Chapter 15: Construction and Construction Impacts

A. INTRODUCTION

This chapter describes the activities required for construction of the TSM Alternative, Build Alternative 1, and Build Alternative 2. It then considers the environmental impacts that may result from that construction and any required mitigation measures. A summary of major impacts and mitigation measures is provided at the end of the chapter.

B. DESCRIPTION OF CONSTRUCTION ACTIVITIES

NEW YORK BUS LANES CONSTRUCTION: TSM ALTERNATIVE

Construction of the bus lanes would be similar to repaving projects undertaken by the New York City Department of Transportation. The existing pavement would be taken up, and any utilities or storm drains located where the curb is to be built out into the street would be relocated, as appropriate. A new 12-inch-deep concrete pad would be laid at the new bus stops, and the bus lane(s) and curb lane would be repaved and restriped.

Construction of the New York Bus Lanes would likely proceed in short segments of three to four blocks, with several such segments to be constructed concurrently. For two-lane New York Bus Lane treatments between 14th and 96th Streets, construction zones would encompass about half the street (i.e., the curb lane and two adjacent lanes). For one-lane bus treatments between Houston and 14th Streets, the construction zone would encompass the curb lane and one adjacent lane.

Construction of segments with new bus stops could take up to 12 weeks, and construction of segments where only resurfacing is required could take 1 to 2 weeks. All together, construction of the New York Bus Lanes from Houston to 96th Street is expected to take up to approximately 2 years.

NEW SUBWAY CONSTRUCTION: BUILD ALTERNATIVES 1 AND 2

The new north subway would be constructed using three techniques: tunneling with a tunnel boring machine, tunneling using traditional mining techniques, and “cut-and-cover” construction, which would be used predominantly for stations. The first two methods involve excavating the tunnel horizontally, while cut-and-cover construction digs the tunnel vertically, from the top down. The tunnel would be constructed as two separate tubes, one for northbound and one for southbound trains. Figure 15-1 illustrates the construction methods to be used for the subway.

DEEP BORE TUNNEL WITH TUNNEL BORING MACHINE (TBM)

Most of the new subway tunnel would be constructed using a tunnel boring machine, or TBM, to drill the tunnel through bedrock. With the TBM, all the construction activities would occur in...
bedrock, deep below the ground surface, with no disruption at the surface except at the con-
struction staging location, where materials and workers would enter and exit the tunnel. The
TBM would be used to drill the portions of the tunnel south of 92nd Street. North of 92nd Street,
conditions would not be appropriate for a TBM for two reasons: (1) the bedrock is too deep to
accommodate a railroad profile, and (2) the existing (and shallow) tunnel portions between 99th
and 105th Streets and between 110th and 120th Streets are not large enough for the TBM to
pass through, while the length of new tunnel between and beyond the existing segments (north
of 115th Street) would be too short to warrant use of a separate TBM.

A TBM is basically a very large diameter drill that bores a tunnel segment and can also erect
precast concrete tunnel lining segments. TBMs are specifically designed and built for the
geologic conditions of the area under construction and for the specific needs of the project being
constructed. For MESA, the TBM would have a diameter of approximately 21 feet, allowing it
to drill the size tunnel required for the new subway, and it would be approximately 39 feet long
(depending on the size of the tunnel lining segments to be installed). As it drills the rock, sup-
ports, such as steel ribs or rock bolts, would be installed behind the tunnel face, followed by a
permanent tunnel liner. Because the tunnel would consist of two separate tubes, it may be
constructed by two TBMs operating simultaneously, to expedite the construction schedule. A
backup train would provide all the necessary auxiliary facilities for the operation of each TBM,
including electrical power, hydraulic power, grouting plant, lining segment conveyor, mucking
deVICES, etc. rail cars and/or conveyor belt systems would be used to carry the excavated
materials from the tunnel and to bring materials and personnel to the tunnel face.

