Working Paper

ESTIMATION OF TIME AND OTHER BENEFITS FROM NINE PROPOSED TRANSIT CAPITAL PROJECTS IN NEW YORK CITY

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Introduction.

Momentum is growing for an ambitious round of investments in transportation projects in New York City. At a time of fiscal crisis, and uncertainties over the direction of the economy in Lower Manhattan and the city as a whole, new transportation infrastructure is increasingly being seen as critical for the city's future. Buoyed by calls from elected officials and civic and business groups, a wide array of government agencies – including the Metropolitan Transportation Authority, the Port Authority, New Jersey Transit, the New York State Department of Transportation, and the city and state economic development corporations – are undertaking studies of transportation megaprojects.

Building all of the proposed projects would require well over $50 billion over the next two decades, far more than will be available. As a result, the city and the region face important choices about how to prioritize these investments. But an objective evaluation of the alternatives is extremely difficult. First, the agencies currently studying the various proposals are extremely competitive and secretive, leading to a scarcity of comparable information about the projects. Second, the projects themselves are diverse, achieving a wide range of different policy goals that are not easily weighed against one another. Some of the goals include:

- Transporting people and goods faster from place to place.
- Promoting local economic development though improved access to specific parts of the city.
- Building enough transit capacity for the city to benefit fully from the next economic boom.
- Creating high-paying construction jobs as a near-term economic stimulus.
- Ensuring efficient linkages with the global economy through improved connections with intercity passenger and freight terminals.
- Establishing new public spaces and improving the comfort and quality of travel.
- Improving passenger safety and security.

The Partnership for New York City asked the authors of this research to evaluate the costs and benefits of some of the major proposals. From an initial list of 25 major projects, nine were selected for closer examination:

- Fulton Transit Center, permanent PATH terminal, and pedestrian concourse, and Fulton Street Station)
- West Street Tunnel
- Second Avenue Subway
- #7 Subway Extension to the Far West Side
- Access to the Region's Core, providing more Hudson River tunnel capacity for N.J. Transit
- East Side Access, connecting LIRR to Grand Central Terminal
- LIRR/JFK Access to Lower Manhattan
- Creation of a new Penn Station in the Farley Post Office
- Extending PATH to Newark Airport Station

The authors evaluated all projects according to multiple criteria. This working paper presents a portion of this analysis, focusing on a limited range of project benefits: including in-vehicle time

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savings, out-of-vehicle time savings, reduced externalities of automobile use, and the productivity benefits of reduced overcrowding.

Some of these projects (including the Downtown Hub and East Side Access) are virtually guaranteed funding, and therefore will almost certainly be built. Others are backed by substantial political commitments, but their future will depend on whether specific funding sources can be locked into place. For the purposes of analysis, this paper starts with a blank slate. Unless otherwise noted, it analyses each project individually, assuming that none of the others will be built.

Results in Brief.

One of the major findings of this analysis is that savings from out-of-vehicle travel times (including walking to stations, waiting on platforms, and transferring) represent the largest category of benefits for most of the projects examined. This runs counter to the general assumptions of most public debate over transportation projects, which tends to value point-to-point vehicle speed as the most important planning factor.

Figure 1 shows the value of time savings for each project, divided into "in-vehicle" and "out-of-vehicle categories. Some projects show negative values for certain categories. In these cases, riders trade off a small increase in one type of travel time against a larger time savings elsewhere. For example, after the LIRR East Side Access project is complete, many riders will choose a slightly longer train trip to Grand Central Station, since that will enable them to reach their destinations more easily once they get off the train.

Figure 1: Estimated Value of Travel Time Savings

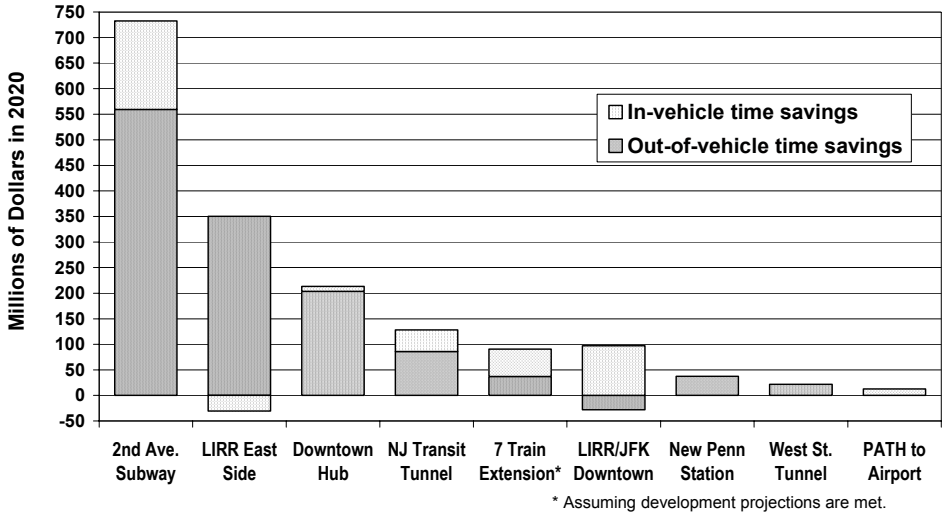

Figure 2 slices these same results another way: into direct users and non-users of the facility. Three of these projects benefit non-users: the Second Avenue Subway reduces congestion and improves travel times on the Lexington Ave. Express lines; East Side Access enables more frequent LIRR service systemwide; and the Downtown Transit Hub reduces platform congestion

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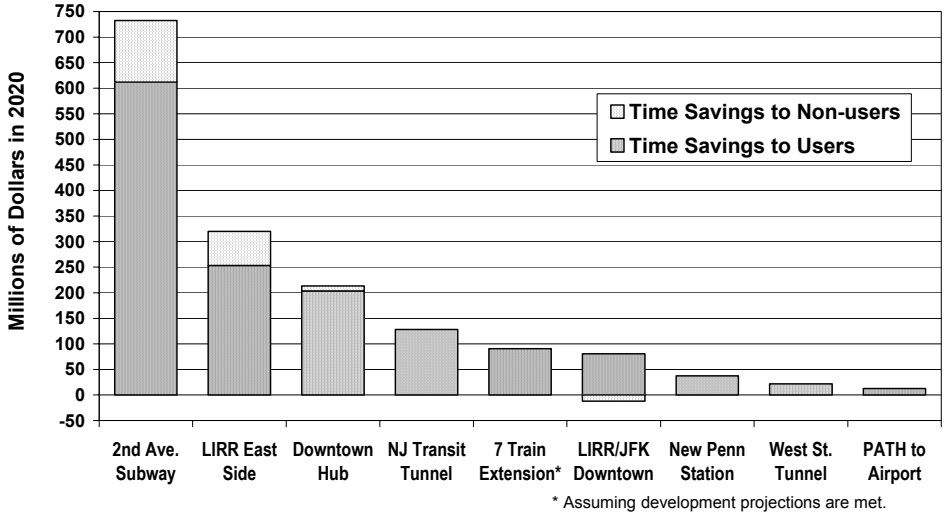
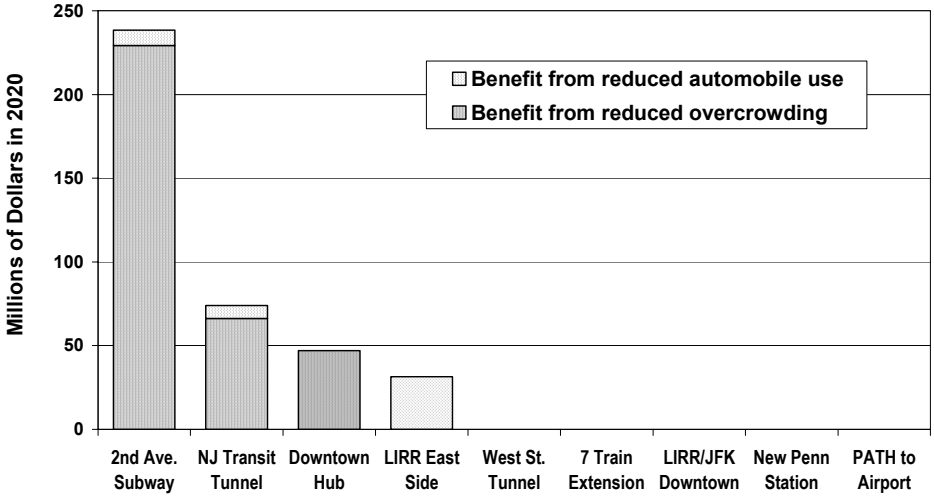
and reduces delay to passengers passing through it. The LIRR/JFK Airport connection to Lower Manhattan would increase travel times for some subway riders, at least in the option evaluated in this study.

Figure 2: Estimated Savings to Users and Non-Users



Several of the projects also have important benefits not related to travel times. These are summarized in Figure 3. These effects are generally small in comparison to the time benefits noted earlier.

Figure 3: Other Transportation Benefits



The overall results of this analysis are summarized below in Table 1. Please note that this represents only a partial evaluation of these projects. Several of these projects may have economic development benefits that are distinct from the benefits quantified here. These have been studied by the Boston Consulting Group as a separate component of this larger study. Any complete evaluation must also take into account capital and operating costs, as well as construction times. This analysis is available in a separate paper written by Joseph Berechman.

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Table 1. Summary of estimated benefits.

Project	Direct Benefits ($M)			Indirect Benefits ($M)				Total ($M)	Year of Estimate
	Walking + Waiting Time	In-Vehicle Travel Time	Exposure to Over-crowding	Walking + Waiting Time	In-Vehicle Travel Time	Exposure to Over-crowding	Externa-lities of Auto Use		
A Fulton Transit Center & PATH	$185.22	$0.00	$42.79	$0.00	$8.99	$0.00	$0.00	$237.0	2002
B West St. Tunnel	$19.67	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$19.7	2001
C Second Avenue Subway	$557.68	$54.27	$0.00	$1.81	$118.54	$229.33	$9.13	$970.8	2020
D Number 7 Subway Extension	$37.03	$53.57	$0.00	$0.00	$0.00	$0.00	$0.00	$90.6	2020
E NJT Access to Region's Core	$85.89	$42.29	$66.25	$0.00	$0.00	$0.00	$7.72	$202.1	2020
F LIRR East Side Access	$269.21	-$28.30	$0.00	$63.41	$0.00	$0.00	$29.78	$334.1	2010
G LIRR/JFK Downtown Access	-$14.96	$88.38	$0.00	-$10.72	$0.00	$0.00	$0.00	$62.7	2000
H New Penn Station	$33.32	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$33.3	2000
I PATH to Newark Airport	$0.00	$10.91	$0.00	$0.00	$0.00	$0.00	$0.00	$10.9	2010

Methodology and Assumptions.

Time savings.

