,266	15%	2,556
East 34th St	Pier 11 / Wall St	6,290	14%	870

Ridership Results: Potential LaGuardia Airport Service

A separate APPENDIX 5 details the analysis of potential LaGuardia Airport service, which is summarized below. In the analysis, two potential ferry landing sites at LaGuardia Airport are assessed, one at Bowery Bay and the other at Flushing Bay. Potential ferry routes were developed to serve each airport ferry landing. The CFS2013 examined market potential from ferry sites at Pier 11 Wall Street, East 34th Street and East 90th Street – each site had previously had ferry services to LaGuardia.

boats. The operator can mitigate the risk of reaching capacity in three ways: increase the fare to lower ridership, increase the frequency of service, or increase the capacity of the boats. Increasing the fare lowers ridership and thus reduces the wider economic benefits of the service. Increasing the frequency of service can actually attract more ridership than the addition capacity, thus failing to resolve the issue. The CFS2013 forecasted 4-boat and 5-boat scenarios, and found that they still faced capacity issues and required higher subsidies per passenger. The best solution, therefore, is to expand the capacity of the boats. Retrofitting boats with new engines could increase their capacity, while also lowering operating expenses through use of more fuel-efficient propulsion systems.

Figure 6.5: LaGuardia Airport Service



In addition, a new site in Brooklyn was examined for potential ridership. A stop at Pier 6 in Brooklyn was added for analysis given its 15-minute walking access to the neighborhoods of Brooklyn Heights to the north and Cobble Hill to the south. Access to the site from Atlantic Avenue may also be efficient for drop offs from private vehicles as well as service from the MTA B63 bus.

North Williamsburg in Brooklyn was also considered. The analysis, however, did not show significant ridership at this location. This may result from the fact that the neighborhood still growing and the LaGuardia Airport survey sample size was not sufficiently robust. The low ridership may also be attributed to a relatively a short cab ride such that the ferry market is less competitive than other transportation options. North Williamsburg should not be ruled out for future LaGuardia service as its population grows.

The Queens waterfront was not analyzed. Given its proximity to LaGuardia Airport and highly competitive car service options to the airport, it was not considered a viable ferry airport market. For example, a taxi fare from Gantry State Park in Long Island City to LaGuardia Airport is estimated at $23 and may take only 16 minutes door-to-door. On a ferry, travel time from Gantry State Park would be greater than 15 minutes to the LaGuardia Airport ferry terminal and longer to the air terminals, and the fare modeled is $25.

The careful estimate of travel speeds is essential to the ridership forecasting exercise. To model travel times, a speed analysis was prepared for the route using the most cost-efficient speeds with the majority of the fleet available within the harbor. Travel speeds of 20 to 25 miles per hour were assumed for more cost-efficient operations. To maximize fuel efficiency, this is the predominant range of speeds for many of the current East River and Hudson River routes. While there are vessels that travel at higher speeds, this analysis focuses on examining what may be possible with the region's existing vessels. Vessels capable of traveling more than 30 MPH require much greater fuel usage and therefore have higher operating costs, and ultimately a higher ridership break-even threshold.

The tables below show modeled travel times from the airport to the following stops.

Bowery Bay Service

- 10. 7 miles, 55 minutes route time

LaGuardia Airport Bowery Bay	Depart
▪ East 90th Street	Arrive in 15 minutes
▪ East 34th Street	28 minutes
▪ Pier 11 Wall Street	44 minutes
▪ Pier 6 Brooklyn	51 minutes

Flushing Bay Service

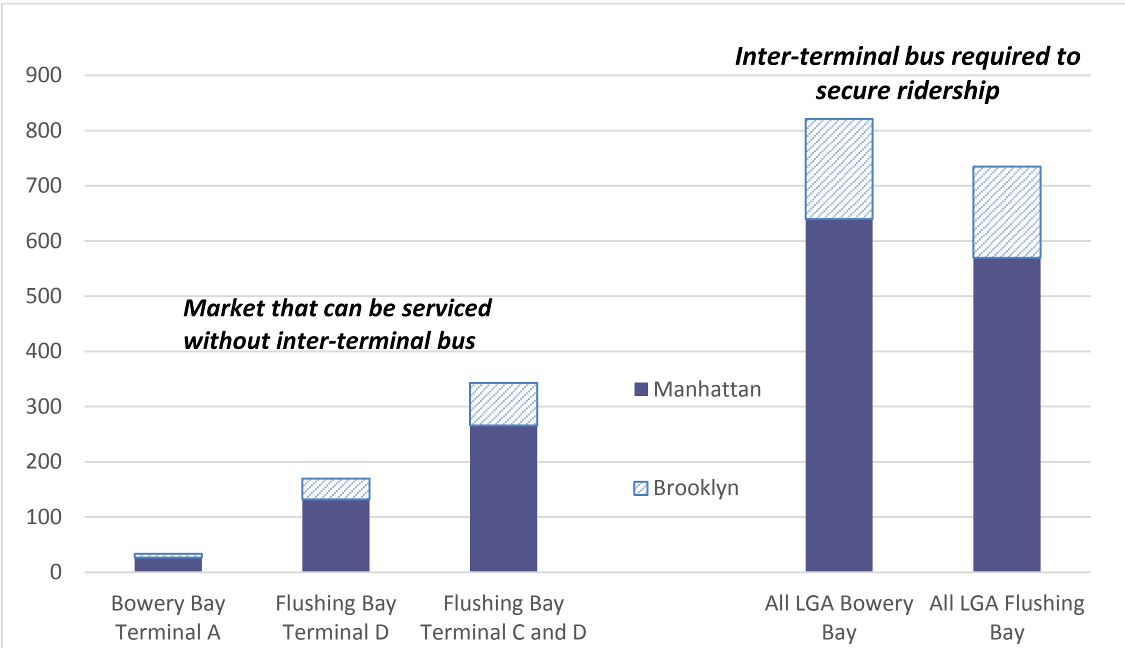
- 15 miles, 65 minutes route time

LaGuardia Airport Flushing Bay	Depart
▪ East 90th Street	Arrive in 27 minutes
▪ East 34th Street	40 minutes
▪ Pier 11 Wall Street	57 minutes
▪ Pier 6 Brooklyn	63 minutes

A ridership forecast was developed for a number of scenarios. Ridership for an hourly service to LaGuardia Airport at a cost of $25 was examined for both the Bowery Bay and the Flushing Bay sites. A fare of $25 was chosen for analysis as this fare level was raised by ferry operators as a possible market competitive fare. Taxi fare, for example, to Lower Manhattan's Wall Street is estimated to be $40 and for Grand Central Midtown, $30 (taxifarefinder.com).

The two landing destinations will generate different ridership estimates due to their travel times. As Flushing Bay is on the eastern portion of LaGuardia Airport, this landing site requires an additional thirteen minutes in travel time compared to a Bowery Bay landing. The longer travel duration is an important service consideration as it will compete with other modes based on time of travel, as well as cost. Once at the LaGuardia Airport, both sites also present different travel time from ferry to air terminal via an inter-terminal bus connection.

Figure 6.6: 2018 Forecast of Potential Daily Ferry Passengers by LaGuardia Airport Ferry Landing Location



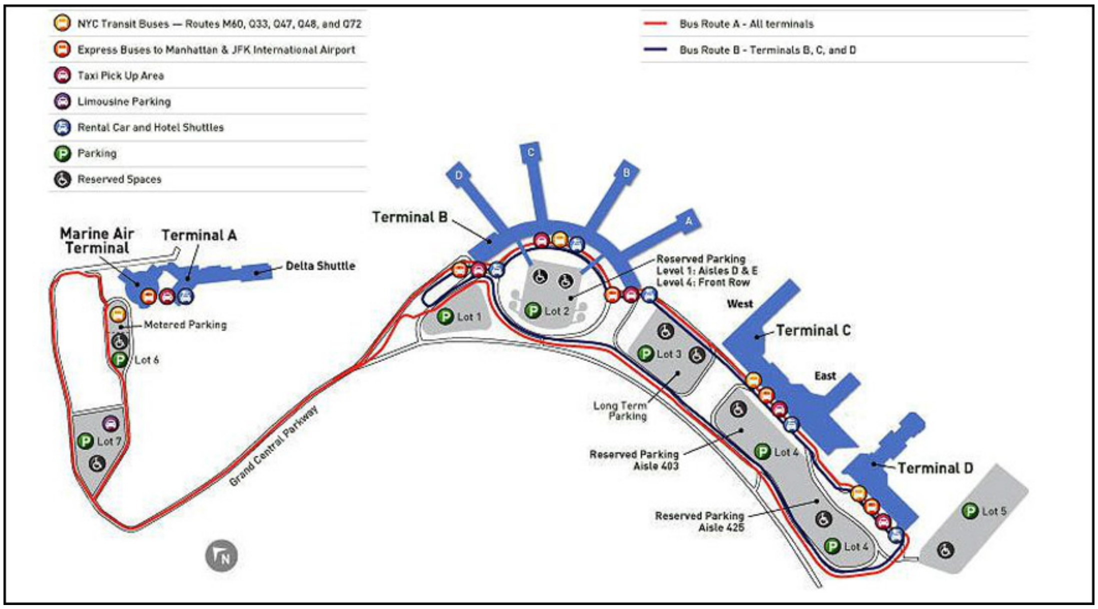
The above diagram shows that an intermodal connection is needed from ferry to the air terminal to sustain necessary ridership. A key finding is that the prior ferry service, while having a dedicated following, did not have sufficient reach to the rest of the LaGuardia Airport market apart from the Marine Air Terminal. The prior service was marketed solely as a Marine Air Terminal service and likely did not attract riders to other air terminals. Interviews and prior reports confirmed that there were few, if any, observed transfers from Terminal A to other terminals from the prior ferry service. However, ridership to Terminal A alone is not sufficient to cover the cost of providing that operation.

If a service were to be reactivated at Bowery Bay, without an efficient and seamless bus connection to the rest of the LaGuardia Airport market, the likelihood of success is low. Likewise, if a service at Flushing Bay were to be developed by Terminal D, without a connecting and seamless inter-terminal bus, that service would also likely have slim success margins. Moreover, even though Terminals C and D are now connected with a moveable walkway, and that market is within walking distance from a Flushing Bay Terminal, that combined market is still insufficient for a successful operation. Ridership to the remaining half of LaGuardia Airport at Terminal B, the Central Terminal Building, is needed for a ferry service to be viable.

In short, in order for a ferry service to work at LaGuardia Airport, an attractive and seamless intermodal connection to the air terminals is required. The connection bus may be as important to the success of the ferry as the waterside operation itself as riders will not deem themselves to have arrived at the airport until they get to their required air terminal, not the LaGuardia Airport ferry landing itself.

LaGuardia Airport currently operates two bus routes, one that connects all terminals, and another that connects all terminals except for Terminal A. See Figure 6.7 below.

Figure 6.7: LaGuardia Airport Bus Routes



Source: www.panynj.gov/airports/LaGuardia Airport-airport-map.html

The team examined the current bus routes and their capacity using data from the PANYNJ.

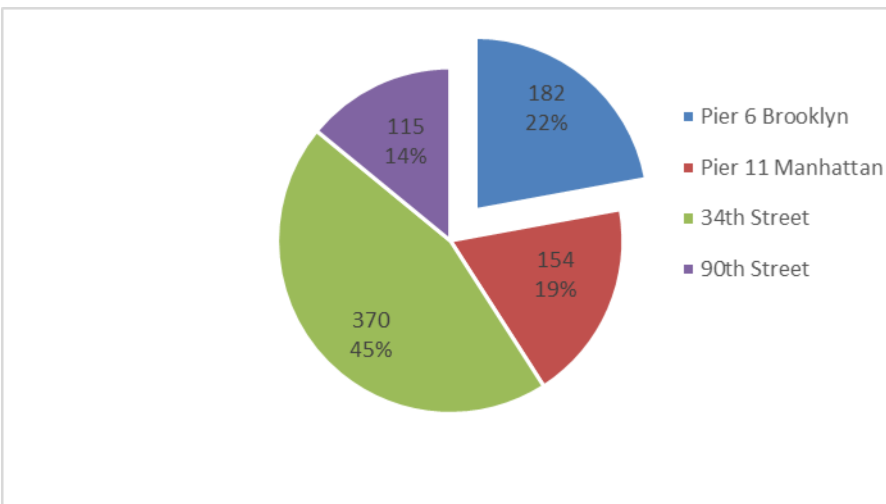
- Route A (Serves all terminals)
  - 2 buses run every 15 minutes with a 30 minute roundtrip
  - Average passengers per hour: 21
  - Capacity: 35-foot buses with seating capacity of 24 and 10-15 standing
  - Current Utilization: 17% (average daily passengers/daily seats)
- Route B (Serves terminals B, C, D)
  - 2 buses run every 10 minutes with a 15 minute roundtrip
  - Average passengers per hour: 45
  - Capacity: 35-foot buses with seating capacity of 24 and 10-15 standing
  - Current Utilization: 26% (average daily passengers/daily seats)

Both bus routes appear to operate with sufficient excess capacity to absorb the forecasted number of riders from a ferry service. Moreover, the current excess capacity will increase as plans are underway at LaGuardia Airport to shift to use of JFK's 40-foot buses, which have the larger seating capacity of 31 and standing capacity for 15-20 passengers.

Ferry riders will expect a bus to meet the ferry upon arrival. Also, if there are ways to ensure the consistency of the connecting bus ride to the air terminal, such as use of any non-public roads separated from the potential traffic of public drop-off and pick-ups areas that a taxi, car service or bus would be subjected to, its reliability would strengthen the overall service.

Forecast of daily riders by terminal stop is shown below with a caveat on the potential Brooklyn ridership. Of the percentages shown below, the Brooklyn forecast warrants additional analysis as the forecasted size of the potential market is not consistent with the actual proportional share of riders of current Manhattan and Brooklyn LaGuardia Airport users. Reasons for this potential forecast distortion may be due to the smaller size of the Brooklyn sample in the survey data as well as unknowns with existing latent preferences for existing modes for airport access. Car service plays a larger role in airport access in Brooklyn than in Manhattan. The team recommends further analysis with a stated preference survey to better gauge Brooklyn ridership.

Figure 6.8: 2018 Forecast of Daily Ferry Riders to Bowery Bay by Stop for Service every 30 Minutes



Estimating Revenue-Maximizing Fares

As discussed above revenue-maximizing fares play an important role in the analysis of the CFS2013. For the scenarios examined in the CFS2013, operating costs are nearly always constant in the fare scenarios tested, which means that revenue maximization is akin to subsidy minimization. Forecasting models were used extensively to calculate revenue-maximizing fare levels for all routes analyzed[30], and major findings included the following:

- Revenue-maximizing fare levels on the current East River Ferry route are estimated to be roughly at current levels, or $3.75.
- Revenue maximizing fares on the proposed new routes are generally lower, in the $2.75 range. St George to Pier 79 is a notable exception at $5.75.

Why the discrepancy between current and proposed routes? The answer is found in the following factors:

- Logit model demand elasticities incorporate all variables in the calculations, so the fare elasticity at a particular fare level will also be affected by other aspects of travel costs, such as travel time, headway, and access time.
- Fundamentally, *relative* travel cost (including travel time, wait time and access time) in comparison to the alternative mode will determine the response of ridership to a change in fare. In the routes modeled here there is a correlation between the total ferry travel cost and the relative travel cost in comparison to the transit alternative - with several notable exceptions - and ferry routes with higher absolute travel costs tend to be less competitive with the alternative mode. This in turn results in a greater ferry demand response to a given change in fare.
- The newly proposed East River Ferry routes tend to have higher ferry travel costs than existing East River Ferry locations: They are further from Pier 11 and 34th Street, and the average commuter in the relevant market area has a longer access time to the ferry. Most important, the relative advantage to the alternative mode is less than for current East River Ferry locations, leading to significantly lower capture rates[31].
- The lower capture rate is indicative of how the higher total travel costs for proposed routes results in a less competitive position for ferries relative to the alternative mode. A given fare increase for ferries will engender a greater reduction in demand than would be the case for a ferry route that is more competitive relative to the alternative mode. In other words, routes that have a low capture rate tend to be at a level where fare is elastic, and there is a potential for increasing revenues by decreasing fares.
- While travel costs for St George to Pier 79 are high, they are very competitive with the alternative transit option, resulting in both demand that is relatively inelastic and a revenue maximizing fare above the initial modeled level of $5.

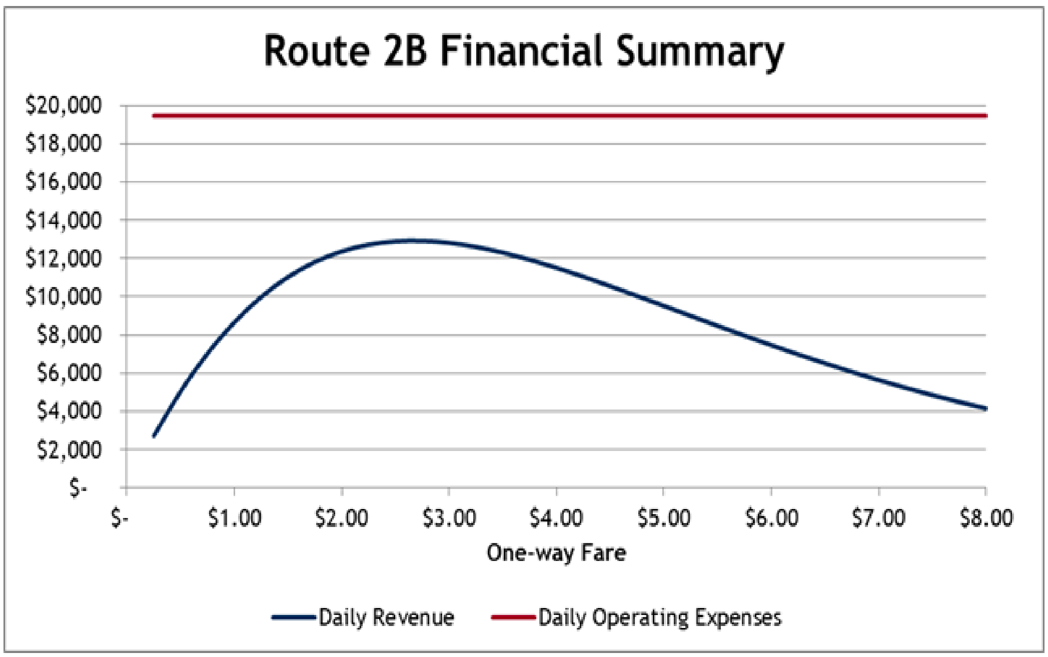
[30] The logit model has an important attribute that allows it to calculate revenue-maximizing fares for proposed ferry services. The logit model's structure is one where elasticities, such as fare elasticities, are non-constant, and will tend tend to increase with price. Demand elasticity measure are defined as % change in demand / % change in price, which will be a negative number since demand decreases as prices rise. As long as the elasticity is less than 1 in absolute value, increasing fares will increase revenues. Once the elasticity measure is greater than 1 in absolute value this is no longer the case, and fare is now at a level above the revenue maximizing fare level.

[31] For example, ½ radius market capture rates for Williamsburg and Greenpoint locations are over 24%, while predicted capture rates for sites such as Pier 6 Brooklyn Bridge Park are closer to 5%.

In short, several factors are at play with revenue-maximizing fare levels. In general, the less competitive the ferry option relative to its alternative, the greater the proportional impact of a given fare change. If the resulting decrease in demand is greater, in percentage terms, than the revenue from a fare increase, then the revenue-maximizing fare has been exceeded. Further, routes with significantly different capture rates at a given fare level should be expected to display different revenue maximizing fares. Revenue-maximizing fares are highly dependent on the characteristics of alternate transit modes, including the competing fare level set on alternate modes.

Figure 5.8 illustrates the issues discussed above. The figure outlines the relationship between fare levels, daily revenues and operating costs for Route 2B (Astoria, Roosevelt Island South, Long Island City North, 34th Street, Pier 11/Wall St). As shown, the revenue maximizing fare is in the $2.75 to $3.00 range, at the point where the total revenue curve peaks. At $2.75 daily revenues are nearly $12,400, while operating costs (which are independent of fare levels) are $19,458 per day. In contrast, the $5 fare is estimated to yield revenues of $9,517 despite the much higher fare level, illustrating that at that level demand is highly elastic. Not surprisingly given the previous discussion, the market capture rate at $5 is relatively low at 6%.

Figure 6.9: Revenue-Maximizing Fare for Route 2B



Other Factors Affecting Ridership

The ridership analysis completed for CFS2013 is comprehensive, and validation tests indicate that the models developed replicate existing ridership at a variety of locations quite well. This confers a significant amount of confidence in the modelled ridership estimates.

As is always the case in ridership modelling, some factors have been omitted in the analysis as they do not robustly fit the framework of the developed models.

Additionally, impacts from other initiatives are so small that they do not warrant significant quantitative analysis.

For example, the increase in bicycle lanes in New York City cannot be properly analyzed in the current models without additional surveys to better understand user preferences for this mode. Similarly, while fare integration has the potential to increase ridership, a rigorous estimate of this effect is not possible without additional surveys to better understand user behavior and preferences. Fare integration would allow ferry passengers to use the same fare payment mechanism elsewhere on the transit system and is discussed in APPENDIX 6 in detail.

Additionally, the potential impact of increased bus rapid transit (BRT) services in New York City, while an attractive transit option, affects the forecasted ferry ridership only minimally. Effects are only minimal because the proposed BRT services do not offer an attractive alternative or convenient access compared to the ferry routes being considered.

7 Route Prioritization

Ridership, Operating Costs and Subsidies

Introduction

This section describes financial performance of the routes modeled and discussed above. As reported in Figure 3.1, current subsidies for the East River Ferry average $2.21 per passenger, are above levels for subways, close to current levels for regular scheduled bus service and well below levels for commuter rail or express bus service.

The role of public subsidies in route prioritization is a prime public policy consideration. Operating subsidy funding is limited and must compete with competing transit initiatives. The discussion below addresses the CFS2013 team's findings with respect to operating costs, ridership and revenue and resulting operating subsidies under two different fare scenarios: A $5 fare and a revenue-maximizing fare that will vary somewhat by route.

Vessel Operating Cost Model

The CFS2013 team developed a vessel operating cost model as a crucial input into the analysis of financial viability of routes. This cost model includes only those costs directly associated with vessel operations, and does not include ancillary costs such as shuttle buses, terminal agents, or landing fees. These ancillary costs are calculated separately for inclusion in the overall system cost model.

The existing private ferry fleet and routes in New York Harbor were assessed to define typical vessel types that are likely to serve the new routes identified as part of this study. The vessels assessed range from small monohulls carrying less than 100 passengers cruising at less than 20 miles per hour to large catamarans carrying over 400 passengers at over 30 miles per hour. These vessels serve routes that vary in length from less than one mile to over 20 miles. From this analysis, five different vessel types were identified for the purposes of developing typical hourly operating costs. The general characteristics of these five types are listed in APPENDIX 7.

The CFS2013 included the following components of operating costs:

- Fuel costs
- Labor (including out-of-service labor)
- Maintenance (including hull maintenance and haul out)
- Lease or depreciation
- Insurance, administration, and overhead

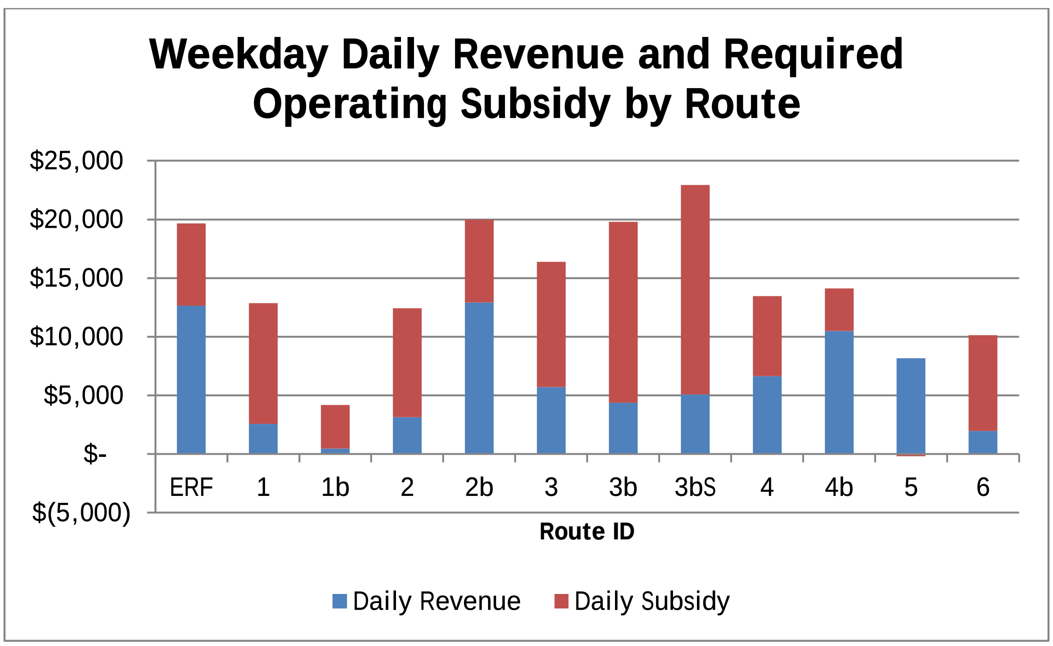
Based on the factors discussed above, typical hourly operating costs estimates were developed for the five vessel classes and typical route profiles defined previously. These estimates are intended to be used for initial route evaluations and comparisons only. When specific routes are identified, more refined annual operating costs estimates should be developed based on the planned operating schedule, anticipated annual ridership, and whether the new route will be operated by a new (small) organization or be part of a larger fleet. The typical hourly costs are provided in APPENDIX 7, and the operating models used costs for a Medium Catamaran operating at Medium speeds (Vessel Type E, $570 per hour) as the default operating scenario assumed in the CFS2013's analysis.

Revenues, Net Revenues and Subsidy Levels per Passenger for Commuter and Leisure Routes

As reported in the Section 6, all routes benefitted from extensive ridership modeling (with Route 5, St George to Pier 79, being analyzed in a separate manner given data constraints). An extensive analysis of operating costs, revenues and subsidies was carried out, revealing that of the new potential ferry service configurations, Routes 1, 1b, 2, 3, and 3B – Select (see page 38 for route descriptions) proved to require considerable subsidies and were not recommended for further consideration at the present time.

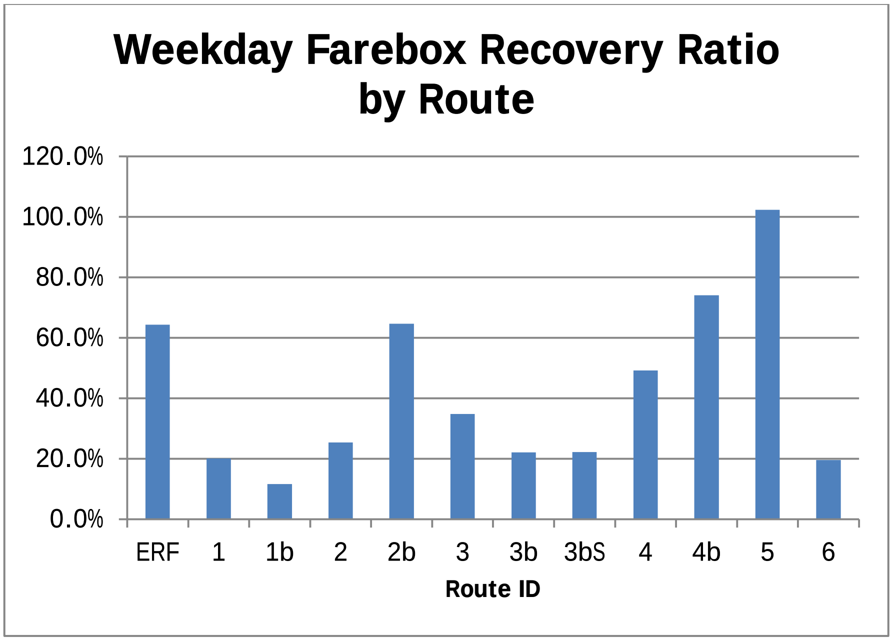
Summary financial outcomes for the routes are detailed in Figure 7.1 and Figure 7.2 below (operating costs only--capital costs are discussed separately below). The figures reflect outcomes under revenue maximizing fares in 2018 (typically in the $2.50 to $2.75 range). The choice of revenue maximizing fare will produce the optimal financial outcome expected, but even in this situation, scenarios such as Route 1 (Bay Ridge, Red Hook, Pier 6 - Brooklyn Bridge Park, Pier 11/Wall St) or Route 1b (Red Hook, Pier 6 – Brooklyn Bridge Park, Pier 11/Wall St) per passenger subsidy levels reach nearly $11 and $19, respectively.

Figure 7.1: Summary Financial Outcomes by Route: 2018 Weekday Revenue and Required Operating Subsidy Levels at Revenue Maximizing Fare



Note: Route outcome based on revenue maximizing fares except East River Ferry which reflects current daily revenues and subsidies

Figure 7.2: Summary Financial Outcomes by Route: 2018 Weekday Farebox Recovery at Revenue Maximizing Fare



Note: Route outcome based on revenue maximizing fares except East River Ferry, which reflects current daily revenues and subsidies

The preceding analysis led to the narrowing of routes to a group that includes

- Route 2B: Astoria, Roosevelt Island, Long Island City North, East 34th St, Pier 11
- Route 3B: Soundview, East 90th St, East 62nd St, Pier 11
- Route 4: East 34th St, East 23rd St, Grand St, Pier 11
- Route 4B: Long Island City North, East 34th St, East 23rd St, Grand St, Pier 11
- Route 5: St George, Pier 79

The tables below present more detailed financial outcomes for each, comparing outcomes under a $5 or revenue maximizing fare and headways typically close to those of the East River Ferry. As shown:

- **Route 2B** is one of the most successful routes, achieving nearly 65% farebox coverage of operating costs and per passenger subsidy levels close to those experienced by the East River Ferry. Route 2B operating costs are relatively high, reflecting the length of the route which extends to Astoria.
- **Route 3B** is the most successful route that incorporates service to the Bronx waterfront. Route 3B allows the bundling of Soundview service with stops at East 90th St and East 62nd St towards Pier 11, with the Upper East Side stops helping to defray per passenger operating costs. At revenue maximizing fares Soundview ridership is close to 250 daily weekday riders, and overall per passenger subsidies approach $10.
- **Route 4** produces significant ridership while also serving Grand St, a location characterized by more diverse income levels than many other waterfront locations.

Under $2.75 fares that maximize revenues Route 4 generates per passenger subsidies for a typical 2018 weekday below $3.

- **Route 4B** adds a Long Island City North stop to Route 4, greatly increasing potential ridership. Here farebox revenues cover 74% of operating costs under the revenue optimizing fare. However, Route 4B cannot be combined in an expansion including Route 2B as both serve Long Island City North demand to reach Pier 11.
- **Route 5** presents a different analysis than used for the preceding routes: The route, which would serve New York Wheel visitors as well as a small population of commuters, would achieve self-sufficiency at a $10 fare (with local commuters charged $5 through monthly or weekly passes) if 6% of New York Wheel visitors originating in Manhattan were attracted to the ferry service. Determining whether this outcome is realistic will require further study focused on projected New York Wheel visitors.

Table 7.1: Route 2B Revenue Analysis (Astoria, Roosevelt Island, Long Island City North, East 34th St, Pier 11)

	20 Minute Headway/$5 Fare	20 Minute Headway/$2.75 Fare**
2013 Daily Ridership	660	1620
2013 Daily Revenue	$3,300	$4,455
2018 Daily Ridership	1903	4700
2018 Daily Revenue	$9,517	$12,925
2018 Daily Operating Expenses	$19,976	$19,976
2018 Daily Net Revenue	-$10,460	-$7,051
2018 Farebox Coverage	47.6%	64.7%
2018 Subsidy / Passenger	$5.50	$2.50

*Note: **indicates fare is revenue maximizing fare*

Table 7.2: Route 3B Revenue Analysis (Soundview, East 90th St, East 62nd St, Pier 11)

	29 Minute Headway/$5 Fare	29 Minute Headway/$2.75 Fare**
2013 Daily Ridership	517	1427
2013 Daily Revenue	$2,583	$3,567
2018 Daily Ridership	660	1590
2018 Daily Revenue	$3,300	$4,373
2018 Daily Operating Expenses	$19,795	$19,795
2018 Daily Net Revenue	-$16,495	-$15,422
2018 Farebox Coverage	16.7%	22.1%
2018 Subsidy / Passenger	$24.99	$9.70

*Note: **indicates fare is revenue maximizing fare*

Table 7.3: Route 4 Revenue Analysis (East 34th St, East 23rd St, Grand St, Pier 11)

	18 Minute Headway/$5 Fare	18 Minute Headway/$2.75 Fare**
2013 Daily Ridership	830	2,077
2013 Daily Revenue	$4,150	$5,711
2018 Daily Ridership	963	2,413
2018 Daily Revenue	$4,817	$7,847
2018 Daily Operating Expenses	$13,476	$13,476
2018 Daily Net Revenue	-$8,659	-$16,296
2018 Farebox Coverage	35.7%	49.2%
2018 Subsidy / Passenger	$8.99	$2.83

*Note: **indicates fare is revenue maximizing fare*

Table 7.4: Route 4B Revenue Analysis (Long Island City North, East 34th St, East 23rd St, Grand St, Pier 11)

	22 Minute Headway/$5 Fare	22 Minute Headway/$2.50 Fare**
2013 Daily Ridership	823	2,300
2013 Daily Revenue	$4,117	$5,750
2018 Daily Ridership	1,483	4,190
2018 Daily Revenue	$7,417	$10,475
2018 Daily Operating Expenses	$14,130	$14,130
2018 Daily Net Revenue	-$6,714	-$3,655
2018 Farebox Coverage	52.5%	74.1%
2018 Subsidy / Passenger	$4.53	$0.87

*Note: **indicates fare is revenue maximizing fare*

Table 7.5: Route 5 Revenue Analysis (St George, Pier 79)

	60 Minute Headway/$5 Fare (commuter) or $10 Fare (other)
2018 Daily Ridership Commuter	53
2018 Daily Commuter Revenue	$267
2018 Daily Ridership Visitors (= 789 trips)***	395
2018 Daily Visitation Revenue	$7,890
2018 Daily Operating Expenses	$7,970
2018 Daily Net Revenue	$187
2018 Farebox Coverage	102%
2018 Subsidy / Passenger	-$0.05

*Note: **indicates fare is revenue maximizing fare*

******Ridership by visitors assumes a 6% capture rate of visitors originating in Manhattan***

Revenues, Net Revenues and Subsidy Levels per Passenger for LaGuardia Airport Service

In serving LaGuardia Airport by ferry, an hourly service and a service every 30 minutes have been discussed over the years. The prior defunct ferry service to LaGuardia Airport was an hourly service. A service every half hour has been proposed in the past but never implemented. Two vessels would be needed to provide an hourly service. To provide a more attractive service every 30 minutes, four vessels would be needed. This makes a service every half hour twice the operational cost of an hourly service.

The prior Delta Water Shuttle, at one time during its 12-year run, operated on a split schedule with a morning service of 6am to 10am and an afternoon service of 3pm to 7pm. This schedule was likely timed with the Delta shuttle service, which had a morning peak and afternoon peak for a Washington D.C. - New York City – Boston travel market. However, in attempting to serve the whole LaGuardia Airport market which offers 1,000 daily landings and take-offs to destinations nationwide as well as Canada and the Caribbean, there are not the same morning and afternoon peaks. Therefore, an analysis for a split service is not presented below.

For a consecutive12-hour operation, conclusions from the farebox recovery analysis are:

- For both scenarios, the Bowery Bay landing alternative is the less expensive to operate
- Ridership for Bowery Bay is also more robust compared to Flushing Bay given the shorter ferry travel times
- For an hourly service, which requires two vessels, routes to either Bowery Bay or Flushing Bay may achieve sufficient ridership to be self-sustaining without operating subsidies
- Anticipated revenues from service every 30-minutes, which requires four vessels, would be insufficient towards covering operational costs and would require a subsidy

The analysis does not incorporate an added cost for the required inter-terminal bus connection as there is an existing inter-terminal bus system in place that has capacity to accommodate added ridership from a ferry mode. However, that system would need to be modified to meet the ferry upon arrival and be sufficiently reliable to be attractive to riders.

Table 7.6: Farebox Recovery for 2-Vessel Operating Scenario at fare of $25

2 vessels for hourly service	Bowery Bay 55 min headway	Flushing Bay 65 min headway
Daily Ridership	626	574
Daily Revenue	$15,650	$14,350
Daily Operating Expense	$12,649	$12,859
Daily Net Revenue	$3,000	$1,491
Farebox Coverage	124%	116%
Subsidy / Passenger	0	0

Table 7.7: Farebox Recovery for 4-Vessel Operating Scenario at fare of $25

4 vessels for service every half hour	Bowery Bay 28 min headway	Flushing Bay 33 min headway
Daily Ridership	729	652
Daily Revenue	$18,225	$16,300
Daily Operating Expense	$25,299	$25,718
Daily Net Revenue	-$7,074	-$9,418
Farebox Coverage	72%	63%
Estimated Subsidy / Passenger	$9.70	$14.44

For a service that does not break even, there are a number of areas where the public sector may provide support if the service provides a public benefit, such as reduced congestion on crowded highways accessing LaGuardia Airport.

- Operating assistance
  - Direct subsidy - East River Ferry model

- Operating agreement - MTA model for Ossining-Haverstraw ferry service where MTA commissions service for a defined period
- Fuel – Delta Water Shuttle model where Delta provided fuel subsidy for sponsorship

- Non-operating assistance
  - Marketing – Unlike marketing commuter service to a targeted, local audience, the airport access market is broader and would require more extensive marketing efforts and reach to raise awareness that such a service exists. Operators have noted that the City's extensive marketing efforts by NYCEDC and NYC & Company, which included the placement of street banners on major thoroughfares, generated significant awareness of the East River Ferry pilot and contributed to its success. Identifying ferry terminals and their routes and connections on widely-used transportation resources, such as the MTA Subway Map, would help raise awareness of a LaGuardia Airport ferry, as well as other long-term ferry services.

Staffing of LaGuardia Airport ferry terminal site – The ferry terminal site should be staffed with personnel to answer questions from passengers, similar to the staffing of the platforms at the AirTrain terminals at JFK, and to assist in coordinating the ferry-bus connection.

Capital Costs

In order to accurately assess the viability of a ferry route, capital costs must be taken into account. The useful life associated with ferry landing infrastructure is generally 25 to 30 years, allowing for cost amortization over a similar time period. The CFS2013 team produced planning level estimates for the construction of the needed infrastructure improvements for study sites that were incorporated into each proposed route. The estimates for new infrastructure include upland amenities which encompass shelters, benches, bike racks and ticketing machines. The estimates all plan for a two-slip barge. Table 7.8 contains a summary of capital costs for each proposed site that needs infrastructure improvements and is included in a modeled route.

Table 7.8: Summary Capital Costs

Route	Site Name	Project Cost
1/1B	Van Brunt Street – Red Hook	$4.9M
1	Bay Ridge	$5.5M
2/2B	Astoria Cove	$7.2M
2/2B	Roosevelt Island South	$7.2M
2/2B	Long Island City North	$5.6M
3/3B	Soundview	$9.3M
3/3B	E 62nd Street	$7.3M
4/4B	E 23rd Street	$6.1M
4/4B	Grand Street	$5.8M
5	St George	$5.4M
6	Beach 108^{th}/116^{th} Street	$5.5M

The detailed estimates produced by the CFS2013 are included as APPENDIX 8. The estimates often include a new pier at sites with an existing pier or bulkhead. This was done for the following reasons:

- To allow placing the float at an acceptable location due to site constraints.
- To provide space for queued ferry riders such that adjacent landside uses are not impacted.
- To bridge across, or locate the gangway away from existing shore protection (riprap).

The estimates also show dredging at a few sites that may require it due to existing water depths. It could well be that it is not required, which can be confirmed with a bathymetric survey. It is also possible that dredging may not present serious permitting issues if the site was already permitted for a deeper dredge depth in the past and has merely silted in from lack of use in more recent years.

In addition to the infrastructure costs, as mentioned previously, improvements to vessel capacity are needed for route 2B to perform optimally. The two ways to increase vessel capacity are to procure larger vessels or to reconfigure existing vessels for higher passenger capacity. In order to accommodate the capacity demands on route 2B while maintaining 20 minute headways, at least one of the vessel capacities would need to be increased. The most cost effective way to do this is through vessel reconfiguration.

The medium catamarans with 149 passenger capacity make up most of the ferry fleet that operates in New York. The four engines on the vessels can be replaced with two Tier 2 IMP/EPA compliant engines. The engines upgrades allow the vessels to be reconfigured to increase the passenger capacity to 240. When combined with changes to the propulsion system, converting from jet engines to props, the changes reduce the vessel's emissions, increase fuel efficiency, reduce overall noise levels and increase the useful life of the vessels by at least five years. The cost to reconfigure each vessel is approximately $700k, however operators generally do a full overhaul of a vessel while it is undergoing modifications. The full cost to retrofit a vessel when including the cost to do a full overhaul is approximately $1M. This is significantly lower than the costs to procure new high capacity vessel which range between $3.5M and $5M.

Table 7.9: Summary Characteristics of Priority Routes ($5 Fares)

Route	Annual Weekday Subsidy Requirement ($ Millions)	Capital Cost Requirements ($ Millions)	Peak Period Vessel Requirements
Route 2B: Astoria, Roosevelt Island, Long Island City North, East 34th St, Pier 11 / Wall St	$2.7	$19.9	4
Route 3B: Soundview, East 90th St, East 62nd St, Pier 11 / Wall St	$4.3	$16.6	3
Route 4: East 34th St, East 23rd St, Grand St, Pier 11 / Wall St	$2.3	$11.9	3
Route 4B: Long Island City North, East 34th St, East 23rd St, Grand St, Pier 11 / Wall St	$1.7	$17.5	3
Route 5: St George, Pier 79	0	$5.5	1

APPENDIX 9 summarizes the entire vessel fleet operating the privately-run services in the Harbor. The assessment, confirmed by operator discussions as part of the stakeholder outreach, is that there is limited ability for the current fleet to serve, at its current size, a significant increase in service and ridership. This could be an issue for expanding passenger ferry service in the region: As mentioned previously, the current contract term for operators is for 5 years in duration, a length of time which may not cover the amortization of a vessel purchase.

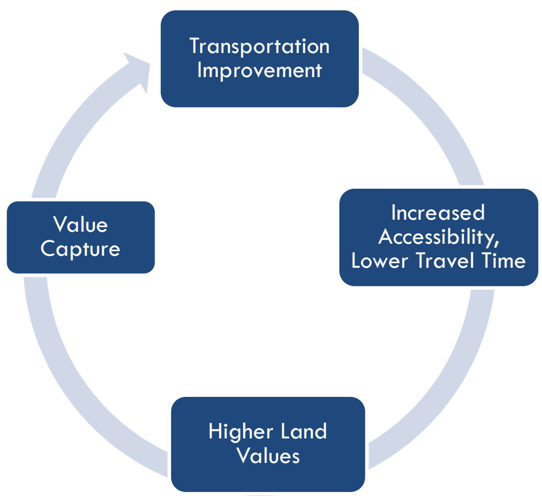
Funding Potential: Private Sector

Introduction

Expanding passenger ferry service within New York City will require both capital and operating funds that will not be generated from fare revenues. The CFS2013 examined the potential for generating funding from private sector partners. The findings are summarized here.

The Concept of Value Capture

Ferry service improves the accessibility of waterfront land, creating value for users, landowners, and developers. For example, the CFS2013 found that the East River Ferry improved home values within 0.25 miles of a ferry landing (see Section 4 and APPENDIX 2 for further detail). As such, there is an opportunity to capture the value created for residents and business that stand to benefit from expanded ferry service to help fund ferry investment and operations. Four value capture mechanisms – negotiation exactions, special assessment districts, tax increment financing, and development bonuses – are available for use with ferry service in New York City.



Value Capture Mechanisms

Developer Contribution: Developers can directly deliver or fund new ferry infrastructure and/or service. The flexibility of developer contribution and the lack of a lengthy legal process for implementation make this value capture mechanism appealing. Increased development costs to support ferries may discourage development, and participating developers may insist on locating ferry stops on or adjacent to their property, though other locations may better serve the neighborhood.

Special Assessment Districts: Special assessment districts generate funds from a special tax placed on property owners and/or businesses within a formally defined area. Business Improvement Districts (BIDs), a type of special assessment district, have been used extensively in New York City to fund maintenance, security, district promotion, amenities, and, rarely, transportation. BIDs can provide an ongoing funding source well-suited for operational funding. However, the BID creation process is time- and resource-intensive, requiring significant upfront investment, buy-in from property owners and businesses, and City approvals. Funding of ferry service using Special Assessment Districts in New York City will inevitably compete against other district priorities, potentially limiting available resources.

