A. INTRODUCTION

The Federal Transit Administration (FTA) and the Metropolitan Transportation Authority (MTA), in cooperation with MTA New York City Transit (NYCT), propose to construct the Second Avenue Subway in Manhattan to provide much-needed transit access to East Side residents, workers, and visitors, to reduce excess crowding on the nearly 100-year-old Lexington Avenue subway, and to improve mobility for all New Yorkers.

The proposed project analyzed in the Final Environmental Impact Statement (FEIS) is a full-length Second Avenue Subway from Harlem in Upper Manhattan to the Financial District in Lower Manhattan. This project is being recommended after careful consideration of a full range of alternatives in the Major Investment Study (MIS) for Manhattan East Side Transit Alternatives (MESA) and public and agency response to the MESA MIS and Draft Environmental Impact Statement (DEIS) published in 1999.[1] The FEIS has been prepared pursuant to the National Environmental Policy Act (NEPA). Consistent with the regulations implementing NEPA, its purpose is to assess the short- and long-term impacts, both beneficial and adverse, to the human and natural environment that would be created by the Second Avenue Subway during both its construction and operation. The FTA cannot approve or fund the construction of the Second Avenue Subway until the requirements of NEPA are satisfied. A Final Section 4(f) Evaluation and Section 6(f) Evaluation and a Programmatic Agreement between the FTA, MTA, NYCT, and the New York State Historic Preservation Officer (SHPO) are included in this FEIS.[2]

As shown in Figure S-1, the Second Avenue Subway would be a new, two-track, approximately 8.5-mile rail line extending the length of Manhattan's East Side corridor from 125th Street to Hanover Square, serving East Harlem, the Upper East Side, Midtown, Gramercy Park/Union Square, the East Village/Lower East Side/Chinatown, and Lower Manhattan. These neighborhoods contain more than 700,000 residents according to the 2000 Census, two of the

[1] These studies were undertaken in compliance with the National Environmental Policy Act (NEPA) and the MIS process established by the Intermodal Surface Transportation Efficiency Act (ISTEA), now the Transportation Efficiency Act for the 21st Century (TEA-21).

[2] These documents satisfy the requirements of 49 USC §303(c) commonly referred to as Section 4(f) of the Department of Transportation Act of 1966, the Land & Water Conservation Fund Act (LWCFA), 16 U.S.C. §§ 460*l*-4 to 460*l*-11, which is commonly referred to as Section 6(f), and Section 106 of the National Historic Preservation Act of 1966, respectively. Consistent with the requirements of Executive Order 12898 of 1994, issues concerning environmental justice have also been assessed and are included within this FEIS. FTA has coordinated compliance with the Executive Order and the statutes regarding Sections 4(f), 6(f), and 106 with the NEPA process. Further, NYCT and the FTA have also conducted and coordinated the public outreach processes required by NEPA, the Executive Order, and Sections 4(f) and 106.

largest Central Business Districts (CBDs) in the United States, and approximately 45 percent of all private sector jobs in Manhattan, including many of the world's leading financial, cultural, medical, educational, and communications employers. The added capacity provided by the Second Avenue Subway would improve service for passengers traveling into and through the East Side corridor on the new service as well as for passengers on the existing Lexington Avenue Line (4 5 6), which currently provides the only full north-south rapid transit subway service on the East Side to Lower Manhattan. The new line would make the East Side neighborhoods more accessible not only to those who live there, but to visitors and workers traveling from other parts of New York City as well. A new connection at Metro-North's Harlem-125th Street Station would also improve regional access to the East Side and Lower Manhattan for commuters entering and leaving Manhattan from suburbs located north of Manhattan in both New York State and Connecticut. With completion of the East Side Access Project connecting Long Island Rail Road service to Grand Central Terminal, the Second Avenue Subway would also serve commuters from Long Island arriving at Grand Central who transfer to the Lexington Avenue Line, since the new subway would alleviate crowding on that line.

The Second Avenue Subway is planned to provide two subway services in this corridor, as shown in Figure S-1. The first would be the full-length Second Avenue route operating between 125th Street and Hanover Square. The second service would operate along Second Avenue from 125th Street to 63rd Street, and then travel west along the existing 63rd Street Line and stop at the existing Lexington Avenue-63rd Street Station; it would then join the existing Broadway Line (currently served by N R Q W) via an existing connection and serve express stations along Seventh Avenue and Broadway before crossing the Manhattan Bridge to Brooklyn. Passengers traveling to Lower Manhattan on this route could transfer to local services for destinations south of Canal Street.

The estimated cost to construct the full-length Second Avenue Subway and all of its ancillary facilities is $13.3 billion in 2004 dollars, or $16.8 billion in year-of-expenditure dollars.

FTA indicated in its Fiscal Year 2005 Annual Report on New Starts[1] that, given the Second Avenue Subway project's total capital cost and requested New Starts share, a minimum operable segment (MOS) will be required before the project is permitted to advance into final design. The MOS must be fully operable, with access to maintenance and storage facilities, so that it offers transportation benefits even if no further federal investment in the larger project is made. To comply with this, construction of the Second Avenue Subway will be phased. The phasing plan described in the FEIS incorporates information obtained through ongoing engineering and achieves the best balance between constructability, operability, and the availability of funding. In addition, the phasing plan responds to public comments on construction schedule and sequencing. The four phases, which could potentially overlap, are as follows:

[1] U.S. Department of Transportation, Federal Transit Administration, *Annual Report on New Starts, Proposed Allocation of Funds for Fiscal Year 2005*, Report of the Secretary of Transportation to the United States Congress Pursuant to 49 USC 5309(o)(1), Report No. FTA-TBP10-2004-1, 2004.

- Phase 1: 105th Street to 62nd Street, including the tunnel connection to the 63rd Street/ Broadway Line, Q passenger service extended from 57th Street to 96th Street. The cost for this phase in year of expenditure dollars is $3.8 billion. The Second Avenue Subway would carry 202,000 riders on an average weekday at the completion of Phase 1.
- Phase 2: 125th Street to 105th Street, Q passenger service extended from 96th Street to 125th Street. This phase would cost $3.4 billion in year of expenditure dollars. The Second Avenue Subway would carry 303,000 riders on an average weekday at the completion of Phase 2.
- Phase 3: 62nd Street to Houston Street, including the 63rd Street tunnel connection to Queens for non-passenger services, new T passenger service from Houston Street to 125th Street. Phase 3 would cost $4.8 billion (in year of expenditure dollars). At the completion of Phase 3, the Second Avenue Subway would carry 456,000 riders on an average weekday.
- Phase 4: Houston Street to Hanover Square tail tracks, T service extended from Houston Street to Hanover Square. The cost for Phase 4 would be $4.8 billion in year of expenditure dollars. The completed Second Avenue Subway is forecasted to carry 560,000 riders on an average weekday.

The costs listed above may change depending on the actual construction schedule for each phase, which could be affected by the amount and availability of federal funding.

The Second Avenue Subway would greatly improve transit access for communities on the East Side, connecting them from Harlem to the Financial District and would decrease the distance customers on the far East Side would have to walk to reach a subway station. In addition, the proposed Second Avenue Subway service via the Broadway Line would create for the first time a one-vehicle ride from East Harlem and the Upper East Side to West Midtown and points south. Subway access for persons with disabilities would be provided on the new line, and riders heading into or out of Manhattan on the Metro-North commuter rail system would benefit from a new transfer at the Harlem-125th Street Station.

B. PROJECT PURPOSE AND NEED

The purpose of the Second Avenue Subway is to address the problems and deficiencies in access and mobility associated with an overburdened transit infrastructure that is struggling to accommodate existing customers as well as new customers from the continuing growth on Manhattan's East Side. The Second Avenue Subway is one of a number of transportation projects in the region now under construction or in the planning stage aimed at expanding MTA's public transit system. Major transportation initiatives sponsored by the MTA and other city, state, regional, and federal agencies would improve access to and from Manhattan and enhance the existing transit system. The Second Avenue Subway would also add new subway service to Lower Manhattan, supporting the ongoing efforts to rebuild the area. It would also serve demand generated not only by existing land uses on the densely developed East Side of Manhattan, but also by several public and private economic and land development initiatives that are planned for the East Side such as the proposed Consolidated Edison site development, the new United Nations building, and a number of hospital-related developments.

STUDY AREA PROBLEMS AND NEEDS

The East Side is densely developed with residential, retail, and commercial office uses. Each day, more than 2 million people travel in the project area (that is, the portions of Manhattan that

would be both served by both the new Second Avenue Line and the Broadway Line and affected by its construction—see Figure S-2) as they commute to and from work. Over three-quarters (78.5 percent) of people working in the project area use the subway, bus, rail, or ferry to get to and from their jobs during the morning and evening rush hours. A total of 1.8 million people travel into the area of Manhattan south of 60th Street each day by subway (for a total of 3.6 million round-trips each day). Employment and population in the study area are expected to increase, with 327,000 new workers. Forty-seven percent of that amount—nearly 155,000 jobs—are expected along the Second Avenue Subway corridor. Additionally, over 60,000 new residents are anticipated by 2025. The remainder of Manhattan will also see population and employment increases, which will influence travel throughout the project area.

OVERCROWDED AND UNRELIABLE SUBWAY SERVICE

The Lexington Avenue Line, the only north-south route serving the East Side, already carries more passengers than any other subway line in the United States. The Lexington Avenue Line alone carries approximately 1.3 million riders each weekday—more than the combined ridership of San Francisco, Chicago, and Boston's *entire* transit systems. With continued growth in the study area, more riders are expected to use the crowded trains, stations, and platforms of the Lexington Avenue Line in the future.

Longer delays and slower travel times occur with more congestion, as trains stop for longer periods at stations to load and unload passengers. In turn, this causes even greater crowding and less reliability. The Lexington Avenue subway operates over capacity during peak hours, and must also support a significant volume of transfers from crosstown subway routes and other routes that cross Lexington Avenue and then run north-south on the West Side.[1] In addition, already heavily used and frequently delayed north-south bus routes on the East Side will also see increased patronage and exacerbated service problems. The lack of capacity and resulting congestion in the city's transportation system eventually leads to the deterioration of environmental and socioeconomic conditions that affect residents' and workers' quality of life. These crowded conditions are described in further detail below in the Transportation section and are illustrated in Tables S-2, S-3, and S-4 later in this Executive Summary.

POOR ACCESS TO SUBWAYS

Because the Lexington Avenue Line is the only route serving most of Manhattan's East Side, workers and residents in much of the study area also have to contend with poor access and walks of 10 to 15 minutes (½ to ¾ mile) to and from the subway. Another factor affects accessibility and mobility in the project area: the Lexington Avenue Line is the only direct subway route between Grand Central Terminal and Lower Manhattan; and passengers on the local (6) trains traveling to Lower Manhattan (south of Brooklyn Bridge–City Hall) from the Bronx, East Harlem, the Upper East Side, and Midtown must transfer to the overloaded express routes (4 5) to reach their final destination. Without subway service east of Lexington Avenue, many residents and commuters rely on buses, vans, or taxis, contributing to the often severe congestion on East Side avenues and cross streets.

[1] It is not feasible to widen the platforms on the Lexington Avenue Line stations because of the presence of buildings' foundations and basements immediately adjacent to the subway.

As other transit and development projects are built, such as MTA's East Side Access Project (bringing new LIRR service to Grand Central Terminal), they will also add to ridership on East Side subways and buses. Without improvements to the existing capacity of the system, it will be difficult for NYCT to meet current, emerging, and future ridership demand.

PROJECT GOALS AND OBJECTIVES

The project's goals, and the objectives to support them, address the corridor's transit problems and needs. They were developed with input from MTA's Long-Range Planning Framework (an internal working group of project managers leading MTA's major long-range transportation projects), various civic and community groups, a Technical Advisory Committee (TAC) that included a broad range of governmental agencies and a Public Advisory Committee. These groups were convened for the MESA MIS/DEIS study initiated in 1995 and for the subsequent SDEIS and this FEIS. The goals and objectives were used to develop and evaluate the alternatives presented and analyzed in the MIS/DEIS and have aided in this study of the full-length Second Avenue Subway.

The project's three main goals are to improve mobility on the East Side of Manhattan, achieve economic feasibility and cost-effectiveness, and maintain or improve environmental conditions. Each goal has supporting objectives (identified in Chapter 1 of the FEIS, "Project Purpose and Need"), which have been used to guide development of plans for the Second Avenue Subway. As demonstrated in the following sections of this FEIS, the Second Avenue Subway would achieve these identified goals. In contrast, the No Build Alternative defined below would not meet any of these goals or objectives to any substantial degree. In particular, it would not meet the first goal of improving mobility on the East Side of Manhattan: with the No Build Alternative, no new transit service would be provided, there would be no reduction in overcrowding and congestion of current transit lines, and accessibility for residents of Manhattan's East Side would not be improved. In addition, the No Build Alternative would not improve environmental conditions (the project's third goal); it would not reduce vehicle trips, improve air quality, support existing land uses, or strengthen the city's economic base.

C. PROJECT ALTERNATIVES

Numerous alternatives have been developed and analyzed for a new Second Avenue Subway since the project was first conceived 75 years ago. During the 1970s, small portions of the Subway were actually constructed in East Harlem and the Lower East Side before construction was suspended because of New York City's fiscal situation at the time. Most recently, the MIS/DEIS published for the MESA Study in August 1999 analyzed a wide range of possible alternatives to ease transit problems on Manhattan's East Side. (For more information on the MIS/DEIS, see section E, "Public Outreach and Review Process," below.)

The MIS/DEIS evaluated a large number of possible alternatives, considering the project's goals and objectives, environmental impacts, cost and feasibility, and public input. Four alternatives were subject to detailed analysis: 1) a No Build Alternative, which included those improvements in the region's transportation system that were expected to be instituted by the future analysis year; 2) a Transportation Systems Management (TSM) Alternative—intended to meet the project's goals and objectives to the extent feasible at relatively low cost—which included improvements to station dwell times on the Lexington Avenue Line, introduction of bus priority lanes on First and Second Avenues between Houston and 96th Streets, and improvements to bus service on the Lower East Side; 3) Build Alternative 1, a new Second Avenue Subway from

125th Street at Lexington Avenue to 63rd Street, and continuing south to Lower Manhattan via the existing Broadway Line; and 4) Build Alternative 2, the same subway element as in Build Alternative 1, supplemented by new light rail transit service on the Lower East Side. Following the publication of the MIS/DEIS and an extensive public outreach effort to solicit comments and suggestions, the public voiced its strong support for a full-length Second Avenue Subway. The MTA Board determined that a full-length Second Avenue Subway from 125th Street to the Financial District in Lower Manhattan should be pursued and further analyzed.

Since the publication of the MIS/DEIS, and especially since the alternatives screening in 1997, subway ridership has increased markedly. This 35 percent increase has exacerbated crowding on the Lexington Avenue Line, increasing the need for a full-length subway line on Manhattan's East Side. In addition, MTA's East Side Access Project will place further importance on relieving the Lexington Avenue Line at Grand Central Terminal. This project was added to the Second Avenue Subway's No Build Alternative after the 1999 MIS/DEIS, based on more secure funding commitments. Because the full-length subway was not analyzed in detail in the MIS/DEIS, the SDEIS, dated March 2003, was prepared to provide such analysis.

After selection of the full-length Second Avenue Subway for continued study, that preferred alternative was refined through an interactive process involving transportation planning, project design, and community outreach. Design refinements were made to the northern portion of the project, including changes to the design of the northern terminal station at 125th Street and modifications to the project alignment between 125th Street and 116th Street to reduce the number of easements required under private property and allow for a new 116th Street Station. Other studies were conducted that focused on alignment and station location considerations between 72nd and 42nd Streets to permit connections at 63rd Street to and from the existing 63rd Street Line, development of multiple alignment options between Houston and Canal Streets, and the Lower Manhattan alignment and southern terminal. That project was described and assessed in the SDEIS. Since then, a number of refinements to the proposed alignment have been made as a result of public comments on the SDEIS, further community outreach, and ongoing engineering studies. These refinements are described in this FEIS and summarized below, along with the No Build Alternative, as required for comparative analysis under NEPA.

NO BUILD ALTERNATIVE

The No Build Alternative consists of projects and initiatives to be undertaken or implemented by MTA NYCT before 2025 (the analysis year for the FEIS), regardless of whether a Second Avenue Subway is implemented. The analysis year—a long-term forecast year in which the subway would be fully operational—for the FEIS has been changed to 2025, rather than the 2020 analysis year used in the SDEIS. This was done to maintain a 20-year forecast period and to be consistent with the Second Avenue Subway's Section 5309 FTA New Starts Annual Update for 2005 as well as with the 2025 forecasts included in the regional forecasts developed by the New York Metropolitan Transportation Council (NYMTC), the area's Metropolitan Planning Organization (MPO), and the forecasts from the MTA's Regional Transit Forecasting Model, used for MTA's Long Range Planning Framework analyses.

The No Build Alternative includes projects that have been approved and will be implemented by 2025 as identified in the MTA 2000-2004 Capital Program and 2000-2019 20-Year Needs Assessment. This includes initiatives to continue to bring the system to a state-of-good-repair (i.e., purchase of new rail cars, track improvements, etc.); major capital improvements, such as station rehabilitations; and planned route changes as well as normal replacement and network

expansion initiatives. In addition, the No Build Alternative includes other plans that will be completed by 2025, such as the MTA LIRR East Side Access Project and other public and private development initiatives. The existing conditions analyses in the FEIS reflect conditions before the loss of the World Trade Center on September 11, 2001, in areas where quantitative analyses were required; baseline conditions for analyses are intended to represent "normal" conditions, and post-September 11 conditions for areas such as traffic, would not represent such conditions. Where possible, qualitative assessments, such as social conditions, reflect current conditions. No Build Alternative assumes that the area in the former World Trade Center site will be fully redeveloped well before 2025, and thus the No Build Alternative assumes a fully redeveloped Lower Manhattan.

SECOND AVENUE SUBWAY

The Second Avenue Subway's tunnel alignment; station locations, design, and access; storage and maintenance facilities; and other features summarized below were developed to meet the project's goals and objectives and in accordance with criteria developed to guide the design.

Since publication of the SDEIS, several design refinements have been made as result of ongoing engineering work:

- *Track Depth and Location:* To minimize the amount of surface disruption that would occur from cut-and-cover construction, the alignment has been adjusted to be deeper in certain locations. This would allow certain stations to be built using mining techniques, thereby minimizing impacts from surface construction. Such deepening is most notable at the 125th and 42nd Street Stations, in the area from 23rd Street to Houston Street, and at the Seaport Station. In addition, the number of locations where a third (or more) track would be necessary has been changed. Areas along Second Avenue north of 120th Street, between 42nd and 34th Streets, and along Water Street between Pine Street and Coenties Slip are no longer proposed with three (or more) tracks. There would be no new impacts resulting from refinements to track depth. By reducing the amount of cut-and-cover construction required along the alignment, surface disruptions and associated impact would be reduced overall.

- *Adjustment to the Curve at 125th Street and Second Avenue:* In the vicinity of 125th Street and Second Avenue where the tunnels would curve beneath private property, numerous alignment options were explored to minimize the number of properties that would be affected, and the alignment with the fewest impacts to standing structures has been selected. With this alignment, much of the curve would be constructed using a tunnel boring machine, reducing the need for open excavation and eliminating any disturbance to the park at Triboro Plaza or to the ramps of the Triborough Bridge. The plan to protect properties on the southwest corner of 125th Street and Second Avenue has been further developed since the SDEIS as well (and is discussed below under "Displacement and Relocation").

- *Selection of a Modified Deep Chrystie Option for the Alignment South of Houston Street:* As a result of ongoing engineering, a preferred alignment option—the modified Deep Chrystie Option—has been selected for the alignment south of Houston Street. The Shallow Chrystie Option was eliminated prior to publication of the SDEIS. The Forsyth Street Option has also now been eliminated because it would create construction disturbances in a wider area and also attract a lower number of passengers transferring between the new Second Avenue Line and the existing Ⓑ Ⓓ service. In the modified Deep Chrystie Option, a short section of the alignment would be located under a portion of Sara D. Roosevelt Park between East

Houston Street and Delancey Street rather than beneath Chrystie Street, to avoid subsurface obstructions beneath Chrystie Street that would have resulted in significant adverse impacts to the adjoining park, neighborhood, and archaeological resources. The revised alignment would result in some construction impacts to the park, but less than the original alignment in this area. The areas within Sara D. Roosevelt Park that would be used directly for construction activity have been revised as a result of this project refinement, overall however, no new impacts to the park would result.

- *Station Design, Entrances, and Ancillary Facilities:* As a result of ongoing engineering, the locations of proposed entrances, ancillary facilities (such as ventilation and air cooling), and emergency exits have been preliminarily identified. As a result, a preliminary list of properties that might be acquired has now been developed; this was not included in the SDEIS (see "Displacement and Relocation" below).

- *Storage Tracks.* Additional studies of options for train storage have resulted in several design modifications. The potential storage yard site at Coney Island Creek, adjacent to the existing NYCT Coney Island Yard, has been eliminated from consideration because of its high operational impacts, costs and adverse impacts to wetlands. The configuration of the storage tracks west of the 125th Street Station ("tail tracks") has been refined, so that the tunnels can be bored using a tunnel boring machine and remain entirely beneath the streetbed but would now extend to approximately 525 feet west of Fifth Avenue, rather than ending at Fifth Avenue as described in the SDEIS. Similarly, the storage tracks under consideration north of 125th Street would occupy a narrower area, only within the streetbed, minimizing impacts to local parks and businesses. At Hanover Square, tail tracks are also being evaluated. Finally, new midline storage tracks would be located between 21st and 9th Streets, on both sides of the tunnel alignment. These refinements would reduce the project's impacts during construction by eliminating work near a wetland (Coney Island Creek) and greatly reducing the area of cut and cover construction.

SUBWAY ALIGNMENT

The Second Avenue Subway would provide new subway service beneath the full length of Second Avenue from 125th Street to Hanover Square, and along the existing Broadway Line south of 63rd Street in Manhattan. The subway would include two tracks (one northbound and one southbound) at most points along the alignment. However, in certain locations a third or fourth track would allow trains to reverse direction, move in or out of service, connect to other lines, or be stored along the alignment. These locations, some of which have been modified slightly as a result of project refinement since issuance of the SDEIS, are: 125th Street from just west of Park Avenue to just east of Third Avenue, Second Avenue at approximately 121st Street, Second Avenue in the vicinity of the 72nd Street Station, Second Avenue between 62nd and 56th Streets, and Second Avenue between 21st Street and approximately 9th Street. The Second Avenue Subway would generally be deeper than most subway lines in New York City to minimize the need for disruptive cut-and-cover excavation and associated environmental impacts; to safely pass under existing utilities, as well as subway, train, and vehicular tunnels; and because of the location and quality of the bedrock along the alignment, through which more than half the length of the tunnel would be constructed.

125th Street to Houston Street

Starting in the north, the Second Avenue Subway would begin at a new station on 125th Street between Park and Lexington Avenues, where transfer connections would be provided to the existing Lexington Avenue Line (4 5 6) and to Metro-North's Harlem-125th Street Station. Tail tracks, which permit trains to enter the station at sufficient speeds to allow the operation of 30 trains per hour and allow for train storage during off-peak hours, would be located underground to the west of the new 125th Street Station to approximately 525 feet west of Fifth Avenue. Moving east along 125th Street, the new subway would transition to Second Avenue via a curve between 125th and 121st Streets; this curve would pass deep beneath 11 private properties (10 low-rise buildings and a vacant lot) on the southwest corner of Second Avenue and 125th Street. Between approximately 124th and 122nd Streets, the tunnel would curve slightly beneath Triboro Plaza and Robert Wagner Houses on the east side of Second Avenue, before straightening to continue beneath Second Avenue. As described in more detail below in "Displacement and Relocation," the duration of property impacts would be longer in this area than described in the SDEIS, but fewer properties would be affected.