CONSTRUCTION STAGING AND SHAFT SITE

A construction staging area would be established along the subway route. This site is required
for the access shaft for the tunnel, as a construction staging area for stockpiling materials and
equipment and for removal of excavated materials, and for repair shops. The TBM, too large to
arrive on-site completed and ready for construction, would be assembled at this location. The ac-
cess shaft would be constructed via traditional excavation techniques (see the discussion of cut-
and-cover construction below), and would be up to 60 feet in diameter. This shaft would be used
as the entry point for the TBM at the beginning of construction, and for entry and exit of
construction workers and materials to and from the tunnel during construction. At the surface,
the excavated materials would be hauled away from the site, most likely by trucks. Traffic
routes and times would have to be designated and coordinated with local traffic conditions and
patterns. The storage area would have the capacity to hold excavated material until it could be
hauled away. Once construction is complete, the access shaft could be used for a fan plant
and/or emergency exit.

The staging site must be large enough to accommodate the 60-foot-wide access shaft and the
required storage and maintenance areas (a minimum of 10,000 square feet, but more optimally
40,000 to 60,000 square feet). This site must be located close to the new tunnel (to avoid any
necessary tunneling between the shaft site and Second Avenue) and must be either at the north
or south end to allow the TBM to proceed from one end to the other without turning, since the
TBM cannot be turned inside the tunnel. Several possible sites were examined for use as the
construction staging and shaft site. Of these, three were eliminated from further consideration
and three candidate sites remain, as described below and shown in Figures 15-2 through 15-4.
Sites Eliminated from Consideration

! Within the streetbed of Second Avenue at a location between 92nd and 97th Streets. To be large enough to accommodate the access shaft and the required storage and maintenance areas, the site at this location would require closing a large area of Second Avenue for most of the construction period. Even so, the restrictions in size at such a site would introduce difficulties that would most likely lengthen the duration of construction. Consequently, a shaft site in the streetbed of Second Avenue is not practicable and was eliminated from further consideration.

! Within the streetbed of a side street close to Second Avenue between 92nd and 97th Streets. Because of the width required for the construction shaft, this option would require closing the side street entirely for most of the construction period. Consequently, such a shaft site is not practicable and was eliminated from further consideration.

! In the school playground and park located between 96th and 97th Streets on the east side of Second Avenue (adjacent to the High School for Cooperative Technical Education). Under this option, all of the park and playground would be used. Under Section 4(f) of the Department of Transportation Act of 1966 (U.S. Code, Title 23, Section 138), agencies under the Secretary of Transportation cannot approve the use of any parkland for transportation unless they determine that there is no feasible and prudent alternative to using the land, and that the action includes all possible planning to minimize harm to the property. This applies to all agencies under jurisdiction of the U.S. Department of Transportation, including the Federal Transit Administration. Therefore, because it would involve closing the park for the entire construction period, this site would only be selected if no other site were feasible. Because other candidate sites were identified that did not involve the use of a park, this alternative was eliminated from further consideration.

Candidate Sites Under Consideration

! The site also proposed for potential use as the shaft site and construction staging area for the MTA/Long Island Rail Road (LIRR) East Side Access Project (see Figure 15-2). (This project is described in Chapter 1 under “Current Planning Context.”) This site is on the east side of Second Avenue between 63rd and 62nd Streets, and is currently temporarily occupied by an outdoor garden supply center. The feasibility of using this site would depend on the timing of the East Side Access Project (since both projects cannot use it at the same time), and on the long-term use of this space by LIRR (e.g., as a vent shaft).

! On private property at the south end of the tunnel (see Figure 15-3). Most of the blocks at the south end of the tunnel are fully occupied by numerous active uses (predominantly residential buildings). One potential site was identified on the east side of Second Avenue between 65th and 66th Streets. This site is now occupied by a one-story bank branch, a movie theater, and a two-story building used by Memorial Sloan-Kettering Cancer Center for offices. Use of this site could be problematic, because the TBM could not be used to excavate the portion of the tunnel beneath Second Avenue south of 65th Street (extending down to 63rd Street).