Tax Increment Financing: Tax increment financing (TIF) allocates new, incremental property tax revenues in a designated area to fund improvement projects that will benefit property values in that area. Future taxes beyond a baseline amount are allocated towards a special purpose entity and can be used to fund or finance transportation improvements or operations. Tax increment financing is authorized by state legislation in New York, but has been challenging to implement in New York City under this statute; a potentially more viable alternative is to utilize payments in lieu of taxes (PILOTs) and allocate these PILOTs towards a special purpose entity that can raise funds from dedicated PILOT payments. An example is the Hudson Yards District where PILOTs from new development are allocated to the Hudson Yards Investment Corporation to repay bonds that were issued to finance the extension of the subway. Bond proceeds from TIF can provide immediately available funds for ferry investment, while tax allocations can provide ongoing proceeds suited for operational investment. However, establishing a TIF or PILOT financing district requires Office of Management and Budget (OMB) and/or City Council approval, and raising funds from TIF proceeds is dependent on investor confidence in the ongoing revenue stream.

Development Bonuses: Development bonuses allow a developer to build additional density in exchange for funding of new transit improvements. In addition to providing funding or in-kind contributions for ferry service, bonuses can create higher densities, thus increasing potential demand for ferry operation. However, bonuses are effective primarily in core markets where the additional floor area has value, and will not be applicable where bonus floor area cannot be absorbed by the market. Development bonuses to fund ferry improvements would require a zoning change, subject to the City’s Uniform Land Use Review Procedure (ULURP). Similar to negotiating exactions with developers, using development bonus proceeds for ferry service could lead to developer pressure to site landings in non-ideal locations. In any case of developer-led investment in ferry infrastructure, standards for ferry landing construction and maintenance should be defined and enforced by a City agency.

Other Mechanisms: Other value capture mechanisms include joint development and air rights development, but they are unlikely to be applicable in the case of ferry investment. Joint development requires the unique case of private real estate development of publicly owned land. Unlike subway and train stops, ferry landings rarely include significant air rights. Additional mechanisms include development impact fees and a transportation utility fee, but they would require a change in City and/or State legislation, and thus face limited applicability to the case of value capture for ferry service in New York City.

Value Capture Mechanism	Capital or Operations	City Action Required	Application
Developer Contribution	Capital or Operations (via lockboxing of funds)	Negotiations with developer	Project-level
Special Assessment Districts	Operations	NYC Small Business Services coordination with local organizers; City Council approval	District-level
Tax Increment Financing	Capital or Operations (via lockboxing of funds)	Creation of special purpose entity; OMB and/or City Council approval for allocation of PILOT revenue	District-level
Development Bonus	Capital or Operations (via lockboxing of funds)	Assessment of appropriate price or service provision; ULURP approval	Project-level or District-level

8 Conclusions and Next Steps

The CFS2013 involved an extensive analysis of potential opportunities to expand passenger ferry service in New York City. Starting with over 50 potential sites, the CFS2013 identified the following as the most promising new routes:

- Route 2B: Astoria, Roosevelt Island, Long Island City North, East 34th St, Pier 11/Wall St
- Route 3B: Soundview, East 90th St, East 62nd St, Pier 11/Wall St
- Route 4: East 34th St, East 23rd St, Grand St, Pier 11/Wall St
- Route 4B: Long Island City North, East 34th St, East 23rd St, Grand St, Pier 11/Wall Street
- Route 5: St George, Pier 79
- LaGuardia Airport Service

The ridership potential of these routes is considerable: routes 2B, 3B, 4 together could achieve daily ridership close to that seen by the current East River Ferry.

However, the new routes tend to be longer and more expensive to operate, while mostly serving locations whose densities are less than those on the East River Ferry: With the exception of Route 4B, all are estimated to require operating subsidies per passenger above those of the East River Ferry.

Several of the locations also require considerable capital investments, as described in the report. In short, the study has focused on identifying the most promising potential routes, but these routes require considerable capital and operating subsidies: An extended network including the East River Ferry, Route 2B, Route 3B and Route 4 would be estimated to require an annual subsidy for weekday service of close to $10 million.

Extending service to the Bronx entails challenges due to the distances involved and the generally modest ridership generated. The subsidy levels mentioned above are reduced by 40% if Route 3B (which includes service to Soundview) is not included in a service expansion.

The next steps in the development of an expanded ferry network include:

Pursue revenue enhancing fares: The extensive ridership modeling in the CFS2013 suggested that while the East River Ferry may well be operating at a revenue maximizing fare, optimal fares could be lower for most other potential routes. Based on the ridership modeling, charging a uniform lower fare in the $3 range for a broader ferry network including multiple routes would be essentially revenue neutral in comparison to the $5 fare, while potentially generating ridership close to double that under the $5 fare. Keeping in mind the uncertainty attached to any ridership modeling, the characteristics of the potential new routes do lend credence to this finding. The potential benefits in terms of accessibility would suggest that at the very least the potential for ferry network expansion at a lower uniform fare should be further explored.

Develop value capture mechanisms: the study carefully estimated the real estate benefits of the East River Ferry and found them to be considerable, as both economic theory and the experience of numerous other transit systems would suggest. As described in the report, there is no single value capture mechanism that can be easily applied without some challenges, but the potential benefits in terms of increasing available funding for passenger ferry services make it imperative to identify and pursue potential value capture strategies.

It will important to ensure that expanding ferry service does not generate negative environmental impacts. CFS2013 included a general analysis of wake and surge issues, included here as APPENDIX 10, which generally find that environmental considerations are modest. However, given the localized nature of such issues, continued vigilance will be important in future planning.

Ultimately, the information and analysis contained in this report are provided as a planning tool for elected decision-makers, private ferry operators, and stakeholders at large. As demand for ferries continues to increase and New York City's relationship with its waterfront evolves, it is important to pursue thoughtful planning solutions to identify opportunities to fill transit gaps through waterborne transportation.

9 APPENDIX 1: Existing New Jersey to New York City and Cross-Hudson Ferry Services

Route	One-Way Fare	Headway (Peak)	2006 Weekday Ridership	2011 Weekday Ridership	2012 Weekday Ridership	2013 Weekday Ridership	2006-2011 Annual Growth	2011-2012
Atlantic Highlands - Pier 11/34th St	$26.00	30	1,120	1,482	1,450	1,143	5.8%	-2.2%
Belford - Pier 11	$21.50	30	2,144	1,813	1,749	1,830	-3.3%	-3.5%
Edgewater - Pier 79	$10.25	30	NA	563	622	657	NA	10.5%
Haverstraw - Ossining	$3.75	30	490	438	467	487	-2.2%	6.6%
Hoboken - Pier 11	$7.00	15	4,472	3,188	2,628	2,236	-6.5%	-17.6%
Hoboken - Pier 79	$9.00	20	1,754	1,872	181	2,287	1.3%	-90.3%
Hoboken - WFC	$10.75	18	3,774	2,297	2,886	2,460	-9.5%	25.7%
Liberty Harbor - Pier 11	$7.00	15	2,830	665	603	548	-25.1%	-9.4%
Liberty Harbor - WFC	$7.00	30		360	417	560	NA	15.9%
Lincoln Harbor - Pier 79	$9.00	18	2,830	1,681	1,717	1,735	-9.9%	2.1%
Newburgh - Beacon	$1.75	17	280	297	300	252	1.2%	0.9%
Newport - Pier 79	$8.00	30	NA	211	222	122	NA	5.1%
Paulus Hook - Pier 11	$7.00	13	NA	1,562	1,516	1,403	NA	-2.9%
Paulus Hook - Pier 79	$8.00	30	NA	445	477	573	NA	7.3%
Paulus Hook - WFC	$6.00	6	NA	3,067	3,358	3,001	NA	9.5%
Port Liberté - Pier 11	$10.00	40	516	395	367	308	-5.2%	-7.1%
Weehawken - Hoboken No. - WFC	$13.00	23	717	788	871	891	1.9%	10.5%
Weehawken - Pier 11	$13.00	20	1,238	904	815	768	-6.1%	-9.9%
Weehawken - Pier 79	$9.00	10	6,501	5,476	5,308	5,193	-3.4%	-3.1%

Note: WFC = World Financial Center; This table includes two cross-Hudson routes entirely within New York State (Newburgh - Beacon and Haverstraw – Ossining)

10 APPENDIX 2: Real Estate Development Impact of the East River Ferry

Economic Development Impacts - Executive Summary

This study provides the first estimate of the impact of the East River Ferry service on house values and real estate development. The research draws on the considerable experience modeling the impacts of amenities, including public transit, on real estate outcomes, and follows methodologies consistent with the broad literature. The following summarizes the key results:

- Property values within 1/8 mile of the closest ferry stop increased by 8.0%,
- For all residential properties within one mile of a ferry stop, the ferry service increased property values by $0.5 billion;

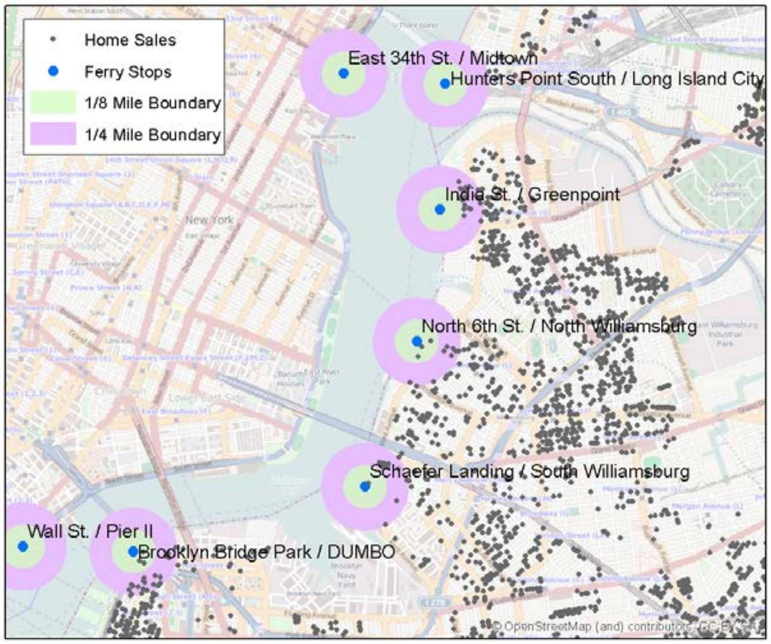
The higher real estate values also coincided with an increase in residential and commercial building space of over 600,000 square feet, a 4.9% increase of space within 1/4 mile. This includes:

- An increase in the nearby supply of residential housing by 487,238 square feet, or over 7%; and
- An increase in the supply of retail space within ¼ mile by over 20,000 square feet, or 4.2%.

Since its opening in 2011, demand for New York City's East River Ferry has exceeded expectations. The service provides a way for residents of Brooklyn and Queens to access Manhattan, and is for many a faster and more pleasant mode of transportation than other available options. The popularity of the ferry illustrates a strong demand for this service and suggests the high value that households place on it. Economic theory predicts that this higher demand for ferry service should lead to higher residential prices and rents as homes with access to ferry stops now come bundled with the amenity of access to the ferry network. Furthermore, the increase in real estate prices should spur new residential development by increasing the value of building new properties relative to development costs, which on the margin should spur new residential development.

The CFS2013 focuses on residential real estate prices rather than the prices of commercial real estate leases due to the long-term nature of commercial leases, which would make the data relatively sparse and price changes occur at a slow pace that would be difficult to measure. Using publically available data on housing transactions and following well-established methods for determining the real estate impacts of transit services, the CFS2013 team estimated the impact of the new ferry services on house prices and rates of real estate development. The data set contains a sufficiently large sample of 8,827 condo sales that are within two miles of the closest ferry stop between 2003 and 2012. Figure 10.1 below shows the home sales data along with the East River Ferry stops:

Figure 10.1: New York City Home Sales and Ferry Stops



The CFS2013 finds that the ferry service has a positive and statistically significant impact on house prices. The regression analysis shows that, after controlling for pre-existing conditions and building quality, value of being close to a ferry stop increased after November 2010, and therefore the introduction of the ferry has a positive amenity value Specifically, the ferry service increased the value of homes that were 1/8 mile away by 4.2%, and 2.1% for homes 1/4 mile away. The impact falls to less than 1% for homes a mile or more away. Impacts within this walking distance area are consistent with a survey performed on over 1,300 East River Ferry riders, in which over 75% of ferry riders reported that they walk to and from the ferry at either end of the trip.

These results imply that the ferry service has increased the average value of a house within one mile of the ferry by over 1.2%, and has increased residential value by roughly one half billion dollars in aggregate. Within 1/8 mile the average impact is 8.0%, which is consistent with the results found in the wider literature on the impact of public transit on house prices.

Table 10.1: Property Value Impact by distance from Ferry Stop

Distance (miles)					
From	To	Total Value (millions)	% Impact	$ Impact (millions)	Cumulative Impact (millions)
0.000	0.125	$ 1,298	8.0%	$ 92	$ 92
0.125	0.250	$ 2,872	2.5%	$ 74	$ 166
0.250	0.375	$ 6,249	1.6%	$ 98	$ 264
0.375	0.500	$ 5,557	1.1%	$ 63	$ 327
0.500	0.625	$ 5,117	0.9%	$ 47	$ 374
0.625	0.750	$ 7,897	0.7%	$ 56	$ 431
0.750	0.875	$ 5,204	0.6%	$ 32	$ 463
0.875	1.000	$ 5,468	0.5%	$ 29	$ 492

Overall, the East River Ferry Service increased house values by nearly half a billion dollars in the Brooklyn and Queens areas of New York City. The largest impact, of over $90 million, was in the immediate 1/8 mile vicinity.

Our analysis also confirms that the ferry service has a positive impact on the pace of development. The results from the construction impact analysis are consistent with the impact on prices: for most measures, there was a statistically and economically significant impact on development in the immediate area, and a declining impact at farther distances. The analysis controls for other factors that may affect development by looking at changes in the pace of development at the block level prior to the ferry service compared to the pace of development in those same blocks after the ferry service. This makes the results more robust by accounting for pre-existing differences between areas near the ferry and those farther away. Table 10.2 below shows the amount of new developments within 1/4 mile that can be attributed to the East River Ferry service. The largest impact was on residential development, which increased by nearly 350 additional residential units and 487,238 residential square feet.

Table 10.2: Change in Construction from Having East River Ferry Stop within a Quarter Mile

Type	Stock In 2009	Additive Square Footage	Percent Increase
Buildings	732	9	1.2%
Residential Units	6,051	350	5.8%
Building Area	12,300,000	608,615	4.9%
Commercial Area	5,466,094	183,963	3.4%
Office Area	953,887	948	0.1%
Retail Area	485,488	20,284	4.2%
Residential Area	6,745,500	487,238	7.2%

The East River Ferry and Economic Development

A crucial feature of urban economic models is that the demand for real estate in a particular area is, in part, a function of the transportation access in that area. Easy transportation in and out of a neighborhood lowers the travel time cost for households to live in the neighborhood and work elsewhere. In addition, it lowers the cost for consumers to travel into the neighborhood to shop, thus facilitating the supply of local retail and jobs that serves as an additional amenity. Finally, it reduces the cost of locating in that area for businesses that require the movement of employees to and from the office.

Additionally, the value of the East River Ferry can be seen in its impact on travel times. Table 10.3 below shows the travel time going from residential areas in neighborhoods near ferry stops to Broad Street and Wall Street in Manhattan Downtown Central Business District. The two times reported are for using ferry travel and using the next best public transportation option. The results illustrate that the time spent in transit is lower using the ferry, saving travelers between 3 and 14 minutes one-way.

Table 10.3: Travel Time between Neighborhoods and the New York Stock Exchange (minutes)

	LIC	Greenpoint	N. Wbrg	S. Wbrg	DUMBO
Ferry	32	27	22	17	12
Pub Trans	35	41	31	31	17
Time Savings	3	14	9	14	5

In addition to saving time, anecdotal evidence suggests a perceived quality difference, with the ferry being a more pleasant trip than the subway. The service allows for an open air ride, or a seat inside, and also offers a view of the city.[32] A 2012 rider survey showed that 85% of riders are local residents, and two-thirds use the ferry to commute to and from work, which suggests the value of the service is not just as a novelty for tourists, but as a neighborhood amenity for residents.

The desirability of the ferry service is backed up by empirical evidence as well. The CFS2013 team's research involving a mode choice model developed for the Port Authority shows that, even after statistically controlling for fare and travel time considerations, travelers have an inherent preference for using the ferry over the subway.

The popularity of the East River Ferry illustrates a strong demand for this service and the high value that households place on it. Economic theory predicts that this higher demand should lead to higher house prices and rents as houses with access to ferry stops now come bundled with the amenity of access to these stations. These higher prices then increase the value of building new properties relative to development costs, which on the margin should spur new residential development.

Economic theory therefore provides two testable predictions about the East River Ferry: (1) that house prices near the ferry stops should increase after the introduction of the ferry, and (2) new construction near the ferry stops should increase as well.

[32] http://www.dnainfo.com/new-york/20121227/long-island-city/east-river-ferry-service-stay-afloat-through-2019

Previous Research

Public transportation can bring a variety of benefits to the communities they provide access to, including lower congestion, decreased travel time, lower fuel consumption, fewer traffic accidents, and expanded labor markets for employers and employees. Despite the range of possible outcomes that can be measured, the majority of public transit impact studies have focused on property values. One reason for this focus is that some of the beneficial improvements in other outcomes should be reflected in increased property values. Therefore property values can serve as a lower bound summary measure for overall improvement in a neighborhood's desirability arising from a disparate range of benefits.

While there is extensive research on the impact of public transportation, such as fixed rail, on real estate outcomes, there are no empirical studies examining the impact of ferry service. However, there are commonalities across public transportation impact studies that provide guidance on the general approach and magnitude of likely impacts for ferries.

Within the broad literature on public transportation's impact on real estate outcomes, examples can be found of studies showing positive, negative, and insignificant results, although the preponderance of evidence suggests a positive impact. Some overall conclusions can be drawn from the large body of literature.

- A recent meta-analysis of studies on the effects of railway stations on property values looked at 75 estimates from a variety of studies and found an average impact on residential prices within a quarter mile of 8.1% (Debrezion et al, 2007). The estimated standard deviation of 0.263 confirms the large degree of variation in estimated impacts. For residential properties the effect is typically lower than for commercial, with the former averaging 4.6% and the latter at 19.1%.
- Another summary of the literature on public transit impacts from Fogarty et. al (2008) reports a range of impacts for single-family homes from 2% to 32%, and 2% to 18% for condominiums. In addition, the meta-analysis of Debrezion et. al (2007) showed that the effects varied by type of railway station. Table 4 below shows the average estimated impact from the sampled studies on real estate prices within a quarter mile of each station. The impacts range from a low of 1.7% for bus rapid transit (BRT) to a high of 18.7% for commuter rail transit (CRT).
- In addition to a higher simple mean of estimated impacts, the meta-analysis suggests that after controlling for other study characteristics, CRT transit has a statistically significantly larger impact than other types.

Table 10.4: Average Price Impact of Transit Stations by Type

Station type	Average Impact
Light Rail Transit	7.1%
Heavy Rail Transit	2.1%
Commuter Rail Transit	18.7%
Bus Rapid Transit	1.7%

Source: Debrezion et al, 2007

While there is variation in the specifics of the models used, the most common econometric approach in the literature is hedonic regression. This is a statistical technique that models the prices for a good as a function of that good's characteristics. In studies of public transportation's impact on housing the hedonic model estimated is usually specified using the logarithm of house sale prices as the dependent variable, while the independent variables are physical and geographic characteristics of the sold property. For example, square footage of a building and the number of bedrooms are common physical characteristics used in these studies, and the Census Tract or zip codes are common geographic variables. The impact of public transportation is captured by including measures of transit access as independent variables. In a fixed-rail study, for example, this might include a variable indicating whether a house was within 1/8 mile of a station stop.

While most studies share the broad econometric approach of hedonic analysis, there is variation in how access to public transportation is measured. The meta-analysis of Debrenzion reports that a dummy variable indicating whether a property is within 1/4 mile of a station stop is a prominent measure. Other measures include linear distance, log-linear distance, and other discrete distance categorical variables. Fogarty et al (2008) lists five studies that use distances of 500 feet or less as categorical access variables. Garrett (2004) measures access to the St. Louis light rail system as being within 100 feet. At the other end of the spectrum, Fogarty lists four studies that define access to a transit stop using a distance of ½ of a mile.

In general, several conclusions can be drawn from the literature.

- The property impacts of public transportation typically range from the single digit percentages to the mid-teens.
- The most common empirical approach taken in the literature is the use of hedonic regression that measures the log of property sale prices as a function of building and neighborhood characteristics and a measure of transit access.
- The independent variable measuring transit access can either be a continuous distance measure or a discrete measure of distance ranging from as little as 100 feet to up to a ½ of a mile.

Econometric Analysis

To test the theories that the East River Ferry increased house values and real estate development, publicly available data from several sources was used. Data on property sales comes from the New York City Department of Finance ACRIS system. These data are matched to property characteristics from the NYC Department of City Planning's Public Land Use Tax Lot Output (PLUTO) dataset and their Public Address Directory (PAD) dataset, including geographic information.[33] The resulting dataset contains information on the sale date, sale price, and property characteristics for owner-occupied homes in Brooklyn and Queens, the areas of New York City identified as most likely to be impacted. The analysis includes arms-length residential sales of units in condominium buildings.[34] To estimate the value of East River Ferry service, the distance is measured between each home sale and the closest ferry stop. The sample was restricted to observations within two miles of the closest ferry stop, thereby excluding portions of New York City in order to maximize sample heterogeneity but retain enough observations to retain sufficient statistical power to test the hypothesis. The resulting sample size is 9,015 sales between 2003 and 2012.

A simple analytical approach would be to include this distance measure as an independent variable in the hedonic model to capture the value of being close to a ferry stop on house prices. The following equation illustrates this simple model:

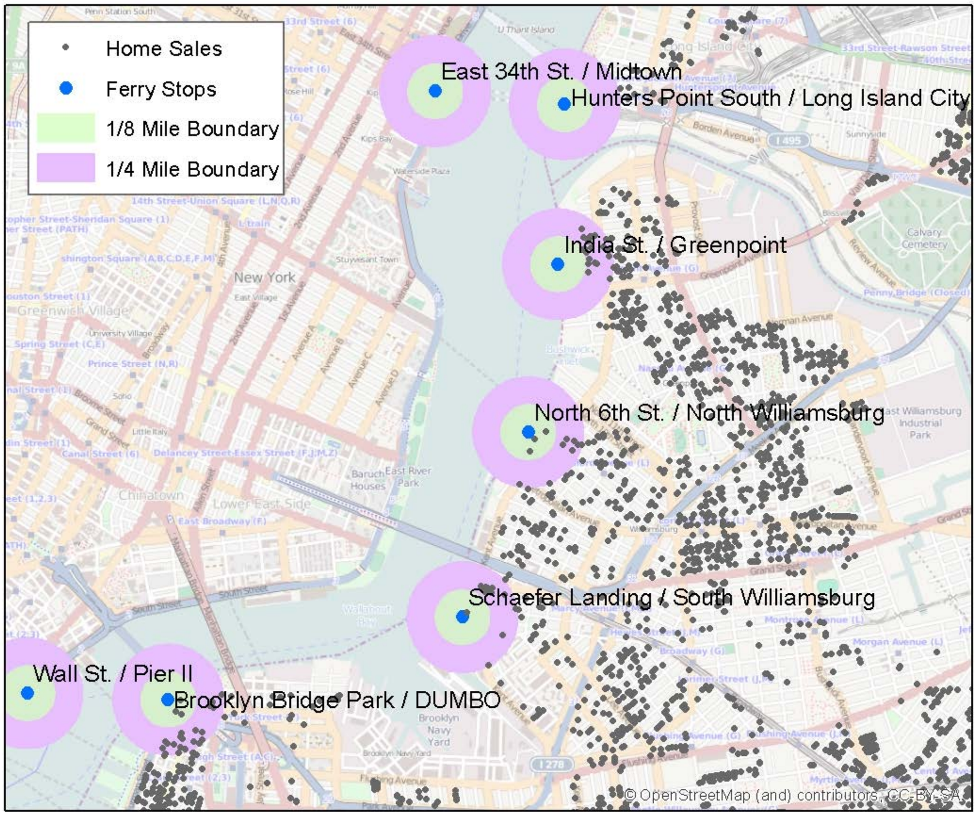
$$\ln(Y_i) = f(X_i) + \beta_1 \frac{1}{D_i} + \varepsilon_i$$

Where Y_i is the price of housing unit i, X_i is a vector of property characteristics for unit i, $\varepsilon_i$is an error term, and D_i represents the distance between unit i and the closest ferry stop. In this formula, if the estimated coefficient β_1 has a positive coefficient in the regression it would suggest that those housing units farther away from the ferry have lower prices, all else equal, and therefore that being near a ferry stop has a positive impact on prices. This implies that ferries are a positive amenity, and β_1 indicates the marginal value of being closer to a ferry strop.

[33] PLUTO and PAD datasets are available at the NYC Department of City Planning's website. http://www.nyc.gov/html/dcp/html/bytes/applbyte.shtml

[34] Sales with prices less than $5,000 were dropped from the analysis. In addition, the analysis does not include any unit that includes commercial square footage.

Figure 10.2: New York City Home Sales and Ferry Stops



However, it may be the case that for reasons that are not captured in the model, higher quality homes simply happen to be built closer to the ferry stop, and that a positive coefficient on this variable would be due to these omitted quality variables. To control for this, two measures are used in the regression: distance to closest ferry stop D_i, and distance to closest ferry stop interacted with a dummy I_{POST} that is equal to one if the house sale is in the post-Ferry period, e.g. the sale occurred after the ferry was formally announced on November, 2010, and equal to zero otherwise. While the existence of a ferry service was under discussion for throughout the mid-2000s, the most plausible date after which prices are likely to be impacted is November, 2010 when the service was formally announced.

$$\ln(Y_i) = f(X_i) + \beta_1 D_i + \beta_2 \frac{1}{D_i} I_{POST} + \varepsilon_i$$

The β_2 coefficient then represents the change in the amenity/disamenity of being near a ferry stop location after the ferry was announced. By including both the distance measure and the distance measure interacted with a post-ferry dummy, the omitted variable effects of being located near a ferry stop are controlled for with D_i and the causal effect of the ferry is captured by the interaction $D_i I_{POST}$.

Despite controlling for omitted variables using the distance and distance interacted with the post-period dummy, there is a possibility that homes with higher unmeasured quality sold relatively closer to the ferry in the post-period than in the pre-period. This would bias upward the estimate of the impact of ferry service on home prices. As an additional robustness test, a building level fixed effects estimation can be used. This uses a dummy variable for every borough, block, and lot combination in the dataset. The fixed effect therefore controls for the average quality of units within a condo building. To allow estimation of the fixed effects, only units or buildings with five or more sales in the dataset are used, which reduces the sample size to 8,827 sales.

Table 5 below provides the results of the regression analysis. The positive and statistically significant coefficient of β_2 suggest in both OLS and fixed-effects regressions that the value of being close to a ferry stop increased after November 2010, and therefore the introduction of the ferry has a positive amenity value. Specifically, the fixed-effect coefficient estimate of .005 suggests that ferry service increased the value of homes 1/8 mile away by 4.2%, and 2.1% for homes a quarter of a mile away. The impact falls further to less than 1% for homes a mile or more away.

Table 10.5: Property Value Impacts by Distance, Regression Results

		Base Model	**Fixed-Effects**
β_1: Miles from closest ferry	Coeff.	0.006	N/A
	P-Value	0.000	N/A
β_2: Miles from closest ferry x Post ferry dummy	Coeff.	0.004	0.005
	P-Value	0.039	0.026
Adj. R-squared		0.310	0.501
Sample size		9,015	8,827
Impact on 1/8 mile properties		3.1%	4.2%
Impact on 1/4 mile properties		1.5%	2.1%
Impact on 1/2 mile properties		0.8%	1.1%
Impact on 1 mile properties		0.4%	0.5%

These impacts are within the range found in the literature of public transportation's effects on property values. The ferry estimates are below the average impact of 8.1% reported Debrezion et al, (2007), however this represents the impact on properties that are exactly 1/8 mile away and not the average impact within 1/8 mile. The average impact will depend on the distribution of housing within the 1/8 mile boundary.

Robustness Test

A robustness test and alternative econometric analysis can be used that follows the existing literature by utilizing a hedonic regression that models the log of house prices as a function of building characteristics. The variables used in the regression model to "explain" house prices include the following:

- number of floors in the building;
- quarter sold;
- dummy indicating if the building is a walkup or elevator type condo unit,;
- geographic controls (latitude and longitude);
- recent alteration dummy;
- zip code dummies; and
- property tax exemption amount.

Number of floors enters the regression both linearly and in square and cubic terms, and the geographic controls enter linear and in square terms, to allow for non-linear impacts on prices.

Finally, to ensure that distance from closest ferry is not picking up the amenity value of distance from the waterfront, the distance between each home sale and the closest point on the water front is also calculated and included in the regression as an independent variable.

A difference-in-difference approach was then utilized to control for pre-existing differences in prices for homes near a ferry stop. The base model is then defined as:

$$\ln(Y_i) = f(X_i) + \beta_1 I_{FERRY} + \beta_2 I_{POST} + \varepsilon_i$$

The difference-in-difference estimation is captured using a dummy variable I_{FERRY} equal to one if the sale occurs within 1/8 mile of a ferry stop, and another dummy variable I_{POST} equal to one if the sale occurs within 1/8 mile of a ferry stop and in the post-Ferry period. This difference-in-difference approach examines whether the relative difference between prices within the affected area and the control area changed after the ferry service began. This type of estimate thereby accounts for pre-existing differences in the areas with ferry service.

The base model was estimated using ordinarly least squares results. The results in Table 6 suggest that being within 1/8 mile of a ferry stop in any time period has been associated with a higher sales price of 14.1% overall. In the period since the announcement of the East River Ferry service, the effect of being within a ferry stop has been an additional 11.5% higher price.

As shown in Table 10.6 below, the fixed-effect model suggests a statistically significant impact of 13.5% impact of the ferry service on prices within 1/8 mile. Given the large degree of freedom loss from the estimation of building level fixed effects, the statistically significant coefficient with a value close to the baseline difference-in-difference estimate represents strong evidence in favor of a positive impact on prices.

Table 10.6: Regression Results

		Base Model	Fixed Effect
Within 1/8 mile of ferry stop	Coeff.	0.141	N/A
	P-Value	0.000	N/A
Within 1/8 mile of ferry stop X effected period	Coeff.	0.115	0.135
	P-Value	0.004	0.006
Adj. R-squared		0.31	0.50
Sample size		9,015	8,827

The impact of 13.5% is within the 2% to 18% range of transit impacts reported in Fogarty et al (2008), and within one standard deviation of the average 8.1% impact reported by Debrezion et al (2007).

However, to the extent that this estimate is larger than expected given the prior availability of subway and bus transit in the area is explainable by the use of a 1/8 mile dummy rather than the 1/4 mile average more commonly used. Repeating the fixed-effects regressions using 1/4 mile produces a 6% impact with a marginally statistically significant p-value of 9%.[35] This estimate is below the 8.1% quarter mile average reported by Debrezion et al (2007) and would be consistent with a marginal increase in transit availability.

Econometric Summary

Overall, the results suggest that the ferry service has had a positive impact on the value of nearby housing units. Within 1/8 mile, the data suggests an impact between 4.2% and 13.5%. The combined fixed-effects and difference-in-difference approaches likely control for a large amount of unobserved quality differences. Fixed effects controls for unobserved overall building quality, and difference-in-difference controls for unmeasured quality differences between those within the 1/8 mile area and those outside it. However, it may be the case that areas falling within 1/8 mile benefitted from coincidental improvements in market conditions, which would bias the coefficient upward. One challenge in relying on the 1/8 mile estimate is that over 98% of the sales in the post-ferry period that are within 1/8 of a mile of a ferry stop are located near the North 6th St. / North Williamsburg ferry stop.

Utilizing the continuous distance measure, in contrast, brings in far more observations with varying levels of exposure to the ferry service. In addition, this estimate makes more robust assumptions that unmeasured quality does not exist along a non-linear continuous plane rather than within a small discrete area. Given the more robust

[35] When the sample size is expanded to include observations within five or six miles of the closest ferry stop, the p-value falls to 5.7% and 4.7% respectively, while the coefficient is largely unchanged at 6.0% and 6.2%.

assumptions, the 4.2% 1/8 mile estimated derived from the continuous distance measure is considered the most reliable.

Overall it is important to emphasize that the above analysis represents a more rigorous estimation approach than is commonly employed in the literature, where a distance measure is often used without building fixed-effects or differences-in-differences. The 1/8 mile impact of 4.2% is therefore a conservative estimate.

Estimated Overall Impact

The above analysis provides coefficients that can be used to provide a dollar value estimate of how ferry service has impacted nearby property prices. As a baseline estimate, the assessment values from the New York City Department of Finance's PLUTO dataset are used to impute a market value.[36] Table 10.7 below summarizes the impacts for areas within a mile of the closest ferry stop. Within 1/8 mile the average impact is 8.0%, which is nearly identical to the average found in the literature of 8.1% (Debrezion et al., 2007).

Table 10.7: Property Value Impact by distance from Ferry Stop

Distance (miles)					
From	To	Total Value (millions)	% Impact	$ Impact (millions)	Cumulative Impact (millions)
0.000	0.125	$ 1,298	8.0%	$ 92	$ 92
0.125	0.250	$ 2,872	2.5%	$ 74	$ 166
0.250	0.375	$ 6,249	1.6%	$ 98	$ 264
0.375	0.500	$ 5,557	1.1%	$ 63	$ 327
0.500	0.625	$ 5,117	0.9%	$ 47	$ 374
0.625	0.750	$ 7,897	0.7%	$ 56	$ 431
0.750	0.875	$ 5,204	0.6%	$ 32	$ 463
0.875	1.000	$ 5,468	0.5%	$ 29	$ 492

Overall, the East River Ferry Service increased house values by nearly half a billion dollars in the Brooklyn and Queens areas of New York City. The largest impact, of over $90 million, was in the immediate 1/8 mile vicinity.

[36] The Department of Finance used an assessed to market value of 6% for Tax Class 1 properties and 45% for Tax Class 2 properties. The assessments were compared to recent sales and these ratios are accurate for Tax Class 1 and conservative for Tax Class 2. To remain conservative, these ratios were utilized.

Induced Quantity of Development

There is far less literature on public transit's impact on the quantity of real estate development than on its impact on real estate prices. Studies on the impact of BART, a rapid transit and commuter rail system in California's San Francisco Bay area, have found positive impacts on redevelopment and employment growth (Cervero and Landis, 1997). However, a study of Atlanta's MARTA rapid transit system found no impact on population and employment density (Bollinger and Ihlanfeldt, 1997). While the existing literature is therefore mixed, the positive impact of ferry service on prices demonstrates an increase in the willingness to pay for housing in the area. Economic theory predicts that a secondary result of this increase in prices is an increase in the quantity of property supplied in the area. Econometric analysis can be used to test this theory, and to quantify the impact of ferry services on real estate development.

The PLUTO data utilized in the property value impact analysis was also used to estimate the amount of new construction in the Brooklyn and Queens area near ferry stops. Using the variable on year built for each property, a panel dataset was constructed that measured the total amount in each city block of the following measures:

- Number of buildings;
- Count of residential units;
- Total building square footage;
- Total retail square footage;
- Total office square footage;
- Total residential square footage; and
- Total other commercial square footage.

The dataset was limited to blocks within two miles of the nearest ferry stop, with the resulting sample consisting of the annual stock and change in each of the above measures for 1,854 neighborhood blocks from 2000 through 2012.[37]

[37] Because the data does not track the demolition of real estate stock, the measures only capture new supply and not net new supply. However, for the purposes of measuring investment in real estate this measure is more relevant than net new, since a building that is demolished and replaced by a new building of equal size is still new real estate investment despite not increasing the net stock.

Table 10.8: Average Annual New Construction Summary By Block From 2000 to 2012

Type	Percent Of Blocks With New Each Year	Average Amount New
Buildings	6.7%	0.11
Residential Units	5.8%	1.6
Building Area (sf)	6.6%	2,284
Office Area (sf)	0.7%	182
Retail Area (sf)	0.8%	75
Other Commercial Area (sf)	2.9%	637
Residential Area (sf)	5.7%	1,646

As expected given the small geographic size of blocks, the data show that new construction happens only periodically. Table 10.8 reports the percent of blocks that receive new construction of each kind in a given year, and the average amount of new construction in each block in each year. The average tract gets a new residential space 5.7% of the time, so that in any given year a block on average gets 1,646 new residential square feet every year.

The low percent of blocks that receive new construction each year leads to a panel dataset predominated by zeroes and large values, which would generate problematic heteroskedasticity and outliers for a regression analysis. To prevent this, the data is aggregated into total block level development for two periods: the pre-ferry period (2000 through 2009), and the post-ferry period (2010 through 2012). Table 10.9 below shows the percent of blocks with new development in the pre and post time periods:

Table 10.9: Percent of Blocks With New Construction by Time Period

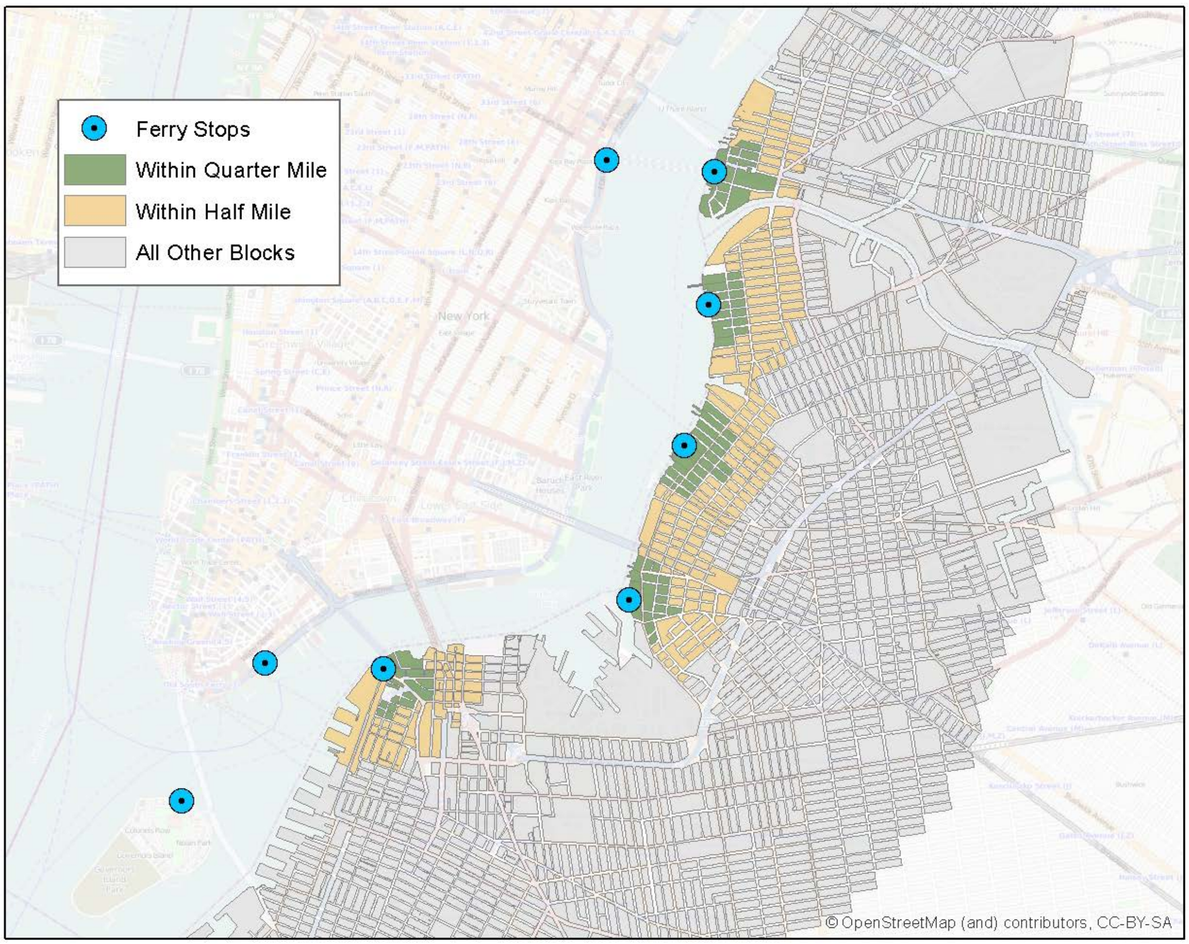
Type	Pre: ‘00-‘09	Post: ’10-‘12
Buildings	40.2%	11.1%
Residential Units	33.7%	9.1%
Building Area	40.1%	10.7%
Office Area	7.1%	1.1%
Retail Area	8.0%	2.0%
Other Commercial Area	23.6%	5.8%
Residential Area	33.4%	9.0%

However, after controlling for pre-existing development trends, is development in the post period higher in areas near the ferry? Specifically, the following models are estimated:

$$Z_{post} = \alpha Z_{pre} + \delta_1 I_{quarter} + \delta_2 I_{half} + \omega$$

Where for a given block Z_{post} is a measure of new development in the post period, $Z_{pre}$is that same measure in the pre period, $I_{quarter}$ and I_{half} are dummy variables indicating of the block is within a 1/4 mile or within ½ of a mile (and outside of 1/4 mile) of a ferry stop, and ω is an error term. [38] Figure 10.3 below shows the sample of blocks used in the analysis and those that are within ½ of a mile, within 1/4 mile, or in the control group.

Figure 10.3: Blocks Used in Regression Analysis



[38] To be more consistent with the evidence on price impacts and 1/8 mile would be more desirable, but the necessity of using blocks rather than properties, as with the previous analysis, leads to a small sample of observations within 1/8 mile. There are 18 blocks within a 1/4 mile, but 76 and 284 within 1/4 and 1/2, respectively.

The regression results, shown in Table 10.10 below, suggest that the ferry is associated with increases in development near ferry stops.[39] The largest impact is on residential development, which increased by over 6,400 square feet and 4.6 additional units in blocks within 1/4 mile from the stops. The least affected property type was office space, which increased but not by a statistically significant amount.

Table 10.10: Development Regression results

		Buildings	Residential Units	Building Area	Commercial Area	Office Area	Retail Area	Residential Area
δ_1: Quarter mile	b	0.1	4.6	8,008.1	2,420.6	12.5	266.9	6,411.0
	p	0.02	0.01	0.00	0.00	0.28	0.00	0.00
δ_2: Half mile	b	0.1	2.4	2,095.4	143.9	8.1	103.9	2,260.1
	p	0.04	0.04	0.17	0.74	0.26	0.03	0.06

Impacts can be expressed in percentage increase in total development by combining the above coefficients with the existing stock prior to the opening of the ferry. These results for all blocks within 1/4 mile are shown in Table 10.11 below. This translates to an overall impact on residential development of nearly 350 additional residential units and 487,238 residential square feet.

Table 10.11: Construction Impact in Inducing Square Feet of Development due to East River Ferry Stop Within A Quarter Mile

Type	Stock In 2009	Additive Sq footage	Percent Increase
Buildings	732	9	1.2%
Residential Units	6,051	350	5.8%
Building Area	12,300,000	608,615	4.9%
Commercial Area	5,466,094	183,963	3.4%
Office Area	953,887	948	0.1%
Retail Area	485,488	20,284	4.2%
Residential Area	6,745,500	487,238	7.2%

Overall, the results from the construction impact analysis are consistent with the impact on prices: there was a statistically and economically significant impact on prices and development in the immediate area, and a declining impact at farther

[39]Even using the larger time period aggregation, there exist a small number of outliers that influence the estimates. Each regression was run once and residuals with absolute values more than five standard deviations from the mean were removed. The coefficients presented are for the second regression with outliers excluded.

distances. The plausibility of the results is supported by the variation in effects by property type. The ferry is primarily used by households, and therefore the strongest effect was on residential units and square footage. Office space is the least affected, with retail, other commercial, and overall measures, like total buildings and building square footage, in between. This is also consistent with the admittedly limit evidence on the effect of public transit on development, which at least suggests that positive impacts can occur.

Economic Impacts Bibliography

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11 Appendix 3A: Site Profiles

Due to its extensive size, Appendix 3A is can be found in a standalone document.

12 APPENDIX 3B: Site Profiles - Development

INTRODUCTION

This document provides a profile of potential ferry landing sites. Sites were selected if they feature sites feature major development projects within walking distance of a potential ferry landing. These profiles provide information on existing conditions, a description of the development in the pipeline, and key considerations in planning for ferry service to those sites. The development projects discussed here may influence the need for ferry service by generating ridership and/or new ferry service could improve prospects for development.

BROOKLYN

Site Profile | Brooklyn Navy Yard

Nearest ferry study locations: S. Williamsburg, DUMBO

Overview

The Brooklyn Navy Yard is a 300-acre former US Navy facility that has been transformed into a major employment center. The Navy Yard closed in 1966 and ownership was transferred to New York City. The non-profit Brooklyn Navy Yard Development Corporation, established in 1981, manages the property on behalf of the City. Since the early 2000s, the City has invested heavily in infrastructure improvements and development on the site. Businesses located on the site currently employ approximately 10,000 people. The largest expansion at the Navy Yard since World War II is currently underway and is expected to create 2,500 new jobs and includes development of 1.8 million square feet of new space by 2025.

Existing Transportation/Access

Subway: The nearest subway stations, the A/C at High Street and F at York Street, are a 15-minute walk away. The Navy Yard provides free shuttle van access between the campus and neighboring subway stations, or to the East River Ferry by request.

Ferry: The South Williamsburg stop on the East River Ferry is a 10 minute walk from the closest entrance to the Navy Yard. The DUMBO ferry stop is a 20-minute walk from the closest entrance to the Navy Yard.