The ideal way to estimate the benefits from these projects is to use a regional transportation model. The behaviors of travelers due to these transportation improvements will change in complex and potentially unforeseen ways. Before a project is actually built, the best way to examine changes in these travel patterns is to develop systems of equations that approximate the total costs of various travel modes (walking, or taking a bus, subway, taxi, etc.) by time of day. These total costs incorporate the out-of-pocket costs of the trip, the amount of time it would require, and other factors, such as comfort levels and physical exertion required. By combining forecasts of total demand (where and when people want to travel) with these cost equations, it is possible to estimate in the short run the travel demand along various routes and modes.[1]

With the time and resources available for this study, it was not feasible to use a regional transportation model. Instead, the authors relied primarily on published documents from the agencies sponsoring the various projects. In two cases, the Second Avenue Subway and LIRR East Side Access, draft environmental impact statements containing detailed model results were available. For most other projects, we had to rely on far more skeletal data, supplemented by their own series of conservative assumptions.

Estimating the time savings benefits from each project required several steps. First, we identified potential ways in which passengers might save time, along with the specific user groups that would experience those time savings. Great care was taken to ensure that the definition of these time savings and user groups did not double-count passenger benefits. Using project documents and other data sources, we then developed of the size of each user group, the scale of the time savings, and the portion of the day (all day or peak period) over which the benefits would be experienced.

Next, we identified appropriate scaling factors to combine these estimates into annual time savings (see Table 2). If a benefit could be enjoyed any time of day (e.g. elimination of a

[1] A key flaw in this approach is that it does not take into account how activity patterns might change in response to the availability of a new transportation facility. Failure to account for this can produce unrealistic results; nonetheless these changes are typically ignored in practice.

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transfer), then we used agency-specific data from the New York Metropolitan Transportation Council and the Federal Transit Administration to estimate daily/peak hour and annual/daily ridership ratios. If a benefit was likely to be enjoyed only during the peak period, we assumed the equivalent of four peak hours per day, and 261 weekdays per year.

Table 2. Multipliers used for time period conversions.

Times When Benefit is Experienced	Weekday/Peak Hour Multiplier	Annual/Weekday Multiplier
Peak Hours Only	4	261
Any Time of Day	Ratio of daily to peak hour trips derived from NYMTC's *Hub Bound* report for each transit agency.	Ratio of annual to average daily trips derived from FTA's *National Transit Database* for each transit agency.

Value of time savings.

Finally, we assigned economic values to these time savings, based on the U.S. Department of Transportation's guidelines for estimating the economic value of travel time savings due to transit projects.[2] For personal trips, these guidelines recommend approximating the value of time as the median household income (as reported in the Census) divided by 2,000 work hours per year. For business trips, they suggest using the average wage rate, as reported by the Bureau of Labor Statistics. Because none of the available data on the proposed transit projects differentiates between personal and business trips, we have used the mean between the personal and business wage rates.[3]

Next the guidelines recommend valuing travel time differently for different trip segments. For travel within a transit vehicle, they suggest using valuing travel time at 100% of the wage rate for business travel, and 50% of the wage rate for personal travel. For time spent walking to transit, waiting at a station, or transferring between vehicles, they suggest using 100% of the wage rate. Again, because no data was available on the distribution of trip purposes, we have taken used average values of 75% of the wage rate for in-vehicle travel time, and 100% of the wage rate for out-of-vehicle time.

Finally, the guidelines do not recommend using different wage rates for each project based on the income levels of the expected beneficiaries; instead, they propose using average values for the nation as a whole. The reason for this is presumably to ensure fairness among different regions of the country when their projects compete for federal funding. Because this study focuses on projects primarily benefiting individuals traveling in Manhattan, we have used Manhattan wage rates and household income levels to estimate the value of passengers' time.

[2] Federal Transit Administration, U.S. Department of Transportation. "Section 5309 (Section 3(j)) FTA New Starts Criteria; Notice" *Federal Register* 62:218 (November 12, 1997), pp. 60755-60758.

[3] This is effectively assuming a 50/50 split between personal and business travel. Overall, trips to and from work represent less than a third of all travel, but we expect that figure to be higher for most of the projects under consideration in our study.

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The one exception is the extension of PATH to Newark Airport, for which we used average wage and household income levels for the entire metropolitan region.

Reduced externalities of vehicle use.

In several cases, project sponsors have estimated reductions in motor vehicle use due to the improvements in transit services. These traffic reductions will bring social benefits in the form of reduced pollution, accidents, traffic congestion. We developed multipliers that roughly approximate the external social benefits from this reduced automobile use, based on the findings from Mark Delucci's study of the costs and benefits of motor vehicle use.[4]

Delucci identifies six general categories of costs associated with motor vehicle use (see Table 3). For the purposes of this study, we have included only the external costs of automobile use (those included in items 5 and 6). Adding the midpoints of these two cost categories, dividing by the 2.17 trillion vehicle miles traveled in the U.S. in 1991, and adjusting to 2002 dollars yields a cost estimate of about 30 cents per mile. Note that this value represents a national average for all travel, based on a wide range of potential impacts, and so should not automatically be taken as a reliable estimate of motor vehicle-related externalities. The real costs of travel are highly variable, depending on the specific time and location where the travel takes place. Nonetheless, given that the location (the nation's largest city) and time (largely rush hour) of the changes in automobile use examined in the present study would suggest external costs than are much higher than the national average, the result of 30 cents per mile seems a reasonably conservative estimate.

Table 3. Estimated total national costs of motor vehicle use (in 1991 dollars).

Category	Examples	Estimated Range
1. Personal nonmonetary costs	Free-flow travel time, maintenance and refueling time, self-injury from accidents	$544 - $953 billion
2. Goods & services priced in the private sector	Vehicles, fuel, parts, paid parking	$807 - $919 billion
3. Goods & services bundled in other costs	Free off-street parking; streets funded by developers within subdivisions	$76 - $280 billion
4. Goods & services provided by the government	Roads and highways, on-street parking, highway patrol, control of air and water pollution	$132 - $241 billion
5. Monetary externalities*	Fuel and lost time due to congestion, medical and property damage to others not covered by insurance	$30 - $125 billion
6. Nonmonetary externalities*	Others' accidental pain and suffering not covered by driver's insurance; unmitigated impacts of air and water pollution, greenhouse gas emissions, and noise	$69 - $755 billion

* Included in our estimates

Source: Mark A. Delucchi, *The Annualized Social Cost of Motor-Vehicle Use in the U.S. 1990-1991: Summary of Theory, Data, Methods, and Results*. UCTC Working Paper #311. Berkeley: University of California Transportation Center.

Productivity benefits of reducing overcrowding.

Several of the projects, including the Second Avenue Subway and the Downtown Transit Hub, are described as providing important benefits by relieving overcrowded conditions. Unfortunately, the economic benefits of reduced overcrowding are not as easily estimated as they

[4] Mark A. Delucchi, *The Annualized Social Cost of Motor-Vehicle Use in the U.S. 1990-1991: Summary of Theory, Data, Methods, and Results*. UCTC Working Paper #311. Berkeley: University of California Transportation Center. Tables 1-1, 1-8, and 1-9a. [http://www.uctc.net/papers/311.pdf]

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are for time savings. Overcrowding creates hazardous conditions on subway platforms, a particular concern on the Lexington Avenue lines. It also contributes to the stress of commuting, which has implications for passengers' quality of life, health, and workplace productivity.

An assessment of the monetary value of reduced overcrowding is beyond the scope of this research. However, because reduced overcrowding is an important consideration in the evaluation of these projects, we have attempted to provide a rough indicator of its benefits. In all cases, we have assumed that passengers exposed to extremely overcrowded conditions lose five minutes of productivity at work. Onboard transit vehicles, we have defined overcrowded conditions as passenger volumes in excess of crush load capacity; in a station, we defined it as crowding levels sufficient to cause transit service delays.

Quality of the data.

The reliability of our estimates is dependent on the quality of data available. None of the agencies sponsoring projects evaluated in this report were willing to share their own unpublished forecasts or analyses. As a result we have varying degrees of confidence in the results we obtained (see Table 4).

Table 4. Quality of the data used to evaluate each project

Rating	Explanation	Projects
A	Primarily based on existing ridership data.	Fulton Transit Center & PATH Station New Penn Station in Farley Post Office
B	Primarily based on published results from sponsoring agency computer models.	Second Avenue Subway LIRR East Side Access Access to the Region's Core
C1	Travel demand is known to exist; estimates based on assumptions about the share of the market that will be captured.	West Street Tunnel PATH Extension to Newark Airport LIRR/JFK Downtown Access
C2	Travel demand does not yet exist; estimates based on potential future demand.	#7 Subway Extension

Benefits not evaluated.

Many of these projects have secondary benefits that were not evaluated here because they would require additional capital investments beyond what is being proposed at the present time. As the Regional Plan Association has pointed out, these second-round benefits are important to keep in mind when evaluating capital investment strategies over the long term. In some cases, these later project components will have much higher benefit-cost ratios than the initial capital investments on which they depend.

Here are some of the most significant second-round projects made possible by the projects in this study:

Second Avenue Subway: At nearly $2 billion per mile, the trunk line along 2nd Avenue will be an extremely expensive investment regardless of how much ridership it attracts. The value of this investment can be maximized through extensions into the Bronx, along 125th Street in Manhattan, and into Brooklyn and Queens, utilizing existing infrastructure and rights-of-way wherever possible. Even without new capital investment, a third subway route can be added to

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the current Second Avenue Subway proposal by rerouting the V Train from Queens through the 63rd Street Tunnel and down Second Avenue to Lower Manhattan.

Number 7 Subway Extension: The City has proposed building a transportation hub on the Far West Side of Manhattan that would combine terminals for the #7 Subway, Long Island Railroad, and Metro-North. While such a terminal would help the area's development prospects, futther analysis is needed to determine whether it would have adverse consequences for other riders (e.g. Metro-North passengers with destinations closer to Penn Station). The #7 Subway extension also makes it possible to consider a future extension to Hoboken or Secaucus, which could have significant regional transportation benefits.

East Side Access and New Penn Station: By freeing up track capacity and more passenger space in Penn Station, these projects will enable a future expansion in the range of transportation services offered from Penn. They will enable Metro-North to run trains to Penn Station from two of its three East-of-Hudson lines. The Farley Post Office project will create space for a new air passenger terminal, which may enable the future establishment of one-seat rail access to JFK Airport.

LIRR/JFK Airport Downtown Access: If this project includes a new connection between the subway system and the LIRR Atlantic Avenue tracks, it provides an opportunity for new express subway services between Lower Manhattan and eastern Queens. This could be important because all current subway routes from eastern Queens into Manhattan are either over capacity or have excessive travel times.

The following sections examine the methodology and results for each project in greater detail.

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A. Fulton Transit Center and Permanent PATH Station.