! On private property at the north end of the tunnel (see Figure 15-4). Similar to the south end, most of the blocks between 92nd and 97th Streets along Second Avenue are fully occupied
by numerous active uses (again, predominantly residential buildings) that would be difficult and prohibitively expensive to displace. One potential site was identified at the southwest corner of 97th Street and Second Avenue. This site is now occupied by a one-story building supply and lumber store.

The three construction staging and shaft sites still under consideration are each located in developed, urban areas of Manhattan that are served by mass transit. Hence, only a very small percentage of construction workers would be expected to commute by automobile. No special provision, therefore, would be made for parking for workers' vehicles. This is standard practice for major construction sites in Manhattan.

OTHER DEEP BORE TUNNELING TECHNIQUES

North of 96th Street, the TBM cannot be used, as explained above. Therefore, north of the existing tunnel section at 115th Street, traditional mining techniques would be used to construct the part of the tunnel that would curve over to Lexington Avenue. These methods include drilling and blasting, and modern hydraulic or chemical rock splitting techniques. This construction would occur in bedrock, deep below the surface. Materials and personnel would enter and exit through the same construction staging site used for the TBM (discussed above), although as work progressed northward, the 110th Street station site or the new 125th Street station site could also be used.

CUT-AND-COVER CONSTRUCTION

“Cut-and-cover” construction, which requires excavation down from the street surface, would be limited to the sites of the five new subway stations, and where it is required to connect new stations to the two tunnel segments that already exist between 99th and 105th Streets and between 110th and 120th Streets. Specific locations to be constructed using this technique would be as follows:

- Second Avenue from 69th to 72nd Street.
- Second Avenue from 83rd to 86th Street.
- Second Avenue from 92nd to 99th Street.
- Second Avenue from 105th to 111th Street.
- 124th and 125th Streets, from Lexington Avenue approximately 100 feet eastward.

Cut-and-cover construction would also be necessary for vent shafts located approximately every 400 feet between stations, and for fan plants, located halfway between each station. If a new station is added at 116th Street, some cut and cover work could also be required near that station, although a tunnel has already been constructed beneath Second Avenue there. If additional excavation is required there, it would be much less extensive than at the other station locations. No cut and cover construction is anticipated for work related to the Canal Street flip or the City Hall station reconstruction.

Many of the existing subway tunnels in New York City, including the Lexington Avenue line (and the segments of tunnel already built beneath Second Avenue), were built using cut-and-cover construction techniques. Cut-and-cover construction, most appropriate for shallower tunnels, involves excavating the tunnel by digging from the street level downward. Once the tunnel is deep enough, temporary decking can be installed to permit traffic and pedestrians to use the
street and sidewalk above while construction continues underneath. As the excavation proceeds downward, piles, sheeting, and bracing are installed at the sides of the excavation site to support the sides and to prevent movement of the surrounding ground. The traditional method of bracing consists of soldier piles that are driven at a predetermined spacing and braced by horizontal steel struts or prestressed tiebacks. As excavation proceeds downward, the vertical face is supported by timber lagging or steel sheet piling placed between the soldier piles. When the excavation is complete, a permanent concrete tunnel box is constructed above the site.

Structures that are close to the edge of the excavation would be underpinned to ensure that they remain structurally sound. Underpinning involves hand excavation of pits below the existing foundations, to a level even with the base of excavation for the adjacent subway. The pits are then filled with concrete, transmitting the structure loads to an undisturbed stratum outside the influence of the subway.

Backhoes and cranes would be used as required to move materials into and out of excavation sites, and to place bracing along the sides. In locations where the crane would be required to swing over the sidewalk, sidewalk sheds would be installed to protect pedestrians.

