A. INTRODUCTION

This chapter describes the activities required for construction of the project alternatives, described in Chapter 2, "Project Alternatives." It then considers the environmental impacts that may result from that construction and any required mitigation measures.

B. DESCRIPTION OF CONSTRUCTION ACTIVITIES

NO ACTION ALTERNATIVE

Since the No Action Alternative would not create new facilities or services other than those planned to occur without East Side Access, it also would not require construction activities.

TSM ALTERNATIVE

PLATFORM LENGTHENING AND TRACK RECONFIGURATION

Lengthening platforms at selected Long Island Rail Road (LIRR) stations to accommodate 12-car trains would require limited excavation to install foundations for the extended platform areas. Track reconfiguration would require removing existing trackage (where present), grading, and installing new tracks and switches.

COVERED WALKWAY: LONG ISLAND CITY STATION TO FERRY TERMINAL

Constructing a covered walkway along public right-of-ways from the Long Island City station to the ferry terminal would require minimal construction. Small poles would be mounted in the sidewalk and in the ferry terminal parking lot to support the walkway's overhead structure.

PEDESTRIAN BRIDGE: HUNTERSPOINT AVENUE LIRR STATION TO SUBWAY STATION

The pedestrian bridge connecting the LIRR and subway stations at Hunters Point, to run adjacent to the west side of the Hunters Point Avenue Bridge, would require widening the existing bridge for the approximately 200-foot length between the LIRR platform and subway station. Two additional new bridge piers would be installed to support the bridge, parallel to existing piers. Installing a new, widened stairwell, a new elevator up from the LIRR platform, and opening a new entrance directly into the subway station mezzanine from the walkway, may require temporary closing of portions of the Hunterspoint Avenue LIRR platforms, the Hunters Point subway station, and possibly one lane of traffic along the Hunters Point Avenue bridge. No. 7 subway service might be affected on limited nights and weekends as a result of construction.

CONTRAFLOW BUS/TAXI LANE

The TSM Alternative's new flyover and ramp on the Long Island Expressway (LIE) between 74th and 80th Streets would necessitate reconstruction of all the westbound traffic lanes and service ramps and lanes in this area. In addition, where the LIE passes beneath the LIRR at 86th Street, the eastbound LIE would have to be reduced and the LIRR bridge would likely require substantial reconstruction.

PREFERRED ALTERNATIVE

For many of its components, the Preferred Alternative would require construction of underground spaces in the form of tunnels and caverns. Most of this work would be done underground, with limited disruption at the surface. The Preferred Alternative would select among a variety of methods to construct these spaces: tunnel boring machines could construct some tunnels in both rock and soft ground for train routes deep underground, while drill-and-controlled-blasting could be used to excavate both single-track tunnels and large underground spaces. For areas that require excavation downward from street level, cut-and-cover methods would be required. The following sections briefly describe the construction for each component of the Preferred Alternative, in the approximate order in which they would be built. Construction would begin in early 2001 and continue through 2011 (see Figure 17-1).

HIGHBRIDGE YARD MAINTENANCE AND STORAGE FACILITIES

Replacement storage and maintenance facilities for Metro-North Railroad (MNR) trains would be among the first components constructed, before Madison Yard is taken out of service. Subsequent to the clean-up of any contaminated materials (see Chapter 14, "Contaminated Materials"), construction at Highbridge Yard would require removing all existing yard tracks and relocating the Oak Point Link freight tracks to the western portion of the yard. Surface regrading and shallow trenching would be required in some areas (for building and lighting pole foundations). Following site preparation work, the new buildings, maintenance facilities, and tracks would be constructed.

A covered overpass would cross over the MNR main line tracks to provide access to the second floor of the Car Appearance Facility. The overpass would be constructed with a steel frame structure, metal decks, and a concrete topping most likely supported on a pile foundation. A foundation system would be determined after the geotechnical investigation of the site has been completed.

MANHATTAN TRACK ALIGNMENT

The two engineering options being considered for the Manhattan track alignment differ in the depth and alignment of their tracks and tunnels, particularly close to Grand Central Terminal (GCT) under Park Avenue. As such, construction methods for Option 1 (new tracks and platforms in GCT's existing lower level) and Option 2 (new tracks and platforms below GCT's existing lower level) also differ significantly. As described below, Option 1 would require more difficult construction and much more street-level disruption during construction. As a result, Option 2 is the preferred option for construction in Manhattan.

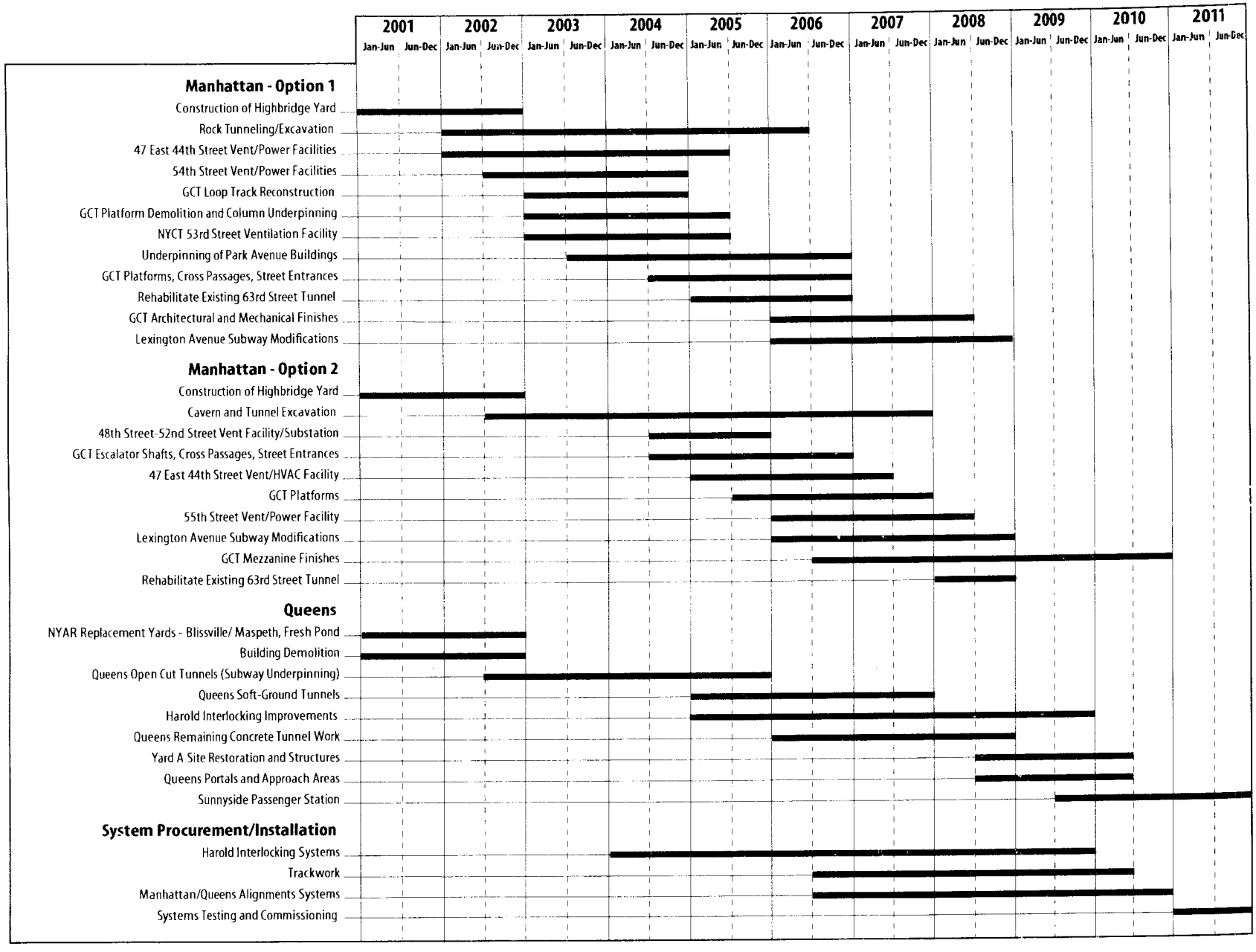


Figure 17-1

Preliminary Construction Staging

Manhattan Track Alignment—Option 1

Option 1 would require the construction of single-track tunnels and multiple-track openings of various types. Work would take approximately 4 to 5 years to complete.

Single Track Tunnels: 63rd Street Tunnel to Park Avenue. Single-track tunnel construction would extend south and west from Second Avenue and 63rd Street to Park Avenue and 56th Street (for tracks 1, 2, and 3) and Park Avenue and 48th Street (for tracks 4 and 5). These tunnels could be constructed either with a Tunnel Boring Machine (TBM) or by drill-and-blast construction methods, using controlled blasting techniques. The decision on tunneling methods would depend on the ground conditions, length of tunnels, economical viability, and environmental limitations.

A TBM is basically a large diameter drill that excavates a circular tunnel section. TBMs are custom designed and built for specific geologic conditions and other project requirements. The TBMs for this project would be designed for the hard, abrasive rock conditions that are anticipated. They would have a diameter of approximately 22 feet, the size required to excavate the single-track tunnels for the LIRR.

If TBMs are used to create the Manhattan rock tunnels, they would be transported as pre-assembled elements from the Queens end of the existing 63rd Street Tunnel, just north of Northern Boulevard, through the tunnel itself, to its existing terminus at Second Avenue and 63rd Street in Manhattan. At this terminus, approximately 140 feet below the street, the TBMs would be assembled in a pre-excavated underground assembly chamber and begin to bore the new tunnels. All TBM work would occur entirely underground, with no disruption at the street level in Manhattan.

As the TBM excavates the tunnel, rock supports would be installed behind the TBM cutter head. Rail-mounted gear would contain all necessary facilities for TBM operation. The excavated material (or "spoil") would be transported by a combination of rail cars and conveyor belts, from the excavation face, back through the newly excavated tunnel and the existing 63rd Street Tunnel beneath the East River, to a shaft in Queens. Material would then be removed from the tunnel and either taken away via truck, or transported across Northern Boulevard and into Yard A via a conveyor system, and taken away via rail.

Where the tunnels are constructed by drill-and-blast methods, using controlled blasting techniques, a large number of small diameter holes are drilled into the rock face and loaded with explosives. The explosives are then detonated, fragmenting the rock.

Controlled blasting techniques involve the judicious use of these explosives to excavate the required openings underground. Controlled blasting allows the contractor to excavate the openings with minimal overbreak and with the least possible disturbance of the remaining rock. This is done by drilling many holes and placing small amounts of explosive in each hole. The explosives are then detonated sequentially, breaking the rock while spreading the release of energy from the explosives over a longer period, lessening potential ground vibration and air blast at nearby structures Typically, there would be five or fewer blasting occurrences per day, each lasting for only a few seconds.

The type of explosives that would most likely be used for drill-and-blast excavation are called emulsion or water-based explosives, referring to the fact that the explosive is an emulsion of water and the explosive agent. This type of explosive is very safe to handle because it is extremely insensitive to shock and virtually impossible to set off without the proper detonators and

boosters. These materials will not explode under duress of shock or heat and have never been set off by fire or even high-velocity firearms.

Once the tunnel is excavated, a final tunnel lining for the single-track tunnels would provide permanent support to the tunnels. Whether the tunnels are constructed by controlled blasting methods or by TBM, the final tunnel lining would be cast-in-place concrete, placed after excavation has been completed for that tunnel. As this lining is placed, voids between the lining and the rock would be sealed by injecting cement grout, under pressure, into the voids. This creates an effective barrier against the seepage of water into the tunnel.

The tunnels in Manhattan from Second Avenue to GCT would be within bedrock and the amount of settlement of earth or structures above the tunnels is expected to be insignificant. Conceptual parametric studies of settlement potential conducted for structures overlying the multiple station caverns at GCT found them to be minimal, on the order of a few millimeters. Above the running tunnels, the amount of underground excavation is smaller and the excavations are much deeper. Therefore, the influence of these excavations on overlying structures would be minimal.

Multiple Track Openings (Various Locations). Areas where multiple-track openings (excavated areas that would carry more than one track) are required would be excavated completely or partially by drill-and-blast methods, using controlled blasting techniques. The most extensive use of drill-and-blast construction would occur between 56th and 52nd Streets, where LIRR tracks would rise from beneath the MNR tunnels beneath Park Avenue to run beneath buildings on the west side of Park Avenue. This is described in more detail in the following two sections. This method would also be used to lower the loop track between 43rd and 47th Streets, also described below. Additionally, if a TBM is used to excavate the tunnels, removal of any remaining rock in the caverns would be done via the drill-and-controlled-blast method.

Cut and Cover and Underpinning of Park Avenue Buildings (52nd to 55th Streets). Traveling south under Park Avenue, the LIRR tunnels would gradually rise and then move westward to run beside MNR's lower-level tracks. At 52nd Street, these new tracks west of Park Avenue would enter the existing GCT structure, which extends west of Park Avenue between 42nd and 52nd Streets. Accordingly, as the new tracks shift west, they would pass beneath the basements of four buildings on the west side of Park Avenue between 52nd and 55th Streets. Those four buildings would need to be underpinned prior to construction of the new tunnels: the Racquet & Tennis Club (between 52nd and 53rd Streets), Lever House (between 53rd and 54th Streets), and 400 and 410 Park Avenue (between 54th and 55th Streets). In addition, three streetbeds would need to be opened to construct portions of the tunnels: 52nd, 53rd, and 54th Streets.

Cut and Cover Beneath Streets. Cut-and-cover techniques would be necessary under 52nd Street to remove GCT's existing north wall and to access the portion of the Racquet & Tennis Club to be underpinned. Similarly, cut-and-cover would be required at 53rd and 54th Streets to build ventilation plants directly under the streetbeds as well as to access underpinning work. This work would last about 2 years on 52nd Street, 4 years on 53rd Street, and 3 years on 54th Street. Within those periods, portions of the sidewalk and one curb lane would be closed. Total street closures would be required at night for a few weeks at the start of excavation and, later on, sporadically for deliveries. (In addition, as described later in this chapter, small areas on other streets between 44th and 51st Streets would also be subject to cut and cover for entrances and substations. The work in these areas would last 1 to 1½ years at each location and would require closure of portions of the sidewalk and/or curb lane.)

Access to adjacent properties would be maintained at all times during construction. In areas where sidewalks or street lanes are being closed for extended periods of time, standard practices for maintaining access would be followed, including providing alternate routes of entry into buildings for employees, residents, and deliveries; providing appropriate signage to direct people to these alternate entrances; establishing a traffic management plan to ensure vehicular access to affected buildings; and implementing an outreach program to share construction schedules, potential impacts, and mitigation measures with local retailers, businesses, and residents.

Cut-and-cover construction involves excavating down from the street level or ground surface. In these situations, temporary decking would be installed above the areas of excavation to permit traffic and/or pedestrians to use the street and sidewalk above while construction continues underneath. Cranes would be used as required to move materials into and out of excavation sites. In locations where the crane would be required to swing over the sidewalk, sidewalk sheds would be installed to protect pedestrians.

While the work on each street would be slightly different, the cut-and-cover techniques to be used on 52nd Street are representative of the type of work required on 53rd and 54th Streets as well. Work at 52nd Street would be staged to permit traffic to use portions of the street during construction. Work would begin through two openings just west of Park Avenue: one along the southern sidewalk and street and one along the northern sidewalk. Trenches would be dug approximately 50 feet down from each side of 52nd Street. Then, the two trenches would be connected underground, leaving most of the street in place. During this work, the rock and utilities above would be braced with temporary supports until the final tunnel structure is in place. Once permanent roof steel and steel columns are in place under 52nd Street, tunnel excavation would continue northward under the Racquet & Tennis Club building.

Underpinning Buildings. To construct tunnels directly under the four buildings west of Park Avenue—the Racquet & Tennis Club, Lever House, 400 Park Avenue, and 410 Park Avenue—underpinning would be required. Underpinning is a common construction technique that involves placing new foundations under an existing building to allow construction to occur in the area of the original foundations. Figure 17-2 illustrates the underpinning process in four stages, using the Racquet & Tennis Club building as an example of how construction would proceed. As shown in Figure 17-1, above, the underpinning work would last a total of approximately 4 years; at each affected property, the work would last approximately 2 years.

When completed, the tracks for the Preferred Alternative's Option 1 would be located in the rock that currently supports the existing Racquet & Tennis Club's foundation. As shown in Figure 17-2, stage 1 of the underpinning process would involve installation of temporary vertical support columns in caissons, below the bottom of the new tunnel structure. These caissons would be constructed by drilling through the existing basement and the rock below it. Once the caissons are in place, stage 2 could begin.

Stage 2 would install a structural framing system between the caissons and the existing building's substructure. The new framing system would transfer the building's load from the old columns to the caissons using hydraulic jacks. During the operation, the status of the affected building columns would be closely monitored. Once the connection is made, and the building's load transferred, the building would be supported by the new foundations at a much lower depth than its original rock support.

In stage 3, the existing rock below the original foundation would be removed. This would be accomplished with drilling in conjunction with controlled blasting to excavate the rock in small batches. The new tunnel would be supported by a temporary structure; once the excavation reaches the depth of the new tunnel, the permanent new tunnel structure would be installed as shown in stage 4.

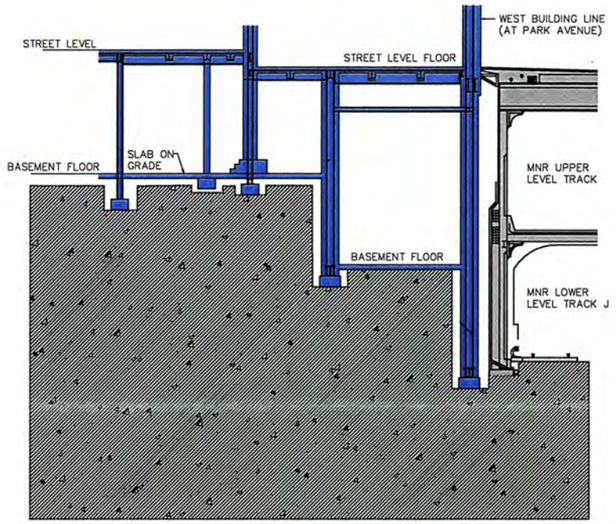
Once the tunnel construction is complete (see final conditions drawing in Figure 17-2), the existing building would rest on top of the new structure, fully supported by the new structure and the rock below. To isolate the building above from vibration and ground-borne noise of train operations, special track fixation methods would be employed.

Support of Metro-North Tracks (54th to 56th Streets). As new LIRR tracks continue toward Queens, they would curve eastward from under the buildings at 400 and 410 Park Avenue to under the streetbed of Park Avenue, passing just beneath the foundations of the MNR tunnels above. To ensure that construction of these new tunnels does not undermine existing MNR tunnels, the soil beneath the MNR tunnels between 54th and 56th Streets would be stabilized and the columns supporting the tunnels would be underpinned. The soil stabilization could potentially be done using jet grout. This involves drilling holes down from the MNR track level, and then injecting a mixture of cement, water, and pressurized air into the those holes. The grout mixture then hardens in columns that stabilize the soil. Once the soil is stabilized, approximately 10 MNR columns would be underpinned in a similar manner to the building columns, described above. At the location of each MNR column, two mini-piles would be drilled into the rock below the bottom of future LIRR tunnel, connecting the column to the rock.

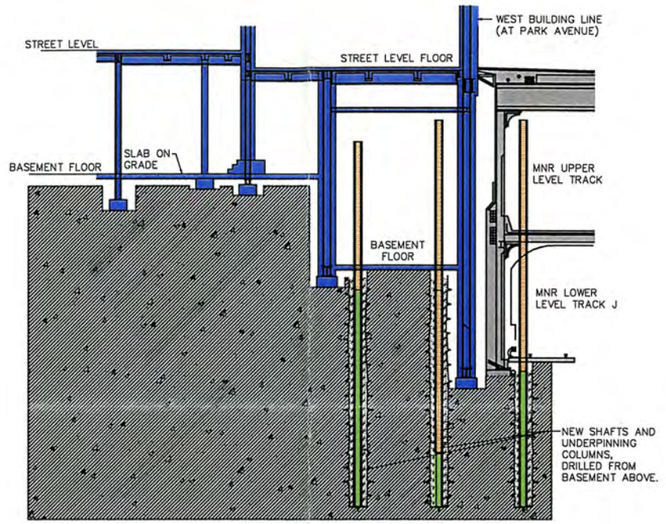
Lowering of the Loop Track (43rd to 47th Street). To allow new LIRR trains to use the GCT loop track, the existing lower-level loop track would be excavated using drill and controlled blasting to descend from south of 44th Street to approximately 47th Street, where it would meet the new tunnel (described above). During construction, overhead beams that support the existing upper-level storage track would be supported. This would permit continued use of the upper-level storage track during most stages of construction.

Manhattan Track Alignment—Option 2

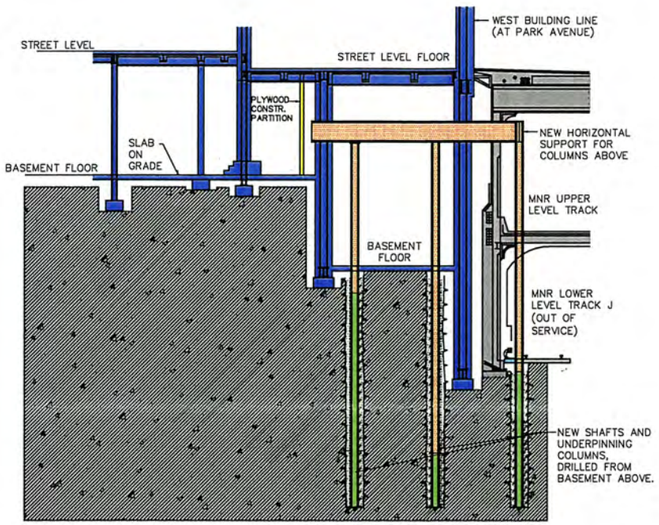
Option 2 would eliminate the need for substantial cut-and-cover construction in Manhattan. By creating tunnels at a much lower depth than in Option 1, Option 2 would eliminate the need to underpin Park Avenue buildings and MNR tunnels. Option 2 would also potentially use TBMs more extensively to construct the new tunnels. In Option 2, TBMs and/or controlled blasting methods would be used to excavate tunnels from 63rd to *43rd* Street. Construction of the tunnels for Option 2 would begin at the existing terminus of the 63rd Street Tunnel and move west and south towards GCT. Should two TBMs be used, they would bore tunnels simultaneously towards GCT and then double-back to create additional tunnels south of *59th* Street. From *59th* Street to 48th Street, TBM and/or controlled blasting would be used to create *four* caverns fanning out from the two tunnels. Drill and controlled blasting would be used in areas where two or more mined tunnels meet. Small areas of cut-and-cover construction would still be required for entrances and vent facilities, as described below. Unlike Option 1, the tunnels in Option 2 would pass more than *80* feet below both MNR tracks under Park Avenue and building basements west of Park Avenue, and 125 feet below Park Avenue itself.