Table 5. Estimated benefits for the Fulton Transit Center and Permanent PATH Station in 2002.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$185.2 M		$42.8 M	
Non-Users (or users & non-users)		$9.0 M		

The Downtown Transit Hub is actually three projects in one. The first component, at the World Trade Center site, will create a permanent PATH terminal to replace the temporary structure expected to open later this year. This terminal will feature longer platforms (able to accommodate 10-car trains), and will also include underground connections reaching west to the World Financial Center, as well as north and south. The second project will rework the existing Fulton/Broadway/Nassau complex of subway stations into a better-integrated whole with more efficient connections and greater passenger capacity. Finally, a new underground pedestrian concourse will contain moving walkways that will speed people traveling between the new Fulton Station and the PATH terminal. No detailed forecasts are available for passenger volumes or time savings from the sponsors of this project.

These three projects will provide transportation benefits to many different categories of users. The greatest benefits will accrue to four groups passengers traveling on foot through various parts of the Downtown Hub:

- Passengers entering or exiting the subway system at Fulton Station will save about two minutes each due to the wider staircases and more direct platform connections that will result from this project.

- Passengers transferring trains at Fulton Station will also save about two minutes each.

- Users of the pedestrian concourse between the subway station and the PATH terminal are expected to save about ten minutes each.

- Passengers exiting the PATH terminal toward the north, south, or west will also save time due to the improved access passageways in these directions, helping them avoid crossing streets at surface level.

Together, these improvements will save passengers about 5.7 million person-hours per year, bringing a benefit of about $185 million.

A second set of users who will benefit are those passengers who ride IRT subways through Fulton Station, without getting on or off. Because of severe congestion on the passenger platforms during the rush hour, the 2/3 and 4/5 trains experience unnecessarily long dwell times in this station. Improving the connections between these lines and the A/C line is expected to help ease this problem. We estimate that it will save through passengers about 30 seconds per trip during the peak hours. This amounts to another 370,000 person-hours per year, or about $9 million in benefits.

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Another benefit of the project is that it will relieve overcrowded conditions in Fulton Station. We assumed that during the AM and PM peak periods, half of the passengers in the station experience extremely overcrowded conditions. If each gains five minutes of productive time as a result of reduced stress, their total benefit would be about $43 million per year.

Finally, the project will also provide a new, free transfer between the E train and the N/R trains. We did not estimate the user benefits for this component of the project.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average	Benefit		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
			Description	Min.		Daily	Annual	Time		
1	Passengers boarding/alighting at Fulton Station	115,320 Full Weekday [1]	Reduced street/platform walk time	2	24h	1.0	295.1	$32.40	1,134,230	$36.8
2	Passengers transferring at Fulton Station	109,680 Full Weekday [2]	Reduced walking time for transfer	2	24h	1.0	295.1	$32.40	1,078,758	$35.0
3a	Users of the Underground Concourse	55,330 Full Weekday [3a]	Reduced walking time	10	24h	1.0	295.1	$32.40	2,720,992	$88.2
3b	Other PATH terminal users	79,500 Full Weekday [3b]	Reduced walking time	2	24h	1.0	295.1	$32.40	781,923	$25.3
4a	Through riders on the 2/3 trains	17,500 AM Peak Hour [4]	Reduced congestion-related delay	0.5	Peak Pd.	4.0	261.0	$24.30	152,250	$3.7
4b	Through riders on the 4/5 trains	25,000 AM Peak Hour [5]	Reduced congestion-related delay	0.5	Peak Pd.	4.0	261.0	$24.30	217,500	$5.3
Total									6,085,653	$194.2

Benefits from Reduced Overcrowding

Group	Description	Weekday Average	Benefit		Time of Benefit	Multipliers				Value ($M/yr)
			Description	Min.		Daily	Annual	Time		
1 & 2	Half of passengers using Fulton Station	15,177 AM Peak Hour [6]	Productivity Improvement	5	Peak Pd.	4.0	261.0	$32.40		$42.8

Increase in peak-hour passenger capacity

Into Manhattan [7]	7800
Into Lower Manhattan [7]	7800
Into Midtown	0

Other Results

Direct Users of the Facility (pax per average weekday)	331,000
Total Time Savings (minutes per average weekday)	1,247,300

Notes

[1] Double the 57,660 daily boardings at the Fulton/Broadway/Nassau station. (NYC Transit, October 2002 Average Weekday Ridership, unpublished data).
[2] 225,000 passengers use the Fulton Station daily (MTA, EIS Draft Scoping Document). The difference between this value and the number of entries/exits is the number of transfers.
[3a] We assume that two groups use the concourse: roughly 25% of the passengers using the PATH terminal who want to exit toward the east, and about 25% of the passengers using the Fulton St. Station who want to exit toward the West.
[3b] The 75% of PATH terminal users who do not use the pedestrian concourse to the east will take advantage of the improved passageways to the N, S, or W.
[4] Same as [5] below, adjusted for the ratio of PM peak boardings at stations south of Fulton St.
[5] Based on estimate of 26,200 AM peak hour passengers leaving Brooklyn Bridge station southbound, on p. 5B-21 of the 2nd Ave. Subway SDEIS.
[6] 225,000 passengers use the Fulton Station daily (MTA, EIS Draft Scoping Document). Extreme overcrowding is assumed to occur only at the AM and PM peak periods. We assume that half of the passengers during these times
[7] The capacity increase comes from increasing the length of PATH platforms from 8 to 10 cars. We assume 30 trains/hour and 130 pax/car. This increase is only possible if other PATH stations can also handle 10-car trains.

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B. West Street Tunnel.

Table 6. Estimated benefits for the West Street Tunnel in 2001.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$19.7 M			
Non-Users (or users & non-users)				

Several different versions of the West Street Tunnel have been considered. The configuration most likely to move forward is a short tunnel running from Vesey to Liberty Streets, next to the World Trade Center site. Longer versions of the tunnel appear to have been ruled out because of the disruption likely to be caused by their construction, and because they would not adequately serve the traffic in the area.

The major transportation benefit of the West Street tunnel is the time that pedestrians will save attempting to cross West Street. Because of the high traffic volumes, great width, and long signal timings, we estimate that the tunnel will save pedestrians crossing West Street about two minutes each. In the absence of data on pedestrian activity, we have relied on a newspaper estimate that 10,000 people cross West Street during the AM peak hour.[5] These estimates yield a total of about 606,000 person-hours saved per year, or about $20 million in annual benefits.

The short West Street Tunnel should not make an appreciable difference in travel time or travel demand for motor vehicles. It will not have any impact on air quality or transit overcrowding.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average	Benefit		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
			Description	Min.		Daily [2]	Annual	Time		
1	Pedestrians crossing West St. below Chambers St.	10,000 AM Peak Hour [1]	Reduced delay crossing West St.	2	24h	6.2	295.7	$32.40	606,952	$19.7
2	Vehicles using West St.	7,500 AM Peak Hour [1]	No change in travel time	0	24h				0	$0.0
Total									606,952	$19.7

Increase in peak-hour passenger capacity

Into Manhattan	0
Into Lower Manhattan	0
Into Midtown	0

Other Results

Direct Users of the Facility (pax per average weekday)	61,573
Total Time Savings (minutes per average weekday)	123,146

Notes

[1] Josh Rogers, "State D.O.T. Skeptical of Long West Street Tunnel," Downtown Express (November 27, 2002). [Pre-9/11 Estimates]

[2] 24-hour / AM peak hour ratio for West St. pedestrians is assumed to be equal to the value for PATH users.

[5] Josh Rogers, "State D.O.T. Skeptical of Long West Street Tunnel," *Downtown Express* (November 27, 2002).

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C. Second Avenue Subway.

Table 7. Estimated benefits for the Second Avenue Subway in 2020.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$557.7 M	$54.3 M		
Non-Users (or users & non-users)	$1.8 M	$118.5 M	$229.3 M	$9.1 M

The Second Avenue Subway is the most complex project in this study. The Metropolitan Transportation Authority is proposing a two-track tunnel between 125th Street and Hanover Square in Lower Manhattan, with direct connections to the 63rd Street tunnel in Midtown. This would enable the establishment of two new subway lines: the T train, which would follow the new tunnel the length of Manhattan, and an extended Q train, which would connect existing Broadway express service with the Upper East Side via the 63rd Street connection.

A significant amount of data is available on the project, in the form of the Metropolitan Transportation Authority's Supplemental Draft Environmental Impact Statement (SDEIS). But that document does not specifically focus on estimating the benefits of the project, and does not provide data in a manner that is optimal for that purpose. A complete analysis of the net benefits is therefore not possible.

We estimated time savings for several different user groups:

- The primary benefit will come from the reduction in walk access time from the Far East Side. We developed a simple walk access time savings model, based on the number of street crossings and walk distances for each census tract on the East Side, weighted by residential population. This model suggested a time savings of about 4.3 minutes per subway trip end (an origin or a destination) along the Second Avenue corridor. Station volume forecasts in the SDEIS showed about 79,000 trip ends during the AM peak hour. In all, East Side residents and workers will save about 14 million person hours per year, or about $453 million annually.

- Passengers switching to the new subway line from the M15 bus will save nearly 14 minutes in travel time per trip, but will spend about 1.6 minutes longer reaching a subway station, since these are located farther apart than are bus stops. In all, they will enjoy about $46 million in annual benefits.

- Passengers riding the Q train from the Upper East Side to Times Square and the Broadway corridor will save about five minutes each due to the elimination of a transfer. The value of this time savings is about $113 million per year.

Passengers on other lines will benefit from the project as well:

- Express passengers on the Lexington Avenue lines (4 and 5) will save time in several different ways. First, they will experience reduced delays due to platform overcrowding during the AM and PM peak periods. Based on an analysis of subway schedules, we

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determined that the typical passenger will save about 7.2 minutes during the AM peak and 3.2 minutes in the PM peak. This will provide about $119 million in annual benefits.

- Lexington Avenue Express passengers will also save time due to reduced headways made possible by the easing of overcrowded conditions. The reduced waiting time due to this increase in service will bring about $4.6 million in annual benefits.

- With the addition of local service on the Second Avenue line, service will be reduced on the Lexington Avenue Local (6 train). The remaining passengers on this line will experience longer headways, for a time cost of about $9.2 million per year.

- Existing passengers on the Broadway Express lines (N and Q) will save time due to shorter headways ($6.4 million per year).

The primary rationale used to justify the Second Avenue Subway has not been its time savings, but its benefits due to reduced overcrowding. As explained in the methodology section, we are only able to estimate a portion of these, a rough indicator of the productivity benefits of reduced worker stress due to reduced exposure to crush conditions. We have estimated that in the AM peak hour, approximately 81,000 riders of the Lexington Ave. lines will change from riding trains that exceed MTA loading guidelines to trains that are still crowded but not exceptionally uncomfortable. Assuming four hours of crush loading per day, and 5 minutes of productivity benefits for each passenger, this will provide an annual benefit of $229 million per year.