The excavations for the station areas would affect most of the width of the street and portions of the sidewalk as well. To minimize disruption to traffic and pedestrians, the work in each segment would be done in four approximately 15-foot-wide stages—i.e., the western sidewalk and parking lane, the western through lanes, the eastern through lanes, and the eastern parking lane and sidewalk. The segments would be excavated one section at a time, with the section decked over before the next section was excavated. The decking would probably be precast concrete panels with neoprene pads for bearing. Steel plates or timber decking may be used in certain areas where frequent access below the deck may be required.

Cut-and-cover construction for subway station areas along Second Avenue would result in the closure of one to two lanes of traffic in the construction zones. Traffic would be maintained through the implementation of curb parking prohibitions and signal timing modifications, although it would move more slowly than without construction (see Figures 15-5 and 15-6). Some diversion of traffic to parallel streets and avenues can be expected. Cross street traffic flows may be cut off across the construction zone as well.

In the construction zones, sidewalk widths would be reduced from the existing 20 feet on each side of Second Avenue to 10 feet, with possible reductions to 5 feet at some locations. Pedestrian circulation paths would be maintained throughout the construction process. Traffic lanes would be separated from sidewalks by barricades, probably of timber or concrete materials.

OTHER CONSTRUCTION ELEMENTS

In addition to the work required for the new subway tunnel, the new subway contemplated under Build Alternatives 1 and 2 would also require construction in existing subway tunnels. This would include work to connect the new north subway to the existing system at 125th Street and 63rd Street, as well as work at the Canal Street and City Hall N and R line stations. That work is described below, and detailed in Appendix D, the Final Engineering Report.
125th Street Station

The new 125th Street station on the East Side subway extension would be constructed by mining excavation. The new station would have a mezzanine roof approximately 50 feet below the surface. The length of the mezzanine would be about half the length of the platform which would be located 20 feet below the mezzanine. A center platform 30 feet wide would be constructed, so as to make use of the wider track spacings needed to accommodate a double track crossover located immediately south of the station. Work at this station would involve connecting the new mezzanine to the existing station by construction of two transfer passageways, one each located below 124th and 125th Streets. Additional work includes the construction of seven escalators/stairways and two ADA-compliant elevators.

Two 20-foot-wide passageways would be constructed between the existing 125th Street/Lexington Avenue station and the new 125th Street station. Additionally, an escalator and stairway would connect the Second Avenue passageway level to the Lexington Avenue mezzanine. Design drawings for the 125th Station passageways are included in Appendix F.

Minimal impact on rail service is anticipated to occur at the existing 125th Street/Lexington Avenue station. Some work in this station would be necessary to interconnect with the adjacent, new 125th Street station (paid transfer passageway, escalator, and stairway), but most of this work can be done through careful staging during normal work hours. As described later under “Transportation,” work at the station could affect service on the Lexington Avenue line during late nights and weekends for up to about one year.

Lexington Avenue/63rd Street Station

Portions of the existing Lexington Avenue/63rd Street station must be completed before the station can serve the proposed new subway service. The station is structurally complete, but the two platform levels are currently only finished on the south side. A longitudinal partition separates the finished portions from the unfinished portions. Most of the finish work for the north side of the platform, serving Tracks 3 and 4, can be done with the longitudinal partition in place without affecting current operations. After the work behind the partition is completed, temporary barriers would be placed to allow the remaining center portions of the platform to be completed with only minor inconvenience to passengers.

The Third Avenue entrance/exit at the Lexington Avenue/63rd Street station is also structurally complete, but unfinished, including wall and floor finishes, lighting, signs, escalators, etc. Completing this entrance/exit would cost up to an additional $30 million in 1998 dollars. At this time, MTA New York City Transit has not decided whether it would open the Third Avenue entrance/exit in conjunction with the proposed project. This issue will be studied further as part of the FEIS. The preferred alignment for the East Side subway extension makes use of the existing bellmouth and tunnel, and therefore, the proposed project would not affect the future completion of the Third Avenue entrance/exit.