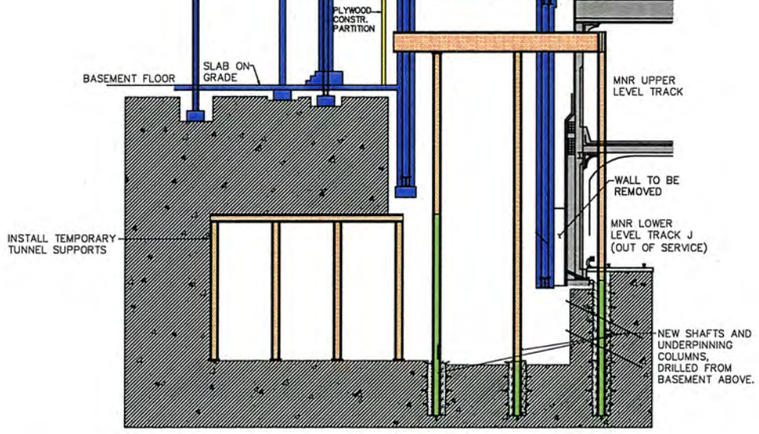
EXISTING CONDITIONS:
BUILDING COLUMNS RESTING ON ROCK



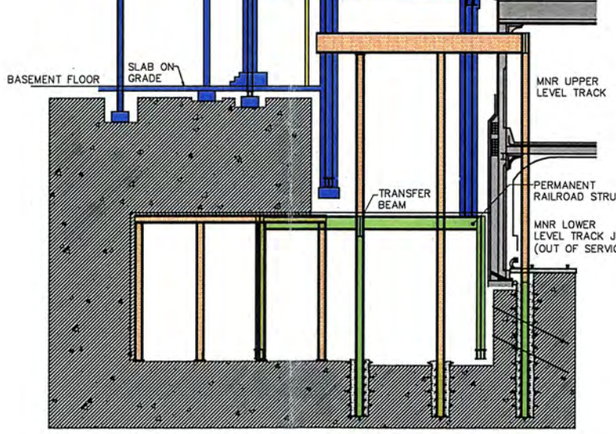
UNDERPINNING STAGE 1:
INSTALL TEMPORARY COLUMNS THROUGH BASEMENT



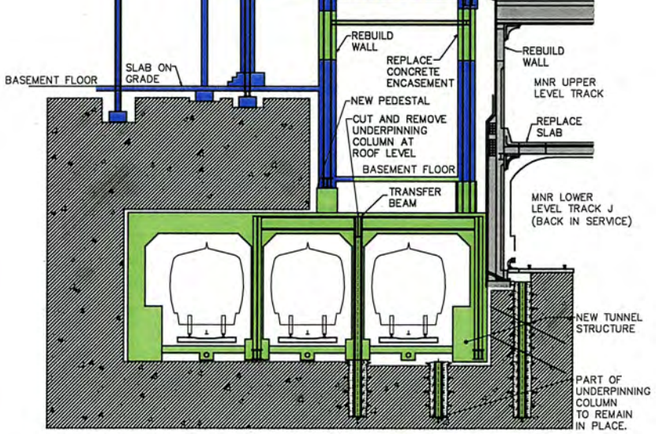
UNDERPINNING STAGE 2:
INSTALL TEMPORARY HORIZONTAL SUPPORT



UNDERPINNING STAGE 3:
REMOVE ROCK AND INSTALL TEMPORARY TUNNEL SUPPORTS



UNDERPINNING STAGE 4:
INSTALL TRANSFER BEAM AND BEGIN PERMANENT RAILROAD STRUCTURE



FINAL CONDITIONS:
UNDERPINNING COLUMNS REMOVED, BUILDING COLUMNS RESTING ON TUNNEL STRUCTURE SUPPORTED BY ROCK

0 10 20 30 FEET
SCALE

LEGEND

- *Existing Racquet Club Structure*
- *Existing MNR Structure*
- *Temporary New Structure*
- *Permanent New Structure*
- *Existing Rock*

MTA/LIRR
East Side Access

Figure 17-2

Option 1: Underpinning of Racquet & Tennis Club (Cross-Section Looking North)

GRAND CENTRAL TERMINAL

Each of the two engineering options would construct different elements in GCT. New construction for Option 1 would include various escalators and elevators in the western portion of GCT, removal and reconstruction of lower-level platforms and tracks, a new passenger mezzanine near the existing Dining Concourse, new passenger space at the lower-level track area, three new cross passageways perpendicular to the new platforms, and various new exits to the street. New construction for Option 2 would include a track and platform area deep under the western portion of GCT, a passenger mezzanine replacing current lower-level tracks in the western portion of GCT, cross passageways and vertical circulation elements connecting tracks and platforms to the mezzanine, and various new exits to the street.

Option 1: Station in the Existing Lower Level of Grand Central Terminal

Option 1 would use existing track, platform, and concourse space for new LIRR tracks, platforms, and concourses. The demolition and reconstruction within GCT would not require major excavation of rock. However, significant underpinning and reconstruction of existing columns supporting the train shed and buildings above would be required. Additionally, rock would have to be excavated to lower the GCT lower-level loop track and to create entrances to the new station from the street.

For the most part, LIRR tracks and platforms would be constructed where existing tracks and platforms are located. This would require re-framing and relocating existing columns, removing and rebuilding all platforms and tracks west of MNR track 112, and removing the existing wall that separates MNR tracks from Madison Yard tracks. In addition, tracks in MNR's East Yard (in the lower level) would be taken out of service for the purposes of expansion and reconfiguration.

Then, new tracks and platforms for the LIRR would be constructed. Work would require relocating columns and expanding the narrow train tunnels between 48th and 51st Streets to allow for more extensive track connections and switches. At the same time, two cross passageways, at 45th and 48th Streets, would be constructed above and perpendicular to new LIRR tracks, in existing air space within GCT. This would require rebuilding the structural support system for some upper-level tracks. A third cross passageway, between 43rd and 44th Streets, would be constructed in an existing space below GCT's lower-level tracks.

Exits would be constructed from new GCT space up into buildings and onto sidewalks, along with platforms and cross passageways. This would entail closing off the affected portion of the building space or sidewalk and excavating from the sidewalk down to the cross passageway below. The construction of the new 45th Street cross passageway would require cut-and-cover construction from the streetbed above. Construction of off-street entrances at 45th and 48th Streets, as well as the new stair to the 47th Street cross passageway, would require breaking through MNR platform P at the upper level of GCT. The exit to be located inside the building at 347 Madison Avenue would be constructed through the ground floor and basement of the affected space in that building.

The project would also require construction in GCT at the lower track level, Dining Concourse level, and Main Concourse level to create stairs, escalators, elevators, and new waiting and ticketing areas. Small portions of GCT would be closed off during this process. Work in GCT would occur towards the end of construction and last approximately 2½ years.

Option 2: Station Below the Existing Lower Level in Grand Central Terminal

Option 2 would require relatively little major new construction in the public spaces of GCT. As in Option 1, constructing the GCT elements of Option 2 would require the removal of all lower-level platforms and tracks west of track 113 (including those in Madison Yard) along with the wall that separates MNR tracks from Madison Yard tracks. This area would be reconstructed as a new mezzanine, rather than with the tracks and platforms of Option 1. Little underpinning or reframing of existing columns would be required, except in areas where stair/escalator wells lead down to the new cross passageways. In these locations, some existing columns would need to be underpinned.

Construction of the elevators, escalators, and cross passageways (beneath the lower level) and the platforms and tracks (beneath the cross passageways) would proceed in stages either down from the mezzanine or up from the track/platform cavern. Space for elevators and escalators would be excavated using controlled blasting methods. The rock would be transported upward into the GCT construction area. Approximately *80* feet below the mezzanine (and *120* feet below the street), the cross passageways would be excavated using controlled blasting methods, proceeding horizontally from the escalator shafts.

As the cross passageways are being constructed, the track and platform areas would also be excavated using TBM and/or controlled blasting methods. One scenario is for one or two TBMs to continue south into the track/platform area after they have completed the approach tunnels to the north (described above). Using these two TBM tunnels as a starting point, controlled blasting methods would be used with TBMs to enlarge these caverns to *create* the remainder of the track and platform area. If only controlled blasting methods are used to excavate the approach tunnels, the platform area construction would proceed in a similar manner.

Exits from the mezzanine to the street would be constructed in the same fashion as described for Option 1, above. Cut-and-cover excavation would be used, requiring closures to areas of the sidewalk and/or curb lane for approximately a year at each location. Limited cut-and-cover excavation would also be necessary to construct a vent plant beneath 55th Street (described below). Construction work at the vent plant would last approximately 2½ years. Most of the plant would be constructed by mining from the tunnels below. Cut-and-cover work would follow to complete the structure and provide the necessary sidewalk grating. There would be intermittent street-level disruptions for about 8 months, requiring closure of a 150-foot-long portion of the curb lane and a smaller section of the sidewalk.

EXISTING 63RD STREET TUNNEL

The lower level of the 63rd Street Tunnel would require moderate structural rehabilitation and construction to prepare it for train use. A trackbed and tracks would be laid, a safety walk and duct bank would be constructed in each trackway, existing ventilation facilities would be outfitted with equipment to serve the lower level tunnels, and permanent drainage, signals, lighting, communication, and power systems would be installed.

MANHATTAN VENTILATION FACILITIES

Since most of the Preferred Alternative's ventilation facilities (for both options) would connect the underground spaces to the street level and would require the installation of sidewalk gratings or other surface features, cut-and-cover construction methods would be the primary means of constructing the ventilation facilities in the vicinity of Park Avenue for both Option 1 and

Option 2. In these areas, portions of the affected streets would be occupied by open cuts in the street and sidewalk, construction laydown areas, and trailers. These are described below.

Option 1

Of the four ventilation plants required for Option 1 of the Preferred Alternative in Manhattan, one would be constructed as a new structure at 47 East 44th Street, two would be constructed under 54th Street (between Park and Madison Avenues, and between Lexington and Park Avenues), and one would be installed inside an existing ventilation facility at 63rd Street east of Second Avenue. In addition to these four ventilation plants, the tunnels in Option 1 would affect an existing ventilation facility under 53rd Street (between Park and Madison Avenues) that currently serves New York City Transit's (NYCT) E and F subway lines. This facility would need to be reconstructed (which would take approximately 2 years).

47 East 44th Street Facility. To ventilate the LIRR trainshed at GCT, a new, above-ground facility would be constructed in place of an existing 5-story commercial building. This would require demolition of the existing building and construction of the new structure over a period of approximately 2 years. As described above, it would also require closure of the sidewalk and curb lane on 44th Street for about 8 months.

53rd and 54th Street Facilities. Construction of the two facilities on either side of Park Avenue at 54th Street (as well as work at 53rd Street) would involve cut-and-cover construction techniques (although a fan room for the facility east of Park Avenue would be constructed using tunneling methods). At each location, part of the sidewalk on one side of the street and one lane of traffic would be closed temporarily.

As the excavation proceeds, utilities beneath the street would be relocated or supported in place. At 53rd Street, the street would be excavated to the depth of the E and F subway line that runs below, approximately 50 feet deep. At 54th Street, the street would be excavated to a maximum depth of approximately 75 feet. Once the excavation is 8 to 10 feet deep, the opening at street level would be covered to allow for street and pedestrian traffic, and vent construction work would continue underneath for approximately 2 to 2½ years. During this period, the street-level decking would periodically be removed to allow materials to be delivered to the excavated area underneath. Construction of both the 53rd and the 54th Street ventilation facilities may require complete closure of the street during off-peak hours for up to a few hours at a time during the entire period that the construction is under way in the area (4 years on 53rd Street and 3 years on 54th Street).

Second Avenue Facility. New ventilation-related equipment at 63rd Street east of Second Avenue would be installed entirely inside the existing facility there, as would emergency egress and maintenance access to the 63rd Street Tunnel. No major construction is anticipated.

Option 2

As described in Chapter 2, "Project Alternatives," Option 2 calls for the creation of four ventilation plants in Manhattan. Two would be in the same locations as for Option 1 (on East 44th Street and at 63rd Street east of Second Avenue) and two would be in other locations (in an area currently occupied by GCT's lower-level tracks between 48th and 52nd Streets and under 55th Street between Park and Madison Avenues). Option 2 would also require a number of additional small air supply shafts above the trainshed, to be constructed using cut-and-cover techniques.

47 East 44th Street Facility. Option 2 would construct both a ventilation facility and a heating and air conditioning plant on 44th Street, to serve the new mezzanine, cross passages, and portions of the track and platform areas. Construction would take approximately 2 years, a similar amount of time as with Option 1. As in Option 1, work would include closure of the curb lane and sidewalk for about 8 months.

GCT between 48th and 52nd Streets. The new ventilation facility in the lower level of GCT would be constructed underground and would require a temporary sidewalk and partial street closing at 49th and 50th Streets west of Park Avenue to install ventilation grates.

55th Street Facility. The new ventilation facility under 55th Street would be constructed principally by mining beneath the street. Cut-and-cover construction would be needed for the sidewalk gratings and creation of the ventilation shaft itself. A portion of the sidewalk and one lane of traffic would be temporarily closed to permit excavation for the facility. In addition, during off-peak hours for up to a few hours of time, the entire street may be closed to facilitate certain construction activities. The total construction time would be 2½ years.

Second Avenue Facility. Construction of the facility at Second Avenue would be the same as described above, for Option 1.

MANHATTAN SUBSTATIONS

Under both Option 1 and Option 2, construction of the substation between 51st and 52nd Streets, located in the upper level of the GCT trainshed, would take place inside GCT. It would require the creation of an access hatch in the 52nd Street sidewalk; ventilation gratings in sidewalks on 51st Street, Park Avenue, and 52nd Street; and new walls within the GCT trainshed.

For Option 1, a substation would be constructed under 54th Street as part of a planned ventilation facility. For Option 2, this substation would be constructed as part of the planned ventilation facility at 55th Street rather than 54th Street.

At 63rd Street east of Second Avenue, substation equipment would be installed entirely within the existing facility at this location.

ROOSEVELT ISLAND SUBSTATION

To create a substation on Roosevelt Island next to the existing 63rd Street Tunnel ventilation shaft, a 40- by 60-foot area would be excavated adjacent to the north wall of the existing shaft. In addition to this excavation, a manhole would be built to tie into Con Edison's existing power lines. A small duct linking this manhole to the substation would be constructed (requiring a shallow trench to be dug). Construction at Roosevelt Island would last approximately 1 year.

RELOCATION OF NEW YORK & ATLANTIC RAILWAY (NYAR) FROM YARD A IN QUEENS

One of the first project elements that would be completed in Queens is the relocation of NYAR storage and maintenance facilities from Yard A, potentially to Fresh Pond Yard and either Blissville or Maspeth Yard. Construction at each yard would last approximately 1 year.

Blissville or Maspeth Yard

Construction of new tracks, switches, and lighting at either Blissville Yard or Maspeth Yard would require shallow trenching and regrading in the vicinity of the new tracks. Both yards

would also require new track connections to the LIRR Montauk Branch mainline. At Blissville, the existing track and ballast would be removed before the new tracks could be laid.

Fresh Pond Yard

Construction at Fresh Pond Yard would consist of a new maintenance facility for NYAR and new yard lead tracks into the building. The current double-wide trailer in the center of the East Yard would be removed and an area of approximately 6,000 square feet would be cleared for the construction of a pre-engineered, metal panel maintenance building with a concrete slab foundation. A pit would be dug inside the new building to create an area for maintenance of the undercarriage of trains. Connections for power, communications, water, and sewer would also be provided.

QUEENS TRACK ALIGNMENT

To connect the LIRR Main Line, Port Washington Branch, and loop tracks leading to Yard A (all at Harold Interlocking) to the existing 63rd Street Tunnel (just north of Northern Boulevard at 41st Avenue), two types of construction would be used. From the existing tunnel to the northern edge of Sunnyside Yard, tunnels would be excavated from the surface using the cut-and-cover method. Beneath the Sunnyside Yard track area to connections to existing tracks at Harold Interlocking, tunnels would be constructed using both a TBM (for areas under Sunnyside Yard) and by cut-and-cover and open-cut excavation (as the tunnels approach the track grade level). Figures 17-3 and 17-4 illustrate key elements of construction work and contractor staging for the Queens track alignment, described below. *While the two primary staging areas are not in Sunnyside Yard, the access across Amtrak's property to other staging areas shown in Figure 17-4 would be subject to Amtrak's review and approval.*

Cut and Cover and Underpinning: 63rd Street Tunnel to Yard A

Just north of Northern Boulevard near 41st Avenue, the lower level of the existing 63rd Street Tunnel terminates at a bulkhead wall (this area is called the tunnel's "bellmouth," since the track area begins to widen here), while the two tracks from its upper level curve east to connect to existing NYCT subway lines. To extend the currently stub-ended tracks (and two additional NYCT tracks that also end at the bellmouth) south toward Sunnyside Yard, the existing bulkhead would be removed and a new cut-and-cover tunnel would be constructed. This section would run from the bellmouth, underneath Northern Boulevard and the subway running beneath Northern Boulevard. It would continue south of Northern Boulevard, through Yard A, *ending approximately 150 feet from the* edge of Sunnyside Yard.

Typically, when earth is excavated to a depth below the groundwater level (as would be the case in Queens), water is pumped out of the area of excavation. However, because of concerns about contaminated materials in the groundwater at Sunnyside Yard, this excavation would be enclosed with virtually watertight walls. The first component to be constructed would be the walls of this enclosed excavation, or "bathtub," which would extend down to the rockline, below the water table. *Excavation for East Side Access tunnel structures and the TBM launch shaft would take place within sealed cofferdams. Incidental ingress of groundwater would be collected and continuously recharged to ensure that drawdown of groundwater in the immediate vicinity of the excavation would be held within the limits of normal seasonal variation. Far field effects on groundwater (e.g., the effects in the vicinity of the plume) are calculated to be negligible. As the project design progresses, East Side Access engineers will continue to study conditions at Sunnyside Yard and work with Amtrak and*

NYSDEC to explore other technologies to ensure that the groundwater and contaminated plume do not move during construction for East Side Access.

First, the NYCT buildings at 2950 and 2970 Northern Boulevard, would be demolished and the site cleared for construction. Subterranean construction would begin with the creation of walls of the new bathtub on either side of Northern Boulevard. These would be slurry walls, created by excavating the ground where the wall is to be placed and filling it with a bentonite (clay-type) slurry to hold the ground in place. Once the ground for the wall is excavated and filled with slurry, concrete would be pumped into the slurry mixture, replacing it from the bottom up, and creating a permanent wall.

Next, under Northern Boulevard (and the subways that run above and below it), the walls of the bathtub would be created. Proceeding in stages so that some lanes of traffic could remain open at all times, utilities would be relocated, trenches would be dug from the street, and temporary decking would be placed on top of the trenches to allow for traffic above. Then, the soil would be stabilized around and beneath the below-grade subway, to support the subway structure. This work would be done in much the same way as the work required under Option 1 near MNR's tracks in Manhattan (described above under "Support of Metro-North Tracks"). Soil stabilization would involve drilling holes from the street and injecting jet grout. The cement grout would mix with the soil and form a cemented soil called "soil-crete." Once the soil is thus stabilized, both the elevated and underground subway tracks would be underpinned to allow for excavation of a new cavern below. The underpinning would be done either by drilling a series of small piles down into the ground and re-supporting the tunnel on them (similar to the way the subway structure was underpinned as part of NYCT's 63rd Street Connector project) or by excavating a series of pits under the subway, and filling them with concrete to form pillars that support the tunnel.

Once the bathtub and subway underpinning are in place, excavation for the new LIRR and NYCT tunnels would take place inside the bathtub. All rock, soil, and water would be excavated from the bathtub. Beneath Northern Boulevard, this work would occur underground from the trenches described above.

During excavation of the bathtub and construction of the structures within the bathtub, most operations at Yard A would be suspended, with the following exceptions:

- Spoils from the Third Water Tunnel project would continue to be transported through Yard A. This route may also be used to dispose excavated rock from the Manhattan tunnel construction.
- Amtrak would continue to access its High Speed facility at the western limit of Sunnyside Yard between Yard A and the location of the launch shaft, via temporary tracks.
- NYAR would continue to have access to the Arch Street Yard west of Yard A, from the east, via a temporary track.

TBM: From Yard A to Connections with Main Line, Port Washington Branch, and Loop Tracks

Five new tunnels would be constructed beneath Sunnyside Yard using TBM(s), to avoid disrupting the yard operations above. Unlike in Manhattan, where the tunnels would be bored through hard rock, subsurface conditions at Sunnyside are a mixture of rock and soils of different types. This would call for the use of a different type of TBM. One possibility is an Earth Pressure Balance TBM, which exerts soil pressure on the tunnel face as it carves out the rock