Once on Second Avenue, the alignment would continue through new tunnel construction and existing tunnel segments built in the 1970s south to 63rd Street, where trains would either continue south to Lower Manhattan via the paths described below, or onto the 63rd Street Line and then the Broadway Line. In most cases, the new tunnels would be beneath the existing street or avenue right-of-way, and would not pass directly beneath structures. However, exceptions would occur in several locations—most notably, the area between approximately 21st and 9th Streets, where new midline storage tracks are proposed, and on the curved connection to the 63rd Street Line.

Houston Street to Hanover Square

South of Houston Street, the alignment would curve east to pass under a portion of Sara D. Roosevelt Park between Houston and Delancey Streets. At Delancey Street, the tunnel would return to Chrystie Street, where it would run beneath the existing B D subway lines in a new lower level at the existing Grand Street Station. Continuing south, the alignment would curve slightly to the west, passing deep beneath five private properties near Canal Street. The route would continue beneath the Bowery to the Chatham Square Station. Near the Manhattan Bridge, the existing Second Avenue Subway tunnel segment built in the 1970s would be used for ancillary facilities.

South of the Chatham Square Station, the alignment would continue south under St. James Place, following that street below the Brooklyn Bridge and its ramps. From the Brooklyn Bridge, the tunnel would follow Pearl Street and then Water Street to a terminus near Hanover Square. South of the Hanover Square Station, with underground storage tracks for up to four trains.

Connection to Broadway Line

In addition to the new tunnels along Second Avenue, the Second Avenue Subway would also connect to the 63rd Street Line and from there to the Broadway Line. Southbound Second Avenue Subway trains would access the Broadway Line through a track switch connecting to a track curve starting at approximately 65th Street that turns westward to join the 63rd Street Line at the Lexington Avenue-63rd Street Station. New entrances to the station would be located at 63rd Street and Third Avenue. Trains would stop at that station on an existing track that is not currently used for passenger service and a currently unused platform. Trains would use the 63rd

Street Line to travel beneath Central Park via an existing but normally unused track connection to the existing express tracks of the Broadway Line at 57th Street/Seventh Avenue and continue south, making express stops to Canal Street and then continuing to Brooklyn over the Manhattan Bridge.

Connection to Queens

The Second Avenue Subway would provide a connection to the 63rd Street Tunnel east of Second Avenue via a switch to a curved tunnel at approximately 61st Street and Second Avenue (see Figure S-3). In the near term, the connection to the 63rd Street Line toward the east would be used for non-passenger service access and reroutes of passenger service due to disruptions. If the capacity of the Queens subway network is substantially increased in the future, or if existing service is reconfigured, this connection, along with the available track capacity on the planned Second Avenue Line south of 63rd Street, would enable additional subway service between Queens, Midtown, and the Financial District to be provided.

Future Connections to the West Side of Manhattan, the Bronx, and Brooklyn

The northern and southern portions of the alignment would be designed to not preclude future connections to the west side of Manhattan in northern Manhattan, the Bronx, and Brooklyn. In the north, the underground storage tracks west of the 125th Street Station, which are described below, could be extended further west in the future. At approximately 121st Street a bellmouth would be constructed along Second Avenue as part of the curve from Second Avenue to 125th Street to allow for a future connection to the Bronx. (The bellmouth, which was shifted four blocks south from the location identified in the SDEIS to minimize property impacts in the vicinity, would not be needed if storage tracks were to be constructed at 129th Street, as the storage tracks themselves, which are described below, would function as a portion of the extension to the Bronx.) In the south, the Hanover Square Station would be constructed to allow for a potential future extension of Second Avenue Subway service to Brooklyn. None of these potential future extensions, however, is the subject of this document.

STATIONS

Locations and Connections to Existing Transit Facilities

As shown in Figure S-3, the Second Avenue Subway would have 16 new stations, most spaced approximately 10 blocks apart, providing a balance between speed of operation and passenger convenience. Typical stations would be constructed at or near major crosstown streets.

Enclosed pedestrian connections between existing subway lines and the Second Avenue Subway are likely at the following locations:

- To the 4 5 6 and Metro-North at 125th Street and Lexington and Park Avenues, where entrances to the Second Avenue Subway on Lexington Avenue would be combined with existing entrances for the Lexington Avenue Line;
- To the L at 14th Street (Third Avenue Station);
- To the F V at Houston Street (Lower East Side/Second Avenue Station); and
- To the B D at Grand Street (Grand Street Station).

Other enclosed transfers still under consideration and being evaluated include transfers to the E V service at 53rd Street (Lexington Avenue-53rd Street Station), and to the 4 5 6 7 and S services at 42nd Street (42nd Street-Grand Central Station). In both of these cases, the

construction costs and disruption to existing subway lines would be considerably greater than with the other possible transfers.

Depending on cost and feasibility, it is possible that not all of these connections would be constructed as part of the Second Avenue Subway. On the 63rd Street and Broadway Lines, stops would include Lexington Avenue-63rd Street (Ⓕ) on the 63rd Street Line (where an entrance would be added at Third Avenue and 63rd Street), 57th Street, Times Square-42nd Street, 34th Street-Herald Square, 14th Street-Union Square, and Canal Street on the Broadway Line. After Canal Street, service would continue to Brooklyn via the Manhattan Bridge. Stops south of Canal Street would be available on the Broadway Line local service with continuing service to Brooklyn via the Montague Street Tunnel.

Station Design

Detailed designs for stations along the Second Avenue Subway will continue to be developed during ongoing engineering. However, the basic concepts for each station have been developed. Entrances to the new Second Avenue Subway stations would consist of a combination of elevators, escalators, and stairs, with every station served by at least one elevator. Most of the new stations would have one central island platform, while the 125th Street and 72nd Street Stations would have two platforms, because they would have three tracks rather than two. The terminal stations at 125th Street and Hanover Square would also be larger than other stations, as they would contain additional support facilities.

Although final decisions about the locations of station entrances have not been made, most stations would have street entrances at two or more distinct intersections—one on the major cross street for which the station is named, and others located two or three blocks north or south of the main entrance. These stations would typically have an upper mezzanine at each entrance, each with its own customer service area adjacent to the fare control area. Other stations would have one entrance at the crosstown street for which the station is named.

All new stations would also be constructed under the MTA's "Arts for Transit" (AFT) program. AFT would provide input to the selection of architectural firms; the design of stations; historic preservation of existing facilities; and the selection of public art installations. Sustainable design principles, including energy efficiency, natural day lighting, natural ventilation, and material conservation, would be used throughout station planning and design.

Station Access

Access from the street would typically be located within buildings or in a plaza. To conform with Americans with Disabilities Act (ADA) regulations, building codes, and National Fire Protection Association (NFPA) guidance, all stations would be accessible by escalators, elevators, and stairs. Escalators and elevators require more space than stairs, and also require that station entrances be covered for weather protection. For these reasons, the new subway system's entrances would be larger than the entrance stairs to NYCT's existing, older subway lines, and would not fit within the city sidewalks without causing substantial obstruction. Therefore, most stations would have either an off-street entrance or open air entrances in wide plaza areas of the sidewalk. In certain locations where space and traffic levels permit, entrances could include locations where the sidewalk is widened (no more than 8 feet) into the parking lane (called a sidewalk "bump out").

In many locations along the Second Avenue Subway route, buildings constructed since the Special Transit Land Use Zoning District was created in the 1970s have been required under

New York City zoning to allocate space for possible off-sidewalk station entryways. Such transit easements have already been acquired at a number of locations along the alignment in anticipation of station construction and more could be acquired on a case-by-case basis. Generally, three to eight easements or property acquisitions (but up to 11 properties in a few locations) would likely be needed at every station (see "Displacement and Relocation" for details).

All new stations would fully comply with ADA regulations and would have safety provisions, adequately sized corridors and doorways, and public address systems for the hearing and visually impaired. Newly constructed transfer points between the Second Avenue Subway and existing train lines would also be ADA-accessible, unless technically infeasible, as defined by ADA. Stations would also be designed in accordance with the national fire/life safety codes for fixed-rail transit systems developed by the NFPA, including those known as NFPA 130.

ANCILLARY FACILITIES

Various ancillary facilities—such as ventilation facilities, substations, pump rooms, maintenance rooms, and fan plants—would be required to operate the new subway line. Typically, these would be built within the envelope of the new stations, but certain facilities would have to be located away from the stations above street-level and within a given distance of the alignment. When possible, the project would share the use of existing transit facilities, such as NYCT's Subway Control Center.

Since completion of the SDEIS, engineering has advanced on the required ancillary facilities and more information is now available about their designs. Each station would have ventilation systems to refresh air in the station, the train area, and over the tracks. Vent structures—about 25 feet to 40 feet wide, 75 feet deep, and four to five stories tall—would allow fresh air intake and exhaust. Most of these structures would also provide emergency exits to the streets. All stations would also have an air-tempering system, possibly featuring cooling towers on the roofs of the vent structures, to lower station temperatures in hot weather. The system's equipment would be hidden by privacy screens and include noise-attenuation devices to mitigate impacts on the surrounding buildings.

In addition, power substations, each measuring approximately 50 feet by 100 feet, would be located underground at each station. Pump plants would be provided at low points midway between stations, as needed.

SIGNALS AND ROLLING STOCK

The Second Avenue Subway would employ Communication-Based Train Control (CBTC) technology, a state-of-the-art train control signal system. CBTC allows more efficient operation of trains in the system, with regular travel speed and shorter distances between trains.

The rolling stock would be similar to the standard equipment used on NYCT's B Division routes (i.e., train routes designated by letters). The new line would accommodate 60- and 75-foot-long cars, with total train length of 600 feet, and train capacity of approximately 1,400 to 1,450 passengers per train. The proposed service plan for 28 trains per hour in the peak hour in the peak direction (rather than 24 described in the SDEIS) would require the operation of approximately 33 new train sets, including spares (compared to 28 in the SDEIS).

SERVICE PLAN SUMMARY

The Second Avenue Subway would operate 24 hours a day, seven days a week. Upon completion of the entire alignment, new service (referred to in this FEIS as T service) would run between 125th Street in East Harlem and Hanover Square in Lower Manhattan, via Second Avenue. New Q service would also run between 125th Street and Brooklyn via Second Avenue, the 63rd Street Line, the Broadway Line (along the existing Q route), and the Manhattan Bridge (with transfers to Lower Manhattan via the Broadway Line local service). By 2025, service would operate at about 2-minute intervals during peak hours north of 63rd Street and at about 4½-minute intervals on the Broadway and Second Avenue Lines south of 63rd Street.

As described below in the discussion of construction techniques, construction of the project has been planned to permit portions of the new subway line to become operational before the entire 8½-mile route is complete.

STORAGE AND MAINTENANCE FACILITIES

Approximately 25 10-car, 600-foot-long trains for the Second Avenue Subway would need to be stored overnight.[1] Specific designs for the configuration of the train storage are being developed. The new storage and maintenance facilities being considered are described below. Since a few trains could also be stored on existing tracks at night, all of these facilities would not be required; rather, a combination of some of these storage options would be selected to handle the project's storage needs:

- Two underground storage tracks west of the 125th Street Terminal, extending to approximately 525 feet west of Fifth Avenue, could provide storage for up to four trains. One train could also be stored on the line at the 125th Street and 72nd Street Stations.
- Underground storage tracks beneath Second Avenue north of 125th Street to 129th Street could store up to four trains (a decrease from nine trains as described in the SDEIS) on two tracks overnight.
- Two midline underground storage tracks between 21st and 9th Streets could store eight trains.
- New above-ground storage tracks for eight trains (instead of nine described in the SDEIS) in a portion of the existing 36th-38th Street Yard in Brooklyn.
- Two tail tracks south of the Hanover Square Station to store up to four trains. These tracks could enable possible future expansion of the Second Avenue Subway to Brooklyn.

Three new tracks also would be needed to meet routine maintenance and inspection requirements for the Second Avenue Subway fleet. Because there is no appropriate vacant land available for such facilities near either the northern or southern terminus (at 125th Street and in Lower Manhattan, respectively), NYCT sought to identify locations accessible to the Second Avenue Subway trains where the trains could be maintained. The most efficient solution would be to use an existing NYCT maintenance facility that, with some internal modifications, could be

[1] Of the 33 trains needed for the Second Avenue Subway, five would operate overnight between 125th Street and Hanover Square and one would be in the maintenance shop. Two could be stored on the Broadway Line north of 57th Street during late night periods under some conditions. This leaves 25 trains that would have to be stored overnight. This is three more than described in the SDEIS.

improved to provide capacity adequate for the Second Avenue Subway trains, rather than to construct a new maintenance facility. NYCT's existing Coney Island complex at the southernmost end of the Broadway Line was identified as a suitable location to maintain the Second Avenue fleet. Studies determined that capacity for the Second Avenue trains at Coney Island could be created by adding capacity (within the boundaries of NYCT property) to either the 207th Street Yard maintenance shop in northern Manhattan or the Concourse Yard maintenance shop in the Bronx, and shifting some trains that are now maintained in Coney Island to one of these northern shops. This FEIS assesses the potential impacts resulting from such shifts.

PROJECT BENEFITS

The Second Avenue Subway would generate enormous benefits for the residents and businesses of New York City and the New York region. Its key benefits include the following:

- *Bolstering the Economy of New York City and the New York Region:* The Second Avenue Subway would help sustain and improve the region's economy, which represents over 3.4 percent of the nation's gross domestic product, by reducing congestion, improving access and adding capacity. The new subway would help bolster economic activity in the midtown and downtown CBDs as well as induce new investment in areas, such as East Harlem and the East Village/Lower East Side/Chinatown.
- *Reducing Subway Crowding and Improving Reliability:* The new Second Avenue Subway would reduce overcrowding and improve reliability on the Lexington Avenue Line, the nation's most heavily used subway line. Approximately 560,000 riders would use the Second Avenue Subway each weekday (with nearly 78,000 in the AM peak hour alone), many of whom would switch from the Lexington Avenue Line.[1] The remaining Lexington Avenue riders would benefit from reduced crowding, decreased travel time, and improved reliability.
- *Improving Access to the Subway:* The new subway would greatly improve transit access for communities on the East Side, from East Harlem to the Financial District, and bring subway service closer to people who currently must walk substantial distances. In addition, subway access for people with disabilities would be provided on the new line, as all new stations would comply with Americans with Disabilities Act (ADA) regulations and newly constructed transfer points between the Second Avenue Subway and existing train lines would be either ADA-accessible or ADA-compliant. In addition, the service via the Broadway Line would create for the first time a one-seat ride from East Harlem and the Upper East Side to West Midtown.
- *Reducing Vehicle Use and Improving Air Quality:* The Second Avenue Subway would also help reduce congestion on the city's avenues and streets. Besides attracting some Lexington Avenue riders and reducing crowding on that line, the full-length Second Avenue Subway from 125th Street in the north to the Wall Street area in Lower Manhattan would also divert some peak-hour trips from auto and taxi modes to subway. As a result, auto travel would be reduced by 93,130 vehicle miles on an average weekday and areawide traffic volumes would

[1] Information on ridership for the new subway (as well as the reduction in automobile use that would result) has been revised since the SDEIS. For more information, see "Transportation" below.

be reduced by more than 8,300 vehicle trips per day. A commensurate improvement in air quality would also result.

D. DESCRIPTION OF CONSTRUCTION METHODS AND ACTIVITIES

Design of the Second Avenue Subway is still ongoing and will continue to evolve over the next year. Consequently, the FEIS assesses the reasonable worst-case scenario to describe potential impacts from the construction methods and activities that may be required. The Second Avenue Subway would consist largely of twin tunnels (one northbound and one southbound) with outside diameters of approximately 23½ feet.[1] Each tunnel would be about 8.5 miles long. Sixteen new stations, numerous fan plants and ventilation cooling facilities, pumping stations, electrical power substations, new train storage yards, connections to existing stations, and various other elements would also be built. Construction activities could take place up to 24 hours a day, 6 days a week. Construction is expected to start in 2004 and last approximately 16 years.

PROJECT PHASING

The MTA has developed a phasing plan for construction of the Second Avenue Subway that incorporates information obtained through ongoing engineering and achieves the best balance between constructability, operability, and the availability of funding. The phasing plan also responds to public comments regarding construction schedule and sequencing. Given the project's 8.5-mile length and its overall complexity, building and operating the new subway service in phases is the fastest way to provide many passengers with new subway service while also relieving some of the severe overcrowding on the Lexington Avenue Line.

In developing a phasing plan, several different options were considered. Key goals for the plan were reducing congestion on the Lexington Avenue Line expeditiously, providing improved service to subway passengers, minimizing environmental impacts where practicable, and designing the operating phases in a way that resulted in manageable financial outlays that could be distributed across the lengthy construction period. In addition, it was determined that any interim operating segment would have to be connected initially to the 63rd Street Line to allow trains to enter the system and reach NYCT's maintenance shops in Brooklyn.

The proposed phasing plan is described below and shown in Figures S-4, S-5, S-6, and S-7. Following that discussion, more information is provided on the construction techniques to be used in each phase. With this phasing plan, each operating segment would result in a new and fully functional portion of the overall subway project. Moreover, operation of each of these phases could occur while subsequent phases are under construction. Once construction of a particular length of the alignment is completed, the surrounding neighborhood would not experience further impacts during construction of the subsequent phases. The proposed phasing plan is also extremely flexible, in that it would permit, if practicable, multiple phases to be constructed simultaneously. Passengers would still benefit from new subway service as soon as the first phase is complete.

[1] The tunnels described in the SDEIS would have had outside diameters of 21 feet; because of this change and several others, the project analyzed in this FEIS would produce more spoils during construction. This is discussed later in the description of construction activities.

- *Phase 1:* Phase 1, to be completed in 7 years, would include construction of three entirely new subway stations—96th Street, 86th Street, and 72nd Street—plus new Third Avenue subway entrances at the existing Lexington Avenue/63rd Street subway station on the 63rd Street Line. It also includes tunnels and tracks connecting the Second Avenue Line to the 63rd Street Line and on Second Avenue from 105th Street to 62nd Street, as well as a third track at the 72nd Street Station to be used for train storage or to accommodate train diversions if necessary. After the completion of Phase 1, the new subway service would operate from 96th Street and to West Midtown and Brooklyn via the Broadway Line.

  Construction of Phase 1 would involve launching a tunnel boring machine from a shaft site between 93rd and 91st Streets, from which two tunnels would be bored to 62nd Street. To support tunneling activities, a staging area would be established in the 90s that would include a portion of Playground 96, on the east side of Second Avenue between 96th Street and 97th Street. Cut-and-cover excavation would be used to create the 96th Street Station and connections to the existing tunnel segment at 99th Street. New 86th Street and 72nd Street Stations would be constructed by mining. In addition, the curved tunnel connector to the 63rd Street Line would be built using mining techniques via a shaft at 66th Street and Second Avenue. The existing Lexington Avenue/63rd Street Station would be modified and upgraded, including the creation of two new Third Avenue entrances.

- *Phase 2:* Phase 2 would complete the project's East Harlem segment. This would entail building three new subway stations—at 125th Street, 116th Street, and 106th Street. The tunnels under 125th Street would be built using TBMs. On Second Avenue, connections would be made (via cut-and-cover construction) between the existing tunnel segments, so that the tunnels would connect to Phase 1 at 105th Street (106th Street Station). The existing tunnel between 120th and 110th Streets would be outfitted with tracks and other essential features. In addition, the bellmouth to permit a future connection to the Bronx would be built as would the underground storage tracks extending west of the 125th Street Station. If an underground storage yard north of 125th Street on Second Avenue is included as part of the project, this would also be built as part of Phase 2. Additionally, some improvements to two of NYCT's existing yards/maintenance facilities—the 36th-38th Street Yard in Brooklyn and the Concourse Yard in the Bronx—may also be made during this phase. Phase 2 construction (which could overlap with other phases) would require approximately 7 years.

- *Phase 3:* In Phase 3, tunnels would be constructed by TBM from 62nd Street (the southernmost point of Phase 1) to approximately 4th Street, near the north end of the new Houston Street Station, and stations would be opened at 55th Street, 42nd Street, 34th Street, 23rd Street, 14th Street, and Houston Street. During this phase, the 63rd Street tunnel connection to Queens for non-passenger services would also be completed. The midline storage tracks between 21st and 9th Streets would be built during this phase. In Phase 3, TBM shaft sites and staging areas would be established near 34th Street, including a portion of St. Vartan Park (between 35th and 36th Street on the east side of Second Avenue) and a service roadway between 33rd and 32nd Streets. These sites would be used to stage the tunnel boring activities in Stage 3. A shaft site and staging area could also be established at the Houston Street Station. Phase 3 construction (which could overlap with other phases) would require approximately 9 years.

- *Phase 4:* The final construction phase would extend from Houston Street to south of the Hanover Square Station and include new stations at Grand Street, Chatham Square, Seaport, and Hanover Square, as well a fully reconstructed Grand Street Station on the existing B D

service at Grand Street. Tunnels would be constructed via TBM working from a shaft site on Water Street at the Hanover Square Station. In Phase 4, a temporary barge facility would also be built at Pier 6 to facilitate the removal of station and tunnel spoils associated with this phase. Phase 4 construction (which could overlap with other phases) would require approximately 7 years.

CONSTRUCTION METHODS

Three main construction techniques would be used for tunnel and station construction depending on geological conditions, the presence or absence of existing transit facilities below ground, and/or the feasibility of minimizing environmental impacts. The three construction methods, described below, are mechanized tunnel boring, cut and cover, and mining. The construction methods and activities that would be required at the various locations along the entire alignment are illustrated in Figure S-8 and summarized in Table S-1. Construction methods or the potential uses proposed for a particular segment of the alignment may change as engineering continues.

MECHANIZED TUNNEL BORING

Much of the Second Avenue Subway would be built using tunnel boring technology, in which a powerful circular cutting machine drills a tunnel in rock or soil with minimum disruption to the street. The excavated rock and soil—together called "spoils"—are then conveyed to street level at a consolidated work site and removed by truck and/or barge. Wherever possible, tunneling would be done through bedrock, which is quicker and more cost effective than cut and cover or other methods of mining.

Different types of boring machines are designed for different geological conditions. A rock tunnel boring machine (TBM) is mostly used in self-supporting, rock. Other kinds of TBMs, such as the earth-pressure-balance boring machine (EPBM) or similar machines, are used for mining in soil and degraded rock. A rock TBM is likely to be used between approximately 92nd Street and about 4th Street (instead of 6th Street as described in the SDEIS), because bedrock is close to the surface in this area. TBMs designed for mixed soil conditions would be used for the 125th Street tunnels extending to approximately 122nd Street on Second Avenue and 125th Street and Third Avenue, and south of the Houston Street Station, because the bedrock is relatively deep in these areas, rising and falling along the alignment, and thus below the planned subway alignment. Overall, the amount of TBM use has increased since the issuance of the SDEIS, resulting in a reduction in the amount of disruptive surface construction activities.

The tunnel construction would occur without many street disruptions. However, significant street disruptions would occur wherever the TBMs are inserted into and removed from the ground, wherever spoils are removed, and wherever stations and support facilities (such as vent shafts) are constructed. In such places, some cut-and-cover construction would also be needed.