At the time of the Lexington Avenue/63rd Street station’s original construction in the early 1980’s, street-level entrances/exits were built within the sidewalk area at the northeast and northwest corners of Third Avenue and 63rd Street. These entrances/exits have been temporarily sealed with a concrete slab, and remain available. The new subway could use these...
entrances/exits from the Third Avenue end of the station. During the next phase of the project, the availability of easements for off-street station entrances/exits will be investigated.

*Canal Street Station*

At Canal Street, these alternatives propose to switch the connections of the express and local tracks on the N and R lines. The local tracks, which currently continue to Lower Manhattan, would be redirected to cross the Manhattan Bridge (assuming that the bridge will be reopened to rail traffic), and the express tracks, which currently extend to the bridge, would instead continue to Lower Manhattan. This “Canal Street Flip” would require modification of tracks on the upper level, extension of the Canal Street station platforms, and connection of the local tracks to those leading to the bridge. The construction work would be performed entirely underground, with materials and equipment brought to the site by work train. As described later under “Transportation,” due to complex construction issues, such as steep grades and confined work areas, this work would require suspension of subway service at this station during weeknights and weekends for about one year.

*City Hall Station*

The project may involve some internal construction at the City Hall station on the N and R lines, to reactivate the currently unused lower level platforms for use by the new subway service. These platforms would have to be extended and some new track work would be required. Underpinning of the upper tracks would be required, as well as modifications to signals and tunnel lighting. Construction work at this station would be entirely underground, with materials and equipment brought to the site by work train. As described below under “Transportation,” service on the N and R lines at this station could be affected for up to 2 to 3 months on weeknights and weekends to accomplish this work. The subway trains that are currently stored on the lower level would have to be stored elsewhere as a result of the project.

*Brooklyn Subway Yard*

Construction work would also be required at the yard to be used for light maintenance, inspection, and storage of the new subway line’s additional cars, most likely at the existing yards in Brooklyn at 36th/38th Street near the junction of the 4th Avenue subway and the West End lines (see the discussions in Chapter 2 and Appendix D for more on yards). This yard could maintain its present use for maintenance of way and work train operations, but it would be reconfigured to permit the necessary train storage as well. This reconfiguration would require some yard improvements, but the impact on the surrounding private properties would be very limited. Up to 10 new storage tracks would be added and some loading and unloading operations would be relocated to a new set of team tracks. The changes would not alter the basic purpose of the yard today, which is the handling and transfer of track hardware and the storage of trains. Reconfiguration of the yard near 10th Avenue and 38th Street could involve minor impacts to private property. Detailed information on the current and proposed use of this yard is provided in Appendix D (the Final Engineering Report).

In addition, an existing NYCT subway yard—most likely the Coney Island Yard—would have to be altered to accommodate the new line’s heavy maintenance. Alterations would be made to the yard to expand an inspection shop, but this would not affect the area outside the yard.
CONSTRUCTION SCHEDULE

The schedule for construction of the new subway would depend on the characteristics of the rock encountered, the number of shifts per day, the number of elements constructed simultaneously, and the location selected for the construction shaft and staging site. The estimated schedule for different project elements would be as follows:

! The TBM would require approximately 12 months to design, construct, disassemble, and ship to the construction site; once on-site, assembly of the machine would take approximately 2 months.

! Each TBM can proceed at an estimated rate of about 600 feet per month (this rate includes time required for maintenance). Overall, the new tunnel south of 96th Street would require approximately 2 years to complete, assuming two TBMs operate simultaneously.

! The other tunneling work north of 96th Street would also require approximately four years to complete. This work could be undertaken at the same time as the TBM drilling, depending on availability of funding.

! At each station requiring cut-and-cover construction, work would proceed in longitudinal sections, probably one block at a time. Each block would take approximately 3 to 4 months to excavate and cover with decking, so that the total excavation time at each station would be approximately 1 year. Should more complex construction require the installation of jet-grouting or slurry walls, a construction period would continue up to 2 years. Construction of each station beneath the decking would continue for approximately 1½ years. Stations can be constructed simultaneously. The vent shafts and fan plants would require about 18-24 months each to construct and could also be constructed simultaneously.