Bus: The Navy Yard is accessible via the B48 bus to Prospect Park, the B57 bus to Williamsburg, the B62 bus to Williamsburg, Greenpoint and Long Island City, and the B67 bus to Atlantic Avenue. All buses run every 15-20 minutes.

Car: The Flushing Avenue exit of the Brooklyn Queens Expressway provides immediate access to the Brooklyn Navy Yard.

Bike Share: 3 bike share locations along Flushing Avenue (southern border of Brooklyn Navy Yard), and 2 bike share locations within the complex (7th Avenue and Farragut Street, and Railroad Avenue and Kay Avenue)

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

There are currently no plans for improved transportation to the Brooklyn Navy Yard.

Resident/Visitor/Worker Overview

Planned expansion at the Navy Yard over the next 10 to 12 years is estimated to create over 2,500 new jobs focused in the light manufacturing, retail, technology, and arts industries.

Development Considerations

The Brooklyn Navy Yard Development Corporation has announced four major planned expansions and redevelopments.

Development Program and Timing

Green Manufacturing Center: A $60 million project with expected completion in 2014, the Green Manufacturing Center project will renovate a former machine shop building to create a high-tech, sustainable manufacturing center. The development will include:

- 215,000 square feet of space anchored by Crye Precision and New Lab
- Creation of 300 permanent jobs

Admirals Row: Located on six acres at the southwest corner of the Brooklyn Navy Yard in close proximity to three public housing complexes, Admirals Row will become a mixed-use shopping, commercial, and industrial space with expected completion in 2015. This development will include:

- 74,000 square foot supermarket

- 86,000 square feet of neighborhood retail, commercial, and office space
- 125,000 square feet of light industrial space
- Creation of 200 light industrial and 350 retail jobs

Building 77: The largest structure on the Brooklyn Navy Yard site will undergo a $50 million renovation, with estimated completion in 2016. The renovation will yield:

- 960,000 square feet of space to be anchored by Shiel Medical Laboratories and attract other technology, biomedical, or small manufacturing companies
- Creation of over 1,000 permanent jobs

Steiner Media Campus: A $347 million phased expansion is planned, creating the largest studio complex outside of Hollywood, projected for full build-out by 2025. This expansion will include:

- 960,000 square feet of new development
- Creation of 2,200 permanent jobs

Project Status

- Admirals Row completed Final Environmental Impact Statement in October 2011
- Construction on Building 77 was slated to begin in Spring 2013
- The City has already invested $22 million in infrastructure upgrades in preparation for the Steiner Media project

Summary and Key Considerations for Ferry Service Planning

The Brooklyn Navy Yard is a major and growing employment center on the Brooklyn waterfront that lacks proximate rapid transit access. Development projects will create an additional 2,500 jobs at the Brooklyn Navy Yard over the next 10 or more years in addition to the 10,000 already employed at the site. The nearest ferry service is a ten-minute walk, and the nearest subway station is a 15 minute walk away. Enhanced ferry service to this area of Brooklyn might be considered to support job growth on the Navy Yard campus.

Sources

- Admirals Row Plaza Final Environmental Impact Statement, http://www.nyc.gov/ , October 2011
- "Brooklyn Navy Yard: An Analysis of its Economic Impact and Opportunities for Replication, Pratt Center for Community Development, 2013
- Brooklyn Navy Yard Development Map, brooklynnavyyard.org

Nearest ferry study locations: Valentino Pier and Van Brunt St.

Overview

Situated on Brooklyn's southern waterfront, Red Hook was heavily impacted by Hurricane Sandy and is currently the subject of a number of recovery efforts and resiliency planning studies. The neighborhood is home to Brooklyn's largest public housing complex, Red Hook Houses, with 2,878 apartments housing an estimated 6,000 residents. The Red Hook waterfront is a diverse employment center, including a 346,000 square foot IKEA store and a 52,000 square foot Fairway Market, a cruise ship port of call at the 182,000-square-foot Brooklyn Cruise Terminal, and the Red Hook Marine Terminal, a container terminal operated by the Port Authority. A major shipping center through the early 20th century, Red Hook's economy declined as shipping activity moved out of New York City. In recent years, the Terminal has seen major investments.

Red Hook has seen increasing public and private investment and development in recent years, including development of IKEA in 2008, the opening of Fairway in 2006, with a $200,000 subsidy from the State of New York through the Empire Zone program, reinvigoration of Van Brunt Street, the neighborhood's small business commercial corridor, and enhancements to three waterfront parks.

The Red Hook waterfront is a working waterfront. In recent years, the City has invested over $50 million in infrastructure improvements for the Brooklyn Cruise Terminal and the Red Hook waterfront was part of the Southwest Brooklyn Industrial Business Zone (IBZ), which was designated to ensure that the City's key waterfront industrial properties would not be rezoned for residential uses. Firms relocating to the IBZ were offered a tax credit of $1,000 per employee to reduce relocation costs.

Many believe Red Hook has development potential that could be unlocked through improved transportation access, but it is important to note that increasing residential density near the waterfront is limited by existing zoning regulations.

Existing Access/Transportation

Subway: There is no subway access to Red Hook. The closest subway stop is Carroll Street on the F and G lines, a 30-minute walk from the Red Hook waterfront and retail.

Ferry: Since 2008, New York Water Taxi has operated ferry service from Pier 11 in Lower Manhattan to IKEA in Red Hook's Erie Basin. Year-round weekday service costs $5 one way (free with an eligible purchase at IKEA) and runs twice an hour between 2pm and 8pm. Free weekend service runs twice an hour between 11am and 8pm. In reaction to Hurricane Sandy, the City led expansion of free weekend service in the summer of 2013 to include a stop at the existing but unused Van Brunt dock near Fairway between May 25 and September 29 to promote neighborhood revitalization and attract more customers to businesses in Red Hook that were affected by Hurricane Sandy. This free service was offered as a result of a partnership between the City, New York Water Taxi, IKEA, Fairway, and the O'Connell Organization, which owns the property used to access the Van Brunt dock. The weekend service attracted 90,000 riders over the course of the summer of 2013, with approximately 25% of riders traveling to or from the new Van Brunt location.

Bus: The B61 bus connects Red Hook with Prospect Park and Atlantic Avenue every 10 minutes. The B57 bus runs from the Red Hook waterfront to northern Brooklyn every 20 minutes.

Car: The Hugh L. Carey Tunnel connects Red Hook directly with Lower Manhattan and I-278 (the Brooklyn Queens Expressway/Gowanus Expressway) connects Red Hook to Brooklyn and Queens.

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

Transportation has been, and continues to be, an obstacle to real estate development in Red Hook. There are no public proposals or plans for improved or increased transportation access to the area.

Resident/Visitor/Worker Overview

IKEA and Fairway currently attract New York City residents from neighborhoods in Brooklyn and the other boroughs. Aside from these large-format retailers, Red Hook's local retail serves the neighborhood population, a mix of middle-income households and residents of the New York City Housing Authority properties in the neighborhood.

Development Considerations

Red Hook's economy has been in flux since the mid-20th century, recently attracting entrepreneurs, artists, and creative professionals to the neighborhood. The O'Connell Organization and Estate Four represent the two major property owners on the Red Hook waterfront today.

Development Program and Timing

Estate Four is planning to redevelop three sites:

- **160 Imlay Street**: conversion of the 225,000 square foot former New York Dock Building into condominiums, planned for completion in 2 years.
- **202 Coffey Street**: transformation of 170,000 square feet of abandoned warehouse into office space, galleries, event space, and studios for artists and creative industries
- **68 Ferris Street**: redevelopment of 790,000 square feet of factory space into office space for creative industries

The O'Connell Organization owns approximately three million square feet of commercial space in Red Hook, including the Fairway Market building.

Project Status

- Estate Four has acquired all three properties and is rumored to be breaking ground first at 160 Imlay.

Summary and Key Considerations for Ferry Service Planning

Red Hook is already served by ferry. The current service, partially funded by IKEA, primarily serves as a means of bringing shoppers and visitors to Red Hook rather than as a commuter service to Manhattan. Further study is required to determine if additional ferry service would draw incremental visitation, and what changes to service or waterfront development would need to occur in order to attract commuters. While this public housing complex is the densest residential area in Red Hook and poorly served by public transit, Red Hook Houses are not located near the waterfront, and therefore would not be well-served by ferry service without additional upland connection services.

Private developers would likely benefit from expanded ferry service to Red Hook, to serve as an amenity to their projects. New landings would impact property owned by Estate Four and the O'Connell Organization and potentially unlock value for future development. Further study is needed to determine whether the proposed developments on Coffey Street and Imlay Street will generate enough traffic to warrant a new service or landing, and whether a public-private partnership could be structured to fund ferry investment.

Sources

- "Red Hook Intro" webpage, Estate Four, estate4.co.uk
- Brownstoner.com, "The Hot Seat: Gregory T. O'Connell," June 8, 2012.
- Brownstoner.com, "Developer to Break Ground on Condos and Artist Studios on Red Hook Waterfront," October 1, 2013.

Site Profile | Sunset Park

Nearest ferry study location: Brooklyn Army Terminal (BAT)

Project Summary/Background

Sunset Park is a diverse residential and industrial neighborhood in southern Brooklyn. The historic manufacturing waterfront has over 14 million square feet of publicly and privately owned industrial space, much of potential for further development. The Sunset Park waterfront was part of the Southwest Brooklyn Industrial Business Zone (IBZ), designated to ensure that waterfront industrial property would not be rezoned for residential uses. Firms relocating to the IBZ area were offered a tax credit of $1,000 per employee to reduce relocation costs. Since 2007, the City has committed to facilitating the revitalization of Sunset Park's industrial waterfront through the implementation of a Vision Plan for the area. The Sunset Park Vision Plan includes short-, medium-, and long-term strategies and investments with the goal of creating a modern industrial waterfront while also providing public amenities such as new open space at Bush Terminal Piers. The City also recently invested over $100 million in infrastructure improvements at South Brooklyn Marine Terminal to support the growth of industrial jobs.

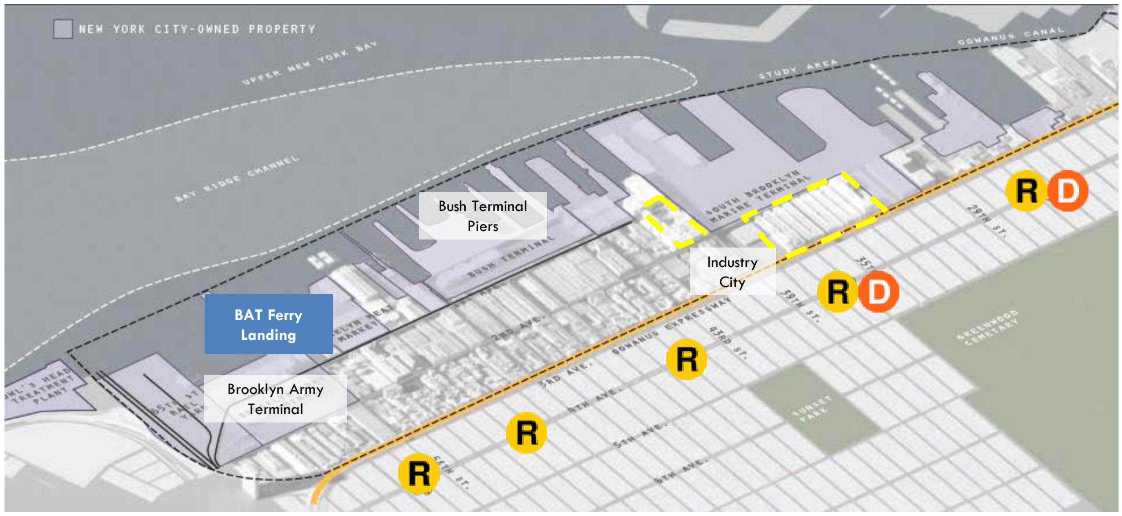
Existing Access/Transportation

Subway: Sunset Park is accessible to Manhattan via the D, N, and R trains. Subway stops at 45th Street, 53rd Street, and 59th Street are all a ten minute walk from the waterfront. However, the R train tunnel between Brooklyn and Manhattan is closed through late 2014 for repairs of damage from Hurricane Sandy.

Ferry: Temporary ferry service subsidized by NYCEDC and operated by Seastreak is currently offered between Brooklyn Army Terminal in Sunset Park, Pier 11 in Lower Manhattan, and East 34th Street in Midtown Manhattan during the R-train tunnel closure at a one-way price of $3.50. The service runs hourly from 6am and 10am from Brooklyn to Manhattan and between 3:00pm and 8:00pm from Manhattan to Brooklyn, and includes free parking at the ferry pier in Brooklyn. This service location was added to the existing Rockaway ferry service, and has been in operation since August 2013.

Bus: The area is well-served by bus lines, including the B11 to central Brooklyn, the B63 to Atlantic Avenue, and the X27, X37, X17, and X28 express buses to Manhattan and Staten Island, all of which run approximately every ten minutes.

Car: Sunset Park is bisected by I-278 (Gowanus Expressway), connecting the neighborhood to Brooklyn and Queens.



Source: Sunset Park Waterfront Vision Plan, 2009

Planned Transportation or Infrastructure Improvements

The City operated temporary ferry service to Sunset Park while repairs were performed on the R train. The City has also made significant investments in freight, maritime, and surface road networks in the area.

Resident/Visitor/Worker Overview

In the Sunset Park Vision Plan, NYCEDC projects the creation of 5,000 jobs in Sunset Park in the short-term and 11,000 jobs in the long-term, particularly in small-scale manufacturing, green manufacturing, and emerging industries such as film and media.

Development Considerations

Development Program and Timeline:

The Sunset Park Vision Plan, released in 2009, lays out a long-term plan for the neighborhood's economic development. Plans include:

- Infrastructure improvements
- Capital investment
- Marketing of the neighborhood
- Adaptation and modernization of existing industrial buildings and infrastructure to attract smaller manufacturers and emerging industries such as film, media, high-tech product development, and green manufacturing
- Activation of 3.5 million square feet of industrial space
- Creation or inducement 11,000 jobs in Sunset Park

Brooklyn Army Terminal is a 97 acre commercial and light industrial facility with 3.1 million rentable square feet on the Sunset Park waterfront. NYCEDC, which leases the space to large and small tenants, invested over $4 million in upgrades in 2011. As of April 2014, leasable space at the Brooklyn Army Terminal was 99 percent occupied with rents at $6 to $15 per square foot.

Bush Terminal Piers Revitalization: Since 2005, the City has spearheaded the effort to revitalize Bush Terminal Piers, a brownfield on a former port complex. The park will include:

- Two multi-use soccer and baseball fields
- Two tidal pools, picnic areas,
- Passive open space, providing recreational space and public access to the waterfront

Other major job centers located near the Sunset Park waterfront include: Liberty View Industrial Plaza, which contains 1.3 million square feet of recently renovated space for industrial and tech tenants; Lutheran Medical Center, a 450-bed academic teaching hospital; and Industry City, which includes six million square feet of space at Bush Terminal currently under major renovation.

Summary and Key Considerations for Ferry Service Planning

The Sunset Park waterfront is an industrial waterfront anticipated to grow with new industrial and creative employment. Property owners, employers, and advocacy groups have expressed interest in long-term ferry service as a means for commuters from elsewhere in the city access jobs in Sunset Park, but viability of ferry service is largely dependent on development of the area that is ongoing and requires further study. NYCEDC projects the creation of 11,000 jobs in the next ten years with implementation of the Sunset Park Vision Plan. Much of the employment growth may take place at Industry City, a major privately-owned building complex targeting industrial and creative tenants. There may be potential to create partnerships with Industry City owners and other stakeholders to bring new ferry service to the area.

Sunset Park has a network of local and express subway service within a ten minute walk from the waterfront. The temporary ferry service to Sunset Park generates limited ridership, but planned increases in the area's density along the waterfront could bring new demand for ferry service. The costs and benefits of bringing additional ferry service to Sunset Park must be evaluated.

Sources

- The Sunset Park Waterfront Vision Plan, NYCEDC, nycedc.com, 2009
- "City Announces Ferry Service Until January for Stuck Brooklyn R Train Riders and Rockaway Residents," New York Daily News, August 21, 2013
- "Industry City Investors Hope 'Made in Brooklyn' Lures Tenants," The Wall Street Journal, online.wsj.com, September 17, 2013
- "Brooklyn's Industrial Space Retools for a New Era," New York Times, September 25, 2012

MANHATTAN

Site Profile | Seward Park Mixed-Use Development Project

Nearest ferry study location: Grand Street

Overview

The Seward Park Mixed-Use Development Project will result in the redevelopment of the largest underdeveloped City-owned property below 96th Street. Much of the site is located in the former Seward Park Extension Urban Renewal Area, which was established in 1965 and expired in 2005 after numerous development efforts stalled due to a lack of community consensus. As a result, the area remains underutilized and includes a number of parking lots, a largely-vacant residential building, and vacant commercial space. The site's center at Delancey and Essex Streets is located within a 15 to 20minute walk from the potential ferry site at Grand Street on the East River in the rapidly-developing Lower East Side neighborhood around Grand Street, Delancey Street, and Essex Street. Essex Crossing is located north of the Seward Park Cooperative, four 20-story market-rate apartment towers historically organized as affordable co-ops, now market rate. Other large historic co-op towers, including Hillman Houses and Amalgamated Dwellings are also nearby. The project seeks to transform underutilized City properties into a dynamic mixed-use area, provide a mix of affordable and market-rate housing, and integrate the new development into the broader Lower East Side.

Delancey Street Associates LLC, a joint venture of L+M Development Partners, BFC Partners, and Taconic Investment Partners will invest $1.1 billion and develop a 1.65 million square foot mixed-use development.

Existing Transportation/Access

Subway: The Seward Park area is well served by the F, J, M, and Z lines at the Essex Street-Delancey Street station, which is adjacent to the project site.

Bus: Local bus routes include the M9, M14A, M15, M21, and M22 connect the neighborhood to the East Side and Lower Manhattan. The B39 bus provides service across the Williamsburg Bridge.

Car: Seward Park is located at the base of the Williamsburg Bridge and within a short distance from the FDR Drive.

Bike Share: Two bike share locations are on the site of the future development at Broome and Norfolk Streets and Grand and Clinton Streets.

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

The development plans include up to 500 new parking spaces. Publicly released information does not indicate any proposed public transportation enhancements.

Resident/Visitor/Worker Overview

The Essex Crossing project is expected to create 1,600 jobs at full build-out by 2024. Half of the 1,000 planned residential units will be affordable to low- and moderate-income households. Seward Park is also projected to accommodate creative and technology co-working spaces.

Development Considerations

Development Program and Timing

The Essex Crossing project will bring 1.65 million square feet of mixed-use development between 2015 and 2024. The City selected a developer, Delancey Street Associates LLC, through a competitive process that plans to invest $1.1 billion in the project. Plans for Essex Crossing include:

- 500 units affordable housing
- 500 units market-rate housing
- 15,000 square feet of open space
- 250,000 square feet of office space
- Renovation and expansion of Essex Street Market
- New Andy Warhol Museum
- 470,000 square feet of mixed retail

Project Status

- Final Environmental Impact Statement filed in August 2012
- Project approved by unanimous City Council vote in October 2012
- Delancey Street Associates LLC was announced as the winner of the bid process to build Essex Crossing in September 2013
- Construction is projected to begin in spring 2015 with five buildings completed by summer 2018, including 580 housing units. The next two buildings, to be built by summer 2022, will complete the majority of proposed housing units. The final two buildings will be completed by 2024.

Summary and Key Considerations for Ferry Service Planning

Essex Crossing will revitalize the largest underdeveloped City-owned property below 96th Street, in an area well-served by subway and bus service. The project will be a vibrant mixed-use destination. The area is already served by subway and bus service and is a ten-minute walk to the waterfront, which would require a new ferry landing. However, it is possible that the increased density planned for the area could help to support ferry service to the nearby Grand Street location considered in the ferry study.

Sources

- Seward Park Mixed-Use Development Project, NYCEDC, www.nycedc.com
- *Seward Park Mixed-Use Development Project Final Generic Environmental Impact Statement*, www.nyc.gov, August 2012

Nearest ferry study location: West 125th Street, Manhattan

Overview

In 2002, the New York City Economic Development Corporation (NYCEDC) launched a comprehensive planning process with the aim of revitalizing the area between West 125th and West 135th Streets, from Broadway to the Hudson River. The process resulted in the West Harlem Master Plan, which included three strategies for revitalizing the area, including: creation of a waterfront amenity, an initiative that resulted in the development of the two-acre West Harlem Piers Park; implementation of transportation improvements, mainly focused on increasing safe pedestrian access to West Harlem Piers Park through streetscape improvements; and support for economic and institutional development, which was advanced through a comprehensive rezoning of the area in 2009.

The $20 million West Harlem Piers Park opened in 2009, and includes a kayak launch, fishing pier, open lawn space, and a landing at the end of the pier currently available for charter services through DOCKNYC.

The 2009 rezoning enabled Columbia University's planned Manhattanville campus, which will transform a 17-acre site north of Columbia's Morningside Heights campus into 6.8 million square feet of academic and research space, ground-floor retail and other supporting uses, as well as open space. At the time of approval in 2009, the project was estimated to cost $6.2 billion and create 6,000 permanent jobs. The first phase of development, already underway and continuing through 2015, includes concentrated development of academic facilities and research space. The second phase, scheduled for development from 2018 to 2030, will include academic facilities, research space, limited University housing, publicly-accessible open space, and other support facilities.

The streetscape improvements envisioned in the West Harlem Master Plan include widening area sidewalks and adding new cross walks, improving or adding street and pedestrian lights, realigning roadways, as necessary, adding new street furniture and plantings, as well as artistic lighting under the IRT viaduct and the 12th Avenue viaduct at West 125th Street.

Existing Access/Transportation

Subway: The 1 train provides direct access at West 125th Street & Broadway

Bus: Five NYC Transit bus lines, the M4, M5, M11, M104, and Bx15 provide frequent service to the area, running every ten minutes or less.

Car: North and southbound vehicles can access the area via the 125th Street exit from the West Side Highway (State Route 9A). Access from the east side of Manhattan is via 125th Street, a major arterial, connecting with the FDR Drive on the east side of Manhattan.

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

The Final Environmental Impact Statement (FEIS) describes streetscape and roadway improvements proposed for the area, including pedestrian improvements and signal changes along major intersections and roadways in the area. The FEIS assumes that shuttle bus transportation will be provided for Columbia students and faculty between the Manhattanville and Morningside Heights campuses at ten-minute headways.

Resident/Visitor/Worker Overview

Introduction of students and University faculty will represent a significant shift in the daytime and residential population in West Harlem. Phase I, to be completed in 2015, will bring 2,800 students and 1,700 employees to the Manhattanville campus. Upon full build out, the total campus population is expected to reach 4,300 students and 6,400 employees. The 35,000 square foot Fairway Market at West 132nd Street on the waterfront also remains a destination for residents from surrounding neighborhoods.

Development Considerations

Per the FEIS, development of Manhattanville is divided into three subdistricts by concentration of use and development:

- Subdistrict A, an academic mixed-use district, is anticipated to include 6.8 million SF of development and approximately 93,000 SF of publicly accessible open space to be developed by Columbia University;
- Subdistrict B, the western-most subdistrict, abutting West Harlem Piers Park, was rezoned to encourage commercial development at increased density, for future development; and

- Subdistrict C, the smallest development area, on the northwest corner of the site, was rezoned to encourage commercial development at increased density, noting that any future development should be compatible with adjacent residential uses.

Development Program and Timing

Phase I (currently underway with projected completion in 2015) includes:

- 740,000 square feet of academic space,
- 350,000 square feet of space dedicated to academic research,
- 53,600 square feet of University housing,
- 60,449 square feet of active ground-floor uses, such as neighborhood retail, and
- 29,000 square feet of public, open space.

Phase II (projected for development from 2018 to 2030) includes:

- 1.4 million square feet of academic space,
- 2.6 million square feet of academic research space,
- 400,000 square feet of recreation space,
- 160,000 square feet of active ground-floor space, and
- The remaining public, open space (approximately 64,000 square feet).

Project Status

- West Harlem Master Plan launched by NYCEDC in 2002
- Final public approval by the New York State Public Authorities Control Board in May 2009
- West Harlem Piers Park opened in 2009
- Construction of Phase I is ongoing

Manhattanville Development, Phase I (2015) Site Plan

Source: *Manhattanville FEIS, Executive Summary*

Summary and Key Considerations for Ferry Service Planning

The influx of residents and University staff and faculty will create a major activity center in West Harlem stretching to the Hudson River and West Harlem Piers Park.

The area is well-served by subway service and will be served by a frequent Columbia University shuttle service connecting its two campuses. While there is a ferry landing at West Harlem Piers Park, there is no active ferry service.

Sources

- Final Environmental Impact Statement for the Proposed Manhattanville in West Harlem Rezoning and Academic Mixed Use Development, November 16, 2007
- "Manhattanville Development", facilities.columbia.edu/manhattanville, 2013
- "Manhattanville in West Harlem", neighbors.columbia.edu
- "West Harlem Redevelopment," www.nycedc.com/project, 2013

QUEENS

Site Profile | Astoria – Hallets Point and Astoria Cove

Nearest ferry study locations: Astoria Cove and Hallets Point

Overview

Two large multifamily waterfront developments are proposed for Astoria, on the same peninsula as Astoria Houses, a New York City Housing Authority development home to 3,100 residents. Hallets Point is being developed by Lincoln Equities and will include 2,600 new units across eight buildings, 68,000 square feet of retail space, and 2.4 acres of open space. The second major project is Astoria Cove which will comprise 1,700 residential units, 117,000 square feet of retail space, including a 25,000 square foot grocery store, a 456-seat elementary school, and over three acres of open space.

Though still in the regulatory process, both projects have spent years in planning stages, and are now moving toward approvals. Hallets Point was approved by the City Planning Commission in the summer of 2013 and City Council in October 2013, while information about Astoria Cove's pre-development timeline remains unknown. In October 2013, local Councilman Peter Vallone Jr. expressed support for Hallets Point, noting that he would like to see expanded infrastructure to support the project, including ferry service directly to the area.

Existing Access/Transportation

Subway: The N and Q trains provide access to Astoria. However, trains are a 20-minute walk from the Hallets Point and Astoria Cove development sites, and there are some concerns with limited capacity of these lines to accommodate the additional residential density planned for the area.

Bus: The Q18, Q102, and Q103 (weekdays only) buses provide service along 27th Avenue, directly to the development sites, running every 15 minutes to one hour, from other parts of Astoria, Hunter's Point, Long Island City, and Roosevelt Island, with stops within a short walk (under five minutes) from the sites.

Car: The development sites are located near the base of the Robert F. Kennedy Bridge. The Final Environmental Impact Statement (FEIS) notes that development at Hallets Point would include 1,400 off-street parking spaces, 28 on-street spaces, and replacement of existing NYCHA parking spaces that will be displaced by new development.

Source: ESRI Business Analyst, HR&A Advisors

Resident/Visitor/Worker Overview

The new development would bring a significant influx of market-rate housing to the Astoria waterfront, which currently consists primarily of public housing and industrial uses.

Planned Transportation or Infrastructure Improvements

The Hallets Point FEIS notes that project development will necessitate expanded bus service, and that parking demand may exceed the planned number of parking spaces during overnight periods. In addition, Hallets Point is anticipated to include a publicly accessible waterfront esplanade facing the East River.

Development Considerations

Development Program and Timing

Hallets Point: phased development is projected for full build-out by 2022 with the first building expected to open in 2016. New construction will take place within the Astoria Houses complex, concentrated along the waterfront, as presented in the figure below from the project FEIS. Plans include:

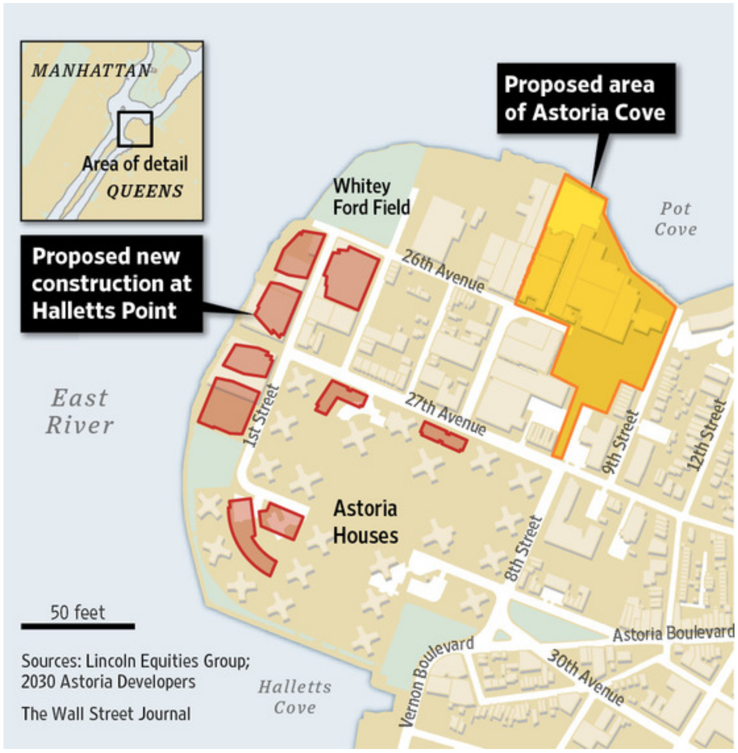
- 1,760 market-rate residential units
- 440 affordable residential units
- First building expected to open in 2016

Astoria Cove is projected to include:

- 1,800 residential units, of which a minimum of 340 will be affordable

Project Status

- Hallets Point completed Final Environmental Impact Statement in August 2013
- City Council approved the Hallets Point project October 2013
- Information about Astoria Cove's pre-development timeline remains unknown



Source: The Wall Street Journal

Summary and Key Considerations for Ferry Service Planning

Private Hallets Point and Astoria Cove developments could attract thousands of new residents to the Astoria waterfront, a considerable distance from subway service. The projects could produce 4,300 units of housing on the peninsula above Hallets Cove. Because residents commuting by subway would need to walk 15 to 20-minutes to the train, ferry service may be an attractive amenity for future residents. In October 2013, the local Councilman Peter Vallone announced that the City will study the feasibility of bringing ferry service to the site.

Sources

- Hallets Point Redevelopment Final Environmental Impact Statement, August 2013
- Astoria Cove Development, Environmental Assessment Statement, April 25, 2013
- "Halletts Point Gets Attention with Projects," The Wall Street Journal, May 23, 2013
- "Halletts Point heads for final approval from city," Times Ledger, timesledger.com, August 30, 2013
- "Huge Halletts Point Project Wins Key Nod", Crain's New York Business, October 9, 2013

- "City Planning Commission greenlights $1 billion Astoria development on waterfront," New York Daily News, August 21, 2013

Nearest ferry study location: Citi Field

Overview

Willets Point is located in northern Queens, adjacent to Citi Field. The area consists of auto repair, scrapping, and waste processing industries many of which have recently vacated the area as the City's development of the area has moved forward. The area also lacks basic infrastructure in many places. Citi Field, the home of the New York Mets, opened in 2009, replacing Shea Stadium. The City is spearheading redevelopment of the area and has invested over $50 million in infrastructure upgrades in Willets Point in preparation for significant residential, commercial, retail, and open space development. Goals of development at Willets Point include the remediation of hazardous and polluted land, providing links to basic infrastructure, provision of jobs, creation of new retail, and the provision of housing. Phase 1 of development of Willets Point is underway and will include hotel, retail, residential, and entertainment space. Full build-out of the Willets Point Redevelopment Plan is expected by 2032.

Existing Transportation/Access

Subway: Willets Point is accessible via the 7 train at the Mets – Willets Point stop adjacent to Citi Field, which is within walking distance of all proposed development. The Long Island Railroad's Port Washington Branch also serves the Mets – Willets Point station.

Bus: Willets Point is served by the Q48 bus connecting Flushing to LaGuardia Airport every 20 minutes, the Q19 to Astoria every 20 minutes, and the Q66 to Long Island City every 10 to 15 minutes.

Car: Willets Point lies between I-678 (Van Wyck Expressway) and the Grand Central Parkway. However, access is limited given the lack of ramp access from the Van Wyck Expressway into Willets Point.

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

The Federal Highway Administration has approved plans to construct access ramps from the Van Wyck Expressway into Willets Point, improving automobile access in preparation for full build-out of development plans. Ramp construction is slated for completion in 2024.

There are a few transit improvements planned for both 7-train and LIRR service. The MTA is currently working to implement communications-based train control (CBTC) on the 7-train, which will increase capacity. Also, East Side Access capacity enhancements on the LIRR will enable more frequent service on the Port Washington line.

Resident/Visitor/Worker Overview

The City is seeking to create a regional entertainment destination and activity center at Willets Point, which by 2032 is expected to include up to 5,850 units of market-rate and affordable housing and create over 7,000 permanent jobs.

Development Considerations

The City's Willets Point Development Plan proposes remediation and phased development of the space adjacent to Citi Field. Development of Willets Point over the next 20 years will transform the neighborhood from an industrial area to a regional destination for entertainment, housing, and retail with nearly nine million square feet of mixed-use development by 2032.

Development Program and Timing

Phase 1A, with expected completion in 2018, will include:

- Remediation of a 23-acre site east of Citi Field

- New 200-room hotel
- 30,000 square feet of retail,
- 2,750-space surface parking lot
- 1.4 million square feet of retail stores, theaters, restaurants, and other entertainment venues west of Citi Field. Completion of Phase 1A is expected in 2018.

Phase 1B, with projected construction from 2024 to 2028, will replace surface parking from Phase 1A with:

- 2,490 residential units (827 affordable)
- 875,000 square feet of retail space
- 500,000 square feet of office space
- 235,000 square feet of hotel space
- 25,000 square feet of community facilities
- New school building
- Structured parking facility
- 6 acres of open space
- Creation of over 7,000 permanent jobs, including jobs created in Phase 1A.

Phase 2, with expected completion in 2032, will further develop the area east of Citi Field. Upon completion of Phase 2, Willets Point will include:

- Up to 5,850 units of housing (2,048 affordable)
- 1.25 million gross square feet of retail
- 500,000 gross square feet of office space
- 400,000 gross square feet of convention center use
- 150,000 gross square feet of community facilities
- 8 acres of public open space
- A new public school.

Project Status

- City broke ground on infrastructure improvements in December 2011, with expected completion in 2014
- The first phase of the project was awarded to Queens Development Group, a joint venture of the Related Companies and Sterling Equities in 2012.
- Project certified into the Uniform Land Use Review Procedure in March 2013
- Final Environmental Impact Statement completed in August 2013
- City Council approved the project October 2013, including a pledge regarding the City's full commitment to building the Van Wyck Ramps to ensure that both Phase 1B and Phase 2 are built to fully realize the vision at Willets Point.

Summary and Key Considerations for Ferry Service Planning

The City and private market are both investing heavily in Willets Point to create a regional housing, retail, and entertainment hub. By 2032, almost nine million square feet of new development will bring significant numbers of new residents, employees and visitors to Willets Point.

Ferry service to Willets Point does not currently exist, but may provide an amenity to the new development and complement the subway and Long Island Railroad service in place. The costs and benefits of bringing ferry service to Willets Point require further research, and the opportunity for a public-private partnership with the Queens Development Group should be explored.

Sources

- Willets Point Development Final Environmental Impact Statement, www.nycedc.com, March 2013
- Willets Point, NYCEDC, www.nyc.gov
- Statement by Mayor Bloomberg, www.nyc.gov, June 12, 2012

Site Profile | Long Island City - Hunter's Point South

Nearest ferry study location: Long Island City – South

Overview

Hunter's Point South is a City-led development on 30-acres of waterfront property in Long Island City, Queens. A former low-density, industrial area, the site is now slated for development including residential and commercial uses with a new waterfront park. When fully built, Hunter's Point South will be the largest affordable housing complex built in New York City since the 1970s. Current plans include 5,000 residential units, 60 percent of which will be permanently affordable to low- and middle-income families.

A partnership of the Related Companies, Phipps Houses, and Monadnock Construction was selected to develop Phase I of the project, approximately 900 residential units and 17,000 square feet of retail space. Construction is currently underway, with completion expected in 2014. In August 2013, the first five acres of the Hunter's Point South Waterfront Park opened and the New York City Economic Development Corporation issued a Request for Proposals for development of the second phase of the project.

Existing Transportation/Access

Subway/Train: Hunter's Point South is a ten-minute walk from the 7 train's Vernon Boulevard-Jackson Avenue stop. The Long Island City stop on the Long Island Railroad, which is the terminal station for the Main Line and Montauk Branch, is located adjacent to the project area.

Ferry: There is an existing East River Ferry landing, the Long Island City stop, at Hunter's Point South.

Bus: The Q103 bus provides service from the 7 train station northward along Vernon Boulevard.

Car: Hunter's Point South is directly accessible by the Queens-Midtown Tunnel on I-495, connecting the neighborhood to Manhattan.

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

New street infrastructure at Hunter's Point South will include separated bikeways along 2nd Street and Center Boulevard.

Applicants for the City's RFP to develop Phase 2 (Site C) of the redevelopment area had the option to propose an upgrade of the existing Hunter's Point South Terminal, but the selected Respondent's proposal did not include ferry infrastructure improvements.

Pedestrian access to the terminal has significantly improved since the first phase of the riverfront park opened. When the East River Ferry was first launched, ferry riders navigated around a construction site to access the landing; now, riders walk through an attractive park. Ridership has grown since this improvement.

In addition, the MTA is currently working to implement communications-based train control (CBTC) on the 7-train, which will increase capacity.

Resident/Visitor/Worker Overview

Of the full 5,000 residential units anticipated for development over multiple phases, 60 percent are slated to be affordable to households up to 165% of Area Median Income (AMI), or about $68,500 to $142,000 for a family of four.

Development Considerations

Phased development of Hunter's Point South is anticipated to create a mixed-use, waterfront neighborhood.

Development Program and Timing

Phase I, which broke ground in March 2013 and is expected to be complete by 2014, will include:

- Two residential buildings with approximately 900 total units, all of which will be permanently affordable to low- and middle-income families.
- 17,000 square feet of new retail
- Parking
- New public roadways
- A new school
- Infrastructure improvements, including water mains, lighting, traffic signals, and sewers.

Phase 2, for which the City Selected a developer in December 2013, is projected to include:

- 1,200 units of housing (50-60% affordable)
- 28,000 square feet of community and commercial space

Project Status

- Plans for Hunter's Point South received ULURP certification in April 2008
- Final Environmental Impact Statement was completed in August 2008
- Through an RFP process, in 2011 the City selected Phipps Houses, Related Companies, and Monadnock Construction to complete Phase 1
- Phase 1 broke ground in March 2013
- TF Cornerstone was selected for the development of Phase 2 Five acres of Hunter's Point South Waterfront Park opened in August 2013, including a central green, playground, promenade, and a 13,000 square foot pavilion for restrooms, concessions, and a café.

Summary and Key Considerations for Ferry Service Planning

Large-scale redevelopment of the Hunter's Point South is underway and will result in new high-density waterfront housing. Full build-out will result in 5,000 units of market-rate and affordable housing.

Hunter's Point South is already served by the East River Ferry. The existing facilities are aging, and the need for new ferry infrastructure is likely to support continued service.

Sources

- Hunter's Point South, NYCEDC, www.nycedc.com
- *Request for Proposals: Hunter's Point South Parcel C*, New York City Department of Housing Preservation and Development, April 2013

Site Profile | Rockaways

Nearest ferry study locations: Beach 67th Street, Beach 108th Street, Beach 116th Street, Jacob Riis Park

Overview

The Rockaway Peninsula, a peninsula in Queens, is home to several residential neighborhoods. In recent years, beaches at Fort Tilden and Jacob Riis Park and the 5.5 mile boardwalk have become increasingly popular. In 2008, the New York City Department of City Planning rezoned 280 blocks in five neighborhoods on the eastern portion of the peninsula. The rezoning, in part, facilitates new residential and commercial development in select locations, especially those close to transit. One large-scale development project, known as Arverne East, was slated for development in 2007, but had been delayed by the economic downturn in 2008. The development group, a partnership between L+M Development, the Bluestone Group, and Triangle Equities, was preparing to begin development in late 2012 when Hurricane Sandy (Sandy) struck New York and devastated much of the Rockaways through flooding and fire.

Since Sandy, communities along the peninsula have worked toward rebuilding, drawing national attention as the City debates how to rebuild the area, and protect homes and businesses in the face of future climate change and extreme weather events. In the spring of 2013, at the suggestion of the Department of Housing Preservation and Development (HPD), the Arverne East developer group released a Request for Proposals for sustainable, resilient development of the 80-acre parcel. .

Existing Transportation/Access

Subway/Train: The A train connects the Rockaways to Manhattan, and the S shuttle train runs from Broad Chanel in Jamaica Bay toward Rockaway Park/Beach 116th Street. Long Island Railroad (LIRR) also serves the eastern end of the peninsula with the Far Rockaway station on Nameoke Street and Redfern Avenue, with service to Atlantic Terminal in Brooklyn and Penn Station-New York in Manhattan.

Ferry: Since Hurricane Sandy, the Rockaways have been served by a temporary weekday ferry service between Beach 108th Street and Pier 11 in Lower Manhattan, the Brooklyn Army Terminal in Sunset Park, and East 34th Street in Midtown Manhattan. The service, operated by Seastreak through a contract with the NYCEDC, currently runs at 50 to 70-minute headways during the morning rush hour, from 5:45 am to 9:20 am, and in the evening, departing East 34th Street between 4:20 pm and 7:30 pm. One additional ferry also leaves from East 34th Street at 2:45 pm and arrives in the Rockaways at 3:55 pm. A private operator provides unsubsidized service between Lower Manhattan Pier 11 and Riis Landing for beach access during summer weekends.

Bus: The Q22, Q52, Q53, and Q35 bus lines travel along Beach Channel Drive and Rockaway Beach Boulevard, providing access beyond the subway line, and running at ten to 20 minute intervals. Express bus service (including the QM 16 and QM 17 lines) to Manhattan runs at 15 to 20-minute intervals on weekday mornings, at 20 to 25-minute intervals on weekends.

Car: The Rockaway peninsula is accessible by vehicle via the Cross Bay Boulevard and Rockaway Boulevard from Queens to Rockaway Beach and Arverne, respectively, and from Brooklyn via the Marine Parkway Gil Hodges Memorial Bridge at Roxbury. Lack of access, especially from points further southwest along the peninsula, is a major concern during extreme weather events.

Source: Rockaway Waterfront Alliance

Planned Transportation or Infrastructure Improvements

Restoring A train service to the Rockaways in the aftermath of Sandy required a $75 million line improvement, and an additional $9 million in funding to operate replacement bus and shuttle bus service. Though the storm raised questions about the necessity to rethink transit and infrastructure in the Rockaways, no formal plans for new transportation infrastructure have been released.

Resident/Visitor/Worker Overview

The Rockaways are a primarily residential area with mixed-incomes in housing ranging from single-family homes to multifamily buildings. Rockaway beaches also attract a significant number of visitors from elsewhere in the city during the summer season.

Development Considerations

Redevelopment of the Arverne neighborhood began in the early 2000s with Arverne by the Sea, a development home to over 1,000 families as of 2012. Continued development of Arverne East was part of a design competition – FAR ROC – to plan for the sustainable development of the large parcel, fulfilling the second portion of an Urban Renewal Plan established for Arverne in the early 2000s. Additional development is currently focused on rebuilding and recovery from Sandy damage, including plans to improve the Beach 116th commercial corridor and rebuilding homes in significantly damaged communities.

Development Program and Timing

Future development is projected to include:

- Up to 1,500 units of housing, in a mix of low- to midrise buildings;
- Up to 500,000 square feet of commercial and recreational space;
- A 35-acre nature preserve;
- A 9-acre dune preserve; and
- 3.3 acres of open space.

Project Status

- Final Environmental Impact Statement was completed in 2003
- In the spring of 2013, the Arverne East developer group released a Request for Proposals for development of the remaining 80-acre parcel. In October 2013, the Stockholm-based firm White Arkitekter’s proposal Small Means and Great Ends was selected as the winning design of the FAR ROC design competition launched for this site.

Summary and Key Considerations for Ferry Service Planning

The Rockaways is a residential area with a tourist draw. The area benefits from existing A train service, but temporary weekday ferry service has supplemented accessibility. Continued ferry service to the area is costly, but is highly desired by the community and would potentially provide redundancy of transit options.

Sources

- “New Rockaway Ferry Service,” NYCEDC, nycedc.com, January 18, 2013
- *Planning for a Resilient Rockaways: A Strategic Planning Framework for Arverne East*, Rockaway Waterfront Alliance, rwalliance.org, 2012
- “Rockaway Neighborhoods Rezoning,” NYC Department of City Planning, nyc.gov, August 18, 2008

- “FAR ROC: For a Resilient Rockaway,” farroc.com, 2013
- “A bold experiment on 80-acre Rockaways site,” Crain’s NY Business, crainsnewyork.com, July 18, 2013
- “Architects from around the world imagine fanciful future for Rockaway's Arverne East,” New York Daily News, nydailynews.com, July 18, 2013
- “A Much Criticized Pocket of the Rockaways, Built to Survive a Storm,” The New York Times, November 12, 2012

THE BRONX

Site Profile | Whitestone Multiplex - Paragon Outlets

Nearest ferry study locations: Ferry Point Park and Soundview

Overview

The 19-acre site of the former Whitestone Multiplex just north of Ferry Point in the Bronx, at 2505 Bruckner Boulevard, has been rumored to be the site of the City's next outlet mall, placing the complex in competition with the proposed retail outlet center at St. George in Staten Island. The Lightstone Group, a local developer and investor in projects throughout New York City, purchased the site in the spring of 2012 for $30 million, and closed the 30-year old Whitestone Multiplex Cinemas in the spring of 2013.