Before the TBMs can be launched, at the start of construction, shaft sites and associated staging areas for removing spoils and conducting other necessary operations must be established. Such areas must be identified near every location where boring machines would be inserted. This would occur where geological conditions and the length of the tunnel segment to be bored are appropriate for starting mechanized tunnel excavation. Ideally, shaft sites and associated spoils removal areas should be near entry points to New York City's highway system, to allow quick access to and egress from Manhattan. In addition, shaft sites and spoils removal areas should also be located adjacent to the Second Avenue Subway alignment and oriented to allow efficient handling of spoils and construction materials.

The sites currently under consideration for spoils removal and/or associated staging activities include the following:

- Along Second Avenue north of 125th Street for potential underground storage tracks constructed as part of Phase 2;
- At 125th Street and Third Avenue, within the project right-of-way to be used during construction of Phase 2[1];
- Near 96th Street or 92nd Street for up to 8 years during construction of Phase 1 (this is a reduction from the 10 years described in the SDEIS);
- At 66th Street in the vicinity of the 63rd Street connector tunnels for up to 4 years during Phase 1's construction (this is an increase from the 2-year duration described in the SDEIS);
- Near 35th and 32nd Streets to be used for up to 8 years during construction of Phase 3 (this is a reduction from the 10 years described in the SDEIS);
- Near Houston Street used during construction of Phase 3; and/or
- Along Water Street in Lower Manhattan during Phase 4's construction. A barge site at Pier 6 on the East River is under consideration for use (for spoils removal and materials delivery) during Phase 4.[2]

Each shaft site must have a staging area to house the facilities necessary to support the tunneling below ground. Equipment to be located at the staging area includes electrical service equipment or a substation to provide power to the TBM operations below ground; generators, silos or storage bins; a maintenance shop for tools and machinery; facilities for workers to change and shower; compressors and water treatment areas; and ventilation equipment for the tunnels. If a slurry TBM is used, a slurry plant would also be required.

In addition to TBM shaft sites, spoils would also need to be removed at all 16 stations and any cut-and-cover tunnel segments. Each of these locations would also require construction staging areas.

CUT AND COVER

Most of New York City's subway system was built using the cut-and-cover technique. This method consists of several sequential steps:

- Temporary lane closures on the avenue and potentially some side streets;
- Support or relocation of existing utilities, and construction of retaining walls to support excavations;
- Pile installation in the center of the street to support decks;
- Street excavation; and

[1] No TBM shaft sites were identified in the SDEIS in the vicinity of 125th Street for either the 125th Street tail tracks or the 125th Street curve. At the time the SDEIS was prepared, it was anticipated that the 125th Street tail tracks would be constructed using cut-and-cover techniques, and that the 125th Street curve would be built using conventional mining. Engineering refinements were made to allow use of TBMs so as to reduce the extent of surface construction disruption at these locations.

[2] The SDEIS also included consideration of a barge site at 129th Street and the Harlem River. That site is no longer under consideration because the New York City Department of Transportation's reconstruction of the Willis and Third Avenue Bridges in that area would make the site unavailable.

- Placement of temporary decking over the excavation area, and continued construction below the deck.

In most cases, retaining walls are constructed using "slurry walls," which are concrete walls constructed progressively by excavating trenches, and then inserting long steel reinforcement cages and a slurry of bentonite. The slurry is eventually replaced by concrete, which is pumped into the trenches. The temporary decking on top of the excavation area then allows the street to remain open to traffic and pedestrians while excavation and construction continue below the surface. A slurry plant and other machinery would be required in the vicinity of each station.

Cut-and-cover construction would be necessary at all 16 station locations and at several other locations. Aside from the shaft sites/spoils removal areas identified above, at each station, spoils would have to be removed from shafts created during the station's construction process. At deeper stations, some areas could be constructed by mining and cut-and-cover would be used for entrances and shallow mezzanines. Two shafts would be required at all stations. At shallower stations, a three- to five-block area would be in construction for three to four years (including one year for utility relocation and one year for slurry wall construction). Cut-and-cover construction would also be needed at other places where access to the street is required, and for sections of the alignment where the tunnel would be very close to the surface, such as the sections between existing tunnel segments in East Harlem that were built in the 1970s. Through the "cut" in the street, spoils can be removed and equipment can enter or exit the tunnel. Overall, the amount of cut-and-cover construction planned has been reduced since issuance of the SDEIS.

At almost all times, traffic would be maintained on half of both Second Avenue and the adjacent cross streets during the construction period.

MINING

The primary method of mining in rock is called "drill and blast." This procedure involves drilling many small holes within a rock area and then placing small amounts of explosives in each hole. Under carefully controlled and monitored conditions, explosives are then detonated sequentially for short intervals, breaking the rock while spreading the release of energy from the explosives over a longer period, lessening potential ground vibration at nearby structures. When mining is done in soil, the drill-and-blast method is not required. Spoils would be removed by backhoes, bulldozers, and a clamshell shovel suspended by a crane.

Mining would be used on portions of the tunnel too short to make tunnel boring cost effective and on curved portions of the tunnel that are too constrained for a boring machine. Some stations would be mined from below street level, and the street would be penetrated to build station entrances and venting. When mining is used, an access shaft would be needed to remove excavated materials and to bring in or remove equipment from the tunnel. The shaft would be constructed using the cut-and-cover technique.

TRUCKING ACTIVITY

In addition to removing spoils from the tunnels and stations, it would also be necessary to bring a large quantity of a wide range of supplies and materials to the various shaft sites throughout the project's duration. Excavation of the Second Avenue Subway tunnels alone would require more than 200,000 truck trips entering and leaving Manhattan over the course of the project; this

number has doubled since the SDEIS was published.[1] Trucks would also bring supplies and other deliveries to the construction sites, including tunnel lining and other construction materials and equipment (i.e., structural steel, roadway deck panels, rock anchors, etc.).

The approximate number of round-trip truck trips required at each type of construction site during peak construction periods is as follows for individual sites:

- Slurry wall construction—Total of 140, with 100 trucks entering and exiting the site per day on average to remove spoils and an additional 40 trucks per day bringing deliveries.
- Cut-and-cover station excavation—Total of 120 to 150, with 70 to 100 trucks entering and exiting a site per day on average for spoils removal (vs. 200 identified in the SDEIS) and another 50 trucks entering and exiting for deliveries. Once excavation is complete, the number would drop to about 30 trucks arriving and departing at a site to bring deliveries.
- Mined station excavation—Total of 85 to 105, with 60 to 80 trucks entering and exiting a site per day on average for spoils removal (instead of the 20 cited in the SDEIS, because the proposed station volumes are larger), and another 25 trucks bringing deliveries.
- Soft ground tunneling with TBMs—Total of 155, with 105 trucks entering and exiting a site per day on average at shaft sites to remove spoils and another 50 trucks making deliveries daily.
- Hard rock tunneling—Total of 210, with 160 trucks entering and exiting a site per day on average at shaft sites to remove spoils and another 50 trucks making deliveries.

BUILDING AND INFRASTRUCTURE PROTECTION

Structural and ground improvement techniques would be used to permit mechanized boring machines to tunnel in areas where geological conditions are poor, or to minimize ground settlements, or preserve the structural integrity of various facilities, including other transportation facilities, utility lines, buildings, tunnels, and ramps. Underpinning is a construction technique that includes the use of drilled or jacked supporting piles to provide support or reinforcement to protect existing structures. Grouting is a typical soil improvement option used to control ground settlement and distortion. Building structural support frames would also be employed to protect nearby structures and groundwater recharge could be used to maintain the groundwater table.

REMOVAL AND BENEFICIAL REUSE OF SPOILS

Cranes, small rail cars, and conveyors would be used to bring excavated rock and soil to the street level. At the surface, this material would be transferred either directly to trucks and/or

[1] Since completion of the SDEIS, the volume of spoils to be removed has increased from 3 million cubic yards to 6.3 million cubic yards. However, in all cases, the maximum amount of spoils that could be removed on any given day would be constrained by the speed at which tunneling activity can occur. Conservative assumptions for the analyses presented in this document were made regarding the intensity with which these activities can take place, and these assumptions have not changed since the SDEIS. All stations were assumed to be constructed by cut-and-cover. While the number of trucks that would be generated project-wide would increase, the daily volumes at any spoils removal site would not increase beyond volumes assessed in the SDEIS. Therefore, construction impacts from trucking and other operations would not be more intense than those identified in the SDEIS.

barges or temporarily stored for later processing. Trucks would transport spoils out of Manhattan. In addition, spoils could be transported by barge from a site near Pier 6 on the East River in Lower Manhattan. If only trucks are used, more than 200,000 truck trips would be required over the course of the project—double the number since the SDEIS was published, as a result of an increase in the amount of spoils to be removed. The barge site at 129th Street, which was assessed in the SDEIS, is no longer under consideration.

A total of about 6.3 million cubic yards of spoils would be removed. This has increased from the 3 million cubic yards estimated in the SDEIS, primarily because of three factors: an increase in the tunnel diameter; more spoils need to be removed at stations; and a larger percentage of train storage space would be located underground. Most of the spoils would be clean crushed rock that can be used for such projects as filling abandoned mines, building artificial reefs, reinforcing bulkheads, or paving roads. Consistent with the New York State Department of Environmental Conservation's Solid Waste Management requirements, beneficial use opportunities would be sought for these spoils as the project evolves and continues through construction.

ACCESS LIMITATIONS AND DISPLACEMENT DURING CONSTRUCTION

A key aspect of Second Avenue Subway construction is to develop a plan that will minimize disruptions to businesses, residents, and pedestrian and vehicular traffic. During construction, half the roadway and some sidewalk space would be closed to permit tunnel, station, or shaft site related construction. The remainder of the street and sidewalk would be open to traffic. This could last from less than 6 months to about 4 years in station locations and up to 8 years in a few key staging area and spoils removal locations, depending on the specific work required. Efforts would be made to maintain normal access to businesses and residences; however, in certain areas, it would be necessary to limit or provide alternate means of access for periods ranging from several hours to up to 6 months. In one location—at the corner of 125th Street and Second Avenue construction work associated with the new subway could affect access to private property for up to 12 months, possibly resulting in temporary but long-term displacement of existing occupants of buildings there. This location is sensitive because it is the only location along the alignment where tunnels would need to be constructed directly beneath buildings supported on shallow-founded timber frames resting on poor quality soils.[1] See "Displacement and Relocation," below, for details.

CONSTRUCTION COMPLIANCE AND ENVIRONMENTAL DESIGN

The Second Avenue Subway would include design, construction, and operational elements that foster the prevention of pollution and minimization of waste. The project would make efforts to use the best available technologies to minimize adverse environmental impacts and incorporate sustainable design principles, including energy efficiency, enhanced environmental quality, and material conservation, where practicable. These procedures are consistent with NYCT's

[1] The effects to the buildings at the corner of 125th Street and Second Avenue have been studied in further detail since publication of the SDEIS. For this reason, the period of potential displacement has increased from 6 months to up to 12 months. In addition, the SDEIS described long-term construction activities that could affect private property along Second Avenue north of 125th Street and in the area south of Houston Street. In both locations, construction activities proposed have been refined to eliminate this long-term impact to private property.

commitments to environmental excellence in capital projects embraced in its Environmental Management System (EMS), which conforms with the internationally recognized ISO 14001 Standard. The EMS requires not only a continuing compliance with relevant legislation, but also that NYCT remain committed to achieving improvements in these key areas.

NYCT has also adopted Design for the Environment Guidelines for use during the project's design phase. The purpose of these guidelines is to establish a process for the creation of an environmentally responsible subway system that is appreciably ahead of current standards and practices when compared with similar transportation systems. In addition, during construction NYCT would take aggressive measures to reduce dust and air pollution. NYCT would require that all heavy equipment use only ultra-low sulfur diesel fuel and employ diesel particulate filters or other retrofit technology to reduce diesel emissions. Throughout construction, NYCT would mandate dust control measures and would develop and monitor a dust suppression program.

When construction of the new subway is complete, all streets, sidewalks, parks, and other areas that were disturbed by construction would be returned to normal or improved conditions. As work at a particular station or excavation site is completed, streets and sidewalks would be reconstructed and repaved. This reconstruction would be conducted in coordination with the New York City Department of Transportation, the New York City Department of Parks and Recreation, and any other relevant city agencies. The subway stations, vent structures, and other subway facilities would become a permanent part of the city's infrastructure, in combination with the other elements of the urban environment.

E. PUBLIC OUTREACH AND REVIEW PROCESS

The analysis of the project's environmental effects began in 1995, concurrent with the preparation of the MIS/DEIS phase of the project MESA Study. In July 1995, FTA published a Notice of Intent for the project and FTA and MTA held a joint public scoping meeting to satisfy NEPA requirements for the EIS process. The MIS was conducted pursuant to the transportation planning procedures established under ISTEA, requiring the preparation of an MIS in connection with an application for federal funding of capital projects for mass transportation systems. The MIS was prepared to evaluate the effectiveness of a wide range of alternative investments or strategies to attain the transportation goals established for the East Side of Manhattan as part of the study. NYCT and FTA completed the MESA MIS/DEIS and published a Notice of Availability in the Federal Register in August 1999. The MIS/DEIS and a notice of its availability were widely distributed, and notice of the public hearing and the availability of the MIS/DEIS was published in local subway stations, on NYCT buses and minority and community newspapers, as well as general circulation newspapers. A public hearing was conducted in September 1999 to receive comments on the project and the MIS/DEIS. At the hearing and through written comments submitted during the comment period, members of the public, community groups, and elected officials voiced their support for a full-length Second Avenue Subway from 125th Street to Lower Manhattan.

The project has included an extensive public outreach program, initiated during the MIS/DEIS phase and continuing through the SDEIS and FEIS phases. This effort is ongoing and will continue through the project's design and construction. It has included dozens of meetings with Community Boards, the public, local and regional organizations, the project's Technical Advisory Committee (TAC) and Public Advisory Committee (PAC), elected officials, and interested governmental agencies.

Table S-1
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 2 Construction Activities			
525 feet west of Fifth Ave on 125 St	450 feet west of Fifth Ave on 125th St	Cut and cover (shaft site for TBM retrieval)[2]	Underground boring Utility relocation Pile installation Excavation of street to depth sufficient to permit decking to be installed and to retrieve TBM Transfer of materials through shaft opening Trucking of TBM components
450 feet west of Fifth Ave on 125 St	Park Avenue on 125 St	Bored tunnel[2]	Underground boring
Park Ave on 125 St	Third Ave on 125 St	Cut and cover station (125th Street)	Underground boring Spoils removal Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through shaft opening Trucking
Third Ave on 125 St	Third Ave on 125 St	Cut and cover (shaft site for TBM launch and spoils removal for curve and tail tracks)	Underground boring Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to launch TBM Transfer of materials through deck opening Spoils removal Trucking
129 St	122 St	Cut and cover tunnel (storage tracks)[2]	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct storage tracks Spoils removal Trucking
Third Ave at 125 St	122 St	Soft ground bored tunnel	Underground mining Ground improvement

Table S-1 (cont'd)
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 2 Construction Activities (Cont'd)			
122 St	120 St	Cut and cover (tunnel and TBM retrieval)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed, to construct tracks, and to retrieve TBM Transfer of materials through deck opening Trucking
120 St	119 St	Existing tunnel	None
119 St	115 St	Cut and cover station (116th Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Spoils removal Trucking
115 St	110 St	Existing tunnel	None
110 St	108 St	Cut and cover tunnel	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct tracks
108 St	105 St	Cut and cover station (106th Street)	Utility relocation Demolition of existing station wall Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and construct station Transfer of materials through deck opening Trucking
Phase 1 Construction Activities			
105 St	99 St	Existing tunnel	Demolition of some existing walls Construction of new walls Trucking
99 St	98 St	Cut and cover tunnel	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct tracks

Table S-1 (cont'd)
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 1 Construction Activities (Cont'd)			
98 St	94 St	Cut and cover station (96th Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Trucking
97 St	96 St	Construction support and staging site (Playground 96)	Various staging processes and tunneling support facilities
94 St	92 St	Cut and cover shaft site	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and launch and retrieve TBM
		Shaft site	Spoils removal Trucking
92 St	87 St	Bored tunnel in rock	Underground boring
87 St	83 St	Bored tunnel in rock	Underground boring
		Mined station (86th Street)	Underground horizontal blasting to create cavern Vertical blasting to create shafts Openings to bring materials in and out and to create station entrances Spoils removal Trucking
		Cut and cover station component (86th Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation
83 St	73 St	Bored tunnel in rock	Underground boring
73 St	69 St	Bored tunnel in rock	Underground boring
73 St	69 St	Mined station (72nd Street)	Underground horizontal blasting to create cavern Vertical blasting to create shafts Openings to bring materials in and out and to create station entrances Spoils removal Trucking and other activity
		Cut and cover station component (72nd Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation

Table S-1 (cont'd)
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 1 Construction Activities (Cont'd)			
69 St	62 St	Bored tunnel in rock	Underground boring Underground drill and blast Ground stabilization (65th to 62nd Street)
65 St	63 St	Mined tunnel (63rd St connector—curve west)	Underground drill and blast Vertical blasting to create shaft site at 66th Street/Second Avenue Spoils removal Trucking
63 St	61 St	Mined tunnel (63rd St connector—curve east)	Underground drill and blast
Phase 3 Construction Activities			
62 St	52 St	Bored tunnel in rock	Underground boring
		Cut and cover station (55th Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Spoils removal Trucking
52 St	45 St	Bored tunnel in rock	Underground boring
45 St	41 St	Bored tunnel in rock	Underground boring
		Mined station (42nd Street)	Underground horizontal blasting to create cavern Vertical blasting to create shafts Openings to bring materials in and out and to create station entrances Spoils removal Trucking
		Cut and cover station component	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation
41 St	36 St	Bored tunnel in rock	Underground boring

Table S-1 (cont'd)
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 3 Construction Activities (Cont'd)			
36 St	33 St	Bored tunnel in rock	Underground boring
		Cut and cover station (34th Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Spoils removal Trucking
		Construction support and staging site (St. Vartan Park)	Various staging processes and tunneling support facilities
		Shaft site at 35th and 32nd Sts (TBM insertion and spoils removal)	Spoils removal Trucking
33 St	26 St	Bored tunnel in rock	Underground boring
26 St	23 St	Bored tunnel in rock	Underground boring
		Mined station (23rd Street)	Underground horizontal blasting to create cavern Vertical blasting to create shafts Openings to bring materials in and out and to create station entrances Spoils removal Trucking and other activity
		Cut and cover station component (23rd Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation
23 St	15 St	Bored tunnel in rock	Underground boring
15 St	11 St	Bored tunnel in rock	Underground boring
		Mined station (14th Street)	Underground horizontal blasting to create cavern Vertical blasting to create shafts Openings to bring materials in and out, and to create station entrances Spoils removal Trucking and other activity
		Cut and cover station component (14th Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation

Table S-1 (cont'd)
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 3 Construction Activities (Cont'd)			
11 St	4 St	Bored tunnel in rock	Underground boring
4 St	Houston St	Cut and cover station (Houston Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Trucking
		Possible shaft site	Spoils removal Trucking
Phase 4 Construction Activities			
Houston	Delancey	Bored tunnel in soil	Cut and cover to remove steel piles and TBM Underground boring
Delancey	Hester	Bored tunnel in soil	Underground boring
Delancey	Hester	Cut and cover station (Grand Street)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Trucking
Hester	Pell	Bored tunnel in soil	Ground improvement Cut and cover construction to remove steel piles Underground boring
Pell	Madison	Bored tunnel in soil	Underground boring
		Cut and cover station (Chatham Square)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and to construct station Transfer of materials through deck opening Trucking
Madison	Dover	Bored tunnel in soil	Underground boring Underpinning beneath certain Brooklyn Bridge approach ramps
Dover	John	Cut and cover station (Seaport Station)	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street to depth sufficient to permit decking to be installed and construct station Transfer of materials through deck opening Trucking

Table S-1 (cont'd)
Description of Likely Construction Methods

From[1]	To[1]	Activity	Typical Construction Activity
Phase 4 Construction Activities (Cont'd)			
John	Wall	Bored tunnel in rock	Underground boring Ground stabilization (John Street to Maiden Lane)
Wall	Coenties Slip	Bored tunnel in rock	Underground boring
		Mined station (Hanover Square)	Underground horizontal blasting to create cavern Vertical blasting to create shafts Openings to bring materials in and out and to create station entrances Spoils removal for stations, tunnels, and tail tracks Trucking and other activity
		Cut and cover station component (Hanover Square)	Construction of retaining walls (e.g., slurry wall) Pile installation Utility relocation
Coenties Slip	Broad	Bored tunnel in rock (storage tracks)[2]	Underground boring or mining
Pier 6 on East River		Barge operation for spoils removal	Possible bulkhead repairs Installation of piles Placement of barge cranes Operation of barges transporting spoils and materials
Broad	South	Bored tunnel in rock[2]	Underground boring or mining
Whitehall		Cut and cover construction for ancillary facility [2]	Utility relocation Construction of retaining walls (e.g., slurry wall) Pile installation Excavation of street Transfer of materials through deck opening Trucking

Notes:

[1] Unless otherwise stated, construction would occur on the extended Second Avenue corridor at the indicated cross-street.

[2] Construction in these areas would only occur if train storage tracks are constructed.

This table has been revised for the FEIS to reflect design refinements.

Public review of the SDEIS began with its publication. A Notice of Availability of the SDEIS was published in the Federal Register on April 11, 2003. The SDEIS and notice of its availability were widely distributed to involved and interested agencies and other parties and posted on the MTA's website, and the public hearings on the document were advertised in community newspapers and MTA website. The MTA held two public hearings to receive comments on the document: on May 12, 2003, in the auditorium of the Alexander Hamilton U.S. Custom House at One Bowling Green; and on May 13, 2003, in the Hecksher Auditorium at El Museo del Barrio, 1230 Fifth Avenue (at 104th Street). The public comment period remained open until June 10, 2003.

During the public comment period for the SDEIS, many members of the general public as well as public officials and agency representatives submitted comments to the MTA to express their support for the full-length Second Avenue Subway. Among those submitting comments, there was general agreement in support of the project's purpose and need to relieve overcrowding on East Side subways and buses, to support the land uses on the East Side with new transit service, and to support the coordinated efforts of city and state officials to rebuild Lower Manhattan.

Other comments received on the SDEIS related to requests to extend the Second Avenue Subway service to the Bronx, Brooklyn, Queens, and other parts of Manhattan, as well as issues related to the cost and financing for the project, potential construction impacts and the measures that would be implemented to minimize effects on the surrounding community, and other environmental issues.

This FEIS responds to the comments received on the MIS/DEIS published in 1999, and to comments received on the SDEIS during the public comment period. It identifies particular options that have been selected during the ongoing engineering process and mitigation measures that would be employed to minimize significant impacts. It also identifies and assesses the refinements to the proposed alignment that have been made as a result of public comments on the SDEIS, further community outreach, and ongoing engineering studies. A summary of the SDEIS comments is provided in Chapter 23 of the FEIS. Letters from federal resource agencies, including the U.S. Department of the Interior and U.S. Environmental Protection Agency, are included at the end of Chapter 23. The full text of all other public agency comments, written public comments, and hearing transcripts is available for public review upon advance request to MTA Government and Community Affairs.

Prior to preparing this FEIS, NYCT has used its ongoing public outreach process to update the public on a variety of issues related to project design and construction. NYCT has attended periodic meetings with the affected community boards to discuss such issues as station entrance locations and construction methodologies and to seek public input regarding construction-related issues, such as noise. During and subsequent to such meetings, NYCT has made efforts to answer questions and refine mitigation measures with the public's comments in mind. For instance, in response to community input, the amount of cut-and-cover construction in East Harlem has been reduced since publication of the SDEIS, and the selection of the Deep Chrystie option for the alignment also reflected community preference. In some instances, although NYCT was not able to accommodate requests for all station entrance locations, the entrances that have been preliminarily identified were chosen in response to community input. For example, the 14th Street Station is being designed to avoid direct impacts on Stuyvesant Square, and at the Seaport Station, the preliminary location for the ancillary facilities has been relocated to avoid Pearl Street Playground and a house of worship. NYCT is continuing to work with the communities as planning regarding the siting of the many required facilities evolves.