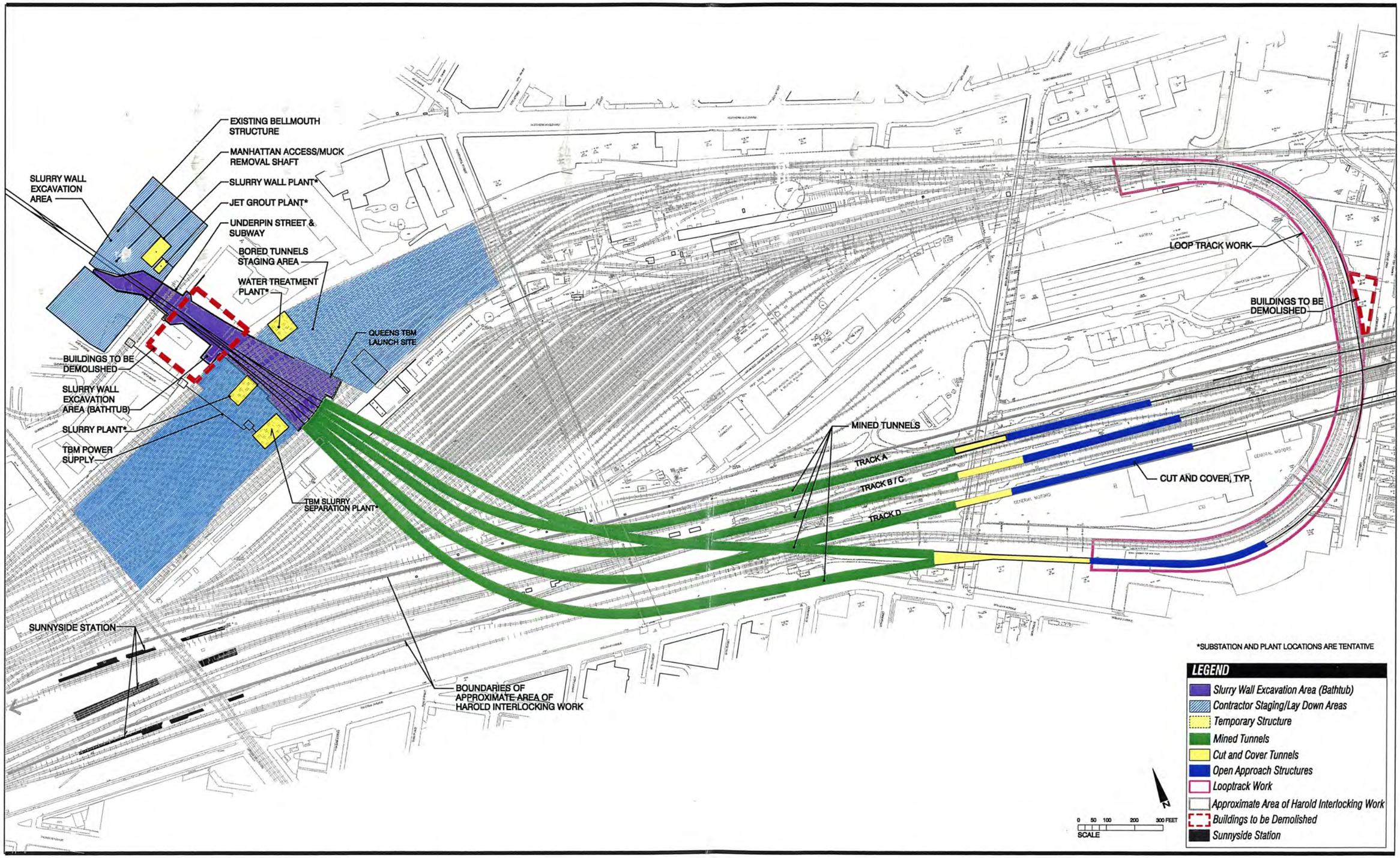
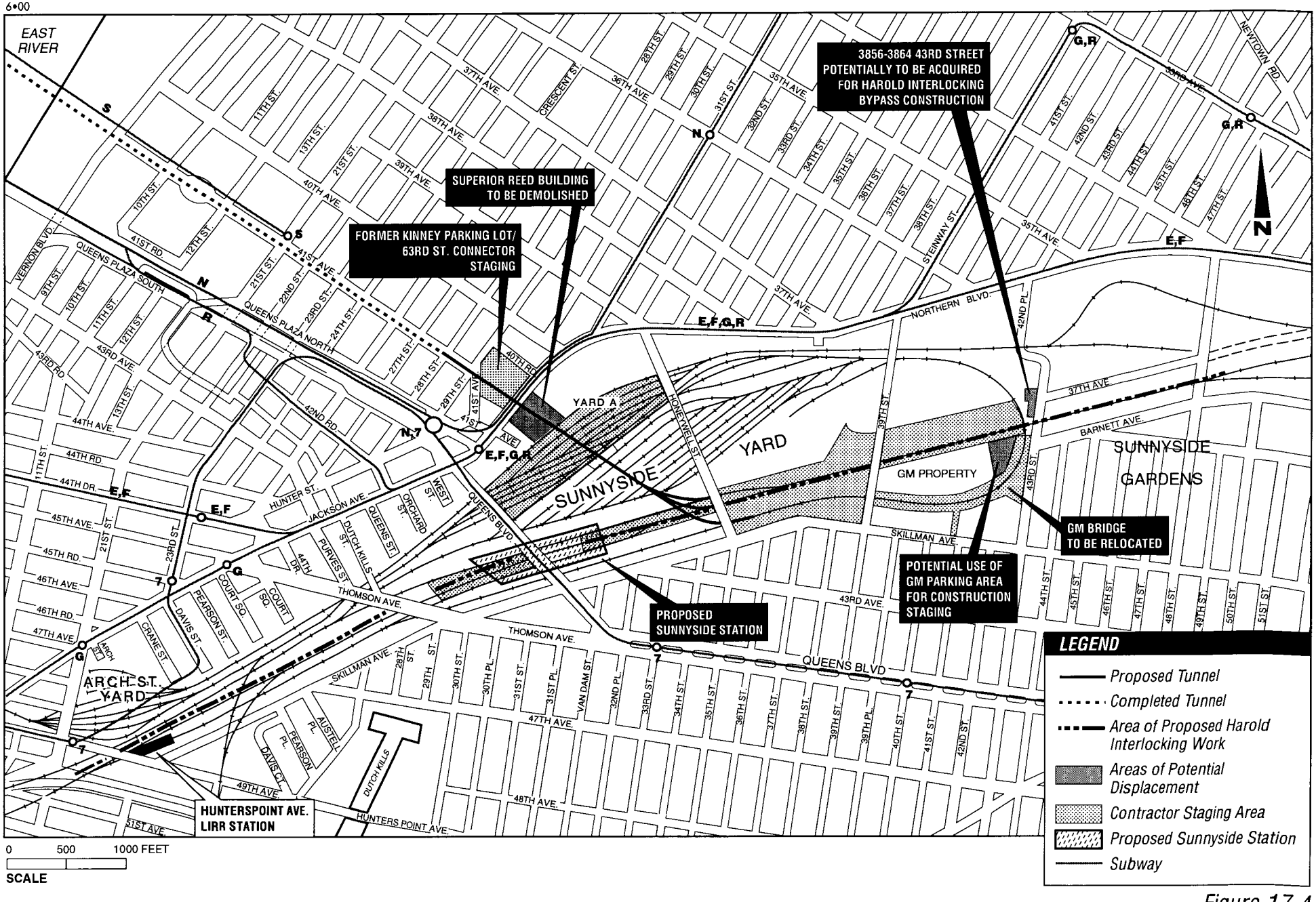


Figure 17-3

Queens Construction Techniques



MTA / LIRR

East Side Access

Figure 17-4

Queens Areas of Contractor Staging and Affected Property

and soil. The pressure prevents extra rock and soil from coming loose as the tunnel is bored, avoiding ground settlement, groundwater seepage, and cave-ins. Alternatively, a Slurry Shield TBM could be used, which prevents soil settlement by mixing excavated soils in a slurry as they are removed, using the slurry to exert pressure on the face of the tunnel. The Slurry TBM constantly removes the soil/slurry mixture from the tunnel and replaces the mixture with new slurry at the tunnel face. The removed slurry is then separated from the excavated material at a slurry plant (which would be located in Yard A) and returned to the tunnel face for reuse.

Either one or two TBMs would create the tunnels in Queens. The TBM(s) would begin work by breaking through the walls at the edge of the bathtub at Yard A. From this TBM launch site, tunnels would be bored beneath Sunnyside Yard to emerge at exit portals just west of the 39th Street bridge. At the exit portals, tracks would continue to rise in open cuts with retaining walls for approximately 500 to 650 feet (varying by approach), until reaching grade level between active tracks. The southernmost of these open cuts would be close to an industrial building on the north side of Skillman Avenue. This building, at 39-15 Skillman Avenue, would need to be underpinned during construction.

Settlement Control Measures for Queens Tunnels. Tunneling in soil would be performed using methods and principles that most effectively control ground loss and thus minimize settlements. Provisions would be made to discover unacceptable settlements in time to take necessary action, including settlement minimization and emergency action, if required.

The recommended tunneling methodology using pressurized-face TBM, either the slurry TBM or Earth Pressure Balance TBM, together with other monitoring devices, would be employed to control ground loss and minimize resulting settlements. Notable features to control ground loss include:

- *Pressurized face of the TBM maintains the state of stress in the ground and the groundwater in front of the face of the machine.*
- *Continuous tail void grouting to fill the tail void left outside the erected lining behind the tail of the shield.*
- *A one-pass watertight lining that minimizes ground loss, ground movement, and groundwater lowering.*
- *Ground improvement at the location of the breakout from the launch shaft to avoid ground loss from inflow of soil or water as the TBM breaks through the excavation wall.*
- *Local and remote monitoring and recording devices to verify at all times the proper operation of essential components of the machine, including face or slurry pressure; grout pressure; volumes of soil excavated and of grout injected; the advance of the tunnel; and controls to prevent advancing the TBM if it is not operating properly to control ground loss, i.e., installation of monitoring points along the tunnel profiles.*
- *Alarms and safety shutdowns in the event of machine malfunction.*

Criteria would define the limits of acceptable ground movements and levels of ground movements for which remedial or mitigation measures would be considered. To apply these criteria, a comprehensive monitoring program would be implemented to measure

ground movements, movements of existing facilities, and groundwater levels, including surface and deep settlement points, before, during, and after construction.

Remediation or mitigation of settlements that exceed these limits would include:

- *A standby ballasting crew to restore rail track to the proper elevation, as required, by releveling rails and retamping rail ballast when limiting values are exceeded.*
- *Retension catenary installations.*
- *Compensation grouting (compaction or fracture grouting) under foundations.*
- *Underpinning of bridge piers.*

The comprehensive monitoring program would be developed during final design.

Ventilation Facility at Yard A

When the construction of tunnels in the vicinity of Yard A is complete, a ventilation facility would be constructed just above the tunnel structures (as described in more detail below). This facility would extend from Northern Boulevard across Yard A, just above the roof of the new train tunnels.

Emergency Exit Tunnel Along Track Alignment

In addition to the train tunnels, the project would also construct an emergency exit tunnel east of the Honeywell Street bridge, across the top of the new train tunnels. This tunnel would probably be excavated manually, using soil stabilization methods.

LIRR MIDDAY STORAGE AND MAINTENANCE FACILITIES

Constructing facilities for LIRR trains to be stored and maintained during the midday involves work at Yard A, Arch Street Yard, and at the loop track that links Yard A to Harold Interlocking. Construction in each of these areas is described below.

Midday Train Storage Facilities at Yard A

The construction of storage tracks in Yard A would commence after cut-and-cover tunnels under Yard A and the bored tunnels under Sunnyside Yard are complete. This work would entail grading the surface, laying new tracks and power feeds, and installing utilities in shallow trenches.

Due to the historically swampy nature of the western end of Yard A and Arch Street Yard, constructing the buildings there may require pile foundations and excavation of unsuitable soils. Similarly, yard lighting would require overhead supports. The train washer facility at Yard A would be constructed on conventional spread footings 4 to 5 feet deep.

Train Access to Yard A: The Loop Track

To provide access for LIRR trains to Yard A, a fourth loop track would be built inside of the three existing loop tracks used by Amtrak. Construction would require physical adjustments to all three existing loop tracks, as well as creating a section of tunnel crossing under the embankment that carries Main Line and Port Washington Branch tracks west of 43rd Street. It would also require constructing a new retaining wall to widen the loop track's existing open cut right-of-way. Additionally, a bridge leading to a General Motors facility across the existing loop tracks would have to be removed and rebuilt to accommodate the new loop track. *This rebuilt*

access bridge would be constructed adjacent to the existing bridge. Each of the components of the new Yard A loop track would be constructed as part of Stage 1 of the Harold Interlocking work, described below.

IMPROVEMENTS AT HAROLD INTERLOCKING

As excavation and tunneling work proceeds in Yard A and Sunnyside Yard, construction work at Harold Interlocking, as well as related improvements to the area, would also be taking place. This work would be staged to minimize disruption to commuter and other rail services through Harold Interlocking and to coincide with key construction elements for the 63rd Street Tunnel extension. Improvements in the vicinity of Harold Interlocking would occur in five stages, as outlined below:

- Stage 1: Construction of detour tracks, switches, and crossovers for LIRR and Amtrak trains. This first step would permit work to occur on Main Line and Port Washington tracks while preserving operations through the interlocking. New tracks would be constructed to detour existing train traffic from lines that would be affected by work in future stages. In addition to constructing new trackage, additional work at this stage includes demolishing a portion or all of the building at the northwest corner of 43rd Street and the LIRR viaduct bridges, relocating the vehicular bridge to the GM plant, relocating 39th Street bridge piers, and constructing the new loop track tunnel and retaining wall.
- Stage 2: Re-routing of trains onto temporary trackwork and construction of permanent new tunnels. Once train traffic has been detoured to the trackage constructed in Stage 1, the tunnel elements of the Harold Interlocking improvements would be constructed. Cut-and-cover methods could be used to construct these two short sections of tunnel. This stage would also include relocating one Honeywell Street bridge pier and underpinning two others, as well as relocating one Thomson Avenue bridge pier.
- Stage 3: Construction of viaduct structure in vicinity of 48th Street, including widening of 43rd Street and 48th Street rail bridges. This structure would start as a widening of the embankment that carries LIRR tracks in an east-west direction, and continue as a viaduct that crosses over LIRR tracks as it approaches 48th Street. LIRR trains would continue to operate through this area on relocated tracks (Stage 2).
- Stage 4: Reconstruction of center routes through Harold Interlocking, construction of new Sunnyside station "headhouse," and construction of two side platforms for Sunnyside station. This stage would bring new Harold Interlocking tracks into operation and restore previously decommissioned tracks. At the conclusion of Stage 4, the new Harold Interlocking tracks would be ready for use by Amtrak and some LIRR Port Washington Branch trains.
- Stage 5: Completion of Sunnyside station and adjacent tracks. Work to complete construction the new LIRR station at Queens Boulevard in Sunnyside would occur as part of the final two stages of improvements at Harold Interlocking, and is discussed separately below under "Sunnyside Station."

The work on Harold Interlocking would involve creating a new viaduct to carry trains just south of the existing tracks between 43rd and 48th Streets, just east of Sunnyside Yard. As part of this work, the railroad bridges above 43rd, 44th, 45th, 46th, 47th, and 48th Streets would require some reconstruction work. There are a number of options currently under consideration to create adequate space for viaduct construction activities to take place while maintaining Amtrak and

LIRR train service. If feasible, construction access would be achieved via either the east curb at the 43rd Street bridge, or the west abutment of the 48th Street bridge. Neither of these options would require property acquisitions or easements. Alternately, construction access may require the use of portions of the General Motors property west of 43rd Street. This would require a 2-year construction easement, including an access easement on the bridge to the facility, which may require relocation.

SUNNYSIDE STATION

Two access options are being considered for the construction of the new Sunnyside station. The first option would provide truck access from Skillman Avenue for the delivery of heavy materials and equipment. The second option would involve constructing the overhead pedestrian walkways first and then using them to access the remainder of the construction site. This would minimize the potential disruption to the mainline tracks. Construction workers, small equipment, and some materials could be brought in through the walkways; however, heavy materials and large equipment would still need to use the Skillman Avenue entrance.

In either case, construction staging would occur in Sunnyside Yard in the area between Skillman Avenue and the south yard lead track. Construction of the south (eastbound) platform would be similar under both options. The construction of this platform may require that the south yard lead track be taken out of service at various times during the day or the use of a flagman controlled crossing.

For the center island platform and the headhouse, the first option would require access from the Queens Boulevard bridge and possibly a new spur track to provide rail access to the construction site. The second option would use the pedestrian walkway bridges, or railcar via construction of a new spur track similar to the first option. This would eliminate the need to bring equipment and materials via the Queens Boulevard bridge.

For construction of the north or westbound platform, the first option would probably require a small hoist or platform off the Queens Boulevard bridge. The sidewalk and one traffic lane would have to be closed for limited periods, subject to approval from the New York City Department of Transportation. To minimize traffic impacts on the bridge, materials would be brought during off-peak hours. Depending on the grade, it may also be possible to construct a spur track off the yard lead to remove excavated materials by railcars. The second option would not require the construction of a platform on the south side of the bridge since the overhead walkways could be used for access.

QUEENS SUBSTATIONS AND VENTILATION FACILITIES

In Queens, a combined substation and ventilation facility would be constructed as part of the cut-and-cover construction of new LIRR tunnels extending from Northern Boulevard across Yard A. All new underground construction in this area—tunnels, the ventilation facility, and the substation—would be part of one unified structure that would also include an above-ground employee facility fronting on Northern Boulevard.

In addition, an existing substation enclosure within the existing 63rd Street Tunnel ventilation facility in Queensbridge Park would be equipped to serve the tunnel's lower-level tracks. The existing underground facility would be structurally re-framed to accommodate additional equipment. This work would take place inside the existing structure and materials would be delivered to the site through existing hatches. A manhole would be created at the park's edge in the bed

of Vernon Boulevard to link to Con Edison's power system, and an approximately 50-foot-long duct would have to be installed to bring power to the substation. This duct would be constructed using shallow trenching. Work to equip the substation would last approximately 1 year.

SPOIL DISPOSAL FOR THE PREFERRED ALTERNATIVE

Creating tunnels and other underground spaces for the Preferred Alternative would result in a large volume of excavated material, or spoil, that would require either removal to an off-site location or reuse on site. The majority of spoil would be generated by the tunnels in Manhattan and Queens. The creation of new underground ventilation facilities, entrances, passenger concourse areas, platforms, and other spaces in and around GCT would also generate spoil.

Manhattan Tunnels and GCT

Total quantities of material that would be excavated to create tunnels and underground spaces in Manhattan (for either option of the Preferred Alternative) would be on the order of 600,000 bank cubic yards (BCY), equivalent to 900,000 loose cubic yards (LCY).* Approximately 160,000 to 180,000 BCY of material would be generated by tunnel construction north of 52nd Street, while approximately 420,000 to 440,000 BCY of material would be generated by tunnel construction and GCT excavation south of 52nd Street, as detailed below.

Option 1. The tunneling between 55th and 63rd Streets under Option 1 would generate approximately 180,000 BCY (or 270,000 LCY) of hard bedrock to be transported off-site. The maximum daily generation of spoil would be approximately 600 BCY (or 900 LCY). Excavated materials would be removed by a combination of rail haulage and conveyor systems through the tunnels to a shaft in Queens at 41st Avenue and Northern Boulevard (the site currently being used for construction activities associated with NYCT's 63rd Street Connector Project). From this shaft, the spoil would be disposed of in one of two ways:

- Preferably, spoil would be transported from the access shaft site to Yard A via a conveyor system over Northern Boulevard, under the overhead subway structure. Steel nets beneath the conveyor would prevent debris from falling onto Northern Boulevard. This conveyor would provide continuous operation without the need to interrupt street traffic below. Spoil would then be removed from Yard A using either rail or truck, as described below in "Stockpiled Spoil from Queens and Manhattan Tunnels."
- Alternatively, spoil from Manhattan may be removed from the access shaft site by truck, along designated truck routes in Queens, as described below in "Spoil Disposal Truck Routes."

Between 44th and 55th Streets under Option 1, construction of off-street entrances, ventilation facilities, substations, and underpinning work would require cut-and-cover excavation. Because these areas would not have connections to rail tunnels, the spoil from this activity could not be removed underground through the tunnels. Instead, it would be lifted by crane to the street and

* Bank volumes are the volumes of soil and rock before excavation, while they are compacted by pressure from surrounding rock and soil. Once excavated, these materials typically expand by 30 to 50 percent. To convert to loose volumes, bank volumes are multiplied by a "swell ratio," to account for the amount they will expand once loose. Swell ratios for rock are typically 1.4 to 1.5, while soil swell ratios are usually from 1.3 to 1.4.

removed by truck, with an average of 20 to 60 truck trips per day—typically about 6 trips per hour, with a maximum of 12 trips per hour.

All debris and excavated material from work in GCT and south of 52nd Street would be taken via rail cars along MNR tracks, to points north. The most likely destination for these spoils would be Metro-North's BN Yard, located in the Marble Hill section of the Bronx. From BN Yard, spoil would be removed via truck to locations to be determined by the contractor, most likely using the Major Deegan Expressway.

Option 2. Option 2 would generate approximately 160,000 BCY (or 240,000 LCY) of material to be transported off-site. As in Option 1, the maximum daily generation of spoil would be approximately 600 BCY (or 900 LCY).

For Option 2, material excavated from tunnels would be transported either through the tunnels to Queens, as in Option 1, or through the lower level of GCT to be hauled out by trains via Metro-North tracks to the Bronx. The rock excavated to create the LIRR track and platform areas at GCT would also be removed from the site via the tunnels to Queens. Unlike Option 1, Option 2 would not construct cut-and-cover tunnels directly under the foundations of buildings along Park Avenue and therefore would not require trucking of this spoil from Manhattan tunnels along Manhattan streets.

As in Option 1, however, the debris and material excavated for the creation of the mezzanine, vertical circulation elements, and cross passageways would be removed from the site via rail cars operating along existing MNR tracks, perhaps to BN yard. Similar to Option 1, material excavated for station entrances, the 55th Street ventilation facility, and any other facilities at the street level would have to be hauled out by truck.

Queens Tunnels

The excavation of Queens tunnels would result in the following volumes of excavated material, which would either be re-used on-site, or transported off-site:

- For the cut-and-cover structure in the vicinity of Yard A, 300,000 BCY (or 400,000 LCY);
- For the bored tunnels under Sunnyside Yard and Harold Interlocking, 150,000 BCY (or 200,000 LCY);
- For the bored tunnel approach structures, 70,000 BCY (or 100,000 LCY); and
- For the Harold Interlocking improvement tunnels, 50,000 BCY (or 70,000 LCY).

Approximately 190,000 BCY would be used as backfill over the completed structures to restore existing grades. One possible use of some of the remaining Queens spoil would be as fill for Yard A and other project construction areas, including Highbridge Yard. Some fill could also be used for embankments to be constructed as part of the Harold Interlocking improvements, but this would depend on the final construction staging for elements in Queens. *All soil disposal from Sunnyside Yard would be coordinated with Amtrak.*

Stockpiled Spoil from Queens and Manhattan Tunnels

The stockpiling of spoil in Yard A would permit remaining material from both Queens and Manhattan to be removed by rail, in the same fashion as spoil from the Queens portion of the New York City Department of Environmental Protection's Third Water Tunnel is currently being transported to eastern Long Island. For the water tunnel, spoil is hauled from the site by NYAR,

through Yard A, to the Ronkonkoma Branch of the LIRR, to a private material stockpile yard near Holtsville in eastern Long Island. Using rail to remove the spoil in Queens is strongly preferred.

A less desirable option would be to remove the spoil from Yard A (and also from the Manhattan access shaft) via truck. This would result in the generation of approximately 124 truck trips per day during peak periods of tunneling work. Due to the potential for a large number of both daily truck trips and total truck trips (since nearly 750,000 BCY of material could potentially require transport from Yard A, a total of 94,000 truck trips over the approximately 10-year construction period might be required), rail transport is the preferred option for removing spoil from Yard A.

Potential Truck Routes for Spoil

Disposal from Manhattan Sites. In Manhattan, material excavated for new GCT entrances, ventilation facilities, and portions of tunnel would have to be removed via truck, since tunnel connections to rail tracks would not be available from these areas. As described earlier, Option 1 would require more such truck trips than Option 2. To remove spoil from the area of construction in Manhattan (generally between 42nd and 55th Streets, between Lexington and Madison Avenues), the truck routes shown in Figure 17-5 and outlined below, are likely:

- To access points north, trucks would use First Avenue north to the Willis Avenue Bridge (or another Harlem River crossing), to the Major Deegan Expressway or Bruckner Expressway.
- To access points east, trucks would take Second Avenue south to the Queens-Midtown Tunnel and onto the LIE.
- To access points south and west, trucks would take either 42nd or 57th Street west to Ninth Avenue south, to the Lincoln Tunnel and New Jersey.

Disposal from Queens Sites. As described above, rail transport of spoil from Queens is the preferred option. If trucks were used to transport the rock spoil from the Manhattan access shaft at Northern Boulevard and from Yard A, the contractor would be required to use designated truck routes to local expressways. Trucks carrying spoil would most likely use the designated truck routes shown in Figure 17-5 and outlined below:

- To access points east, in eastern Queens and the rest of Long Island, trucks would use Northern Boulevard and Roosevelt Avenue, as well as 39th Street south to the LIE and Brooklyn-Queens Expressway (BQE)
- To access points south, in Brooklyn, Staten Island, and southern New Jersey, trucks would use 39th Street south to the BQE.
- To access points north, in the Bronx, northern New Jersey, Westchester County ,and beyond, trucks would use Northern Boulevard east to either 31st Street or Steinway Street north, to the Triborough Bridge. Should an exit from Yard A be created at Queens Street, some trucks may choose to take 42nd Road or 43rd Avenue west to 21st Street north, to the Triborough Bridge.

Because traffic conditions on and near the Queensboro Bridge and in Manhattan are typically congested, trucks would most likely avoid a route directly west through Manhattan to access points in New Jersey, instead choosing a route via the Triborough Bridge to the George Washington Bridge, or the BQE to the Verrazano-Narrows Bridge.