A plan for redevelopment is not yet publicly confirmed, but promotional materials and news media report that Lightstone has begun to brand the development as Paragon Outlets, consistent with their subsidiary, which develops outlet malls across the country. Reports indicate that the site would become a regional retail center, drawing shoppers from Manhattan, the boroughs, and the tri-state area. While no public approvals are necessary to redevelop the site, as the area is already zoned for commercial development, news media suggests that increased traffic generated by an intensive retail use may pose a concern for surrounding arterials and neighborhoods, and that construction and excavation on the site may trigger a need for environmental remediation. In the summer of 2012, a Lightstone spokeswoman noted that the project would bring a new source of employment and revenue to the area, but cautioned that the group was still considering the economic feasibility of the project.

Existing Access/Transportation to site

Subway: The 2505 Bruckner site is not directly accessible by subway. The Zerega Avenue stop on the 6 train line is approximately half a mile from the site, but requires that pedestrians cross an inlet from the East River, running under the Bruckner and Cross Bronx Expressways.

Bus: The Q44, Q50, Bx5, and BxM8 provide bus service to the site, but are separated by a web of on and off-ramps, making pedestrian access from local stops difficult. Local bus lines provide access to Flushing, Jamaica, and other sites within the Bronx.

Car: Situated at the junction of the Cross Bronx Expressway, Bruckner Expressway, Bruckner Boulevard, and Hutchinson River Parkway, the site at 2505 Bruckner is most easily accessed by car. Via Bruckner Boulevard, the site is a 30 minute drive from Manhattan, approximately 15 minutes from New Jersey upon entering the George Washington Bridge, and easily accessible from points in Westchester County and Connecticut via the Hutchinson River Parkway.

Source: ESRI Business Analyst, HR&A Advisors

Resident/Visitor/Worker Overview

The primary market area surrounding the site is not a residential neighborhood, with very few recorded residents (below 100 residents). Redevelopment of the site as proposed would likely generate significant visitation to the area and generate retail jobs. However, due to the early and confidential nature of the plans, the number of jobs and visitors is not publicly available.

Planned Transportation or Infrastructure Improvements

No transportation or infrastructure improvements related to the development of Paragon Outlets are planned at this time.

Development Considerations

Development Program and Timing

- News reports and promotional materials indicate planned development of the Paragon Outlets, though no detailed plans have been made public.
- Current zoning would allow up to 800,000 square feet of development

Project Status

- The Lightstone Group purchased the site in the spring of 2012 for $30 million

Summary and Key Considerations for Ferry Service Planning

Proposed redevelopment of the Whitestone Multiplex is yet to be confirmed, with an unidentified lead time for planning and potential public approvals. At this time, projections on visitation and trips generated by the proposed outlet mall are unclear, with no formal plans for development confirmed.

Ferry service to the redevelopment would primarily serve workers and visitors at the retail center. A public-private partnership to bring ferry service to the retail center should be explored given the benefits would accrue primarily to the project and its workers.

Sources

- "Mall May Soon Come to Whitestone Cinema," Bronx Times, bxtimes.com, June 7, 2012
- "Bronx site could become city's first outlet mall," Crain's NY Business, crainsnewyork.com, July 16, 2012
- "City's first outlet mall is in the works," The Real Deal, therealdeal.com, July 16, 2012
- "Replacing the Whitestone Multiplex Cinemas with an Outlet Mall," examiner.com, July 25, 2012

Site Profile | Stapleton - Homeport

Nearest ferry study location: Stapleton

Overview

The Homeport is a decommissioned US Naval base located in Stapleton, a waterfront neighborhood in northeast Staten Island that experienced heavy flooding during Hurricane Sandy. The 35-acre site includes a 1,410-foot pier extending into New York Bay. The City took ownership of the site after it was decommissioned in 1995. The New Stapleton Waterfront Development Plan, launched by NYCEDC and the Department of City Planning in 2003, seeks to create a vibrant mixed-use residential neighborhood on the site. In 2011, Ironstate Development Company was chosen to complete Phase 1 of development and transform seven acres of the site into 900 units of new rental housing and 30,000 square feet of retail space.

Existing Access/Transportation to site

Train: The Homeport is located across the street from the Stapleton stop on the Staten Island Railway, connecting it to points north and south on Staten Island. Trains run every 15 to 30 minutes during weekday commute times, and every 30 minutes on weekends.

Ferry: The Staten Island Ferry provides service from Staten Island to Lower Manhattan. The Homeport is accessible to the St. George Ferry Terminal via a 30-minute walk, a 10-15 minute bus ride, or 6- 10 minute Staten Island Railway ride.

Bus: The site is served by the S76/S86 between Oakwood Beach and St. George Ferry Terminal, S74/S84 between Bricktown Mall and St. George Ferry Terminal, and S51/S81 between Grant City and St. George Ferry Terminal. Buses serve the area every 20 minutes.

Car: In addition to local street access to the rest of Staten Island, Stapleton is accessible from I-278 via the Verrazano Narrows Bridge, connecting Staten Island to Brooklyn, and traveling the width of the island to the Goethals Bridge to New Jersey.

Source: ESRI Business Analyst, HR&A Advisors

Resident/Visitor/Worker Overview

Preliminary plans by Ironstate indicate that 20 percent of new proposed residential units will be affordable housing. Phase 1 is expected to create 150 permanent jobs.

Planned Transportation or Infrastructure Improvements

The City is investing $32 million in roadway and infrastructure improvements around the Homeport site. The first phase of this work was completed in early 2014, and the remaining planned improvements are scheduled for completion in early 2016. In addition, former Staten Island Borough President James Molinaro committed to invest $1 million in the Stapleton station of the Staten Island Railway, directly across the street from the Homeport.

Development Considerations

Ironstate Development closed an agreement with the City in 2011 for Phase 1 of development of the Homeport. Full build-out of Phase 1 will include 900 units of housing. As part of open space improvements, the City will also invest in the creation of a new waterfront esplanade in Stapleton.

Development Program and Timing

The first stage of Phase 1 is projected to be completed in 2015. Plans include:

- 340,000 square feet of housing
- 25,000 square feet of retail with accessory parking

The second stage of Phase 1 will include:

- 260,000 square feet of housing
- 5,000 square feet of retail

Project Status

- Creation of a New Stapleton Waterfront Plan began in 2003 through a collaboration of NYCEDC, Department of City Planning, and local leaders and community members.
- Project completed Final Environmental Impact Statement in 2006
- Ironstate Development closed agreement with the City for Phase 1 development in 2011
- Local roadway improvements around the site began in 2012, including resurfacing, stormwater management upgrades, bike lane installation, and sidewalk upgrades.
- Ironstate Development broke ground on the first stage of construction in June 2013.
- Future phases will include additional open space, roadway and infrastructure improvements, and mixed-use development, with current projections for approximately 1300 more units of housing.

Summary and Key Considerations for Ferry Service Planning

The current construction of 900 units of housing and retail space and projected development of remaining parcels will create new jobs and attract new residents to the Homeport, and to the Stapleton area. The site is near the Staten Island Ferry terminal either by walk, bus, or Staten Island Railway and the revitalizing neighborhood of Stapleton, a historic town center two blocks from the campus. The costs and benefits of the potential amenity of additional ferry service directly to Homeport should be evaluated.

Sources

- New Stapleton Waterfront Development Plan Final Environmental Impact Statement, www.nyc.gov , September 2006
- New Stapleton Waterfront, NYCEDC, www.nycedc.com
- “Finally, It’s a Go for Staten Island’s Homeport,” Crain’s New York Business, www.crainsnewyork.com

ADDITIONAL

Site Profile | Domino Sugar Factory

Nearest ferry study locations: North Williamsburg and South Williamsburg

Overview

The Domino Sugar Factory, formerly the home of production for Domino brand sugar, operated from the late 1800s through 2004 on the Williamsburg waterfront. The site has been rezoned for residential mixed-use reuse and redevelopment. In 2010, the City Planning Commission approved the Community Preservation Corporation's (CPC) site plan for 2,400 residential units, up to 127,000 square feet of retail and commercial development, up to 146,000 square feet of community facility space, and up to 98,000 square feet of commercial office space. The 2010 plan also called for creation of a publicly accessible waterfront park and esplanade along the water's edge.

Two Trees Management purchased the site from Refinery LLC, a subsidiary of CPC Resources, in the summer of 2012. Two Trees has created a revised master plan for the area designed by SHoP Architects and James Corner Field Operations, increasing the proposed number of affordable housing units, recreational space, and office space. The plan includes four new towers on the site of up to 55 stories, and redevelopment and reuse of the refinery building for commercial office space. The City Planning Commission approved of these revised plans on March 5, 2014. While Williamsburg has seen a concentration of multifamily and commercial development over the past decade, the Domino redevelopment would place a concentration of residents and jobs directly on the waterfront, and between two other large waterfront developments at the Edge and Schaefer Landing.

Existing Access/Transportation to site

Subway: Williamsburg and the Domino site are served by the L train and J/M/Z train lines, running between Manhattan and Brooklyn. The Bedford L stop and Marcy Ave. J/M/Z stop are approximately three-quarters of a mile from the site, or a 15-minute walk. Ridership on the L train has skyrocketed since 2005, with the Bedford Avenue station experiencing the largest absolute increase in ridership of any station on the line. In 2013, over 9 million riders used the Bedford Ave L stop, an 11% growth over 2012 and a 42% growth from 2008.

Ferry: There are two East River Ferry landings roughly 0.5 miles from the Domino site catering to Williamsburg visitors and residents proximate to the piers, particularly those at the Edge and Northside Piers (North Williamsburg) and Schaefer Landing (South Williamsburg).

Bus: The site is served by the new B32 bus which links the site to Greenpoint and Long Island City and the Q59 bus which provides service to Rego Park, Queens along Grand Avenue. Buses run at 15 to 20-minute frequencies.

Car: The site is accessible by vehicle from the Williamsburg Bridge from the Lower East Side of Manhattan and from the Brooklyn Queens Expressway.

Bike Share: The Domino site has 1 bike share location nearby on South 4th Street and Wythe Street.

Source: ESRI Business Analyst, HR&A Advisors

Planned Transportation or Infrastructure Improvements

No formal plans for additional transportation improvements have been released as part of the plan, or as part of other pipeline development in Williamsburg. The MTA recently completed Communications-based Train Control (CBTC) to enhance capacity on the L train.

Resident/Visitor/Worker Overview

Williamsburg has experienced significant growth and change in population over the past decade since the rezoning of the neighborhood in 2006 to allow for higher-density multifamily development and the attraction of the neighborhood to workers seeking high-quality access to Manhattan and cultural/recreational assets prevalent in Williamsburg. The proposed redevelopment will continue the trend of new residential growth, but it will also include a significant employment component with 3,000 new jobs to be housed in new office space. The project will also attract visitors to new waterfront amenities.

Development Considerations

Development Program and Timing

- Proposed development, for which timelines are currently unavailable, includes:
  - 2.3 million square feet of residential space, approximately 2,300 units
  - 79,000 square feet of retail space
  - 631,000 square feet of "small business commercial" space
  - 146,000 square feet of community space
  - 239,000 square feet of public space

Project Status

- Two Trees Management purchased the site in 2012, created a revised master plan. The City Planning Commission approved the project on March 5, 2014.

Summary and Key Considerations for Ferry Service Planning

The costs and benefits of locating an additional East River Ferry stop at Domino should be evaluated. The Williamsburg waterfront is already served by the East River Ferry in two locations, approximately one mile apart. While service to Domino may generate ridership, it must be balanced against the impact to travel time and the need for additional vessels to maintain headways on the existing East River Ferry.

A partnership with Two Trees should be explored for capital improvements and/or operations of new ferry service. Two Trees' renderings for Domino show ferry service to the site. As it may be a key amenity for workers and residents at Domino, there may be an opportunity to structure a partnership with Two Trees to support the capital and operating investments needed to realize ferry service.

Sources

- Domino Sugar Factory Rezoning Final Environmental Impact Statement, May 2010
- "Brooklyn would hit new heights with Domino Sugar development," Crain's NY Business, crainsnewyork.com, June 9, 2013
- "Rush Hour in Williamsburg…at 1 AM," NYU Rudin Center for Transportation Policy & Management Blog, January 2013
- "Domino Sugar Factory Master Plan Development," Arch Daily, archdaily.com, March 5, 2013
- "Two Trees: Domino Sugar Factory Tour," Two Trees Management, August 28, 2013

"Annual Subway Ridership," Metropolitan Transportation Authority, March 2013

13 APPENDIX 3C: Site Profiles - Visitation

INTRODUCTION

This document provides a profile of potential ferry landing sites. Sites were selected if they feature sites feature major visitation destinations within walking distance of a potential ferry landing. HR&A evaluated visitation trends at five locations of interest throughout the city, and has provided implications and key considerations for ferry service planning in the attached profiles. These locations include:

- Four Freedoms Park and Cornell NYC Tech, Roosevelt Island
- New York Wheel and Empire Outlets in St. George, Staten Island
- Brooklyn Bridge Park, Pier 5 and 6, Brooklyn
- The Noguchi Museum and Socrates Sculpture Park, Queens
- Governor's Island

HR&A conducted seven interviews with representatives from the governing bodies or organizations charged with operating these destinations. HR&A also synthesized public documents and media coverage, and utilized site-specific visitor data when available.

Site Profile | Four Freedoms Park & Cornell NYC Tech, Roosevelt Island

SITE DESCRIPTION & TRANSIT ACCESS

Four Freedoms Park

The Franklin D. Roosevelt Four Freedoms Park is a four-acre park located on the southern end of Roosevelt Island. The $53 million park, based on a 1970s design by the visionary architect Louis Kahn, serves as a memorial to President Roosevelt but also serves as an impressive public space. Groundbreaking took place in 2010, and the park opened in October 2012. The park features a monument engraved with a quote from President Roosevelt's Four Freedoms speech to Congress in 1941, a bronze portrait of President Roosevelt, five copper beech trees, 120 little-leaf linden trees, and an open lawn. The park is free to visitors, and is open from 9 AM to 7 PM six days a week. The park is currently closed on Tuesdays each week. The Park is now operated by the Four Freedoms Park Conservancy.

Though the Roosevelt Island Tram and F train subway provide multimodal access to Roosevelt Island from Midtown Manhattan and the Queens Boulevard corridor in Queens, the Park is beyond walking distance for many visitors and requires a transfer.

Subway: The Park is accessible by subway on the F train. The Roosevelt Island stop is a 15-minute walk north of the Park, or one block from the Red Bus stop, which serves as a circulator bus for Roosevelt Island, running with 8-minute frequencies on weekday rush hours, 15-minute frequency during weekday off-peak hours, and 15- to 30-minute frequency on weekends. The fare for the Red Bus is $0.25.

Tram: The site is accessible by tram from East Midtown Manhattan to Roosevelt Island at eight-minute frequencies during peak hours and 15-minute frequencies during off-peak hours. The Park is a 15-minute walk or $0.25 Red Bus ride south of the tram stop.

Bus: The Park is accessible by the Q102 bus, which stops three minutes from the Park by foot, and provides service to Long Island City and Astoria at 15- to 30-minute frequencies on the weekdays and 30-minute frequencies on the weekends.

Car: Roosevelt Island can only be accessed from the Roosevelt Island Bridge from Queens. The Park does not provide public parking and there is limited parking on Roosevelt Island.

Cornell NYC Tech Campus

The City of New York launched the Applied Sciences NYC Initiative in 2010, culminating in a competition for a world-class academic institution to build an applied sciences and engineering campus in New York City. The City selected Cornell University and their partner, Technion - Israel Institute of Technology, to develop the $2 billion Applied Sciences NYC project at the Goldwater Hospital site on Roosevelt Island in late 2010. According to the *Cornell NYC Tech Final Environmental Impact Statement* (FEIS), the project will be built in two phases, with a total build out of approximately 2.1 million square feet (SF) and include 2.5 acres of open space.

Phase 1, to be completed in 2017, is anticipated to include:

- A 150,000 SF academic building to be occupied by Cornell;
- A corporate co-location building of approximately 150,000 SF, of which 50,000 SF would be reserved for academic use, and the remaining 100,000 SF would be available for corporate office users;
- A 300,000 SF residential building to house campus faculty and students, housing 442 units and an estimated 572 residents;
- An Executive Education Center of approximately 170,000 SF, including a conference facility, a 225-room hotel which may accommodate executive education programs, tech-centered conferences, and additional programming to complement the campus' focus;
- Approximately 10,000 SF of University-focused retail, such as a bookstore; and
- 1.3 acres of open space.

Phase 2, anticipated to be completed in 2038, will include:

- Up to 420,000 SF of academic space;
- Up to 500,000 SF, or approximately 600 units, of residential product;
- Up to 400,000 SF of corporate co-location space, primarily for corporate users; and
- Additional open space.

The campus will not be gated and is intended to be integrated with the rest of Roosevelt Island. Cornell anticipates that students will live on and off campus, and University faculty, guest lecturers, and corporate occupants will commute to the campus from elsewhere in the New York City metropolitan area.

Subway: The campus is accessible from Manhattan and Queens via the F train. The subway stops just north of the campus, within a five-minute walk.

Tram: The site is accessible by tram from East Midtown Manhattan to Roosevelt Island. The Park is a five-minute walk from the tram stop.

Bus: The campus is accessible by the Q102 bus, which stops on the west side of the campus.

Car: Roosevelt Island can only be accessed by the Roosevelt Island Bridge from Queens. The campus program will include limited parking for the corporate co-location building, hotel, and Executive Education Center. Per the FEIS, up to 250 parking spaces can be built in Phase 1, with an additional 250 spaces allowed in Phase 2.

VISITATION

Four Freedoms Park

The park has received approximately 120,000 visitors since opening (over approximately 11 months). For the first six months of operations, the park opened four days each week, with limited hours. Four Freedoms Park also closed for an entire week over the beginning of November, as Hurricane Sandy suspended operations. As of April 2013, Four Freedoms Park expanded its open hours to extend from 9am to 7pm, and is closed only on Tuesdays.

Most visitors access the Park via the Roosevelt Island Tram. According to the Conservancy's surveys, a majority of visitors reach the park by tram, either taking the tram and walking to the park (49.5%) or taking the tram and then the Red Bus (9.5%). Very few visitors reach the site by car or taxi. Table 13.1 below presents the modal split for visitors to Four Freedoms to date. Note that Conservancy representatives report that Roosevelt Island residents frequent the park, walking directly from their homes, but do not include these visitors in their modal split analysis.

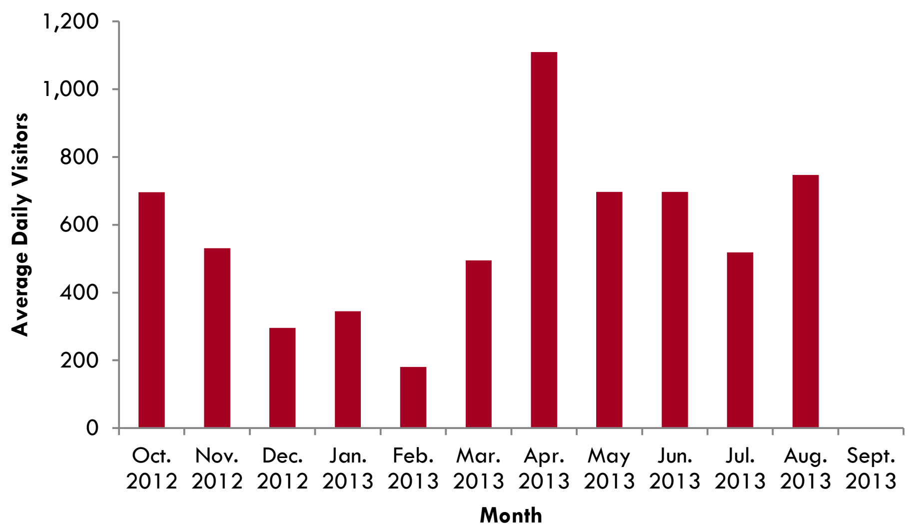
Table 13.1: Four Freedoms Park, Modal Split for Visitors to Date

Mode of Transportation	Share
Subway	14%
Bus	0%
Bike	19%
Personal Vehicle	6%
Taxi/Hired Car	2%
Tram	59%
Total	100%

Source: Four Freedoms Park Visitor Survey, Spring 2013

Visitation peaked this spring, with over 1,000 visitors per day. In the winter months, visitation dropped to as low as 180 visitors per day. Figure 13.1 below presents average daily visitation each month.

Figure 13.1: Four Freedoms Park, Average Daily Visitation by Month

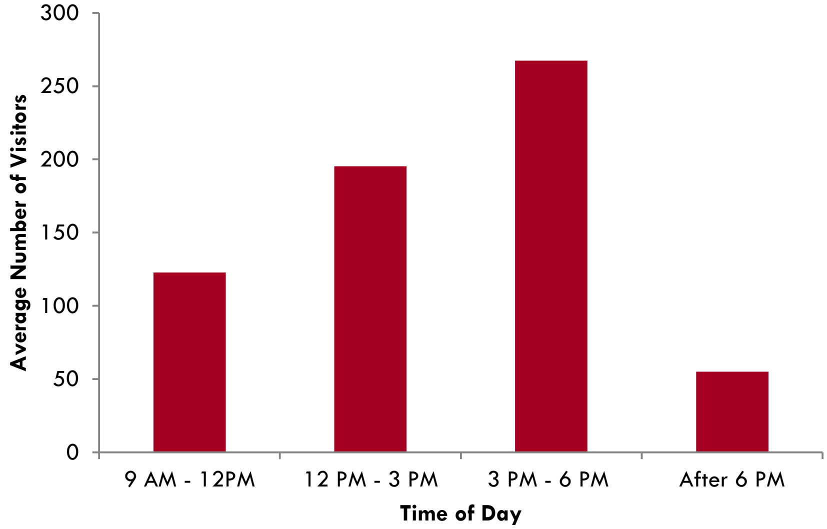


Source: Four Freedoms Park Visitor Survey, Spring 2013

Daily visitation peaks in the late afternoon. Visitation peaks between 3pm and 4pm, across all months in which the park has been open, as shown in Figure 13.2 below.

The Conservancy does not formally project visitation growth, but anticipates that visitation will continue to grow as the Conservancy expands its marketing and public relations efforts.

Figure 13.2: four Freedoms Park, Average Daily visitation by Time of Day



Source: Four Freedoms Park Visitor Survey, Spring 2013

Cornell NYC Tech Campus

Cornell NYC Tech will be a major, mixed-use activity center on Roosevelt Island, including faculty, students, and office tenants that will travel to Roosevelt Island from elsewhere. Cornell's FEIS considers seven groups who will work and live on the campus, including administrative staff, leadership, faculty and visitors/adjuncts, postdoctoral fellows, Ph.D. candidates, master's students, and funded researchers. In the first phase of development, Cornell anticipates accommodating a daytime population of approximately 800 people across these categories. At full build, currently estimated to be in 2038, the campus will have a daytime population of 3,000 people. There will be 1,000 residential units developed on-site, suggesting that while some individuals will both live and study or work on the campus, most will travel from off Roosevelt Island. Students, in particular, are expected to commute from Brooklyn and Queens.

The FEIS, which does not assume any ferry service to Roosevelt Island, anticipates most visitors will reach the campus by subway, followed by auto, particularly for those traveling to the hotel or Executive Education Center. Across all categories of trip generation, subway is the primary mode of travel ranging from 17% for the retail uses to 71% for the population living in External University Housing. The Roosevelt Island Tram is not expected to be used in any significant way, likely due to adequate alternative forms of transportation, largely subway.

SOURCES

- Four Freedoms Park Visitor Survey, Spring 2013
- Interview: September 5th, 2013; Sally Minard, President, Four Freedoms Park Conservancy
- Cornell NYC Tech Final Environmental Impact Statement, March 2013
- Interview: September 5th, 2013; Jennifer Klein, Assistant Director for Strategic Capital Partnerships

SUMMARY & IMPLICATIONS

Four Freedoms Park and Cornell NYC Tech on Roosevelt Island are served by two forms of public transportation providing access to Midtown Manhattan and Queens. A ferry landing near the facilities would reduce travel time for those who would otherwise have to walk or take a Red Bus from the Roosevelt Island tram and F train.

Ferry service would expand the reach of Four Freedoms Park, a significant open space destination, and Cornell NYC Tech, a major public-private initiative. For Cornell NYC Tech, ferry service could potentially improve student, faculty, and staff commutation to other ferry-served neighborhoods, such as those along the Brooklyn-Queens waterfront.

Key considerations for ferry service planning include:

- Identifying a feasible ferry landing.
- Exploring a potential public-private partnership with Cornell NYC Tech to fund capital and operating expenses.

SITE DESCRIPTION & TRANSIT ACCESS

St. George is a neighborhood at the northern tip of Staten Island. The Staten Island Ferry, operated by the New York City Department of Transportation, provides a free and frequent 25-minute ride between St. George Terminal and Whitehall Terminal in Lower Manhattan. The service operates every day, 24 hours a day and attracts 22 million passengers annually, including 1.5 million tourists annually. The Staten Island Railway and numerous bus services connect St. George to the rest of Staten Island. St. George is home to a historic district, the Richmond County Bank Ballpark, and Richmond County administrative offices.

The St. George Waterfront Redevelopment Project, spearheaded by the New York City Economic Development Corporation, includes the transformation of two sites adjacent to the Richmond County Bank Ballpark. For the purposes of this analysis, HR&A refers to the two sites as the "North Site" and "South Site," consistent with the *St. George Waterfront Redevelopment Draft Environmental Impact Statement* (DEIS).

According to the DEIS, the North Site will be developed with the New York Observation Wheel (the Wheel), a 625-foot-tall observation wheel, giving riders panoramic views of New York Harbor and New York City. The Wheel will be situated above a 120,000 SF Wheel Terminal Building, programmed with commercial, retail, exhibition space, theater space, and up to 950 underground parking spaces for cars, and 12 spaces for bus parking. The South Site will be home to a new retail center, to be developed by BFC Partners, which will include a 340,000 SF retail outlet center known as Empire Outlets, 130,000 SF hotel, and 20,000 SF catering facility. Empire Outlets will also include new structured parking, with up to 1,250 parking spaces, with approximately 40 of these reserved for MTA personnel.

A primary goal of the project is to attract tourists to Staten Island including those already riding the Staten Island Ferry, enticing visitors to ride the Wheel, shop, dine, and spend time in the area.

Subway: The northern terminus of the Staten Island Railway (SIR), the site is reachable from numerous other locations within the borough. It is not accessible via subway from New York City's other boroughs.

Ferry: The Staten Island Ferry provides free service between Whitehall Terminal in Manhattan and St. George Terminal, running 24 hours a day. Ferries run every 60 minutes at off-peak times, and as frequently as every 15 to 30 minutes during peak times. The current Staten Island Ferry Terminal is adjacent to the proposed Empire Outlets site and a five to ten minute walk from the site of the Wheel.

While the DEIS notes potential for new waterborne transit to serve the new nodes of activity at St. George, it does not include detailed information on route or ridership, as anticipated passenger loads are not expected to overwhelm Staten Island Ferry service.

Bus: 22 New York City Transit buses connect the St. George Terminal to areas throughout the borough.

Car: Drivers can reach the site, about three miles from the Staten Island Expressway which connects New Jersey via the Goethals Bridge to Brooklyn via the Verrazano Bridge.

VISITATION

Up to three million visitors annually, primarily (80%) from Manhattan, are expected to visit the Wheel. For the purposes of the DEIS, transportation consultants assumed a higher base visitation of 4.5 million visitors per year based on benchmark analysis against the London Eye and the Singapore Flyer, providing a more conservative assumption for transportation load calculations. The majority of visitors to the Wheel are anticipated to be tourists, as opposed to residents likely to visit the Wheel infrequently. In addition to the high share (80%) expected to come from Manhattan, those coming from the Bronx, Queens, and Westchester/Connecticut are likely to travel to Staten Island via Lower Manhattan.

Table 13.2: New York Wheel Visitor Origins

Origin	Share
Manhattan	80%
New Jersey	5%
Brooklyn	4%
Queens	4%
Staten Island	4%
Bronx	1%
Nassau/Suffolk	1%
Westchester/CT	1%
Total	100%

Source: St. George Waterfront Redevelopment, DEIS, Appendix E-Transportation

Empire Outlets will draw not only tourists, but area residents including those living on Staten Island (35% of overall visitation). Points of origin for Empire Outlets were based on retail developer knowledge and market projections, and include a large share of Staten Island residents. The outlets will be home to 50 to 125 retailers, providing a significant concentration of retail and accessory eating and drinking establishments in St. George, currently a 20-minute drive from the borough's largest shopping center, the Staten Island Mall.

Table 13.3: Retail Center Visitor origins

Origin	Share (%)
Manhattan	45%
Staten Island	35%
Brooklyn	9%
Queens	6%
Bronx	4%
New Jersey	1%
Nassau/Suffolk	0%
Westchester/CT	0%
Total	100%

Source: St. George Waterfront Redevelopment, DEIS, Appendix E-Transportation

The DEIS projects that most visitors to the Wheel will travel by ferry while most visitors to Empire Outlets will travel by automobile. However, for those coming to Empire Outlets from Manhattan specifically, the DEIS estimates most visitors will travel by ferry. Given the prevalence of ferry riders coming from Manhattan, and current capacity of the Staten Island Ferry service, a new, separate form of waterborne transit has been considered. However, due to the adequate capacity of the Staten Island Ferry, this service was not studied as part of the DEIS.

Table 13.4: New York Wheel Modal Splits

Mode of Transportation	New York Wheel Share	Retail Center Share
Ferry	81.9%	46.5%
Personal Vehicle	8.3%	43.6%
Bus	7.7%	3.5%
Taxi/Hired Car	1.6%	4.0%
Walk/Bike	0.2%	0.7%
Subway	N/A	N/A

Source: St. George Waterfront Redevelopment, DEIS, Appendix E-Transportation

SOURCES

- St. George Waterfront Redevelopment Draft Environmental Impact Statement, Spring 2013
- Interview: August 29th, 2013; Julieanne Herskowitz, Senior Project Manager, NYC Economic Development Corporation

SUMMARY & IMPLICATIONS

The target markets for the New York Wheel and Empire Outlets are well-served by the free Staten Island Ferry that connects St. George to Lower Manhattan. Additional ferry service could expand the reach of these projects and potentially encourage a shift in modes. Ferry service may improve prospects of attracting visitors from parts of New York City well-connected to Lower Manhattan.

Key considerations for ferry service planning include:

- Ascertaining what ferry connections would be impactful for encouraging visitation to St. George, above and beyond the current Staten Island Ferry service.
- Exploring a potential public-private partnership with the developers of the New York Wheel and Empire Outlets to fund capital and operating expenses.

SITE DESCRIPTION & TRANSIT ACCESS

Brooklyn Bridge Park comprises of 85 acres of waterfront land under the Brooklyn Bridge, running 1.3 miles, south to Atlantic Street and north to Jay Street. Construction began in early 2008 and by early 2010, the first six acres of the park opened on Pier 1 followed by Pier 2 and the initial phase of Pier 6 in 2010, and Pier 5 in 2013.

Pier 6 sits at the southern end of the park at the intersection of Furman Street and Atlantic Avenue. The initial development of the pier includes sand volleyball courts, a dog run, food concessions, and natural habitat. At full build, expected in 2016, Pier 6 will include open space and an architecturally signature viewing platform providing unique views of Lower Manhattan and the Statue of Liberty. This addition is anticipated to cost $8 million, to be paid for by private sources. Pier 6 serves as both a neighborhood and destination park, attracting residents from One Brooklyn Bridge Park, a 438 unit condominium project that opened in 2008, located at the base of the pier, residents from the surrounding Cobble Hill and Brooklyn Heights neighborhoods, residents from elsewhere in New York City, and tourists. Pier 5 includes 200,000 SF of turf play fields, two children's play areas, and a fishing area. In addition, a series of highly utilized picnic tables and barbecue grills that opened in 2013 connects Pier 5 and Pier 6 to the northern piers (Pier 1and Pier 2).

Brooklyn Bridge Park Development Corporation also controls two development sites at the base of Pier 6 that can accommodate up to 430 residential units and ground-floor retail.

Subway: Visitors can walk along Atlantic Avenue to reach Pier 5 and Pier 6 either from Borough Hall (2, 3, and 4, service) or Jay Street (A, C, and F service), a 15 minute trip by foot. The Atlantic Avenue transit hub is a 1.5 mile, 20-plus minute walk to Pier 5 and Pier 6.

Ferry: In addition to the East River Ferry landing at Pier 1 (a 15 minute walk to Pier 5 and Pier 6) and the New York Water Taxi service from Pier 1 to South Street Seaport, a free ferry connects Governors Island to Pier 6 with eight trips per day. Visitors may only access Governors Island from late May through late September.

Bus: The B63 bus provides access to Pier 6 from neighborhoods to the south and west of the park, including Fort Hamilton, Bay Ridge, Sunset Park, Park Slope, and Downtown Brooklyn.

Car: The Brooklyn Queens Expressway (BQE) provides immediate access to Pier 5 and Pier 6. A public Quik Park garage across the street from Pier 6 includes approximately 300 spaces.

VISITATION

Visitation to Pier 6 is heaviest on weekends, when most visitors bring their children. A survey taken in the summer of 2012 recorded nearly 90,000 weekend visitors, versus approximately 12,000 weekday visitors. 67% of respondents answered that they were a parent or caregiver, and 77% of respondents reported bringing their children with them.[40]

Most (36%) visitors walk to Pier 6, followed by those traveling by subway and personal vehicle (both 22%). The high share of walking indicates that visitors to Pier 6 come from the surrounding neighborhood. Table 13.5 below presents the modal split for visitors during the summer of 2012.

[40] Data for Pier 5, which opened in late 2012, was unavailable at the time of this study.

Table 13.5: Pier 6 Modal Split

Mode of Transportation	Share
Walking	36%
Personal Vehicle	22%
Subway	22%
Bike	8%
Taxi/Hired Car	1%
Ferry	1%
Bus	1%
Total	100%

Source: Pier 6, Usership Profile, Summer 2012

SOURCES

- Pier 6, Usership Profile, Summer 2012
- Interview: September 5th, 2013; Teresa Gonzalez, Vice President – Strategic Partnerships, Brooklyn Bridge Park Development Corporation

SUMMARY & IMPLICATIONS

Multiple subway lines and the ferry service to Pier 1 provide visitors excellent access to Pier 5 and Pier 6 at Brooklyn Bridge Park. Additional ferry service, beyond the free service between Pier 6 and Governors Island, may expand reach and reduce visitor travel times by minimizing origin and destination walk distances.

There is some current and projected residential development at the base of Pier 6 that can benefit from additional ferry service, but the surrounding neighborhoods are well-served by subway transit, but distanced from Pier 5 and Pier 6 by the BQE. Ferry service may have limited appeal for area residents and commuters due to multiple existing transit options and the distance and perceived barrier of the BQE.

Key considerations for ferry service planning include:

- Evaluating the potential rider benefit of providing additional ferry service to Pier 5 and Pier 6 vs. maintaining or enhancing services to Pier 1.
- Exploring a potential public-private partnership with the Brooklyn Bridge Park Development Corporation and/or the residential developers of the current and future buildings at the base of Pier 6 to fund capital and operating expenses

Site Profile | Noguchi Museum & Socrates Sculpture Park, Astoria

SITE DESCRIPTION & TRANSIT ACCESS

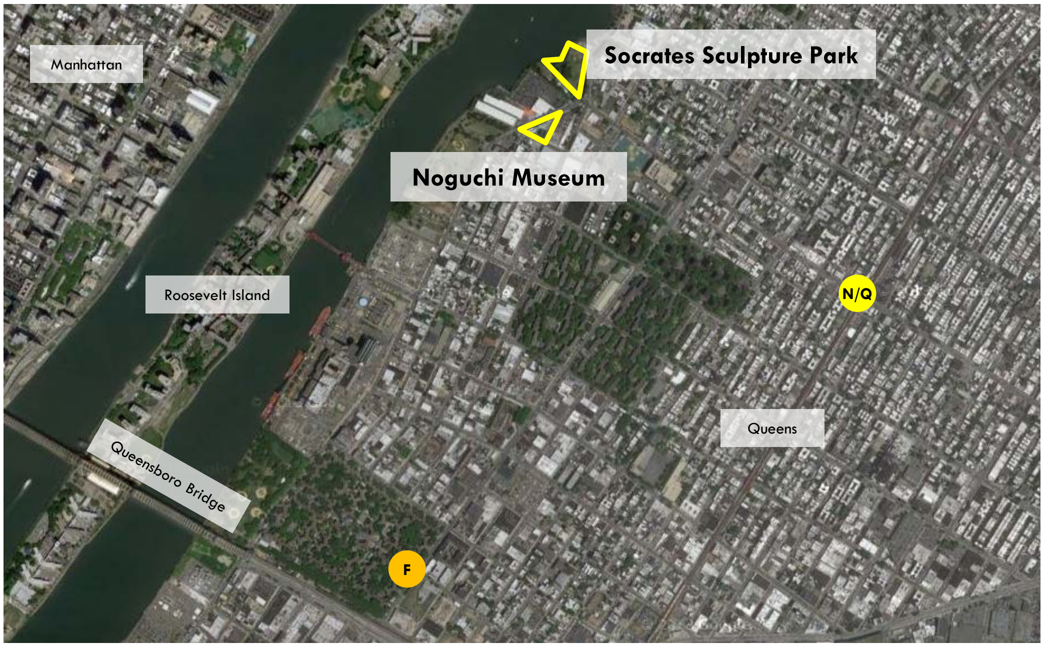
The Noguchi Museum and Socrates Sculpture Park are unique attractions on the Queens West waterfront, adjacent to a Costco and largely by warehouses used for storage, light manufacturing, and fabrication. The Noguchi Museum opened in 1985 in a former industrial building, and now occupies approximately 27,000 square feet, housing both a permanent exhibition of Isamu Noguchi's work and temporary exhibitions. Noguchi's work extends into the private garden attached to the museum building.

Across Vernon Boulevard, Socrates Sculpture Park was the vision of a coalition of local artists, led by Mark di Suvero. The group turned the former landfill and illegal dumpsite into a four-acre outdoor studio and exhibition space. Socrates Sculpture Park became an official New York City park in 1998, and is now operated by the Socrates Sculpture Park non-profit.

Subway: The Noguchi Museum and Socrates Sculpture Park are accessible from the N and Q trains, a 15-minute walk from the Broadway subway station, or a 20-minute walk from the F train at 21st Street-Queensbridge.

Bus: The Q100, Q102, and Q103 (weekdays only) buses provide service to the Noguchi Museum and Park, running every 15 minutes to one hour, from points in Manhattan, Roosevelt Island, Hunter's Island, Long Island City, and Astoria, with stops within a short walk (under five minutes) from the sites.

Car: From Manhattan, the Noguchi Museum and Park are accessible via the Queensboro and Triborough Bridges, and the Midtown Tunnel. From Brooklyn and other points in Queens, vehicles can access the site from the Long Island Expressway and Brooklyn-Queens Expressway (BQE). While there is not reserved parking for Noguchi Museum or Park patrons at either location, street parking is generally available in the neighborhood.



VISITATION

The Noguchi Museum does not currently survey visitors for information regarding point of origin, mode of transit, or trip purpose, but shared estimates of overall attendance and modal split for the purposes of this study.

The Noguchi draws approximately 30,000 visitors and Socrates Sculpture Park attracts approximately 100,000 visitors per year. Of these, 10% of the Noguchi Museum's visitors are public school groups who attend the museum as part of a school outing, arriving by school bus. Socrates also hosts school groups, who usually visit during weekdays.

Both the Noguchi and Socrates receive a large portion of visitors from Manhattan, with a sizeable tourist contingent. The Noguchi Museum attracts a diverse audience of resident and tourist visitors. Specifically, the Noguchi Museum noted a high share of international visitors. While neighborhood residents visit Socrates, treating it as one of their neighborhood parks, visitors also travel from other boroughs to attend installations and other programming. Of visitors from outside the neighborhood, Socrates estimates that approximately two-thirds travel from Manhattan, and one-third from Brooklyn.

The largest share of visitors to Socrates come between May and October each year. Socrates receives approximately two-thirds of their annual visitors in these months, and holds most programming during this time, including large-scale sculptural exhibits and outdoor movies. Visitation generally peaks for outdoor movies, with up to 1,800 attendees for a showing. The Park plans to continue to cultivate a visitor base from throughout New York City by continuing programming and expanding press efforts.

The majority of visitors arrive by mass transit. The Noguchi estimates that approximately two-thirds of visitors arrive by public transportation, using subway and bus, or a combination of the two. The museum also runs a shuttle bus on Sundays from the Upper East Side in Manhattan (at Park Avenue and East 70th Street) for a fare of $5 each way. The shuttle runs to the museum every hour between 12:30 PM and 3:30 PM, returning every hour from 1:00 PM to 5:00 PM, and holds 25 passengers.

SOURCES

- Interview: September 6th, 2013; Amy Hau, Director of Administration & External Affairs, The Noguchi Museum
- Interview: September 4h, 2013; John Hatfield, Executive Director, Socrates Sculpture Park

SUMMARY & IMPLICATIONS

Both the Noguchi Museum and Socrates Sculpture Park draw visitors from around New York City, despite being far from transit. Ferry service may expand these institutions' reach, enabling visitors from Manhattan, Brooklyn, and other parts of Queens, to reach the Noguchi and Socrates more easily and efficiently.

Key considerations for ferry service planning include:

- Understanding the magnitude and nature of real estate development activity in the neighborhood, which will provide a pool of potential riders and an opportunity for public-private partnerships to fund ferry capital and operating costs.

SITE DESCRIPTION & TRANSIT ACCESS

A former military base, Governors Island is a 172-acre island in the New York Harbor. The City and State of New York jointly govern 150 acres of the island, overseen by the Trust for Governors Island; the National Park Service oversees management of the remaining 22 acres, which were declared a National Monument. Today, Governors Island is undergoing a major transformation to revitalize public space and expand educational, not-for-profit, and commercial facilities. Phase 1 of the transformation began in May, 2012, and is part of a multi-phase, $250 million 87-acre Park and Public Space Plan, including:

- Liggett Terrace: a six-acre plaza with moveable seating, public art and water features;
- Hammock Grove: Ten acres of open space including new trees and hammocks;
- Play Lawn: 14 acres including passive open space and two playfields;
- Historic District: 34 acres of flexible open space, with new signage, lighting and amenities; and
- The Hills: a grouping of hills on the south end of the Island that will give visitors views of the Statue of Liberty and New York Harbor.

33 acres along the shores of the south side of the island are being held for future development. The Trust for Governors Island released a Request for Expressions of Interest in early 2013, with development plans now on hold.

The Trust for Governors Island also issued a Request for Proposals earlier this year for occupancy of over one million SF of space in a series of historic buildings at the northern part of the Island. The Trust for Governors Island plans to make an announcement regarding the result of the RFP that will likely entail an end user that will generate traffic between the Island and the remainder of New York City throughout the day. This agreement is anticipated to result in the tenanting of existing historic structures, which will create an increase in traffic throughout the day when Governors Island is open.

Governors Island currently hosts fewer than twenty large events per year, and does not anticipate adding additional large-scale event programming.

Subway: Governors Island is not accessible via subway. Subway stops are three to five minutes from the Battery Terminal Building in Lower Manhattan, from which one of the free Governors Island ferries departs

Ferry: Ferry is the only form of transportation to Governors Island. Visitors can catch the free Governors Island ferry from the Battery Terminal Building in Lower Manhattan, or Pier 6 in Brooklyn. The ferry departs from Manhattan every 30 minutes between 11:00 AM and 5:30 PM (13 trips per day) and from Brooklyn every 60 minutes during the same time period (8 trips per day). East River Ferry also provides scheduled service to Governors Island when Governors Island is open to the public.

Bus: There is no direct bus service to Governors Island, though buses service both the Manhattan and Brooklyn ferry landings within a five minute walk.

Car: Vehicles are not allowed on Governors Island, and parking specifically for visitors is not reserved at either ferry landing.

VISITATION

Visitation to Governors Island is constrained by its open season and hours. The Island is currently open to the public from Memorial Day through the end of September, on weekends and holiday Mondays. Over two years ago, the Island was also open on Fridays during this season, but has shortened its open hours to accommodate construction of new open space since then. As of 2014 and going forward, the Island may be open for expanded hours, though these are not yet defined.

Average daily visitation is under 10,000, and is heavily affected by weather. Recent average weekend days have received ~8,000 visitors, with steep drop-offs during inclement weather, as Governors Island activities center around open space. These estimates exclude visitation attributable to concerts. Concert organizers provide separate ferry service for these events.

Visitors often stay for multiple hours, causing large queues as Governors Island closes. Visitors often stay for as many as four hours before returning to Manhattan or Brooklyn, creating long lines and crowding at the existing ferry landings in the hour before the Island closes.