Overall, accounting for contingencies, construction of the entire new northern subway is expected to take up to approximately 10 years, not including design work before construction begins.

LIGHT RAIL TRANSIT CONSTRUCTION: BUILD ALTERNATIVE 2

The light rail transit system would have three different components, requiring different construction techniques. Most of the alignment would be at-grade, but part of the line would run through an existing subway tunnel, and connections between the tunnel and the at-grade portion would be required.

AT-GRADE SEGMENTS

For the at-grade route, the existing pavement would be taken up, and any utilities located in the top 2 to 3 feet of the roadbed would be relocated. New concrete slabs would then be laid to support the tracks.

The LRT would be constructed one track at a time, to minimize disruption. Construction would likely proceed one block at a time, between cross streets, and after several blocks of track have been constructed, the portions that cross other streets could be constructed during off-peak hours.
TUNNEL SEGMENTS

Most of the underground LRT route would be within existing subway tunnels beneath Centre and Canal Streets. Work in the tunnel would involve realigning tracks. At the southern and northern ends of the tunnel segment, additional work would be required to transition to the at-grade portion of the route, as follows.

At Frankfort Street, excavation would be required to build the new sloping grade down to the tunnel portal. The portal and the new tunnel to its west would be constructed using cut-and-cover techniques (for more information on cut-and-cover, see the discussion for the subway, above). This excavation work would occur on Frankfort Street between Pearl and Centre Streets. During the several months while this work is under way, Frankfort Street would most likely be closed to through traffic.

Beneath Canal Street between the Bowery (where the LRT would connect with an existing subway tunnel) and Chrystie Street, the new LRT tunnel would be constructed using traditional hard rock mining techniques (discussed above for the subway). Between Chrystie and Ludlow Streets, cut-and-cover construction would be used to construct the sloping section where the LRT makes the transition between the tunnel and street level.

Cut-and-cover construction would also be used for the proposed storage yard on the south side of Delancey Street and for the track connection to the yard along Delancey Street South. This excavation work would occur along Delancey Street South between Kazan Street and the yard just east of Clinton Street. The western end of the yard, beneath the Essex Street Market building, would be hand excavated and the building would be underpinned.

SCHEDULE

Construction of the LRT would take 2 to 3 months per block, and many blocks could be constructed simultaneously. The cut-and-cover work required to construct the portals and adjoining tunnels on Canal and Frankfort Streets could take up to 2 years. Similar to the work required for the new subway stations, described above, after about 3 to 4 months, the excavation site could be decked over so that traffic could use the roadway above. Construction activities would continue at those locations for 3 to 4 years, as interior work in the tunnels continues. Construction equipment and workers would access the tunnel from the portal locations, and some kind of storage yard would likely be required near the entrance. Construction of the entire system would likely require about 3 to 4 years, but this schedule could be expedited or slowed down, depending how many segments are constructed at once.

C. POSSIBLE IMPACTS DURING CONSTRUCTION AND ASSOCIATED MITIGATION MEASURES

Since the No Build Alternative would not require new construction, no construction-related impacts would occur. The other project alternatives would each result in some disruption, primarily related to noise, dust, and traffic. Any construction project inevitably results in temporary but unavoidable inconveniences to residences, workers, shoppers, and visitors to the surrounding neighborhood. The disturbances associated with construction of the TSM Alternative would be relatively minor and short-term, while those of Build Alternatives 1 and 2 would be more disruptive and longer term, although still temporary. The potential impacts associated with the
Project alternatives are described below, and where significant adverse impacts are identified, mitigation measures are described. It should be noted that for each of the analysis areas considered below, the earlier chapter covering that subject (in Chapters 3 through 17) provides detailed information on the existing conditions and context against which to consider impacts.

**LAND USE, ZONING, AND PUBLIC POLICY**

**TSM ALTERNATIVE**

The limited construction activities associated with the TSM Alternative would not result in significant impacts in terms of land use.