Consistent with the requirements of NEPA, a ROD will be prepared by FTA stating FTA's basis for decision no earlier than 30 days after the publication of a Notice of Availability of the FEIS in the *Federal Register*. Once the ROD is issued, NYCT will continue to meet with the public to discuss any refinements to the mitigation measures identified in the FEIS and ROD. Prior to and throughout construction of the project, NYCT and its contractors will also present information concerning construction activities specifically relevant for each Community Board.

The public outreach program for the Second Avenue Subway complies with the requirements of NEPA and those of Section 106 of the National Historic Preservation Act of 1966 (as implemented by federal regulations appearing at 36 Code of Federal Regulations Part 800); Section 4(f) of the Department of Transportation Act of 1966 (49 USC §303(c)); and Executive Order 12898, which addresses environmental justice issues in federal decision making. The SDEIS provides an opportunity for the public to review and comment on the project's environmental effects (NEPA), effects to historic and archaeological resources (Section 106), and effects on parks and historic properties (Section 4(f)). Furthermore, the project has included a public outreach program in all Community Boards along the alignment, including those with predominantly low-income and minority populations (where environmental justice could be a concern). A Final Programmatic Agreement describing future steps to be taken with respect to historic and archaeological resources is provided at the end of this FEIS. The project has also undertaken additional outreach as part of the Section 106 process, to identify parties, such as federally and state-recognized Native American tribes, who might have specific interest in historic or archaeological resources along the alignment.

Detailed design and engineering will continue subsequent to the FEIS and the FTA's ROD, and NYCT will continue to meet with affected Community Boards, the public, local and regional organizations, interested governmental agencies and elected officials, and those who would be directly affected by construction to inform them about project plans, including detailed mitigation measures.

Numerous environmental and regulatory approvals and permits would be required to construct the Second Avenue Subway from such agencies as the U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Department of the Interior, the New York State Department of Environmental Conservation, and the New York State Legislature. In addition, the project must also comply with many laws and policies regulating worker and public safety, relocation procedures, use of parkland and historic resources, endangered and protected species and wildlife habitat, air and water quality, contaminated materials, solid waste, wetlands, and floodplains, etc., and may require certain ministerial permits as well.

F. IMPACTS OF THE SECOND AVENUE SUBWAY DURING CONSTRUCTION AND OPERATION

Any large-scale infrastructure project would necessarily result in unavoidable disruptions during construction. Once completed, the operating Second Avenue Subway would also have a range of effects on the neighborhoods it passes through. Most of the effects of the new transit service on Manhattan's East Side would be beneficial, though some adverse impacts would be expected, as summarized below. The temporary impacts that would result during construction and permanent benefits and impacts from operations of the Second Avenue Subway are described below.

The No Build Alternative would not result in construction impacts, but also would not bring the benefits expected with the new subway. It would provide no new service on the East Side of

Manhattan, and therefore conditions on the currently severely overcrowded Lexington Avenue Line would be exacerbated, because ridership is expected to increase by a substantial 14 percent between 2000 and 2025. Average passenger loads on five of the six express stops on the Lexington Avenue 4 5 express trains from 125th Street to Brooklyn Bridge would exceed NYCT's subway car passenger loading guidelines—at one station stop by 27 percent—during the 2025 AM peak hour. Already crowded local trains at several stations would also become more crowded. Vehicular congestion on the East Side's major north-south thoroughfares would also worsen.

As noted earlier, for all analysis chapters, the project's analysis year has been changed to the year 2025 instead of the year 2020 analysis year used in the SDEIS.

TRANSPORTATION

SUBWAYS AND COMMUTER RAIL

Construction Impacts

Construction of the new subway would require temporary disruption to several other subway lines as well as Metro-North Railroad. Disruption would occur predominantly where the new subway line would be constructed directly beneath another subway tunnel constructed in soil (or beneath the Metro-North viaduct over Park Avenue near 125th Street), so that underpinning is required to protect the existing structure. At locations where the project would cross other subway tunnels constructed in rock, no underpinning would be required, and effects would be minimal (e.g., temporary speed restrictions). Where underpinning would occur, temporary service changes on selected nights and weekends would be required. Potential effects are as follows:

- Where the new tunnels pass below existing subway and commuter rail lines, it may be necessary to protect existing structures during tunnel excavation. This would cause service disruptions ranging from speed restrictions to subway service suspensions on nights and weekends. If the subway line crossing were deep in rock, it would not be necessary to protect these existing subway or commuter line structures, although rock reinforcement may be required to ensure stable openings. The duration of these disruptions would range from 2 months to 2 years. The affected subway and commuter rail lines are as follows:
  - Metro-North Railroad—Park Avenue Viaduct, Park Avenue and 125th Street.
  - 4 5 6 subway services—Lexington Avenue Line, Lexington Avenue and 125th Street.
  - N R W subway services—60th Street Line, 60th Street and Second Avenue.
  - L subway services—Canarsie Line, 14th Street and Second Avenue.
  - F V subway services—Sixth Avenue Line, Houston Street and Second Avenue.
  - J M Z subway services—Nassau Street Line, Delancey Street and Chrystie Street.
  - B D subway services—Sixth Avenue Line, Manhattan Bridge Approach
  - Q N subway services—Broadway Line, Manhattan Bridge Approach.
  - A C subway services—Eighth Avenue Line, Fulton Street and Water Street.
  - 2 3 subway services—Broadway-Seventh Avenue Line, Old Slip and Water Street.

- In addition, the tail track option that extends south from Hanover Square Station would pass under a number of existing NYCT subway tunnels:
  - M subway service – Nassau Street Line, Broad Street and Water Street.
  - R W subway services – Broadway Line, Whitehall and Water Street.
  - 4 5 subway services – Lexington Avenue Line under Peter Minuit Plaza.
  - 1 9 subway services – South Ferry Station of the Broadway Line under Peter Minuit Plaza.
- Where the new Second Avenue Subway tunnels would pass above an existing subway or commuter rail line, it would not be necessary to carry out extensive protective works to the existing structure during tunnel excavation. However, the subway and commuter rail tunnel below would still have to be protected from the overhead construction, and the existing ground conditions maintained at current levels. This work would be done carefully to avoid affecting existing subway and future commuter rail services at the following locations:
  - F subway and LIRR services—63rd Street Line, 63rd Street and Second Avenue.
  - E V subway services—53rd Street Line, 53rd Street and Second Avenue.
  - 7 subway service—Flushing Line, 42nd Street and Second Avenue.
  - LIRR, NJ Transit, and Amtrak services, LIRR Mainline Tunnel, 33rd/32nd Streets and Second Avenue.

  Nevertheless, it is still possible that some short-term service disruptions could result. In this case, these would be considered significant adverse impacts.

As described above, in order to accommodate an increase in passengers transferring from the Second Avenue Line, the existing Grand Street Station would have to be reconstructed. Some of this work would require track outages. Service on the B D routes would be suspended through the Grand Street Station and between Sixth Avenue and Brooklyn on most nights and weekends over a 1- to 2-year period. Minor impacts to the F V routes are anticipated, including possible track outages on nights and weekends to allow ground treatment and other proactive measures to be undertaken to permit the tunnels for the Second Avenue Subway to pass under the Lower East Side and Second Avenue lines.

Operational Impacts

Current plans call for the Second Avenue Subway to be put into operation in four phases. As noted earlier, these phases would include the following:

- *Phase 1:* Q service would operate from Brooklyn to 96th Street and Second Avenue. Service would extend from the existing terminus at the 57th Street-Seventh Avenue Station and make stops at Lexington Avenue-63rd Street, and 72nd Street, 86th Street, and 96th Street on Second Avenue. The Second Avenue Subway would carry 202,000 riders on an average weekday at the completion of Phase 1.
- *Phase 2:* The Q service would be extended to its new terminus at 125th Street Station (at Park Avenue), also stopping at 106th Street and 116th Street Stations on Second Avenue. The Second Avenue Subway would carry 303,000 riders on an average weekday at the completion of Phase 2.
- *Phase 3:* In addition to the Q service described for Phases 1 and 2, in Phase 3 a new subway service (the T route) would operate on Second Avenue from 125th Street Station to a new

southern terminus at Houston Street. Six new stations would be added in Phase 3: 55th Street, 42nd Street, 34th Street, 23rd Street, 14th Street, and Houston Street. At the completion of Phase 3, the Second Avenue Subway would carry 456,000 riders on an average weekday.

- *Phase 4:* With the completion of Phase 4, the full-length Second Avenue Subway would be complete. This phase would add four additional subway stations for the T route: Grand Street, Chatham Square, Seaport, and Hanover Square. The completed Second Avenue Subway is forecasted to carry 560,000 riders on an average weekday.[1]

The 560,000 riders forecasted to use the Second Avenue Subway on an average weekday includes 11,400 riders (or 3,500,000, annually) who formerly used non-transit modes, such as auto, taxi, and light truck trips, as well as walking trips that did not involve transit.

The new Second Avenue Subway between 125th Street and Hanover Square would greatly improve transit access for communities on the East Side, connecting them from East Harlem to the Financial District. In addition, the proposed Second Avenue Subway service via the Broadway Line would create for the first time a one-seat ride from East Harlem and the Upper East Side to West Midtown. Ridership modeling conducted for the project indicates that a new Second Avenue Subway would carry 77,900 AM peak hour riders and approximately 560,000 daily riders in 2025.

Each of the 16 new stations on the Second Avenue Line would comply fully with the regulations of the Americans with Disabilities Act (ADA), providing access to the transit system for physically challenged individuals. Among the features to be included in the new stations are elevators between the street, platforms, and fare control areas; "truncated dome" warning strips at platform edges; wide corridors and entranceways; and public address systems that incorporate video and audio communications. Newly constructed transfer points between the Second Avenue Subway and existing train lines would also be ADA-accessible, unless technically infeasible, as defined by ADA. These improvements would be considered benefits over the existing system.

Many of the new riders on the Second Avenue Line would switch from the currently over-crowded Lexington Avenue Line. This would reduce average subway car passenger loads on the Lexington Avenue 4 5 express and 6 local trains substantially. Overall, it is projected that Lexington Avenue ridership in Manhattan would decline by approximately 27,000 southbound and 9,000 northbound riders in the 2025 AM peak hour, or 24 and 13 percent, respectively. (The AM peak hour was selected to analyze the impacts of the Second Avenue Subway, because AM peak hour volumes are consistently higher than PM peak hour volumes.)

Riders would switch to the new Second Avenue service from the Lexington Avenue Line because of better accessibility to the riders' origins or destinations, and because for many riders, the new service would be faster than their commute via the Lexington Avenue Line. Simulation

[1] Since completion of the SDEIS, ridership modeling has been revised to incorporate the new 2025 analysis year, and to more fully capture the growth in off-peak ridership that has occurred since introduction of the MetroCard. These ridership forecasts are slightly lower (an approximately 5 percent decrease) than in SDEIS, because as engineering progressed, more accurate station entrance times have been incorporated into the model. In many cases, stations are deeper than originally projected to reduce surface construction impacts. As a result, entrance times are longer, making the new line slightly less attractive to some riders. In addition, the use of updated socioeconomic forecasts with slower employment growth also contributed to the decrease in projected ridership.

modeling conducted for the new system concluded that during the AM peak hour, passengers would have substantial time savings in the southbound direction, which is the direction on which the Lexington Avenue Line experiences the greatest delays. For example, a passenger boarding the Second Avenue Subway service on the Second Avenue Line at 125th Street and traveling to Hanover Square Station would have a train trip that would be 5 minutes faster than a passenger who boarded the 4 5 express services at the 125th Street Station on the Lexington Avenue Line and traveled to the Wall Street Station. Overall, the proposed Second Avenue Subway would be significantly faster in the southbound direction than the existing Lexington Avenue 4 5 express, despite making all station stops. The running time savings are less in the northbound direction, ranging from 1.0-minute reduction to a 1.0-minute increase, because delays on the Lexington Avenue Line are less in this direction during the AM peak hour, although many riders will save significant station access time, depending on their destination.

The reduction in Lexington Avenue Line ridership during the AM peak hour is shown in Table S-2. The substantial reduction in ridership on the Lexington Avenue Line would in turn lead to improved service, with reduced dwell times and increased reliability and train frequency. Crowding and travel time would be reduced substantially on both the express and local service, with the greatest crowding reductions on the local line. As shown in Tables S-3 and S-4, passenger loadings would be below NYCT's guidelines as southbound Lexington Avenue Line trains pass through all stations. As a result of the decreased ridership on the Lexington Avenue Line, crowding in Lexington Avenue Line stations would also decrease significantly.

Table S-2
2025 AM Peak Hour Lexington Avenue Line Ridership in Manhattan
Comparing Build vs. No Build Conditions

Route	Southbound				Northbound			
	No Build	Build	Change	%	No Build	Build	Change	%
4 5 Express	59,600	49,300	-10,300	-17.3%	41,800	37,300	-4,500	-10.9%
6 Local	54,200	37,200	-17,000	-31.4%	26,400	22,200	-4,200	-15.9%
Total	113,800	86,500	-27,300	-24.0%	68,200	59,500	-8,700	-12.8%

Notes:
This table is new for the FEIS.
Southbound volumes are based upon the number of passengers on-board trains departing the 125th Street Station and the number of passengers boarding at stations south to Wall Street for the 4 5 or Brooklyn Bridge for the 6.
Northbound volumes are based upon the number passengers on-board trains departing the Bowling Station and the number of passengers boarding at stations north to 86th Street Station for the 4 5 or the number of passengers boarding between Brooklyn Bridge and 116th Street Stations for the 6. (Passengers boarding at the 125th Street Station are not included in the northbound volumes.)
Source: NYCT Transit Model Outputs – May 2003.

Overall, with the implementation of new Second Avenue Subway service, the incidence of "crush conditions" on existing Lexington Avenue Line service—which are expected to become more severe under the No Build condition—would be substantially reduced. Based on average conditions in the AM peak hour, approximately 49,500 southbound 4 5 riders in the AM peak hour would no longer experience crowding in 2025 on the Lexington Avenue Line with the addition of the Second Avenue Subway Line. While many passengers at peak hours would still be required to stand, there would be more space per passenger, and passengers would be able to enter the first train arriving at their station.

Table S-3
Loading Conditions for Lexington Avenue Express 4 5 Trains
2025 AM Peak Hour

Station	Trains per Hour		Leave Load (V)		Capacity (C)		Average Volume/Capacity (V/C) Ratio		
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	% Change
Southbound									
125 St	28	29	31,400	25,700	30,800	31,900	1.02	0.81	-20.5%
86 St	26	28	32,400	24,500	28,600	30,800	1.13	0.80	-29.8%
59 St	26	28	29,800	23,500	28,600	30,800	1.04	0.76	-26.8%
42 St / GCT	25	28	34,800	29,000	27,500	30,800	1.27	0.94	-25.6%
Union Sq	25	27	31,100	25,500	27,500	29,700	1.13	0.86	-24.1%
Brooklyn Br	25	27	26,600	21,300	27,500	29,700	0.97	0.72	-25.9%
Fulton St.	25	27	17,700	13,700	27,500	29,700	0.64	0.46	-22.6%
Wall St.	25	27	6,800	5,900	27,500	29,700	0.25	0.20	-13.2%
Northbound									
Borough Hall	26	26	21,700	20,800	28,600	28,600	0.76	0.73	-4.5%
Bowling Green	26	26	20,800	19,500	28,600	28,600	0.73	0.68	-6.3%
Wall St	26	26	21,100	19,200	28,600	28,600	0.74	0.67	-9.0%
Fulton St	26	26	23,500	20,500	28,600	28,600	0.82	0.72	-12.7%
Brooklyn Br	26	26	24,000	20,700	28,600	28,600	0.84	0.72	-13.8%
Union Sq	26	26	28,100	23,400	28,600	28,600	0.98	0.82	-16.8%
42 St / GCT	26	26	10,700	8,900	28,600	28,600	0.37	0.31	-16.1%

Note: This table is new for the FEIS.
Source: Vollmer Associates based on NYCT Model Outputs – May 2003.

Table S-4
Loading Conditions for Lexington Avenue Local 6 Trains
2025 AM Peak Hour

Station	Trains per Hour		Leave Load (V)		Capacity (C)		Average Volume/Capacity (V/C) Ratio		
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	% Change
Southbound									
125 St	25	25	11,400	8,200	27,500	27,500	0.41	0.30	-28.1%
86 St	25	25	23,900	12,800	27,500	27,500	0.87	0.47	-46.4%
77 St	25	25	29,500	15,200	27,500	27,500	1.07	0.55	-48.5%
68 St	25	25	29,200	14,800	27,500	27,500	1.06	0.54	-49.3%
59 St	25	25	28,000	17,700	27,500	27,500	1.02	0.64	-36.8%
51 St	25	25	24,300	15,000	27,500	27,500	0.88	0.55	-38.3%
42 St / GCT	25	25	21,700	15,400	27,500	27,500	0.79	0.56	-29.0%
Union Sq	25	25	8,800	6,300	27,500	27,500	0.32	0.23	-28.4%
Northbound									
Brooklyn Br	17	17	600	500	18,700	18,700	0.03	0.03	-22.9%
Bleecker St	17	17	5,000	3,600	18,700	18,700	0.27	0.19	-28.3%
Astor Pl	17	17	5,600	3,800	18,700	18,700	0.30	0.20	-32.5%
Union Sq	17	17	12,300	9,700	18,700	18,700	0.66	0.52	-20.8%
23 St	17	17	10,600	7,700	18,700	18,700	0.57	0.41	-27.1%
28 St	17	17	11,000	8,000	18,700	18,700	0.59	0.43	-27.2%
33 St	17	17	8,800	5,500	18,700	18,700	0.47	0.29	-37.9%
42 St / GCT	17	17	13,000	9,800	18,700	18,700	0.70	0.52	-24.9%

Note: This table is new for the FEIS.
Source: Vollmer Associates based on NYCT Model Outputs – May 2003.

This reduction in subway car crowding during the AM peak hour would help reduce or eliminate the long dwell times experienced in the No Build condition, resulting in shorter travel times, and an increase in the number of departing trains at 125th Street, 86th Street and Grand Central-42nd Street Stations. For example, at Grand Central-42nd Street Station, the number of departing 4 5 express trains would be expected to increase from 25 to 28 trains per hour between the No Build and Build conditions. This outcome satisfies a chief project goal.

The extended Q service via 63rd Street and Second Avenue would substantially increase subway ridership on the Broadway Line. With the proposed project, the Broadway Line N Q express service would carry a total of 17,500 more riders southbound and 3,850 fewer riders northbound under the Build Alternative in the 2025 AM peak hour. This is an increase of about 105 percent and 0.4 percent, respectively, compared with the No Build Alternative. During the AM peak hour, the Broadway Line R W local services would carry 1,200 fewer riders southbound and 3,700 fewer riders northbound under the Build Alternative. This is a reduction of about 5 percent and 20 percent, respectively, compared with the No Build condition. Overall, the four subway lines encompassing the Broadway Line (N Q R W) would carry nearly 41 percent more riders southbound and 7 percent fewer riders northbound with the proposed Second Avenue Subway. With these increases, ample capacity would still remain on the Broadway Line trains during the peak hours. Table S-5 shows the increases in Broadway Line ridership that would occur with the Second Avenue Subway as compared to the No Build condition.

Table S-5
2025 AM Peak Hour Broadway Line Ridership in Manhattan
Comparing Build vs. No Build Conditions

Route	Southbound				Northbound			
	No Build	Build	Change	%	No Build	Build	Change	%
N Q Express	17,900	36,600	18,700	104.5%	35,400	35,300	-100	-0.3%
R W Local	24,800	23,700	-1,100	-4.4%	18,800	15,100	-3,700	-19.7%
Total	42,700	60,300	17,600	41.2%	54,200	50,400	-3,800	-7.0%

Notes:
This table is new for the FEIS.
Southbound volumes are based the number of passengers on-board trains leaving Queens on the N R W (or Lexington-63 St Station on the Q) and the number of passengers boarding at stations south to Broadway-Canal on the N Q or Whitehall Street on the R W.
Northbound volumes are based the number of passengers on-board trains leaving Brooklyn on the N Q R or the Whitehall St Station on the W and the number of passengers boarding at stations north to Lexington Av-63rd Street Station on the N R W or 57 St Station on the Q.
Source: Vollmer Associates based upon NYCT Model Outputs – May 2003.

Increased riders on the Broadway Line's extended Q service would increase crowding on some platform and mezzanine stairs at the Times Square Station. This increased crowding would result in significant adverse impacts. These could be mitigated if additional platform stair and mezzanine stair capacity on the Broadway Line at the north end of the Times Square Station can be provided. If these stairs cannot be provided practicably, an unmitigated significant adverse impact would occur.

The Second Avenue Subway would also affect ridership on Metro-North Railroad and Long Island Rail Road (LIRR). Metro-North would have an increase in 2025 AM peak period arrivals and departures at the Harlem-125th Street Station due to the new transfer there to the Second

Avenue Subway. There is expected to be a corresponding decrease in arrivals but a small increase in departures at Grand Central Terminal. Similarly, the LIRR would have an increase in 2025 AM peak period arrivals at Grand Central Terminal, due to improved east side subway service, and a decrease in arrivals at New York Penn Station. Departures at both stations would decrease slightly. The overall change in ridership in both cases is expected to be negligible.

SURFACE TRANSIT

During the project's construction and upon completion of the Second Avenue Subway, NYCT would continue its normal practice of monitoring bus ridership levels on each route, and would increase or decrease bus service to accommodate actual ridership demands.

Construction Impacts

Construction of the new subway would require some lane closures along Second Avenue at the various construction zones required to build stations and other project elements. These lane closures and the presence of construction zones would result in service delays on the M15 bus route, which operates along Second Avenue, as well as some Lexington Avenue buses, resulting in significant adverse impacts to these services. Some bus stops would be relocated outside the construction zones, and bus service would likely be delayed by traffic congestion through the construction zones. It is also possible that at some locations, bus routes may be temporarily changed to avoid construction areas. This congestion during subway construction might divert some motorists and bus riders to Lexington Avenue, adding to delays currently experienced by Lexington Avenue buses due to additional roadway traffic and longer passenger processing times. A comprehensive areawide traffic management and mitigation plan, developed by NYCT, would be reviewed by an Interagency Traffic Management Task Force of affected and responsible agencies and would include a traffic monitoring program. This program would evaluate traffic conditions—including conditions for buses—to ensure that traffic detours and mitigation measures respond effectively to changing traffic patterns.

In addition, after completion of Phase 1 but prior to completion of Phase 2 of the project the southbound M15 route would experience increases in ridership in areas of East Harlem, resulting from people traveling to the Second Avenue Subway's initial northern terminus, but would remain within NYCT guidelines for passenger loading. Similarly, following completion of Phase 3 of the project, the South Ferry and Park Row/City Hall branches of the M15 would experience temporary ridership increases from passengers traveling from the interim southern terminus at Houston Street to Lower Manhattan, which would result in the exceedance of NYCT loading guidelines and therefore require provision of additional bus service.

Operational Impacts

Once the new subway is completed, it is expected to reduce overall bus ridership on the north/south routes through the East Side, as many bus riders will shift to faster subway alternatives. The largest ridership reduction would occur on the southbound M15 route, the route that most closely follows the alignment of the proposed Second Avenue Subway. Northbound bus routes on First and Third Avenues would experience a smaller reduction in ridership. Farther west of Second Avenue, bus ridership reductions would be lower.