For a project of its scale, the Second Avenue Subway will provide a very small shift in automobile use (an important criterion for attracting federal funding). The SDEIS estimates an annual reduction vehicle use of about 30.7 million VMT per year. This will provide about $9.1 million in benefits due to the reduction in social and environmental externalities.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average		Note	Benefit		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
					Description	Minutes		Daily	Annual	Time		
1a	SAS Passengers shifted from other subways	39,585	Peak Hour	[1]	Reduced walk time	8.5	24 hour	8.42	295.1	$32.40	13,979,363	$453.0
1b	SAS Passengers shifted from M15 bus	3,148	Peak Hour	[2]	Increased walk time	-1.6	24 hour	10.42	295.1	$32.40	-259,691	-$8.4
1b	SAS Passengers shifted from M15 bus	3,148	Peak Hour	[2]	Reduced travel time	13.8	24 hour	10.42	295.1	$24.30	2,232,958	$54.3
1c	SAS Passengers using the extended Q train	16,860	Peak Hour	[3]	Elimination of a transfer	5.0	24 hour	8.42	295.1	$32.40	3,490,117	$113.1
1c/2	All Broadway Express (N/Q) passengers	68,100	Peak Hour	[4]	Reduced wait times	0.17	Peak Periods	4.00	261.0	$32.40	197,490	$6.4
3a	Lexington Ave. Express (4/5) passengers	53,700	Peak Hour	[5]	Reduced delays (SB-AM)	7.23	Peak Period	2.00	261.0	$24.30	3,376,829	$82.1
3a	Lexington Ave. Express (4/5) passengers	53,700	Peak Hour	[5]	Reduced delays (NB-PM)	3.21	Peak Period	2.00	261.0	$24.30	1,500,813	$36.5
3a	Lexington Ave. Express (4/5) passengers	92,400	Peak Hour	[4]	Reduced wait times	0.09	Peak Periods	4.00	261.0	$32.40	142,912	$4.6
3b	Lexington Ave. Local (6) passengers	54,500	Peak Hour	[4]	Increased wait times	-0.30	Peak Periods	4.00	261.0	$32.40	-284,490	-$9.2
Total											24,376,301	$732.3

Reduced Externalities of Auto Use

Group	Description	Weekday Average		Note	Benefit		Time of Benefit	Multipliers				Value ($M/yr)
					Description	$/VMT		Daily	Annual	Time		
1d	SAS Passengers shifted from automobile	30700000	Annual VMT	[6]	Reduced externalities	$0.298	24 hour	1.00	1.0			$9.1

Reduced Overcrowding

Group	Description	Weekday Average		Note	Benefit		Time of Benefit	Multipliers				Value ($M/yr)
					Description	Minutes		Daily	Annual	Time		
3	Lexingon Ave Express & Local passengers	81,347	Peak Hour	[7]	Reduced overcrowding	5.0	Peak Periods	4.00	261.0	$32.40		$229.3

Increase in peak-hour passenger capacity

Into Manhattan [8]	2200
Into Lower Manhattan [9]	19620
Into Midtown [10]	31470

Other Results

Direct Users of the Facility (pax per average weekday) [11]	591,000
Total Time Savings (minutes per average weekday)	5,087,734

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Notes

[1] Estimates for the change in walk access time to 2nd Ave Subway stations were estimated as follows:

1. I assumed that walk access time savings would only be realized for trip ends at new stations. If a passenger entered the system at an existing station, made a transfer, and exited at a new station, she would only save time at the destination. I used entry/exit volumes for the AM peak hour from the SAS SDEIS, Table 5B-19.

2. For all census tracts that would be closer to the SAS than to the Lexington Ave. lines, I estimated the difference in walk access time to the nearest stations on each line. I then weighted this time difference by the population in each tract, and then smoothed the result out from North to South by taking a rolling average.

3. I multiplied these to get the total time savings

4. The adjusted number of trips made is the total number of trip ends at the new stations divided by two.

Station	Passenger Volume Entry	Exit	Total	Time savings for station access	Total Savings
125	1,680	1,150	2,830	0.00	0
116	2,120	400	2,520	4.36	10987
106	1,580	530	2,110	4.30	9073
96	7,900	1,100	9,010	4.22	38022
86	7,090	2,130	9,220	4.73	43611
72	4,590	6,070	10,650	4.62	49203
57	1,410	4,090	5,500	4.42	24310
42	2,170	7,880	10,050	5.06	50853
34	2,040	1,460	3,500	6.50	22750
23	1,630	3,280	4,910	6.72	32995
14	1,670	1,370	3,050	6.07	18514
Houston St	620	500	1,110	2.86	3175
Grand St	170	770	940	2.50	2350
Chatham Sq	740	1,260	2,010	7.05	14171
Seaport	520	2,720	3,240	1.50	4860
Hanover Sq	140	8,380	8,520	1.50	12780
			79,170		337653
	Adjusted number of trips		39585		
				Time Per Trip	8.53

[2] Passengers shifting from the M15 to the Second Ave. Subway will experience longer walk access times, but shorter travel times. Unfortunately, the data in the SDEIS does not allow a direct analysis of these time changes.

According to NYCT data, there are	15798	M15 riders during the 3-hr AM peak period.
We assume that	50%	of AM peak period riders board in the AM peak hour.
That means there are about	7899	AM peak hour riders.

In order to allocate these riders to the Northbound and Southbound directions, we look at the split on the Lexington Ave. Local train, using data from the SDEIS (Table 5B-4).

Direction	#6 Train Ridership, 2020 No-Build		2002	2020 No Build	2020 Build		Change
Southbound	55,400	64.8%	5118	5374	-45%	2956	2418
Northbound	30,100	35.2%	2781	2920	-25%	2190	730
Total	85,500		9901	8294		5146	3148
				The SDEIS Projects 5% growth by 2020 (p. 5C-4).	Percent changes in NB and SB ridership from Table 5C-1.		

Additional walk time due to increased spacing of stations…

Average subway station spacing	8	blocks
Average bus stop spacing	3	blocks
Average additional walk distance	2.5	blocks
Block length	260	feet
Walk speed	4.4	feet/sec
Street-crossing delay	15	seconds
Average additional walk time	1.61	minutes

(The stations are nominally 10 blocks apart, but the distances between entrances are shorter)

Reduced travel time due to faster travel speeds…

Analysis of schedules indicates that travel from 125th St. to Houston St. takes an average of 69 minutes by local bus and 24 minutes by local subway.

	125th to Houston Avg. Time	Distance	Rate
Bus	69	6.25	11.04 minutes/mi.
Subway	24	6.25	3.84 minutes/mi.
Difference			7.2 minutes/mi.

Average bus trip distance:	1.92	miles
Average travel time savings:	13.8	minutes

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[3] Passengers riding the Q train to/from the Upper East Side can reach the West Side without transferring.

SB leave load for 72nd St. Station	32800	Q and T lines	Table 5b-15
SB as % of all passengers	81.9%		Table 5b-9
SB leave load for 57th St. Station	16800	T line only	Table 5b-15
Entry volume at 57th St.	1410	T line only	Table 5b-19
Exit volume at 57th St.	4090	T line only	Table 5b-19
SB leave load for 72nd St. Station	18994	T line only	
SB leave load for 72nd St. Station	13806	Q line only	
All Q passengers at 72nd St.	16860	Q line only	

[4] Reduced wait times due to improved service frequency.
Data from p. 5B-20 and 5B-22.

	No-Build		Build		Difference	
	Freq.	Headway	Freq.	Headway	Headway	Avg. Wait
Broadway Express (N/Q)	18	3.33	20	3.00	0.33	0.17
Lexington Express (4/5)	25	2.40	27	2.22	0.18	0.09
Lexington Local (6)	25	2.40	20	3.00	-0.60	-0.30

[5] Reduced travel times due to reduced congestion on Lexington Ave. Express
Data from p. 5B-20 and from NYCT subway schedules.

				AM Peak			**PM Peak**		
	Distance 125th to Brooklyn Bridge (mi)	Off-Peak travel time (min)	Rate (min/mi)	AM Peak travel time (min)	Rate (min/mi)	Delay (min)	PM Peak (min)	Rate (min/mi)	Delay (min)
125th St to Brooklyn Bridge	7.29	19.0	2.61	28.0	3.84	9.00	23.0	3.16	4.00
Average Subway Trip	5.85	15.3	2.61	22.5	3.84	7.23	18.5	3.16	3.21

[6] Includes externalities of motor vehicle use, including external costs of congestion, pollution, and accidents. From Delucchi study.
Estimate of annual VMT reduction from p. 5D-28.

[7] We have approximated the number of passengers experiencing reduced overcrowding by using the peak passenger loads and boardings on the Lexington Ave. lines in the no-build scenario. We started with the southbound AM peak hour loads at the 86th Street Station, approximately where crush loading conditions begin. At each station, we add a number of passengers equal to the total boardings at the station, multiplied by our estimate of the share of the passengers who will travel southbound and the share expected to take the express line.

Exposure to Crush Conditions on the Lexington Ave. Subways

	Lexington Avenue Express				**Lexington Avenue Local**		
	Load at 125th Street	86	59	42	Load at 77th Street	68	59
Initial southbound load	34,300				27,900		
Additional Boardings		7,140	1,440	18,080		7,140	1,440
% Southbound		90%	80%	67%		90%	80%
% taking this route (express vs. local)		60%	51%	64%		100%	49%
Estimated Additional Southbound Boardings		3,862	591	7,707		6,426	561
Total cumulative exposure to crush loads	46,460				34,887		

Data sources: SDEIS, Tables 5B-11, 5B-12, 5B-16).

[8] On 4/5 Trains only. Based on SDEIS service pattern. Assumes 2 additional trains, each with 10 cars and 110 pax/car.
[9] Two trains on 4/5 lines (10 cars, 110 pax/car) + 12 trains on T line (10 cars, 145 pax/car)
[10] Southbound only. Two 4/5 trains (10 cars, 110 pax/car) + 24 Q and T trains (10 cars, 145 pax/car) - 4 6 trains (10 cars, 110 pax/car)
[11] From SDEIS, p. 5B-19.

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D. #7 Subway Extension to the Far West Side.

Table 8. Estimated benefits for the #7 Subway Extension in 2020.*

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$37.0 M	$53.6 M		
Non-Users (or users & non-users)				

*Assuming the City's development objectives are met.

As part of its plans to redevelop the Far West Side of Manhattan, New York City has proposed extending the #7 Subway to the Jacob Javits Convention Center on 11th Avenue. The goals of this project are primarily economic: allowing the continued growth of Midtown, revitalizing the area around the Convention Center, and supporting the city's bid to sponsor the 2012 Olympics. As such, this is the project in our study aimed at supporting future development, rather than meeting current or anticipated needs.

At current levels of development on the Far West Side, use of any westward extention of the #7 Subway would be very low. But for the purposes of this study, it seems appropriate to develop a ballpark figure of the passenger time savings that would be experienced at a higher level of development. We assumed a scenario in 2020 in which the new station areas on the Far West Side had densities and activities comparable to the 50th Street station on the 8th Avenue C/E line. This station is the closest non-transfer station in the system, and has a mix of residential, office, and entertainment uses nearby that seems to match the city's development objectives.