**BUILD ALTERNATIVE 1**

As would be expected for a major construction project in a densely developed part of Manhattan, construction of the new subway under Build Alternative 1 would result in temporary disruptions and inconveniences in the surrounding areas. The potential for impacts would be limited greatly by the use of a tunnel boring machine to excavate most segments of the new tunnel. Construction activities would be disruptive, however, at the locations where cut and cover construction would be required for new stations and at the site selected for use as an access shaft and staging area. Some impacts to nearby uses could also occur near the 36th-38th Street Yard in Brooklyn.

**Cut and Cover Work for New Stations**

As described above, although construction of the new subway tunnel would be accomplished with a tunnel boring machine to limit disturbance of neighborhoods along the alignment, the new subway stations would have to be constructed using cut-and-cover construction techniques. At each station, this work could last up to 2½ years. This construction work would inevitably be disruptive to the surrounding land uses, although the disturbances would be limited as much as possible through the use of traffic maintenance plans and other such measures. 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 community facilities, economic conditions, noise and vibration, etc., is provided later in this chapter.) The neighborhoods around each of the proposed stations on the Upper East Side and in East Harlem are largely residential, with ground-floor commercial (retail) uses, as described below. Figures G-1 through G-6 in Appendix G illustrate the area around each of the proposed station locations.

**72nd Street Station**. The construction area for this station would extend from 69th to 72nd Street on Second Avenue. The area around this station location is largely residential, with a mix of lower (4- to 5-story) residential buildings and high-rise residential buildings, both with ground-floor retail uses on the avenue. The area around this station is illustrated in Figure G-1 in Appendix G. The side streets in this area are also largely residential. 72nd Street is a wide two-way street with some ground-floor retail uses.

**86th Street Station**. Uses in this area, between 83rd and 86th Street on Second Avenue, are similar to those near the 72nd Street station: a mix of low- and high-rise residential buildings with ground-floor retail uses. In general, the buildings south of 86th Street are older low-rise buildings,
while those on the north side of 86th Street are newer high-rise structures set back from the street. Figures G-2 and G-3 in Appendix G illustrate views of this area. The side streets in this area are also largely residential. 86th Street itself is a wide two-way street with ground-floor retail uses.

96th Street Station. As described earlier, the area to be excavated by cut-and-cover construction would extend from 92nd to 99th Street, in both the Upper East Side and East Harlem. Figures G-4 and G-5 in Appendix G provide views of this area. South of 96th Street, this section of Second Avenue again includes a mix of low- and high-rise residential buildings with ground-floor retail uses. On the west side of Second Avenue, the larger buildings include Ruppert House, with a 17-story building on the west side of Second Avenue between 92nd and 93rd Streets; the 32-story Astor Terrace one block to the north; and the full block 38-story Normandie Court between 95th and 96th Streets. On the east side of the avenue, tall buildings include the 45-story Waterford at 93rd Street and the 31-story Huntington at 94th Street. The side streets in this area are also largely residential, although some blocks also include industrial (largely auto-related) space. 96th Street is a wide two-way street with ground-floor retail uses. North of 96th Street, the mix of uses and building types is different. Between 96th and 97th Streets, the west side of the avenue is occupied by low-rise residential buildings and a two-story lumber store; the east side is occupied by a city park and a paved playground associated with the High School for Cooperative Technical Education at the First Avenue end of the block. North of 97th Street are large-scale uses: George Washington Houses, with three 14-story residential buildings and a 2-story community center within a landscaped area, is located on the west side of the street, and Metropolitan Hospital Center is on the east.

106th Street Station. In this construction zone, between 105th and 111th Streets, uses are predominantly residential. Low-rise buildings with ground-floor retail occupy the blocks south of 106th Street as well as the east side of the avenue north of 108th Street. Between 106th and 108th Street, the Ben Franklin Houses complex occupies both sides of the avenue; north of 108th Street the west side of the avenue is occupied by a school. Figure G-6 in Appendix G illustrates the area around this station location. Side streets in the area are largely residential, but also include schools and park areas. 106th Street is a wide two-way street with ground-floor retail.