Potential Destinations for Spoil

The total quantity of spoil that would be generated by the Preferred Alternative would exceed 1 million BCY over an 8-year period. While there are a number of potential destinations for this material, specific locations cannot be determined at this time, due to a number of factors:

- The sequence and duration of construction, and hence the timing for generation of spoil, has not yet been finalized.
- The results of site testing in Queens to determine suitability of soil for disposal or reuse are not yet known.
- Construction methodologies (drill-and-controlled-blasting vs. TBM in Manhattan; type of TBM to be used in Queens) have not yet been finalized.
- It is not currently known what other large construction projects might be under way that might be able to use fill materials generated by the Preferred Alternative. For example, the Fresh Kills Landfill or other landfills might require fill materials for final cap and cover; previous landfill closings have required up to one million cubic yards of fill for that purpose. Large-scale waterfront projects under way in New York City (such as Riverside South, Queens West, or the Hudson River Park) might also be able to use rock removed from project tunnels for repairs to rip rap and shoreline edges.

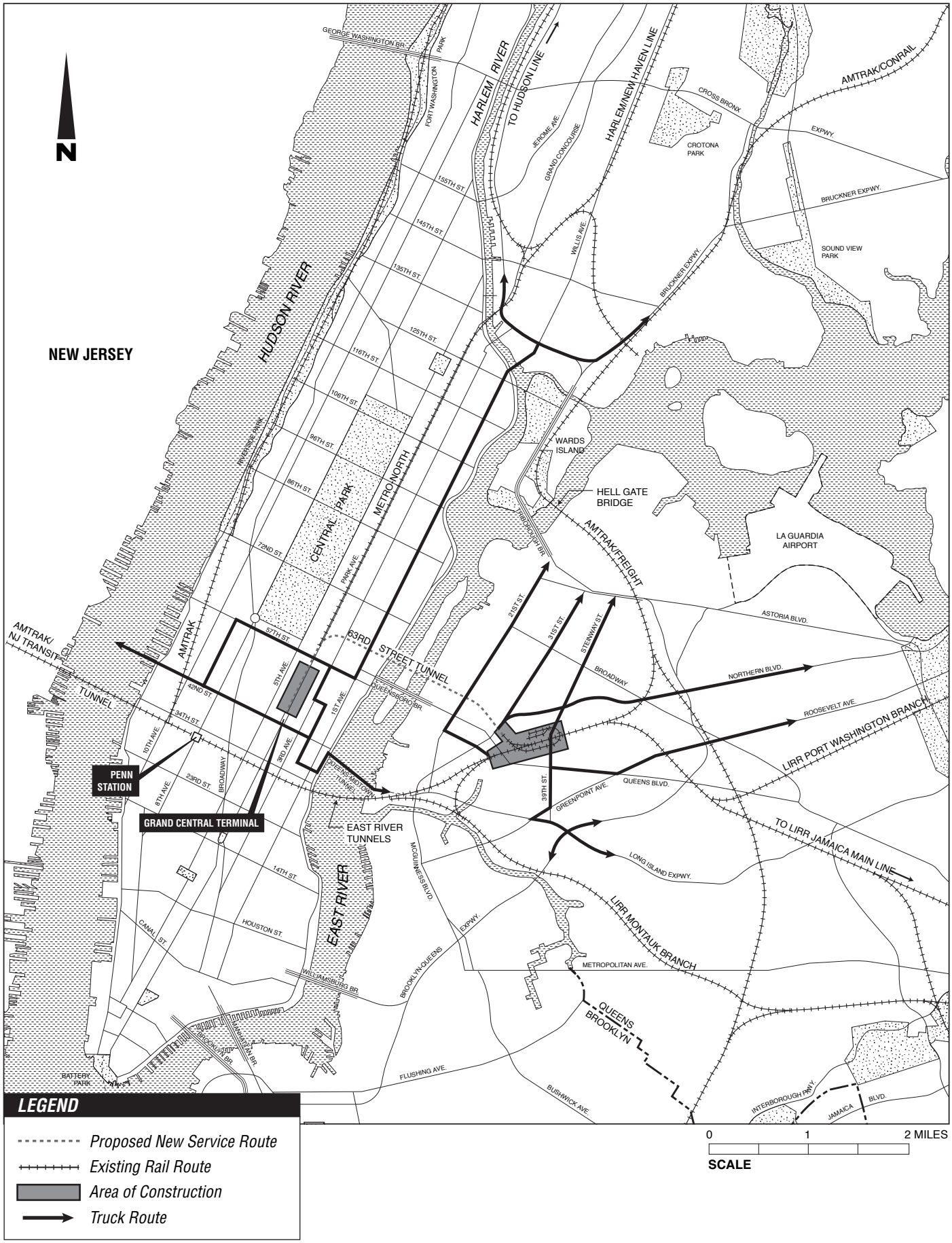
With these variables in mind, there are a number of potential uses of spoil generated by the Preferred Alternative, including construction projects that might require a sizable amount of fill. In addition to other projects, a considerable amount of material may be reused on-site for backfill and site fill in Yard A, in the vicinity of Harold Interlocking.

LONG ISLAND STORAGE YARDS

Construction of *new* storage yards on Long Island would last approximately 1 year at each of the sites chosen. Should construction take place at sites currently occupied by buildings, these buildings would be demolished prior to construction, in accordance with applicable regulations. At all potential sites, construction of new tracks, lighting, and fences, walls, or landscaping, as relevant, would require shallow trenching and regrading at each site. Each yard would also require track connections to the existing LIRR right-of-way at one or both ends of the new yard.

C. POSSIBLE IMPACTS OF THE PREFERRED ALTERNATIVE DURING CONSTRUCTION AND ASSOCIATED MITIGATION MEASURES

Since the No Action Alternative would not require new construction, no construction-related impacts would occur. The TSM Alternative would result in some disruption, but this would be relatively minor compared to the work required for the Preferred Alternative. The construction work related to the TSM Alternative would result in some noise, dust, and disruption near the Hunterspoint LIRR station and the affected portion of the LIE. Service at the LIRR station and subway station at Hunters Point Avenue could be affected for a short-time during off-peak hours. The TSM Alternative would also result in disruptions to traffic flows on the LIE while the required reconstruction work is underway, similar to the effects on any highway repaving or reconstruction project. Overall, however, impacts of the TSM Alternative during construction would be insignificant.



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East Side Access

Figure 17-5

Probable Truck Routes from Construction Locations

This section of the chapter describes the potential impacts associated with the Preferred Alternative. Where significant adverse impacts are identified, mitigation measures are also described. It should be noted that for each of the analysis areas considered below, the earlier chapter covering that subject (in Chapters 3 through 16) provides detailed information on the existing conditions and context against which to consider impacts.

LAND USE AND SOCIAL CONDITIONS

To consider the potential construction impacts of the Preferred Alternative, the land uses and social conditions in the immediate area of the Preferred Alternative were examined in detail. Zoning and land use policy are not addressed here, since the long-term plans and land use policies for the area are not particularly relevant to the short-term effects of a construction project. However, existing zoning and land use policies applicable to the broader study areas, along with a thorough discussion of land uses and social conditions in the broader study areas, are discussed in Chapter 3, "Land Use, Zoning, and Public Policy."

EXISTING LAND USE AND SOCIAL CONDITIONS NEAR CONSTRUCTION AREAS

Manhattan

The area surrounding the project alignment in Manhattan is predominantly commercial south of 60th Street and predominantly residential to the north. Community facilities include several churches and synagogues, schools, and libraries. The area within approximately a block of the project alignment in Manhattan had a residential population of approximately 15,500 people in 1990, of whom some 12.7 percent were members of minorities (compared to 52 percent overall in Manhattan). This population includes the numerous homeless people who were counted at GCT itself during surveys conducted for the 1990 census. The 1989 median household income of this population was $47,276 (compared to $32,262 for all of Manhattan and $29,823 for New York City).

South of 60th Street: East Midtown. As described in Chapter 3, "Land Use, Zoning, and Public Policy," of this EIS, the area north of Grand Central Terminal along the project route is densely developed with office towers. Tall commercial buildings line most of Park Avenue, some extending the full blocks through to Madison and Lexington Avenues as well. Major non-commercial uses along this part of Park Avenue include St. Bartholomew's Church at 50th Street and the Racquet & Tennis Club, a private sports club at Park Avenue between 52nd and 53rd Streets. In addition, one of the city's most famous hotels, the Waldorf-Astoria, occupies the full block bounded by 49th and 50th Streets and Park and Lexington Avenues. Close to GCT, a large new commercial building is being constructed by Bear Stearns at 383 Madison Avenue between 45th and 46th Streets, above the westernmost tracks at GCT. Along Madison and Lexington Avenues, office buildings typically have ground-floor retail uses.

In addition to large commercial buildings, the midblocks between Madison and Park Avenues are occupied by a mix of smaller commercial buildings, ground-floor retail with residential apartments above, and hotels. Closest to GCT, uses include the Yale Club on Vanderbilt Avenue and the Roosevelt Hotel on East 45th Street. Community facilities in this area include St. Bartholomew's Church and Community House on Park Avenue at 50th Street (which is also a New York City Landmark) and Central Synagogue on Lexington Avenue at 55th Street.

Land Uses Adjacent to Construction Sites. Noticeable construction activities would be focused at or near Grand Central Terminal, a grand historic structure in the heart of the Midtown

Manhattan commercial core. There are shops and restaurants at street level on all sides of the Grand Central Terminal superblock and on the blocks between Vanderbilt and Madison Avenues. In this area, Park Avenue is a wide boulevard divided by a landscaped median, and flanked by modern high-rise office towers. As described earlier, both options of the Preferred Alternative would require some street-level disruption in this area. Under Option 1, extensive cut-and-cover construction would occur along four side streets just west and east of Park Avenue—East 52nd, 53rd, and 54th Streets between Park Avenue and Madison Avenue, and East 54th Street between Park and Lexington Avenues; as well as less extensive cut-and-cover along East 45th Street and other streets between 44th and 51st Streets for entrances and substations. Option 2 would require mush less disruption, with limited cut-and-cover work along one side street—East 55th Street between Park and Madison Avenues—and small areas of cut-and-cover work along other side streets in the area between 44th and 54th Streets and Park and Madison Avenues.

All of these blocks are dominated by office buildings and commercial uses. High-rise commercial towers line Park and Madison Avenues, while mid-rise office buildings and an occasional hotel occupy the lots between the avenues. There are only two residential buildings on the five blocks that could experience the more disruptive work. Ground-floor retail exists consistently on the Park and Madison Avenue corners, and sporadically along midblocks. The other blocks that could experience the most serious disruption are described below.

East 52nd Street between Park and Madison Avenues is lined on its southern side with office towers ranging from 24 to 30 stories tall. On the north side of the block at Park Avenue is the Racquet & Tennis Club, occupying the entire blockfront west of Park Avenue between 52nd and 53rd Streets. From the middle of the block, west to Madison Avenue, are three office buildings ranging in height from 7 to 40 stories. Ground-floor retail establishments exist from the middle of the block to Madison Avenue.

East 53rd Street between Park and Madison Avenues is similarly lined with office towers, with the exception of the Racquet & Tennis Club. On the south side of 53rd Street are two office buildings: one on the corner of Madison Avenue, 21 stories tall, and another that stretches across to 52nd Street, 40 stories tall. On the north side are 20- and 42-story tall office buildings, and the 21-story high Lever House Building at Park Avenue. The only ground-floor retail establishment on the block are at the bases of the two office towers along Madison Avenue.

East 53rd Street between Park and Lexington Avenues is slightly more mixed in character than the other blocks. On its south side is the 43-story Citibank building, spanning the entire block. On the north side of the block are low- and mid-rise office buildings, a hotel, and a 15-story residential building—one of only two residential buildings on these five blocks. Ground-floor retail is limited to the corners at Lexington Avenue, and at the base of the residential building.

East 54th Street between Park and Madison Avenues contains the other residential building in the area, a 5-story residence on the north side of the street. Also on the north side of the street is a 21-story office tower at 400 Park Avenue, a 36-story office tower at the corner of Madison Avenue, and an 8-story office building along with a restaurant in two 4-story buildings in the middle of the block. The south side of the block contains the Lever House at Park Avenue, a 25-story office tower at Madison Avenue, and a hotel between them.

East 55th Street between Park and Madison Avenues is completely lined with office buildings ranging from 17 to 33 stories tall, except for a 5-story private club in the middle of the north side of the block.

East 44th Street between Vanderbilt and Madison Avenues consists of tall buildings fronting on the avenues. The only exception to this pattern is the 5-story commercial building at 47 East 44th Street, which would be acquired for the Preferred Alternative. Land use in the area is predominantly commercial. The building at the corner of Vanderbilt Avenue and 44th Street, adjacent to 47 East 44th Street, is the 21-story Yale Club.

North of 60th Street: Upper East Side. The character of the area along the project alignment changes markedly north of 60th Street. Heading east from Park Avenue, the tunnels of the Preferred Alternative would pass beneath blocks between roughly 58th and 63rd Street before reaching the existing 63rd Street Tunnel at Second Avenue (see Chapter 2, "Project Alternatives," for maps of the alignment). Uses above the tunnel alignment above the project route are predominantly residential. Third and Second Avenues are lined by tall apartment buildings, but Lexington Avenue and the midblocks are typically lower density (3- to 5-story rowhouses). Along the 61st and 62nd Street midblocks between Second and Third Avenues is the Treadwell Farms Historic District, a group of row houses dating to the 1870's. Along Lexington, Third, and Second Avenues, most buildings have ground-floor retail uses. The Barbizon Hotel is also located along this part of Lexington Avenue, at the corner of 63rd Street. A prominent institution in this area is the Manhattan Eye, Ear and Throat Hospital, at the center of the block bounded by 63rd and 64th Streets and Second and Third Avenues. In addition, there are numerous small institutions (schools, libraries, churches, and synagogues) in this area. East of Second Avenue (approximately where the existing rail tunnel begins) uses continue to be primarily residential, but also include a Con Edison substation, a parking garage, a movie theater, and a health clinic.

Roosevelt Island

The existing 63rd Street Tunnel passes beneath the center of Roosevelt Island, beneath the subway station there and the vacant Central Nurses Residence building. The existing tunnel vent building is located on the western shore of the island, between Main Street (the single road serving the island) and the East River, and is adjacent to a waterfront esplanade that curves around the vent building and the proposed construction site. The area close to the subway vent is otherwise predominantly vacant.

Queens Tunnel Alignment and Sunnyside Yard/Yard A/Harold Interlocking

In Queens, the existing 63rd Street Tunnel travels along 41st Avenue, passing beneath Queensbridge Park, a 20-acre park along the East River just north of the Queensboro Bridge, and continuing beneath the Queensbridge Houses public housing complex. East of 21st Street, uses become more varied but are largely light industry, storage, and auto-related, including surface parking lots. Scattered residential development generally consists of older 2-story brick and frame homes and a few small to medium apartment buildings.

Closer to Northern Boulevard along the tunnel route is a concentration of commercial uses including banking and office space, clustered near Queens Plaza. A public high school, which includes the Academy of American Studies and the Newcomer High School, is at 41st Avenue between 28th and 29th Streets. Construction work taking place on the block bounded by 40th Road, 41st Avenue, and Northern Boulevard related to MTA New York City Transit's 63rd Street Tunnel Connector Project has been under way for a number of years.

As described in Chapter 3, the Yard A/Arch Street Yard/Sunnyside Yard railroad complex occupies a large area that is predominantly separated from the surrounding neighborhood by grade changes, fences, and bulky industrial buildings. Surrounding the yards, land use is

overwhelmingly industrial and commercial, with auto-related uses as well (including car dealerships along Northern Boulevard east of Queens Plaza).The area is further characterized by a network of transportation structures that include the streets passing over the rail yard, elevated subway tracks on Queens Boulevard and Northern Boulevard, and the approach to the Queensboro Bridge that runs above Queens Plaza.

Exceptions to the industrial and commercial pattern include several residences along 38th Avenue and 32nd Street near Northern Boulevard, a church and center for mentally challenged adults, both on 39th Avenue, and a large Korean Presbyterian Church in a new building adjacent to the yards at 37th Avenue. East of Queens Plaza, some office uses are focused around Court House Square. In addition, south of the yards, LaGuardia Community College is located in a large formerly industrial building on Thomson Avenue, while residential uses are also located in the area south of Skillman Avenue, including several apartment buildings and 2-story houses. The north side of Skillman Avenue, along the south side of the rail yard between 43rd and 39th Streets, is industrial with the exception of a public playground and a small church.

Near the eastern end of Sunnyside Yard, a General Motors facility occupies the area from 39th to 43rd Street, between the main line tracks and the loop tracks that lead to Sunnyside Yard and Yard A. Access to the facility is via a bridge over the loop track from 43rd Street. The 2-acre Torsney Playground is located at the corner of Skillman Avenue and 43rd Street, just south of the loop track, in this area.

East of 43rd Street, Harold Interlocking continues on an elevated embankment eastward alongside Barnett Avenue. The north side of Barnett Avenue, adjacent to the railroad tracks, is lined by auto-related and industrial uses, including 20 privately owned residential garages. The south side of Barnett Avenue marks the beginning of the Sunnyside Gardens residential neighborhood, a multi-block complex of low-rise residences designated as a historic district.

Although it is predominantly industrial in character, because of its large size the area close to the project alignment is home to approximately 22,000 people (according to the 1990 census). Most of these residents are at the edges of the area, either near the East River in the northwestern part of the alignment or near Sunnyside Gardens in the southeastern portion. More than half of this population (52 percent) consists of minorities. The 1989 median household income of this population was $21,996 (compared to $34,186 for Queens and $29,823 for New York City as a whole).

Replacement Yards

As described in Chapter 3, land use around Blissville and Maspeth Yards is predominantly industrial, with the exception of a small residential neighborhood across from a portion of Maspeth Yard. The area around Fresh Pond Yard is predominantly residential, but a buffer of industrial and commercial buildings almost completely separates the yard from the residential uses. Mafera Park, a New York City Park, also abuts a small corner of Fresh Pond Yard. Highbridge Yard is separated from the nearest residential uses by grade changes and the Harlem River and Major Deegan Expressway.

LONG ISLAND STORAGE YARDS

As described in Chapter 3, the area around the *potential* Babylon Yard expansion is industrial to the north and residential to the south. At Cerro Wire and Ronkonkoma sites, land use is predominantly industrial. Around the Pilgrim Hospital site, current land uses are a mix of

undeveloped land and institutional, but in the future, mixed-use development of some of the surrounding area may occur. At the Yaphank East site, surrounding land is agricultural on the south, wooded on the east, and industrial to the west. Southaven County Park is close to the Yaphank site on the east. At the Yaphank West site, surrounding land is either occupied by municipal uses or undeveloped and agricultural; the Suffolk County Farm and Education Center is just north of the Yaphank West site. The Riverhead site is bordered on the north by residences and on the south by undeveloped land. Directly east of the Riverhead site is the wooded Indian Island County Park.

POSSIBLE IMPACTS DURING CONSTRUCTION

Construction of the Preferred Alternative would result in disruptions and inconveniences in areas near the construction sites. Considering the size and scope of the project, however, the disruption would be quite limited. Most of the work would occur either underground, with limited or no activity at the surface or in public areas, or in railroad yards that are separated from surrounding uses. Disruptions would occur near Grand Central Terminal in Manhattan, and near Northern Boulevard in Queens. Under Option 1 in Manhattan, extensive cut-and-cover construction work would be required at 52nd, 53rd, and 54th Streets. Under Option 2, only limited cut-and-cover construction work would be required. Because it would result in far less disruption during construction, Option 2 is the preferred project option.

Access to affected commercial establishments and residences would be maintained at all times during construction. In areas where sidewalks or street lanes are being closed for extended periods of time, standard practices for maintaining access would be followed, including providing alternate routes of entry into buildings for employees, residents, and deliveries; providing appropriate signage to direct people to these alternate entrances; establishing a traffic management plan to ensure vehicular access to affected buildings; and implementing an outreach program to share construction schedules, potential impacts, and mitigation measures with local retailers, businesses, and residents.

Manhattan

Option 1. Most of the work in Manhattan would be related to construction of the new tunnels deep beneath the surface. This would not be perceptible at the surface, except for some possible ground-borne noise during the few weeks of construction directly under some buildings (see the discussion below under "Vibration"). As described earlier, the cut-and-cover work would last 2 to 4 years at any given location. During that time, portions of the sidewalk and curb lane would be closed. Total street closings would be required sporadically for deliveries.

The cut-and-cover work near Park Avenue in the 40's and 50's would be disruptive to surrounding land uses, however. These uses are predominantly commercial, but do include some residential and hotel uses, as described above and in Chapter 3, "Land Use, Zoning, and Public Policy." The anticipated sources of disturbance would include dust, noise, and vibration during surface excavation; storage and handling of construction materials; and temporary reductions in sidewalk width, traffic lanes, and curbside parking. (Specific information about effects on traffic, noise, and vibration is provided later in this chapter.)

Option 2. For Option 2, an even greater portion of construction would occur well beneath the surface, with few impacts at the street level. Work at street entrances would be similar to Option 1, as would work in front of 47 East 44th Street. In addition, some excavation would be required

on other streets in the area for substations and ventilation facilities. Limited cut-and-cover work would occur at 55th Street, which would disrupt traffic and pedestrian flows for about 8 months.

Queens Alignment/Sunnyside Yard/Yard A/Harold Interlocking

Most of the work along the Queens alignment and in the railroad yard complex would be buffered from surrounding uses *and is not expected to result in impacts to open spaces in the area*. Work in the existing 63rd Street Tunnel would not be perceptible at the surface, except for some possible ground-borne noise (see "Vibration," below).

Construction activities on either side of Northern Boulevard at 41st Avenue (near Queens Plaza) would in effect continue the construction activities that have been ongoing there for the 63rd Street Tunnel Connector Project. The construction site being used for that project would also be used for East Side Access. This would cause some disruption (principally noise and also some vibration) at the Newcomers High School at 28-01 41st Avenue, adjacent to the site. *To minimize disruptions at Newcomers High School, adjacent to the construction staging and tunnel access shaft in Long Island City, Queens, MTA would work with representatives from the school to develop a plan to mitigate the construction-related noise effects. Such a plan would include sound-insulating construction fencing and the installation of double-glazed windows or air conditioning units. MTA would continue to coordinate with school representatives throughout the construction period to address problems if they arise.*

Construction of the new Sunnyside station is not likely to disrupt surrounding land uses, which are predominantly industrial. Much of the construction activity would take place in the yard and would not be visible from the street level. Most material and equipment would be delivered to the site either by rail or through street access from Skillman Avenue. Some work would involve using the eastbound curb lane and sidewalk on the Queens Boulevard bridge for short periods of time during off-peak periods.

Replacement Yards

The construction activities proposed at Blissville or Maspeth Yard, Fresh Pond Yard, and Highbridge Yard are relatively minor. Considering that uses immediate to Blissville and Maspeth are predominantly industrial, this work would cause little to no disruption to surrounding uses. While there are residences in the immediate vicinity of Fresh Pond Yard, a buffer of industrial uses lies between these residences and the potential construction site in the yard, so work is not likely to disrupt *them. Construction is also not likely to disrupt the activities in Mafera Park, just west of the yard, which is buffered from the yard by trees and other vegetation.*

Long Island Storage Yards

The impacts associated with constructing new LIRR yards on Long Island would vary depending on the yard sites selected. At Cerro Wire and Ronkonkoma, construction would be unlikely to be disruptive to surrounding uses, as those uses are predominantly industrial. At the Yaphank East site, the Suffolk County Department of Public Works' storage and stockpiling area, as well as a privately owned tree farm, would have to be relocated. At the Yaphank West site, construction generally would not disturb surrounding agricultural and municipal uses. It could, however, be disruptive to the nearby Suffolk County Farm and Education Center. At Babylon and Riverhead, construction would occur adjacent to residences and therefore could be

disruptive. At Babylon, residences as well as commercial establishments would be displaced by construction of a new yard.