Following the alignment identified in the EIS Scoping Document for the #7 Subway Extension, we assume that the line will run along 43rd Street and 11th Ave., with stations located at 41st Street & 10th Ave. and 33rd Street and 11th Ave.

We assume that the two stations on the Far West Side will serve about 33,000 daily passengers each, the same as at the 50th Street Station. We estimated that passengers traveling to the 11th Ave. station would save 10 minutes over travel by bus, and passengers at 9th Ave/10th Ave. Station would save 5 minutes. This would provide a total benefit of about $54 million per year.

Passengers would also benefit from the more frequent service the subway provides. In all, these travelers would save about 3.4 million person-hours per year, or an annual benefit of $37 million. This assumes that the increased development on the Far West Side would not spur increases in the frequency of bus service.

Ultimately, the city is planning a small transit hub on the Far West Side, with new LIRR and Metro-North terminals near the convention center and proposed sports complex at 11th Avenue. This will bring additional benefits to LIRR and Metro-North passengers reaching destinations on the Far West Side. We did not estimate travel time benefits for this group because the Far West Side transit hub was not included in the EIS Scoping Document. It is not clear whether the MTA endorses construction of such a hub.

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It is worth noting that an alternative alignment for the #7 Subway Extension would provide significantly greater benefits. If it were feasible to run the line down 8th Avenue and westward along 34th Street, as had been proposed in earlier documents, then the line would for the first time provide a direct subway connection between Penn Station and Grand Central Station. Currently, there is no direct transit connection between New York's two primary rail passenger terminals. We developed a rough proxy for the number of passengers who want to travel between these stations based on data from the commuter rail studies.[6] We assumed that 52% of the commuter rail passengers arriving at Penn Station prefer destinations on the East Side, and that 48% of arrivals at Grand Central Station prefer designations on the West Side. We further assumed that in each case, about 50% of these people looking to cross Manhattan would prefer to use the extended 7 Train over other services currently available. Together, these estimates yield a daily demand of about 150,000 passengers between the two terminals. Eliminating the need to transfer will save them about 5 minutes each, with $120 million in annual benefits. This estimate should be used with caution, as we did not look directly at subway ridership, and it is likely that East Side Access will significantly change patterns of east-west travel in Midtown. It is not included in the total results for this project.

From an economic development perspective, connecting the #7 with Penn Station would have a second added benefit: it would allow NJ Transit and LIRR commuters to reach the new business district on the Far West Side. By skipping Penn Station, the 43rd Street/11th Avenue alignment does not provide this service.

This project is not expected to have significant impacts on automobile use, or transit overcrowding.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average	Benefit		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
			Description	Minutes		Daily	Annual	Time		
1a	Passengers using the 41st/10th Station	33,200 Full Weekday	Reduced travel time	4.5	24h	1.0	295.1	$24.30	734,712	$17.9
1b	Passengers using the 33rd/11th Station	33,200 Full Weekday	Reduced travel time	9.0	24h	1.0	295.1	$24.30	1,469,424	$35.7
1a & 1b	Passengers using both Far West Side stations	66,400 Full Weekday	Reduced wait time	3.5	24h	1.0	295.1	$32.40	1,142,886	$37.0
Total									3,347,022	$90.6

Increase in peak-hour passenger capacity

Into Manhattan	0
Into Lower Manhattan	0
Into Midtown	0

Other Results

Direct Users of the Facility (pax per average weekday)	66,400
Total Time Savings (minutes per average weekday)	680,600

Notes

We assume the extension will include two stations: 41st Street & 10th Ave., and 33rd Street & 11th Ave.

Estimates for passengers boarding/alighting on the Far West Side

Assume these stations are similar in demand levels and activity patterns to the 50th Street IND station (Both are non-transfer stations in mixed-use entertainment/office/retail districts). The 50th Street station has 16,600 weekday boardings, or 33,200 total weekday passengers.

	Travel Time Javits to Times Square	Headway AM Peak	Midday
M42 Bus	12	10.0	12.0
#7 Train	3	3	5
Average difference in travel time	9		
Average difference in wait time		3.5	3.5

[6] Our estimates assume that East Side Access and Access to the Region's Core are not built.

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E. Access to the Region's Core

Table 9. Estimated benefits for the New Hudson Tunnel and Deep Penn Station in 2020.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$85.9 M	$42.3 M	$66.3 M	
Non-Users (or users & non-users)				$7.7 M

This project would provide more Hudson River tunnel capacity for N.J. Transit trains into Midtown. Several options are currently being studied, including a new, deep-level terminal at Penn Station, a new tunnel connecting Penn with the Grand Central Terminal, and an additional connecting Penn with Sunnyside Yards in Queens. This results reported above are for the Deep Penn Station Penn option ("Option P"), although all three options were examined. Our analysis relies on modeling results developed as part of preliminary studies for the project.[7]

All New Jersey Transit passengers using lines that run into Manhattan will benefit if they travel during the peak period, from the additional service frequencies that will be possible when the tunnel capacity is increased. Under Option P, capacity into Penn Station will be increased by 21 trains per hour. We found a peak-hour time savings of about 3.5 minutes per passenger. If there are about four hours of capacity-limited service per day, then the total time benefits from this increased service are about $86 million annually.

A second important benefit from this project are time savings to passengers who are crowded out of NJ Transit service to Penn Station. The Access to the Region's Core study estimates a peak hour demand of about 28,500 passengers into Penn Station, but only peak hour capacity of 23,500 passengers. We assume that the extra 5,000 passengers will have to take trains to Hoboken and transfer to ferries or PATH. By providing capacity for these passengers to reach Penn Station without a transfer, we estimate that this project will save each passenger 20 minutes per trip. This provides a total benefit of about $42 million annually.

In addition, there will be significant benefits from reducing the overcrowded conditions on the trains that do reach Penn Station. While these trains may not reach the "crush loading" level identified earlier as the threshold for considering the benefits from reduced crowding, they will exceed the trains' loading standards used for planning purposes. Given the long travel times on commuter trains, it seems appropriate to include the benefits from reduced crowding here. Assuming five minutes of productivity gains for each commuter experiencing overcrowded conditions, the extra train capacity will provide a benefit of about $66 million per year.

Finally, the project is expected to shift 4,600 trips from automobile to transit on an average weekday. Assuming the average length of these trips matches N.J. Transit riders' average trip length of 21.6 miles, we estimated an annual benefit of about $7.7 million per year.

[7] Access to the Region's Core Study, "Regional Citizens Advisory Committee Meeting Highlights, Monday, April 29, 2002."

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Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average	Benefit		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
			Description	Minutes		Daily	Annual	Time		
Option G - Hudson Tunnels with Connection to Grand Central Station										
1	All NJT passengers disembarking in NYC	52,344 AM Peak Hr. [2]	Reduced headway: 13 more trains	2.8	Peak	4.00	261.0	$32.40	2,537,211	$82.2
1a	NJT Passengers - Disembarking at GCT	13,400 AM Peak Hr.	Reduced walk access time	15.0	24h	5.99	297.8	$32.40	5,974,875	$193.6
1a	NJT Passengers - Disembarking at GCT	13,400 AM Peak Hr.	Increased in-vehicle time	-5.0	24h	5.99	297.8	$24.30	-1,991,625	-$48.4
2	MNRR Passengers - Disembarking at Penn	2,600 AM Peak Hr.	Reduced walk access time	15.0	24h	5.99	297.8	$32.40	1,159,304	$37.6
2	MNRR Passengers - Disembarking at Penn	2,600 AM Peak Hr.	Increased in-vehicle time	-5.0	24h	5.99	297.8	$24.30	-386,435	-$9.4
3a	Baseline NJT pax gaining direct Penn access	5,000 AM Peak Hr. [1]	Reduced in-vehicle time	20.0	Peak	4.00	261.0	$24.30	1,740,000	$42.3
Total									7,293,330	$255.6
Option P - Hudson Tunnels with Deep Penn Station Platforms										
1	All NJT passengers disembarking in NYC	50,444 AM Peak Hr. [2]	Reduced headway: 21 more trains	3.5	Peak	4.00	261.0	$32.40	2,650,405	$85.9
3a	Baseline NJT pax gaining direct Penn access	5,000 AM Peak Hr. [1]	Reduced in-vehicle time	20.0	Peak	4.00	261.0	$24.30	1,740,000	$42.3
Total									2,650,405	$85.9
Option S - Hudson Tunnels with Connection to Sunnyside Yards										
1	All NJT passengers disembarking in NYC	50,044 AM Peak Hr. [2]	Reduced headway: 17 more trains	3.2	Peak	4.00	261.0	$32.40	2,394,622	$77.6
3a	Baseline NJT pax gaining direct Penn access	5,000 AM Peak Hr. [1]	Reduced in-vehicle time	20.0	Peak	4.00	261.0	$24.30	1,740,000	$42.3
Total									2,394,622	$77.6

Reduced Overcrowding

Group	Description	Weekday Average	Benefit		Time of Benefit	Multipliers				Value ($M/yr)
			Description	Minutes		Daily	Annual	Time		
3b	Baseline NJT pax in crowded trains - G/P/S	23,500 AM Peak Hr. [1]	Reduced overcrowding	5.0	Peak	4.00	261.0	$32.40		$66.3

Reduced Externalities of Auto Use

Group	Description	Weekday Average Vehicle Trips	Benefit		Time of Benefit	Multipliers				Value ($M/yr)
			Description	$/VMT		Daily	Annual	Time		
4G	Auto trips diverted to rail - Option G	9,400 Weekday [3]	Reduced congestion, air pollution	$0.298	24h	1.00	261.0			$15.8
4P	Auto trips diverted to rail - Option P	4,600 Weekday [3]	Reduced congestion, air pollution	$0.298	24h	1.00	261.0			$7.7
4S	Auto trips diverted to rail - Option S	4,200 Weekday [3]	Reduced congestion, air pollution	$0.298	24h	1.00	261.0			$7.0

Increase in peak-hour passenger capacity

Into Manhattan [4]	20160
Into Lower Manhattan	0
Into Midtown [4]	20160

Other Results

Direct Users of the Facility (pax per average weekday)	201,778
Total Time Savings (minutes per average weekday)	1,106,222

Notes

Unless otherwise noted, data is from Access to the Region's Core Study, "Regional Citizens Advisory Committee Meeting Highlights, Monday, April 29, 2002"

[1]

Baseline 2020 NJT Ridership into Manhattan	28,500	AM Peak Hour
Baseline 2020 NJT Capacity into Manhattan	23,500	AM Peak Hour
Passengers having to commute via Hoboken Terminal	5,000	AM Peak Hour

[2] One of the primary benefits of this project is increased service frequency along the lines that run into Manhattan. All users of these lines will benefit from this increase in frequency, not just those traveling into Manhattan

Average Weekday Trips, First Quarter 2003

Line	Total Trips	To/From Manh.	% Into Manhattan
NE Corridor	80300	61600	77%
North Jersey Coast	27400	17000	62%
Raritan Valley	16000	7500	47%
Morris & Essex	41600	25800	62%
Montclair/Boonton	9700	3700	38%
Total	175000	115600	66%

Option	Baseline 2020 passengers into Manhattan	NYC Share of NYC + Newark Boardings (2002)	Estimated total baseline passengers	Build Scenario passengers into Manhattan	Total passengers benefiting from increased service
Option G	28,500	66%	43,144	37,700	52,344
Option P	28,500	66%	43,144	35,800	50,444
Option S	28,500	66%	43,144	35,400	50,044

Source: NJT Facts at a Glance (http://www.njtransit.com/pdf/an_Facts2002.pdf)

[3] Average auto commute trip is 21.6 miles, same as the average NJ Transit trip
New train service is divided among the four lines that run into Penn Station.
FY 2002: Avg. NJT Weekday Rail Trips = 212600 NJT Weekday Trips In/Out of NYC = 117616 Share of all trips = 55%

Option	Baseline Scenario Trains	Baseline Scenario Headway	Build Scenario Trains	Build Scenario Headway	Avg. Time Saved
Option G	15	12	28	6.4	2.79
Option P	15	12	36	5.0	3.50
Option S	15	12	32	5.6	3.19

Assumes eight peak hour trains are Amtrak, not NJ Transit
Also assumes service is divided equally among three NJ Transit branches.