VEHICULAR TRAFFIC

Construction Impacts

The Second Avenue Subway construction would generate a significant volume of truck traffic through the East Side of Manhattan for spoils removal from and materials delivery to the construction sites. The peak construction and trucking activity period would most likely occur during the construction phases when cut-and-cover excavation and slurry wall construction occur at station locations, access shafts, and TBM insertion locations. During these periods, more than one station or access site could be excavated simultaneously, resulting in multiple spoils removal and material delivery truck trips to adjacent station locations. Despite the increase in the overall amount of spoils that would need to be removed throughout the project's construction period from that described in the SDEIS (see above), construction impacts from trucking and other operations would not be more intense than those identified in the SDEIS. The analysis conducted for the SDEIS and FEIS includes conservative assumptions about construction duration at tunnel shaft sites and about the number of trucks that would be required daily at each construction activity site to remove spoils. Consequently, the new trucking numbers and durations are within the ranges included in the SDEIS to conduct traffic, air quality, and other analyses. While the number of trucks that would be generated project-wide would increase, the daily volumes at any spoils removal site would not increase beyond volumes assessed in the SDEIS and described below.

In addition, some lane closures would be necessary in each construction zone. Up to half the width of the Second Avenue roadway could be closed at proposed station locations and construction work zones. Three effective moving lanes would be maintained on Second Avenue adjacent to the four- to five-block-long construction zones by prohibiting curbside pick-ups/drop-offs and deliveries and by relocating bus stops. The construction zones on two-way streets, such as 125th Street and Water Street, would reduce the roadways to primarily one travel lane per direction with no curbside stopping, including for taxis that currently queue on 125th Street at Park Avenue. Provision for two travel lanes would be provided at some locations (i.e., approaches to key intersections). In addition to reducing roadway capacity, construction activity would increase volumes on East Side streets affected by deliveries to and from construction zones by 15 to 50 trucks per peak hour depending upon the location and on the construction phasing sequence and methods.

Traffic analyses indicated that the influence of a reduced number of travel lanes adjacent to the construction zones has a far more significant impact on roadway capacity than the volume of trucks that would be added to the street network. Nearly all intersections along the alignment at a major cross street (such as 125th, 96th, 86th, 72nd, 57th, 42nd, 34th, 23rd, 14th, Houston, Grand, Fulton, and Wall Streets, and East Broadway), and many minor cross-street intersections within the construction zones would deteriorate to severely congested conditions during the AM and PM peak hours when the capacity of Second Avenue is reduced to three lanes. Significant traffic impacts in station areas at intersections along the two-way streets (e.g., 125th, Chrystie, Pearl, and Water Streets) would also occur.

MTA/NYCT has committed to developing an Interagency Traffic Management Task Force to implement and monitor a comprehensive traffic mitigation plan, to be developed by NYCT, which will address such impacts throughout construction. To ensure that this process is as inclusive as possible, the Interagency Traffic Task Force will include such agencies as the New York City and New York State Departments of Transportation (NYCDOT and NYSDOT) and MTA Bridges & Tunnels. As the traffic mitigation plan is being developed, NYCT will maintain

regular communication with local elected officials and affected community groups regarding the work of the Interagency Traffic Management Task Force, and the traffic mitigation plan will be refined as needed to accommodate traveler and community needs while maintaining the safe and efficient construction of the subway in as timely a manner as possible.

Most impacts could be mitigated with standard traffic engineering improvements, such as signal timing modifications, relocating bus stops, parking restrictions, or lane restripings. These improvement measures may not fully mitigate the impacts at the following intersections:

- 125th Street at Lexington Avenue
- 125th Street at Second Avenue
- 96th Street at Second Avenue
- 72nd Street at Second Avenue
- 66th Street Shaft Site/Spoils Removal Area
- 57th Street at Second Avenue
- 53rd Street at Second Avenue
- 42nd/34th/23rd/14th Street Station Areas
- Second Avenue/Chrystie Street and Houston Street
- Chatham Square Station Area
- Water and Broad Streets
- Water Street and Maiden Lane

Several of these intersections could be successfully mitigated by narrowing sidewalks to 5 feet to provide a fourth southbound moving lane on Second Avenue. At the most severely impacted intersections, such as 34th Street, these measures and a more aggressive diversion plan would be needed to further improve traffic conditions.

It is also possible that significant impacts at the minor cross-street intersections between 72nd and 30th Streets would not be fully mitigated by standard traffic engineering improvements, because of high volumes these streets process for traffic approaching or leaving the Queensboro Bridge and Queens-Midtown Tunnel. In these areas, capacity could be increased by providing a fourth southbound moving lane on Second Avenue at some critical intersections, and by narrowing the sidewalks to 5 feet (the minimum width of sidewalks adjacent to construction sites in New York City). These measures would successfully mitigate most traffic impacts.

In certain locations, a more aggressive diversion of Second Avenue traffic to alternative southbound routes during the AM and PM peak hours would also be needed. For example, one severely affected intersection would be 34th Street on Second Avenue, as traffic at this intersection is presently extremely congested. This intersection may be indicative of construction phase traffic conditions expected at the normally congested East Midtown locations approaching 42nd Street and the Queensboro Bridge (59th and 60th Streets) on Second Avenue, as well. At 34th Street, providing a fourth southbound lane through the construction zone would not be sufficient to fully mitigate impacts. North of the Queensboro Bridge, it is necessary to maintain five travel lanes on Second Avenue so that they remain clear of any parking, delivery, or bus stop activity within the construction zone for the four blocks between 63rd and 59th Streets. For several blocks north of 66th Street in the area of the 66th Street shaft site, four clear travel lanes need to maintained in order to mitigate potential construction-related traffic impacts.

Other mitigation, including more aggressive traffic diversion, would also need to be evaluated for the 125th Street area as part of the traffic management plan that would be developed by

NYCT and reviewed, approved and monitored by the Interagency Traffic Management Task Force.

Some traffic is expected to divert off of the Second Avenue corridor and use parallel routes such as Lexington or Park Avenues. Diverted southbound traffic from Second Avenue would cause significant impacts on Lexington Avenue at 129th, 128th, 127th, and 59th Streets; Park Avenue at 126th and 124th Streets; and Bowery at Houston Street. These impacts could be mitigated by signal retiming and parking restrictions. Additional truck trips on First Avenue and 96th and 86th Streets would also cause significant impacts that could be mitigated by signal timing changes.

Operational Impacts

Once completed, the Second Avenue Subway would greatly improve subway service on Manhattan's East Side. The subway would divert some peak hour trips from auto and taxi modes to subway. Vehicle miles traveled would be reduced by 28.4 million miles per year and areawide traffic volumes would be reduced by some 8,300 vehicular trips per day (5,100 drive alone trips), 1,600 shared ride trips, and 1,600 taxi trips). This daily trip reduction translates into a reduction of about 20 to 30 vehicles per hour (vph) on the major north-south avenues in East Midtown and a 10 vph reduction on Water Street in the southern half of the study area.

PARKING

Construction Impacts

During construction, approximately 50 to 80 curbside parking spaces might be lost within and adjacent to each four- to five-block station construction zone. Truck delivery loading and unloading zones would need to be provided on adjacent cross streets to compensate for lost parking spaces within the construction zones, resulting in the loss of an additional 10 to 20 spaces on cross streets. To mitigate traffic impacts on alternative southbound routes from diverted traffic, additional parking restrictions during peak hours could be implemented. Any parking garages or lots located adjacent to construction areas would be adversely affected unless alternative entrances/egresses to the garages are available from outside the construction areas. No significant adverse impacts would result on parking supply in these neighborhoods from these construction-related changes, because adequate off-street parking capacity to accommodate any displaced cars remains in other parking garages located within a quarter-mile radius of the affected curbside parking spaces or garages.

Operational Impacts

There would be little if any change to the number of curb spaces available throughout the study area once the subway is built and is operational. Immediately adjacent to new subway station locations, there could be a minor loss of curb spaces if the stairwells or escalators are located adjacent to the curb or if curb extensions are provided. (Curb extensions are a widening of the sidewalk into the parking lane to accommodate a new subway stairwell or to provide additional pedestrian space.) Relocating adjacent mid-block fire hydrants to curb extension areas may reduce the net number of on-street parking spaces that might be eliminated. At the Grand Street Station, the north and south sidewalks along Grand Street between Forsyth and Chrystie Streets may be widened into the parking lanes to provide room for station entrances or ancillary facilities. This would result in the elimination of approximately five metered spaces on the south side of Grand Street and a five-vehicle taxi relief stand on the north side of the street beginning

in Phase 4 of the project. The taxi relief stand would be replaced within the area, potentially resulting in the removal of an additional five metered spaces. Similar reductions in the number of parking spaces could also occur at the 116th Street, Chatham Square, and potentially Seaport and Hanover Square Stations depending on final station locations and designs.

At the Grand Street Station, a property at 89 Chrystie Street now occupied by a public parking garage with a posted capacity of 140 cars may be acquired so that an ancillary facility can be constructed at that location. If so, the business would be displaced and the cars would have to be parked elsewhere. This would not be a significant adverse impact, since other parking garages and lots are located in the vicinity. Portions of several parking areas may be acquired for ancillary facilities and emergency egress associated with stations. These include parking areas on the south side of 125th Street between Park and Lexington Avenues for the 125th Street Station; on the west side of St. James Place across from James Street for the Chatham Square Station; and on the northeast corner of Beekman Street and the southeast corner of Peck Slip for the Seaport Station. No significant adverse impact on parking would be created if portions of these lots are acquired since other parking garages and lots are located in the vicinity of these parking areas and the entirety of the parking facility would not be acquired. Overall, the total number of parking spaces along the Second Avenue Subway corridor would be similar to that with the No Build Alternative, and no significant adverse impacts would result.

PEDESTRIANS

Construction Impacts

The construction of the subway would result in the narrowing or closure of sidewalks adjacent to construction zones along the alignment. At some locations, the sidewalk on both sides of the street might need to be narrowed to 5 feet (the minimum width of sidewalks adjacent to construction sites in New York City) to provide an additional travel lane or a wider construction area. Pedestrian conditions on the construction side and non-construction side of the street could deteriorate to unacceptable levels of service in certain areas. Significant adverse impacts would also occur if the sidewalk in any one location would be closed for longer than 2 weeks. This could result in pedestrian impacts during the temporary construction phase. To ensure pedestrian safety, physical separation between the construction zone and sidewalks, such as concrete barriers and fencing, would be provided and the walkways may need to be enclosed if necessary. These safety design procedures would be similar to those provided at all New York City street construction areas.

Operational Impacts

Based upon the proposed phasing plan, portions of the project would be operational before construction of the entire line is complete. The initial service would operate from 96th Street to 63rd Street and then connect to the Broadway Line, which goes to West Midtown and over the Manhattan Bridge to Brooklyn. The effects of such a temporary terminal station on pedestrian conditions on nearby sidewalks and crosswalks were analyzed in this chapter using a reasonable worst case pedestrian analysis approach, which assumed that the initial interim terminal station would be at 96th Street. The analyses indicated that during operation of the Phase 1 of the project, as well as with the full-length Second Avenue Subway, there would be no significant adverse impacts to pedestrian conditions at 96th Street. However, there would be significant adverse impacts at 94th Street, where additional entrances to the 96th Street Station would be located, during both Phase 1 of the project and with the full-length Second Avenue Subway.

There would be no significant adverse impacts to pedestrian conditions at Houston Street (the interim southern terminal) upon completion of Phase 3 of the project.

Once the new subway is complete, on-street pedestrian volumes would increase adjacent to new Second Avenue Subway entrances, while on-street pedestrian congestion would be reduced at existing Lexington Avenue subway stations. Analyses were conducted at 11 representative station locations on the Second Avenue and Broadway Lines and at Grand Central-42nd Street Station on the existing Lexington Avenue Line. Based on preliminary plans for entrance locations, crosswalk and corner reservoir area pedestrian impacts could be expected at some of the new station entrance locations, beginning at the completion of the construction phase in which that station is built. No temporary significant adverse impacts to pedestrian conditions are predicted to occur as a result of the phased construction of the project and phased implementation of new subway service. Sidewalk impacts could be expected if stairwells reduce the effective sidewalk width below acceptable threshold levels. In most cases, relocating all street furniture, such as refuse cans, mail boxes, and phone booths from the corner reservoir area would mitigate the significant adverse impacts. Since the locations of station entrances will not be final until ongoing engineering is completed, the exact nature of the impacts at these locations may change.

At existing station entrance locations along the Broadway Line, the new Second Avenue Subway express service would result in some pedestrian impacts at the Times Square Station that could be mitigated using standard pedestrian improvements, such as widening the crosswalks. At the Herald Square Station, the moderate overall increase in entry/exit volumes, be satisfactorily accommodated without mitigation.

SOCIAL AND ECONOMIC CONDITIONS

CONSTRUCTION IMPACTS

Construction activities associated with large-scale projects are necessarily disruptive. For the Second Avenue Subway, the design is being developed to minimize such disruption to the surrounding community to the greatest extent possible. This would be done by maximizing the amount of the project that would be constructed by working below-ground (e.g., by mining or tunnel boring), and minimizing the street-level activities. Some project elements, however, would have to be constructed at street level. These include the entrances to the stations, as well as additional station components in locations where the station must be constructed in soil rather than rock. In addition, several access shafts must be created through which workers and materials travel to and from the below-ground tunnels, and staging areas must be established at street-level.

Below-ground construction activities would not materially affect land use, neighborhood character, economic conditions, or the visual environment and resources. However, the various above-ground construction methods that would be required to construct the Second Avenue Subway would result in a number of temporary but significant impacts to those areas, as described below.

General Disruption Associated with Street-Level Construction

Construction activities would result in unavoidable increases in traffic, truck movements, dust, and noise and vibrations in the areas nearby. At each approximately five-block-long station site, approximately half of Second Avenue and some of the adjacent sidewalk would be closed at a

time to serve as a construction zone. In this area, trucks would travel to and from the site making deliveries and removing earth and other materials. Certain construction activities could require restricting access to buildings for several hours or days at a time over a several week period. In certain limited locations, access to buildings could be disrupted for a longer period of time. For more information, see the discussion below under "Displacement and Relocation."

However, in most cases, safe access to buildings, including street-level businesses, would be maintained throughout the construction period, although pedestrian and vehicular access would be altered or restricted by the construction of sidewalk sheds and the removal of parking and travel lanes, and the visibility of some businesses would be reduced. The associated disruptions to access and travel patterns as well as the increases in noise, vibration, and dust and the visual effects from barriers, construction equipment (including nighttime lighting), and activities would adversely affect the neighborhood character and visual environment of the surrounding area during construction. To help minimize potential impacts, NYCT would make every reasonable effort to maintain access; control noise, vibration, and dust; screen construction activities; and minimize other disruptions, where practicable.

In places where there are sensitive land uses (such as hospitals, schools, and fire department facilities, etc.), NYCT would work with the affected properties to devise a transportation management plan (TMP) so that ambulances, emergency vehicles, doctors, patients, students, and others could access these sites without experiencing delays. If access would be affected in the vicinity of any essential emergency services these facilities might have to temporarily relocate during a portion of the construction period, if the TMP were to show that access could not be maintained 24 hours a day, seven days a week. This would be considered a significant adverse impact.

As described later, barriers would be used to reduce noise from particularly noisy activities where practicable. At three of the parks where construction activities would occupy parkland—Playground 96, St. Vartan Park, and Sara D. Roosevelt Park—walls would be erected around the construction areas to reduce noise in the adjacent park.[1] These walls would be approximately 12 feet tall (rather than 20 to 30 feet tall as described in the SDEIS) and constructed of timber, steel, or concrete. While the walls would block noise from and limit views into the construction sites where they are employed, they would themselves be visually intrusive. Barriers located near parks would block views into those parks; any barriers near buildings could limit views from windows on the lower floors. In areas other than the three parks mentioned above, the decision as to whether such walls should be used will eventually be made in consultation with the affected community after considering the advantages (e.g. noise reduction) and disadvantages (e.g. visual impacts) of using such barriers during construction.

The disruptions associated with construction activities could also adversely affect nearby businesses—and particularly retail establishments with outdoor activities on the sidewalk, which would have to be removed when construction is occurring nearby. Though temporary, this effect could affect the businesses' revenue streams and profit margins, and could make the areas in the vicinity of construction activities less desirable locations for new businesses. In the worst-case scenario, if a substantial number of businesses in a given area were to close as a result of

[1] Further engineering studies completed since the SDEIS have resulted in a determination that building walls as tall as 30 feet (which was considered in the SDEIS) is not practicable, because the construction of such walls would require significant piles, bracing, and foundation systems to support the walls. In addition, tall construction equipment could not operate within the confines of these walls.

construction, leaving street-level retail space vacant for a relatively long time, the character of the neighborhood could also be altered. At the same time, however, construction activities would also likely result in positive local economic benefits—particularly to local convenience stores, neighborhood services, and eating and drinking establishments—resulting from the introduction of a large construction worker population. Positive effects from the project's construction would also be experienced throughout Manhattan, New York City as a whole, the tri-state metropolitan region, and all of New York State, as these economies are integrated functionally with respect to construction labor supply, materials and equipment purchases, sales and income tax revenues, and general economic output.

It is possible that development of new buildings in an area with subway construction would be slowed until after construction is completed, thus delaying or perhaps altering land use and economic development trends. In East Harlem and the East Village/Lower East Side/Chinatown, which are currently undergoing an expansion of their commercial and residential uses, Second Avenue Subway construction may temporarily affect neighborhood character and economic development to the extent that some developers could be dissuaded from initiating projects in the area because of the disruptiveness of subway construction operations. On the other hand, it is also possible that some developers would begin construction activities foreseeing the benefits of a future Second Avenue Subway.

In general, the project's potential construction impacts on neighborhood character, economic conditions, and the visual environment on Manhattan's East Side would depend partially on the duration and overlap of the construction phases and construction activities within each phase. If many areas were under excavation at the same time, there is greater potential for there to be a cumulative effect from an areawide deterioration of conditions (i.e., access, congestion, truck travel, noise, vibration, and visual), and impacts would occur throughout the neighborhood zone. With a slower construction schedule, fewer locations would be affected at any one time, so the land use and neighborhood character impacts would be more geographically limited. However, slowing construction could increase the overall cost of the project, elongate the overall construction disruption to the East Side, and delay the ultimate benefit of having a new full-length subway in place.

Long-Term Construction Staging and Activity Sites

In several locations, longer term construction activities would be required to stage and manage the construction of the project's below-ground tunnels. At these long-term sites, construction disruption would be similar in nature to that at the shorter- term sites, but would be longer and at times more intense. As at the shorter-term sites, significant adverse impacts to land use and neighborhood character, economic conditions, and the visual environment could result from the construction activities at these sites. Spoils removal activities on 66th Street at Second Avenue would be less intense than at other shaft sites/staging areas, because of the shorter duration (up to 4 years) and fewer trucks that would be required to construct the curved tunnel and caverns connecting to the 63rd Street Line in this area. (The duration of the construction activities at 66th Street has increased from 2 to 4 years since issuance of the SDEIS; the duration of activities between 99th and 91st Streets and between 36th and 32nd Streets has been reduced from 10 years to 8 years.)

Construction Activities South of Houston Street

Because of the presence of numerous existing subway tunnels in the soft ground immediately south of Houston Street, constructing this portion of the Second Avenue Subway alignment

while maintaining nearby subway service would be particularly difficult. Construction of the alignment and the Grand Street Station would generally result in neighborhood character, economic, and visual impacts in the nearby area, such as potential temporary displacement of residents and businesses, removal of trees and recreational facilities at Sara D. Roosevelt Park, and disruption of traffic on Chrystie Street and surrounding streets. Different construction techniques would be employed to minimize impacts to parkland and adjacent buildings while maintaining beneficial transfers between the new service and the existing Grand Street Station (Ⓑ Ⓓ).

OPERATIONAL IMPACTS

Overall, the Second Avenue Subway would greatly support study area neighborhoods by adding travel options for residents, workers, and visitors in these communities at the completion of each construction phase as well as at completion of the full-length line; and by improving access to important land uses, such as hospitals, museums, schools, parks and other regional institutions. Along the entire alignment, neighborhood character and economic conditions would be enhanced by improved access to public transit, and the quality-of-life benefits resulting from faster and more efficient commutes and additional travel options. Large institutional uses located near or adjacent to the Second Avenue Subway alignment would benefit greatly from improved access for employees and those in need of the important services offered by these facilities. In addition, all new subway stations on the Second Avenue Subway Line would be accessible to the physically challenged and would comply with ADA requirements, providing a substantial benefit to the disabled community.

The ability of transportation systems to conveniently serve major residential and employment centers also contributes to economic growth and productivity. The new subway would play a key role in helping the city sustain and improve its economic vitality, facilitating retention of jobs, expansion of existing businesses, and development of new businesses. It would also induce new investment in residential areas, such as East Harlem and the East Village/Lower East Side/ Chinatown, and facilitate the revitalization of Lower Manhattan by increasing access to the area. Existing congestion and access problems within the subway network would be substantially reduced, and new capacity would be provided to support future economic growth. By improving the transportation infrastructure, the proposed Second Avenue Subway would help maintain the city's competitive edge and its ability to increase its economic output. New transit connections to and from other parts of the city and region would also extend the project's economic benefits outside of Manhattan. Furthermore, since the city contributes greatly to the economy of the tri-state metropolitan region and New York State as a whole, these areas would also benefit from the project.

Because the Second Avenue Subway would provide access to the Midtown and Lower Manhattan CBDs and relieve congestion on the Lexington Avenue Line, it would support existing commercial uses. It would also help to make the areas more attractive for the prospective residential and retail uses that the city's zoning policies encourage. In areas like East Harlem and the East Village/Lower East Side/Chinatown, the Second Avenue Subway would support existing trends toward increased development, support public efforts to promote more commercial uses and provide more housing. It would also be an important asset in helping to attract new investment. Thus, the potential land use and economic impacts in these areas would be beneficial. In other areas that are already very densely developed (such as the Upper East Side, East Midtown, Gramercy Park/Union Square, and Lower Manhattan), the Second Avenue Subway would support existing and planned development by increasing proximity to public

transit, reducing auto congestion, and improving transit access. This would constitute an additional public service for current and prospective residents.

On a localized level, the new subway would support the neighborhoods where it would provide new service. Its visible elements, including station entrances and above-ground ventilation and cooling structures, are all common features of Manhattan streetscapes and would not be incongruous to the visual environment. Moreover, the design of the station entrances and ancillary facilities would be sensitive to the surrounding architectural context; they would not disturb views in the study area, nor would they change the study area's urban design. Furthermore, near the stations, pedestrian activity would be significantly higher with the Second Avenue Subway, resulting in increased pedestrian traffic (and resulting business) for convenience-related retail businesses and neighborhood services adjacent to or near proposed subway station entrances. In areas where there is currently a considerable amount of retail vacancy (e.g., Houston Street), the stations may attract new commercial development and the vacant spaces would be reoccupied. Moreover, the stations would support other forms of development in the future. These would certainly be positive economic effects, which could strengthen the overall character of the neighborhood and its retail environment.