Large events can attract almost twice as many visitors as normal weekends. During events such as the Jazz Age Lawn Party and Figment, the Island receives as many as 16,000 visitors. For such events, the Trust for Governors Island rents larger ferry boats from their contracted operator to accommodate large crowds traveling to and from the Island at the same time.

Due to current ferry service, approximately two-thirds of visitors travel from Manhattan, while one-third comes from Brooklyn. The majority of riders come from Manhattan, which has more frequent service to the Island, versus Brooklyn's service.

SOURCES

- Interview: September 13th, 2013; Jon Meyers, Chief Operating Officer, Trust for Governors Island

SUMMARY & IMPLICATIONS

New or additional ferry service to Governors Island may draw more visitors and support the operations of the end user of the historic structures. Governors Island, currently only accessible by ferry service, is undergoing a $250 million, publicly funded, open space and infrastructure investment, and will soon have up to 400,000 SF of tenanted, programmable space in historic structures. Additional ferry service is the most direct way to bring more visitors to the Island as it attracts greater interest.

Key considerations for ferry service planning include:

- Understanding the travel patterns of workers and visitors to the end user that will occupy the historic structures.
- Ascertaining the new tenants' interest and capacity to contribute to additional the capital and operating costs of ferry service.
- Understanding the future operating plans for public visitation and access to Governors Island, which may impact ferry service demand from future visitors and commuters.

Understanding the impact of new open spaces on travel behavior, including length of stay and likely target markets, and the need to accommodate for this behavior through modifying operating hours, frequency of service, or boat type and size.

14 Appendix 3D: Site Prioritization for Emergency Service

Table 14.1: Existing Landings - Operational

Operational Landings		
Yankee Stadium, Bronx	Brooklyn Army Terminal, Brooklyn	Fulton Ferry, Brooklyn
Greenpoint, Brooklyn	North Williamsburg, Brooklyn	South Williamsburg, Brooklyn
Pier 6, Brooklyn	Van Brunt St, Brooklyn	E 34th St, Manhattan
E 90th St, Manhattan	Christopher St, Manhattan	Pier 11, Manhattan
Pier 79, Manhattan	World Financial Center	Beach 108th St, Queens
Citi Field, Queens	Jacob Riis Park, Queens	Long Island City – South, Queens
Glenn Cove, Long Island	Governors Island	

Table 14.2: Existing Landings – Not Operational

Not Operational Landings		
W 125th St, Manhattan	Snug Harbor, Staten Island	

Table 14.3: No Existing Landing – Potentially Viable for Emergency Use

No Existing Landings		
Clemete State Park, Bronx	Hunts Point, Bronx	Bay Ridge, Brooklyn
Brooklyn Navy Yard, Brooklyn	Coney Island – Beach, Brooklyn	Coney Island – Creek, Brooklyn
Valentino Pier, Brooklyn	Dyckman St, Manhattan	E 23rd St, Manhattan
E 62nd St, Manhattan	E 69th St, Manhattan	E 71st St, Manhattan
Grand St, Manhattan	Astoria Cove, Queens	Beach 116th St, Queens
Hallets Point, Queens	Long Island City – North, Queens	JFK International Airport, Queens
Port Richmond, Staten Island	Stapleton, Staten Island	
Roosevelt Island – North	Roosevelt Island - South	

Table 14.4: No Existing Landing - Difficult to Utilize for Emergency Use

Brooklyn	
Location	**Remarks**
Floyd Bennett Field	NOAA bathymetry inconclusive. Ocean exposure poses issue.
Sheepshead Bay	NOAA bathymetry inconclusive
Bronx	
Location	**Remarks**
City Island	NOAA bathy inconclusive
Co-Op City	NOAA bathy inconclusive
Ferry Point Park	Substantial dredging needed.
Fordham Landing	NOAA bathy inconclusive
Orchard Beach	NOAA charts show inadequate depths. Bathy survey needed to confirm.
Riverdale	Access blocked by rail. Inadequate water depths.
Soundview	NOAA charts show inadequate depths. Bathy survey needed to confirm.
Queens	
Location	**Remarks**
Beach 67th St	Dredging or bulkhead, float, piles and pier or long gangway needed.
Staten Island	
Location	**Remarks**
Camp St. Edward	Dredging needed.
St. George	Close proximity to fuel facilities of larger ferry vessels.
Tottenville	Inadequate water depth.
Other	
South Amboy, NJ	NOAA bathy inconclusive

15 APPENDIX 4: Ridership Model Descriptions

Commuter and Leisure Weekday Models

Background

The ridership modeling for the Project relied extensively on an existing set of models developed recently for the PANYNJ[41]. These models focused specifically on the portions of the New York City transit market which would be potential users of passenger ferries in New York Harbor, namely residents living close to the water or able to access ferry landings with ease.

Prior to the work to develop the PANYNJ models, there was a lack of understanding of the ferry passenger market in New York City. For this reason a comprehensive stated preference (SP) survey was completed to better understand the travel preferences of potential ferry riders originating in the five New York City boroughs and to serve as the empirical basis for a predictive passenger ferry demand model.

The SP exercise is a standard tool for transit planners in developing demand models for planned services. The process for the PANYNJ models involved developing a large random sample of respondents, and then presenting each with a series of options for completing a hypothetical trip, either by ferry or by their current mode of transit (in this case, subway or bus). Respondent mode choices when presented with varying hypothetical mode characteristics (such as frequency, travel time, access time, and applicable fare) then form the basis for a predictive model[42].

Developing the Mode Choice Models

Survey data were then used to develop predictive models for two distinct New York City markets, current subway users and current express bus users. For each market a mode choice model based on the logit estimator was developed to predict changes in travel behavior given changes in mode characteristics (such as travel time, access time, wait time, fare and frequency)[43].

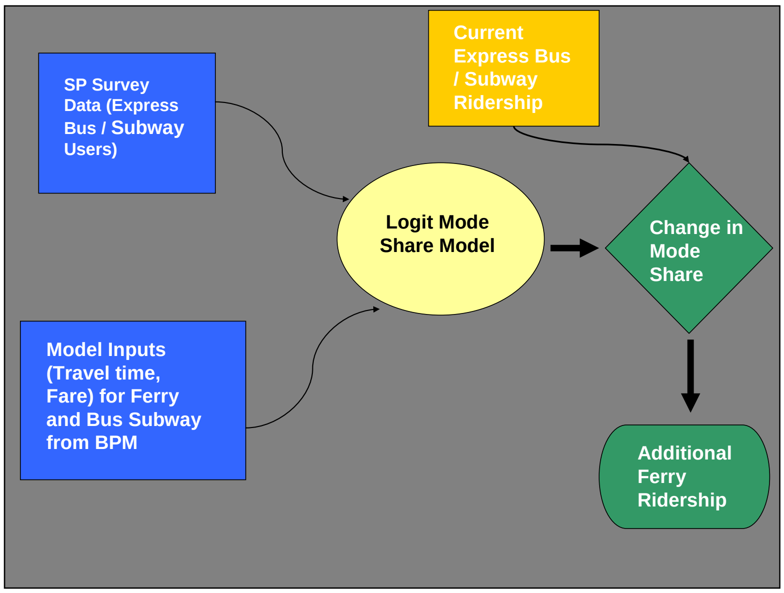
[41] Halcrow, Inc., 2010. *Study of Regional Private Passenger Ferry Services in the New York Metropolitan Area: Interim Report 7 Stated Preference Survey and Ridership Forecasts for Potential Routes*. Report Submitted to the Port Authority of New York and New Jersey.

[42] The SP exercise involved intercepting travelers at various bus and subway locations and encouraging their participation in a web-based survey. The results of the survey generated a very large set of responses that were then used to estimate a mode choice model which predicts how users will opt for a passenger ferry option in response to characteristics such as travel time, headway and fare. The five intercept locations which provided the survey respondents included Staten Island (intercepts occurred at select express bus stops in Manhattan with destinations in the Mariners Harbor area of Staten Island) Williamsburg, Brooklyn (intercepts occurred at the entrances to the Bedford Avenue station on the L Line), Astoria, Queens (intercepts occurred at the entrances to the 30th Avenue Station on the N/W Lines), Upper East Side of Manhattan (intercepts occurred along the eastern stretch of 86th Street), AND Soundview, Bronx (intercepts occurred at the Parkchester, Elder Avenue, Morrison/Soundview Avenue, and St Lawrence Avenue stations on the 6 Line).

[43] The simplest form of the logit model (and the one used for most of the analysis here) involves a binary form, where the model – based on the survey data - estimates market share of ferry and express bus/subway ridership. Thus, for

Mode choice models also can incorporate characteristics of users, for example choosing a particular mode might be dependent on a person's income, age group or gender. These models can then be used to predict the probability that an individual with certain characteristics would adopt a given mode of transport. Generalized over a market (such as a half-mile radius around a ferry pier) the models then predict a market capture of a mode for users. This predicted capture rate is then applied to the relevant population (such as commuters between the pier and a Manhattan destination) to generate predicted demand for the ferry service.

Figure 15.1: Modeling Approach



Source: Halcrow (2010) op. cit.

The estimation of the two mode choice models (referred to henceforth as the *Subway/Ferry Mode Choice* Model and the *Bus/Ferry Mode Choice Model)* is described in detail in a recent PANYNJ report[44], but the most salient facts are the following:

- The estimation was based on a large number of responses and produced a model with very strong statistical significance

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purposes of using the survey results, only two modes of travel between each origin and destination are assumed to exist. Mathematically such models can be expressed as

$$P_n(Ferry) = \frac{e^{v(ferry)}}{e^{v(ferry)} + e^{v(Bus)}}$$

Where the function *V(ferry)* is referred to as a systematic component of the user's "utility", which can be written as $\boldsymbol{\Sigma_j xj\beta j}$ where $\boldsymbol{xj}$ are the different attributes of the mode and other relevant characteristics of individuals (such as income).

The usefulness of the model described by (1) is that it allows the calculation of predicted market share changes based on changes in the relative attributes of the different modes.

[44] PANYNJ (2010) op. cit.

- As expected, the models predict that ferry ridership would decline with increases in fare, in-vessel time, wait time and access time. The model estimation also revealed a lower probability of choosing ferries for female respondents[45].
- Respondents also exhibited an inherent preference for the ferry mode over their current subway or express bus option. The preference for ferry is a measure of how much respondents would be willing to pay for a ferry option if all characteristics were equal to the current option. For subway users (who face a generally shorter commute) the willingness-to-pay for a ferry option was equal to $1.15; for express bus users (who typically face a longer commute) the valuation of the ferry option was $1.92)[46].

The model coefficients have expected signs. For example, increasing ferry travel time relative to subway decreases the probability that patrons would adopt ferry as a mode of choice. Similarly, increases in fare or headway decreases the probability that ferry would be adopted as a mode of choice. The mode choice constant is positive, implying that ferries are preferred by users as a mode of travel compared to subway.In initial applications the Subway/Ferry Mode Choice Model was used to test demand for a then hypothetical ferry service between several locations (notably Williamsburg) and Pier 11 or 34th Street in Manhattan. The assumed characteristics were not identical to the current East River Ferry, but resulting ridership forecasts were comparable to current East River Ferry ridership, suggesting that the model would be a robust tool for forecasting ridership of proposed passenger ferry services in New York Harbor. A more complete validation exercise was carried out in the context of the current project based on actual East River Ferry characteristics and ridership results.

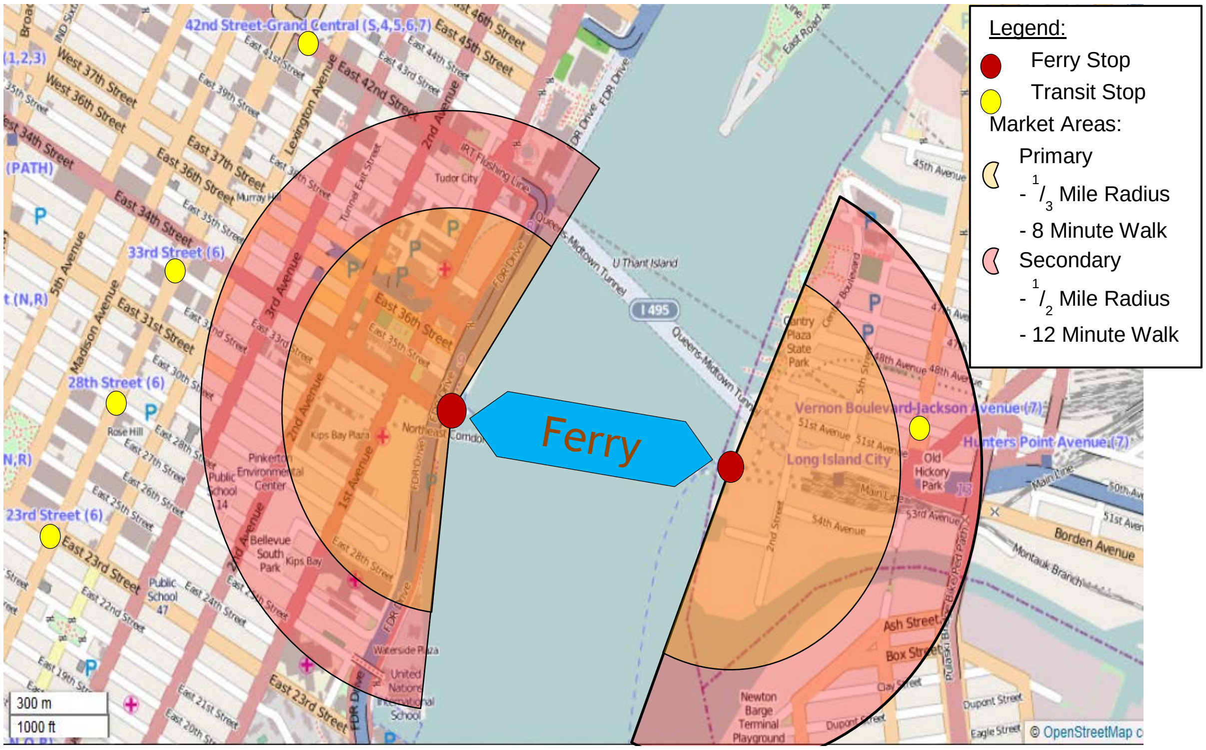
Validation Tests

The East River Ferry has been in service for over two years and the detailed ridership data provided a unique opportunity to validate the Sub/Ferry Mode Choice Model. In particular, an assessment was made to see how well the Model predicted current East River Ferry ridership by location given the actual fare, travel time, headway of each mode, as well as the calculated access times for specific locations. As shown in Figure 2, the process involved defining a relevant market area (usually a Primary Market Area and a Secondary Market Area) with relevant costs (fare, travel time, headway, access time) for both the East River Ferry and the competing subway service.

Figure 15.2: Validation Approach Based on Comparing East River Ferry Service to Transit Alternatives

[45] An alternative formulation of the mode choice models also revealed that high-income users (with income over $100,000) were more likely to choose the ferry *all else equal*, and respondents also were more likely to choose the ferry option if it were part of an integrated fare structure. These model formulations proved to have lower predictive power and were therefore abandoned in favor of model formulations incorporating only fare, headway, access time, and gender.

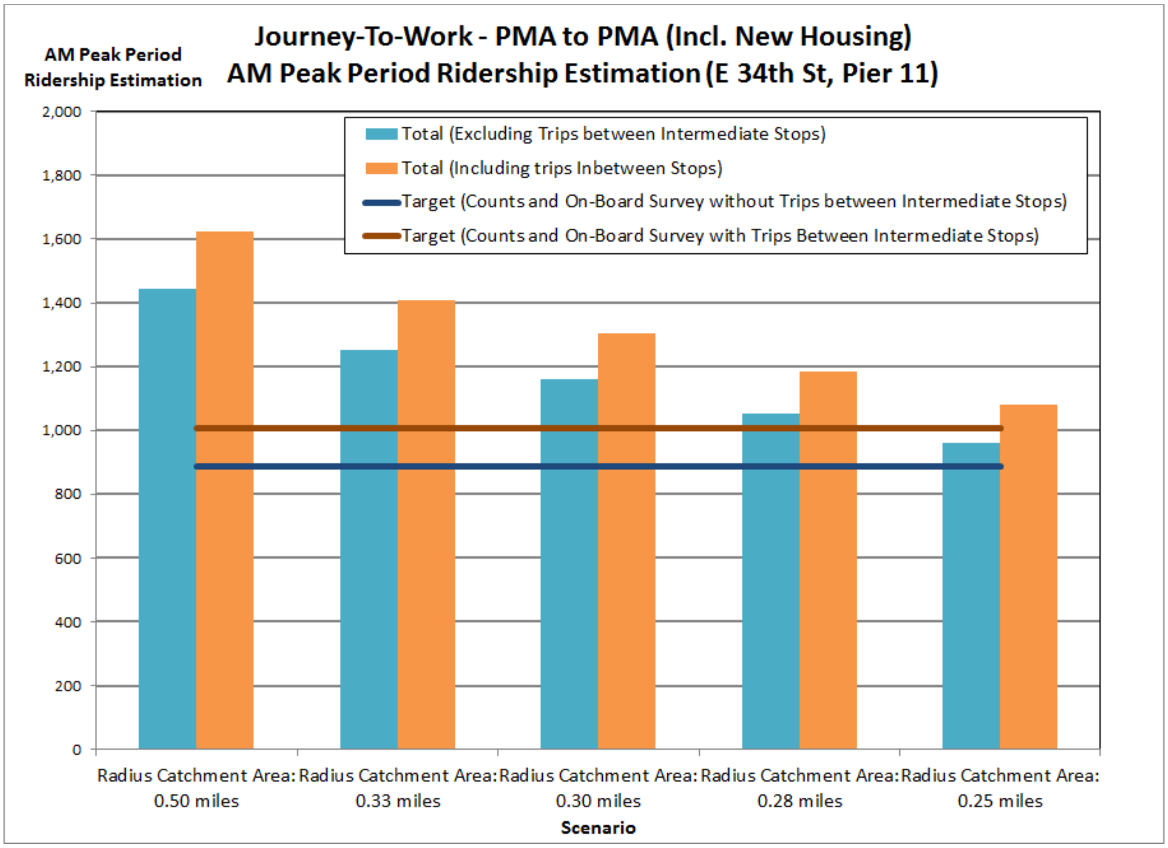
[46] Note that this preference is for a ferry service which, as presented to respondents in the SP survey, is a premium service such as the East River Ferry.



Map Background: © OpenStreetMap contributors

The validation process revealed that given a definition of the market area for East River Ferry stops based on a ½ mile radius (with a ¼ mile radius primary market area) the Subway/Ferry Mode Choice Model replicates current East River Ferry ridership very closely.

Figure 15.3: Validation Results Comparing East River Ferry Service to Transit Alternatives



Weekend Ridership Model

As detailed in Figure 3.2, weekend ridership is a significant component of overall revenues and usage for the East River Ferry service. This is particularly true in warmer months, where weekend ridership outpaces weekday ridership from April through October. A complete picture of potential ridership for proposed routes requires an understanding of the potential weekend, as well as weekday, ridership.

Weekend ridership forecasting is challenging. As opposed to weekday ridership, it is not really anchored by a journey-to-work market but rather is mostly comprised of leisure and visitation trips. While journey-to-work ridership is based on solid relatively detailed information commutation patterns, no such information exists about weekend leisure travel. While some destinations have occasional visitation surveys, they are typically not the norm[47].

In order to overcome the lack of visitation data and still develop weekend ridership forecasts SDG developed an econometric model to estimate weekend ridership indirectly. In this approach average ridership per weekend day based on average

[47] A review of a selected group of visitation sites that are accessible by ferry revealed that Four Freedoms Park on Roosevelt Island, Govenpr's Island and Brooklyn Bridge Park had some visitation estmates and some visitation surveys.

ridership per weekday based on data from the East River Ferry to estimate this relationship. Whereas the relationship of weekday peak period to off-peak period ridership is quite consistent across locations, this is not the case with weekend ridership as locations differ significantly in terms of their attraction for what are primarily leisure users. For example, weekend ferry service to DUMBO is quite high relative to its weekday patronage, reflecting the presence of a wide array of recreational and cultural offerings near the pier. At the other extreme, Greenpoint weekend service is relatively low, reflecting the primarily residential nature of the area near the pier, suggesting that users are primarily using the ferry to access other locations rather than vice versa.

To reflect this heterogeneity, it was decided to group East River Ferry locations into three broad groupings to reflect their attractiveness as weekend service *relative to weekday service.* The resulting categorization – high, medium and low – is then given to each station, as detailed in the Table below.

Table 15.1: Categorization of Existing Stations

Station name	Expected proportion of weekend riders
East 34th Street	High
Pier 6/DUMBO	High
/Long Island City	Low
Greenpoint	Low
North Williamsburg	Medium
South Williamsburg	Medium

A regression model is then estimated to explain weekend boardings as a function of weekday boardings within each of the groupings. The resulting statistical analysis reveals that for high and medium categories the relationship between weekday and weekend boardings is highly significant, and varies considerably by season.

The results detailed in Table 1.2 reveal the following: For high-category station weekend ridership is equal to 62% of weekday ridership in January, then increasing substantially as a percentage of weekday ridership through the Spring, Summer and Fall months. A similar (though smaller) relationship is found for medium-category stations, which the relationship is greatly reduced (and not significant) for low-category stations.

Table 15.2: Regression output

	'High' stations	'Medium' stations	'Low' stations
average weekday boardings	0.621***	0.306**	0.0547
February	-0.102	0.0499	0.0972
March	0.404***	0.743***	0.717***
April	1.104***	1.354***	1.124***
May	1.325***	1.598***	1.424***
June	1.379***	1.730***	1.769***
July	1.284***	1.668***	1.669***
August	1.068***	1.716***	1.636***
September	1.202***	1.561***	1.589***
October	1.004***	1.394***	1.294***
November	0.803***	1.095***	0.892***
December	-0.0226	0.180	0.0557
Constant	1.415***	1.511**	3.013***

*Note: *** p<0.01, ** p<0.05, * p <0.1 (p is the probability that the observation was only by chance. The lower the p, the higher the statistical significance. A value of 0.05 or lower suggests that the variable has a highly significant effect on average weekend boardings.*

Another measure of how good the models described above are at prediction is to use it them to "predict" actual past data using the model results reported previously. As shown in the subsequent figures, the models do a very good job of predicting past weekend ridership primarily based on past weekday ridership for the same station.

Figure 15.4: Brooklyn Bridge Park/DUMBO/Fulton Ferry (High)

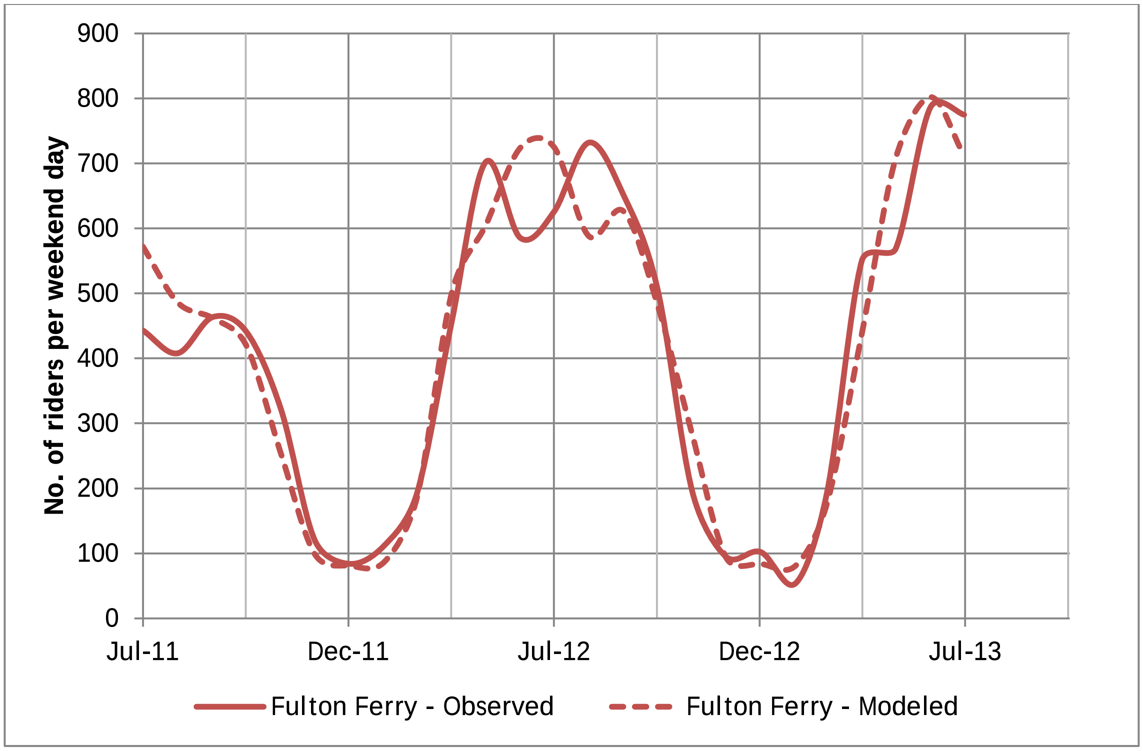


Figure 15.2: East 34th Street/Midtown (High)

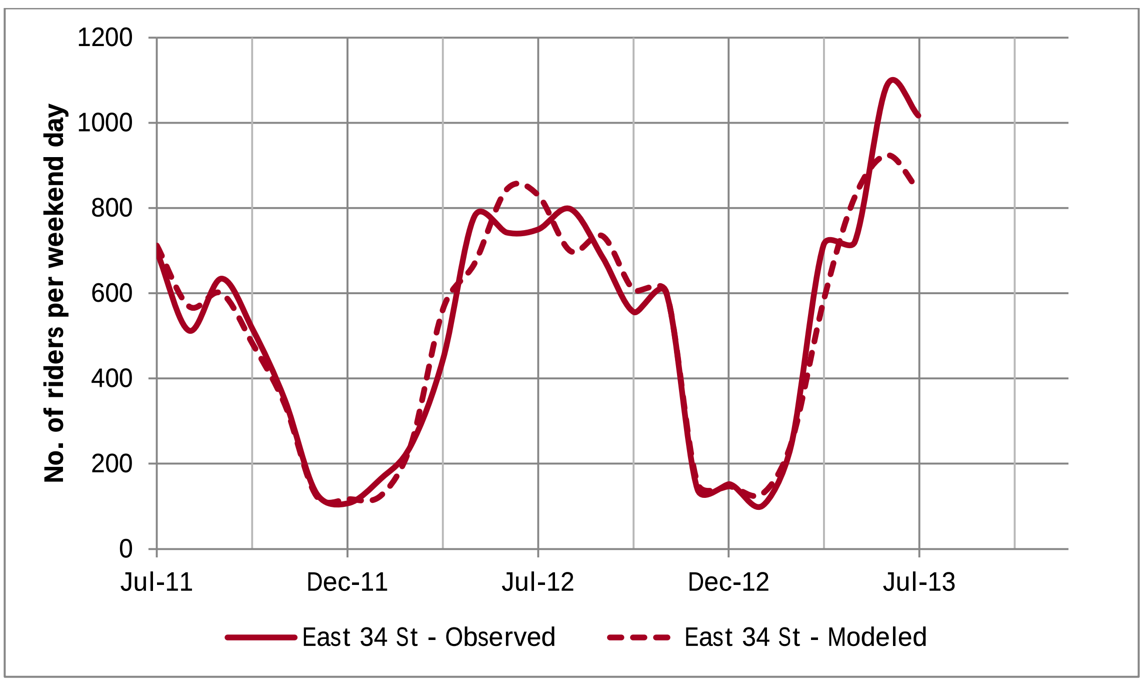


Figure 15.3: North Williamsburg/N. 6th St. (Medium)

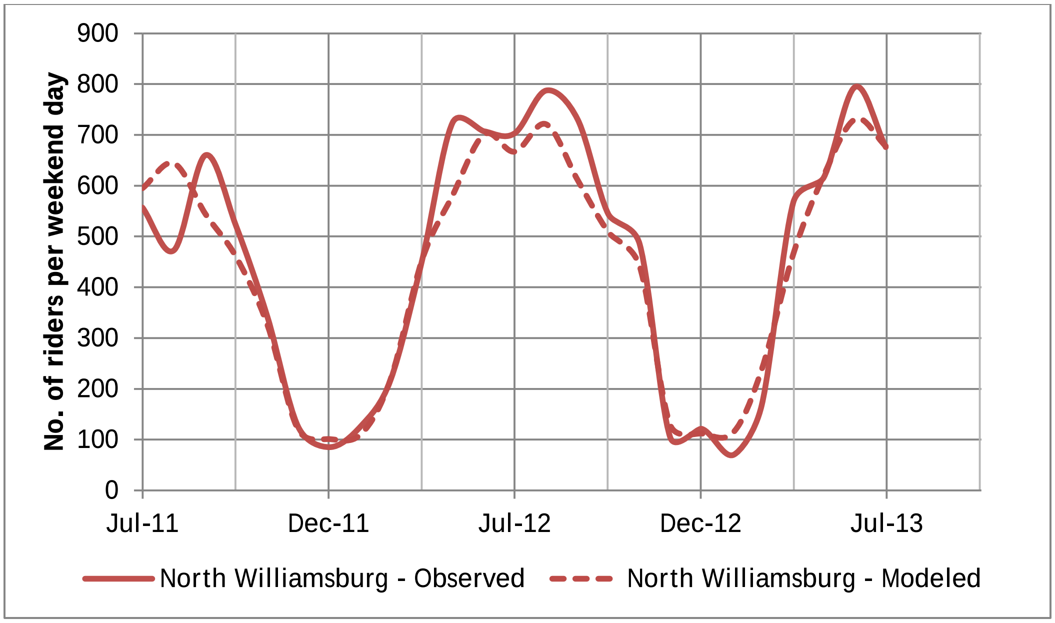


Figure 15.4: South Williamsburg/Schaefer Landing (Medium)

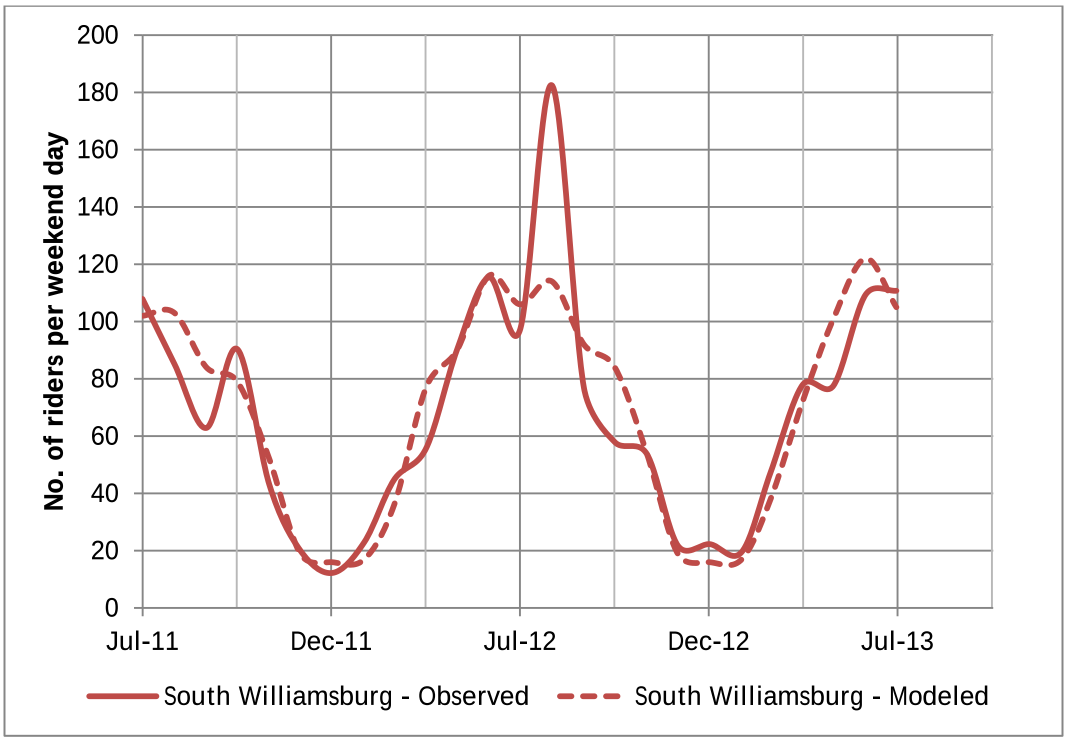


Figure 15.5: Hunters Point South/Long Island City (Low)

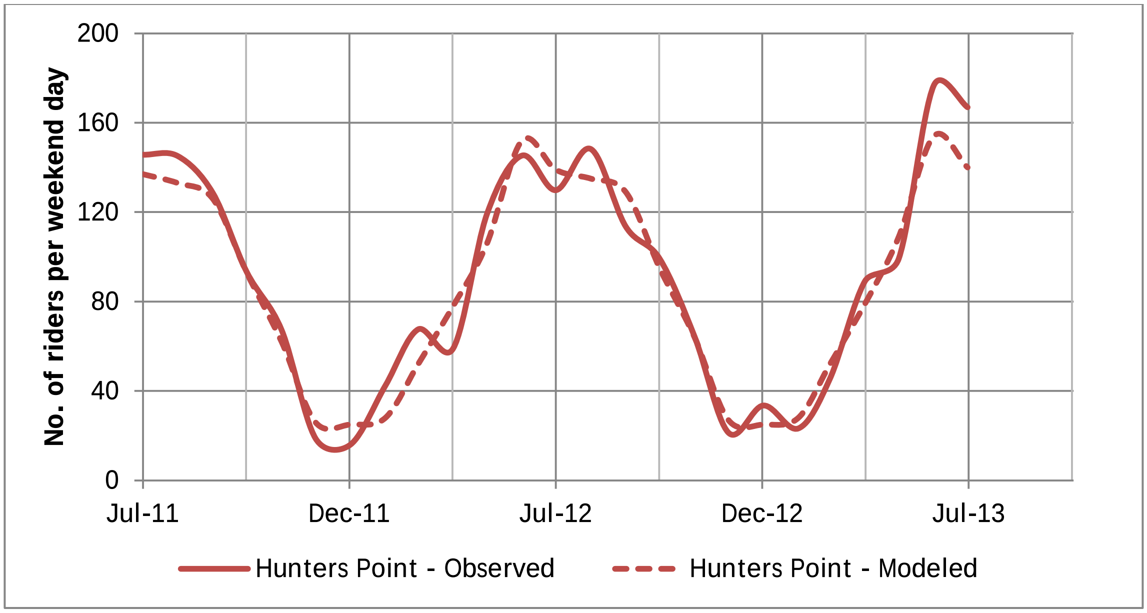
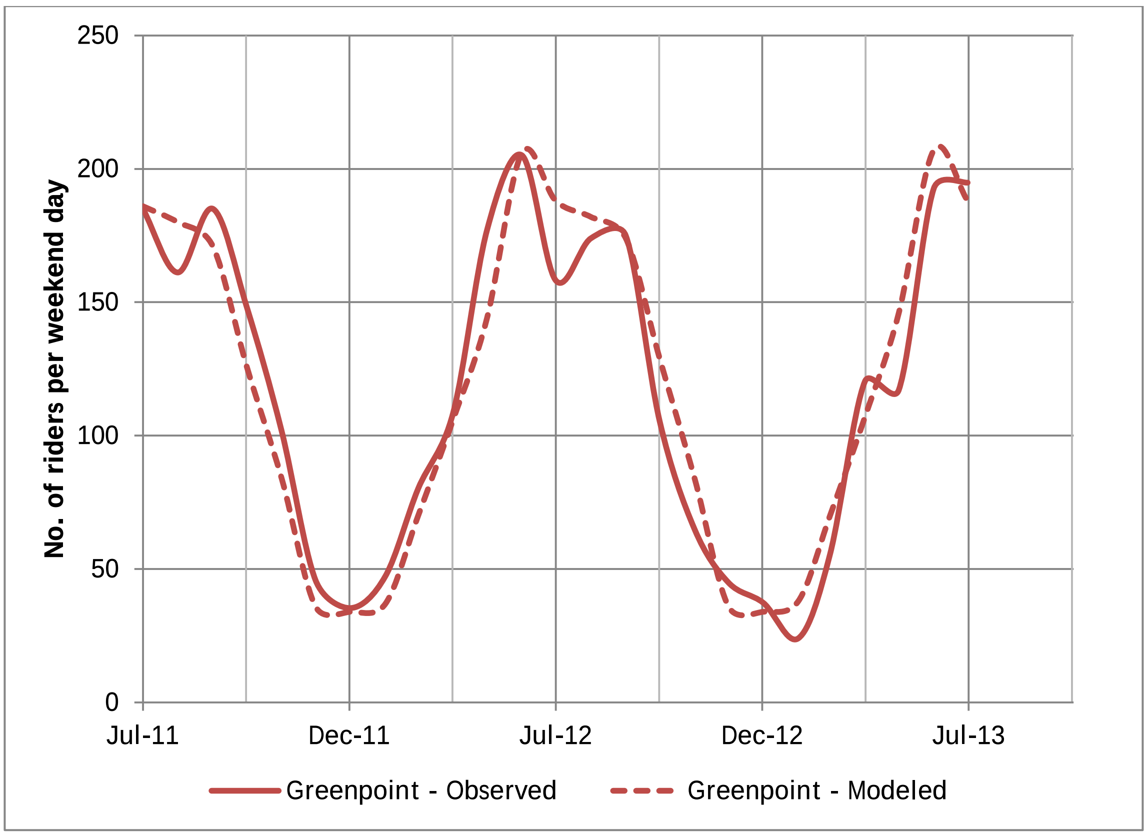


Figure 15.6: India St./Greenpoint (Low)



In conclusion, the SDG Team developed a weekend ridership model framework quite distinct from the weekday models. Here the approach is to generate weekend ridership based on weekday ridership, with the actual strength of the relationship varying based on the leisure attractions at the locations. While the models were not used for the ridership analysis contained herein, the models could be brought to use in future analyses to estimate weekend ridership for proposed locations.

LaGuardia Airport Model

Background

There was a privately-operated ferry service to LaGuardia Airport from 1988 to 2000. This service, connecting ferry terminals at Pier 11 and East 34th Street in Manhattan with the Marine Air Terminal at LaGuardia Airport, was sponsored by Delta Airlines and was marketed as the *Delta Water Shuttle* to provide a connection to Delta's flights to Washington D.C. and Boston. Since the service was sponsored solely to support flights leaving from the Marine Air Terminal (Terminal A), connections to other terminals were not marketed. In interviews with ferry operators familiar with the service, it was described as a "nice service", "consistent" for customers, but one that "lost money" for the operator as well as for Delta, which provided a fuel subsidy for their sponsorship.

There was no public subsidy for this service. Fares at one point in time were $15 one way and $25 roundtrip, and were reported to be up to $19 one way when the service was operated most recently by New York Waterway. Data from four years of ridership show some patterns:

- Average daily ridership was 130 passengers per day.
- January was consistently the lowest month for ridership.
- June is almost consistently the highest ridership month.
- Daily highs were reported anecdotally as up to 200 per day.

In looking at what it may take to reactivate this service, it is worth examining what has changed since the prior ferry service ceased operations. There have been numerous developments to both ferry services as well as at LaGuardia Airport that may support the viability of a revived ferry service.

The potential for a water taxi or ferry service to and from LaGuardia Airport from Manhattan's East Side was studied in 2006. The 2006 study relied heavily on customer satisfaction data provided by the PANYNJ that included additional information on how passengers accessed the airport. For this analysis, the econometric model from that prior study was updated with 2011 customer satisfaction survey data. No stated preference surveys were conducted as part of this effort. There were also no current or historical surveys available to the study on customer perceptions of the prior service, or surveys on the current East River Ferry customers regarding their likelihood of taking a ferry to LaGuardia Airport.

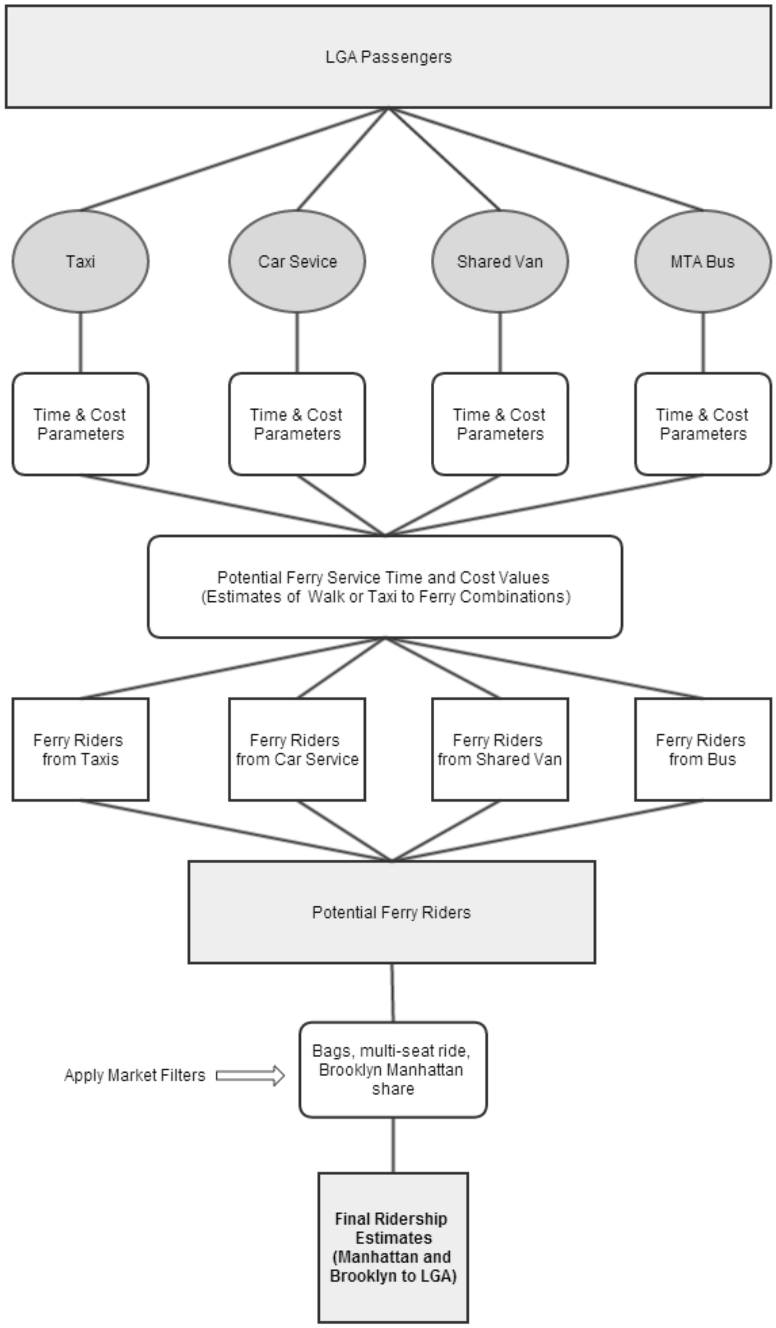
Developing the Mode Choice Model

To develop a mode choice model, a probability model was developed whereby riders are presented choices from their origin to LaGuardia Airport based on time and cost combinations. Cost, access fares and distances were estimated using zip code-level trip origins, which were then used to supplement the data set. Total market size of

LaGuardia Airport is 25.7 million passengers/year. Of that, 50% of LaGuardia Airport users were destined to Manhattan, 10% are destined to Brooklyn, and the remainder of LaGuardia Airport users are dispersed throughout the region.

Ferry market potential was limited to LaGuardia Airport users who currently access the airport by taxis, car services, shared-van service (e.g. Super Shuttle), or public transit such as the MTA bus. All users that drive their own vehicles or are dropped-off by a non-commercial vehicle were excluded. All users carrying two or more bags are ruled out from potential ridership pool because of inconvenience of moving luggage to and from ferry. A flow chart summarizing this process is on the following page. More details on the modelling methodology is provided in APPENDIX III.

Figure 15.5: Flowchart of LaGuardia Airport Modelling Methodology



16 APPENDIX 5: Analysis of Ferry Service to LaGuardia Airport

As part of the update to the Citywide Ferry Study, the study evaluated the potential of ferry service to LaGuardia Airport (LaGuardia Airport). Considerations for travel to and from one of the region's major airports are different in nature than a journey-to-work commute or a leisure trip. Hence a ridership model specific to LaGuardia Airport access mode choice was created for this analysis. In addition to market potential, a number of questions needed to be addressed as part of this effort:

- What is the history of the prior ferry service to LaGuardia Airport?
- Why is that service no longer in operation?
- What, if anything, has changed since the cessation of that service that may hold promise for the success of a revived service?
- Where could a ferry terminal be located at LaGuardia Airport? What is the estimated cost of that facility?
- What would the potential ridership be? What is the anticipated farebox recovery of that service? Would a subsidy be required?

The results of this analysis reveal five primary findings:

- The likely reason for the failure of the prior ferry service was insufficient market reach to other LaGuardia Airport terminals. The Terminal A market was inadequate to support two vessels with hourly service. An inter-terminal connection was never promoted with the ferry service, as it was sponsored by one airline as an added amenity to its aviation shuttle services located in Terminal A.
- For a LaGuardia Airport ferry service to be viable, it must be combined with an attractive and efficient inter-terminal bus connection to attract and serve riders.
- Hourly service with two vessels is estimated to have a positive operating margin and may be self-sustaining without subsidies.
- Service every half hour with four vessels to Bowery Bay has a significantly slimmer profit margin and may not break even with higher fares than the $25 fare modelled.
- If a new ferry landing were to be developed at LaGuardia Airport to accommodate a reactivated service, development at Bowery Bay is recommended at this point in time over Flushing Bay.