[4] Assumes 21 trains, 8 cars per train, 120 passengers/car.

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F. East Side Access

Table 10. Estimated benefits for LIRR East Side Access in 2010.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$269.2 M	-$28.3 M		
Non-Users (or users & non-users)	$63.4 M			$29.8 M

The East Side Access project would enable Long Island Railroad commuter trains to reach Grand Central Station via the existing lower level of the 63rd Street Tunnel. This project would unleash multiple and complex changes in travel demand and behavior. Fortunately, the Environmental Impact Study that was completed for the East Side Access project included a modeling analysis that estimated these changes in travel patterns. Our analysis is based on the EIS model results.

In terms of travel time savings, the most significant benefit of the project will be to offer passengers a choice of two terminals with Midtown, instead of just one. This is important, because most jobs in Midtown are located on the East Side, a significant distance away from Penn Station. Allowing passengers to choose the terminal closest to their ultimate destination will significantly reduce their total travel times. The EIS estimates that about 52% of LIRR passengers will choose to disembark at Grand Central Terminal. On average, they will spend about 1.5 minutes longer onboard the train, but will save nearly 11 minutes between the terminal and their destinations. This saves a total of 7.1 million hours per year, with a total value of about $241 million.

Because Penn Station is at capacity, the East Side Access project will enable LIRR to increase service frequencies throughout its system. This will benefit all LIRR passengers, not just those choosing to travel to Grand Central. According to the service plan included in the EIS, a total of 18 trains will be added in the peak hour. This will save rush hour passengers nearly 2 million hours in waiting time per year, or about $63 million.

According to the EIS model results, this project will also cause some automobile passengers to switch to the train. This will provide nearly $30 million annually in benefits due to the reduced externalities of motor vehicle use.

East Side Access has other important benefits that are not quantified here. By freeing up track capacity in Penn Station, it will enable Metro-North to proceed with its plans to run some trains on the Hudson and New Haven lines directly to Penn instead of Grand Central. By providing Metro-North passengers with a choice of two terminals instead of one, this will again benefit passengers by reducing access time between terminals and workplaces. In addition, this track capacity could be used to increase NJ Transit service into Penn Station.

East Side Access also includes the construction of a new rail station in Sunnyside Yards adjacent to Queens Plaza. While the station itself will be simple, it could be quite important to the city economically. It would accommodate all four major commuter and intercity rail operators in the region (New Jersey Transit, Long Island Railroad, Metro North, and Amtrak) in one place, close to several subway lines and the emerging new Long Island City business district. The benefits

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from this project are assessed as part of the Boston Consulting Group's economic development analysis.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average		Benefit		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
				Description	Minutes		Daily	Annual	Time		
1	LIRR passengers who switch to GCT and Sunnyside	156,736	All day, 2010 [1]	In-vehicle time [2]	-1.5	24h	1.0	292.9	$24.30	-1,164,500	-$28.3
1	LIRR passengers who switch to GCT and Sunnyside	156,736	All day, 2010 [1]	Out-of-vehicle time [2]	10.9	24h	1.0	292.9	$32.40	8,307,896	$269.2
2	All LIRR passengers - benefit from increased service	148,780	AM Peak Hr, 2010 [7]	Reduced headways	0.8	Peak Pds.	4.0	261.0	$32.40	1,956,694	$63.4
Total										9,100,090	$304.3
1	LIRR passengers who switch to GCT and Sunnyside	166,972	All day, 2020 [3]	In-vehicle time [4]	-1.5	24h	1.0	292.9	$24.30	-1,189,395	-$28.9
1	LIRR passengers who switch to GCT and Sunnyside	166,972	All day, 2020 [3]	Out-of-vehicle time [4]	10.9	24h	1.0	292.9	$32.40	8,858,807	$287.1
2	All LIRR passengers - benefit from increased service	159,670	AM Peak Hr, 2010 [7]	Reduced headways	0.8	Peak Pds.	4.0	261.0	$32.40	2,099,915	$68.0
Total										9,769,327	$326.2

Reduced Externalities of Auto Use

Group	Description	Weekday Average Vehicle Trips		Benefit		Time of Benefit	Multipliers				Value ($M/yr)
				Description	$/VMT		Daily	Annual	Time		
3	Mode shift from automobile to rail 2010	341,786	VMT, all day, 2010 [5]	Reduced VMT	0.298	24h	1.0	292.9			$29.8
3	Mode shift from automobile to rail 2020	374,662	VMT, all day, 2020 [6]	Reduced VMT	0.298	24h	1.0	292.9			$32.6

Increase in peak-hour passenger capacity

Into Manhattan [8]	19440
Into Lower Manhattan	0
Into Midtown [8]	19440

Other Results

Direct Users of the Facility (pax per average weekday, 2010)	156,736
Total Time Savings (minutes per average weekday, 2010)	1,913,215

Notes

[1] KPMG, "Draft Ridership Forecasting Results Report," (July 13, 1999). Appendix C in MTA, *East Side Access Draft EIS* (May 2000): Table 4-5.
[2] *Ibid*., Table 4-6
[3] *Ibid*., Table 5-5
[4] *Ibid*., Table 5-6
[5] *Ibid*., Table 4-8
[6] *Ibid*., Table 5-8

[7] AM Peak Hour Boardings and Trains by Branch

Branch	2010 Passengers %	2010 Passengers # (build scenario)	2010 Trains No build	2010 Trains Build	2010 Headway NB	2010 Headway Build	Avg. Time Saved	Total Time Saved (min)
City Terminal Zone	5.5%	8223	31	37	1.94	1.62	0.16	1290
Babylon	22.7%	33745	18	18	3.33	3.33	0.00	0
Far Rockaway	5.6%	8367	5	4	12.00	15.00	-1.50	-12551
Hempstead	4.6%	6838	4	6	15.00	10.00	2.50	17095
Long Beach	5.4%	8035	4	6	15.00	10.00	2.50	20088
Montauk	3.0%	4411	5	4	12.00	15.00	-1.50	-6617
Oyster Bay	2.0%	2964	3	2	20.00	30.00	-5.00	-14820
Port Jefferson	22.4%	33334	8	13	7.50	4.62	1.44	48078
Port Washington	14.3%	21283	8	12	7.50	5.00	1.25	26604
Ronkonkoma	13.1%	19416	5	7	12.00	8.57	1.71	33285
West Hempstead	1.5%	2162	2	2	30.00	30.00	0.00	0
Total		148778						112452

Source: *East Side Access Draft EIS* (May 2000): Tables 9B-3

Time Savings Per AM Peak Passenger Due to Reduced Headway	0.76 min

[8] Assumes 18 trains, 9 cars/train, 120 passenger/car

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G. LIRR/JFK Access to Lower Manhattan

Table 11. Estimated benefits for LIRR/Airtrain Lower Manhattan Access in 2000.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	-$15.0 M	$88.4 M		
Non-Users (or users & non-users)	-$10.7 M			

The concept of providing a one-seat ride from Lower Manhattan to JFK International Airport has gained prominence since the terrorist attacks of Sept. 11, 2001. However, unlike many of the other projects proposed for Lower Manhattan (including the Fulton Transit Center, permanent PATH station, and new South Ferry Station), there is no overall consensus over what overall form this project should take. Several different operational concepts (a self-enclosed shuttle system, integration with LIRR operations, integration with the subway system) and alignments (using existing tunnels, building new tunnels) have been proposed, each of which would serve different segments of the transportation market more effectively. The Lower Manhattan Development Corporation, Metropolitan Transportation Authority, and Port Authority will be studying the various options with the goal of selecting a preferred alternative by 2004.

The Partnership for New York City has requested that we examine the "Super Shuttle" proposal being advanced by Brookfield Properties, because it has been the option most prominently debated in the media. Under this proposal, trains would run north from JFK Airport on the Port Authority's new Airtrain tracks to Jamaica Station, where it would connect with LIRR and NYC Transit services. From there, it would run down the LIRR's Atlantic Avenue tracks (expected to see less commuter train use once LIRR begins running trains into Grand Central Terminal) to Downtown Brooklyn. Next, the train would run through a new tunnel connecting to the tracks currently used by the A & C subway lines, and use the Rutgers Tunnel to reach the Fulton Transit Center and a possible new terminal near the World Trade Center site. To free up enough track capacity for the Super Shuttle, the C subway line would be diverted to share tracks with the F line between Jay Street in Brooklyn and West 4th Street in Manhattan.

Three major transportation markets would be served by this new service. First, we assume that the existence of a new one-seat ride to Lower Manhattan will double the total number of passengers using Airtrain for off-airport access. The Port Authority projects 11,000 daily off-airport Airtrain passengers, so we assume this project will contribute another 11,000. We estimate that these passengers will save an average of 14 minutes between the airport and their destinations, for a total annual value of $18.3 million.

The second market is Long Island Railroad commuters with destinations in Downtown Brooklyn and Lower Manhattan, about 49,000 daily. They will save about 2.3 minutes each using the Super Shuttle rather than taking LIRR to Penn Station or Grand Central Terminal and transferring to an express subway. This provides a benefit of $18.3 million per year.