PUBLIC OPEN SPACE

CONSTRUCTION IMPACTS

A number of parks and public open spaces line the 8.5-mile route proposed for the Second Avenue Subway. Most parks would remain fully accessible to the public during construction. However, several parks would be partially closed to the public for use by the project during construction. (More information on the use of parks is provided in the Section 4(f) Evaluation and Section 6(f) Evaluation conducted for the project, which is included at the end of the main volume of the FEIS). The parks that would be temporarily affected by project construction are as follows:

- Western portion of Playground 96 (Second Avenue between 97th and 96th Streets/0.5 acres): This area would be used for up to 8 years during Phase 1 (a reduction in time from the 10 year maximum construction period described in the SDEIS) as a staging area for tunnel and station construction activities.
- Western portion of St. Vartan Park (Second Avenue to Tunnel Access Road between 36th and 35th Streets/0.6-acres): This area would be used for up to 8 years as a staging area for tunnel and station construction activities in Phase 3 (a reduction from the 10 years identified in the SDEIS).
- First Park (north side of Houston Street between Second and First Avenues/portion of 1.4 total acres): The western portion of this park, which is currently fenced and closed to the public, would be excavated to install ancillary equipment beneath the park during Phase 3.
- Portions of Sara D. Roosevelt Park (between Chrystie and Forsyth Streets from Rivington to Hester Street/ portion of 7.9 acres total): The western edge of the park from Delancey to Hester Street and the area along Grand Street would be excavated to allow construction of a new lower level to the existing Grand Street Station as well as to widen the existing platform there. This would result in the loss in this area of the parallel rows of trees that line the western edge of the park. In addition, excavation would occur immediately north of Delancey Street in a community garden to remove piles that could obstruct the new Second

Avenue Subway tunnels to be built there. Construction activities in the park could last 4 to 5 years during Phase 4. Construction activities within the community garden would last up to 6 months and would be performed in the winter, when the garden is less heavily used, to minimize impacts.

- Kimlau Square (at Chatham Square/0.1 acres): This park would be excavated during construction of the station below in Phase 4.
- Pearl Street Playground (Water Street at Fulton Street/0.2 acres): A station entrance in a portion of this playground is currently being evaluated. Any entrance at this location would be constructed during Phase 4 of the project.
- Fulton Street Plaza (Water Street at Fulton Street/0.2 acres): A station entrance is currently being evaluated at this open space, and if built would be constructed during Phase 4 of the project.
- Wall Street Triangle (Wall Street west of Water Street): A station entrance is currently being evaluated in this street area, which is proposed to become a Greenstreet under the jurisdiction of the New York City Department of Parks and Recreation (NYCDPR). Any entrance at this location would be constructed during Phase 4 of the project.
- Coenties Slip (west side of Water Street one block north of Broad Street/0.06 acres): A station entrance is currently being evaluated for this area, which is proposed to be converted to parkland, and if built would be constructed during Phase 4 of the project.

As a result of ongoing engineering studies conducted since issuance of the SDEIS, the proposed underground storage tracks on Second Avenue north of 125th Street have been substantially reduced in size. Construction activities there would thus no longer directly affect Crack is Wack Playground and Triboro Plaza, as was described in the SDEIS.

For park facilities rendered unusable by construction activities that would last for a number of years, NYCT would work with NYCDPR to identify the mitigation plan most compatible with each neighborhood's parks and open spaces, which in some cases would include identifying potential temporary replacement spaces. For St. Vartan Park, this would consist of identifying a temporary replacement space for recreational facilities displaced during construction, as per the requirements of Section 6(f). This replacement park would be created prior to any construction in the park. At Sara D. Roosevelt Park, where construction for the adjacent station could result in disruption to a large area of the park, it is anticipated that construction would be staged to limit the area being affected at any one time. In addition, NYCT would work with NYCDPR and the community to reconfigure displaced recreational facilities on the portions of the park that would remain publicly accessible. In all cases where a park would be used for construction staging activities, the park would be fully restored, in consultation with NYCDPR, after construction of each construction phase is complete.

At other public open spaces along the alignment, nearby cut-and-cover activities could result in significant adverse impacts on certain parks because of access limitations or construction disturbances (such as increased noise and dust). These include Harlem River Drive Park, Wagner Pool, Wagner Houses Playground, the eastern portions of Playground 96 and St. Vartan Park, Stuyvesant Square, First Park, the portions of Sara D. Roosevelt Park not directly affected by construction, St. James Triangle, Fishbridge Garden, Vietnam Veterans Plaza, and, even if they are not directly affected by construction, Pearl Street Playground, Fulton Street Plaza, Wall Street Triangle, and Coenties Slip. Some park users are likely to use other nearby parks with

similar facilities to avoid noise or other construction disturbances. Public plazas provided as part of private developments located along the alignment could experience similar impacts if located adjacent to surface construction. In addition, significant adverse noise impacts would occur during construction at other parks located along the alignment and up to 750 feet from surface construction.

Efforts would be made to minimize any impacts to park trees. NYCT will develop a forestry plan with NYCDPR to specify the plans for protection and replacement of trees for all parks where trees would be affected. This plan will be included in the project's Construction Environmental Protection Plan (this document, the CEPP, will set forth all project commitments and requirements related to construction. NYCT will incorporate relevant portions of the CEPP in all construction contracts, and contractors will be obligated to follow these provisions). As part of this plan, trees would be replaced at all locations where they must be removed prior to completion of each phase, Playground 96, St. Vartan Park, Sara D. Roosevelt Park, and Kimlau Square, as well as street trees and trees at any other areas, such as Greenstreets and public plazas on private property. Trees would be replaced according to NYCDPR's policies, which involve replacing trees with those of the same size, or with multiple smaller trees. Some new trees would be planted in advance of construction activities that must remove trees.

OPERATIONAL IMPACTS

After completion of the Second Avenue Subway, park facilities affected by construction would be restored, replaced, or repaired in accordance with agreements reached between the MTA and NYCDPR. However, five parks (Sara D. Roosevelt Park, Pearl Street Playground, Fulton Street Plaza, Wall Street Triangle, and Coenties Slip) could be permanently affected by the presence of subway entrances or emergency exits within these parks. If so, this would result in a permanent loss of parkland—a significant adverse impact. As mitigation, NYCT would work to design subway facilities located in parks to complement the park environment, wherever practicable. Mitigation could also include the identification of replacement park space elsewhere in the city. Subway entrances within Playground 96 and Kimlau Square, which were mentioned as a possibility in the SDEIS, are no longer under consideration.

When construction is completed in Sara D. Roosevelt Park, trees lost in the area immediately north of Delancey Street and on the west side of the park between Delancey and Hester Streets would be replanted to the extent feasible in consultation with NYCDPR. Despite the replanting, the loss of the original trees would still be noticeable, and because of the number of trees affected and the contribution that this park's parallel rows of trees makes to its overall design, would create visual and neighborhood character impacts.

DISPLACEMENT AND RELOCATION

Construction activities for the Second Avenue Subway could result in some direct displacement of businesses and residents where access to building entrances is disrupted and where work nearby requires temporary relocation for safety reasons. The project would also require acquisition of property to be used as off-street staging and shaft sites and for permanent vent structures or station entrances.

SHORT-TERM DISRUPTION

Disruptions to access would usually be short-term and temporary. Such short-term access disruptions could occur in areas where excavation would occur close to existing buildings and

where tunnels would be constructed in soil immediately below or near existing buildings, so that measures to support and protect existing structures would be implemented. These disruptions would generally be for a few hours at a time, but in a few instances, disruption could extend for up to 6 months. In one location—the area of Chrystie Street between Delancey and Hester Streets—pedestrian access could be prohibited for up to 2 weeks and vehicular access for several 2-week periods.

LONG-TERM OR PERMANENT DISPLACEMENT

In most locations, it is not anticipated that NYCT will need to acquire buildings or permanently evacuate residents and businesses from buildings adjacent to the construction work. However, at one location—at the corner of 125th Street and Second Avenue, where the project's tunnels would be constructed in soil directly beneath standing buildings during Phase 2—11 properties would experience long-term disruption. Two of these properties (one vacant lot and one 2-story mixed use building) would be acquired for use during construction. Two businesses with an estimated 21 employees (full-time equivalents) and 8 apartments with an estimated 21 residents would be displaced in the 2-story building to be acquired. Access to the other nine properties could be curtailed for up to a year. While demolition of these buildings is not contemplated, it is possible that NYCT would acquire these properties or appropriate interests in these properties (e.g., leases, licenses, occupancy agreement, easements, etc.) to facilitate construction. An estimated 35 employees, 278 residents, and a religious institution, the United Christian Prison Ministry, would be affected in these nine buildings. Four of the nine buildings are currently being renovated, but it is assumed that they would be fully occupied by the time construction of the subway in this area commences.

Another private property may also need to be acquired at 24 Second Avenue, at the northeast corner of First Street, to accommodate construction staging activities in Phase 3. This property is currently occupied by a gas station and employs no more than 10 employees.

NYCT will need to acquire property and easements for structures required to support operations of the Second Avenue Subway. New above-ground structures to house entrances, ancillary facilities, and emergency exits would be constructed at each of the project's 16 new stations and at the existing 63rd Street-Lexington Avenue Station on the 63rd Street Line, at 63rd Street and Third Avenue. Although the project has been designed to minimize the number of properties that must be acquired and the number of residents and businesses affected, some private properties must be acquired at each of the new subway's stations. Generally, up to eight properties (but up to 11 properties in a few locations) would be acquired in part or whole at each station. When the SDEIS was published, specific properties that might be acquired were not known. Instead, the SDEIS described the general location of properties that might need to be acquired along the alignment. Since completion of the SDEIS, engineering work has been ongoing, and preliminary designs for station entrances, ventilation facilities, ancillary station facilities, and emergency exits have been developed. Those properties are preliminary, and subject to change as project engineering continues and NYCT meets with local Community Boards. At this time, acquisition is being considered for a mix of different kinds of properties, including privately owned open plaza areas, basement and ground floor areas in large buildings, and entire smaller buildings (because use of lower-level space in small buildings is typically impractical, given structural considerations). Where acquisitions occur, tenants or occupants of buildings would be permanently displaced. These displacements could occur in advance of the start of construction of each phase of the project.

The number of apartments and businesses in the affected buildings was determined through New York City Real Property Assessment Data property records and verified via field surveys; the number of affected residents for each building was calculated using average household size reported in the 2000 Census for the relevant station area in which the building was located and the number of employees were calculated using standard factors, based on estimated square footage. In total, full acquisition of approximately 50 buildings and partial acquisitions within approximately 35 buildings are being considered. This would affect an estimated 350 residents in some 220 apartments and approximately 510 employees of approximately 80 businesses. The preliminary list of properties that might be acquired is provided in Chapter 8 ("Displacement and Relocation") of the FEIS.

MTA and NYCT would provide relocation assistance and benefits to displaced residents and businesses in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as codified in Title 42, Section 4601 *et seq.* of the United States Code, and the applicable implementing regulations set forth in Title 49, Part 24 of the Code of Federal Regulations (collectively, the "Uniform Act"). This entails requirements for appraisal and acquisition of real property, relocation services, moving payments, replacement housing payments, and other allowable payments related to commercial and residential moving costs and displacement. MTA and NYCT also would adhere to the requirements of the New York State Eminent Domain Procedure Law, which establishes procedures for fairly notifying property owners and tenants and compensating them for property interests acquired by condemnation for public projects. For any locations where it would not be feasible for the project to maintain reasonable access to businesses, MTA or NYCT would compensate the landlords for diminution of rental value and, where applicable, provide relocation payments to displaced tenants. Residents temporarily displaced would typically be offered an alternative residential facility, or some equivalent measure of compensation.

NYCT would also acquire permanent, below-ground easements for underground tunnels and support structures, but these would be well below the buildings on those properties and would not affect any building occupants.

HISTORIC AND ARCHAEOLOGICAL RESOURCES

The effects of the project on historic and archaeological resources were assessed in accordance with Section 106 of the National Historic Preservation Act of 1966. Study areas—known as Areas of Potential Effect (APEs)—were identified in consultation with the New York State Historic Preservation Office (SHPO), and historic and archaeological resources were identified through field surveys and documentary research within each APE in consultation with the SHPO and the New York City Landmarks Preservation Commission (NYCLPC).

Historic resources are those that have been officially recognized (i.e., properties that are listed or have been found eligible for listing on the State and National Registers of Historic Places; that are National Historic Landmarks or New York City Landmarks; and properties that have been considered for designation as New York City Landmarks). A total of 87 such historic resources are located within the historic resources APEs for the Second Avenue Subway. Of these, 80 are individually designated structures/sites (including three National Historic Landmarks—the Chrysler Building, the Daily News Building, and the Brooklyn Bridge), and the remaining seven are historic districts. (The number of historic resources has increased from that in the SDEIS, as the revised number includes new historic resources that are located within the APEs of new

project elements that were not included in the SDEIS, such as specific station entrance locations.)

Documentary research conducted for the project's archaeological resources assessment indicated that various archaeological resources may be buried within the area of the project alignment. These include Native American sites along the alignment, early residential uses along the alignment (including the 17th century Village of New Harlem, farms and other residences dating predominantly from the 19th century, but also including some earlier sites, particularly south of Houston Street), and 18th and 19th century residential and commercial uses along the alignment south of Canal Street.

In addition, although the Second Avenue Subway alignment would not pass through any existing cemeteries, it would pass through four locations where burials may once have been located. Some of these are locations that were once cemeteries, but records indicate that marked graves from these cemeteries were moved when the cemeteries were closed. It is possible that unmarked interments or burials were missed during the moving process; if so, they would still be present in their original locations. At other cemeteries, it is possible that burials may have extended outside of their established boundaries, into areas that are now sidewalks and that these may still remain, unrecorded beneath the sidewalks. Until additional research is concluded—some of which is already under way—it was conservatively assumed that the subway could adversely affect burials, if any construction would occur within the potentially sensitive areas.

CONSTRUCTION IMPACTS

The MTA and NYCT would take extensive protection measures to avoid adverse effects on historic and archaeological resources, as they typically undertake with their projects. In addition, ongoing consultation will be undertaken with the SHPO as the project designs proceed, to avoid or minimize the potential for adverse impacts to historic and archaeological resources, including possible burials. The measures to avoid or minimize adverse effects to historic and archaeological resources are set forth in a Programmatic Agreement among the FTA, SHPO, and NYCT. A Construction Protection Plan consisting of an overall plan for protecting and avoiding damage to historic properties would be included as part of the Programmatic Agreement. The project's Programmatic Agreement is included at the end of the main volume of the FEIS.

For historic resources, the following adverse effects might occur:

- Possible accidental damage during construction to any historic resource, because of proximity of the tunnel alignment or stations to various historic structures. For resources located near excavation sites or locations where underpinning ground improvement, conducted, possible effects could include accidental damage by construction equipment and possible structural damage as a result of settlement or other changes to foundation conditions. Accidental damage from vibration during construction is also possible, if no preventative measures are taken.
- Physical alteration to portions of the historic MTA Metro-North Harlem-125th Street Station and associated Comfort Station. The Metro-North Station and Comfort Station would be affected by construction of a new subway station beneath it, since providing a station connection could require physical alteration to its subterranean level that retains features of an earlier railroad station once at the site. The railroad station and Comfort Station could also be affected by construction of new above-grade entrance structures. (As a result of project refinements since the issuance of the SDEIS, the Triborough Bridge entrance and

exit ramps would no longer be affected by Second Avenue Subway construction activities as was described in the SDEIS.)

- Potential for physical alterations to the Daily News Building's plaza (contextual, indirect effect), or to the building itself (direct effect) from a new entrance or to the Chrysler Building during construction of a possible subterranean pedestrian passageway on 42nd Street to connect to the 7 train.
- Potential for accidental damage during construction to the Brooklyn Bridge, as the subway's proposed alignment would be beneath Pearl Street, which crosses beneath the bridge. All prudent precautions will be taken to avoid damage to the Brooklyn Bridge.
- Potential for physical alteration to existing historic resources by construction activities not yet identified or designed.
- Possible temporary changes to the setting or context of historic resources during construction, because of the presence of construction activities nearby.
- Possible permanent changes to the setting or context of historic resources because of new project elements that have not yet been designed that could potentially be constructed near or within historic structures. For example, vent structures near historic buildings could change the setting of the historic buildings if not adequately screened or designed in a visually compelling fashion.

If archaeological resources are present in the locations identified in the APE that would be disturbed by the Second Avenue Subway, and if the resources are significant and eligible for the State and National Registers, the project would result in a significant adverse impact on these resources since the resources would be either disturbed or destroyed. This impact would require implementation of mitigation, such as avoidance or recovery, where practicable. Ongoing consultation mandated by Section 106 of the National Preservation Act of 1966 is being undertaken with the SHPO to investigate further the presence of significant resources and to develop appropriate mitigation measures. In accordance with Section 106 of the National Historic Preservation Act of 1966, which mandates public outreach, consultation is under way with interested parties, such as congregations associated with potential burial remains. This consultation and further work are set forth in the project's Programmatic Agreement.

OPERATIONAL IMPACTS

The analyses conducted for the FEIS indicate that the project would not produce vibration levels that would exceed the FTA's impact criteria, including for sensitive structures, such as historic resources.

The Second Avenue Subway would not have physical effects on any other historic resources in the APE. As noted earlier, the location of street-level subway elements—such as signs, stairways, vents, ventilating structures, and other ancillary facilities—has not yet been determined. In cases where entrances would occur within or adjacent to historic structures, or where ancillary facilities are planned contiguous to or in close proximity to historic structures, consultation with the SHPO, as mandated by Section 106, would be undertaken to avoid or minimize significant adverse contextual effects to the nearby resources. To accomplish this goal, NYCT, in consultation with SHPO, will develop design specifications to ensure that any permanent and visible project elements that may be built within or near a historic resource are compatible with the historic and architectural characteristics of the affected resource(s). In

addition, as engineering proceeds for the project and locations for street-level project elements are determined, proposed plans would be submitted to the SHPO for review during the ongoing consultation process for the Second Avenue Subway project. The procedures to be followed in coordination with the SHPO are set forth in the Programmatic Agreement.

AIR QUALITY

As required by the federal Clean Air Act, the U.S. Environmental Protection Agency (EPA) has set standards for six major air pollutants: nitrogen dioxide and ozone, together a concern for regional levels of ozone; and carbon monoxide (CO), respirable particulate matter (referred to as PM_{10}, indicating particulate matter with a diameter equal to or less than 10 micrometers, and fine particles, or $PM_{2.5}$), sulfur dioxide, and lead, which are of concern on a localized basis. These standards are referred to as the National Ambient Air Quality Standards (NAAQS). On a regional basis, ozone levels are of concern, since the entire New York metropolitan area currently exceeds the federal standard for ozone. Nitrogen oxides (NO_x) and the volatile organic compounds, or VOCs, emitted by motor vehicles contribute to the formation of ozone. $PM_{2.5}$ is also of concern regionally, because it can remain suspended in the air for long periods of time and therefore can be widely dispersed. On a localized basis, pollutants of concern are CO, which is produced predominantly by motor vehicles, and respirable particulate matter, which comes from diesel emissions, industrial sources, and dust, among other sources. New York City has recently been designated as an area in attainment for CO; however, Manhattan is designated as non-attainment for PM_{10}. The standard for $PM_{2.5}$ is new, and EPA and New York State have not yet determined whether the region is in compliance with the standard.

CONSTRUCTION IMPACTS

An analysis of the air quality effects of the project's construction activities on nearby receptors was performed at locations that represent the reasonable worst-case conditions for air quality. Three different air quality analyses were conducted for construction-related air quality effects:

- *Carbon monoxide analysis*—to estimate increases in CO levels resulting from construction-related traffic diversions and congestion.
- *Particulate matter concentrations analysis*—to determine potential increases in PM_{10} and $PM_{2.5}$ near the construction sites and on local streets resulting from construction activities and the use of diesel-powered equipment; and
- *Regional construction impact analysis*—to estimate potential regional increases in NO_x, VOCs, and $PM_{2.5}$ from construction.

The analysis concluded that the project's construction activities, including truck trips, barge operations, congestion, and diversions to existing traffic, would not result in significant adverse impacts on carbon monoxide levels. In addition, PM_{10} concentrations are not predicted to exceed standards, taking into account the effects of truck movements, construction activities, and stationary and mobile construction equipment. In the areas immediately adjacent to major construction sites, the project's construction activities would result in maximum predicted local annual increases of fine respirable particulate matter ($PM_{2.5}$) that would exceed the interim annual threshold value (0.3 µg/m3) being used by the New York State Department of Environmental Conservation (NYSDEC) for its own projects. Some of the background $PM_{2.5}$ levels exceed the annual NAAQS.

The maximum predicted 24-hour average increases of $PM_{2.5}$ from diesel exhaust would not exceed the interim guidance threshold value (of 5 µg/m3) being used by NYSDEC and the New York City Department of Environmental Protection (NYCDEP) for their own projects. The maximum predicted 24-hour increase of $PM_{2.5}$ including both diesel exhaust and fugitive dust would exceed those values. Including background concentrations, cumulative daily $PM_{2.5}$ concentrations during construction would be below the applicable NAAQS in the study area.

The NYSDEC and NYCDEP interim guidance thresholds do not apply to projects that do not require an air permit from NYSDEC or approval from NYCDEP. Nevertheless, the criteria can be applied to assess the magnitude of a project's effects and to determine whether reasonable mitigation measures ought to be employed to minimize the generation of $PM_{2.5}$ to the maximum extent practicable.

The project's construction would be required to follow measures to reduce air pollution. These measures will be set forth in the project's CEPP and include dust covers for trucks, (water) spray misting exposed areas, and using safe chemical dust suppressants to treat and control spoils at construction areas. In addition, a fence of an appropriate height would surround the construction sites to reduce wind-borne dust. To reduce emissions from construction equipment, the CEPP would require diesel emission controls for non-road equipment. These controls will require that all heavy equipment use ultra-low sulfur diesel (ULSD) fuel and diesel particulate filters, or other retrofit technology, in accordance with MTA and NYCT policies. In addition, idling time for all diesel equipment would be limited to 3 consecutive minutes, except in certain limited circumstances.

Regionally, the long-term construction activities required for the project would increase the levels of ozone precursors (NO_x and VOCs) and $PM_{2.5}$. The emissions of these pollutants each year during the project's multi-year construction process would depend on the intensity of construction activities at any one location, the number of locations in construction at once, the type of construction equipment used, and the distance traveled by trucks bringing materials to construction sites and removing excavated materials. The analysis concluded that using barges rather than trucks to transport some of the project's spoils and/or construction materials would result in a benefit to regional air quality.

OPERATIONAL IMPACTS

The air quality analysis for the operations period—a *regional operational impact analysis*—demonstrated the improvements in regional air quality (i.e., decreases in CO, VOCs, NO_x, and PM_{10}) that would result once the Second Avenue Subway is operational. The new Second Avenue Subway would help prevent further deterioration of New York City's air quality by decreasing traffic, resulting in modest improvements to air quality regionally. The project would not increase vehicular traffic at local intersections, and therefore would not result in localized increases in air pollutants.

NOISE AND VIBRATION

CONSTRUCTION IMPACTS

Following FTA's guidance for predicting noise and vibration impacts for transit projects, an analysis was conducted of the project's potential to create impacts on airborne and ground-borne noise, as well as vibration, during construction. *Airborne noise* is what most people think of when they hear the word "noise." It is noise that travels through the air—such as the sound of

traffic on a nearby roadway, or children playing in a playground. *Ground-borne noise* is the rumbling sound caused by *vibration* (or oscillatory motion). With ground-borne noise, buildings and other structures act like speakers for low-amplitude noise. As an example, the low rumbling sound that occurs within a building as a subway passes beneath is ground-borne noise.

Airborne Noise

Both existing and future noise levels in the study area are relatively high at almost all locations in the study area during almost all hours of the day. They reflect the fact that traffic volumes throughout the study area are high, with relatively high truck and bus volumes. Nevertheless, because of both the nature of the construction required to excavate subway tunnels and stations through more than 8 miles of Manhattan and because of Manhattan's overall density, localized airborne noise impacts would occur during the construction period. Although NYCT would undertake numerous mitigation measures to minimize the extent of these impacts, it will not be possible to completely mitigate all impacts—chiefly because of the proximity of existing residential and other buildings to the construction activities.