The analysis is discussed in further detail below.

History

There was a privately-operated ferry service to LaGuardia Airport from 1988 to 2000. This service, connecting ferry terminals at Pier 11, East 34th Street and 90th Street in Manhattan with the Marine Air Terminal at LaGuardia Airport, was sponsored by Delta

Airlines and was marketed as the "Delta Water Shuttle" to provide a connection to Delta's flights to Washington D.C. and Boston. Since the service was sponsored solely to support flights leaving from the Marine Air Terminal (Terminal A), connections to other terminals were not marketed. In interviews with ferry operators familiar with the service, it was described as a "nice service", "consistent" for customers, but one that "lost money" for the operator as well as for Delta, which provided a fuel subsidy for their sponsorship.

There was no public subsidy for this service. Fares at one point in time were $15 one way and $25 roundtrip, and were reported to be up to $19 one way when the service was operated most recently by New York Waterway. Data from four years of ridership show some patterns:

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- Daily highs were reported anecdotally as up to 200 per day.

In looking at what it may take to reactivate this service, it is worth examining what has changed since the prior ferry service ceased operations. There have been numerous developments to both ferry services as well as at LaGuardia Airport that may support the viability of a revived ferry service.

Ferry

- Tremendous waterfront development along East River / Increased density of waterfront population with access to ferry
- Success of East River Ferry Pilot and reawakening of the waterways as a mode of transportation
- Extensive ferry commutation market on the Hudson River with connections from NJ to NYC
- Larger ferry fleet and added ferry companies

Airport

- Growth of LaGuardia Airport activity – passengers up 25% from 1996
- Post 9/11 security screening of passengers adds travel time
- Marine Air Terminal share of LaGuardia Airport market reduced – decrease to 4% of all LaGuardia Airport passengers from 9% in the 1990s
- Delta makes hub at LaGuardia Airport – invests $160M to connect and modernize Terminals C and D.

On the ferry side, the increased level of ferry activity may make it easier for an operator to market a service. And for commuters already accustomed to using ferries for their journey-to-work, using a ferry to reach LaGuardia Airport may be an easier “sell” now than in the past. On the airport side, the continued growth of LaGuardia Airport provides a bigger market for a ferry operator to tap into for ridership. Investments by Delta in connecting Terminals C and D may provide easier access between these terminals for ferry riders. The emergence of a larger single air carrier at LaGuardia Airport with customers at multiple terminals may present a ferry operator with a larger private-sector partner with interest in serving all terminals at the airport. These aspects will be discussed further.

Site Evaluation

Two sites were evaluated as potential ferry landing areas: one on the west end of LaGuardia Airport in Bowery Bay, the second in Flushing Bay on the east end. The prior ferry service operated out of Bowery Bay. That infrastructure was privately owned and has been removed. A northern site was not evaluated as it would be cost prohibitive to construct a passenger tunnel underneath runways that would provide non-conflicting passenger access from the waterside to the terminals. See map below.

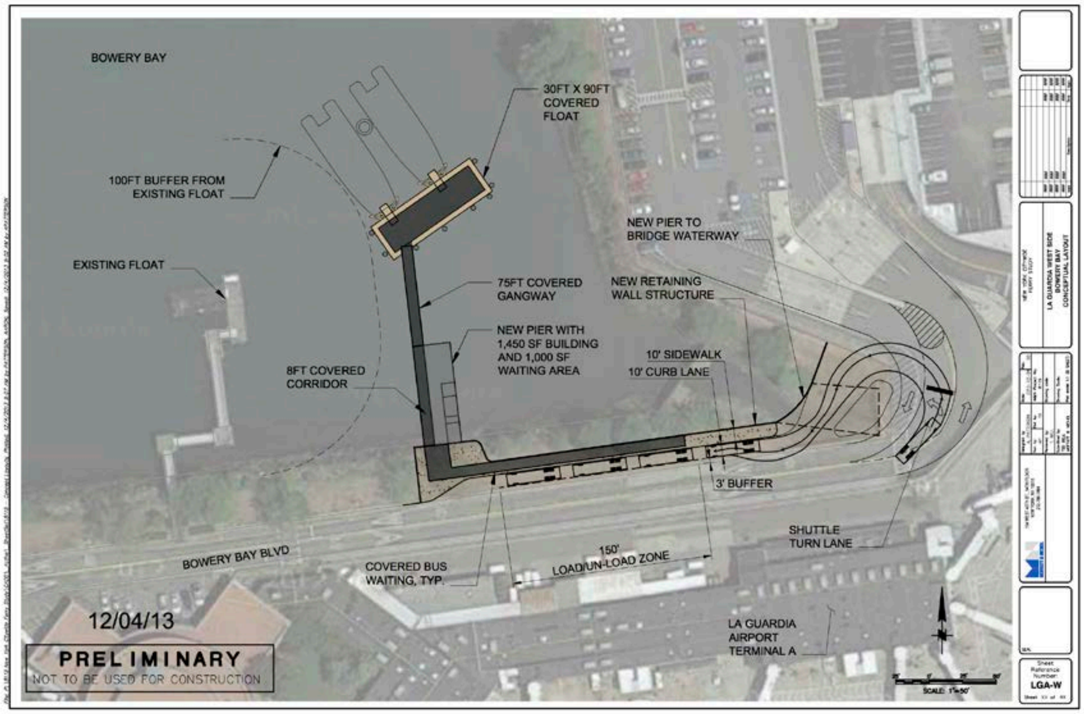
The CFS2013 developed a conceptual site plan and preliminary cost estimates for both sites. To attract a steady customer base and business travelers, costs for both facilities were estimated with the following amenities:

- Covered walkways and gangways to provide continuous weather protection from inter-terminal bus to ferry

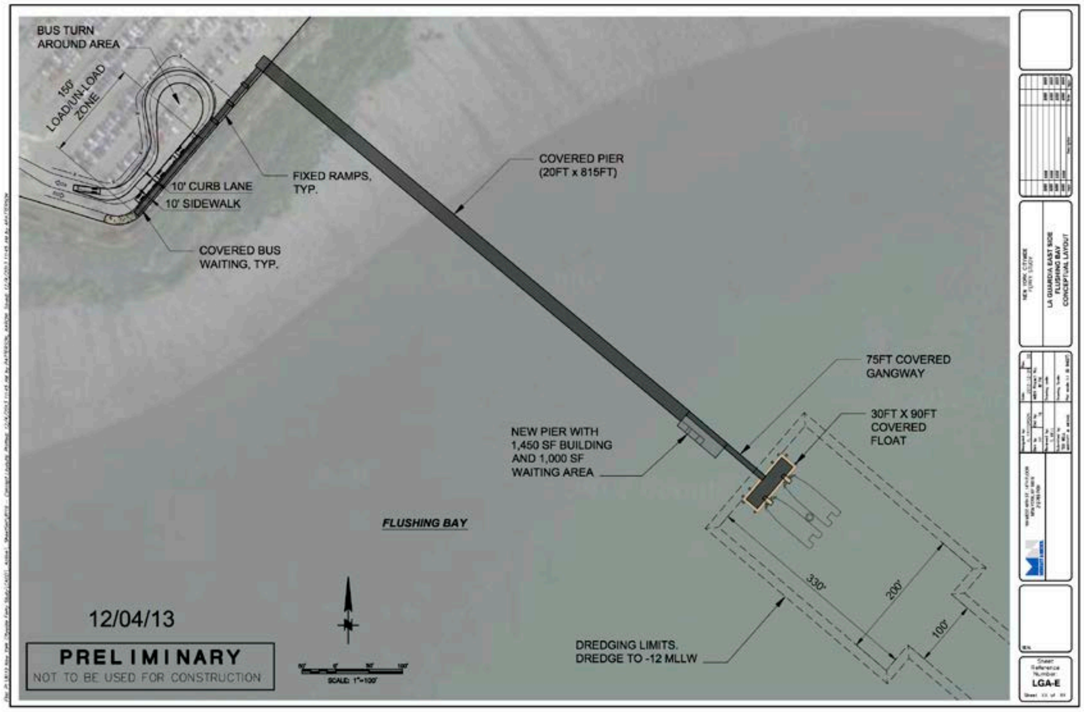
- Enclosed waiting area for weather protection
- Heated restrooms
- Heated staff area for either ticket sales or information both.
- Turn-around areas for inter-terminal bus.

Conceptual designs are shown below for Bowery Bay and Flushing Bay.

Bowery Bay Terminal concept design. Estimated cost: $16 million



Flushing Bay Terminal Conceptual Design. Estimated cost: $47.6 million



The advantages and disadvantages of both sites are summarized below:

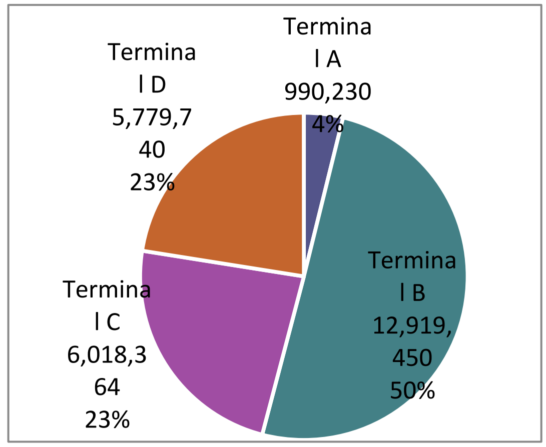
Bowery Bay (West End of LaGuardia Airport)

- Pros
  - Adequate water depth
  - No disturbance to vegetated wetlands
  - Less expensive ferry operations
  - Less expensive terminal construction at $16 million
- Con
  - Not walking distance to 97% of market
  - Greater need for efficient bus connections to other terminals
  - Immediate environs detract from image -adjacent to fuel farm

Flushing Bay (East End of LaGuardia Airport)

- Pros
  - Proximity to half of LaGuardia Airport customers. Walk access to Terminals C and D
- Cons
  - Longer travel time for riders
  - More expensive ferry operation than Bowery Bay by 25% due to longer route distance
  - More expensive terminal needed at $47.6 million (three times cost of Bowery Bay)
  - Requires dredging and environmental mitigation
  - Loss of some parking in Lot 5
  - Longer walk from ferry to shoreline of over 800 feet.

LaGuardia Airport Terminal Characteristics



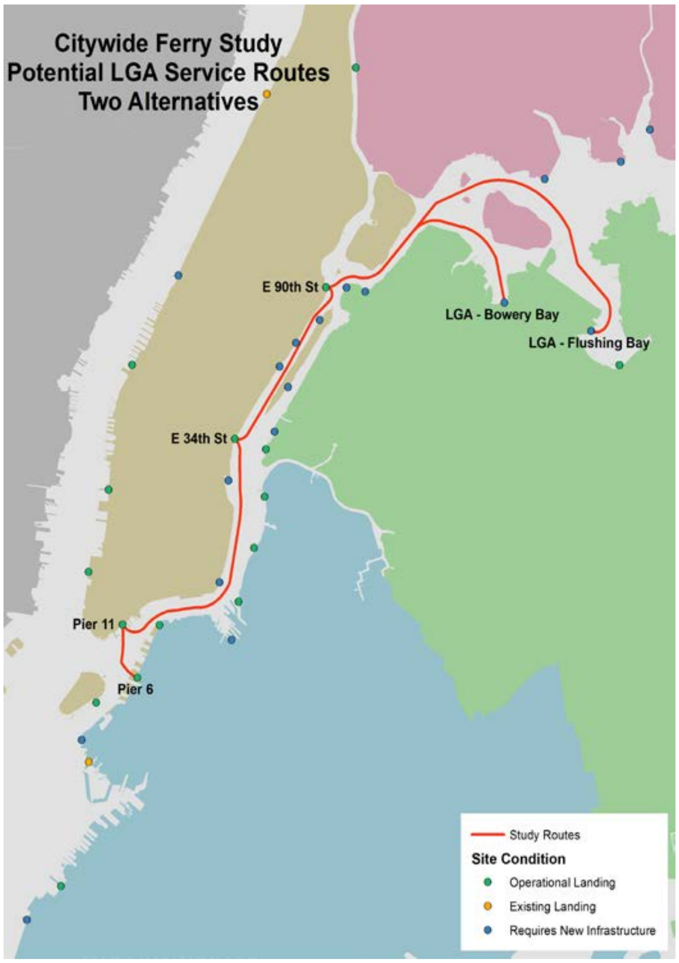
Source: PANYNJ 2012 Annual Traffic Report

Given that the potential ferry terminals are at opposite ends of the airport, it is worth looking at the passenger markets that would be most accessible to each ferry site. A western landing site at Bowery Bay would be walking distance to Terminal A, which is also referred to as the Marine Air Terminal. An eastern landing site at Flushing Bay would be most proximate to Terminal D. See terminal map below. The annual passenger market of each terminal differs in passenger ridership size as shown in the graph below. The potential market within walking distance of a Bowery Bay site is only 3% of the ridership market of LaGuardia Airport. Conversely, the potential market within walking distance of an eastern site at Flushing Bay represents 47% of the airport passenger market. In order for a ferry service to be effective towards servicing the entire airport, an efficient land transportation, such as bus connection, will be required and is discussed subsequently.

Routes Analyzed

With two potential ferry landing sites at LaGuardia Airport defined, the ferry routes to LaGuardia Airport were developed. The CFS2013 examined markets from existing ferry sites that were previously served by these locations to LaGuardia Airport, Pier 11 Wall Street, East 34th Street and East 90th Street.

Origin and destination information from surveys of LaGuardia Airport users indicate



that 50% of passengers are destined to Manhattan and 10% to Brooklyn. To potentially capture a portion of the 10% of LaGuardia Airport passengers destined for Brooklyn, a Brooklyn site was examined for potential ridership.

A stop at Pier 6 in Brooklyn was added for analysis given its 15-minute walking access to the neighborhoods of Brooklyn Heights to the north and Cobble Hill to the south. Access to the site from Atlantic Avenue may also be efficient for drop offs from private vehicles as well as service from the MTA B63 bus.

North Williamsburg in Brooklyn was also considered. The analysis, however, did not show significant ridership at this location. This may be due to the fact that the neighborhood is still growing and the LaGuardia Airport survey sample size was not sufficiently robust for Brooklyn data points or perhaps as North Williamsburg is a relatively a short cab ride away, the ferry market is simply less competitive than other choices. Hence, North Williamsburg should not be ruled out of future planning as it can be easily revisited, particularly if a service proceeds with the first key development of a LaGuardia Airport landing site.

The Queens waterfront was not analyzed separately. Given its proximity to LaGuardia Airport and highly competitive car service options to the airport, it was not considered a viable ferry airport market. For example, a taxi fare from Gantry State Park in

Long Island City to LaGuardia Airport is estimated at $23 and may take only 16 minutes door-to-door. On a ferry, travel time from Gantry State Park would be greater than 15 minutes to the LaGuardia Airport ferry terminal and longer to the air terminals, and the fare modeled is $25.

To model travel times, a speed analysis was prepared for the route using the most cost-efficient speeds with the majority of the fleet available within the harbor. Travel speeds of 20 to 25 miles per hour were assumed for more cost-efficient operations. To maximize fuel efficiency, this is the predominant range of speeds for many of the current East River and Hudson River routes. While there are vessels that travel at higher speeds, this analysis focuses on examining what may be possible with the region's existing vessels. Vessels capable of traveling more than 30 MPH require much greater fuel usage and therefore have higher operating costs, and ultimately a higher ridership break-even threshold.

The tables below show modeled travel times from the airport to the following stops.

Bowery Bay Service

- 10. 7 miles, 55 minutes planning time

▪ LaGuardia Airport Bowery Bay	Depart
▪ East 90th Street	Arrive in 15 minutes
▪ East 34th Street	28 minutes
▪ Pier 11 Wall Street	44 minutes
▪ Pier 6 Brooklyn	51 minutes

Flushing Bay Service

- 15 miles, 65 minutes planning time

▪ LaGuardia Airport Flushing Bay	Depart
▪ East 90th Street	Arrive in 27 minutes
▪ East 34th Street	40 minutes
▪ Pier 11 Wall Street	57 minutes
▪ Pier 6 Brooklyn	63 minutes

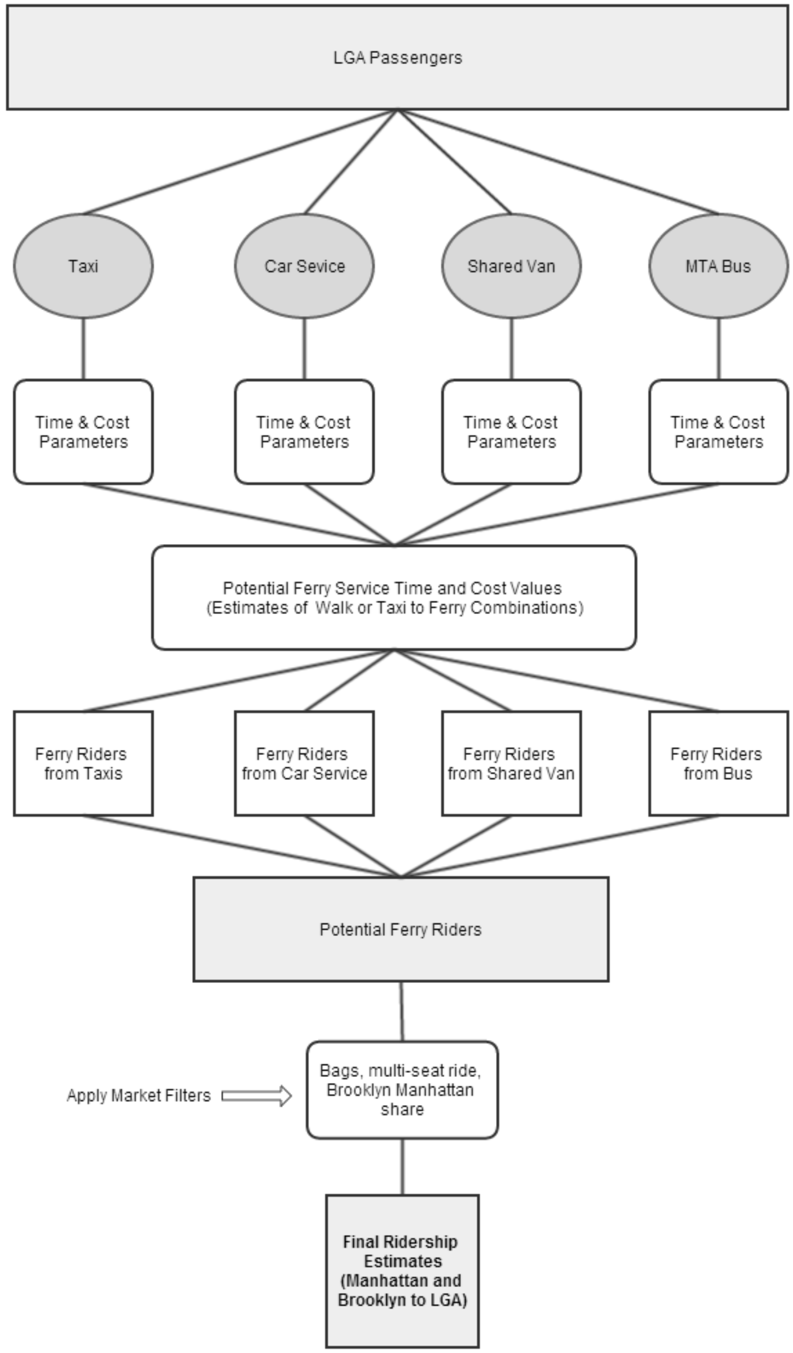
Ridership Modeling and Analysis

The potential for a water taxi or ferry service to and from LaGuardia Airport from Manhattan's East Side was studied in 2006. The 2006 study relied heavily on customer satisfaction data provided by the PANYNJ that included additional information on how passengers accessed the airport. For this analysis, the econometric model from that prior study was updated with 2011 customer satisfaction survey data. No stated preference surveys were conducted as part of this effort. There were also no current or historical surveys available on customer perceptions of the prior service, or surveys on the current East River Ferry customers regarding their likelihood of taking a ferry to LaGuardia Airport.

To develop a mode choice model, a probability model was developed whereby riders are presented choices from their origin to LaGuardia Airport based on time and cost combinations. Cost, access fares and distances were estimated using zip code-level trip origins, which were then used to supplement the data set. Total market size of LaGuardia Airport is 25.7 million passengers/year. Of that, 50% of LaGuardia Airport users were destined to Manhattan, 10% are destined to Brooklyn, and the remainder of LaGuardia Airport users are dispersed throughout the region.

Ferry market potential was limited to LaGuardia Airport users who currently access the airport by taxis, car services, shared-van service (e.g. Super Shuttle), or public transit such as the MTA bus. All users that drive their own vehicles or are dropped-off by a non-commercial vehicle were excluded. All users carrying two or more bags are ruled out from the potential ridership pool because of inconvenience of moving luggage to and from a ferry. A flow chart summarizing this process is on the following page. More details on the modelling methodology is provided in the APPENDIX III to the full report.

Flowchart of Modelling Methodology

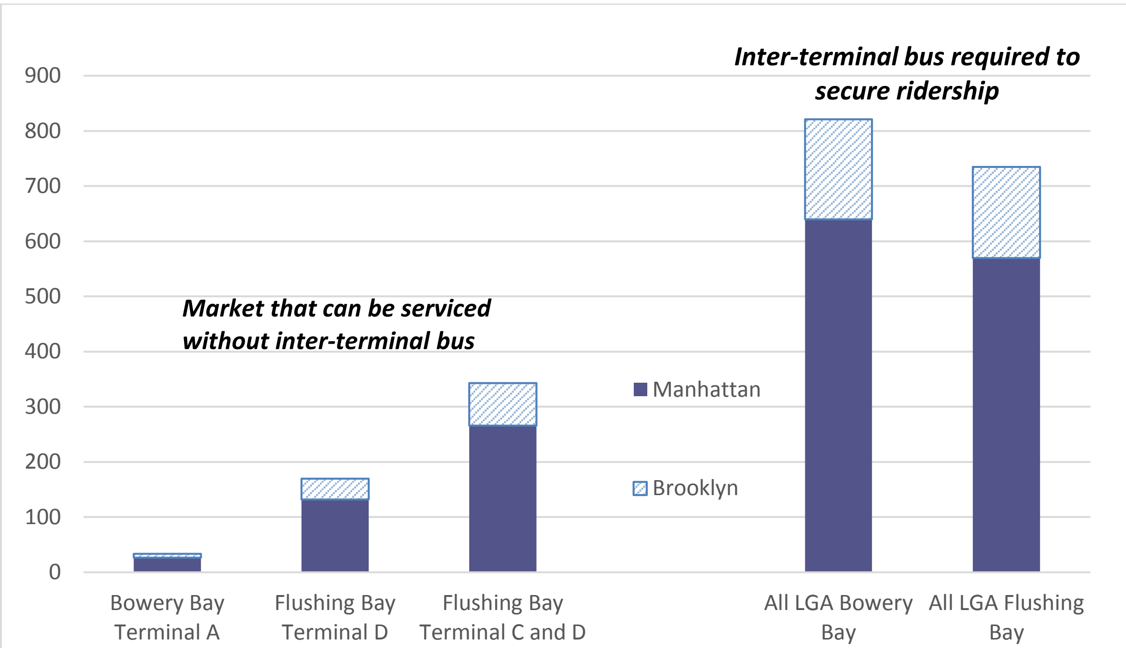


Ridership Forecast

A ridership forecast was developed for a number of scenarios. Ridership for an hourly service to LaGuardia Airport at a price point of $25 was examined for both the Bowery Bay and the Flushing Bay sites. A fare of $25 was chosen for analysis as this fare level was raised by ferry operators as a possible market competitive fare. Taxi fare, for example, to Lower Manhattan's Wall Street is estimated to be $40 and for Grand Central Midtown, $30 (taxifarefinder.com).

The two landing destinations will generate different ridership estimates due to their travel times. As Flushing Bay is on the eastern portion of LaGuardia Airport, this landing site requires an additional thirteen minutes in travel time compared to a Bowery Bay landing. The longer travel duration is an important service feature as it will compete with other modes based on time of travel, as well as cost. Once at the LaGuardia Airport, both sites also present different travel time from ferry to air terminal via an inter-terminal bus connection.

2018 Forecast of Potential Daily Ferry Passengers by LaGuardia Airport Ferry Landing Location

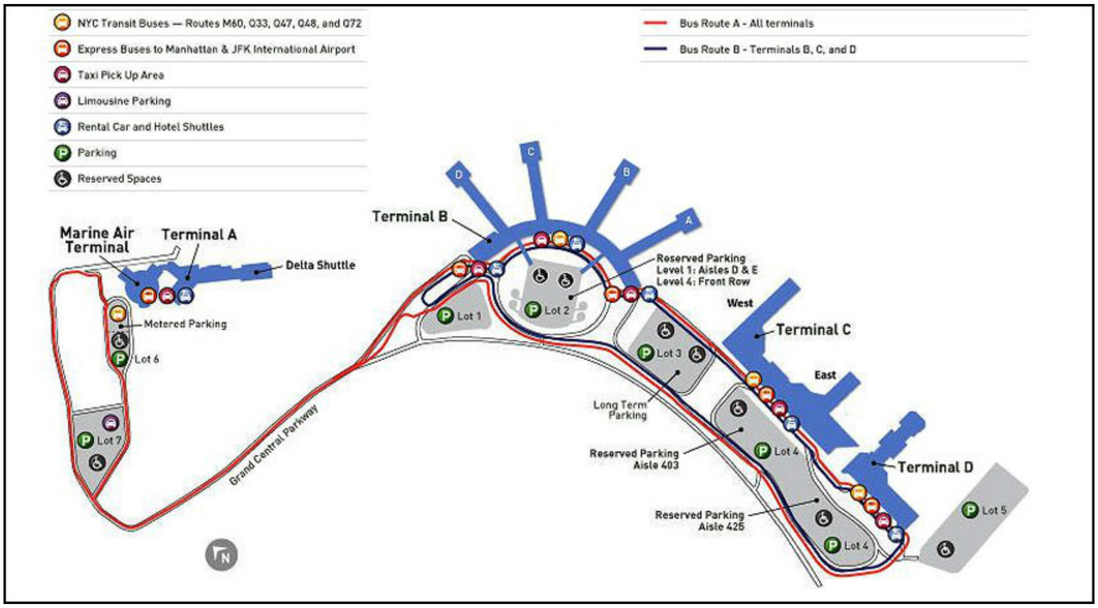


The above diagram shows that an intermodal connection is needed from ferry to the air terminal to sustain necessary ridership. A key finding is that the prior ferry service, while having a dedicated following, did not have sufficient reach to the rest of the LaGuardia Airport market apart from the Marine Air Terminal. The prior service was marketed solely as a Marine Air Terminal service and likely did not attract riders to other air terminals. Interviews and prior reports confirmed that there were few, if any, observed transfers from Terminal A to other terminals from the prior ferry service. However, ridership to Terminal A alone is not sufficient to cover the cost of providing that operation.

If a service were to be reactivated at Bowery Bay, without an efficient and seamless bus connection to the rest of the LaGuardia Airport market, the likelihood of success is low. Likewise, if a service at Flushing Bay were to be developed by Terminal D, without a connecting and seamless inter-terminal bus, that service would also likely have slim success margins. Moreover, even though Terminals C and D are now connected with a moveable walkway, and that market is within walking distance from a Flushing Bay Terminal, that combined market is still insufficient for a successful operation. Ridership to the remaining half of LaGuardia Airport at Terminal B, the Central Terminal Building, is needed for a ferry service to be viable.

In short, in order for a ferry service to work at LaGuardia Airport, an attractive and seamless intermodal connection to the air terminals is required. The connection bus may be as important to the success of the ferry as the waterside operation itself as riders will not deem themselves to have arrived at the airport until they get to their required air terminal, not the LaGuardia Airport ferry landing itself.

LaGuardia Airport currently operates two bus routes, one that connects all terminals, and another that connects all terminals except for Terminal A. See diagram below.



Source: PANYNJ website

The CFS2013 examined the current bus routes and their capacity using data from the PANYNJ.

- Route A (Serves all terminals)
  - 2 buses run every 15 minutes with a 30 minute roundtrip
  - Average passengers per hour: 21
  - Capacity: 35-foot buses with seating capacity of 24 and 10-15 standing
  - Current Utilization: 17% (average daily passengers/daily seats)
- Route B (Serves terminals B, C, D)
  - 2 buses run every 10 minutes with a 15 minute roundtrip
  - Average passengers per hour: 45
  - Capacity: 35-foot buses with seating capacity of 24 and 10-15 standing

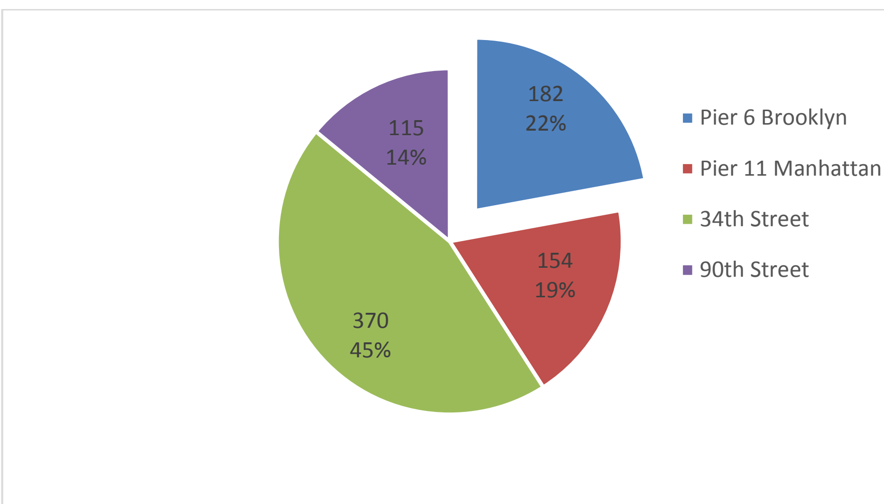
- Current Utilization: 26% (average daily passengers/daily seats)

Both bus routes appear to operate with sufficient excess capacity to absorb the forecasted number of riders from a ferry service. Moreover, the current excess capacity will increase as plans are underway at LaGuardia Airport to shift to use of JFK's 40-foot buses, which have the larger seating capacity of 31 and standing capacity for 15-20 passengers.

Ferry riders will expect a bus to meet the ferry upon arrival. Also, if there are ways to ensure the consistency of the connecting bus ride to the air terminal, such as use of any non-public roads separated from the potential traffic of public drop-off and pick-ups areas that a taxi, car service or bus would be subjected to, its reliability would strengthen the overall service.

Forecast of daily riders by terminal stop is shown below with a caveat on the potential Brooklyn ridership. Of the percentages shown below, the Brooklyn forecast warrants additional analysis as the forecasted size of the potential market is not consistent with the actual proportional share of riders of current Manhattan and Brooklyn LaGuardia Airport users. Reasons for this potential forecast distortion may be due to the smaller size of the Brooklyn sample in the survey data as well as unknowns with existing latent preferences for existing modes for airport access. Car service plays a larger role in airport access in Brooklyn than in Manhattan. The CFS2013 recommends further analysis with a stated preference survey to better gauge Brooklyn ridership.

2018 Forecast of daily ferry riders to Bowery Bay by stop for service every 30 minutes



Farebox Recovery Analysis

The above forecast represents an estimate of potential riders over the course of a full day. So out of the potential of all daily riders, the market was parsed for a 12-hour operational slot of riders using LaGuardia Airport between 6am to 6pm.

In serving LaGuardia Airport by ferry, an hourly service and a service every 30 minutes have been discussed over the years. The prior defunct ferry service to LaGuardia Airport was an hourly service. A service every half hour has been proposed in the past but never implemented. Two vessels would be needed to provide an hourly service. To provide a more attractive service every 30 minutes, four vessels would be needed. This makes a service every half hour twice the operational cost of an hourly service.

The prior Delta Water Shuttle, at one time during its 12-year run, operated on a split schedule with a morning service of 6am to 10am and an afternoon service of 3pm to 7pm. This was likely timed with the Delta shuttle service which had a morning peak and afternoon peak for a Washington D.C. - New York City – Boston travel market. However, in attempting to serve the whole LaGuardia Airport market which offers 1,000 daily landings and take-offs to destinations nationwide as well as Canada and the Caribbean, there are not the same morning and afternoon peaks. Therefore, an analysis for a split service is not presented below.

For a consecutive12-hour operation, conclusions from the farebox recovery analysis are:

- For both scenarios, the Bowery Bay landing alternative is the less expensive to operate.
- Ridership for Bowery Bay is also more robust compared to Flushing Bay given the shorter ferry travel times.
- For an hourly service, which requires two vessels, routes to either Bowery Bay or Flushing Bay may achieve sufficient ridership to be self-sustaining.
- Anticipated revenues from service every 30-minutes, which requires four vessels, would be insufficient towards covering operational costs and would require a subsidy.

The analysis does not incorporate an added cost for the required inter-terminal bus connection as there is an existing inter-terminal bus system in place that has capacity to accommodate added ridership from a ferry mode. However, that system would need to be modified to meet the ferry upon arrival and be sufficiently reliable to be attractive to riders.

Farebox Recovery for 2-Vessel Operating Scenario at fare of $25

2 vessels for hourly service	**Bowery Bay** 55 min headway	**Flushing Bay** 65 min headway
Daily Ridership	626	574
Daily Revenue	$15,650	$14,350
Daily Operating Expense	$12,649	$12,859
Daily Net Revenue	$3,000	$1,491
Farebox Coverage	**124%**	**116%**
Subsidy / Passenger	0	0

Farebox Recovery for 4-Vessel Operating Scenario at fare of $25

4 vessels for service every half hour	**Bowery Bay** 28 min headway	**Flushing Bay** 33 min headway
Daily Ridership	729	652
Daily Revenue	$18,225	$16,300
Daily Operating Expense	$25,299	$25,718
Daily Net Revenue	**-$7,074**	**-$9,418**
Farebox Coverage	**72%**	**63%**
Estimated Subsidy / Passenger	$9.70	$14.44

For a service that does not break even, there are a number of areas where the public sector may provide support if the service provides a public benefit, such as reduced congestion on crowded highways accessing LaGuardia Airport.

- Operating assistance

- Direct subsidy - East River Ferry model
- Operating agreement - MTA model for Ossining-Haverstraw ferry service where MTA commissions service for a defined period
- Fuel – Delta Water Shuttle model where Delta provided fuel subsidy for sponsorship

- Non-operating assistance
  - Marketing – Unlike marketing commuter service to a targeted, local audience, the airport access market is broader and would require more extensive marketing efforts and reach to raise awareness that such a service exists. Operators have noted that the City's extensive marketing efforts from NYCEDC and NYC & Company, which included the placement of street banners on major thorough-fares, generated significant awareness of the East River Ferry pilot and contributed to its success. Identifying ferry terminals and their routes and connections on widely-used transportation resources, such as the MTA Subway Map, would help raise awareness of a LaGuardia Airport ferry, as well as other long-term ferry services.
  - Staffing of LaGuardia Airport ferry terminal site – The ferry terminal site should be staffed with personnel to answer questions from passengers, similar to the staffing of the platforms at the AirTrain terminals at JFK, and to assist in coordinating the ferry-bus connection.

Factors that Affect LaGuardia Airport Ferry Demand

There are numerous factors that may affect ferry demand that is not reflected in the forecast analysis above.

- Time of year/ weather. Historical information shows that ridership in winter months may be half the ridership in warmer months.
- Waterfront population growth Manhattan/Brooklyn. Continued residential development on the waterfront and increased use of the East River Ferry may foster a ferry commuter base amenable to using a ferry to LaGuardia Airport.
- Traffic congestion to LaGuardia Airport. Increasing road congestion may lengthen vehicular access times and decrease reliability of those trip times, which may increase the attractiveness of a ferry option.
- Express bus service. New efficient airport access services, such as the limited stop Q70 bus from Jackson Heights/Woodside Queens to LaGuardia Airport, could take some market share away from all modes to LaGuardia Airport, including a ferry. These are likely to be more price sensitive customers.
- Fuel prices/taxi fares/tolling. Increased taxi fares or tolls on East River Bridges would increase cost of taxi and car service options compared to ferry.
- Airport passenger growth and capacity limits on LaGuardia Airport parking (employees and passengers). Continued growth at LaGuardia Airport compared to limitation in parking may increase potential ridership for all airport access modes, including ferry.

- Ferry branding/marketing/advertising. Marketing will be an important for the success of a service as the wide target audience, as some users will not be residents of the New York metropolitan region.
- Operators' suggestion: Adding an amenity to an LaGuardia Airport Ferry Terminal, such as security screening, to avoid lines at terminals could be a highly valued amenity to business travelers and enhance the attractiveness of a ferry option.

LaGuardia Airport Ferry: Conclusions and Next Steps

This analysis regarding the reactivation a LaGuardia Airport ferry service presents five primary conclusions.

- The likely reason for the failure of the prior ferry service was insufficient market reach to other LaGuardia Airport terminals. The Terminal A market was inadequate to support two vessels with hourly service. An inter-terminal connection was never promoted with the ferry service, as it was sponsored by one airline as an added amenity to its aviation shuttle services located in Terminal A.
- For a LaGuardia Airport ferry service to be viable, it must be combined with an attractive and efficient inter-terminal bus connection to attract and serve riders.
- Hourly service with two vessels is estimated to have a positive operating margin and may be self-sustaining without subsidies.
- Service every half hour with four vessels to Bowery Bay has a significantly slimmer profit margin and may not break even with higher fares than the $25 fare modelled.
- If a new ferry landing were to be developed at LaGuardia Airport to accommodate a reactivated service, Bowery Bay is recommended at this point in time. The Flushing Bay terminal option has some clear disadvantages compared to the Bowery Bay site:
  - With a 25% higher operating costs due to longer route distance, a Flushing Bay landing places more financial stress on the service.
  - Additional transit time of 13 minutes per trip yields a smaller ridership market.
  - Given a longer water route, the potential market is limited to only a few stops with the same number of vessels.
  - At an estimated cost of $47 million for the landing, it is three times the capital cost of Bowery Bay.
  - The required dredging and wetland mitigation would lengthen service implementation.
  - While within reasonable walking distance to 47% of the LaGuardia Airport passenger market, it is still insufficient to form the basis of a self-supporting service without an inter-terminal bus.

However, the analysis also illuminates areas for further research needed for next steps on LaGuardia Airport ferry planning. Time and budget considerations in this study precluded conducting a stated preference survey to test a potential ferry to LaGuardia Airport. The data used for the LaGuardia Airport analysis differs from the quality and depth of data used to develop the commutation forecast for the remainder of the Citywide Ferry Study. For commutation, the CFS2013 was able to use a stated-preference survey findings specific to ferries in this region from a recent PANYNJ study. As such, the CFS2013 recommends additional research to guide decision-making as it relates to potential ferry service to LaGuardia Airport. Below are topics worth further examination:

- What are the mode preferences of people getting to and from LaGuardia Airport?
  - Conduct stated preference survey specific for LaGuardia Airport access to gauge attractiveness of ferry option, willingness-to-pay for ferry options, and sensitivity to other service characteristics.
  - Gather data and examine how LaGuardia Airport workers travel to and from the airport.
- What are NYC-specific latent mode preferences to NYC airports?
  - Examine actual revealed preferences towards multi-seat rides for airport access for a mature service. As JFK AirTrain has been in operation for 10 years, with growth that exceeded forecasting estimates, information from actual users on behavior and mode choices could shed light on the attractiveness of various LaGuardia Airport access options.
  - Evaluate the degree to which the amount of baggage carried impacts mode choice for multi-seat ride customers, as baggage use may be changing given airline travel pricing policies.
- What are characteristics of the future competing mode choices?
  - Conduct highway network modeling to examine mode options over time, particularly with a model updated to incorporate the density changes along the waterfront. Taxi access times to LaGuardia Airport are likely to change. A network modeling analysis will provide an improved comparison of airport access mode competition, including faster bus options such as the new limited-stop Q70 service.
- Evaluate LaGuardia Airport inter-terminal transfers, the required frequency of service and appropriate amenity level for travelers.
- Examine if there is opportunity to provide added amenities to a ferry terminal, e.g. TSA security screening.
- With the above data, undergo detailed site evaluation of Bowery Bay versus Flushing Bay. Current ridership modeling is inconclusive as to differences between sites, but operational and capital costs suggest Bowery Bay as the preferred location.

17 APPENDIX 6: Best Practices

Introduction

The 2010 Citywide Ferry Study Appendix A included a review and comparison of four ferry systems across the US and three international systems. The review focused on service profiles, funding, governance, and fare collection and integration. While each ferry system is unique to the individual region, similarities in systems were identified including the requirement for a solid financial foundation, the necessity for public and political support, and the benefit of fare integration with other regional transit systems.

As part of the 2013 update to the Citywide Ferry Study, the same systems from the 2010 study were revisited and additional ferry systems were reviewed to identify best operational practices. Elements of best practices reviewed in this document include operational efficiencies, transit system integration, and environmental practices.

Scope of Review

Operational Efficiencies

Operational efficiencies are actions that allow a ferry to operate at a minimum cruising speed, thereby reducing fuel costs, while still maintaining schedule. Schedules are more easily maintained by operating a route that avoids slow down zones and by reducing maneuvering and landing time. Low-speed transit time efficiencies can be achieved through location and orientation of the pier and vessel moorage. Similarly, the design of the vessel–to-pier interface can affect the time needed for the ferry to approach and be secured to the pier. Additionally, the dwell time at the pier can be minimized through the location of the queuing area in the terminal, adequate ingress and egress paths for unloading and loading passengers simultaneously, and the type of fare collection system, as well as the location of ticket vending machines or a ticket booth within the terminal.

Transit System Integration

Streamlining the connections between different methods of transportation can improve the effectiveness of a regional transit system. This can be achieved through coordinated fare collection systems, improved distribution of scheduling information, and coordination of service schedules.

Environmental Practices

With technological advances and an increasing awareness of environmental issues, communities are looking for better environmental practices in public transportation. The Passenger Vessel Association (PVA) has developed guidelines to assist in implementing better environmental practices in ferry system operations, which include recommendations for back office operations and vessel fuel consumption.

Ferry Systems Reviewed

The East River Ferry system is a passenger-only, privately operated, publicly subsidized system with high commuter ridership. Accordingly, the best practice review of operational efficiencies focuses on similar systems, and specific routes within a system, that have a high percentage of daily commute walk-on ridership. The systems reviewed are listed in Table 17.1.

Table 17.1: System Profiles Reviewed for Operational Efficiencies

Ferry System	Type of Rider	Type of Route	Passengers (Approximate)	Type of Loading
East River Ferry (NY)	Commuter and recreational	One route with 7 stops	3,400 per day	Bow-loading vessels
Staten Island Ferry (NY)	Commuter and recreational	One 5.2 mile route	62,200 per day	Bow loading vessels
Washington State Ferries (WSF) *Bainbridge and Bremerton routes only*	Commuter and recreational	Two routes reviewed for high commuter ridership	11,700 foot passengers per day for both routes	Side loading vessels (for passengers)
King County Water Taxi (WA)	Commuter and recreational	2 routes, both travelling to one hub terminal	1,200 per day	Side loading vessels
Kitsap County Foot Ferry (WA)	Commuter and recreational	2 routes, both travelling to one hub terminal	1,800 per day	Side loading vessels
San Francisco Bay Ferry (CA)	Commuter and recreational	9 routes	13,000 per day	Side loading vessels
Golden Gate Ferry (CA)	Commuter and recreational	2 routes	3,600 per day	Side loading vessels
Vancouver TransLink SeaBus (Vancouver, BC)	Commuter and recreational	One route	9,000 per day	Side loading vessels

In addition to the systems above, the following transit systems were reviewed for best practices in transit system integration and environmental practices:

- Massachusetts Bay Transportation Authority (MTBA)

- Sydney Harbour Ferries in Australia
- Istanbul Fast Ferries, Inc. (iDO) in Turkey
- London River Bus
- The Hong Kong ferry systems

Findings

Operational Efficiencies

Minimizing Cruising Speed

Fuel is a major cost element for all ferry operators and developing routes and processes that use fuel efficiently is critical to successful operations. To maximize fuel efficiency, the portion of the operating schedule spent at the dock should be minimized to allow the ferry to operate as slow as possible to maintain schedule. Procedures that affect dwell time include landing and mooring, passenger loading and off-loading, and ticket sales. In addition, routes that pass through no-wake or slow-down zones require ferries to cruise at higher speeds outside these zones to meet posted schedules. With efficient operating procedures and careful selection and layout of landing sites, fuel consumption can be significantly reduced.

Location of Facilities

The location of the terminal and the vessel moorage relative to open water and navigation channels can impact transit time. The location of the landing at the outer end of the pier reduces the obstacles to navigate when arriving at and departing from the terminal, allowing the ferry to reach cruising speeds quickly. For further time savings, passenger queuing areas should be as close to the pier ends as possible as long as safety can be maintained.

NYC Department of Transportation's Pier 11 and the World Financial Center Terminal are examples of landing configurations that allow the vessels to depart quickly from the terminal with minimal maneuvering time. The King County Water Taxi is another example of a system with landings at the outer end of pier, therefore requiring less maneuvering during departure.