The third market is subway riders from eastern Queens with destinations in Downtown Brooklyn and Lower Manhattan. We assume that 25% of the passengers boarding E, J, or Z trains in Jamaica have destinations in these areas. Based on an estimated travel time benefit of about 21

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minutes per trip, we find an in-vehicle time savings benefit of about $70 million. But this benefit will come at a cost: by switching from a multiple-stop subway to a shuttle with very few stops, passengers will have longer walks from the train station to their destinations. After this welfare loss of about $33 million is taken into account, the total benefit to these subway riders is about $37 million per year.

The Super Shuttle proposal will also have adverse consequences for subway riders who are inconvenienced by the diversion of the C train. We estimate that about 22,000 daily riders of the C train have destinations in Lower Manhattan, and will need to transfer to another line. We estimate that this will delay them an average of three minutes each, for a total annual cost of about $10.7 million.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average		Note	Time Savings		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
					Description	Minutes		Daily	Annual	Time		
1	C Train Riders (NB) to Lower Manhattan	3,026	AM peak hour	[1]	Must make extra transfer	-3.00	24 hours	7.4	295.1	$32.40	-330,914	-$10.7
2	LIRR Passengers to Lower Manhattan	8,926	AM peak hour	[2]	Travel time savings	2.34	24 hours	5.5	292.9	$32.40	563,975	$18.3
3	Airtrain Passengers to Lower Manhattan	11,000	Full weekday	[3]	Travel time savings	14.00	24 hours	1.0	292.9	$24.30	751,731	$18.3
4a	Jamaica Center/L.M. subway passengers	8,354	Full weekday	[4]	Reduced in-vehicle travel time	21.08	24 hours	1.0	295.1	$24.30	865,945	$21.0
4a	Jamaica Center/L.M. subway passengers	8,354	Full weekday	[4]	Increased walk/transfer time	-13.09	24 hours	1.0	295.1	$32.40	-537,849	-$17.4
4b	Sutphin Blvd/L.M. subway passengers	19,477	Full weekday	[4]	Reduced in-vehicle travel time	21.08	24 hours	1.0	295.1	$24.30	2,018,864	$49.1
4b	Sutphin Blvd/L.M. subway passengers	19,477	Full weekday	[4]	Increased walk/transfer time	-5.09	24 hours	1.0	295.1	$32.40	-487,696	-$15.8
Total											2,844,057	$62.7

Increase in peak-hour passenger capacity

Into Manhattan [5]	2880
Into Lower Manhattan [6]	-6400
Into Midtown	0

Other Results

Direct Users of the Facility (pax per average weekday, 2010)	88,213
Total Time Savings (minutes per average weekday, 2010)	580,319

Notes

[1] The SuperShuttle will reroute the C Train to the F Train tracks between Jay St. and W. 4th Street.
Some of the passengers using the C Train will need to make an extra transfer to reach their destinations.
To find how many people are affected by this change, we first estimated the number of northbound passengers on the C during the AM peak hour.
Based on MTA schedules, we found that about 15 A trains and 7.5 C trains run per hour during the AM peak. We assumed that the A trains are full, and the C trains are half-full.
We further estimated that 50% of these passengers had destinations in Lower Manhattan.
This yielded a result that 20% of all AM Peak passengers through the Cranberry St. tunnel use the C Train.
Finally,we assume that the additional transfer takes about 3 minutes.

	Trains, AM Peak	Passenger Loading Per Train	Trainloads of Passengers	% of Pass.
A Train service, am peak hour	15 trains/hr	100% of capacity	15	80%
C Train service, am peak hour	7.5 trains/hr	50% of capacity	3.75	20%
Total	22.5 trains/hr		18.75	100%

Number of passengers using Cranberry Tunnel (A/C Tunnel to Brooklyn, AM peak) =	30259	[Hub bound, 2000]
Estimated number of northbound C Train passengers, am peak hour	6052	
Estimated share of NB C Train passengers with destination in Lower Manhattan	50%	
Estimated number of NB C Train passengers needing to make an extra transfer to reach Lower Manhattan	3026	

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[2] First, we estimate the number of LIRR passengers bound for Lower Manhattan. The total arrivals below are 2000 data from the MTA. The estimates of the share of arrivals at each destination are from a 1991 MTA survey.

	Total	Share transferring for Lower Manhattan	Total transferring for Lower Manhattan
Arrivals at Penn Station, AM Peak Hour	38960	17%	6623
Arrivals at Atlantic Term., AM Peak Hour	4700	49%	2303
			8926

Next, we estimate the total travel times to each of 8 downtown zones. We thank Jeff Zupan for allowing us to use his data and methodology.

Transfer time: 5 minutes

No-Build Scenario LIRR to Downtown via Atlantic Terminal	Share of LM jobs	Share Transfering in Jamaica	Xfer in Jamaica	Wait in Jamaica	Jamaica to AT	Transfer to Subway	Wait for Sub-way	Time on Sub-way	Walk Dist.	Walk Time	Sum of All Times via AT
West of Bway - North	11.1%	65.2%	3.26	2.8	18.38	5	3	12	625	2.50	46.94
West of Bway - Central	14.8%	65.2%	3.26	2.8	18.38	5	3	10	800	3.20	45.64
West of Bway - South	11.1%	65.2%	3.26	2.8	18.38	5	3	8	625	2.50	42.94
Wall Street - North	21.6%	65.2%	3.26	2.8	18.38	5	3	8	500	2.00	42.44
Wall Street - Central	21.6%	65.2%	3.26	2.8	18.38	5	3	8	500	2.00	42.44
Wall Street - South	10.8%	65.2%	3.26	2.8	18.38	5	3	7	625	2.50	41.94
Govt Ctr - North	5.5%	65.2%	3.26	2.8	18.38	5	3	11	400	1.60	45.04
Govt Ctr - South	3.6%	65.2%	3.26	2.8	18.38	5	3	10	625	2.50	44.94

No-Build Scenario LIRR to Downtown via Penn Station	Share of LM jobs	Share Transfering in Jamaica	Xfer in Jamaica	Wait in Jamaica	Jamaica to PS	Transfer to Subway	Wait for Sub-way	Time on Sub-way	Walk Dist.	Walk Time	Sum of All Times via PS
West of Bway - North	11.1%	36.3%	1.82	0	20.25	5	3.25	9	500	2.00	41.32
West of Bway - Central	14.8%	36.3%	1.82	0	20.25	5	2.75	11.5	625	2.50	43.82
West of Bway - South	11.1%	36.3%	1.82	0	20.25	5	3	12	625	2.50	44.57
Wall Street - North	21.6%	36.3%	1.82	0	20.25	5	3	12	625	2.50	44.57
Wall Street - Central	21.6%	36.3%	1.82	0	20.25	5	3	13	500	2.00	45.07
Wall Street - South	10.8%	36.3%	1.82	0	20.25	5	3	15	625	2.50	47.57
Govt Ctr - North	5.5%	36.3%	1.82	0	20.25	5	3.5	8	750	3.00	41.57
Govt Ctr - South	3.6%	36.3%	1.82	0	20.25	5	3.5	10	635	2.54	43.11

Brookfield Proposal LIRR to Downtown via Atlantic Terminal	Share of LM jobs	Share Transfering in Jamaica	Xfer in Jamaica	Wait in Jamaica	Jamaica to AT	Transfer to Subway	Wait for Sub-way	Time on Sub-way	Walk Dist.	Walk Time	Sum of All Times via AT
West of Bway - North	11.1%	100.0%	5.00	3	18.38	5	3	12	625	2.50	48.88
West of Bway - Central	14.8%	100.0%	5.00	3	18.38	5	3	10	800	3.20	47.58
West of Bway - South	11.1%	100.0%	5.00	3	18.38	5	3	8	625	2.50	44.88
Wall Street - North	21.6%	100.0%	5.00	3	18.38	5	3	8	500	2.00	44.38
Wall Street - Central	21.6%	100.0%	5.00	3	18.38	5	3	8	500	2.00	44.38
Wall Street - South	10.8%	100.0%	5.00	3	18.38	5	3	7	625	2.50	43.88
Govt Ctr - North	5.5%	100.0%	5.00	3	18.38	5	3	11	400	1.60	46.98
Govt Ctr - South	3.6%	100.0%	5.00	3	18.38	5	3	10	625	2.50	46.88

Brookfield Proposal LIRR to Downtown via Penn Station	Share of LM jobs	Share Transfering in Jamaica	Xfer in Jamaica	Wait in Jamaica	Jamaica to PS	Transfer to Subway	Wait for Sub-way	Time on Sub-way	Walk Dist.	Walk Time	Sum of All Times via PS
West of Bway - North	11.1%	0.0%	0.00	0	20.25	5	3.25	9	500	2.00	39.50
West of Bway - Central	14.8%	0.0%	0.00	0	20.25	5	2.75	11.5	625	2.50	42.00
West of Bway - South	11.1%	0.0%	0.00	0	20.25	5	3	12	625	2.50	42.75
Wall Street - North	21.6%	0.0%	0.00	0	20.25	5	3	12	625	2.50	42.75
Wall Street - Central	21.6%	0.0%	0.00	0	20.25	5	3	13	500	2.00	43.25
Wall Street - South	10.8%	0.0%	0.00	0	20.25	5	3	15	625	2.50	45.75
Govt Ctr - North	5.5%	0.0%	0.00	0	20.25	5	3.5	8	750	3.00	39.75
Govt Ctr - South	3.6%	0.0%	0.00	0	20.25	5	3.5	10	625	2.50	41.25

Brookfield Via SuperShuttle	Share of LM jobs	Share Transfering in Jamaica	Xfer in Jamaica	Wait in Jamaica	Jamaica to WTC				Walk Dist.	Walk Time	Sum of All Times via SS
West of Bway - North	11.1%	100.0%	5.00	3	25				1250	5.00	38.00
West of Bway - Central	14.8%	100.0%	5.00	3	25				400	1.60	34.60
West of Bway - South	11.1%	100.0%	5.00	3	25				2100	8.40	41.40
Wall Street - North	21.6%	100.0%	5.00	3	25				1700	6.80	39.80
Wall Street - Central	21.6%	100.0%	5.00	3	25				2500	10.00	43.00
Wall Street - South	10.8%	100.0%	5.00	3	25				2900	11.60	44.60
Govt Ctr - North	5.5%	100.0%	5.00	3	25				2700	10.80	43.80
Govt Ctr - South	3.6%	100.0%	5.00	3	25				1850	7.40	40.40