ECONOMIC CONDITIONS AND RELOCATION

Implementation of the Preferred Alternative would generate economic activity throughout the construction period. At the same time, it would also introduce the potential for adverse impacts on businesses near the construction sites, as described below.

ECONOMIC BENEFITS DURING THE CONSTRUCTION PERIOD

Construction of the proposed project would generate economic benefits for New York City and New York State, particularly from the creation of construction jobs and wages and salaries paid to construction workers, as well as indirect economic activity generated from the direct expenditures throughout the regional economy (often referred to as the "ripple" or "multiplier" effect). With an estimated construction cost of approximately $4.71 billion, Option 1 would generate significant economic benefits. Option 2, with costs of approximately $4.34 billion, would have slightly fewer construction costs and economic benefits than Option 1.*

As a result of direct expenditures, the direct employment from construction activities in both Option 1 and Option 2 would be an estimated 14,200 person-years.** In addition to employment directly attributable to construction of the proposed project, indirect employment would occur from the construction expenditures, including jobs in business establishments providing goods and services to the contractors, as well as in businesses that would provide goods and services to construction workers. Secondary employment from both options is expected to be considerable. While no specific effort is made here to quantify such indirect and induced benefits, it is universally accepted that investments of this magnitude in major transportation infrastructure projects would result in tens of thousands of induced jobs throughout the regional and national economy.

Employment from the project would be concentrated at the peak of construction, between the years 2004 and 2010, when nearly 90 percent of construction period employment would occur.

POTENTIAL ADVERSE ECONOMIC EFFECTS DURING CONSTRUCTION

Economic Effects due to Disruption

In areas adjacent to particularly disruptive construction activities, economic conditions could be affected. In particular, this could occur near the cut-and-cover areas in Manhattan. Around other construction areas, including the work in Queens and at Blissville or Maspeth Yard, Fresh Pond Yard, and Highbridge Yard, construction activities would be largely contained on the construction sites and no adverse effects on economic conditions would be expected.

The disturbance associated with the extensive cut-and-cover construction required in Manhattan could affect economic conditions of businesses nearby. The anticipated sources of disturbance

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* Construction costs include hard and soft construction costs, engineering, management, rolling stock, real estate, escalation, and contingency and have been escalated to the midpoint year of construction.

** A person-year is the equivalent of one employee working full-time for 1 year. Person-years were estimated by East Side Access Project, Program Manager.

would include dust, noise, and vibration during surface excavation; storage and handling of construction materials; and temporary reductions in sidewalk width, traffic lanes, and curbside parking. The effects would be substantially worse under Option 1 than under Option 2. Effects could be expected on pedestrian and shopping patterns, even for a temporary period of time. Real or perceived changes to the physical environment—including narrower sidewalks areas that impede and constrain pedestrian flow, especially for shoppers with large bags or carts; uneven sidewalks or slippery plates; or removal of curbside parking that acts as a safety buffer between pedestrian and vehicular traffic—may divert pedestrians and shoppers from their typical patterns. In addition, elimination of parking lanes and reduction in the number of through lanes are likely to make deliveries to stores and businesses more difficult. Additional time may be required to load and unload trucks, probably resulting in an increase in the retailers' operating expenses. Possible economic impacts could occur to businesses in these construction areas, particularly those that may be marginal. This depends not only on the construction activities, but also on the type and size of businesses in the construction zone. Smaller retailers—particularly those that have competitors nearby—may lose customers who might prefer to shop in a quieter and more comfortable environment.

Displacement and Relocation

As described in Chapter 5, "Economic Conditions" acquisition of private property is required for construction of the Preferred Alternative. Private property is required in Manhattan for the new entrances to GCT and the new ventilation facility on 44th Street, and in Queens for improvements to Harold Interlocking. In addition, permanent subsurface easements are required beneath a number of properties in Manhattan, to allow the tunnel to travel from the existing 63rd Street Tunnel to GCT. In addition, private and/or public property must be permanently acquired for the storage yard sites on Long Island (see Chapter 5). These acquisitions would occur prior to construction, and most would be permanent. In addition to those permanent acquisitions, the project would require certain temporary acquisitions for construction activities. Specifically, Option 1 would require temporary acquisitions of basement spaces in four private buildings in Manhattan during construction, and the project may require temporary use of private property near the Harold Interlocking in Queens.

Manhattan Option 1. In addition to those properties permanently acquired for the project, Option 1 of the Preferred Alternative would require temporary use of private property during the construction period. Specifically, Option 1 would require the use of basements in four private properties—the Racquet & Tennis Club, Lever House, 400 Park Avenue, and 410 Park Avenue. The work in these properties would last approximately 2 years at each property. During that time, the existing uses in those basements would be displaced. After construction is complete, the basement spaces would be returned to the property owners. Affected uses are as follows:

- Racquet & Tennis Club (370 Park Avenue): In this building, Option 1's construction activities would require use of a lunchroom, storage space, and a bathroom currently used by a tenant, American Express; a locker room used by Racquet & Tennis Club members; and a third space currently used by a tenant, Bank of New York. These spaces are nonessential to business operations.
- Lever House (390 Park Avenue): Construction activities associated with Option 1 would require use of the 200-space parking garage in the basement of that building and a 40-foot by 40-foot space. The garage is currently operated by Kinney Parking. The garage would not operate during the construction period.

- 400 Park Avenue: Option 1 would require the use of a 5,000-square-foot basement storage space used by a tenant, Syms clothing store.
- 410 Park Avenue: In 410 Park Avenue, a space currently used as an elevator machine room in a sub-basement would be used. There is a possibility that construction in 410 Park Avenue could take one elevator at a time out of service for the duration of construction.

Queens. In Queens, in addition to the permanent acquisition of a portion or all of the commercial building at 3856-3864 43rd Street (see Chapter 5), one construction option may require a construction easement to use a portion of General Motors property west of 43rd Street as an access and staging area for work along the Harold Interlocking between 43rd and 48th Streets. This space is currently occupied by approximately 28 parking spaces. This property would not be required after construction in this area is complete.

Relocation Procedures. As detailed in Chapter 5, as a federally funded project, East Side Access would be required to follow federal *acquisition* and relocation regulations. The rights of owners and tenants of real property acquired to implement the proposed project, including permanent easements, are protected under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (the Uniform Act). The Uniform Act provides for equitable treatment of persons displaced from their homes, businesses or farms by federal and federally assisted programs. It also establishes uniform and equitable land acquisition procedures. Entitlements for property owners under the law include the following:

- Just compensation for property, which may not be less than the acquiring agency's approved appraisal of the fair market value;
- Determination of just compensation by a court of law;
- The opportunity to accompany the appraiser who appraises their property;
- Written statement of, and summary of the basis for the amount established by the acquiring agency as just compensation;
- Payment of the agreed upon purchase price (or a deposit in the court) before being required to surrender possession of the property;
- Reimbursement for certain expenses incidental to transfer of title to the acquiring agency;
- Reimbursement for certain litigation expenses;
- At least 90 days' written notice to vacate occupied property;
- Relocation services and payments, where applicable; these may involve housing supplements, moving cost, etc. for residential acquisitions, or reestablishment, moving costs, etc. for business, nonprofit, or farm acquisitions; and
- Written statement or brochure advising property owners of their rights and entitlements, and assurance that they receive all of the services and payments to which they are entitled under federal and state law and regulations.

VISUAL AND AESTHETIC CONSIDERATIONS

Most of the construction work required for the Preferred Alternative would occur in areas not accessible to the public. These areas are also, for the most part, not visible to the public.

MANHATTAN

In Manhattan, the cut-and-cover work associated with the Preferred Alternative would clearly be visible to the public in its early stages. During the first approximately 2 months, these locations would be open excavation areas surrounded by plywood fencing. Construction equipment would likely be visible behind the fences. Traffic and pedestrian patterns would be diverted as well (see the discussion below under "Transportation"). Overall, this work would not be greatly different from construction activities that typically occur throughout Manhattan, where pedestrian walkways and construction equipment are not uncommon. Once the excavation areas are covered with concrete decking panels, construction would be less visible at street level. However, there would still be areas of the sidewalk and street used by contractors as construction staging areas. As described earlier, the cut-and-cover work required for construction would be far more extensive under Option 1 than under Option 2.

The work in GCT and related to the new street entrances to the terminal would be closed off from the public by construction walls made of plywood fencing. Consequently, while the public might be aware that construction was under way, the construction activities themselves would not be visible. The work to excavate an approximately 30-foot deep area at 47 East 44th Street would similarly be shielded from public view. However, as is typical for construction of buildings in Manhattan, the site would be used as a construction staging area prior to actual construction. Trucks entering and leaving the site would be visible, as would construction equipment on the site. While a plywood wall would block direct views from the sidewalk into the site, once the first story of the building was complete, it would be visible both from the sidewalk and from surrounding buildings.

ROOSEVELT ISLAND

The work on Roosevelt Island associated with the new underground substation enclosure would be minor and short-term. The construction area would be surrounded by a fence during that time.

QUEENS ALIGNMENT/SUNNYSIDE YARD/YARD A/HAROLD INTERLOCKING

Although extensive construction activities would occur in Queens, most of this work would not be visible to the public. All of the work within Yard A and Sunnyside Yard would be largely invisible, since those yards are separated from surrounding neighborhoods by grade changes, fences, and bulky industrial buildings. Most work outside the yards would be enclosed by fencing, limiting views of the construction materials and equipment. Construction activities that would be most visible in Queens would be related to the new Sunnyside station and the Harold Interlocking work between 43rd and 48th Streets.

Construction activities at Northern Boulevard and 41st Avenue (on the current construction site for the 63rd Street Tunnel Connector Project) and across Northern Boulevard at 2950-2970 Northern Boulevard would be enclosed by high fencing, to limit visual disruption to the area. The conveyor used to transport materials excavated from the Manhattan tunnels across Northern Boulevard would be visible to the public from Northern Boulevard. Efforts would be made to work with the community to safeguard against complaints about dust, noise, traffic and aesthetics during construction of the Preferred Alternative.

Some parts of the new Sunnyside station would be highly visible during construction, because of its location on and adjacent to the Queens Boulevard bridge. These elements would include

the "headhouse" which would open onto Queens Boulevard and the elevated pedestrian walkways connecting to the platforms below. However, these construction elements would not significantly affect the visual character of the area, which consists of a bridge with an elevated subway over an active rail yard in an industrial area.

At the Harold Interlocking between 43rd and 48th Streets, just east of Sunnyside Yard, work on the viaduct and bridges across local streets would be visible to the surrounding community.

REPLACEMENT YARDS

The construction activities required at either Blissville or Maspeth Yard would be minor in extent and duration, and would not result in significant visual changes from the existing conditions at either of those yards. At Fresh Pond Yard, the limited construction activity associated with building a new structure in the center of the yard would not result in significant visual changes, either.

While the work required at Highbridge Yard would be extensive, the yard is separated from other uses and potential viewers by grade changes and distance. Drivers on the Major Deegan Expressway and residents of apartment buildings some distance from the yard would be able to see the construction activities. This would not result in significant visual impacts during construction.

LONG ISLAND STORAGE YARDS

The work required to construct new LIRR yards on Long Island would be minor in extent and duration. At Cerro Wire, Yaphank East, Yaphank West, Ronkonkoma, and Pilgrim Hospital sites, the yards would be separated from surrounding sensitive visual receptors and not result in significant visual impacts during construction. At Babylon and Riverhead sites, construction barriers would be erected to shield areas of construction from surrounding streets and residences.

HISTORIC RESOURCES

Construction activities associated with the Preferred Alternative would take place beneath several historic resources in Manhattan. The tunneling work would be performed to limit vibrations, so that no damage would occur to historic resources above the construction sites (see the discussion under "Vibration," below). The Preferred Alternative would also involve physical alterations to historic structures in Manhattan, as follows:

- In Option 1, three historic resources would be physically altered—Grand Central Terminal, the Racquet & Tennis Club, and Lever House. The project would alter some of the public as well as nonpublic spaces in GCT, and Option 1 would require underpinning of the Racquet & Tennis Club and Lever House.
- In Option 2, only one historic resource, Grand Central Terminal, would be altered.

Both options would also involve construction activities adjacent to the Yale Club, which is also a historic resource. (See Chapter 7, "Historic Resources," for a detailed discussion of historic resources.) To avoid damage to these historic structures, a construction protection plan would be developed and implemented in consultation with the State Historic Preservation Office (SHPO) at the New York State Office of Parks, Recreation and Historic Preservation during the project's ongoing consultation with that agency. The construction protection plan *is* included as

part of *the* Programmatic Agreement executed by FTA, MTA/LIRR, *and* SHPO *for this project.*

In Queens, construction in the Sunnyside Yard/Yard A railyard complex would occur near two historic railroad structures, Switch Tower Q and former Signal Cabin F. These structures would also be included in the construction protection plan to be approved by SHPO prior to the start of construction and included in the project's Programmatic Agreement.

MTA's transportation facilities are exempt from local laws and ordinances pursuant to Public Authorities Law Section 1266, Subdivision 8. The MTA nevertheless intends to continue to seek the advice and counsel of the New York City Landmarks Preservation Commission (LPC) as it goes forward in the same manner as it has in the past. As MTA's plans develop, MTA anticipates that it will submit to LPC information regarding the project, and would expect that LPC, if it so chooses, would hold a public hearing and issue a report on the MTA's plans in the manner that LPC issues reports with respect to city-owned properties.

ARCHAEOLOGICAL RESOURCES

As described in Chapter 8, "Archaeological Resources," there is a possibility that some of the sites to be affected by the Preferred Alternative may contain buried archaeological resources. If any resources are present on project sites, they could be disturbed by construction activities for the Preferred Alternative. To avoid significant adverse impacts on archaeological resources, additional work will be performed in consultation with SHPO where the potential for archaeological resources has been identified. The steps to be taken *are* outlined in the project's Programmatic Agreement. These would include the following measures. Once preliminary engineering is under way, soil borings would be performed in all locations identified as potentially significant (where soil borings have not already been completed and analyzed for the EIS analysis). The results of the borings would be used to determine depths of fill, to better understand the sensitivity of the areas to be affected by the project. The potential for impacts would then be re-evaluated. If the potential for any significant adverse impacts is identified, appropriate mitigation measures would be developed through ongoing consultation with SHPO, so that no adverse impact would occur. Mitigation measures may include subsurface archaeological testing to identify the presence or absence of archaeological features, followed by an assessment of their eligibility for the National Register of Historic Places. For any sites to be affected by the project that are identified as having archaeological features present that are eligible for the National Register, mitigation will be developed. As appropriate, this may include data recovery in the form of a full-scale excavation.

TRANSPORTATION

During construction, the Preferred Alternative has the potential to significantly affect several components of the area's transportation system. Most notable would be the effects of construction on Metro-North Railroad's operations due to work in GCT as well as along the Park Avenue tunnel from 52nd to 56th Streets in Option 1; disruption to street and pedestrian traffic due to cut-and-cover construction at several midblock locations in Midtown, which would be much more extensive under Option 1; operational effects on NYCT subway especially due to the cut-and-cover construction across Northern Boulevard in Queens; and the effects of work within the Harold Interlocking on Amtrak and NJ Transit operations.

COMMUTER RAIL

Effects on Metro-North Railroad—Option 1

Option 1 of the Preferred Alternative would require extensive track outages of various MNR tracks leading to or in GCT, to allow access for the underpinning of four buildings on Park Avenue, underpinning of MNR tracks, alterations to MNR's East Side yard at GCT, and other related project work. These outages are described below. As detailed below, these track outages would adversely affect MNR's service in the event of service disruptions. As a result, MNR's on-time performance would be expected to deteriorate. In addition, the ability of MNR to perform routine track work and infrastructure maintenance without requiring service changes or reductions would be adversely affected. The potential effect on MNR service during construction of Option 1 is one of the reasons that Option 2, which does not require those disruptions, is the preferred option.

Metro-North Tracks from 52nd to 56th Street. The underpinning of the four buildings on the west side of Park Avenue between 52nd and 55th Streets would require closing of some MNR tracks in this area during the construction of Option 1. In addition, some disruption to MNR operations would be required for the construction of the new LIRR tunnel beneath the existing MNR structure between 54th and 56th Streets. As discussed previously, the work in this area would consist of soil stabilization and the underpinning of the existing columns supporting the MNR tracks.

North of approximately 57th Street, the Metro-North tunnel consists of four tracks. South of 57th Street, as the tunnel approaches GCT, these tracks fan out into a number of tracks, called "throat tracks," that enable trains to access all of the upper- and lower-level platforms in GCT. The throat tracks are tracks B, on the east side of the tunnel, through J, on the west side (track A is no longer used as a throat track). Three throat tracks (B, F, and J) provide access to lower-level platforms, Madison Yard, and the East Side storage yard; and six throat tracks (C, D, E, G, H, and I) provide access to upper-level platforms.

During construction of Option 1, the westernmost throat track (track J), would be taken out of service while adjacent LIRR tunnels are constructed under Park Avenue buildings and while the soil below the track is supported in preparation for new tunnels to run beneath it. This combined service outage would last a total of approximately 3½ years. The loss of track J would significantly affect MNR's operations, which require the flexibility of having all three tracks to the lower level available; moreover, any service disruptions would be compounded by the absence of track J.

Prior to track J's decommissioning, a number of tracks and platforms within GCT that are served by track J would be taken out of service in connection with the project. These include the Madison Yard tracks and Metro-North revenue tracks 114-117 (which together are the area to be converted to LIRR tracks and platforms under Option 1), and tracks at MNR's East Yard, which would be altered by the project. This significantly reduces the need to use track J as a throat track for GCT's lower level. Other lower-level tracks currently served by track J would remain in service (including tracks 101-113) and would still be served by throat tracks C and F. While this should provide sufficient capacity to preserve Metro-North service during normal operations, Metro-North's ability to recover from operational incidences would be seriously affected by the loss of Track J.

In addition, track outages would be required on tracks F, G, H, and I to permit the construction of tunnel support structures below. Tracks F and G would have to be taken out of service continuously for 3 months each. Tracks H and I would have to be taken out of service during off-peak hours and weekends for a longer period of time, as discussed below. In addition, while each of those tracks is out of service, an adjacent track would also have to be taken out of service for between five and eight weekends, depending on the particular track outage location.

On the throat tracks serving the lower level, tracks F and J would not be taken out of service out at the same time. This is important because service to the lower level of GCT is provided by only three tracks—tracks B, F and J—and Metro-North could not operate its weekday service with only a single track to the lower level. To avoid taking tracks F and J out of service at the same time, the work near track F would have to either precede the track J outage requirement or occur only during the weekend when no service to the lower level of GCT is provided. If track F is out of service only on weekends, the work nearby would take approximately 30 weekends (or 8 months) to complete. Outages on track B would not be required.

On the throat tracks serving the upper level, Track G would be taken out of service continuously for a period of 3 months without adversely affecting Metro-North's operations to the upper level of GCT. To avoid significant adverse impacts to Metro-North's operations that could occur if tracks H and I were out of service at the same time, these tracks would only be taken out of service one at a time and during off-peak hours and weekends. This off-peak and weekend work would require a combined total of approximately 1 year to complete. (Simultaneous track outages on track H and I would prevent access to certain "ladder" tracks, thereby adversely affecting service to west side platforms 34 to 42.)

Some additional track outages for throat tracks serving GCT's upper-level would be required for utility relocations and related work. Specifically, track outages would be required on track C for 1 month, and tracks D and E for subsequent periods of 3 months each. The track outage on track C would adversely affect train movements from "ladder" tracks M and O, which connect to upper-level platforms and tracks.

In summary, during the peak period, up to two tracks would be out of service continuously and at the same time: track J serving the lower level of GCT, and either track C, D, E, or G serving the upper level of GCT. During off-peak hours and weekends, up to three tracks would be out of service at one time. Tracks H and I would be taken out of service only during off-peak hours and weekends and track F would be taken out of service only during the weekends.

While the construction activities associated with the Preferred Alternative's Option 1 would be performed without reducing Metro-North's planned future service levels, they would nevertheless result in temporary adverse impacts on MNR service. Schedule resiliency, or the ability of the system to absorb delay, and the recoverability of the railroad in the event of equipment failure or another operational incident would be adversely affected for as long as the track outages are required. As a result, MNR's on-time performance would be expected to deteriorate. In addition, the ability of MNR to perform routine track work and infrastructure maintenance without requiring service changes or reductions would be adversely affected.

Measures to minimize prolonged disruptions to Metro-North service resulting from the track outage requirements of Option 1 would include reducing the number of tracks taken out of service during peak periods and sequencing track outages to maximize the efficient completion of construction tasks. Different track outage plans would be developed to reduce the potential to cause MNR service disruptions, while maximizing the number of working hours to shorten the

construction period. The optimum solution would be determined with the help of a simulation model to test the effects of delays and equipment failures under a variety of track outage schemes.

Metro-North Tracks in GCT. Option 1 would require the removal of MNR's revenue tracks 114, 115, and 116 as well as storage tracks 117 to 125. However, before construction activities can begin in this area, storage capacity in MNR's East Yard, on the lower level of GCT, would be restored. Once these tracks are available for MNR use, the lower-level terminal area west of track 113 would be available for construction of the Preferred Alternative.

After providing replacement space for MNR trains, one of the first steps in the construction process for the lower level would involve the relocation, underpinning, or removal of existing structural columns as well as the relocation of track 113. This work would affect MNR operations on the upper level. The general sequence of work, which would proceed in a westerly direction, would be to take two MNR tracks and the island platform on the upper level out of service while the structural reframing on the lower level proceeds. The general sequence would be to perform the construction in three stages. Stage 1 would involve upper-level tracks 32 and 33 and platform P; Stage 2 would involve tracks 34 and 35 and platform Q; and Stage 3 would involve tracks 36 and 37 and platform R.

Each stage would take approximately 6 months. To minimize the overall impacts on MNR operations, the reconstruction of platform P for the off-street entrance at 45th Street as well as the new stair to the 47th Street cross passageway would be constructed concurrently. The 47th Street cross passageway would remain in service, but the stair leading to the upper-level platform would be taken out of service.

In addition, work on the off-street entrance proposed at 245 Park Avenue would also affect the existing 47th Street cross passage. Specifically, the eastern end of the cross passage (which does not currently lead to an exit) would be closed. This work could also require closure to platform E and adjacent tracks 11 and 13 for 6 to 12 months.

The relocation of columns on the lower level would require taking out of service tracks 38 to 42 and platforms S, T, and U at various times. No more than two tracks would be taken out of service at any given time. Track 38 to 39 and platform S would be taken out of service for a 6-month period, continuously and concurrently with the work rebuilding the upper-level track structure for the cross passageways. Next, tracks 39 and 40 and platform T would be taken out of service continuously for another 6 months. Finally, tracks 41 and 42 and platform U would be taken out of service continuously for a period of approximately 8 months.

The activities associated with the underpinning of Metro-North columns in GCT under Option 1 would be performed without reducing MNR's planned future service levels. However, they would nevertheless adversely impact MNR service in the areas of schedule resiliency and the recoverability.

Upper-Level Loop Track in GCT. During construction of the new lower level-loop track under Option 1, one of MNR's upper-level storage tracks (track 3) would be taken out of service. This would occur after alternative storage space is created for MNR at the lower-level East Yard and therefore this service outage would not have an adverse impact on MNR's operations.