Figure 17. 1: Golden Gate Ferry Larkspur Terminal

Source: Google Images

The Larkspur Ferry Terminal for the Golden Gate Ferry system is an example of reduced efficiency resulting from the location of the terminal. The pier is located at the end of a narrow inlet that runs adjacent to a sensitive wetland, requiring the vessels to operate at low speed over a significant distance for each departure and arrival (refer to Figure 17.1). This configuration results in increased transit time for the route.

Minimizing Crew Activity

A well-designed interface between the vessel and the pier can reduce the time required to align the ferry and terminal embarkation stations and secure the vessel to the pier. The use of pre-tied, fixed-length mooring lines or no mooring lines at all minimizes the time spent by the crew securing the vessel for the safe loading and unloading of passengers.

One example of this vessel/pier connection is the bow-loading system used on the East River and Hudson River ferry landings. The bow-loading vessels approach the dock directly, small wing walls guide the ferry into the correct alignment, and the boarding apron is lowered by the push of a button by the crew. This simplifies the crew effort required compared to more traditional side-loading ferries and terminals that often require manually locating gangways between boats and the landing.

Another example of an automated facility that reduces crew involvement at the dock is the Vancouver TransLink SeaBus. The vessel moors into a U-shape dock with floats on either side. This is a side-load ferry system; however, the shape of the terminal guides the ferry into alignment so the multiple side doors on either side of the vessel match up with the doors in the terminal. The doors on the disembarking side are then opened remotely and once most passengers have gotten off the ferry, the embarking doors on the other side open and those passengers board the ferry. The integrated design of the terminal and vessels makes boarding and disembarking the SeaBus very efficient, and the combination of slip design and automated doors almost entirely eliminates the need for crew members to secure the vessel and manually open doors and bulwark gates to allow passenger to get on and off. It also significantly reduces dwell time, as discussed below.

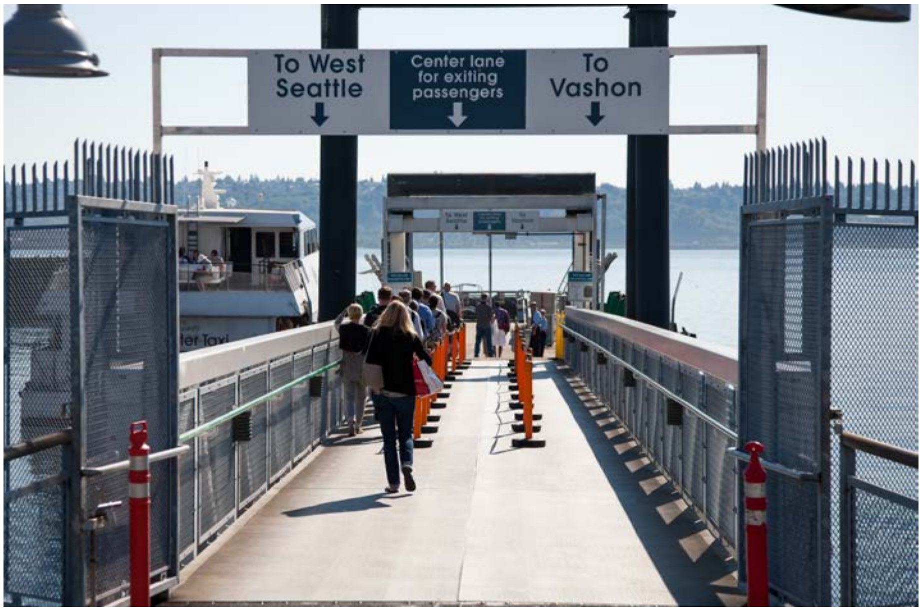
Minimize Dwell Time

Dwell time is the amount of time between a vessel's arrival to the terminal and the vessel's departure. The largest factors for minimizing dwell time include: location of queuing passengers, adequate ingress and egress for loading and unloading passengers, and minimizing fare transaction time.

Location of Queuing

The location of the queuing area for passengers in relation to the vessel can affect the time required for the unloading and loading of passengers. If the queuing area is located far from the vessel, the dwell time will increase due to the additional time required for passengers to walk from the queue to the vessel. Conversely, the closer the queue, the shorter the dwell time. The King County Water Taxi and Kitsap County Foot Ferry provide examples of queuing areas located immediately adjacent to the vessel. In both examples, the pier is also located to minimize transit time, therefore maximizing efficiencies by reducing both transit time and dwell time. Refer to Figure 17.2 for an example of queuing for the King County Water Taxi.

Figure 17.2: King County Water Taxi Queuing



Source: KPFF

Adequate Ingress and Egress Width

Providing adequate ingress and egress width for loading and unloading passenger volumes allows for a higher throughput of passengers and can therefore minimize dwell time. Bow-loading vessels and terminals for boats in New York Harbor generally have loading ramps wide enough to allow 2 or more people to walk abreast when boarding or leaving a ferry. Adequate width for movement of passengers is particularly important for passengers with bicycles and strollers. The 12' wide ramps at the Staten Island Ferry terminals can handle approximately 2,600 people off and on a vessel in eight minutes. The Golden Gate Ferry also provides wide side-loading platforms and loading ramps for quickly loading and unloading passengers.

The Vancouver TransLink SeaBus has four large automated doors on each side of the ferry that allow the loading and unloading of up to 400 passengers in 90 seconds. To achieve this throughput, passengers exit one side of the ferry and board the other side simultaneously.

Minimize Fare Handling by Crew

The location and method of fare collection within the terminal, on the pier, or on the boat can have a large impact on vessel dwell time. Allowing passengers to pay prior to queuing can reduce passenger loading time. Ticket vending machines (TVMs) or booths and a fare-controlled waiting area for paid passengers can speed loading time by eliminating the need for crew members to collect fares.

WSF accepts multiple forms of payment methods, including payment at a ticket booth, TVMs, online ticket purchasing, and accepts the One Regional Card for All (ORCA) regional transportation smart card for payment. All methods of payment are taken prior to passengers proceeding to the waiting area. WSF uses turnstiles to ensure passengers have purchased their tickets. In this example, all fare transactions are completed prior to queuing with payment confirmed through turnstiles. WSF also staffs the terminal to ensure compliance. This method of general queue holding is possible due to the large passenger capacities of the vessels with no risk of overloading.

The Vancouver TransLink SeaBus uses a TVM for all modes of transportation within the City of Vancouver. Upon entering the terminal, passengers purchase their tickets and proceed to the queuing area. The system is not overseen by staff and uses an honor system, with passengers inspected at random by transit police. Using this method of fare collection reduces the time for the ferry crew to monitor payment for each passenger. Refer to Figure 17.3 for an example of the the queuing area at the SeaBus Waterfront Station.

In addition to the TVM fare collection method, NY Waterway has developed a mobile application that allows passengers to purchase tickets prior to their trips. The passengers show the purchased ticket activated on their mobile device to the crew upon boarding. These methods of payment allow passengers to proceed directly to the queuing area and eliminate payment transactions with ticketing agents or machines.

Finally, the Staten Island Ferry completely eliminates any fare collection interaction time as it is a free service.

Figure 17.3: Vancouver TransLink SeaBus Waterfront Station

Source: Jhenifer Pabillano for the TransLink Buzzer blog

Transit System Integration

Connections to Land Transit

Connectivity to land based transit systems is an important component to the success of a ferry system. Most successful ferry systems have terminals located in areas with easy access to bus service. Some systems have coordinated schedules so passengers have a quick transfer to their next mode of transportation. Coordination reduces overall trip time for a commuter and in many cases, creates a competitive commute time to alternative, competing modes. An example of coordinated scheduling, the Vancouver TransLink SeaBus coordinates ferry arrivals with the public bus schedule. Other examples of connections and coordination with land transit are the Hudson and East River ferries, which offer free shuttles to inland destinations, as well as the King County Water Taxi which provides a free shuttle for passengers in addition to connecting to public bus service.

For cities with a subway or rail system, locating and integrating ferry service with other transit services provides even greater connectivity for passengers. The Staten Island Ferry Whitehall and St. George terminals, Vancouver TransLink SeaBus Waterfront Station, the Hong Kong-Maccau Ferry Terminal, and Sydney's Circular Quay Ferry Warf terminals all serve as transportation hubs with connections to rail and bus service within the terminal. This kind of transit integration provides passengers a variety of modes and ease of mode transition during their commute. Clear wayfinding through signage further aids both commuter and recreational riders.

Fare Integration

Because ferries cannot serve stops beyond the waterfront, many riders will need to arrive at or depart from a ferry terminal using another mode of transit. By integrating the ferry fare and fare collection system with other services used by riders, using a ferry will be easier for riders and the fare collection can be simplified. In addition, with an integrated fare system, riders can easily switch modes in response to changes in personal schedules or large scale events like transit strikes or major disasters. Fare integration has been a key element of the success of other ferry systems in becoming a vital part of their regional transportation system.

Fare integration can be accomplished through transfers, magnetized "smart" tickets like MetroCards, flash passes, or regional multi-agency fare cards like ORCA, Oyster, or Clipper cards. One of the greatest challenges to any of these is determining how to share the collected fare for a given trip between the multiple agencies that a single rider may use and establishing the associated back office accounting protocols.

Many regional cards, passes or tickets offer discounts for transfers, which can provide an additional incentive to ride a ferry. An example of a transfer incentive is the ORCA (One Regional Card for All) card used in Washington State's Puget Sound region which can be used to transfer the full value of the fare paid up to two hours after the fare is paid, if the transfer is more, the passenger pays the difference.

Many transit agencies provide fare cards with magnetic strips that can store a desired value on the card and be used on different modes of public transportation. One example of this is the Metropolitan Transportation Authority (MTA) that has an integrated fare collection system using the MetroCard, accepted on New York City Transit services, the Port Authority of New York and New Jersey's PATH and AirTrain services, several local bus services in Westchester and Nassau counties and several other operations[48]. This allows passengers to easily transfer between various modes of transportation and only use one card. Additionally, passengers can receive free or discounted transfers between modes using the same card.

[48] As one of the earliest smart fare payment systems, the MetroCard is now reaching the end of its useful life; local news widely reported the MTA's announcement in early 2014 that Metrocard would be too costly to maintain beyond 2019. With the expected change in fare payment throughout most of the city's transit system, the city's ferry projects are well positioned to participate in upcoming changes or pilot projects for new fare payment mechanisms.

Smart cards can be electronically loaded with stored rides or a designated stored value amount, with most systems allowing for smart cards to be managed by the passengers electronically. The cards can also be synced with a debit or credit card to deduct payment when used at an appropriate machine. For example, the Octopus card in Hong Kong can be reloaded with cash, through TVMs, or can be synced with a credit card. The smart cards are validated through an electronic card reader prior to boarding that allows for minimal to no crew involvement in the payment system.

The use of smart cards within a regional transit system can streamline transfers and provides more flexibility for passengers by managing their accounts online. The ORCA card can be used between rail, bus, and ferry systems. The San Francisco Bay Ferry and Golden Gate Ferry accept the Clipper card between multiple public transportation systems. Additionally, the Octopus card in Hong Kong has been in use since 1997 and can be used for transportation, leisure activities, and retail. Similarly, the several rail lines in Japan sell cards that can also be used at vending machines with train stations and participating retail locations. The smart card eliminates the need to purchase multiple tickets and facilitates fast transfers between transportation methods.

The use of a standardized ticketing method across a region simplifies the use of public transportation for passengers with easier, potentially incentivized transfers and more control of their method of payment. Additionally, a unified regional ticketing method improves ferry operations through reducing the opportunity for fare evasion and streamlining the infrastructure (TVMs or card readers) required to collect tickets. Further, a single card for multiple rides saves time for the rider, who only has to make one transaction, and reduces costs for the agencies, by reducing the number of TVMs and other point-of-sale locations required. As noted previously, use of a single card or fare across multiple agencies requires additional negotiations and more complicated accounting protocols.

Access to Information

Passengers are better able to manage their commute with up-to-date information regarding ferry arrival and departure times. Both “push” and “pull” channels can be used to provide riders with information. “Push” channels include Twitter fees and automated email and text messaging services that send information to riders who have signed up. “Pull” channels provide information through web sites or mobile apps that riders can access when they’re looking for information.

Other Ferry service providers rely on social media (including twitter) and text messaging for travel alerts and notifications to subscribers. This immediate access to information allows passengers to plan their commute accordingly. Electronic message boards also provide current travel information to those passengers at transit facilities without mobile access to the internet. The positive impact of real-time information about vessel arrival times has direct analogs in surface transit, but has not been explored for ferry transit. The use of social media sites for public announcements also engages the community in programmatic changes to ferry systems.

Mobile applications have been developed by both transit agencies and independent third-party developers. Apps developed in-house can access vehicle location and estimated arrival information directly from in-house data feeds. Third-party apps either take publicly available data and make it more user friendly or are given access to agency data feeds. Staten Island Ferry, MBTA, WSF, San Francisco Ferries, Vancouver TransLink, Sydney Ferries, Hong Kong Ferries, and London River Bus all provide mobile applications for real-time arrival and departure information and travel alerts for both ferries and land based public transportation connections.

This kind of information has come to be expected by the consumer and provides passengers with the opportunity to better manage their commute, associated transit connections, and to better understand their regional transit system.

Environmental Practices

Best practices for ferry operations also include implementing sustainable, environmental practices. According to the PVA, there are a variety of ways for both vessel operations and back office operations of ferry service to be more environmentally friendly. To encourage operators to reduce their impact, PVA has started the PVA Waters program, which helps vessel operators implement green business practices.

In addition to green practices for office operations, vessels can incorporate sustainable practices by modifying the power source or fuel source of the fleet, modifying operations for fuel efficiencies, and managing on-board utilities.

Alternative fuels for ferries, including natural gas and biodiesel, are being used on a trial basis by ferry operators around the world, as are hybrid diesel-electric systems. Currently, US Coast Guard regulations are being developed for liquefied natural gas (LNG) and several US operators, including the Staten Island Ferry, are in the process of designing LNG propulsion systems to be retrofitted into existing large passenger-vehicle ferries. Although LNG ferries have significantly lower emissions, the size of the fuel tanks and complexity of the associated fuel management system make its use on small, high-speed passenger-only ferries challenging.

Biodiesel has also been tested by ferry operators with mixed results. While the test ferries were able to operate successfully, the lubricity characteristics of biodiesel required other fuel additives be used to reduce maintenance costs. The higher cost of biodiesel also affects is viability for ferry operators.

San Francisco Ferries added two new ultra low sulfur diesel vessels to their fleet. The ultra-low sulfur diesel can reduce the sulfur content and other pollutants in the air emissions from the ferries but ultra-low sulfur fuel does not have the same lubrication properties as low sulfur fuel, which can cause maintenance issues. Generally, these issues have been overcome and the use of ultra-low sulfur diesel is expected to expand.

As vessels are replaced or repowered, EPA regulations require cleaner engines to be used, with four tiers of regulations coming into force over time. Tier 1 includes all diesel engines produced before any EPA regulations had been published. Tiers 2 through 4 have increasingly strict requirements for allowable pollutants in the engine exhaust. Some operators in NY Harbor have been repowering vessels with Tier 3 engines ahead of the regulatory schedule.

Diesel-electric and electric propulsion systems have been developed for ferries but these technologies are still in a demonstration phase. Electric-only propulsion systems so far have only been used on low speed ferries operating on schedules the provide enough dwell time to recharge the batteries. As the energy density of batteries increases and recharging technology improves, electric medium- and high-speed ferries may become viable but this is not expected to occur in the near term.

Other practices include adjusting the vessel speed for fuel efficiency (discussed earlier), upgrading terminal and vessel lighting with LED and other low-energy fixtures, recycling, implementing water conservation measures, compliance with the Environmental Protection Agency's "Vessel General Permit for Discharges Incidental to the Normal Operation of a Vessel," and regular maintenance on the vessels.

Conclusions

In comparison to ferry services in other regions, ferry operators in the New York City region are collectively relatively efficient, easy to ride, and environmentally conscious. Each ferry service has unique operating practices that have been developed to suit its particular market, with common goals of maximizing ridership and minimizing costs.

In general, bow-loading vessels have proven to be more efficient at unloading and loading passengers, particularly for shorter routes where minimizing dwell time is critical. Additionally, this configuration allows for less maneuvering near the terminal which has benefits for fuel use and wake mitigation.

Ticket sales and fare collection have evolved as ferry operators take advantage of new technology, including ticket vending machines, mobile apps, and online tools. This has made it easier for riders to use the ferries and reduced the cost of transactions for the ferry operators. Fare integration with other regional transit agencies has been a challenge that has not yet been resolved but should be a goal as ferry service expands.

Ferry operators have also successfully taken advantage of technology to provide better real-time information to riders. As these technologies continue to develop, ferry operators should implement improvements that other, larger transit providers have proven to be effective.

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18 APPENDIX 7: Vessel Operating Costs

Background

The vessel operating cost model was developed to support an economic assessment of new ferry routes. The initial unit values used were developed independently and then compared to data provided for the existing East River Ferry service. Based on this review, modifications were made to the model to more accurately reflect the cost of the type of ferry service being analyzed in this study.

This cost model includes only those costs directly associated with vessel operations; it does not include ancillary costs such as shuttle buses, terminal agents, or landing fees. These costs are calculated separately for inclusion in the overall system cost model.

Vessel Types

Private ferry fleet and routes were assessed to define typical vessel types that are likely to serve the new routes identified as part of this study. The vessels assessed range from small monohulls carrying less than 100 passengers cruising at less than 20 miles per hour to large catamarans carrying over 400 passengers at over 30 miles per hour. These vessels serve routes that vary in length from less than one mile to over 20 miles. From this analysis, five different vessel types were identified for the purposes of developing typical hourly operating costs. The general characteristics of these five types are listed in Table 1.

Table 18.1: Vessel Type General Characteristics

Type	Description	Passengers	Crew	Length (ft)	Cruise Speed (mph)	Installed Power (hp)
A	Small Monohull	100	2	65	24	1,800
B	Large Monohull	400	5	90	12	1,350
C	Small Catamaran	80	2	55	18	1,200
D	Medium Catamaran (Slow)	149	3	80	15	2,500
E	Medium Catamaran (Medium)	149	3	80	20	2,500
F	Medium Catamaran (Fast)	149	3	80	25	2,500
G	Large Catamaran	400	5	140	32	8,000

In reviewing current private ferry operations, it was noted that the vessels used on two of the most productive routes (Paulus Hook to WFC and Hoboken NJT to WFC) are served by the same class of vessel that serves several substantially longer routes. However, on the shorter routes these vessels operate at a lower speed. This is the result of two important factors affecting vessel selection: minimizing operating speed to save on fuel costs and maximizing fleet commonality to minimize maintenance costs. Because these vessel are of the same class, but operated differently, they are identified as "Medium Catamaran (Slow)" and "Medium Catamaran (Fast)". An additional category of "Medium Catamaran (Medium)" was also added to address vessels of this class operating at speeds of around 20 miles per hour.

Within the range of speeds seen in the private ferry fleet, fuel consumption, measured in gallons per hour, increases at a rate faster than vessel speed. Because the Paulus Hook to WFC and Hoboken/NJT to WFC routes are so short in distance, a fast cruising speed is not necessary to make the trip competitive with other modes in terms of travel time. The short length of the route also limits the benefits that can be gained with a faster cruising speed, since a 5 mile per hour increase in speed would save less than a minute in travel time but add significantly to fuel consumption. For the longer routes, higher speeds and therefore shorter travel times are necessary to attract riders from other modes of travel. However, this additional vessel speed requires more fuel and adds substantially to operating costs.

The other factor, fleet commonality, drives maintenance costs down by limiting the systems and parts maintenance personnel work with. This commonality limits the variety of consumables and spare parts that must be kept in stock. It also requires maintenance personnel to be familiar with a small variety of engines and propulsion systems. This maintenance savings is also the reason some operators use the same make and model of engine in almost all of their vessels, powering high-speed vessels with three or four of the common make and model rather than one or two larger engines.

Route Profiles

For this study, a typical route profile was developed for each vessel type, based on similar existing private ferry routes. Analysis of the current routes indicates that the shorter routes are generally served by slower vessels and the longest routes are served by the fastest vessels. As discussed above, this is generally due to competitive travel times and fuel consumption considerations. The typical route characteristics for each of the five vessel types are shown in Table 18.2.

Table 18.2: Typical Route Characteristics

Type	Description	Route Length (miles)	Cruising Time (minutes)	Maneuvering Time (minutes)	Idle Time @ Dock (minutes)	One-Way Total Time
A	Small Monohull	3.00	7.2	2.6	2.0	11.9
B	Large Monohull	1.50	5.8	2.6	4.0	12.4
C	Small Catamaran	2.60	7.5	2.6	2.0	12.1
D	Medium Catamaran (Slow)	1.50	4.6	2.6	4.0	11.2
E	Medium Catamaran (Medium)	8.00	23.0	2.6	4.0	29.6
F	Medium Catamaran (Fast)	15.00	35.2	2.6	4.0	41.8
G	Large Catamaran	21.50	39.7	2.6	5.0	47.3

Operating Costs

Fuel

Fuel costs are estimated based on the total installed horsepower, with the assumption that the stated installed power represents the maximum continuous rating (MCR) for the engines with stated service speeds achieved at 85% of the MCR. Most modern marine engines typically consume approximately 0.05 gallons per hour per horsepower, which is the factor used to estimate fuel consumption. As an example, if a vessel is reported to have 1,000 total installed horsepower, it is assumed that 850 horsepower is required at its service speed, which corresponds to burning 42.5 gallons per hour.

To account for typical operating profiles, each route was divided into three operating modes: cruising, maneuvering, and "pushing" the dock[49]. For this study, maneuvering was assumed to require 40% of the power required at cruising speed and "pushing" was assumed to require 25% of cruise power. These assumptions were combined with the route length to develop an estimate of the total fuel consumed over the course of a typical one-way run.

[49] "Pushing" the dock refers the practice of keeping the propulsors (propeller or waterjet) engaged to push the ferry into the boarding slip, rather than holding it in place with mooring lines. This is the standard practice for the bow loading ferries on the Hudson River and East River.

Labor

Private ferries carrying 150 passengers or less typically sail with a crew consisting of one master and one or two deck hands, depending on passenger capacity, vessel configuration, and operating route. For the existing East River Ferry, the crew includes an extra deck hand to open and close the boarding gates at the upper end of the gangways. Larger vessels may also carry an engineer, although all of the vessels in the private ferry fleet are operating with unmanned engine rooms.

The licensing requirements for masters of larger and/or faster vessels are more stringent than those for smaller vessels. Therefore, the master's hourly rate varies accordingly. Deckhand wages are more consistent across vessel sizes and types, with higher wages paid to more senior deckhands on vessels with larger crews.

Out-Of-Service Labor

In addition to the time spent while operating the vessel in service, deck crews also spend time before and after service to properly operate and maintain the vessels. Prior to service, the crew warm up the engines and preparing for the day's operations. After service, crews go through shut-down procedures and spend time on light maintenance such as oil changes, and cleaning. Combined, these activities are assumed to add one hour to each seven hours of operation.

Machinery Maintenance

In general, machinery maintenance costs are higher for larger engines. These costs can be estimated by comparing fuel consumed. The costs covered by this estimate include lubricating oil, filters and other consumable materials, labor other than that provided by the deck crews, and shipyard work.

Hull Maintenance & Haulout

The vessels used in ferry service in New York harbor generally undergo dry docking and inspections on a annual basis to maintain their Certificate of Inspection. This cost is primarily related to the length of the hull. The costs in this estimate include painting, maintenance of the interior outfit and furnishings, and the labor associated with this work.

Lease or Depreciation

The lease or depreciation cost captures the cost of acquiring the assets (vessel) needed for the service. This cost is proportional to the value of the vessel which is most closely related to the vessel's length. However, this cost is also affected by the size of the propulsion plant, as measured by horsepower, and the level of outfit and furnishings. The rate used in the cost model was developed based on data provided for the current East River Ferry service and the assumption that each vessel is operated for approximately 3,000 hours per year or 60 hours per week.

Insurance, Administration, and Overhead

Insurance, administration, and overhead costs vary significantly from operator to operator and will account for a significant portion of a new operator's budget. Existing operators will see only marginal increases in each of these costs as new routes are implemented, due to economies of scale. However, new, stand-alone operators will have to allocate these costs to a smaller operating base, thereby making them a major concern and large portion of a start-up budget. Because the costs estimates developed as part of this study are intended primarily to make potential operators aware of the costs implications of starting new services, these three costs have been grouped together and are calculated as a percentage of the sum of all other cost elements.

Insurance

Insurance costs for ferry operations fall into three categories: comprehensive hull and machinery insurance; liability insurance; and Jones Act insurance (maritime worker's compensation insurance). Hull and machinery insurance premiums are based on replacement value. Liability insurance premiums are based primarily on the total number of passengers carried by the operator per year (not just the number carried on the route in question). Jones Act insurance premiums are based on the total number of maritime workers employed (not just those employed on a specific route). As a result, it is very difficult to develop an accurate estimate of the annual cost of insurance premiums without more specific information about the vessel and intended service.

Insurance for liability and Jones Act will only increase marginally after certain thresholds or breakpoints are reached in ridership counts and the number of employees. As a result, larger operators will see proportionately small increases in insurance costs as ridership and staff size grow, while increasing ridership and staff will incur large proportional insurance cost increases for new and small operators, until their growth reaches significant break points.

Administration

Administrative costs include human resources, ticketing, vessel management, marketing, accounting, and all of the other shore-based activities necessary to successfully operate a ferry service. As with insurance, administrative costs for a new, stand-alone operation can be significant, whereas the marginal administrative cost for a current operator to start a new route would be almost negligible.

Overhead

The costs of moorage, office space, supplies, uniforms, etc. are also an important element of ferry operations. Overhead costs are affected by fleet size, staff size, the number of passengers carried, and market rates.

Hourly Cost Estimates

The unit costs and cost factors for each cost element discussed above are shown in Table 3. These factors are based on information available at the time of the report and can readily be updated as more specific information becomes available.

Table 18.3: Unit Costs and Factors

Cost Element	Cost	Description
Fuel	$3.10	per gallon
Deckhands	$15.00	per hour
Labor Overhead	30%	of direct labor cost
Out-of-Service Labor	12.50%	of labor cost
Machinery Maintenance	10.00%	of fuel costs
Hull Maintenance	$0.25	$ per foot per operating hour
Administration, Insurance, and Overhead	30.00%	of direct costs
Lease Cost / Depreciation	$0.65	$ per foot per operating hour

Based on the factors discussed above, typical hourly operating costs estimates were developed for the five vessel classes and typical route profiles defined previously. These estimates are intended to be used for initial route evaluations and comparisons only. When specific routes are identified, more refined annual operating costs estimates should be developed based on the planned operating schedule, anticipated annual ridership, and whether the new route will be operated by a new (small) organization or be part of a larger fleet. The typical hourly costs are provided in The CFS2013 included the following components of operating costs:

- Fuel costs
- Labor (including out-of-service labor)
- Maintenance (including hull maintenance and haul out)
- Lease or depreciation
- Insurance, administration, and overhead

Based on the factors discussed above, typical hourly operating costs estimates were developed for the five vessel classes and typical route profiles defined previously. These estimates are intended to be used for initial route evaluations and comparisons only. When specific routes are identified, more refined annual operating costs estimates should be developed based on the planned operating schedule, anticipated annual ridership, and whether the new route will be operated by a new (small) organization or be part of a larger fleet. The typical hourly costs are provided in APPENDIX 7, and the operating models used costs for a Medium Catamaran operating at Medium speeds (Vessel Type E, $570 per hour) as the default operating scenario assumed in the CFS2013's analysis.

below:

Table 18.4: Hourly Operating Costs

Type	Description	Fuel	Labor	Machinery & Hull Maintenance	Lease Cost	Admin / Insurance / Overhead	Total Hourly Cost
A	Small Monohull	$176	$56	$34	$42	$80	$388
B	Large Monohull	$112	$123	$34	$59	$81	$408
C	Small Catamaran	$118	$56	$26	$36	$60	$295
D	Medium Catamaran (Slow)	$136	$116	$34	$52	$86	$423
E	Medium Catamaran (Medium)	$239	$116	$44	$52	$120	$570
F	Medium Catamaran (Fast)	$298	$116	$50	$52	$139	$654
G	Large Catamaran	$935	$183	$129	$91	$374	$1,711

Initial Route Evaluations

Based on the hourly operating costs derived from the operating cost model, the one-way cost for a large number of point-to-point ferry routes was estimated. For the purpose of the initial route evaluation, the assumed vessel was a 150 passenger catamaran, operating at a speed appropriate for each specific route. For each route, the total one-way trip time was calculated based on dwell time at the origin, maneuvering time at each end of the route, and cruising time between terminals. The total travel time was then multiplied by the hourly cost to get a one-way cost.

The cruising speed assumed for each route reflects the trade-off between reducing travel time with a faster cruising speed and the increased cost of fuel resulting from the higher cruising speed. The relationship between route length and speed was as follows:

- Routes less than 2 miles: 15 mph cruising speed
- Routes between 2 miles and 10 miles: 20 mph cruising speed
- Routes greater than 10 miles: 25 mph cruising speed.

These cruising speeds were estimated based on the published schedules for existing services in New York Harbor. They do not reflect low-wake, slow-down zones or reduced speeds that may be necessary in areas of heavy traffic. A maneuvering speed of eight miles per hour was assumed over the distance between the landing and open water for each terminal.

Final Route Evaluations

For each of the six routes selected for a more detailed evaluation, a more detailed analysis was done to reflect the specific operating profile for each route. A similar approach was taken to estimate the cost of service to two different landing sites at LaGuardia International Airport.

Because several of the selected routes serve multiple stops separated by runs of varying distances, fuel consumption was calculated for each leg of each route, including the dwell time at each landing.

For this study, a one-way trip was assumed to start when the ferry departed from the originating terminal and end when it departed the final destination. A three minute dwell time was assumed for each stop on the route. The total one-way travel time was used to calculate labor costs.

Maintenance, lease, administration, insurance, and overhead costs were calculated using the same factors developed for the general cost model. The estimated costs do not include shuttle busses, terminal agents, or landing fees.

Table 18.5: Selected Route One-Way Costs

Route #	Description	One-Way Time	One-Way Cost
1	Bay Ridge – Van Brunt – Pier 6 – Pier 11	30 minutes	$247
2	E. 34th St – LIC North – RI South – Astoria Cove	24 minutes	$188
3a	Pier 11 – E. 62nd St. – E. 90th St. – Soundview	45 minutes	$430
3b	Pier 11 – E. 62nd St. – E. 90th St.	27 minutes	$248
4	Pier 11 – Grand St. – E. 23rd St. – E. 34th St.	27 minutes	$217
5	St. George – Pier 79	27 minutes	$285
6	Beach 108th St. – Brooklyn Army Terminal – Pier 11	60 minutes	$633
	LGA (Bowery Bay / Marine Air Terminal)	55 minutes	$454
	LGA (Flushing Bay / Terminal D)	65 minutes	$573

19 APPENDIX 8: Capital Costs

The tables below represent a summary of detailed cost estimation completed for various sites in the context of CFS2013. The team produced planning level estimates for the construction of the needed infrastructure improvements for study sites that were incorporated into each proposed route. The estimates for new infrastructure include upland amenities which encompass shelters, benches, bike racks and ticketing machines.

Summary

Route	Site Name	Assumptions/Comments	Project Cost
1	Van Brunt Street	Assume replace existing float and gangway and reuse existing pier.	$4.85M
1	Bay Ridge	Assume 25'x20' bump-out for gangway on existing pier.	$5.47M
2	Astoria Cove	Assume 50'x20' access pier required.	$7.16M
2	RI South	Assume 30'x20' pier to accommodate gangway running parallel to shoreline.	$7.15M
2	LIC North	Assume 25'x20' bump-out for gangway on existing pier.	$5.55M
3/3a	Soundview	Assume no dredging and lengthened pier (250'x20').	$9.27M
3/3a	E 62nd Street	Assume 30'x20' pier to accommodate gangway running parallel to shoreline.	$7.34M
4	E 23rd Street	Assume new 30'x20' pier off existing L-shaped pier.	$6.08M
4	Grand Street	Assume 30'x20' access pier required.	$5.84M
5	St. George	Assume 30'x20' extension of existing pier required.	$5.35M
6	Beach 116th Street	Assume new 30'x20' access pier adjacent to existing pier. Note that Marine Parkway Bridge has a vertical clearance underneath of 55 feet, in the lowered position, which is adequate for a ferry.	$5.49M

Van Brunt Street Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (existing)**	SF	0	$300	$0
E	**Bulkhead Work & Stabilization**	LS	0	$0	$0
F	**Pier Railing**	LF	0	$750	$0
G	**Corrosion Protection**	LS	1	$25,000	$25,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	0	$0	$0
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$500,000	$500,000
P	**Environmental Mitigation**	LS	1	$75,000	$75,000
	SUBTOTAL				$2,780,000
		Construction Contingency		(15%)	$417,000
		Construction Subtotal			**$3,197,000**
		Construction Total[4]			**$3,197,000**
		Design Engineering		(15%)	$479,550
		Environmental/Permitting		(10%)	$319,700
		Construction Supervision & Inspections		(20%)	$639,400
		Design & Management Subtotal			$1,438,650
		Design & Management Contingency		(15%)	$215,797.50
		Design & Management Total			**$1,654,447.50**
		TOTAL			$4,850,000

NOTES:

1. Assumed float and gangway are replaced to improve ADA accessibility. Further field invetigation and survey could determine this is unecessary. Also assume no dredging is required due to an existing ferry currently operating at the site.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered (no canopy).
7. All costs are in 2013 dollars.

Bay Ridge Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$25,000	$25,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier Bump-out (25' x 20') w/ steel piles, CIP conc. cap & precast conc. deck panels**[1]	SF	500	$350	$175,000
E	**Bulkhead Work & Stabilization**	LS	0	$0	$0
F	**Pier Railing**	LF	60	$750	$45,000
G	**Corrosion Protection**	LS	1	$35,000	$35,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles**[2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	0	$0	$0
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$600,000	$600,000
P	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$3,135,000
		Construction Contingency		(15%)	$470,250
		Construction Subtotal			**$3,605,250**
		Construction Total[4]			**$3,605,250**
		Design Engineering		(15%)	$540,788
		Environmental/Permitting		(10%)	$360,525
		Construction Supervision & Inspections		(20%)	$721,050
		Design & Management Subtotal			$1,622,363
		Design & Management Contingency		(15%)	$243,354
		Design & Management Total			$1,865,717
		TOTAL			$5,470,000

NOTES:

1. To streamline permitting, assume no dredging.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

Astoria Cove Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (50' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	1,000	$300	$300,000
E	**Bulkhead Work & Stabilization**	LS	1	$150,000	$150,000
F	**Pier Railing**	LF	60	$750	$45,000
G	**Corrosion Protection**	LS	1	$50,000	$50,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	1,500	$120	$180,000
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$600,000	$600,000
P	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$3,630,000
		Construction Contingency		(15%)	$544,500
		Construction Subtotal			**$4,174,500**
		Construction Total[4]			**$4,719,000**
		Design Engineering		(15%)	$707,850
		Environmental/Permitting		(10%)	$471,900
		Construction Supervision & Inspections		(20%)	$943,800
		Design & Management Subtotal			$2,123,550
		Design & Management Contingency		(15%)	$318,533
		Design & Management Total			$2,442,083
		TOTAL			$7,160,000

NOTES:

1. To streamline permitting, assume float is 125 feet from shore (50-foot pier plus 75-foot gangway) and minor dredging. Could potentially reduce length/cost of pier and/or dredging if bathymetric survey indicates that water depths are adequate for ferry operation closer to shore than assummed.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

Roosevelt Island South Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	600	$300	$180,000
E	**Bulkhead Work & Stabilization**	LS	1	$100,000	$100,000
F	**Pier Railing**	LF	70	$750	$53,000
G	**Corrosion Protection**	LS	1	$25,000	$25,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$550	$1,485,000
J	**Protection Dolphins (Protect float from adjacent navigation)**	EA	2	$300,000	$600,000
K	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
L	**Dredging**	CY	0	$0	$0
M	**Soil Borings**	EA	2	$25,000	$50,000
N	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
O	**Ticket Vending Machine**	EA	1	$50,000	$50,000
P	**Supporting Infrastructure**[3]	LS	1	$700,000	$700,000
Q	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$4,098,000
		Construction Contingency		(15%)	$614,700
		Construction Subtotal			**$4,712,700**
		Construction Total[4]			**$4,712,700**
		Design Engineering		(15%)	$706,905
		Environmental/Permitting		(10%)	$471,270
		Construction Supervision & Inspections		(20%)	$942,540
		Design & Management Subtotal			$2,120,715
		Design & Management Contingency		(15%)	$318,107
		Design & Management Total			$2,438,822
		TOTAL			$7,150,000

NOTES:

1. To streamline permitting, assume no dredging.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. Float cost incereased to account for deep water. (Gangway assumed 8-foot clear, 10-foot out-to-out dimensio
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

Long Island City North Landing Site

				TOTAL COST	
ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$25,000	$25,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier Bump-out (25' x 20') w/ steel piles, CIP conc. cap & precast conc. deck panels**[1]	SF	500	$300	$150,000
E	**Bulkhead Work & Stabilization**	LS	0	$25,000	$0
F	**Pier Railing**	LF	60	$750	$45,000
G	**Corrosion Protection**	LS	1	$25,000	$25,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	1,500	$120	$180,000
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$500,000	$500,000
P	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$3,180,000
		Construction Contingency		(15%)	$477,000
		Construction Subtotal			**$3,657,000**
		Construction Total[4]			**$3,657,000**
		Design Engineering		(15%)	$548,550
		Environmental/Permitting		(10%)	$365,700
		Construction Supervision & Inspections		(20%)	$731,400
		Design & Management Subtotal			$1,645,650
		Design & Management Contingency		(15%)	$246,848
		Design & Management Total			$1,892,498
		TOTAL			$5,550,000

NOTES:

1. To streamline permitting, assume minor dredging.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

Soundview Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (250' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	5,000	$300	$1,500,000
E	**Bulkhead Work & Stabilization**	LS	1	$50,000	$50,000
F	**Pier Railing**	LF	510	$750	$383,000
G	**Corrosion Protection**	LS	1	$100,000	$100,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	0	$0	$0
L	**Soil Borings**	EA	4	$25,000	$100,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$800,000	$800,000
P	**Environmental Mitigation**	LS	1	$250,000	$250,000
	SUBTOTAL				$5,313,000
		Construction Contingency		(15%)	$796,950
		Construction Subtotal			**$6,109,950**
		Construction Total[4]			**$6,109,950**
		Design Engineering		(15%)	$916,493
		Environmental/Permitting		(10%)	$610,995
		Construction Supervision & Inspections		(20%)	$1,221,990
		Design & Management Subtotal			$2,749,478
		Design & Management Contingency		(15%)	$412,422
		Design & Management Total			$3,161,899
		TOTAL			$9,270,000

NOTES:

1. To streamline permitting, assume no dredging. Could potentially reduce length/cost of pier if bathymetric survey indicates that water depths are adequate for ferry operation closer to shore than assummed.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, transit stop improvements and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

E 62nd Street Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$75,000	$75,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	600	$300	$180,000
E	**Bulkhead Work & Stabilization**	LS	1	$50,000	$50,000
F	**Pier Railing**	LF	70	$750	$53,000
G	**Corrosion Protection**	LS	1	$25,000	$25,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$600	$1,620,000
J	**Protection Dolphins (Protect float from adjacent navigation)**	EA	2	$300,000	$600,000
K	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
L	**Dredging**	CY	0	$0	$0
M	**Soil Borings**	EA	2	$25,000	$50,000
N	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
O	**Ticket Vending Machine**	EA	1	$50,000	$50,000
P	**Supporting Infrastructure**[3]	LS	1	$700,000	$700,000
Q	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$4,208,000
		Construction Contingency		(15%)	$631,200
		Construction Subtotal			**$4,839,200**
		Construction Total[4]			**$4,839,200**
		Design Engineering		(15%)	$725,880
		Environmental/Permitting		(10%)	$483,920
		Construction Supervision & Inspections		(20%)	$967,840
		Design & Management Subtotal			$2,177,640
		Design & Management Contingency		(15%)	$326,646
		Design & Management Total			$2,504,286
		TOTAL			$7,340,000

NOTES:

1. To streamline permitting, assume no dredging.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. Float cost increased to account for deep water. Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels[1]
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

E 23rd Street Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$25,000	$25,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	600	$300	$180,000
E	**Bulkhead Work & Stabilization**	LS	0	$0	$0
F	**Pier Railing**	LF	70	$750	$53,000
G	**Corrosion Protection**	LS	1	$35,000	$35,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	3,000	$120	$360,000
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$500,000	$500,000
P	**Environmental Mitigation**	LS	1	$200,000	$200,000
	SUBTOTAL				$3,483,000

Construction Contingency	(15%)	$522,450
Construction Subtotal		**$4,005,450**
Construction Total[4]		**$4,005,450**
Design Engineering	(15%)	$600,818
Environmental/Permitting	(10%)	$400,545
Construction Supervision & Inspections	(20%)	$801,090
Design & Management Subtotal		$1,802,453
Design & Management Contingency	(15%)	$270,368
Design & Management Total		$2,072,820
TOTAL		$6,080,000

NOTES:

1. To streamline permitting, assume minor dredging. Assume new pier extending to south from existing L-shaped pier at marina.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

Grand Street Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	600	$300	$180,000
E	**Bulkhead Work & Stabilization**	LS	1	$50,000	$50,000
F	**Pier Railing**	LF	70	$750	$53,000
G	**Corrosion Protection**	LS	1	$25,000	$25,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$550	$1,485,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	0	$0	$0
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$600,000	$600,000
P	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$3,348,000
		Construction Contingency		(15%)	$502,200
		Construction Subtotal			**$3,850,200**
		Construction Total[4]			**$3,850,200**
		Design Engineering		(15%)	$577,530
		Environmental/Permitting		(10%)	$385,020
		Construction Supervision & Inspections		(20%)	$770,040
		Design & Management Subtotal			$1,732,590
		Design & Management Contingency		(15%)	$259,889
		Design & Management Total			$1,992,479
		TOTAL			$5,840,000

NOTES:

1. Not used
2. Float and gangway dimensions based on Greenpoint Ferry Landing. Float cost increased to account for deep water. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

St. George Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	600	$300	$180,000
E	**Bulkhead Work & Stabilization**	LS	0	$0	$0
F	**Pier Railing**	LF	70	$750	$53,000
G	**Corrosion Protection**	LS	1	$25,000	$25,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	0	$0	$0
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$500,000	$500,000
P	**Environmental Mitigation**	LS	1	$125,000	$125,000
	SUBTOTAL				$3,063,000
		Construction Contingency		(15%)	$459,450
		Construction Subtotal			**$3,522,450**
		Construction Total[4]			**$3,522,450**
		Design Engineering		(15%)	$528,368
		Environmental/Permitting		(10%)	$352,245
		Construction Supervision & Inspections		(20%)	$704,490
		Design & Management Subtotal			$1,585,103
		Design & Management Contingency		(15%)	$237,765
		Design & Management Total			$1,822,868
		TOTAL			$5,350,000

NOTES:

1. To streamline permitting, assume no dredging with a 30'x20' pier extension.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

Beach 116th Street Landing Site

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY	TOTAL COST UNIT PRICE	TOTAL COST AMOUNT
A	**Contractor Mobilization/Demobilization**	LS	1	$100,000	$100,000
B	**Site Preparation & Demolition**	LS	1	$50,000	$50,000
C	**General Provisions**	LS	1	$200,000	$200,000
D	**Pier (30' x 20') w/ steel piles, CIP concrete cap & precast concrete deck panels**[1]	SF	600	$300	$180,000
E	**Bulkhead Work & Stabilization**	LS	1	$50,000	$50,000
F	**Pier Railing**	LF	70	$750	$53,000
G	**Corrosion Protection**	LS	1	$35,000	$35,000
H	**Gangway (75' x 10')**[2]	SF	750	$200	$150,000
I	**Double Bow Loader Slip Float (90' x 30') w/ two gangplank ramps, fenders & guidepiles** [2]	SF	2,700	$500	$1,350,000
J	**Passenger Shelters (16' x 4')**	EA	3	$60,000	$180,000
K	**Dredging**	CY	0	$0	$0
L	**Soil Borings**	EA	2	$25,000	$50,000
M	**Kiosk/Signage/Wayfinding**	LS	1	$50,000	$50,000
N	**Ticket Vending Machine**	EA	1	$50,000	$50,000
O	**Supporting Infrastructure**[3]	LS	1	$500,000	$500,000
P	**Environmental Mitigation**	LS	1	$150,000	$150,000
	SUBTOTAL				$3,148,000
		Construction Contingency		(15%)	$472,200
		Construction Subtotal			**$3,620,200**
		Construction Total[4]			**$3,620,200**
		Design Engineering		(15%)	$543,030
		Environmental/Permitting		(10%)	$362,020
		Construction Supervision & Inspections		(20%)	$724,040
		Design & Management Subtotal			$1,629,090
		Design & Management Contingency		(15%)	$244,364
		Design & Management Total			$1,873,454
		TOTAL			$5,490,000

NOTES:

1. Assume no dredging required. New pier adjacent to existing pier.
2. Float and gangway dimensions based on Greenpoint Ferry Landing. (Gangway assumed 8-foot clear, 10-foot out-to-out dimension)
3. Supporting infrastructure accounts for items not yet designed including lighting, data, security cameras, security gates, mooring dolphin (if required), refreshed paving at shore, and benches.
4. Total amount paid to construction contractor contingency.
5. Procurement is assumed as Design/Bid/Build.
6. Pier, gangway and float are uncovered. (No canopy)
7. All costs are in 2013 dollars.