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		No-Build Scenario			Brookfield Proposal				
	Share of LM jobs	Via Atlantic Term.	Via Penn Station	**Minimum travel time**	Via Atlantic Term.	Via Penn Station	Via SuperShuttle	**Min. travel time**	**Time Saved**
West of Bway - North	11.1%	46.9	41.3	**41.3**	48.9	39.5	38.0	**38.0**	**3.3**
West of Bway - Central	14.8%	45.6	43.8	**43.8**	47.6	42.0	34.6	**34.6**	**9.2**
West of Bway - South	11.1%	42.9	44.6	**42.9**	44.9	42.8	41.4	**41.4**	**1.5**
Wall Street - North	21.6%	42.4	44.6	**42.4**	44.4	42.8	39.8	**39.8**	**2.6**
Wall Street - Central	21.6%	42.4	45.1	**42.4**	44.4	43.3	43.0	**43.0**	**-0.6**
Wall Street - South	10.8%	41.9	47.6	**41.9**	43.9	45.8	44.6	**43.9**	**-1.9**
Govt Ctr - North	5.5%	45.0	41.6	**41.6**	47.0	39.8	43.8	**39.8**	**1.8**
Govt Ctr - South	3.6%	44.9	43.1	**43.1**	46.9	41.3	40.4	**40.4**	**2.7**
Weighted Average				**42.5**				**40.2**	**2.3**

These travel time savings are a mix of in-vehicle time and out-of-vehicle time.
For the purpose of estimating travel time savings benefits, we have assumed that all of these time savings are out-of-vehicle savings (the higher value-of-time figure)

[3] Baseline projection for off-airport Airtrain ridership 11,000 Daily passengers [Airtrain Website]
Assumed ridership growth as a result of new SuperShuttle connection 100%
Assumed share of transit passengers to airport using SuperShuttle 50%
Estimated number of passengers using SuperShuttle for airport access 11,000 Daily passengers

Average in-vehicle travel time on A Train, Howard Beach to Chambers St. 42 minutes
Average in-vehicle travel time on SuperShuttle, Jamaica to WTC 28 minutes
Difference: 14 minutes

[4] Passengers who currently use the subway to reach Lower Manhattan from Jamaica will now be able to switch to the faster SuperShuttle.
We assume that 25% of the total daily passengers using the two main stations in Jamaica travel to/from Lower Manhattan.

Station	**Total Daily Passengers**	**% to Lower Manh.**	**Estimated Passengers traveling to/from Lower Mahattan**
Jamaica Center	33416	25%	8354
Sutphin Blvd.	77906	25%	19477

Riders Boarding in Jamaica Center	**Via Subway**			**Via Subway & SuperShuttle**						**Time Savings**	
Brookfield Via SuperShuttle	**TT to Lower Manh.**	**Walk Dist.**	**Walk Time**	**Travel to Jamaica**	**Xfer at Jamaica**	**Wait in Jamaica**	**Jamaica to WTC**	**Walk Dist.**	**Walk Time**	**In-Vehicle**	**Out-of-Vehicle**
West of Bway - North	47.0	500	2.00	2.00	5.00	3.00	25.00	1250	5.00	20.00	-11.00
West of Bway - Central	47.0	625	2.50	2.00	5.00	3.00	25.00	400	1.60	20.00	-7.10
West of Bway - South	47.0	625	2.50	2.00	5.00	3.00	25.00	2100	8.40	20.00	-13.90
Wall Street - North	49.0	625	2.50	2.00	5.00	3.00	25.00	1700	6.80	22.00	-12.30
Wall Street - Central	49.0	500	2.00	2.00	5.00	3.00	25.00	2500	10.00	22.00	-16.00
Wall Street - South	49.0	625	2.50	2.00	5.00	3.00	25.00	2900	11.60	22.00	-17.10
Govt Ctr - North	47.0	750	3.00	2.00	5.00	3.00	25.00	2700	10.80	20.00	-15.80
Govt Ctr - South	47.0	625	2.50	2.00	5.00	3.00	25.00	1850	7.40	20.00	-12.90
										21.08	**-13.09**

Riders Boarding at Sutphin Blvd.	**Via Subway**			**Via SuperShuttle**					**Time Savings**	
Brookfield Via SuperShuttle	**TT to Lower Manh.**	**Walk Dist.**	**Walk Time**				**Jamaica to WTC**	**Walk Dist.**	**Walk Time**	**In-Vehicle**	**Out-of-Vehicle**
West of Bway - North	45.0	500	2.00				25.00	1250	5.00	20.00	-3.00
West of Bway - Central	45.0	625	2.50				25.00	400	1.60	20.00	0.90
West of Bway - South	45.0	625	2.50				25.00	2100	8.40	20.00	-5.90
Wall Street - North	47.0	625	2.50				25.00	1700	6.80	22.00	-4.30
Wall Street - Central	47.0	500	2.00				25.00	2500	10.00	22.00	-8.00
Wall Street - South	47.0	625	2.50				25.00	2900	11.60	22.00	-9.10
Govt Ctr - North	45.0	750	3.00				25.00	2700	10.80	20.00	-7.80
Govt Ctr - South	45.0	625	2.50				25.00	1850	7.40	20.00	-4.90
										21.08	**-5.09**

[5] Assumes SuperShuttle carries 6 trains per hour, 4 cars/train, 120 passengers/car
[6] Same as above, but now C trains no longer serve Lower Manhattan. Their capacity is roughly 8 trains/hr., 8 cars/train, 145 passengers/car.

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H. New Penn Station in the Farley Post Office

Table 12. Estimated benefits for the New Penn Station in 2000.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility	$33.3 M			
Non-Users (or users & non-users)				

The Empire State Development Corporation is leading an effort to redevelop the Farley Post Office across 8th Avenue from the existing Penn Station into a grand new rail terminal evocative of the old Penn Station that stood on the site of Madison Square Garden. Under the plans currently being developed, Amtrak would move all of its passenger facilities into the new building (to be renamed Moynihan Station, in honor of the late Senator who championed the project). New Jersey Transit would take over the entire space that it currently shares with Amtrak in the existing Penn Station, and LIRR would remain where it is. Spreading out the passenger facilities in the expanded station would reduce crowding and provide more space for improved retail and services. It would also enable Amtrak to provide amenities competitive with those offered by airlines to their business travelers. Finally, it would also provide space for future Metro-North operations (made possible by East Side Access) and possible express rail service to JFK Airport.

Despite these many benefits, the project will neither increase the track capacity of Penn Station, not increase the frequency of service provided there. As a result, the quantifiable travel time benefits of this project are small. We estimate that the improved passenger circulation and platform access that this project will provide will save the average NJ Transit and Amtrak passenger three minutes each during peak hours. This yields a total benefit of one million hours annually, or about $33 million.

We did not quantify the benefits of potential service improvements that this project would facilitate, because the costs and details of these projects have not been defined.

Detailed Analysis:

Benefits from Time Savings

Group	Description	Weekday Average	Time Savings		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
			Description	Minutes		Daily	Annual	Time		
1	NJ Transit & Amtrak passengers	78,783 Peak periods	Reduced platform access time	3	Peak periods	1.0	261.0	$32.40	1,028,118	$33.3
Total									1,028,118	$33.3

Increase in peak-hour passenger capacity

Into Manhattan	0
Into Lower Manhattan	0
Into Midtown	0

Other Results

Direct Users of the Facility (pax per average weekday, 2010)	78,783
Total Time Savings (minutes per average weekday, 2010)	236,349

Notes

The main travel benefits of this project are that it will relieve overcrowding in the NJ Transit and Amtrak ticketing and waiting areas.
This will reduce the amount of time it takes passengers to reach the platform.
We assume that an estimate of 3 minutes/trip generously accommodates both the platform access time and productivity benefits from reduced overcrowding.

	Inbound		Outbound		
	7-10 am	5-8 pm	7-10 am	5-8 pm	TOTAL
"NJ Sector" Rail Passengers	35518	6296	922	36047	78783

Source: Hub Bound 2000

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I. Extending PATH to Newark Airport Station.

Table 2. Estimated benefits for the Fulton Transit Center and Permanent PATH Station in 2010.

Group of Beneficiaries	Out-of-Vehicle Time Savings	In-Vehicle Time Savings	Reduced Exposure to Overcrowding	Reduced Externalities of Automobile Use
Direct Users of the Facility		$10.9 M		
Non-Users (or users & non-users)				

The final project examined in this study is an extension of the PATH system from its present terminus at Newark's Penn Station to the new Newark Airport Station on the Northeast Corridor. Details of this project are not yet available, but we have assumed that passengers would need to switch to the Airtrain at Newark Airport Station. Although it is not located in New York City proper, this project to benefit Lower Manhattan by providing a convenient connection to Airtrain without requiring a transfer between PATH and NJ Transit.

We are not aware of any ridership projections that have been developed for this project. Development of an accurate forecast is beyond the scope of this study. For the sake of comparison, we analyzed a scenario in which the extension of PATH to Newark Airport Station triples the total Airtrain ridership between the rail station and the airport. We further assumed that there would be no reduction in the number of passengers taking NJ Transit to the Airtrain, and that no passengers would arrive at Newark Airport Station by other modes.

Based on these assumptions, and Port Authority forecasts for Airtrain ridership in 2010 and the share of riders connecting to Newark Airport Station, we estimated 2.1 million additional passengers using the Airtrain to/from Newark Airport Station due to the PATH connection. If each of these riders saves an average of 12 minutes from not having to transfer to a New Jersey Transit train, then the total annual time savings would be 430,000 hours, or about $10.9 million.

Note that in this case, neither the ridership estimate nor the time savings estimate comes from any formal analysis of the project's benefits. We look forward to refining this analysis once more detailed studies of the project become available.

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Detailed Analysis:

Benefits from Time Savings

Group	Description	Annual Average (2010)	Time Savings		Time of Benefit	Multipliers			Time Saved (person-hr/yr)	Value ($M/yr)
			Description	Minutes		Daily	Annual	Time		
1	All passengers using PATH extension	2,137,549 [1]	Reduced travel time	12	24 hours	-	1.0	$25.53	427,510	$10.91
Total									427,510	$10.91

Increase in peak-hour passenger capacity

Into Manhattan	0
Into Lower Manhattan	0
Into Midtown	0

Other Results

Direct Users of the Facility (pax per average weekday, 2010)	7,125
Total Time Savings (minutes per average weekday, 2010)	85,502

Notes

No data is available for this project. Our estimate is based on several coarse assumptions:

1. The PATH extension to Newark Airport Station will carry double the number of passengers taking NJ Transit to the airport.
2. These passengers will save an average of 12 minutes per trip.
3. No other benefits are counted (e.g. PATH passengers using the Newark Airport Station but not traveling to/from the airport).
4. Passenger demand grows in proportion to activity at the airport.

[1] Ridership on extension is assumed to the currently-projected ridership on Airtrain.

Data from the Port Authority on Airtrain ridership.

Year	Million Annual Airline Pax	Airtrain Passengers, Peak Month			Annual Airtrain Pax	Pax connecting to rail station		Growth Rate
		Total	Airport Circulator	Connect-ion to Rail Station		Pct.	Annual Total	
2002	36.2	39900	36020	3700	10101266	9.3%	936,709	
2005	39.1	42900	39000	3900	10860759	9.1%	987,342	
2010	45	49400	45100	4300	12278481	8.7%	1,068,775	1.598%

Source: PANYNJ, "Newark International Airport Monorail Ridership-Historical and Projection" [http://www.panynj.gov/airtrainnewark/history.facts.html].

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