Significant adverse impacts on airborne noise would result at all stations and at all shaft sites/spoils removal locations during certain construction periods because of the proximity of construction to certain sensitive uses. Some activities creating such impacts would not occur during late night and early morning hours (e.g., 10 PM to 7 AM). At this time, NYCT is committed to restricting the timing of vertical blasting operations (and any associated surface drilling) as well as most surface activity related to cut-and-cover construction, such as building slurry walls, pile installation, and surface excavation. Such activities would not occur during the late evening and early morning hours (10 PM to 7 AM), unless they were not in close proximity to residential uses, or unless mitigation measures, were used. In certain extraordinary circumstances, vertical blasting could occur late at night; an example of an "extraordinary circumstance" might occur near hospitals, where blasting would need to be scheduled so as not to interfere with surgical procedures. Another example is where work would occur at or near an existing subway station, where daytime disruptions to service would create adverse impacts on a far greater number of passengers. Also, it is possible that some relatively quiet activities could occur overnight. In addition, as is typical within New York City, most utility work would occur overnight because this activity requires the complete closure of the roadway and shutting off utility service for several hours.

The times and locations where increased noise conditions would occur would vary depending on the location of construction, the equipment and construction methods employed, and the distance between the noise source and the receptor. Construction must occur close to active land uses in order to create new subway stations within the already developed neighborhoods on the East Side of Manhattan. Noise levels at receptor locations where no mitigation is employed would exceed one or more of the FTA construction impact criteria (i.e., 90 dBA for daytime and 80 dBA for nighttime for the one-hour L_{eq} value[1], 80 dBA for daytime and 70 dBA for nighttime for the eight-hour average L_{eq} value, and 10 dBA above the existing ambient for the 30-day average

[1] L_{eq} is the constant sound level that in a given situation and period conveys the same sound energy as the actual time-varying sound.

L_{dn} value[1]) at most locations. These impacts would occur for distances up to approximately 750 feet from where construction operations are taking place.

In general, because the project area has relatively high airborne noise levels due to existing traffic volumes, the increase in noise levels caused by delivery trucks and workers traveling to and from the construction sites would not be perceptible. However, small increases in noise levels would be expected near a few defined delivery truck routes and streets in the immediate vicinity of localized construction areas.

Construction activities would shift along the project alignment during different phases of work. Some locations would necessarily be noisier than others—for example, the locations where new stations would be constructed would be locations with particularly noisy construction work. At these and other areas, more extensive machinery would be required above-ground for portions of the construction period than at locations where most of the activity occurs below-ground.

With regard to noise from tunneling operations conducted using TBMs, noise from this source is generally not expected to be discernible, since most of the noise would be contained underground and would be masked by the high existing ambient noise levels. However, absent the implementation of special measures, noise from TBMs would be discernable at times when these operations are taking place at access/extraction points and other locations where noise can emanate out of openings in the ground. At locations where vertical blasting would occur (such as to create vertical shafts to the tunnel below), noise from the blasting would be discernible for a very short period of time (i.e., for the several-second duration of the blast). In general, though, due to the short duration of these events, average hourly noise levels would not be significantly affected by the blast noise.

Noise would also be generated from ground improvement and trucking activities, slurry wall construction, spoils removal at stations and from the tunnels, and other activities. To reduce noise associated with such construction, performance standards would be established by NYCT and included with contract documents that must be met by all contractors during construction. A variety of measures would be employed to meet these standards, which could include using buckets and vertical conveyors to move spoils to the street level, lining hoppers and trucks with rubber; and using drive-through street-level truck enclosures for truck loading. Overall, the implementation of such measures would reduce the number of adverse airborne noise impacts, but is unlikely to eliminate all of them. Even with these measures, construction operations would create significant adverse airborne noise impacts at a number of locations—in particular, at a large number of residences.

NYCT is committed to developing and implementing an extensive mitigation program to reduce and alleviate construction noise impacts. This program will be included in the project's CEPP, which is being modeled on those developed for other large urban construction projects, such as the MTA's East Side Access Project in Manhattan and the Central Artery/Tunnel Project (also known as the "Big Dig") in Boston and will be mandatory for contractors.

Before construction begins, NYCT will require its contractors to establish and secure its approval for site-specific Noise Control Plans that will describe the particular noise reduction measures required to meet the specified noise level limitations designed to minimize nuisance noise conditions. The Noise Control Plan will include all noise control commitments needed to

[1] L_{dn} is a 24-hour measure that accounts for moment-to-moment fluctuations in noise levels from all sound sources during 24 hours, combined.

achieve a certain level of noise reduction based on established performance standards (with a maximum construction noise level of 90 dB(A) of continuous noise). Prior to construction, ambient noise measurements will be taken at noise-sensitive locations. Once construction begins, 24-hour noise monitoring stations will also be established; these stations will provide NYCT with the ability to monitor its contractors to ensure that the performance standards established by NYCT are met. Contractors will also be required to develop noise monitoring and reporting protocols to be used during construction to ensure compliance with the performance standards and will have to obtain certificates of equipment noise compliance from NYCT or its designee for all construction equipment employed throughout the project. Ultimately, at the time of construction, NYCT's contractors will be able to select from a range of noise abatement measures to ensure that construction noise does not exceed the performance standards. Prior to implementing any of these measures, NYCT will also discuss the advantages (e.g., noise reduction) and disadvantages (e.g., visual impacts) involved with implementing the various measures with the surrounding communities. (See the discussion of "Airborne Noise Mitigation" for other examples of such advantages and disadvantages.) These discussions have already begun with the affected Community Boards.

Ground-Borne Noise and Vibration

Construction activities associated with the proposed Second Avenue Subway would result in varying degrees of ground-borne noise and vibration, depending on the stage of construction, the equipment and construction methods employed, and the distance from the construction to buildings and vibration-sensitive structures. The close proximity between the construction equipment/operations and sensitive receptors would result in perceptible ground-borne noise and vibration levels during a large portion of the construction period. The implementation of properly managed special measures would protect buildings—particularly historic structures or other properties meeting the FTA's definition of "fragile"—from architectural or structural damage that could occur as a result of vibration and ground-borne noise produced by certain construction operations (including use of certain equipment, operation of underground spoils removal trains, and blasting).

NYCT is committed to implementation of a rigorous program of location-specific measures to minimize potential impacts to uses (such as hospitals and other medical facilities) and structures (such as historic buildings) that are sensitive to vibration levels. NYCT has begun implementing a noise and vibration outreach program to institutions and businesses along the alignment that may be particularly sensitive to vibration, such as medical facilities (i.e., hospitals, eye clinics, etc.), laboratories containing sensitive instrumentation, concert halls, auditoriums, theaters, TV and/or recording studios, etc. At each location where a sensitive use is identified, NYCT will conduct outreach to develop a detailed understanding of the specific types of equipment employed at the facility. Analyses will be performed to determine the maximum vibration levels that would be expected at that location due to construction activities, and to assess the ability of the equipment to function properly during the construction period. Finally, each location will also be examined structurally, to determine how the project's construction activities would interact with the building's foundation and construction type. Once these studies are completed, a determination will be made as to what specific mitigation measures could be feasibly implemented to reduce the vibratory levels caused by project construction. These could include changes to construction methods to be used near the sensitive use, to avoid vibration-related impacts. As part of this process, a decision would also be made as to whether, even with implementation of these mitigation measures, construction activities would still produce vibration levels that would temporarily impede or interfere with the normal operations at the site.

At locations where construction activities might have the potential to interfere with vibration-sensitive activities, NYCT would coordinate closely with the affected party to minimize the duration and severity of these impacts.

With regard to structures that may be sensitive to vibration levels—particularly those that have been defined by the FTA criteria as "fragile" in its noise assessment manual—NYCT is committed to implementation of properly managed special measures designed to minimize or avoid architectural or structural damage that could occur as a result of vibrations and ground-borne noise produced by certain construction operations. As described above, NYCT has identified all the historic properties that could be affected by subway construction or operation based on current engineering plans, including from ground-borne noise and vibration impacts. NYCT has worked with the SHPO and the NYCLPC to develop a Programmatic Agreement that, among other measures, outlines a process that would be used to protect historic buildings, including any resources not previously identified that could be affected if project plans were to change. NYCT has also developed both a fragile buildings identification strategy and guidelines to limit vibrations for the various types of structures along the alignment.

NYCT will also continue to explore a variety of other mitigation measures to minimize impacts from ground-borne noise and vibrations. One such potential measure includes such design and construction measures as rerouting heavily loaded trucks away from residential streets, and operating earthmoving and other equipment away from vibration-sensitive sites. Another type of mitigation measure would involve changing the project's sequencing operations, such as altering the phasing of construction activities so that multiple operations producing high vibratory levels do not take place in the same time period, avoiding nighttime activities, etc. A number of other controls would be implemented with respect to mitigation of vibration during construction, including a preconstruction survey of any structure or use likely to be adversely affected by the construction activities and imposition of thresholds that take into account each structure's or use's ability to withstand the loads and displacements due to construction vibrations. A project-wide vibration monitoring program would also be developed and implemented to monitor and identify vibration levels from construction activities at nearby sensitive receptors. Site-specific vibration control plans would also be developed as summarized above, and construction measures such as avoiding impact pile installation and use of equipment with high vibratory levels in sensitive areas, and imposing blasting regulations would be instituted to limit vibration.

With implementation of the measures discussed above, vibration levels during construction would be reduced below the levels that would cause architectural or structural damage. However, vibration levels would still be at levels that are perceptible, and are likely to cause annoyance to residents adjacent to locations where significant construction operations are taking place (i.e., locations adjacent to where excavated material is being removed from tunnel and/or station construction, and locations where tunnel boring, cut-and-cover, and/or mining operations take place). Additionally, at some sensitive locations, such as medical facilities and laboratories, that are very sensitive to vibration levels, it may not be feasible to implement mitigation measures to reduce vibration levels during construction below levels that would interfere with normal operations. In these cases, NYCT would coordinate closely with the affected party to minimize the duration and severity of these impacts.

OPERATIONAL IMPACTS

Once operational, the Second Avenue Subway's trains themselves do not have the potential to create airborne noise impacts outside of the tunnel and stations because they will generally be

deep below ground. However, the various ancillary facilities such as fans, cooling towers, chillers, and pumps required to operate the Second Avenue Subway project have the potential to generate airborne noise. These ancillary facilities would be located at every station and in certain other areas along the entire alignment, and many of these facilities would have to be located above-ground.

The airborne noise analysis concluded that operation of the new subway beneath Second Avenue would not result in any significant adverse impacts on noise levels, either along the project alignment or at potential nighttime storage yards for subway trains. With respect to ancillary facilities, fan and other noise would be controlled using a combination of measures, and no significant adverse impacts would be created.

As described above, since the SDEIS was published, the proposed subway alignment has been adjusted somewhat as a result of ongoing engineering. In several locations, the alignment is now deeper than described in the SDEIS, reducing the potential to create ground-borne noise and vibration impacts to structures nearby. In addition, project engineers have now completed a more detailed, site-specific examination of the alignment in certain locations in order to calibrate the results of the general assessment provided in the SDEIS. The results of this refined analysis shows that impacts from ground-borne noise and vibrations would be reduced from the levels shown in the SDEIS.

The refined analyses indicate that train operations would not produce ground-borne vibration levels that would exceed the FTA impact criteria. This is a reduction from the impacts predicted in the SDEIS, where ground-borne vibration levels would have exceeded FTA criteria on one or both sides of six blocks. The number of locations where train operation would produce ground-borne noise that would exceed FTA impact criteria has also been reduced. In the SDEIS, one or both sides of 63 blocks would have experienced such exceedances, whereas with the refined project, this number is now reduced to one or both sides of 29 blocks adjacent to locations where tangent tracks would be located, and one or both sides of 12 blocks adjacent to where crossovers would be located. Generally, without mitigation, the Second Avenue Subway's train operations on tangent tracks at selected locations could result in exceedances of FTA ground-borne noise criteria by up to 6 dBA, while at crossovers, ground-borne noise levels could exceed FTA criteria by up to 14 dBA without mitigation. NYCT would implement a variety of mitigation measures so that FTA's impact criteria would not be exceeded.

NYCT will mitigate ground-borne noise impacts through application of a menu of several options that provide progressively greater potential to mitigate impacts depending on the situation. In general, the level of ground-borne noise would be reduced by increasing the vertical resilience of the trackform. Along tangent track, resilient rail fasteners would be used to mitigate this impact.

At locations where crossovers would be located, the general assessment predicts that a reduction of up to 14 VdB would be required to mitigate the predicted impacts. NYCT will incorporate design measures into the project at all crossovers so that FTA's impact criteria for ground-borne noise are not exceeded. To provide the required mitigation at crossovers. NYCT is considering different track options, including the use of resiliently supported concrete tie blocks or Direct-Fixation (DF) rail fasteners, both of which have the potential to provide the necessary level of mitigation to meet the FTA criteria at crossovers. In addition, all crossover areas will incorporate NYCT's redesigned frog, which was redesigned to produce lower levels of noise and vibration, by reducing the impacts that occur when a train's wheel traverses the flangeway area of the frog.

Incorporating resilience in the track support structure would provide the necessary level of mitigation to meet FTA impact criteria.

INFRASTRUCTURE AND ENERGY

CONSTRUCTION IMPACTS

Most tunnelling activities occurring below-ground would pass below the existing utilities and the only impact would be as a result of the small ground movements that could occur during tunnelling in soft ground sections (Maiden Lane to Houston Street, and north of 120th Street). In these areas, sensitive utilities may need to be replaced or protected prior to tunnelling. Sensitive utilities include gas and water mains in cast iron pipes, particularly those that have a history of leakage or are heavily corroded.

To minimize environmental impacts resulting from disruptive surface construction, as well as cost and construction duration, NYCT is seeking wherever practicable to limit disruptive construction activities that would require utility relocations. As described above under "Description of Construction Methods and Activities," cut-and-cover construction techniques are being minimized where possible. Stations and tunnels in rock would be constructed by mining from below rather than excavating from the surface. Most stations have been designed to provide enough cover above that utilities can remain in place. Construction would support utilities in place, rather than relocating them, wherever practicable.

To protect utilities during excavation activities, NYCT is coordinating with members of its Utility Task Force, a partnership among NYCT, the various utility companies, and the New York City Department of Environmental Protection (NYCDEP) to ensure that utilities are not damaged. Depending on the construction activity required and specific location, sewers, water mains, gas and electrical lines, Empire City Subway Company duct banks for phone, cable, and other communications, and other utilities would either be avoided entirely, replaced, or relocated. To minimize disruption to users, utility relocations would occur at night, when demand for utility service is lower. Utility service would be maintained throughout construction, except for planned temporary outages, which would be limited to a few hours during the day. Residents and businesses would be notified in advance of these temporary outages.

With respect to energy, the relatively small amount of electricity needed for project construction is unlikely to affect the ability of Con Edison to meet its current peak load demands for New York City. Based on the proposed phasing plan in which two TBMs may be operating concurrently in separate locations, the estimated maximum power requirement for tunnel construction (the most energy-intensive construction activity) would be 5.7 MW per TBM (including approximately 3.7 MW for each TBM and approximately 2.0 MW for the supporting site machinery required per TBM). This value is small compared to the estimated in-city peak load demand of slightly less than 11,000 megawatts. The total energy consumption from electrical power sources during the construction period is estimated to be approximately 390 billion BTUs. Including fuel sources, the total project energy consumption for construction is estimated to be approximately 17 trillion BTUs.

OPERATIONAL IMPACTS

Following construction, no impacts to utilities would occur, as these would be relocated prior to subway operation. Electrical power that would be required for the Second Avenue Subway and its ancillary facilities is estimated at approximately 94.6 megawatts[1]; energy would be obtained from the existing and planned Con Edison electrical grid and delivered from substations. This power requirement is a very small fraction of the total energy consumed in New York City. Further, this increment would be offset somewhat by the reduced auto vehicle miles traveled that would result with the Second Avenue Subway's operation. Furthermore, NYCT is committed to creating an environmentally responsible subway system and has integrated a Design for the Environment team to assess and if possible incorporate "green design" opportunities in the Second Avenue Subway project.

CONTAMINATED MATERIALS

CONSTRUCTION IMPACTS

The Preliminary Environmental Site Assessment (PESA) investigation undertaken for the SDEIS and FEIS identified an initial list of locations along the alignment that have the potential for contaminated soil, soil gas, or groundwater. During construction, there is a potential that contaminated materials could be uncovered during all construction phases, either in locations where research indicated a potential problem or in other unexpected locations. One of the first steps that will occur in the subsequent analysis phase during ongoing engineering will be to further define the locations where excavation would occur, so that areas of potential concern can be analyzed in more detail at those locations.

Since completion of the SDEIS, subsurface site investigations along the corridor have begun at certain sites identified in the PESA as warranting further analysis. As part of this continuing initial environmental sampling program, a program of 11 borings was performed to collect soil and groundwater samples. This program included both field screening to determine potential contamination, as well as collection of soil and groundwater samples that were then sent to a laboratory for analysis. In addition, these borings also allow for the collection of information needed to perform a Hazard Risk Assessment as required by the U.S. Occupational Health and Safety Administration (OSHA).

The results of this sampling generally confirm the findings of the PESA. At four of the 11 soil sampling sites, results indicate elevated contaminant concentrations at subsurface levels that may affect materials handling and disposal during construction, and/or require the implementation of various mitigation measures to minimize exposure to workers and the community. The results are not indicative of conditions at street level because these contaminants are beneath pavement. At these four locales, the results indicate that further study is required to determine appropriate measures to minimize exposure to workers and the community and/or to identify special measures to handle and dispose of materials during construction.

Contaminants not detected during the initial sampling (e.g., PCBs) cannot be dismissed as absent from the alignment and may be encountered during subsequent investigations. The specific measures that would be used during construction for special handling/disposal and to minimize

[1] As a result of project refinements from ongoing engineering, the power consumption forecast has been revised since issuance of the SDEIS.

exposure to workers and the public would depend upon a number of site-specific factors, including the geometry of the work area/excavation; nature of the contaminated medium; type, distribution, and concentration of the contaminant(s), and the potential exposure pathways (e.g., inhalation, ingestion, direct contact).

At the five locales where a sample of groundwater was collected, various contaminants were detected, but at all locales except 97th Street, the levels were sufficiently low that treatment would not be required prior to discharge to the sewer system. At 97th Street, the levels of VOCs indicated that treatment for VOCs might be required before groundwater could be discharged to the sewer system. However, more testing of groundwater will be performed prior to any excavation and dewatering.

For the Second Avenue Subway, preventative measures would be undertaken to protect the safety of the public, community residents, and construction workers, as well as subway workers and the larger environment for areas where the Second Avenue Subway has the potential to encounter areas identified through the preliminary investigation. As described in this section, these include further investigations to better determine the nature and extent of contamination in areas where the project might encounter it, requirements that contractors perform additional borings before excavation for review and approval by NYCT, and prescribed construction measures to manage contaminated materials during construction. All of these measures will be set out in the project's Construction Environmental Protection Plan, both to meet all applicable legal requirements and to minimize potential impacts. Work would be coordinated with NYSDEC as appropriate and in accordance with applicable requirements.

Once contamination is known or judged to exist in a particular area where excavation would be required, a CEPP would be developed to safely manage these areas during construction. To protect workers and the public and to reduce the potential for their being exposed to these contaminants, a number of preventative measures would be established. These would include a site-specific Health and Safety Program (HASP) plan that would be developed and implemented by contractors for each construction phase, defining mandatory health and safety requirements that the contractors and subcontractors would meet. The overall plan would be established by NYCT, and work would be coordinated with the New York State Department of Environmental Conservation as appropriate and in accordance with applicable regulations. In addition, all workers would be required to follow all applicable local, state, and federal regulations. Any contaminated materials encountered during construction would be handled, stored, and disposed of in accordance with all applicable regulations and in compliance with the HASP.

The excavation and off-site disposal of contaminated soils is more costly than the disposal of non-contaminated soil or rock, but it is generally a relatively straightforward process. In some specific instances, contaminated spoils would be mitigated to eliminate contaminant migration into the excavation and/or finished subway system. It may also be possible to alter construction plans to avoid these areas altogether or to prevent impacts by installing a physical barrier.

OPERATIONAL IMPACTS

During operation of the subway, no significant impacts from contaminated materials are expected. Once construction activities are completed, any remaining non-volatile subsurface contaminated materials would be contained or "capped" by paved areas and would not pose a threat to the public. Excavated materials that qualify as hazardous or industrial waste would be removed from the site and disposed of in approved landfills or reused under a beneficial use determination whenever possible.

The subway's concrete tunnel liner construction would form a barrier against either the seepage of water or vapors. To minimize the possibility that vapors and contaminated groundwater could infiltrate the tunnel and station cavern, potential remedial measures include installing vapor and water barriers in areas where it is determined that such a threat exists, and remediation of the affected media. Other techniques, including groundwater collection and disposal in compliance with applicable standards, could also be implemented, as necessary, and this would be determined during the continuing engineering process. Any contaminated groundwater that migrates into the sumps (low points used to collect water and pump it to the sewer system) that exceeds the New York City Department of Environmental Protection's sewer use limitations would need to be treated using readily available technologies and retested prior to its disposal to sewer systems.

Fuels, lubricants, and other oils would be used to operate the subway and at the maintenance yards. All applicable regulations related to the storage, handling, proper use, and disposal of these materials would be closely followed to ensure the safety of workers and the public, and to protect the surrounding areas.

NATURAL RESOURCES

CONSTRUCTION IMPACTS

As described above, the expansion of NYCT's Coney Island yard is no longer contemplated as a potential train storage option for the Second Avenue Subway project, and the 129th Street barge site and staging area have also been eliminated from further consideration. Accordingly, the potential to adversely affect natural resources has been substantially reduced from that identified in the SDEIS.

The construction of the Second Avenue Subway would not alter the underlying geology on Manhattan, nor would it be expected to have any impacts to groundwater, terrestrial vegetation and wildlife, or endangered, threatened, and special concern species during any construction phase. The Second Avenue Subway alignment and some storage tracks pass through the 100-year floodplain in East Harlem and Lower Manhattan. In addition, several project-related construction areas and yard sites would also be located in the floodplain. However, the project is not expected to result in increased flooding.

While the portion of the East River near Pier 6 was designated as littoral zone under New York State Department of Environmental Conservation's tidal wetland mapping system, there is likely no littoral zone remaining at this location because of dredging that occurred in 2001 and the presence of a continuous bulkhead that limits the potential for wetland vegetation. Should sedimentation cause the site to fill in, the site may meet the criteria of a tidal wetland in the future, and the Second Avenue Subway would have the potential to affect this potential resource if the potential barge facility at Pier 6 is used during Phase 4 of the project.

The subway construction is not likely to create significant adverse impacts on the East River or the species present within it. However, some temporary water quality degradation would be caused by dredging, pile driving, and bulkhead restoration or barge operations that could occur at the Pier 6 barge site. This would be limited to increased turbidity and a temporary increase in suspended sediment. The amount of dredged material would be small, if dredging is required at all. Such disturbances could be mitigated with silt curtains and standard erosion-control measures, and water quality would be expected to return to its pre-construction state after the completion of in-water construction. Contaminated materials resuspended due to dredging would

be dispersed and diluted quickly. Contaminated soils disturbed by dredging would be required to be removed from the river bottom and disposed of appropriately. Additional water quality protection measures related to fueling activities and spoils spillage would be made and best management practices would be employed to avoid runoff.