20 APPENDIX 9: Regional Vessel Inventory

Vessel Name	Passenger Capacity	Length	Beam	Year Built	Estimated Replace/ Repower Year	Cruise Speed	Maximum Speed	Total Installed HP	Engine Model
BILLEYBEY FERRY CO.									
Douglas B Garian	97	64.9	17.5	2001	2021	24	28	1,800	3406E x 3
Enduring Freedom	97	64.9	17.5	2002	2022	24	28	1,800	3406E x 3
Father Mychal Judge	97	64.9	17.5	2001	2021	24	28	1,800	3406E x 3
Fred V. Morrone	97	64.9	17.5	2002	2022	24	28	1,800	3406E x 3
Brooklyn	149	78.5	28.4	2002	2022	24	28	2,400	3406E x 4
Christopher Columbus	149	78.5	28.4	2000	2020	24	28	2,400	3406E x 4
Fiorella Laguardia	149	78.5	28.4	1999	2019	24	28	2,400	3406E x 4
Frank Sinatra	149	78.5	28.4	1999	2019	24	28	2,400	3406E x 4
Hoboken	149	78.5	28.4	2002	2022	24	28	2,400	3406E x 4
Peter Weiss	149	78.5	28.4	2001	2021	24	28	2,400	3406E x 4
Senator Frank Lautenberg	149	78.5	28.4	2002	2022	24	28	2,400	3406E x 4
Yogi Berra	149	78.5	28.4	1999	2019	24	28	2,400	3406E x 4
Empire State	399	92.0	24.0	1993	2014	12	15	1,430	C18 x 2
Garden State	399	92.0	24.0	1994	2014	12	15	1,430	C18 x 2
John Stevens	399	92.0	24.0	1996	2013	12	15	1,430	C18 x 2
York	149	69.0	25.7	2010	2030	16	19	1,200	C18 x 2
Jersey	149	69.0	25.7	2010	2030	16	19	1,200	C18 x 2
NY WATER TAXI									
Curt Berger	74	53.3	18.3	2002	2022	24	25	1,200	Series 60 x 2
Ed Rogowsky	149	53.3	18.3	2002	2022	24	25	1,200	Series 60 x 2
John Keith	74	53.3	18.3	2002	2022	24	25	1,200	Series 60 x 2
Michael Mann	74	53.3	18.3	2003	2023	24	25	1,200	Series 60 x 2
Mickey Murphy	74	53.3	18.3	2003	2023	24	25	1,200	Series 60 x 2
Schuyler Meyer, Jr.	74	53.3	18.3	2003	2023	24	25	1,200	Series 60 x 2
Gene Flatow	74	53.3	18.3	2003	2023	24	25	1,200	Series 60 x 2
Seymour B. Durst	149	72.0	27.0	2005	2025	25	26	1,600	QSA19-M
Marian S Heiskell	149	72.0	27.0	2005	2025	25	26	1,600	QSA19-M
Sam Holmes	149	72.0	27.0	2005	2025	25	26	1,600	QSA19-M
NY WATERWAY									
Austin Tobin	97	64.9	17.5	2001	2021	24	28	1,800	3406E x 3
Moira Smith	97	64.9	17.5	2001	2021	24	28	1,800	3406E x 3
Admiral Richard E. Bennis	149	78.5	28.4	2003	2023	24	28	2,400	3406E x 4
Bayonne	149	78.5	28.4	2003	2023	24	28	2,400	3406E x 4
Governor Thomas B. Kean	149	42.1	28.4	2002	2022	24	28	2,400	3406E x 4
Jersey City	149	78.5	28.5	2003	2023	24	28	2,400	3406E x 4
Robert Roe	149	78.5	28.5	2003	2023	24	28	2,400	3406E x 4
Capt. Mark Summers	146	62.0	20.0	1989	2009	12	15	1,160	3406E x 2
Port Imperial New Jersey	399	94.6	24.0	1988	2008	12	15	1,430	C18 X 2
Bravest	350	114.1	32.8	1996	2016	28	30	5,400	16V396 x 2
Finest	350	114.1	32.8	1996	2016	28	30	5,400	16V396 x 2
Henry Hudson	399	92.0	24.0	1992	2012	12	15	1,340	C18 X 2
Robert Fulton	399	92.0	24.0	1993	2013	12	15	1,340	C18 X 2
Thomas Jefferson	399	87.3	24.0	1989	2009	12	15	1,430	C18 X 2
Abraham Lincoln	399	87.3	24.0	1989	2009	12	15	1,430	C18 X 2
Alexander Hamilton	399	87.3	24.0	1989	2009	12	15	1,430	C18 X 2
George Washington	399	87.3	24.0	1989	2009	12	15	1,430	C18 X 2
Port Imperial Manhattan	399	87.3	24.4	1987	2007	12	15	1,500	3412E x 2
SEASTREAK									
New Jersey	396	141.0	34.3	2001	2021	32	40	7,500	KTA50-M2 x 4
New York	396	141.0	34.3	2001	2021	32	40	7,500	KTA50-M2 x 4
Wall Street	396	141.0	34.3	2003	2023	32	40	7,000	16V4000 x 2
Highlands	396	141.0	34.3	2004	2024	32	40	7,500	KTA50-M2 x 4
Whaling City Express	149	82.0	28.0	2004	2024	28	30	2,720	16V2000 x 2
Martha's Vineyard Express	149	82.0	28.0	2005	2025	28	30	2,720	16V2000 x 2
Ocean State	149	65.0	24.0	2003	2023	27	29	2,100	12V2000 x 2

Vessel Name	Passenger Capacity	Length	Beam	Year Built	Estimated Replace/ Repower Year	Cruise Speed	Maximu m Speed	Total Installed HP	Engine Model
Hornblower									
Hornblower NY									
Hornblower Hybrid	600	168.0	40.0	1996	2026	8	10	1,400	Scania DI16
Hornblower Infinity	1000	207.0	45.0	1991	2021	6	8	1,500	Cat 3412
Hornblower Serenity	450	145.0	31.0	1985	2015	11	13	950	MTU Series 60
John James Audubon	517	124.0	32.0	1982	2012	8	9	730	Cat 3408
Liberty Landing Ferry					30				
Little Lady	68	46.0	17.4	1999	2029	8	11	700	Cat 3106
Little Lady II	128	65.0	22.0	2007	2037	12	15	800	Cat 3406
Statue Cruises									
Bay State	473	110.0	27.1	1976	2006	9	11	700	Cat 343
Freedom	431	117.0	23.0	1967	1997	11	13	856	Detroit 1271
Lady Liberty	870	152.0	32.8	1964	1994	11	13	1,200	Cat C18
Miss Ellis Island	689	132.0	32.6	1991	2021	11	13	1,200	Cat C18
Miss Freedom	564	128.0	27.0	1977	2007	10	12	900	Cat C18
Miss Gateway	439	128.0	27.6	1982	2012	12	14	1,200	Cat C18
Miss Liberty	800	128.0	32.5	1954	1984	10	11	916	Cummins KTA-19
Miss New Jersey	689	132.0	32.6	1991	2021	11	13	1,200	Cat C18
Miss New York	690	132.0	32.6	1993	2023	11	13	1,200	Cat C18
Statue of Liberty V	800	135.0	34.6	1977	2007	11	13	2,200	Cat 399
Tom Palladino									
American Princess	250	95.0		1988		20		11,000	1xSeries 60, 2xCats
Captain Lou**	150	80.0		1991		20			
Princess Skyline**	400	100.0		1985		10			
Star Stream**	150	110.0		1990		20		3,000	

The vessel inventory was compiled from the best available information including the 2008 and 2010 National Census of Ferry Operators (NCFO) database, the New York State Energy Research and Development Authority (NYSERDA) September 2006 Report: NYC Private Ferry Fleet Emissions Reduction Technology Study and Demonstration, and current operator's web sites.

* Diesel oxidation catalyst installed on one more more engines
** Chartered on an as-needed basis

21 APPENDIX 10: Ferry Wake and Vessel Surge Policy Discussion

Introduction

The team investigated ferry wake and vessel surge issues and possible policy approaches in association with future expansion of the City's ferry system. Wake and surge concerns were identified in outreach efforts conducted in conjunction with the ferry study.

The wake and surge investigation first determined generally accepted definitions for "wake" and "surge":

- Wake was defined by stakeholders as the waves emanating from the ferry vessel as it passes through the water.
- In this context, surge was defined by stakeholders as the large swell of water (also known as draw-down) produced by large ships as they pass by pushing their way through the water.

Wakes in New York Harbor

Surge from a large ship

Over the course of its involvement in ferry planning and operations, NYCEDC has heard feedback from a variety of marine and waterfront stakeholders regarding the importance of wakes and surge and potential conflicts between different stakeholder needs and waterfront infrastructure and operations. The top concerns and issues prompting further research in these matters are as follows:

- Ferry wakes can potentially impact nearby sensitive shorelines, including:
  - Unprotected shorelines and beaches.
  - Small boats moored in marinas or launched from park landings.
- Ferry wakes can impact stability of other ferries during the loading of passengers as they pass by ferries docked at ferry landings, particularly, side-loading ferries may be most affected.
- Ferry wakes can potentially affect the comfort and navigation of nearby marine traffic -- either directly, or through wave reflection off of hardened shorelines and bulkheads.
- Surge from passing large ships can affect ferry landings and the ability of operators to load passengers, particularly, side-loading ferries may be most affected.

Today, ferry service largely occurs in the busiest sections of New York's harbor. In these areas, shorelines are generally already mitigated for protection from weather and vessel wakes. Even so, there is an ongoing discussion in the maritime community concerning wake impacts as steps are made to address problem areas. Expansion of ferry service to new routes and more remote locations within the network of waterways surrounding New York City may create an increased potential for vessel wake and surge concerns in more constricted areas, or areas with less existing shore protection.

Wake and Surge Investigation

To inform this technical memo, maritime and ferry industry representatives and academic research experts were consulted. These experts were queried on their perspectives of the wake and surge concerns and the range of options available to address the issues.

The following groups and individuals with expertise were consulted:

- New York & New Jersey Harbor Safety and Operations Steering Committee. (Includes U.S. Coast Guard, U.S. Army Corps of Engineers, Port Authority of New

York & New Jersey, the New Jersey Department of Transportation, NYCEDC, and several major harbor stakeholders and maritime operators.)

- Dr. Thomas Herrington, Stevens Institute of Technology.
- Jessica Fain, Planner in the Waterfront and Open Space Division of the New York City Department of Planning.
- Christian Stark, Director of Engineering and Maintenance for Golden Gate Ferries (GGF), a division of the Golden Gate Bridge Highway and Transportation District.

Five ways to address the potential for wake and surge issues were identified in this investigation:

- Operational approaches, such as slowing the vessel down to a no wake speed.
- Ferry landing design.
- Technology solutions, such as specialized vessel design.
- Ferry services procurement – include a "Wake Management Plan".
- Development of new marinas and small boat landings should include protection from wakes.

Operational Approaches to Wake Mitigation

Generally, the outreach to industry found that most agreed that vessel wakes in the New York Harbor area are an on-going concern. The group agreed that, at least initially, operational approaches were the most practical. Operational approaches to mitigating wake impacts were considered by those consulted as generally well understood, and achievable with today's fleet of vessels.

One example of an operational solution for mitigating wakes that was brought up by a couple of sources has to do with a ferry's approach to the ferry landing. If the ferry makes a large sweeping turn approaching the landing, and initiates its slowdown after turning from the main channel, a wave can propagate forward toward shore as the boat settles down in the water from reduced speed. To mitigate this condition, the ferry vessel can first slow down in the main channel while facing parallel to shore. This causes the wave cast by the ferry to propagate in the main channel parallel to shore, thus allowing the wave to dissipate with less effect.

Some experts pointed out that contrary to some perceptions ferries can actually produce less wake at cruising speed than at slower speeds. While not a universal, this can be true for some vessels.

There was caution advised by all parties that operational solutions can be difficult to enforce.

Ferry Landing Design

Design implications are discussed in more detail later in this technical memo. Generally, the location and orientation of ferry slips at a landing can be optimized to encourage operators to maneuver the ferry in a manner creating fewer wake issues.

There was somewhat less consensus on surge issues (surge being the impact of waves following the passage of a large ship). The effect of surge has been brought up with NYCEDC in different venues and there was at least agreement amongst those consulted that it should be considered in the development of a new ferry landing located such that conditions resulting in surge impacts may occur. These conditions are most likely found in constricted waterways, such as small coves or creeks, which are immediately adjacent to shipping channels for large ships.

Surge can affect ferries loading passengers at the dock. The ferry can rock from the surge, and it can become necessary to suspend the passenger loading process. Bow-loading ferries are generally able to better withstand the rocking motion from surge, as they power the bow into the float's fender system during passenger loading. Side-loading ferries sometimes power into their mooring lines to steady the boat from rocking motion caused by wakes or surge. In such cases, the mooring hardware on both the side-loading ferry and the boarding float must be designed to withstand the forces of powering the ferry into the mooring lines.

Technology

Wake issues have arisen as a concern for a number of ferry operators nationally and internationally. In response, technology solutions and vessel design practice has been studied extensively. Technology solutions, such as optimized vessel hull and propulsion system design, to reduce wakes certainly show promise. Over the course of the past 20+ years, the design and construction of low wake ferries has become increasingly understood.

In most cases, the application of technology and special vessel design has occurred with publicly owned ferry vessels. Generally, private operators have shied away from specially designed low wake vessels. Typically, the process first involves study of the appropriate low wake criteria — that is, determining just how "low" of a wake is required for the particular application. In essence, low wake vessels have been custom designed for a particular route. Once the wake criteria are established, then vessels are publically procured through a Request for Proposals (RFP) process, where the shipyard makes commitments to deliver a vessel meeting the low wake criteria — amongst other factors. Design analysis and other documentation are provided to the owner during vessel construction, and a testing occurs according to protocols established in the procurement contract prior to acceptance of the vessel.

The Water Emergency Transportation Authority (WETA), the public ferry authority in San Francisco, utilized a process similar to that described above to develop their low wake ferries. WETA owns its low wake vessels, but provides ferry service through contracts with private operators.

New York's ferry system currently relies on private ownership of ferry vessels. If analysis of a new route indicates a potential for wake concerns, a low wake vessel design may require investigation. Initially, it may prove challenging for the private sector to embark on the design and construction of specialized, low wake ferries without a well-defined plan for cost recovery. Passenger vessels in the size and configuration used for New York's ferries typically achieve a life span of approximately twenty-five years before major renovation or replacement would occur. Therefore, decisions made in a ferry vessel's initial development have long term implications in order for the vessel to achieve its full life expectancy without expensive overhaul. Given a model of private vessel ownership and the long term implications for new vessel construction, a movement toward higher use of technology could entail the need for longer term public commitments to encourage private investment in long term solutions employing technology. If the City elects to pursue a low wake ferry under the current model of private ownership of the ferry vessels, special attention will be necessary in the contract language included in procurement of ferry services in order to facilitate development of proposals addressing the costs of low wake design.

The following steps and questions are outlined in an effort to advise the ferry operators in New York on the use of low wake technology. Secondary benefits, including reduced fuel consumption and reduced emissions, would likely result from a more efficient hull form and propulsion system that would emerge as technology takes a more important role in the design of new vessels utilized in New York's future ferry fleet.

- Apply low wake design where appropriate. Below are some key considerations::
  - What is the impact of wake issues compared with the cost of developing low-wake vessels?
  - Which routes should be considered for low wake technology?
  - How is vessel performance tested and verified to meet wake criteria?
  -
  - Who develops the criteria for vessel wake mitigation? Is this entity responsible if vessel design fails to mitigate wake?
  - What happens if the public or private sector constructs a new vessel and it fails testing?
- How are the additional vessel design costs (e.g., for Computational Fluid Dynamics (CFD) and/or model testing needed to optimize hull form) recovered by the private sector for vessel optimization for low wake? That is, how does the private owner amortize these costs specific to a New York ferry in their proposal for ferry services?

If these fundamental questions can be answered, the City can look forward to achieving the benefits of technology over the long term.

Wake Management Plan

A "wake management plan" describes how operators would address the potential for wake impacts as part of their proposal for ferry services. Operators would outline how they propose to employ a combination of operational strategies (e.g., vessel slowdowns in sensitive areas), and technology (e.g., vessel hull form and/or propulsion system) to ensure wake impacts are adequately addressed. In this way, the City can evaluate the overall proposal in terms of meeting a variety of objectives along with reducing the likelihood of wake-related problems occurring.

Marina Development

Several parties contacted as part of the outreach efforts noted that development of small boat marinas should include sufficient wave protection against waves generated by storms and wakes generated by harbor traffic. It was pointed out that New Jersey recently updated their Coastal Zone Management regulations to strengthen requirements for wave barriers when new marinas are developed. The City of New York may benefit from a review of marina development standards to verify adequate safeguards are in place.

Review of Vessel Generated Wave Studies

Ship and ferry-generated wakes present an established concern in New York's waterways. Future expansion of ferry service will require additional consideration of wake and surge concerns along routes and at ferry landings. As additional guidance, ferry wake research and case studies were reviewed as part of this investigation to provide a national and international background on the relevant issues.

Rich Passage: Washington State Ferry Wake Experience

One of the most problematic wake conditions are found in Rich Passage on Puget Sound in Washington State. Large auto ferries have served the route between Seattle and Bremerton for almost 100 years. The route requires passage through the constricted Rich Passage, which involves an elongated S turn. The auto ferries travel at a speed of 16 and 22 knots, depending on the class of vessel, and the entire trip takes one hour. Although some classes of auto ferries were troubled with wake concerns on the Rich Passage route, the auto service has generally been successful.

Because the Seattle to Bremerton route has a relatively long crossing time of 60 minutes, and is heavily used by commuters destined for the Navy's shipyard in Bremerton, a strong desire emerged for high speed passenger-only ferries that could reduce the one-way trip time to 30 to 40 minutes.

High speed, passenger-only ferry service between Seattle and Bremerton began in 1985 utilizing a 250 passenger catamaran ferry, the MV Tyee. It wasn't long before the service was challenged on the grounds of shoreline damage due to wakes. By the early 1990's WSF began a program to design high speed, low wake ferries for the route, and two specialized boats were built in 1998 and 1999. The new ferries carried 350 passengers and offered a service speed of up to 38 knots. These "low wake" ferries were also challenged for damages caused by their wakes, which ultimately resulted in a multi-million dollar legal settlement with beachfront property owners. Also as a result of the legal challenge, the expensive, high speed ferries were required to slow down to a low wake speed through Rich Passage, thus negating their speed advantage. Finally Washington State terminated the passenger–only service in 2006, and later sold the ferries as surplus to the Golden Gate Bridge Highway and Transportation District.

Still, high speed ferry service was highly desired and Kitsap Transit and other Bremerton area stakeholders were able to secure a series of federal grants to support development of yet another high speed craft capable for navigating Rich Passage at speed. That vessel, christened the Rich Passage 1, was developed as an "ultra-low wake" design, constructed for very low weight, carrying less than half the passengers than prior fast ferries on the route (only 116 passengers), and using smart technology to adjust the vessel's operation through the water. The Rich Passage 1 provided service between 2010 and 2012 utilizing research grant funds, but currently is not in operation.

A number of studies of ferry wakes in Rich passage have been prepared over the years. The studies evaluated wave energy in Rich Passage, focusing on the effect of waves generated by passenger only fast ferry (POFF) on unprotected beaches along the narrow passage of the ferry route. A number of studies of Rich Passage have resulted in a significant data collection effort including utilization of pressure sensing wave gauges, acoustic surface tracking, and sediment tracers to see the movement of sediment and beach topographic data.

It was determined that vessels will operate at this site at speeds greater than 34 knots and ideally greater than 37 knots, and if this is not possible, they should operate at speeds less than 12 knots. Operation within these speed requirements, avoids vessel speeds when wake generation is maximum, and maintains the vessel speeds at the optimal speed producing minimum wake generation. Although the study concluded that some areas are more impacted than others depending on their position with respect to the route track, the impact on the beach morphology as a consequence of the ferry wakes were much smaller than impacts caused by natural forces (wind waves and tidal currents).

Other Ferry Wake Studies

The Field and Laboratory Investigation of High-Speed Ferry Wake Impacts in New York Harbor, led by Stevens University in 2002, identified wave characteristics and patterns in relation to ferry wakes. Wakes are defined in terms of wave height and wave energy. The study showed that ferry wakes are the source of a large portion of wave energy in the region, with the highest influence during the weekday rush hours. Field observations revealed that sharp turns during a transition phase have pronounced effects in producing high wave energy toward the inside of the turn. Additionally, the most damaging wakes (in terms of height) were found to occur at low speed during the transition from low-speed displacement mode to planing mode as well as during particular turning maneuvers. Ferry wakes were longer than wakes of much larger, slow-moving vessels operating in the harbor. The efficiency of hulls also was shown in the field and in the laboratory to have significant effects on wake height and energy.

The Bedford/Halifax Fast Ferry Cultivation Study in 2005 indicated wake wash characteristics specific to high speed craft. While there is a general agreement that faster vessel produce greater wakes, it has been shown to be untrue for high speed craft. All high speed craft exhibit “hump speed,” or the speed at which wake wash generation is the highest. The hump speed of high speed craft vary depending on hull type, and typically is about 15-18 knots. Fast Ferries are designed to have lower wakes at high speeds. Consequently, a slower speed does not necessarily lessen the wake.

Wake studies done in the port of Hamburg, Germany, concluded that ship-induced waves were causing significant riverbank erosion on the River Elbe in unprotected areas and damage in shoreline structures. Ship-wave data was collected using permanent stations equipped with LOG_aLevel acoustic wave measuring stations that work autonomously and independently and transfer data remotely. The measuring device is above the water in a platform, and not exposed to potential damage from traffic. The study results indicated that different vessel types produced very different wave responses. For example, catamaran-high speed ferries (traveling at 31.3 knots) produce exclusively secondary waves (wakes) but primary waves and draw-down (surge) hardly occur. On the other hand, large vessels (Post Panamax container ship) traveling at 15 knots produce very deep draw-down (up to 0.4 m) with a duration of 1.2 – 1.3 minutes and very significant secondary waves that can exceed one meter of amplitude. The Hamburg studies indicate that in New York Harbor, location and design of ferry landings near constrained waterways with large ships operating in higher speed regimes (10 knots+) should consider the surge and draw down effects.

Conclusions

This investigation determined that the most feasible wake and surge management strategies in the short term are likely operational approaches such as vessel slowdowns in critical areas. It would be financially infeasible to replace New York’s ferry fleet on a wholesale basis to employ technology solutions and many of the existing ferry routes may not require low wake technologies.

Because New York City partners with the private sector on delivering ferry service and has not purchased special vessels for the East River service, employing technology on existing services over the short run could prove challenging. However, as new services are well established, the private sector may achieve some benefit by utilizing low wake ferries for certain routes. The low wake ferries may be able to operate without the slow downs, thus allowing shortened trip times, more crossings per day per vessel, resulting in a smaller fleet and reduced operational costs. More efficient, low wake ferries will likely burn less fuel and offer reduced emissions. Therefore, over the long term, technology is expected to play an increasing role in management of wake and surge issues.

The national and international experience with utilizing technology to reduce ferry wakes has not been without pitfalls. Any pursuit of a technological solution must be carefully considered and studied to avoid the problems in applying vessel technology encountered by others.

Pursuit of technology as a long term solution to reduce the impacts of ferry wakes is encouraged. To accomplish this end will require a continued planning dialogue determining the ferry routes that would most benefit from low wake technologies and the necessary low wake design criteria that would be required. Vessel procurement strategies addressing adequate assurance of success and the needs of the private sector for cost recovery will require further investigation.

Surge issues were determined to primarily surround constricted waterways and were not likely a major concern in the main channels such as the Hudson River, or even in much of the East River. The Hudson's width makes it less susceptible to the effects of surge and the current in the East River can also reduce the impacts of surge. However, more constricted waterways, such as a small cove or creek, may feel the effects of surge – but only if located nearby the shipping lanes. Therefore, the potential for surge problems should be a consideration in the design of ferry landings planned for constricted waterways located near shipping lanes for large ships.

Finally, it was confirmed that the City's initiatives to improve resiliency of shorelines work in harmony with expanded ferry service.

Ferry Landing Design Implications

It was also determined in this investigation that ferry landing design is important and design guidance addressing the potential for wake and surge issues should be investigated further.

As background, the location of a ferry landing is highly influenced by landside access and the ability to provide an attractive travel option for potential passengers. A ferry service cannot sustain itself without sufficient ridership demand. Therefore, the general area designated to locate a ferry landing is determined by local population, employment, and other services generating travel demand (e.g., schools, hospitals, sports stadiums, parks), and the availability of competing travel services (e.g., rail and bus transit). Congestion on competing transportation services can also induce ferry ridership. Secondary factors such as the availability of waterfront property are a major factor in locating a ferry landing. Once these factors are weighed, it will then be necessary to determine the best design compromise.

To address the potential for wake and surge concerns, the design of ferry landings should consider the following factors to ensure the issues are identified early on and can be mitigated appropriately.

- Wake assessment of the ferry route serving a new ferry landing.
  - Proposed ferry routes should be screened for the potential for ferry wake concerns. Routes travelling through constricted channels or nearby sensitive shorelines (e.g., unprotected natural beaches, small boat landings or marinas) should be evaluated for the potential of ferry wake concerns. If the evaluation shows the potential for affecting sensitive shorelines, further analysis should be conducted to determine whether mitigation strategies are warranted or feasible.

- Ferry landings planned for constricted waterways (e.g., narrow channels, small coves, creeks or harbors) that are also close to shipping lanes for large ships should be evaluated for the potential of surge effects.
- In areas near sensitive shorelines (e.g., unprotected shorelines, boat landings or marinas) consider locating the boarding float further from shore at the end of an access pier.
- Optimize orientation of the ferry slips relative to the main channel and to shore.
  - To reduce wake impacts on the shoreline or adjacent sensitive waterfront developments (such as marinas), when feasible, consider orienting the ferry slips perpendicular to the main channel to improve navigation access and encourage operators to approach on a perpendicular path rather than a sweeping turn.
  - In locations that experience exposure to high currents and/or the effects of wind, waves or wakes from harbor traffic, consider orienting the slips parallel to shore, or in two directions to assist the operator in landing the ferry under varying conditions and holding the vessel on station while passengers are loading.
- If side-loading slips are provided at a ferry landing, consider strengthening mooring hardware to account for side-loading ferries powering into their mooring lines to steady the ferry when subjected to wakes and surge.

Naturally, each strategy outlined above must be weighed against other factors affecting the ferry landing design.

For example, locating a float and the ferry slips further from shore may well reduce wake impacts on an unprotected beach by providing greater separation. Locating the ferries further from shore may also offer secondary benefits such as: a reduced need for dredging, reduced noise for nearby residents, and it could lessen the impact that waiting ferry passengers impose on public access to the shoreline (by moving waiting ferry passengers out on to the access pier). Additionally locating the float further from shore may make access from the water easier and could offer the ferry captain more maneuvering room to turn the ferry on arrival or departure. However consequences might include reduced ADA accessibility by increasing the distance travelled between transportation modes, higher costs for a larger pier, and greater exposure to weather for passengers waiting out over the water. Similarly, the float structure and ferries might be exposed to more waves and wakes at a location further from shore — increasing the engineering challenges and possibly disrupting ferry service during inclement weather. Each factor should be evaluated in an overall context such that the best design solution can be found.

Wake and Surge Feedback Summary

Several experts in the field of maritime and ferry operations, vessel wakes and shoreline management were consulted as part of this investigation to gather their expertise for consideration by the City in management of ferry wake and surge concerns. Those consultations are summarized below.

New York and New Jersey Harbor Operations & Safety (Ops) Committee

A presentation on the topic of ferry wake and large vessel surge was provided at the March 5, 2014 meeting of the New York & New Jersey Harbor Safety and Operations Steering Committee. The “Harbor Ops” committee is made up of representatives of the U.S. Coast Guard, Army Corps of Engineers, Port Authority of New York & New Jersey, the New Jersey Department of Transportation, NYCEDC, and several major harbor stakeholders and maritime operators.

The group had received a handout prior to the meeting outlining NYCEDC’s Citywide Ferry Study 2013 and the potential for expanding ferry service in the future (see appendix). The handout discussed questions pertaining to ferry wake and vessel surge issues.

NYCEDC outlined for the committee that their Citywide Ferry Study 2013 supports the potential addition of several new routes to the City’s ferry system, primarily in relation to the East River service. NYCEDC stated that the purpose of the Harbor Ops meeting agenda item was to solicit input on ferry wake and vessel surge/wake issues that should be examined as further studies of ferry service expansion progress.

Moffatt & Nichol (M&N) clarified the definition of wake and surge and asked the group for its concurrence to ensure consistency by participants.

Wakes were described as the group of waves that can be seen coming off the ferries as they move through the water. Wakes can be created by the ferries, but are also created by other vessels, large and small, operating in the harbor. M&N outlined typical wake issues, including:

- Wake impacts of one vessel passing the other and affecting safe navigation;
- Wakes striking a sensitive shoreline (e.g., unprotected shorelines or marinas);
- Wakes striking ferry landings and affecting the passenger loading activities of other ferry vessels.

Surge was described as the large volume swell of water that can come off the large ships as they pass by. M&N described the swell as “long period” waves. One committee member outlined an example of surge effects by describing circumstances at Lemon Creek on Staten Island, were surge from large vessels can sometimes rush in and flood the creek’s basin, and then rush out, emptying the creek — grounding some small vessels in the process.

The group felt the Hudson River traffic is generally close to the middle of the channel and the effects of ferry wakes are therefore reduced — as waves attenuate on their own over distance. However, it was also noted that during rush hour on the Hudson, wakes from all directions sometimes produce “washing machine” conditions.

It was mentioned that the wake and surge issue is not just a ferry problem, but an infrastructure problem as well. An infrastructure problem in that shorelines hardened to protect from storms and vessel wakes may also reflect wakes rather than absorb them like a soft shoreline might. Especially in hardened areas, boat wakes can reflect off of bulkheaded shorelines. The question as to what can be done so wakes can diffuse was raised. Some thought in certain cases, the removal of unnecessary bulkheads may help reduce the incidence of reflected waves and allow vessel created wakes to dissipate.

It was noted that there is a misconception that slowing down the ferries can reduce wakes. Especially for small ferries, the wakes may actually diminish when vessels are going faster. It was mentioned this is not necessarily the case for the larger ferries.

Some noted that vessel traffic in the Hudson and East rivers has been reduced from the past, and that the marinas came after the existing traffic pattern existed. In some cases, the marinas were not designed to adequately address the wake conditions they faced.

The group affirmed that wakes from all vessels, not just ferries, are already an issue in the harbor and the full effect will have to be considered in study of future ferry routes.

It was clarified that mitigation of wakes may not be able to include operational solutions for the existing commercial marine traffic. For example, the group described a tug bucking the current which must maintain its speed to maintain steerage and provide for safe navigation. Other commercial vessels operate under similar parameters.

However, the issue of operational solutions might be available to ferry operators. For example, the ferry should maintain a course that includes a more perpendicular approach from the channel to shore at the ferry landings versus a long sweeping turn into the ferry landing, which might throw a wake at the shoreline.

A study might also include assessment of the routes and the ferry landings. The routes could be examined to determine when a slowdown is merited in the route to mitigate impacts. During the design of future ferry landings, engineers and planners should consider impacts from harbor traffic and surge from large passing vessels.

The new Coastal Zone Management (CZM) regulations in New Jersey were mentioned as a good guidance document because these regulations updated best practices for protecting the shoreline. (The new regulations were reviewed and seemed most applicable to marina design and providing protection for moored small boats.)

It was mentioned that in some occasions environmental regulations have hampered the possibility of implementing solutions to reduce wake impact in marinas (that is, wave attenuation measures in marinas).

It was suggested that shoreline development regulations could be more performance-based and less prescriptive. In other words, let the marina owner engineer their solution and as long as the protection and environmental goals are met, let that be the solution.

A study of the impact of softening the shoreline edges (e.g., removing unnecessary bulkheads) and evaluation the potential improvements in wake dissipation was discussed.

The group emphasized that all waterfront developments, (not just ferries) should be designed to fit into the existing community.

Stevens Institute of Technology, Dr. Thomas Herrington

The Stevens Institute of Technology is a private research university located in Hoboken, New Jersey. The Davidson Laboratory is the Stevens Institute of Technology's marine research lab.

Dr. Thomas Herrington is a faculty member of the Davidson Laboratory and the Director of the Stevens – NOAA New Jersey Sea Grant Cooperative Extension. He prepared the *New Jersey Wake Mitigation Study* in March 2010 and has spent a portion of his career studying wakes of ferry vessels in the New York Metro Area, including monohulls and catamarans[50]. Based on his studies of ferry wakes, Dr. Herrington shared some of the wake characteristics typical of the ferries operating on the Hudson and East Rivers, including the transition from planning speeds to displacement speeds.[51]

He explained that when ferries slow down and transition from planing to displacement mode, the bow pushes a wave out in front of the vessel. The bow wave push comes from the boat settling back down in the water after riding on top during planing operations. Dr. Herrington identified an operational solution to this problem. Like the Harbor Operations Committee, he recommends that a ferry approach parallel to the channel, resulting in less wake being "pushed" toward shore. Conversely, if the ferry turns from the channel toward shore, and then slows down, more of the vessel's wake will reach shore. However, he mentioned that operational procedures can sometimes be difficult to enforce.

Dr. Herrington also identified the two most significant wake impacts: 1) wakes striking an unprotected shoreline and/or 2) wakes striking unprotected marinas with small boats moored. He recommended that new marinas be designed with proper protection from vessel wakes. He noted that this usually means some kind of "wave screen" (physical wall or breakwater). He mentioned that floating breakwaters are

[50] Monohulls are single hull vessel, and Catamarans are twin hull vessels.

[51] Ferries operate in "displacement" mode at speeds where the vessel pushes through the water. "Planing" mode occurs when the vessel achieves enough speed where hydrodynamic forces cause the ferry to rise up in the water and partially ride on top of the water (sometimes termed as "getting over the hump", or "getting up on the step").

typically ineffective because they cannot be made wide enough to stop the kinds of waves they will be exposed to (waves can then pass underneath).

Dr. Herrington noted that his research indicates that the monohull ferries operating in New York Harbor typically put out a short period wake with approximately 3 second period waves. The catamaran ferries, with longer, more slender hull form, produce a wake with slightly longer period, 5 second waves.

Surge, (the wave produced from large ships), consists of long period waves – perhaps 10 second period or more. These long period waves are more difficult to combat as they can often pass around marina protection, such as breakwaters. Dr. Herrington felt that surge was probably not a big problem in the Hudson River or the East river, but for different reasons. Surge may not be an issue in wide open channels such as the Hudson River. He felt they may be more of a concern in narrow channels or constricted waterways. He mentioned that with the high currents in the East River, surge will dissipate and should generally not be a major concern.

Regarding future pilot projects, Dr. Herrington suggested the importance of collecting baseline data to establish existing conditions. He noted in some past research, it was shown that much of the wave energy in New York Harbor is caused by vessel wakes from existing harbor traffic, and not wind driven waves.

He felt that design of ferry landings present many challenges and in some cases objectives are in conflict with one another. For example, for a vessel's navigational access from the water and to reduce the effects on a moored ferry from the wakes of passing vessel traffic, the ferry slips may need to be oriented toward the channel, or perpendicular to shore. Orienting the ferry slips perpendicular to shore provides the vessel more direct access from the channel. A perpendicular slip arrangement also turns the stern toward wakes from passing vessels, rather than allowing the wakes to strike the vessel broadside. Striking the narrow stern typically results in less severely rocking the boat than a wave striking broadside.

However, for good control of the ferry at the dock, it may be desirable to orient the ferry slips parallel to the channel to reduce the amount of current the ferry must contend with while loading passengers. Orienting the slips parallel provides the vessel's captain options for approach from either side, which can be an advantage when current or weather patterns change.

Because of the challenges in ferry landing design, Dr. Herrington suggested more research to help define the important design considerations (such as navigation, environmental factors such as wake, and cost) along with establishing ferry landing design best practices would have merit.

Handout for March 5, 2014 Harbor Ops Meeting

NYC EDC Citywide Ferry Study

Vessel Wake & Surge Policy Discussion Paper Questions

Background: Over the past 10 or 15 years, New York City in conjunction with the Port Authority and private ferry operators have successfully developed a network of ferry routes on the Hudson River and East River. Due to the success of the existing ferry service, NYCEDC commissioned the Citywide Ferry Study, which examined the possibility of expanded service. The Citywide study evaluated new routes and over 50 potential ferry landing sites to determine if expansion of the existing route structure is merited. Initial results from the study indicate expansion may be feasible.

Heretofore, ferry service has largely been accomplished in some of the busiest sections of New York's harbor. In these areas, shorelines are generally already hardened for protection from weather and vessel wakes. Therefore, vessel wake and surge impacts have been relatively minimal and easily managed. Expansion of ferry service to new routes and more remote locations within the network of waterways surrounding New York City may create an increased potential for vessel wake and surge concerns in areas with less existing shore protection.

Purpose: The following questions were prepared by Moffatt & Nichol to support EDC's policy discussion paper examining the means by which the City could address the potential for vessel wake and surge concerns as the ferry network is expanded. Subject Matter Experts familiar with ferry services, and the waterways surrounding New York will be queried to support a discussion of vessel wake and surge concerns, along with areas for future study and management strategies the City could elect as part of a program to expand ferry service.

Questions: The City is contemplating expansion of the existing ferry system to include the top 4 to 6 ferry routes identified in the Citywide Ferry Study.

1. What do you see as the major concern regarding vessel wakes should the ferry system in the New York Metropolitan area be expanded?
2. What are the anticipated impacts of surge on ferry operations? What is the priority for reducing impacts of wakes vs. surge from passing vessels? That is, which is more important:
    a. Wake effects on sensitive shorelines?
    b. Wake and surge affecting adjacent vessels navigating in constricted channels?
    c. Wake effects on vessels moored along the waterways?
    d. Surge effect from large vessels on ferry operations?
    e. Other?
3. Should vessel wake and surge become a concern for a proposed new ferry route, do you see the approach to mitigate the concern as:
    f. Requires new vessel type and/or technology?

g. Requires attention to operational procedures (e.g. slow to low wake speed in vicinity of sensitive areas or in close proximity to other vessels operating on the waterways?
h. A combination of vessel type/technology and vessel operations procedures?
i. Ferry landing design to reduce impact from surge?
j. Shoreline treatments to mitigate wake impacts?

4. If the City were to implement a pilot program to reduce the impacts of wake and surge, what would be the most useful trials to be included in such a program?

k. In what areas of the city, would it be most helpful to implement the pilot program in?
l. Real-time wake impact feedback to boat captains?
m. Data collection in controversial areas, such as east of Roosevelt Island?
n. Boat/landing design?

NYC Dept. of Planning, Waterfront and Open Space Division, Jessica Fain

Ms. Fain is a planner in the Waterfront and Open Space Division of the New York City Department of Planning, which is deeply involved in waterfront planning activities in New York City. Ms. Fain was very familiar with the City's shoreline development objectives in waterfront communities.

Ms. Fain mentioned recent revisions to the city's Waterfront Revitalization Program (WRP), which is the city's Coastal Zone Management Program (CZM) from a regulatory standpoint.[52]

The program establishes City policies in regards to use of the shorelines. The WRP revision process evaluated climate change, storm events, sea level rise in addition to the City's development goals.

Ms. Fain outlined that considerable effort was made as part of the WRP revisions to map how the water's edges are used. For example, Priority Maritime Activity Zones (PMAZ), Recognized Ecological Complexes, Special Natural Waterfront Areas, etc. were mapped. The PMAZs are areas where hardened shorelines appropriate for maritime use are encouraged. In areas that are not mapped as PMAZs, softer shoreline edge design should be considered, where appropriate. For example, the Soundview area (one of the potential ferry landing sites evaluated in the Citywide Ferry study) is part of a Special Natural Waterfront Area, so Ms. Fain indicated any ferry activity proposed in that location should pay particular attention to minimizing wake/surge impacts on natural resources both at the shoreline and in-water (she noted there is an oyster restoration project off Soundview Park).

In general, the WRP recognizes the importance of maritime uses of the waterfront, and encourages and promotes maritime activities such as ferries and encourages their ties to new development along the waterfront.

[52] (See link: http://www.nyc.gov/html/dcp/html/wrp/wrp_revisions.shtml)

In regard to vessel wakes, the WRP promotes boating and uses of the waterways, but also encourages protection of natural waterfront areas. New ferry routes traversing the City's waterways should consider the natural areas to ensure that adverse impacts of vessel wakes do not occur, or are appropriately mitigated if unavoidable. Identification of, and establishment of wake mitigation Best Management Practices (BMPs) was suggested. Ms. Fain noted that enforcement of vessel operations can sometimes be challenging.

Finally, Ms. Fain indicated that the WRP also addresses new developments such as marinas and encourages they be designed to adequately protect moored boats from vessel wakes and storms. (For example, Policy 6, which addresses flooding, recognized the importance of maritime infrastructure, such as bulkheads, piers and docks as essential for water-dependent services and protection of public investments.)

Golden Gate Ferries, Christina Stark, Director of Engineering and Maintenance

Golden Gate Ferries (GGF) is a division of the Golden Gate Bridge Highway and Transportation District, primarily responsible for the Golden Gate Bridge, but also responsible for ferries and bus transit divisions. GGF has operated passenger ferries on San Francisco Bay since the late 1970's, providing service from Sausalito and Larkspur in Marin County, to San Francisco. They also provide special event service to San Francisco Giants ball games, and have provided special emergency service (e.g., post-earthquake). In 2013, Golden Gate Ferries carried 2.3 million passengers.

Similar to many other major ferry operators in North America (e.g., Washington State Ferries, BC Ferries, Staten Island Ferry, Marine Atlantic, etc.), Golden Gate Ferries owns their ferries and operated them with their own crews. GGF operates conventional monohull ferries and high speed catamaran ferries. The monohulls operate at approximately 20 knots on service between Sausalito and San Francisco. The catamarans (twin-hulled vessel) operate at about 31 knots providing service between Larkspur and San Francisco.

Mr. Stark was contacted to provide an alternative experience in addressing vessel ownership and ferry operations. Mr. Stark worked for a shipbuilder prior to his current tenure with the GGF. He therefore offered a unique perspective of both the owner/operator, and also that of the shipbuilder.

Mr. Stark outlined the history of operation on the Larkspur – San Francisco route, which began in the 1970's and traverses sensitive shorelines for part for the passage. Initially the GGF's monohull vessels served the route, but their wake characteristics were deemed obtrusive, and became a source of complaints. To reduce wake issues, the vessels were slowed down in the vicinity of the sensitive shorelines, thus lengthening the overall trip time. In time, the catamaran vessels were introduced with better wake characteristics. The catamarans had twin hulls that possessed a more slender form and produced less wake moving through the water than the monohull vessels. The catamarans also possessed greater speed – giving the vessels the ability to make up time, even though they did slow down in some areas along the routes. The catamarans are marketed as a “high speed” service and provide better crossing times on the longer Larkspur to San Francisco route. While passengers prefer faster crossing times, quick crossing times also allow each vessel to make more crossings during its daily service schedule, reducing the need for GGF to add vessels and crew expense for a given level of service.

The catamaran or high speed service has proven popular, and over time it became necessary to expand GGF’s fleet. In approximately 2009/2010, GGF procured new catamarans to add to the fleet of ferries they own and operate. The procurement was public and included the prerequisite specifications for public bidding along with the requirements for service speed, accommodations, passenger capacity and wake characteristics. As the GGF service was a mature service, it was important that the new vessels provide the same level of service in regards to schedule and wakes as the existing vessels in the fleet.

This vessel procurement proved challenging and ultimately, the GGF rejected the single bid. The price bid was high, possibly as a result of little competition. Because passenger ferries are relatively infrequently purchased – especially by public agencies, the shipbuilding industry has relatively little experience with the public procurement process. This lack of experience and the resultant uncertainty can lead to reduced competition as fewer shipyards will incur the expense and risk of bidding publically procured ferries. Ultimately, the GGF procured surplus catamaran vessels from Washington State Ferries (WSF).

The ferries GGF purchased from WSF were specially designed as “low wake”, high speed craft for the Seattle to Bremerton route in Washington State. The vessels were developed as part of an intensive design effort to provide both high speed capability and low wake. Unfortunately, the WSF vessels were unsuccessful in adequately mitigating wake impacts and became a source of litigation over wake issues in Rich Passage. Ultimately, the State of Washington settled the lawsuit with property owners and slowed the vessels down in Rich Passage to a low wake speed. Finally, the State of Washington terminated the service, thus creating the vessels surplus.

My Stark suggested that the City address potential wake issues by requiring a “Wake Management Plan” as part of the RFP process for new ferry service, allowing the proposers to determine if technology (i.e., low wake vessels) or operational procedures, or a combination of both, would be the most cost effective solution to address wake concerns for a new route. Similarly, they would be able to determine if bow loading or side loading vessels would provide the best service for a ferry landing that may be subjected to surge. He felt that the City could then evaluate the entire proposal in light of costs, service and wake management.

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