Effects on Metro-North Railroad—Option 2

Because Option 2's tunnels, tracks, and platforms would be deeper than under Option 1, Option 2 would not require the soil stabilization and underpinning work beneath and around Metro-North's tracks. Consequently, Option 2 would eliminate the extensive disruptions to MNR that are required under Option 1.

Metro-North Tracks from 52nd to 56th Street. Construction of Option 2 would not require any changes in MNR service in this vicinity.

Metro-North Tracks in GCT. The work for Option 2 in GCT would be less extensive than what is required for Option 1 and would not require relocating, underpinning or removing existing structural columns, or relocating track 113. To avoid underpinning MNR columns, ventilation and vertical circulation shafts would be excavated between existing columns. Most of the work in the lower level of GCT would involve removing existing tracks and constructing a concrete platform to form the mezzanine. However, in order to construct the 48th Street entrance, MNR's work train tracks 94 and 95 would need to be shortened.

However, work on the off-street entrance proposed at 245 Park Avenue would affect the existing 47th Street cross passage. Specifically, the eastern end of the cross passage (which does not currently lead to an exit) would be closed. This work could also require closure to platform E and adjacent tracks 11 and 13 for 6 to 12 months.

Effects on LIRR Service

Some of the construction work at Harold Interlocking is likely to require the rerouting of some LIRR trains, either within the track complex at the interlocking itself or elsewhere. Specific service plans would be developed in conjunction with the formulation of construction staging plans. A chief objective of the construction staging plans would be to minimize dislocations to LIRR service.

The LIRR successfully managed service adjustments during a major capital project that rebuilt much of Harold Interlocking several years ago. The same kind of planning would be employed to accommodate construction for the Preferred Alternative of East Side Access.

Effects on Amtrak and NJ Transit

The work on Harold Interlocking would be staged so it would not adversely affect Amtrak's operations through the interlocking. As described earlier, the work would be performed in five stages. The first stage would be to construct new tracks to detour train traffic around work areas, and the second stage would reroute trains onto those temporary tracks. Then, once the improvements at Harold Interlocking are completed, Amtrak trains would be relocated to those new tracks.

Currently, neither NJ Transit nor Amtrak are required to go through Harold Interlocking to access storage tracks at Sunnyside Yard. Construction in the vicinity of the yard would be staged so that all operations at the yard could continue undiminished. Access by NJ Transit and Amtrak to Sunnyside Yard via a minimum of two loop tracks would be maintained during construction of the tunnels under the yard and during work at Harold Interlocking. *If freight trains are used to transport materials during construction, the approximately two 20-car freight trains per day that would carry supplies into and spoil out of construction areas would pass through*

Yard A and use the Montauk Branch during off-peak hours. These trains would not travel through Amtrak's property at Sunnyside Yard.

Since the approach structures at the east end of the bored tunnels at Harold Interlocking are proposed for construction subsequent to bored tunnel construction, materials and equipment could be delivered to these work areas directly from Yard A through the tunnels, greatly reducing the need for surface vehicles to operate through Sunnyside Yard. Access points for work in the vicinity of Harold Interlocking would include the GM property at 43rd Street (south of the interlocking) and the access road from the 39th Street Bridge (north of the interlocking). These access points to construction areas would not directly impact any of Amtrak's maintenance and operations facilities within Sunnyside Yard.

Some structural work, as well as catenary and track relocations, signalization and other systems upgrades in the vicinity of Harold Interlocking, would require work to be performed from work trains. As a result, these operations would require the use of tracks in Harold Interlocking. Extensive coordination between the LIRR, Amtrak, project designers and contractors during final design and construction would establish schedules and allowable work hours for each construction operation at every work location.

While cut-and-cover work is occurring in Yard A, a temporary track would be provided to Amtrak to facilitate access to their new high-speed rail service and inspection (S&I) shop. While the location of this track may shift during the course of Yard A work, *construction would be phased so that* Amtrak would have continuous access to the S&I shop. In addition, the temporary relocation of track for Amtrak access of Sunnyside Yard from the Hell Gate line would be provided throughout the construction period. *The construction plan at Sunnyside calls for the TBM launch wall to be located within Yard A, north of existing Amtrak buildings and Amtrak storage tracks in Sunnyside Yard. As such, East Side Access would not affect body tracks 1 and 2 or outbound motor and north runner tracks at Sunnyside Yard during construction.*

SUBWAYS

Manhattan

In Manhattan, a number of subway lines cross or come in close proximity to the alignment of the Preferred Alternative. As described earlier, the Option 1 alignment would be close to several subway lines and therefore may require support structures for those tunnels. The Option 1 alignment would pass both above and below the E and F subway lines at 53rd Street, below the N and R lines at 60th Street, and below the 4, 5, and 6 lines at Lexington Avenue near 61st Street. The Option 2 alignment would pass well below (more than 25 feet) all of those subway lines in Manhattan. Both options would connect to the lower level of the existing 63rd Street Tunnel at Second Avenue, just below the subway lines that use the upper level of the tunnel. The specific effects on subway lines in Manhattan of construction of the two different options are described below.

Option 1. In Option 1, support for the subway lines may be required. The installation of the support system would require outages during off-peak hours. In addition, the alignment would require the reconstruction of the NYCT 53rd Street ventilation facility. Outages to the E and F train in off-peak hours may be required to construct the vent plant. In this and other areas where

the alignment comes within 200 feet of an existing subway line, the following measures would be taken:

- A control survey of the existing tunnel's horizontal and vertical alignment would be conducted prior to the start of construction; and
- Instrumentation would monitor the subway tunnel for settlement and vibration, as required.

Option 2. As noted above, Option 2 would be located well below the subway lines in Manhattan. No impact on NYCT operations is expected under Option 2.

63rd Street Tunnel

Rehabilitation of the 63rd Street Tunnel to prepare it for East Side Access use may require access to active subway tracks on the upper level of the tunnel. Should this be necessary, work would be staged during nights and weekends, to minimize impacts to subway operations.

During construction design, subsoil conditions, effects of construction dewatering, settlement prevention and mitigation for existing tunnels, and other environmental considerations will be evaluated in depth.

Queens

As described earlier, the alignment for the Preferred Alternative in Queens crosses under both underground and elevated subway lines as it passes beneath Northern Boulevard. Specifically, the G and R (local service) and E and F (express service) lines run beneath Northern Boulevard and the N (local service) line runs above on a viaduct. All these trains stop at Queens Plaza, just south of the area that would be affected by the project's construction work.

The operations of these subway lines under and over Northern Boulevard would be temporarily affected by construction of the Preferred Alternative. Disruptions would occur during underpinning and construction of the bathtub's jet grout walls and piles along the alignment, in the area just north of Queens Plaza. Service disruptions would be expected on the G, R, E, and F trains between Queens Plaza and Roosevelt Avenue express stops during nights and weekends only.

Four tracks, two in each direction, currently serve both express (E and F) trains and local (G and R) trains between Queens Plaza and Roosevelt Avenue. Over an approximately 3-month period, for the installation of the jet grout walls, up to two tracks would need to be taken out of service during weekday nights (between 11 PM and 5 AM) and on weekends (from 11 PM Friday to 5 AM Monday). The 3-month time period allotted for this work assumes that track outages would be allowed every weekend without interruption. Following the installation of the jet grout walls, the bathtub cut-off walls would be constructed. No track outages would be required for this work, which would take approximately 6 months to complete. The installation of the piles to support the NYCT subway structure would follow the construction of the bathtub. Again, up to two tracks would be taken out of service during weekday nights and on weekends for approximately 2 months.

Train reroutings and their effects on NYCT customers would be as follows:

- Westbound local service would be rerouted to the express tracks, and eastbound express service would be rerouted to the local tracks. During this period, since no westbound local service would be provided between Roosevelt Avenue and Queens Boulevard, customers wanting to get off at 36th Street, Steinway Street, 46th Street, Northern Boulevard, or 65th

Street would bypass their local stop, detrain at Queens Plaza, and backtrack on the eastbound local to their destination. Customers at those local stops wanting to board a westbound train would have to take the eastbound local to Roosevelt Avenue where they would connect with the westbound express. Travel between the local stops would require two transfers.

- Later, the eastbound local service would be rerouted to the express tracks and the westbound express service would be rerouted to the local tracks. The same service disruption as described above would occur, in the reverse direction of travel.

STREET DISRUPTIONS: VEHICULAR TRAFFIC, PARKING, AND PEDESTRIANS

Construction of the Preferred Alternative would require closing sidewalks and vehicular traffic lanes, in some cases for short durations and in other cases for longer, and could cause changes to vehicular traffic patterns in the vicinity of traffic lane closures. Disruptions in Manhattan would be much more extensive under Option 1 than Option 2, as described below. *To minimize any potential impacts of construction activities on traffic, Maintenance and Protection of Traffic Plans (MPTs) would be developed and implemented. At all times, at least one moving travel lane would be maintained on each affected street. On streets where lane closures would be necessary, on-street parking would be prohibited and parking regulations would be changed to "No Standing Anytime" to ensure continued vehicular flow. Access to loading areas and driveways would be maintained during construction.* As most Midtown Manhattan streets typically have one effective moving travel lane, with curbs typically occupied by delivery vehicles, taxis, and parked cars, this would not significantly change traffic conditions in Midtown.

Manhattan—Option 1

In Manhattan, for Option 1, portions of the street and sidewalk would need to be closed for the cut-and-cover work on 52nd, 53rd, and 54th Streets (for underpinning work done at 370, 390, 400, and 410 Park Avenue; for tunnel access; for ventilation plant utility relocations; and for ventilation plant construction), at 44th through 48th Streets (for construction of new LIRR entrances and passageways to GCT), and at 51st Street (for construction of a substation).

52nd Street. For underpinning work at the Racquet & Tennis Club, the sidewalk and the curb lane along one side of 52nd Street at a time would need to be closed for about 2 years. Specifically, during removal of the north wall of GCT (on the south side of 52nd Street), the south sidewalk and curb lane would be closed, while during underpinning work at the Racquet & Tennis Club (north of 52nd Street), the north sidewalk and curb lane would be closed. The sidewalk closure would extend for about 60 feet west of Park Avenue; the curb lane closure would extend for about 150 feet to accommodate cranes and other construction work zone material as well as a temporary walkway around the construction zone for pedestrians.

The middle lane of 52nd Street would also be used intermittently by delivery vehicles loading and unloading materials at the construction zone. It is anticipated that the use of this middle lane (i.e., the travel lane) by construction-related vehicles could be restricted to off-peak hours. Therefore, to avoid effectively closing the street, parking would need to be prohibited along both curbs during working periods for about 150 feet west of Park Avenue.

No parking regulation changes are required on the north curb since parking regulations are currently "No Standing Anytime." However, to mitigate potential traffic impacts during construc-

tion, parking regulations on the south curb would need to change from "No Standing Except Trucks Loading and Unloading, 7 AM to 7 PM, Except Sunday," to "No Standing Anytime." In addition, deliveries would be precluded on that side of 52nd Street. Approximately seven curb parking spaces would be lost. However, access would still need to be maintained to the one truck loading bay at 40 East 52nd Street (south side of the street).

53rd Street. For underpinning work at the Racquet & Tennis Club and Lever House, and for reconstruction of the NYCT ventilation facility under the street, the sidewalk and the curb lane along one side of 53rd Street at a time would need to be closed for about 4 years total. Specifically, during underpinning work at the Racquet & Tennis Club (south of 52nd Street), the south sidewalk and curb lane would be closed, while during underpinning work at Lever House (north of 52nd Street), the north sidewalk and curb lane would be closed. During subsequent reconstruction of the NYCT ventilation facility, either the north or the south sidewalk and curb lane may be closed. The sidewalk closure would extend for about 60 feet west of Park Avenue; the curb lane closures would extend for about 150 feet, including provision for a temporary pedestrian walkway around the construction zone. In addition, during the same time period, ventilation plant reconstruction would necessitate lane closures along 53rd Street for a distance of approximately 160 feet. One roadway lane would be closed full-time during excavation and construction, which would necessitate prohibiting parking along one curb lane.

The middle lane of 53rd Street would also be used intermittently by construction-related delivery vehicles, although these activities would be restricted to off-peak hours. Since usage of the one remaining lane on 53rd Street by construction vehicles would completely close the street to through traffic, mitigating measures would be needed to direct traffic to alternate routes during those off-peak periods. A traffic enforcement agent or flagman would be positioned at the intersection of Park Avenue and 53rd Street and direct westbound traffic approaching the intersection to either divert northward or southward on Park Avenue and then use either 55th Street or 51st Street to complete their trip crosstown. Advance signage of this condition would be needed. This would increase traffic volumes and traffic delays on the affected streets, and would pose a significant problem to traffic destined to addresses on 53rd Street between Park and Madison Avenues, since direct access would no longer be possible during periods when truck deliveries block the middle lane. Provision would need to be made for traffic with destinations on that block to get to their destination. A possible strategy involves prohibiting curbside parking along the entire block, and to allow traffic destined to the block to enter from Madison Avenue, effectively providing two-way travel between Madison Avenue and the construction zone. This, however, could pose a serious conflict when a construction vehicle was not blocking the middle lane, and westbound through traffic driving on the block would confront two-way traffic midblock. A detailed plan to accommodate this condition safely would be developed.

Current parking regulations on the north curb are "No Standing 7 AM to 7 PM Except Sunday;" the south curb is signed "No Standing Except Trucks Loading and Unloading, 7 AM to 7 PM, Except Sunday." Both curbs would need to be signed "No Standing Anytime" at their east ends. There are also three midblock truck bays for Park Avenue Plaza and a side alley, which would require that access is maintained. Five curb parking spaces would be lost on each side of the street.

54th Street. For underpinning work at Lever House and 400 Park Avenue, one side of the street at a time would need to be closed for approximately 3 consecutive years. On the south curb, this work would last for about 1 year; along the north curb, it would last for about 2 years. The same types of impacts described above for 53rd Street would occur along 54th Street, with a need to

maintain access to buildings on the block between Park and Madison Avenues at times when both curb lanes are used for construction work zones and the middle lane of 54th Street is being used for delivery vehicle activity. As described above for 53rd Street, additional construction work would also be needed along 54th Street for ventilation plant construction, subsequent to underpinning work in the vicinity. This would last approximately 1 additional year past the underpinning work, for a total of 4 years.

Current parking regulations on the north curb are "No Standing Except Trucks Loading and Unloading, 7 AM to 7 PM, Except Sunday;" the south curb is signed "No Standing 7 AM to 7 PM, Except Sunday." There are two parking garages and one set of truck docks along the south curb, possibly just beyond the construction zone; access would need to be maintained to these facilities. One garage—the 200-space facility serving Lever House (390 Park Avenue)—would be closed.

Construction of the new ventilation facilities would require lane closures along 54th Street for a distance of about 300 feet west of Park Avenue and 200 feet east of Park Avenue. One roadway lane would be closed at a time during decking installation, with work done at night, for 4 months. After that initial 4-month period, one lane would be closed full-time during structure excavation and construction, which would necessitate prohibiting parking along one curb lane. About 13 curb spaces would be lost on the north side of the street and 10 spaces on the south side of the street west of Park Avenue at times when "No Standing Anytime" regulations would be in effect to provide required traffic capacity; east of Park Avenue, 8 spaces would be lost along the north curb and 9 spaces would be lost on the south curb.

44th Street. There would be a significant amount of excavation work related to construction of the new ventilation building at 47 East 44th Street. Prior to the construction of the ventilation building, the site could be used as a contractor staging area. The north curb lane would be taken out of use for about 1½ years, while the middle lane would be used intermittently by delivery vehicles. The street itself would be decked over from the north curb line to the south building line to more easily accommodate the construction. Street and sidewalk impacts would be similar to those described above for 52nd, 53rd, and 54th Streets, but for just a 30-foot section of 44th Street, and over a period of about 1½ years. One curb parking space would be lost.

There is one parking garage, one building freight elevator, and a Federal Express delivery office on this block. Current parking regulations on the north curb are "No Standing Anytime," which would have to be maintained during the construction period. The south curb has "No Standing Except Trucks Loading and Unloading, 7 AM to 7 PM, Except Sunday." This regulation would have to be changed to "No Standing Anytime" to ensure that at least one travel lane exists along 44th Street during delivery of material.

45th Street. Construction work would occur along the south side of 45th Street, east of Vanderbilt Avenue, associated with construction of a new entrance to the LIRR. This work would extend approximately 100 feet west of Vanderbilt Avenue for about 1½ years.

The north curb is frequently used by taxi pickups and dropoffs to the Roosevelt Hotel's front door, which has "No Standing, Hotel Loading" regulations. The south curb has an existing GCT entryway leading to the Roosevelt Passage and one building freight elevator. Current parking regulations on the south curb are "No Standing Except Trucks Loading and Unloading, 7 AM to 7 PM, Except Sunday." This regulation would be changed to "No Standing Anytime" to ensure that construction vehicles can be accommodated along the curb, maintaining one lane for travel; five curb spaces would be lost.

47th Street. There would be some localized construction effects along 47th Street just west of Lexington Avenue associated with the construction of a new entrance to GCT's existing 47th Street cross passage. This would include a possible closure of the sidewalk on the south side of the street near Lexington Avenue for less than 1 year. There are no delivery truck docks on this section of 47th Street. Enforcement of the existing "No Standing 7 AM to 7 PM, Except Sunday" regulations would ensure that any delivery activity to the construction area would be accommodated out of the middle travel lane.

48th Street. One curb lane of 48th Street between Park and Madison Avenues would be used for construction activities for two new entrances to GCT for about 1 year. This block currently has midblock pedestrian cut-through walkways and several building delivery docks on either side and one emergency fire access entryway into GCT along the south side. Access would have to be maintained to these facilities. The north and south curbs do allow for curb deliveries with "No Standing Except Trucks Loading and Unloading, 7 AM to 7 PM, Except Sunday" regulations, although closer to Madison Avenue, no standing rules are posted along the north curb. These rules which would be changed to "No Standing Anytime" to ensure that at least one travel lane is maintained. About 18 curb spaces would be lost on the north side of the street and 14 spaces would be lost on the south side, depending on which side of the street would have its curb lane eliminated.

51st Street. To construct a portion of the underground substation between 51st and 52nd Streets, one of the sidewalks on 51st Street would be closed for a period of 15 months or less.

Effects of Construction on Parking. Construction activities would displace on-street parking on streets where cut-and-cover construction is under way, and the 200-space off-street parking garage beneath Lever House. Regarding on-street parking, during the daytime the affected curb lanes are limited to use by delivery vehicles. At night, the curb lanes are available for parking. Delivery vehicles would either still use the particular side street closest to their destination, since some curb space would be maintained, or they would temporarily park along Park Avenue so that deliveries could be rolled down the sidewalk. For the overnight parking displaced by nighttime construction activities, parking would remain available on other streets in the area, particularly since traffic volumes and overall demands for parking decrease significantly at night.

The second parking issue would be the closure of the 200-space private parking garage beneath Lever House at 390 Park Avenue. The EIS prepared for the Bear Stearns project now being constructed at 383 Madison Avenue presented midday parking utilizations in this area of Midtown, with the key finding that, overall, off-street parking garages in the area are utilized at 70 percent, with 30 percent of the area's off-street parking capacity available. Moreover, between 52nd and 54th Streets from Third Avenue to the Avenue of the Americas, six off-street garages have a combined capacity of 1,000 spaces, with approximately 400 spaces typically not in use. Thus, it appears that the 200 displaced parkers could easily shift to other nearby garages.

Manhattan—Option 2

As described earlier, Option 1 would eliminate the need for extensive cut-and-cover work, and associated disruptions, in Manhattan. This is one of the primary reasons that Option 2 is the preferred option for construction in Manhattan. Option 2 would require a ventilation plant at 55th Street, which would be built mostly from the mined tunnels below but which would require some cut-and-cover construction work at street level. Between 44th and 48th Streets, Option 2

would require construction similar to that for the new entrances in Option 1. Option 2 would also require some street-level work for an underground substation between 51st and 52nd Streets.

55th Street. The work required on 55th Street for Option 2 would be disruptive and could affect traffic movement and parking. However, this work would be much less intrusive than the work described above for 52nd, 53rd, or 54th Streets, since construction work on the new ventilation plant would occur beneath the street, accessed from the newly mined tunnels approximately 120 feet below Park Avenue. Limited disruption at the surface would occur for about 8 months to allow construction of a shaft to the street from the new facility.

49th Street to 52nd Street. Construction of underground ventilation plants and substations from 49th to 52nd Street would require intermittent closures of portions of one sidewalk and curb lane on one or more of these streets for less than 15 months at each site.

Effects of Construction on Parking. Option 2 would displace a smaller number of on-street parking spaces than Option 1 and it would not displace any off-street parking spaces. Therefore, it would not result in any significant adverse impacts to parking during construction.

Roosevelt Island

A limited amount of truck activity would occur on Roosevelt Island during construction of the new substation, to transport soil off of the island. Total construction time at this location would be approximately 1 year.

Sunnyside/Long Island City

In general, construction activities in the Sunnyside/Yard A area would not result in significant traffic impacts since much of the work would be performed in existing rail yards with substantial room for construction staging and material storage. In addition, similar to the Manhattan alignment, much of the usual trucking activity could be avoided through the use of the existing rail infrastructure for the delivery of equipment and material. Some localized issues related to traffic are discussed below.

Construction of the new tunnels underneath Northern Boulevard would involve some cut-and-cover work, as described earlier. In general, one roadway lane would be taken for construction purposes at a time, although two lanes would be used during initial excavation and during final restoration of the roadway. *Disruption of traffic would be minimized at Northern Boulevard by limiting construction activities to nighttime hours when practical and covering excavated areas to maintain traffic flow at street level while underpinning is under way. Similarly, any lane closures associated with work on the Sunnyside station would occur only during off-peak hours, during weekends, or at night. To the maximum extent possible, the existing rail infrastructure would be used to transport materials to and from the various construction sites.*

In the event that rail is not used to transport the Manhattan and Queens tunnel spoil from the stockpile site in Yard A, as well as for the delivery of construction material (e.g. concrete tunnel liners, steel, rail, etc.) truck traffic along Northern Boulevard between 41st Avenue and 42nd Place leading to the Superior Reed site (the major access point to Yard A) would present a potential for increased traffic congestion during the AM and PM peak traffic periods. It is expected that the worst traffic effects along Northern Boulevard would occur between 2005 and 2007 when construction of both the Manhattan and Queens

tunnels is under way. To minimize any potential impacts, a Maintenance and Protection of Traffic Plan (MPT) would be developed and implemented for Northern Boulevard between 42nd Place and 41st Avenue. Measures to minimize the effects of construction traffic would include standard temporary traffic engineering solutions such as on-street parking limitations, lane restripings, dedicated turn lanes, and traffic control personnel.

Construction activity within Sunnyside Yard may have impacts on one or more of the bridges passing over the yards. There may be a need to lower material from the 39th Street bridge to certain tracks. This activity would occur at night, with one of the bridge's lanes used for such activities. There may also be short-term outages on the 43rd and 48th Street rail bridges to lift steel girders into the construction zone. Besides these outages during steel erection, there would be no disruption to vehicular or pedestrian circulation during construction. The contractor would provide a minimum of 5 feet of pedestrian access on both walkways, and vehicular travel lanes in both directions. Parking under the structures during construction would be suspended.

For the replacement of the Thomson Avenue bridge pier, construction access would be provided from the level of existing tracks. A maximum of one vehicular lane would be closed during off-hours to modify the bridge's expansion joints. This pier replacement would not effect pedestrian movements.