The localized increases in turbidity caused by construction activities as well as placement of fixed structures on the rivers at the barge site could temporarily decrease the amount of light penetrating the water column and thereby affect primary production.[1] However, these periods of decreased production would be very limited in duration because of tidal currents and so significant adverse impacts would result. The limited work in the water required to establish barge facility (including possible dredging) could disturb localized areas of habitat for benthic organisms (invertebrate organisms that inhabit river bottom sediments), but these organisms would be expected to recolonize quickly. Construction would not substantially alter the fish communities at any of the construction sites.

A State Pollutant Discharge Elimination System permit would be secured and storm water management plans implemented during construction to minimize the potential for on-site erosion, sedimentation, and storm water pollution. Approval from NYCDEP would also be secured in order to discharge water from dewatering activities into the sewer system.

OPERATIONAL IMPACTS

The operations of the subway would have no significant impacts on geology, groundwater, terrestrial vegetation and wildlife, floodplains, water quality, primary producers or zooplankton, fish, or endangered, threatened, or special concern species. Overall, no long-term adverse impacts would result.

COASTAL ZONE CONSISTENCY

The Second Avenue Subway tunnel alignment and several proposed spoils removal and staging areas would be located within the designated boundaries of New York City's Coastal Zone. The project's location in the Coastal Zone necessitates obtaining a Coastal Zone consistency determination from the State and City for both its construction and operations activities. An assessment of the project's consistency with New York City's Local Waterfront Revitalization Program (LWRP) was therefore conducted and is included as part of the FEIS.

The LWRP includes 44 statewide policies for waterfront protection and improvement and 10 additional policies specifically for sites in New York City. Together, these policies are a response to federal, state, and local concerns about development within the coastal zone. The Second Avenue Subway project would be consistent with most applicable coastal zone policies.

During construction, mitigation measures will be employed so that subway construction activities have no significant adverse impact on wetlands or natural features that protect against flooding and erosion and prevent pollution and contaminated materials from entering the waterways. Construction-period requirements, such as best management practices and stormwater and erosion control measures, would be incorporated into a CEPP. Although portions of the alignment and construction areas are located in the 100-year floodplain mapped

[1] Primary production is the creation of new organic matter from inorganic substances, such as by green plants, phytoplankton, benthic algae, or submerged aquatic vegetation.

by the Federal Emergency Management Agency (FEMA), the Second Avenue Subway construction would not adversely affect the floodplain's ability to store flood waters or lead to additional or increased flooding.

In some cases, the project would result in temporary but unavoidable noncompliance with coastal zone policies during construction. For example, for safety reasons, public access would not be provided to waterfront areas being used for construction activities. Construction activities could also temporarily diminish views to the waterfront or resources that contribute to the overall scenic quality of the coastal area. These impacts would be temporary and views would be restored after construction. Once operational, the Second Avenue Subway project would be consistent with all applicable coastal zone policies.

SAFETY

Construction of the Second Avenue Subway would be done in accordance with a HASP plan developed by NYCT. HASP plans would be prepared and followed, after NYCT acceptance, by contractors. The HASP plans would identify potential safety concerns and describe methods to protect construction workers, as well as detail emergency response procedures to be followed. Contractors would use preventive as well as responsive measures in managing and controlling hazards. NYCT would implement an audit program to ensure all contractors are in conformance with their individual HASP plans and the project-wide HASP.

The design of the Second Avenue Subway would incorporate aspects of train safety, station safety and safety in other facilities. The operating subway would be fully integrated into NYCT's overall System Safety Program Plan, which includes training for staff and contractors in safety procedures. New stations would be designed to support the provision of effective security. Visual surveillance, lighting, emergency communications and egress would be carefully considered in the design. NYCT Police, in coordination with city, state, and federal law enforcement agencies, would develop detailed security plans for the new subway. An important operational safety aspect of the new Second Avenue Subway would be the additional flexibility it would provide for passengers traveling along the eastern side of Manhattan, where subway service for much of the area is currently limited to one line—the severely overcrowded Lexington Avenue Line. As such, the new Second Avenue service would provide a needed alternative to the Lexington Avenue Line in the event of shutdowns to that service due to emergencies or breakdowns.

ENVIRONMENTAL JUSTICE

As a project that would use federal funds, the Second Avenue Subway must comply with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations, and to include outreach to the public in its decision-making process. In the area affected by the Second Avenue Subway, minority and low-income populations are concentrated in East Harlem and the East Village/Lower East Side/Chinatown neighborhood.

Construction impacts would be largely distributed evenly throughout the corridor, and would not disproportionately affect low-income or minority populations. Cut-and-cover construction activities for the new tunnel would occur predominantly in East Harlem, a low-income and minority community, because of the presence of existing tunnels in that area which precludes the

use of TBMs. One of the project activities with the greatest potential for high and adverse impacts is the cut-and-cover excavation of station areas and shaft sites and the associated construction of slurry walls, which would occur during all construction phases. This could occur at any of the 16 new station locations, which are spread evenly throughout the study area and affect neighborhoods with low-income and minority populations as well as other neighborhoods without such populations. Possible temporary disruptions to building access could also occur at locations along the alignment during construction, including neighborhoods with populations of concern for environmental justice and those without. At one location—in East Harlem at 125th Street and Second Avenue—such disruption could last for up to 12 months. This disruption is required to protect the buildings during construction of a new tunnel in soft ground below.

At all locations where new stations would be created—for which there is a need, and which would eventually result in a substantial benefit—impacts would occur during construction. These unavoidable impacts would not be disproportionate, since they would occur over the entire alignment. Thus, this impact would not fall disproportionately on low-income or minority populations. Further, the population that experiences the impact associated with construction of a new station would be the same population that would enjoy the benefits of the new station once construction is complete, and overall the project would result in a substantial transportation benefit that would accrue to all residents of the East Side.

In addition to the work required for the new stations, other construction activities would remove the soil and rock from the tunnels being constructed using mining or tunnel boring techniques. These construction techniques are generally much less disruptive at the street surface than cut-and-cover construction, but the sites where construction staging and spoils removal occur would have substantial disruptive activities. The only shaft/staging area evaluated in the SDEIS that was located in an entirely low-income and minority neighborhood (the 129th Street staging/barge site) has been eliminated from consideration. The five remaining sites evaluated for this function—96th Street, 66th Street, 34th Street, Houston Street, and/or Water Street near Pier 6—are relatively evenly distributed throughout the 8.5-mile-long corridor, and would affect a wide variety of people, including low-income and minority populations. For this reason, this impact would not fall disproportionately on any populations of concern. The two sites with the most intensive activities would be the shaft and staging sites in the 90s and in the 30s, during Phases 1 and 3, respectively. The shaft site and staging area in the 90s has low-income and minority residents as well as residents who are neither low-income nor minority. The shaft and staging site in the 30s has a population that is neither low-income nor minority. The activities that would occur at each of these sites would be similar, including the use of parkland for construction staging. The use of either or both of these sites would not disproportionately affect a minority or low-income population.

At three of the four locations being considered for new underground storage tracks in Manhattan, construction of new storage tracks would generally not result in significant adverse impacts during construction. Construction activities at only one of those sites—the 129th Street storage tracks—would result in significant adverse impacts. This is the only location for storage tracks that would result in significant surface disruption and the only such location that is in a low-income and minority neighborhood, so the impacts of this segment of the project may be considered disproportionate, relative to the impacts of developing the other three storage tracks locations being evaluated. However, in the context of the entire project, where cut-and-cover activities would be located in a wide variety of neighborhoods, such impacts would not be disproportionate. Moreover, since the SDEIS, the overall project has been modified to reduce the amount of disruptive construction in East Harlem (including a reduction to the size of the 129th

Street storage tracks, elimination of the 129th Street barge site, and reduction in areas where cut-and-cover construction would occur). As a result of these refinements, Crack is Wack Playground would no longer be directly used by the project's construction. Further, mitigation measures would be employed to alleviate adverse impacts to the extent practicable. These would include use of barriers to block construction noise at nearby parks, and use of traffic management plans to limit the disruption to traffic patterns in this corner of East Harlem.

INDIRECT AND CUMULATIVE EFFECTS

CONSTRUCTION IMPACTS

A number of transportation, infrastructure, and development projects are proposed in and near the study area for the Second Avenue Subway. Several of these could be under construction at the same time as the new subway, and all of these projects would be operational at the same time as the Second Avenue Subway. While the cumulative impacts of these efforts will ultimately be beneficial, in the short term, their construction impacts, combined with those of the Second Avenue Subway, would generate significant adverse cumulative impacts if Second Avenue Subway construction were to occur in the same vicinity and at the same time as those other projects.

The construction phase of the Second Avenue Subway could last up to 16 years. During that period, the various construction activities would affect land use, economic conditions, visual and neighborhood character, historic resources, transportation, air quality, and noise, as described throughout this FEIS. Temporary cumulative effects could occur if other projects in the vicinity of the Second Avenue Subway alignment were constructed at the same time or in close proximity to subway construction. Cumulative impacts are the net result of the proposed project and other improvements planned in, near or around the project. For each subarea in the project's study area, these cumulative effects would increase the intensity and duration of certain construction-related impacts.

To the greatest degree possible, NYCT would coordinate with public and private contractors to reduce the cumulative impacts of simultaneous construction; however, in some cases it may be impossible to avoid these impacts as developers and agencies strive to complete their projects in a timely and cost-effective manner. In those cases, significant adverse impacts from cumulative impacts could result.

OPERATIONAL IMPACTS

In its operational phase, the Second Avenue Subway is expected to result in few, if any, adverse cumulative impacts. The various development projects described throughout this chapter would increase demand for transit service on Manhattan's East Side, thereby contributing to the goals and objectives of the Second Avenue Subway. Major transportation improvements planned in and near Manhattan would support the Second Avenue Subway in improving access to underserved areas. Cumulatively, these transportation projects would provide access to and within Manhattan, which would be a benefit to the regional transportation system.

G. SUMMARY OF MITIGATION MEASURES

A variety of mitigation measures are proposed or being evaluated for the project's significant impacts. Those impacts are predominantly associated with construction, rather than operation, of

the proposed project. All mitigation measures would be organized into a Construction Environmental Protection Plan that would be applied to all aspects of planned project construction and operation. This CEPP would be implemented through NYCT. The measures are listed briefly below organized by subject area.

TRANSPORTATION

- A comprehensive areawide traffic management and mitigation plan would be developed by NYCT and reviewed by an Interagency Traffic Task Force consisting of affected and responsible agencies (e.g., MTA/NYCT, NYCDOT, NYSDOT, MTA Bridges and Tunnels). The Interagency Task Force would consult with local Community Boards. This plan would include a comprehensive traffic monitoring program, which would continually evaluate traffic conditions and ensure that traffic detours and mitigation measures responded effectively to traffic patterns as they change.
- Standard traffic engineering improvements would be used to mitigate traffic impacts during construction. These include low-cost and readily implementable measures such as adjusting signal phasing and green time, re-striping lanes and/or installing pavement lane markings, prohibiting curb parking, and enforcing prevailing traffic and parking prohibitions.
- Four or five moving lanes would be maintained on Second Avenue at critical intersections at major cross-streets in Midtown (such between 63rd and 59th Streets and in the 34th Street area) by narrowing sidewalks to 5 feet. An aggressive traffic diversion plan would also be implemented at the most severely impacted intersections (such as 34th Street) to further improve traffic conditions.
- Where bus stops would interfere with traffic flow in or near construction zones, bus stops would be shifted short distances away from the critically affected intersections.
- Additional bus ridership is forecast to occur on the Lower East Side south of Houston Street when construction of Phase 3 is complete but Phase 4 is not. NYCT would monitor and review bus loading, and, if required, add service to the South Ferry and Park Row/City Hall branches of M15 bus route, to remain within MTA loading guidelines.
- Widening crosswalks, creating sidewalk bump-outs, or relocating street furniture, would be employed if pedestrian crowding conditions occur at station entrances.

SOCIAL AND ECONOMIC CONDITIONS

- NYCT will employ an extensive community outreach program throughout all phases of construction to keep the affected neighborhoods informed about construction activities taking place. This program will include meetings, newsletters, and a web site. In addition, a project office will be established at one or more locations along the alignment with a 24-hour telephone hotline, to allow people to ask questions and register complaints. NYCT will use the outreach program to work closely with Business Improvement Districts and other related business organizations, as well as other community groups, schools, houses of worship, etc., to spread information about construction activities. NYCT will also help organize community task forces to provide citizen input on construction effects and how they could be mitigated, and will solicit community input on the appearance of ancillary facilities, where practicable.

- NYCT will post subway construction information, possibly including detailed maps showing locations where pedestrian, bicycle, or wheelchair access might be difficult during construction of the relevant phase.
- NYCT will promote high-quality design of sidewalk sheds, such as the addition of windows, better lighting, and good store signage around construction sites in all phases.
- NYCT will coordinate with businesses in each phase to address access/delivery issues; and provide special loading and unloading areas on nearby side streets to locations where access would be curtailed in front of buildings during construction. In those designated side street areas, parking could be prohibited to allow more reliable deliveries and pick-ups.
- Measures would be taken to limit impacts on neighborhood character from construction activities. Certain particularly disruptive activities, such as vertical blasting, would not occur late at night to minimize to the greatest extent possible the unavoidable disruptions to surrounding uses from construction activities during each phase. Screens would be erected to limit lighting emitted from construction areas. A dust suppression program would be used to control dust at the construction sites. In addition, construction areas would be secured to maintain the safety of pedestrians and vehicles.
- Traffic management plans would be employed in each phase to manage the flow of traffic in construction zones as efficiently as possible, and to minimize disruptions to emergency vehicles and sensitive uses. Wherever practicable, trucks would also be routed away from residential streets to minimize disturbance to these areas. Trucking activities at construction sites would be managed to avoid unnecessary queues. This would involve use of radio dispatches to arriving trucks, to limit truck access should construction activities be disrupted, for example.
- Following construction, NYCT would replant any street trees or otherwise restore properties affected during construction to the degree practicable.

PUBLIC OPEN SPACE

- Screens would be erected between construction areas and adjacent sensitive uses and portions of parks not used for construction activities.
- Through its contractors, NYCT will erect attractive sound and safety barriers at Playground 96 (during Phase 1), St. Vartan Park (during Phase 3), and Sara D. Roosevelt Park (during Phase 3) to reduce the effects of noise associated with construction activities on the adjacent park areas and other uses.
- Light screens, best management practices to control dust, and specially quieted construction equipment would be used wherever practicable to separate parks from construction activities.
- NYCT will develop a forestry plan for all affected parks that will be subject to NYCDPR review and approval. In accordance with the plan, trees will be replaced prior to completion of each phase according to NYCDPR specifications for tree protection and replacement. All trees under 4-inch dbh would be replaced according to the Basal Area Replacement Formula, which is designed to ensure that replacement trees are of equal size to removed trees. If a removed tree is larger than 4-inch dbh (the limit of transplantable trees) NYCT, through its contractors, will plant multiple smaller trees, the basal areas of which add up to the basal area of the

original tree, as replacement trees. Several of the replacement trees will be replanted in the vicinity of the trees to be removed prior to construction. The forestry plan will be included in relevant construction contract specifications to protect trees within parks.

- After the completion of each construction phase, NYCT will reconstruct spaces damaged during construction of that phase in coordination with NYCDPR.
- Where parks or portions of parks would be displaced during construction, NYCT will work with NYCDPR to identify the mitigation plan most compatible with each neighborhood's parks and open spaces. NYCT will comply with the letter agreement on St. Vartan Park, pursuant to Section 6(f) of the Land and Water Conservation Fund Act. This would consist of creating either wetlands or a temporary replacement space for recreational facilities displaced during construction. The replacement park would be created prior to construction of Phase 3.
- In all cases where a park would be used for construction staging activities, the park would be fully restored, in consultation with NYCDPR and the affected community, once construction is complete.
- NYCT will work with the NYCDPR and Community Board 3 to design reconfigured recreational facilities in the portions of Sara D. Roosevelt Park that remain publicly accessible during construction.
- NYCT would work with NYCDPR to design any permanent features located in New York City parks to ensure compatibility with park character.

HISTORIC RESOURCES

- Future steps to be taken to protect historic resources are set forth in the Programmatic Agreement for the project that has been executed by FTA, the SHPO, and the MTA. The Programmatic Agreement describes the consultation to be conducted during the project's design process to avoid or minimize permanent adverse effects of the project on historic resources. It also lists the historic resources that may be affected by the project's construction and operation. The Programmatic Agreement is included at the end of the main volume of the FEIS.
- NYCT will consult with the SHPO on the design of project elements that would physically alter a historic resource or that could affect its context or setting.
- A Construction Protection Plan would be developed and implemented to protect historic resources located near construction areas from accidental damage.
- As project designs evolve, any historic resources that might be affected by project elements not yet designed will also be identified and consultation with SHPO undertaken.

ARCHAEOLOGICAL RESOURCES

- The Programmatic Agreement also sets forth the ongoing work and consultation to be undertaken with respect to archaeological resources, to investigate further the presence of significant archaeological resources and to develop appropriate mitigation measures.
- NYCT will perform additional work where the potential for significant impacts to archaeological resources has been identified, to determine whether any archaeological resources are actually present in those locations and whether those resources are significant and eligible for the State and National Register of Historic Places. These steps might include, for

example, a combination of some or all of the following: review of geotechnical boring logs to refine the understanding of subsurface conditions; additional documentary research focused on the potential significance of potential resources; and subsurface testing in locations that would be affected by the project and where the potential for significant archaeological resources exists.

- MTA/NYCT will appoint a Cultural Resource Manager who will be responsible for determining the nature of any discovery during construction. The Cultural Resource Manager will be a professional archaeologist who meets the standards of the New York Archaeological Council and the National Park Service (36 CFR 61) and will be located in the New York City metropolitan area.
- Locations identified as possibly containing burials will be avoided wherever possible. Where avoidance is not possible, NYCT will follow the procedures identified in the Programmatic Agreement concerning testing and excavation.
- Mitigation measures such as data recovery, public interpretation, or additional analysis and curation, would be developed and implemented where future work confirms the presence of significant archaeological resources (i.e., resources that are eligible for listing on the State and National Registers) that would be adversely affected by the project.

DISPLACEMENT

- MTA and NYCT would adhere to the requirements of the Uniform Act and the New York State Eminent Domain Procedure Law for any private properties that would be acquired by the project.
- MTA would hold a public hearing to inform the public and affected parties about the proposed acquisitions.
- Compensation would be made for private properties acquired, based on fair market value and, in the case of partial takings, diminution (if any) to the value of the remaining property.
- Relocation services, moving payments, replacement housing payments, and other allowable payments related to commercial and residential displacement would be provided, in accordance with the Uniform Act.
- For any locations where it would not be feasible for the project to maintain reasonable access to businesses, MTA or NYCT would compensate the landlords for diminution of rental value and, where applicable, provide relocation payments to displaced tenants. Residents temporarily displaced would typically be offered an alternative residential facility, or some equivalent measure of compensation.

AIR QUALITY

- The CEPP and contract obligations will require that all contractors follow NYCT's directive for capital construction projects to minimize PM emissions from use of diesel-powered construction equipment. Diesel emission controls for non-road equipment will be required. Accordingly, all heavy diesel-powered equipment used during construction would be required to use ultra-low sulfur diesel fuel and employ diesel particulate filters or other retrofit technology.

- All diesel equipment would not be permitted to idle for more than 3 consecutive minutes, except in certain limited circumstances.
- A dust suppression program with aggressive measures to reduce dust and air pollution during construction would be developed, included in the CEPP, and used throughout construction.
- The CEPP requirements to reduce emissions of particulate matter from construction activities have been incorporated into the project and taken into account in this analysis. MTA is researching the diesel emissions reduction technologies available, with the objective of stipulating that contractors use the best available emissions reduction technologies, with the first priority being reducing PM emissions, and a secondary objective of reducing other pollutants. With these commitments to controlling the emission of PM from construction activities, PM emissions would be reduced to the extent practicable.
- Particulates could be further reduced at construction sites by enclosing areas where spoils from tunnel boring or mining operations would occur, or at station locations where spoils removal would take place for some period of time. Such measures are currently being evaluated.

NOISE

- NYCT is committed to developing and implementing an extensive mitigation program to reduce and alleviate noise impacts during construction. The FEIS provides a list of proposed mitigation measures on a site-by-site basis. Contractors will be required to implement mitigation measures to achieve levels specified in performance standards identified in the FEIS and the project's CEPP.
- Potential mitigation measures for airborne noise generated by construction work include: enclosing areas where spoils from tunnel boring or mining operations would be loaded into trucks, or at station locations where spoils removal would take place for some period of time or at night; placing some equipment or operations below grade in shielded locations; changing construction sequencing to reduce noise impacts by combining noisy operations to occur in the same time period or by spreading them out; avoiding nighttime activities; and using alternative construction methods, such as avoiding impact pile installation in sensitive areas, using specially quieted equipment, and selecting and specifying quieter demolition methods. Despite these measures, it will not be possible to fully mitigate all airborne noise impacts because of the proximity of residences and other sensitive uses to construction.
- Potential mitigation measures for ground-borne noise and vibration from construction include development of a project-wide vibration monitoring program to minimize vibration levels and respond to community complaints and concerns as they arise.
- Site-specific vibration control measures during construction could include multi-delay blasting techniques, careful installation of tracks for spoils removal trains, and imposition of blasting regulations.
- To mitigate ground-borne noise impacts from train operations, the project would include resilient track fasteners or track support structures or other similar measures at all locations where operational ground-borne noise impacts are predicted. Ground-borne noise levels would be reduced at all locations to below FTA's impact thresholds.

- NYCT will continue its ongoing outreach program to discuss mitigation options with the public, including to sensitive uses—such as hospitals—that could be particularly affected by various project disturbances.

CONTAMINATED MATERIALS

- Investigations, including subsurface site investigations, are ongoing and will continue throughout the ongoing engineering phase and during later design and construction phases to better determine the nature and extent of contamination in areas where the project might encounter it. A sampling protocol would be prepared and followed in areas requiring physical testing.
- Dust control and soil gas control measures would be employed throughout the project area.
- Any groundwater resulting from dewatering exceeding the sewer use limitations set by NYCDEP would need to be treated and retested prior to its discharge to sewer systems or area water body via a SPDES permit.
- Health and safety procedures would be employed to minimize exposure to workers and the public. Procedures for handling, stockpiling, testing, loading, transporting, and disposing of contaminated material in accordance with all applicable laws and regulations would also be followed.
- Site-specific HASP plans for each construction phase would describe in detail the health and safety guidelines, procedures, and work practices that must be adhered to and the work to be performed, and will also include special details governing certain work, such as working in confined spaces.
- All workers would be required to follow all applicable local, state, and OSHA construction codes and regulations.
- A hazardous materials management plan will be developed for testing, handling, transporting, and disposing of contaminated materials encountered during the proposed excavations, consistent with applicable regulations. This plan will be included in the project's CEPP.
- Should contaminants be found, appropriate measures would be taken to mitigate potential effects on the operating subway. This may include excavation of contaminated soils and disposal at an appropriate facility.

NATURAL RESOURCES

- MTA/NYCT will work with regulatory agencies in developing the Second Avenue Subway project in order to minimize disturbances to natural resources. All project commitments and conditions would be organized into the CEPP, and its relevant provisions would be incorporated into construction contracts that contractors would be obligated to follow.
- The project will use specific techniques and safeguards to protect water quality and best management practices to control runoff and stormwater at all locations near surface waters. A storm water pollution prevention plan (SPPP) will also be developed for Pier 6.
- Any additional necessary project commitments or measures to minimize disturbances to natural resources would be determined as part of permitting requirements established by federal and state agencies. ✷