The Honeywell Street bridge is currently closed to both vehicular and pedestrian traffic. Should it be opened prior to construction for the Preferred Alternative, such construction would not preclude vehicular or pedestrian traffic across the bridge. Construction on both the Honeywell Street bridge and the Queens Boulevard bridge (discussed above) would be coordinated with the New York City Department of Transportation's (NYCDOT) programs for rehabilitating these structures.

A portion of a parking lot serving the GM facility west of 43rd Street might be temporarily acquired for use as a staging area during construction. This would displace approximately 28 parking spaces for the 2-year duration of construction. The GM facility has adequate remaining parking spaces.

Construction of the new Sunnyside station (to occur after the construction in the vicinity of Northern Boulevard is complete) would require some temporary closures of one of two curb lanes on the Queens Boulevard bridge. While the construction staging for this element of the project would be within Sunnyside Yard with a main access point from Skillman Avenue, some portions of the construction process may require delivery of materials from the Queens Boulevard bridge. In addition, to the extent feasible, material and equipment would also be brought to the site via rail to a new spur track. However, temporary closures to a lane on the bridge during off-peak periods could probably not be avoided. Because of the importance of this arterial and the level of traffic using Queens Boulevard throughout most of the day, closures would be based on approval from NYCDOT, and may only occur during the weekend or at night. It is also expected that the one sidewalk would be closed during these times. Since this work would most likely occur at night, it is expected that the one remaining sidewalk could accommodate the pedestrian activity at that time. This is expected to last for 1½ years.

Installation of new fencing along the sidewalks of Queens Boulevard might require temporary closure of sidewalks on either side of the bridge. The construction of a new passenger drop-off area on the north side of Skillman Avenue would require temporary closure of the sidewalk and potentially, temporary closure of one westbound lane. Skillman Avenue in this area has one

travel lane in each direction and curb parking just along its north curb, so some on-street parking spaces would be lost.

Replacement Yards

It is not expected that the construction activities at Blissville, Maspeth, Fresh Pond, or Highbridge would result in any significant adverse traffic effects on transportation. Blissville, Maspeth, and Fresh Pond Yards would require a limited amount of work that would not require a significant number of truck trips or any disruptions to local streets. The work at Highbridge Yard would be isolated from the surrounding area, and trucks could access the yard easily from the nearby Major Deegan Expressway.

Long Island Storage Yards

It is not expected that the activities related to construction of new LIRR yards on Long Island would result in any significant adverse traffic effects. The work at these yards would be of limited scope and duration, and the number of truck trips or employee trips would not be significant.

AIR QUALITY

Possible effects on local air quality during construction of the Preferred Alternative may result from fugitive dust (particulate) emissions from construction of the surface track work, cut-and-cover sections, and, to a lesser extent, tunnel excavation. Air quality may also be affected by mobile source emissions—including PM_{10}, VOCs, NO_x, and CO emissions—from construction workers' private vehicles, disruptions in traffic due to construction, additional truck traffic, and construction equipment at the locations undergoing construction. It is expected that the any potential effects on air quality during construction would be temporary and of a relatively short duration.

FUGITIVE EMISSIONS

Fugitive dust emissions from construction operations can occur from excavation, hauling, dumping, spreading, grading, compaction, wind erosion, and traffic over unpaved areas. Actual quantities of emissions depend on the extent and nature of the clearing operations, type of equipment employed, physical characteristics of the underlying soil, speed at which construction vehicles are operated, and type of fugitive dust control methods employed. The U.S. Environmental Protection Agency (EPA) has suggested, in general, an overall emission rate of about 1.2 tons of particulates per acre per month of active construction from all phases of land clearing operations with no fugitive dust control measures. However, this is a national estimate and actual emissions vary widely depending on many factors, including the intensity and type of land clearing operations. Much of the fugitive dust generated by construction activities consists of relatively large particles, which are expected to settle within a short distance from the construction site. For this project, excavation and construction would be conducted with care and all appropriate fugitive dust control measures—including watering of exposed areas and dust covers for trucks—would be employed to minimize effects to nearby people or buildings.

Since much of the tunnel excavation work would not involve surface disturbance, many of the fugitive dust sources typically associated with construction work could be avoided. Excavated material would be transported through the existing 63rd Street Tunnel to the staging area at Northern Boulevard in Queens. The most likely transport method would be a conveyor system. While it is expected that large quantities of dust or blast fumes would be generated by the tunnel

excavation, dust would be controlled at the source through the use of foams or other wetting agents. The work area within the tunnel would also be equipped with a mechanical ventilation system. This ventilation system, consisting of flexible ductwork and fans, would be equipped with air pollution control and noise attenuation equipment at its exhaust point, most likely in the staging yard north of Northern Boulevard.

MOBILE SOURCE EMISSIONS

Creation of Tunnels and Underground Spaces

As discussed previously, the creation of tunnels and other underground spaces for the Preferred Alternative would result in a large volume of excavated material that would either be transported to an off-site location or reused on site. Preferably, the project would use rail transport to the maximum extent possible to move construction supplies, materials, and excavate, thereby limiting the number of trucks required and the air quality effects typically associated with trucking activity compared to other projects of this size. With the exception of the cut-and-cover work for the Preferred Alternative's ventilation facilities and new entrances, much of the proposed work in Manhattan would be accessed via rail. To the extent feasible, material would be transported to the construction site using MNR facilities and the existing 63rd Street Tunnel, and excavated material would be removed using the same routes. This would eliminate the need to use a large number of trucks in Midtown Manhattan, where traffic congestion is greatest, thereby minimizing the potential for local short-term air quality impacts.

Mobile source emissions may be of concern in two areas. One is on 52nd, 53rd and 54th Street, where construction and underpinning required by Option 1 may result in the partial loss of moving lanes. However, as discussed below, this loss of traffic capacity would not occur for the entire construction period in this area. The other area of concern for mobile source emissions is in the Sunnyside area in Queens, which is the site of extensive construction and of the shaft site for access for the Manhattan tunnels.

According to federal regulations on transportation conformity, CO and PM_{10} microscale (or hot-spot) analyses are not required to consider construction-related activities that cause temporary increases in emissions. (The requirements for quantitative analysis of PM_{10} will not take effect until EPA releases modeling guidance on the subject and announces in the Federal Register that these requirements are in effect.) Temporary increases are defined as those that occur only during the construction phase and last 5 years or less at any individual site. Construction activities generating truck traffic, construction-related work trips, and street or lane closures in Manhattan would occur for less than a 5-year period at any particular site under both options. Under Option 1, construction activities with the potential to affect air quality in Manhattan would not last longer than 4 years at any specific location, and activities would occur intermittently and on different streets. Under Option 2, construction activities with the potential to affect air quality in Manhattan would be less extensive, of shorter duration, and confined to fewer locations as compared to Option 1.

Manhattan. As described earlier, Option 1 would require construction on 52nd, 53rd, and 54th Streets that would last up to 4 years long at any single location. Significant air quality impacts are not anticipated from this work. For the most part, the construction would involve the loss of one or both curb lanes throughout the construction process, but at least one moving lane would be provided for through traffic. Therefore, while parking and access to some sites would be affected, overall traffic flow on the streets would not be significantly worsened. It should be noted

that construction on side streets in Manhattan (with the provision of one moving lane) commonly has no adverse air quality effects, because the volumes of traffic affected are much lower than the volumes required for an exceedance of the National Ambient Air Quality Standards (NAAQS)—even if the traffic is moving slowly. In addition, the capacity and the overall travel speed on the street are actually controlled by the traffic signal at the avenue, unless the travel lanes are completely blocked at some portion of the midblock. Any complete street closings required (to excavate, cover, or deliver materials to the site) would be of short duration and normally during off-peak hours (on weekends or at night).

Queens. For much of the work in Queens, the existing rail network would be used for delivery of materials and removal of construction debris, rock, and soil. Although the final destination for excavated material has not been selected, using rail transport to either that final destination or a location more suited for truck activity (i.e., less densely developed, with better connections to the regional highway system) would minimize or avoid any potential for adverse air quality impacts.

A far less desirable option would be to remove the excavated material via truck. As discussed earlier, in Queens this would generate approximately 124 truck trips per day during peak periods of tunneling work. Trucks carrying spoil would use designated truck routes to local expressways, as shown previously in Figure 17-5. To identify the potential air quality effects resulting from this increased truck activity, as well as worker vehicle trips in and out of the construction areas at Yard A/Sunnyside Yard, a mobile source air quality analysis was conducted. The analysis was performed to address the potential effects on ambient CO concentrations due to these construction activities.

The air quality receptor site for analysis was selected based on examination of the potential travel routes to be used by worker vehicles and construction-related trucks entering and leaving the construction area. The analysis assumed that ⅓ of the total vehicles would travel to or from Brooklyn, Staten Island, and New Jersey; ⅓ to and from eastern Queens and Long Island; and the remaining ⅓ to and from northern Queens and upstate New York. To reach their final destinations, the majority of these vehicles would likely pass through the intersection of Northern Boulevard and 39th Street, and therefore this intersection was selected as the worst-case air quality receptor site for the analysis.

The mobile source analysis was performed for the worst-case year of 2006, for the PM peak period, when approximately 159 trucks and worker vehicles would be expected to enter and leave the construction site area. The methodology used in this analysis is described in Chapter 10, "Air Quality." In the future, the No Action condition includes traffic volumes associated with the Long Island City Rezoning and Queens West Development Projects, both of which may be completed by the analysis year of 2006. The results of the mobile source air quality analysis are presented in Table 17-1, below.

Table 17-1

Maximum Predicted Construction Related 8-Hour Average Carbon Monoxide Concentrations in 2006 (parts per million)

Receptor Site	Location	Time Period	No Action	Preferred Alternative
1	Northern Boulevard/39th Street	PM	5.7	5.8
Note: The 8-hour NAAQS for CO is 9 parts per million.				

As shown in Table 17-1, the maximum predicted 8-hour CO concentration resulting from construction activities at this receptor location is well below the 8-hour NAAQS of 9 parts per million. Therefore, the construction activities as part of the Preferred Alternative would not result in any new violations of National Ambient Air Quality Standards or significant adverse air quality impacts.

Use of Excavating Machines

Since the TBM would be powered electrically using energy provided by Con Edison from existing power plants, direct emissions would not be of concern. In fact, by using a TBM rather than cut-and-cover methods for most of the tunneling work, in conjunction with using rail transport to remove much of the excavated material, pollutant emissions for the Preferred Alternative would be much lower than other projects of this magnitude. *Temporary ventilation of the Queens tunnels would be provided from the TBM launch site in Yard A. Specifically, fresh air would be pumped into the tunnels, which would cause air within the tunnels to circulate back out into Yard A. The air coming from the tunnels would contain the same constituents as the ambient air at Yard A.*

MITIGATION

Excavation and construction would be conducted with care, and all appropriate fugitive dust control measures—including watering of exposed areas and dust covers for trucks—would be employed to minimize effects to nearby people or buildings. The traffic maintenance and protection plans would be designed to minimize, to the extent practicable, the vehicular congestion and associated air quality problems. Finally, to the maximum extent possible, the existing rail infrastructure would be used to transport materials to the various construction sites.

NOISE AND VIBRATION

As for most major projects, construction of the Preferred Alternative would result in increased noise and vibration levels during the construction period. Noise and vibration levels at a given location would depend on the kind and number of pieces of construction equipment being operated, as well as the distance from the construction site. These increases were calculated following the methodology described in Chapter 11, "Noise and Vibration," and are described below. (Chapter 11 also explains the analysis terminology associated with noise and vibration.) As noted in Chapter 11, potential noise and vibration impacts were evaluated using FTA's criteria set forth in its report, *Transit Noise and Vibration Impact Assessment* (April 1995).

NOISE

Typical noise levels of construction equipment expected to be employed during the construction process are presented in Table 17-2. Noise from construction equipment is regulated by EPA noise emission standards. These federal requirements mandate that: 1) certain classifications of construction equipment and motor vehicles meet specified noise emissions standards; and 2) construction material be handled and transported in such a manner as not to create unnecessary noise. These regulations would be carefully followed. In addition, appropriate low-noise emission level equipment would be used and operational procedures implemented. Increases 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 are expected to be found near a few defined delivery truck routes and the streets in the immediate vicinity of local construction

Table 17-2
Typical Noise Emission Levels for Construction Equipment

Equipment Item	Noise Level at 50 Feet (dBA)
Air Compressor	81
Asphalt Spreader (Paver)	89
Asphalt Truck	88
Backhoe	85
Bulldozer	87
Compactor	80
Concrete Plant	83[1]
Concrete Spreader	89
Concrete Mixer	85
Concrete Vibrator	76
Crane (Derrick)	76
Delivery Truck	88
Diamond Saw	90[2]
Dredge	88
Dump Truck	88
Front End Loader	84
Gas-driven Vibro-compactor	76
Hoist	76
Jackhammer (Paving Breaker)	88
Line Drill	98
Motor Crane	83
Pile Driver/Extractor	101
Pump	76
Roller	80
Shovel	82
Truck	88
Tug	85[3]
Vibratory Pile Driver/Extractor	89[4]

Notes:

[1] Wood, E.W. and A.R. Thompson, Sound Level Survey, Concrete Batch Plant: Limerick Generating Station, Bolt Beranek and Newman Inc., Report 2825 Cambridge, MA, May 1974.

[2] New York State Department of Environmental Conservation, Construction Noise Survey, Report No. NC-P2, Albany, NY, April 1974.

[3] Bungener, J.H., Sound Level Survey: Wise's Landing, Kentucky, Bolt Beranek and Newman Inc., Report 2880, Downers Grove, IL, June 1975.

[4] F.B. Foster Company, Foster Vibro Driver/Extractors, Electric Series Brochure, W-925-10-75-5M.

Source: Patterson, W.N., R.A. Ely, and S.M. Swanson, Regulation of Construction Activity Noise, Bolt Beranek and Newman, Inc., Report 2887.

areas. Except for the areas immediately adjacent to the sites, all truck trips would be restricted to truck routes. Specific issues related to each alternative are described below.

The noise associated with the different construction elements for the new tunnels, cut-and-cover construction in Manhattan and in Queens at Northern Boulevard, and work at the various yards in Queens, the Bronx, and Long Island is described below.

Tunneling Activities

In Manhattan, the new tunnels would be constructed using a variety of mining techniques, with such construction equipment as TBMs, jackhammers, line drills, and controlled blasting. Noise from mining activity under either option is not anticipated to be discernible, as most noise would be contained underground. Ground-borne noise is discussed below under "Vibration."

Cut-and-Cover Construction—Manhattan and Queens

The noise from excavation associated with the cut-and-cover construction would include noise from construction equipment such as backhoes, bulldozers, cranes, concrete mixers, concrete delivery trucks, delivery trucks, dump trucks, front-end loaders, pile drivers, and jackhammers.

In Manhattan, limited controlled blasting may also be required in some of the cut-and-cover areas where it is necessary to excavate below the rock level. At these locations, noise produced from blasting operations would be clearly discernible. Blasting operations would not occur on a regular schedule, and would only cause momentary increases in noise levels for the duration of the actual blasting (usually several seconds). In general, average hourly noise levels would be unaffected by blasting noise because of its short duration. However, the rapid and dynamic change in noise levels that result from blasting operations would be clearly discernible and intrusive at nearby residences and businesses. Blasting operations would be temporary, and are not expected to occur for more than a few months, for each localized construction area (i.e., an individual ventilation facility).

A specification would be inserted into construction contracts with regard to blasting operations requiring the contractor to implement a program to minimize noise impacts. Modern blasting techniques—such as timed multiple charges, blastmats, etc.—which tend to lessen the severity of blasting noise levels, would be employed.

At excavation sites in Manhattan, retaining walls would be constructed using drilled piles and lagging. At sites in Queens (such as Northern Boulevard), either drilled soldier piles and lagging, or driven piles would be used. The impulsive noise produced from the hammering of piles or sheet piles into the soil in Queens would produce noise levels that are clearly discernible for distances of approximately 1,500 feet, and may be considered intrusive and annoying. Pile driving/sheet pile driving noise would be temporary, and is expected to occur during the early phases of each construction area.

Traffic diversions to side streets that may occur near construction areas would cause localized increases in noise on affected streets. In addition, the decking materials used as temporary cover for the excavated areas could cause increases in localized noise: in locations where steel plates are used to deck over the construction area, traffic passing over the plates would produce localized increases in noise levels as tires contact the discontinuity between the street surface and steel plates.

Overall, construction noise at sites excavated using cut-and-cover techniques would be intrusive and annoying, especially under Option 1, where work along 52nd, 53rd, and 54th Streets would

take several years. The cut-and-cover work would create intermittent noise at the specific locations where the work is occurring. Under Option 1, the work would last for 4 years in any one location. For Option 2, only 55th Street between Park and Madison Avenues would experience cut-and-cover work for an extended period (2½ years).

Sunnyside Yard/Yard A

While much of the construction work in this area would be noisy, it is not expected to be intrusive to the surrounding neighborhood. The yard complex is surrounded by industrial uses and existing noise levels outside the yards are high, especially along Northern Boulevard with its elevated subway. The cut-and-cover work at Northern Boulevard would be the most noticeable, but considering the existing noise from the elevated subway and the heavy vehicular traffic at Queens Plaza, it is not expected that this work would have significant noise impacts on surrounding uses, which are commercial and industrial.

A construction noise impact assessment was performed at Newcomers High School to quantify worst-case noise levels during the height of construction activities occurring on the proposed Queens staging area near the school. Figure 17-6 shows construction activities that would occur near the school. The assessment included interior and exterior noise monitoring to estimate ambient noise levels without construction activities and to determine the amount of attenuation provided by the walls and windows of the school. Estimates of the equipment to be used on site, utilization rates, and noise reference levels were used to predict worst-case noise levels assuming that the maximum number of construction machinery would be operating simultaneously. The results of the analysis indicate that interior and exterior noise levels could increase by up to 10 dBA (constituting a doubling of loudness) due to project-related construction activities. While this increase would be temporary (the majority of work would occur over a 2½-year period, with minimal activity occurring on the site for another 2½ years), the magnitude of the increase could potentially affect the learning environment in the classrooms facing the staging area on 29th Street. More details about the noise analysis are included in Appendix E.

While a noise barrier would effectively mitigate the noise level increase for first-floor classrooms, it would be relatively ineffective for the upper floors of the school. Mitigation for the upper floors would require other measures, which would include the installation of double-glazed windows or air conditioning units. The MTA/LIRR will work with representatives from Newcomers High School to develop a plan to mitigate the construction-related noise effects.

Harold Interlocking Reconstruction Between 43rd and 48th Streets

In Queens, it is expected that the construction work on Harold Interlocking between 43rd and 48th Streets would result in the greatest noise effects on nearby sensitive receptors. Residential uses exist just across Barnett Avenue, approximately 70 feet from the proposed construction area. The most intrusive activity would involve the placement of piles for the viaduct's foundation and noise from construction equipment. Viaduct piles would be constructed via auger/cast-in-place methods to minimize construction noise. Construction auguring would occur during off-peak, daylight hours, during a 3-month period. While intrusive, most of the noise-intensive activity such as pile-drilling would occur during the day and would be temporary in nature. Furthermore, a noise barrier could be installed along the construction alignment to minimize the noise effect on the adjacent neighborhood.

Replacement Yards

The construction work anticipated at the various yards—Blissville or Maspeth, Fresh Pond, and Highbridge—would not be significant. Most of the construction involves only surface track work with some utility work. Some structures would be constructed, possibly requiring deep foundations. At all locations, existing noise levels are high because of rail and/or highway activity, and surrounding areas are either predominantly industrial or (at Fresh Pond and Highbridge) residential uses are buffered from the construction area.

Long Island Storage Yards

Similarly, the work required at the sites on Long Island selected for nighttime storage yards also would not be significant. The noise from construction activities at those yards would be short-term.

Noise Mitigation Measures

The construction contracts would include specifications related to blasting operations, requiring the contractors to implement a program to minimize noise impacts. Modern blasting techniques—such as timed multiple charges, blastmats, etc.—would be employed to lessen the severity of blasting noise levels.

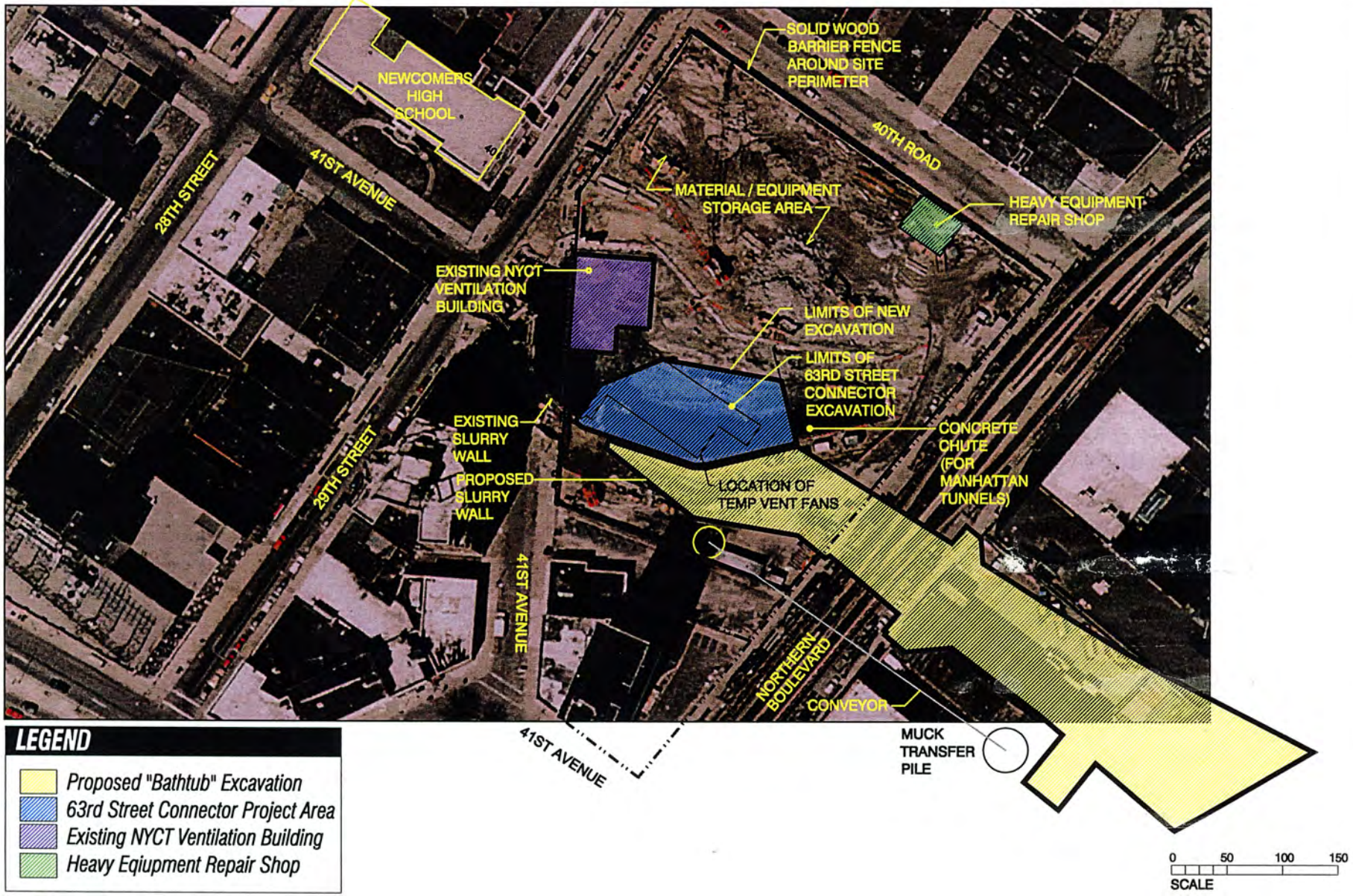
To minimize disruptions at Newcomers High School, adjacent to the construction staging and tunnel access shaft in Long Island City, Queens, MTA would work with representatives from the school to develop a plan to mitigate the construction-related noise effects. Such a plan would include sound-insulating construction fencing and the installation of double-glazed windows or air conditioning units. MTA would continue to coordinate with school representatives throughout the construction period to address problems if they arise.

At the site of cut-and-cover sections in Manhattan and in Queens in the vicinity of Northern Boulevard, as well as near the Harold Interlocking work east of 43rd Street in Queens, noise from construction activities would result in *intrusive* noise *levels* at surrounding receptors. At locations where it is feasible, plywood barriers would be constructed around the excavation of cut-and-cover sections to reduce noise levels. However, these barriers would have limited effectiveness in reducing noise levels from construction activities. In general, such barriers reduce noise at receptors that are shielded from the line of sight of the noise source, but not at those that maintain a line of sight.

There are no cost-effective mitigation techniques that effectively reduce noise from pile driving operations. In certain geological conditions, however, vibratory pile drivers can be used. These produce noise levels that are approximately 7 dBA lower than impact pile drivers.

VIBRATION

Controlled blasting, pile driving, pavement-breaking, TBM, and train operations to remove spoil would create the most noticeable change in vibration levels. The FTA has set vibration-induced architectural damage thresholds at a Peak Particle Velocity (PPV) of 0.20 inches per second (100 VdB) for fragile buildings and 0.12 inches per second (95 VdB) for extremely fragile buildings. "Architectural" damage refers to minor cosmetic cracking. Structural damage can occur at much higher vibration levels. Construction projects typically employ a nominal structural damage criterion of 2 inches per second (126 VdB). Human annoyance vibration criteria are



MTA / LIRR
East Side Access

Figure 17-6

Queens Cut and Cover Tunnels Construction Site Plan - Manhattan Access Shaft

much lower (perception is at approximately 65 VdB; the FTA annoyance-based impact criterion is 72 VdB for frequent events) than structural or architectural damage criteria.

The FTA guidance document provides vibration levels and methods for calculating vibration levels at a specified distance for various pieces of construction equipment. However, the guidance does not address many of the vibration-producing construction techniques that may be employed in this project. Based on the FTA and other sources, vibration source levels were defined for various construction activities and are shown in Table 17-3.

Table 17-3
Typical Vibration Source Levels

Activity	PPV Vibration Levels at 25 feet (in/sec)
Pile Driving/Sheet Pile Driving (Impact)	1.518
Pile Driving/Sheet Pile Driving (Vibratory)	0.734
Pavement Breaking	0.644
Trains to Remove Spoil	0.100
Tunnel Boring Machine (TBM)	0.124
Bulldozing	0.089
Heavy Truck Traffic	0.076
Jackhammers	0.035

Sources:
Wiss, John F. "Construction Vibrations: State-of-the-Art." Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineering Division, Proceedings of the American Society of Civil Engineers, Volume 107, No. GT2, February, 1981.
Standard Recommended Practice for Evaluation of Transportation Related Earthborne Vibrations. ASHTO Designation: R8-81 (1986).
Transit Noise and Vibration Impact Assessment. Federal Transit Administration, U.S. Department of Transportation, April 1995.
Dowding, Charles H. *Construction Vibrations.* Prentice Hall. 1996.
Sauseman, Hugh. "Vibration from Metro Rail Tunneling Operations," LATC. 1993.

The potential for vibration impacts as a result of construction of the Preferred Alternative is described below, and generalized vibration mitigation measures to avoid potential construction-related vibration impacts are identified. A more detailed vibration analysis will be included as part of the final design work, once design details are known. The detailed vibration analysis will account for specific geological conditions, foundation assessment of all structures near vibration-causing construction activities, and the appropriateness of the criteria stated above to each affected building. Finally, the detailed analysis will include specific vibration mitigation measures.

Tunnel Boring Machine(s)

Soil conditions have a strong influence on the levels of ground-borne vibration. Although shallow bedrock tends to transmit vibrations more efficiently, vibration sources in rock tend to result in low amplitudes of vibration levels. The dense bedrock through which the TBMs would tunnel should attenuate vibration levels at the cutting head of the TBMs. Vibration levels at the

foundations of buildings may be perceptible, but should be below the conservative damage threshold of 0.12 inches per second. Ground-borne noise levels resulting from constant operation of the TBMs under either engineering option may produce a perceptible rumbling sound in some nearby buildings for several weeks, as the TBM approaches, passes under, and moves beyond the building.

Trains to Remove Spoil

As described earlier, trains would *most likely* be used to remove spoil or debris from tunneling activities. Data from the Los Angeles County Transportation Commission indicates that these trains can cause perceptible ground-borne vibration in residences within 200 feet, which may be considered intrusive. This vibration is caused by the train wheel/rail interaction and direct contact between the rail and tunnel floor. Vibration from spoil trains would be below the 0.12 inch/second criteria for extremely fragile buildings.

Drill and Controlled Blasting

As described earlier, several project components associated with the Preferred Alternative may require blasting. To avoid vibration-induced damage from any potential blasting operations, monitoring programs and a variety of control measures would be instituted (see vibration mitigation below). Vibration control measures would ensure that vibration levels at the foundations of nearby buildings remain below the architectural (0.20 in./sec for fragile buildings and 0.12 inches/second for extremely fragile historic buildings) and structural damage (nominally 2 inches/second) during blasting operations. Due to their short duration (a few seconds), using cautious blasting techniques, vibrations will be distinctly perceptible at a distance of 200 feet and barely perceptible at 300 feet.

The underpinning of the four office buildings on the west side of Park Avenue and the creation of tunnels beneath them required as part of Option 1 would involve controlled blasting to excavate the rock beneath the existing buildings. For the Lever House and the Racquet & Tennis Club this work would last approximately 6 months, while the work at 400 and 410 Park Avenue would require less time. While the effects would be of very short duration (4-5 seconds a few times a day), they may be disconcerting to some building occupants. At these locations, with primarily daytime uses, all efforts would be made to schedule the blasting during hours of least disruption.

Currently, outreach efforts are focusing on informing building owners and tenants of potential disruptions due to these elements of construction. This outreach will be enhanced during final design of the Preferred Alternative. During construction, public support personnel will be on-site to handle specific issues which may arise.

Cut-and-Cover Construction

At locations where cut-and-cover construction is required, pavement breaking, earthmoving (digging) operations, pile driving, and any potential blasting activity (discussed above) would produce high vibration levels. In areas where buildings are within 80 feet of construction areas, deep saw cuts would be made between areas of pavement breaking and the sidewalk areas in front of buildings. As described earlier, these saw cuts would minimize the transmission of vibrations from pavement-breaking operations to the foundations of nearby structures. With this mitigation, ground-borne vibration levels should be below the criteria at the foundations of nearby buildings. Vibrations from pavement-breaking operations may be annoying at distances of

300 feet from pavement-breaking operations (including basement paving in buildings to be underpinned in Option 1).

Vibration Mitigation Measures

A number of controls would be implemented with respect to mitigation of vibration during construction. A preconstruction survey of any structure likely to be affected by the construction activities would be performed and threshold or limiting values would be established, which take into account each structure's ability to withstand the loads and displacements due to construction vibrations. Detailed construction specifications that impose reasonable acceptance criteria would be included in construction contracts.

A project-wide vibration monitoring program would be developed and implemented to minimize vibration levels from blasting, tunnel boring machine (TBM) operations, and general construction activities at nearby sensitive receptors. A complaint response procedure would be utilized to promptly address community concerns and implement additional control methods where necessary.

Additionally, site-specific vibration control plans would be developed by the contractor and best management practices to limit vibration would be employed. These plans and practices would include the following.

Pavement Breaking. To avoid architectural damage (e.g., cracked plaster) to extremely fragile buildings within 80 feet of the construction work, deep saw cuts would be made between areas of pavement breaking and the sidewalk areas in front of buildings. With this technique, groundborne vibration levels should be below the criteria at the foundations of most buildings and no damage is anticipated. *Additionally, where practical, concrete cutters would be used on pavement surfaces instead of pavement breakers.*

Pile Driving. Pile driving would occur in only a few locations—in Queens at Northern Boulevard, and perhaps in areas of Harold Interlocking work. There are no mitigation techniques that fully reduce vibration from pile driving operations. *However,* in areas where geological conditions permit their use, vibratory pile drivers would be used to reduce the vibrations associated with *the installation of retaining walls and other structural elements.* Unlike noise, the total vibration level produced can be significantly reduced when each vibration source operates separately. In addition, at locations *within 150 feet of fragile historic resources*, additional measures would be employed to keep vibration levels below appropriate damage criteria (see the discussion below).

Drill and Controlled Blasting. The vibration effects from controlled blasting would be intermittent, with blast vibrations occurring for a few seconds at a time. Efforts would be made to minimize potential vibration impacts from blasting operations in all anticipated areas of blasting activity, as described above. A specification would be inserted into construction contracts with regard to blasting operations requiring the contractor to implement a monitoring program and to protect nearby structures from damage, *particularly if situated within 150 feet of drilling activity.*

All blasts would be limited to the U.S. Bureau of Mines Standard for maximum air blast. Borehole size and matrix would be determined on-site by a New York State licensed blaster based on prevailing rock conditions. A licensed blasting contractor would comply with applicable state regulations concerning workplace safety and hazardous materials, under the direction of a

licensed blaster. Each blast would be contained through the use of rubber or steel cable blasting mats, earthen cover, or by utilization of the original overburden to prevent flyrock, all in accordance with New York State Department of Transportation Standard Specifications. Line drilling and smooth-wall techniques would be used to reduce ground vibration. Modern controlled blasting techniques such as timed multiple charges, which lessen the severity of vibration levels, would be implemented. *For blasting within the Amtrak portion of the Sunnyside Yard complex, the project would also follow Amtrak blasting specifications.*

The use of explosives would be limited to labor skilled in their use and all work would be performed under supervision of a licensed blaster. Blasting programs, including the amount and type of explosives and number and type of delays to be used, would be in accordance with all applicable municipal requirements. A daily log would be maintained by the blasting contractor for each blast detonated on each working day. This log would include the date, exact time of firing, number of holes, total poundage used, the distribution of instantaneous and millisecond delay caps, poundage per delay, and location and spacing of drilling holes. The log would be submitted to the project superintendent at the end of each working day.

Vibration levels would be monitored in the foundations of nearby buildings during all blasting activities. Blasting activities resulting in peak particle vibration levels in excess of appropriate damage criteria as measured in the foundations of nearby structures would be immediately stopped until further precautionary measures are taken to reduce blasting-related vibration impacts. Work would not begin again until the steps proposed to stabilize and/or prevent further damage to the designated buildings were approved. In addition, the project, under an OCIP, would carry insurance to cover the expense of restoration caused by any damage that might occur despite this precaution.

Special Provisions For Historic Structures. In addition to the mitigation measures described above, special measures set forth by the New York City Landmarks Preservation Commission would be followed to protect historic resources from increased vibration levels associated with construction activities. At any construction locations where historic resources, and particularly older fragile building, are within an area of potential effect (see Chapter 7, "Historic Resources," for more details), construction contractors would be required to implement special vibration protection measures. These measures, to be included as part of the construction protection program for historic resources (discussed above under "Historic Resources") would likely include the following:

- Inspect and report on the current foundation and structural condition of any historic resources.
- Set up a vibration monitoring program to measure vertical and lateral movement and vibration to the historic structures within *150 feet of* construction activities. Details as to the frequency and duration of the vibration monitoring program would be determined as part of the project's ongoing consultation process with the State Historic Preservation Office.
- Establish and monitor construction methods to limit vibrations to levels that would not cause structural damage to the historic structures, as determined by the condition survey;
- Issue "stop work"orders to the construction contractor, as required, to prevent damage to the structures, based on any vibration levels that exceed the design criteria in lateral or vertical direction. Work would not begin again until the steps proposed to stabilize and/or prevent further damage to the designated buildings were approved.

General Vibration Control Measures. Additional vibration control plans and practices would include routing truck traffic and heavy equipment to avoid impacts to sensitive receptors, properly securing street decking over cut-and-cover excavations, scheduling work to limit nighttime impacts in residential areas, and minimizing the duration of vibration impacts.

ENERGY

The Preferred Alternative would require energy to construct new tunnels, tracks, yards, the terminal in GCT, Sunnyside station, and support systems. The consumption of energy in construction can be estimated by multiplying total lengths of new tracks at-grade, on retained fill, in open cut, or in tunnels, by a per-mile energy consumption factor for each type of track (which includes energy consumed for equipment operation, materials production, and materials transportation). This factor, in British Thermal Units (BTUs), approximates the amount of energy necessary to construct 1 track-foot of typical elevated, surface, or tunnel structure.*

As shown in Table 17-4, the one-time, non-recoverable construction energy expenditure for either option of the Preferred Alternative is estimated at 1.6 trillion BTUs (or 277,000 equivalent barrels of oil [BBL]). However, these one-time, non-recoverable expenditures of energy during construction would be offset by savings in energy expenditures that would result from operation of the Preferred Alternative because of the reduction in vehicle miles traveled that

Table 17-4

Energy Required to Construct the Preferred Alternative*

Type of New Trackage	Length of New Trackage (miles)	Per-Mile BTU Consumption (billions)	Total BTU Consumption (billions)	Total Equivalent BBL Consumption
Tunnels	13.25	99.5	1,319.3	227,459
At-Grade	12.78	12.3	157.1	27,093
On Fill/In Cut	1.89	55.9	105.9	18,254
Elevated	0.47	55.5	26.3	4,527
Total	**28.41**		**1,608.6**	**277,333**
Reduction in Operational Energy Compared with No Action			**(151.0)**	**(26,034)**
Construction Energy Pay-Back Period				**10.7 years**

Note: * Options 1 and 2 would require essentially the same amount of energy to construct.

* Factors are taken from the Congressional Budget Office's December 1977 report: *Urban Transportation and Energy: The Potential Savings of Different Modes*, which is the most current source for roadway energy construction factors. British Thermal Units, or BTUs, are a measure of energy used to compare consumption of energy from different sources, such as gasoline, electricity, etc., taking into consideration how efficiently those sources are converted to energy. One BTU is the quantity of heat required to raise the temperature of one pound of water by one Fahrenheit degree.

would result. After the Preferred Alternative is operational for just over 10½ years, the energy savings accrued by that time would equal the total energy expended during construction. This is the "construction energy payback period."

UTILITIES AND SUBSURFACE STRUCTURES

As described in detail in Chapter 13, "Utilities," some utilities would have to be relocated as part of the construction of the Preferred Alternative. All necessary agreements would be executed with each utility company or governmental agency regarding the temporary or permanent relocation of any utilities, as well as the responsibility for and coordination of the actual work, and method of reimbursement. Overall, utility service would be maintained throughout construction, and no significant impacts would occur.

CONTAMINATED MATERIALS

As discussed in Chapter 14, "Contaminated Materials," construction of the Preferred Alternative has the potential to expose contaminated soil and/or groundwater, as well as asbestos. At areas where surface work (such as laying new track and adding or relocating utilities and signals) would occur, contaminated soils or groundwater could be exposed. In addition, at some project locations, localized pockets of contamination or underground fuel storage tanks or other buried objects such as drums could be encountered during excavating and grading activities at any of the rail yards. Chapter 14 includes a detailed explanation of the areas of concern and specific mitigation measures to be employed during construction of the project. Those measures are summarized below.

Based on the initial sampling effort performed for this EIS, a comprehensive program to sample, analyze, delineate, and quantify contamination within each of the construction areas is under development, and, in one case (Highbridge Yard), nearly complete. Findings Reports will be prepared that document the on-site sampling and analytical efforts at each construction area, and quantify and delineate the contamination found.

Site-specific Construction Contaminant Management Plans (CCMPs) will be prepared for all project areas based on the conclusions in the Findings Reports. Each CCMP will contain a Sampling and Analytical Plan (SAP) to be implemented for contaminated materials that identifies sampling and analytical requirements for materials (soil, groundwater, drums, USTs, and asbestos) encountered during construction (specific to both the cut-and-cover and TBM methods). In addition, the CCMPs will describe the requirements for handling, management, treatment, and disposal of contaminated materials encountered during construction. In the case of groundwater contamination, containment, treatment, and discharge options will be included in the CCMP. All materials leaving the site will require sampling and characterization prior to disposal or reuse off-site. The CCMPs will be coordinated with relevant local, state, and federal agencies.

The CCMPs will identify preliminary requirements for Health and Safety Plans (HASPs) to be submitted by each construction contractor prior to commencement of work at the site. The HASPs will comply with all applicable regulations and will include health and safety requirements related to site-specific environmental conditions at the site. The HASPs will establish methods to limit site access, include an air monitoring program for particulates (dust) and VOCs, and set standard safe operating procedures for the construction crew. The plans will also outline criteria to be used to identify non-routine and potentially dangerous conditions, such as petroleum odors, oil sheens, and discolored soil and groundwater. Any contaminated materials encountered during construction would be handled, stored, and disposed of in accordance with

all applicable federal, state, and local regulations and in compliance with the site-specific HASPs.

As described in Chapter 14, Sunnyside Yard has been designated by the New York State Department of Environmental Conservation (NYSDEC) as a Class II Inactive Hazardous Waste Site. A plume of PCB-contaminated oil has been identified in the groundwater beneath Sunnyside Yard and Yard A. Special care would be taken at Sunnyside Yard, including ongoing coordination with Amtrak and NYSDEC, to ensure that the project would not interfere with any remediation efforts at the yard. The project would construct tunnels deep beneath Sunnyside Yard to avoid affecting contaminated areas in any way, and, where excavation is required, would create a "bathtub" area enclosed by a slurry cut-off wall with limited permeability to minimize the amount of dewatering required. This would avoid the impacts associated with encountering the contaminated plume in the groundwater at Yard A and Sunnyside Yard. In addition, the CCMP would require monitoring during construction to determine whether the plume moves. If it does move, water from dewatering could be reinjected to reduce movement of the plume, or additional extraction wells or slurry walls could be installed to capture *oil and other contamination.* During construction, the HASP would specify precautions to be taken to minimize worker contact with groundwater, including the use of safe work practices and protective clothing.

State and city regulations restrict the pumping of contaminated groundwater to rivers or sewers. The project specifications for dewatering during construction would include testing to ensure that regulatory levels are not exceeded and that, therefore, no significant impacts would occur. Based on groundwater sampling performed to date, all groundwater (other than the PCB-contaminated plume at Sunnyside/Yard A) could be pumped to sewers without further treatment. However, settling basins may be required at Yard A to reduce levels of suspended metals. The CCMPs would provide details on the extent of any groundwater treatment, if necessary, before discharge. *Any contaminated groundwater encountered in Manhattan, potentially in fractures in the bedrock, would also be remediated according to the CCMP.* At Highbridge Yard, the only likely site where discharge to surface water is feasible, sampling results indicate that, if necessary, groundwater could be pumped to the Harlem River without treatment. If dewatering to the river is necessary at Highbridge, a testing program and site-specific discharge limits would be developed with NYSDEC.

NATURAL RESOURCES

During construction activities, there would be increased potential for on-site erosion and sedimentation at construction sites where soils would be disturbed. A detailed storm water management plan would be prepared under NYSDEC State Pollutant Discharge Elimination System (SPDES) permitting requirements for any construction sites larger than 5 acres, and implemented during construction. Storm water management plans would be developed as part of the design process, with implementation to be carried out by the contractors under supervision of the owner, construction manager, and the SPDES permitting and enforcement program administered by NYSDEC.

The storm water management program would contain appropriate requirements for erosion and sedimentation controls to be used during construction. Such controls may include structural as well as vegetative measures such as hay bales, silt fencing, vegetative covers, and slope and soil stabilization methods. A series of temporary sediment traps would be strategically located within the project sites, where runoff within the construction zones would be collected and settled. Straw bales would be used to protect all proposed catch basins and other drainage

structure inlets. Trapped sediment would be stored, sampled, and characterized (as prescribed by the CCMP), as would other excavated soil, and either disposed of or reused. Implementation of the storm water management plan would be the responsibility of the construction contractor with oversight and enforcement provided by the construction manager/owner and regulatory authorities.

Anti-tracking entrances would be installed at the project entrances. In addition, silt fencing would be installed along contours directly below construction zones and used where sheet flow is likely to occur. This fencing would be installed prior to construction activity to delineate areas predetermined as construction zones. Temporary and permanent vegetative measures are proposed to stabilize soils on the site.

With these measures in place, erosion and stormwater pollution would be minimized. This would avoid adverse impacts to water bodies near the construction sites, including the Harlem River adjacent to Highbridge Yard as well as water bodies near the potential yard sites on Long Island.

Excavated material from the project would be managed in accordance with each site-specific CCMP (as discussed in Chapter 14, "Contaminated Materials"). Spoil would be characterized and if it meets all applicable environmental and geotechnical criteria, could be used as fill or grading material elsewhere in the project or for other projects in the region. Otherwise, the spoil would be disposed of according to applicable regulatory requirements. The sampling and characterization procedure to be included in the CCMP would minimize the potential of contaminated spoil being interspersed with "clean" spoil. Details regarding potential quantities, sites, and routes for disposal of spoil can be found in the discussion of spoil disposal earlier in this chapter.

At all construction sites, a rodent control program would prevent rodents from using the construction areas as breeding grounds.

SAFETY AND SECURITY

The project would not involve construction methods, procedures or locations that would pose significant safety or security problems. Most of the construction activities would occur in areas where the general public has no access (e.g., within rail yards and in enclosed underground tunnels). Public access to all construction sites would be restricted. Standard safety and security measures would be followed and the most stringent provisions of the applicable statutes and regulations of New York City and New York State, and the Department of Labor, Occupational Safety and Health Administration, pertaining to the safe performance of the work, would be observed.

In the few instances where contractors would obstruct sidewalk pedestrian areas in the performance of the work (for instance, to excavate for ventilation facilities near Park Avenue in Manhattan), protective sidewalk sheds, barricades, warning signs, and other items to protect the public would be provided.

All sites would be secured during construction to prevent trespass, theft, and vandalism.

A project-wide Environmental HASP is being developed for the project to delineate project-wide policies and requirements for railroad safety, construction safety, environmental safety and industrial hygiene. Contractors would address these policies when preparing their site-specific and activity-specific HASPs. The plan is based on a "Zero Incident" concept that identifies

proactive elements considered essential to achieving and sustaining "Zero Incident" performance. Contractors would use preventive and not reactive measures in controlling hazards. Inspections, self-assessments, and trending to identify problem areas and actions to remediate problem areas would be required.

The safety plans developed by each contractor would contain the following elements:

- Job hazard analysis—requirement for a review of the detailed work scope in order to plan for safety in each task;
- Task descriptions—requirement for including equipment, materials, controls, crew size, job responsibilities, operating procedures, and maintenance practices;
- Hazard assessment—requirement to identify potential safety concerns;
- Protection methods—requirement to describe methods to protect workers, the public, and the environment;
- Protective equipment—requirements for selection and use of the appropriate devices for the hazards to be confronted; and
- Emergency response procedures—requirements for spill response and project participants, local agencies, including fire and police departments, and the community. ❖