116th Street Station (Potential). As described earlier, the potential to add an additional station at 116th Street will be considered for the Final EIS, if the East Side subway extension is part of the preferred alternative. The tunnel in this portion of the alignment has already been constructed, so any effects during construction would most likely be less than at the other station locations. Uses in this area are largely residential, with the large-scale Thomas Jefferson Houses complex south of 115th Street and lower residential buildings to the north.

Access Shaft and Staging Site

As described above, this alternative would require use of a site throughout the 10-year construction period for the access shaft to and from the tunnel and for construction staging, storage, and maintenance areas. At any of the potential sites examined, this use would result in significant disruptions to surrounding uses, which are predominantly residential. (Figures G-7 through G-12 illustrate the uses near the three potential sites.) Disruptions would include dust, noise and vibration, and truck traffic arriving at and departing from the site. Particular issues for each of
the sites would be as follows. (Specific information about effects on community facilities, economic conditions, noise and vibration, etc., is provided later in this chapter.)

**Site between 62nd and 63rd Streets (Possible MTA/LIRR Shaft Site).** If it is feasible, use of this site (on the east side of Second Avenue between 63rd and 62nd Streets) would not require displacement of any active uses, since the site is already owned by MTA. The site is currently occupied by a garden supply retailer, which could be displaced in any case by the MTA/LIRR East Side Access Project.

As is illustrated in Figure G-7 in Appendix G, this site is surrounded largely by residential uses. The block of the shaft site and the blocks to the south are bisected by a ramp leading from the Queensboro Bridge. An MTA ventilation facility is immediately east of the site. Other uses on the shaft site block include a vacant site being developed for residential use, a building occupied by decorative arts businesses, and a 15-story apartment building. The block to the north of the site includes a large Con Edison substation and an industrial loft-type building occupied by decorative arts businesses, as well as residential uses. The blocks across Second Avenue are residential, with high-rise buildings immediately across from the site.

Use of this site would also result in additional traffic conflicts, by introducing construction truck traffic in an already heavily trafficked area of the city close to the Queensboro Bridge. This would also result in greater emissions and traffic-related noise effects.

**Site between 65th and 66th Streets.** Use of the site on the east side of Second Avenue between 65th and 66th Streets would require acquisition of private property and displacement of a one-story bank branch, a movie theater, and a two-story building used by Memorial Sloan-Kettering Cancer Center for offices. Displacement and relocation impacts are described in more detail below under “Economic Conditions.”

Similar to the site at 63rd Street, uses around this site are predominantly residential, with high-rise residential buildings along Second Avenue and lower buildings on the side streets (see Figures G-9 and G-10 in Appendix G for photographs of the surrounding area). The 20-story Manhattan House is across Second Avenue from the site, and other high-rise residential buildings are on the northeast and northwest corners of Second Avenue across from the site. Just east of Second Avenue across from the site is the New York Blood Center.

Use of this site would also result in additional traffic conflicts, by introducing construction truck traffic in an already heavily trafficked area of the city close to the Queensboro Bridge. This would also result in greater emissions and traffic-related noise effects.

**Site between 96th and 97th Streets.** Use of this site on the west side of Second Avenue would require acquisition of private property and displacement of the one-story building supply store at 97th Street and Second Avenue. Displacement and relocation impacts are described in more detail below under “Economic Conditions.”

As described earlier in the discussion of the 96th Street subway station work, uses near this site include residences, a park, and the Metropolitan Hospital Center. Figures G-11 and G-12 in Appendix G illustrate the uses near this potential shaft site. Closest to the site, the uses facing the potential shaft site include low-rise residential buildings, a mosque, and an associated school on the same block as the site; the park on the east side of Second Avenue; the hospital on the opposite corner of the intersection; and George Washington Houses and an associated day care
center directly across 97th Street from the site. Construction activities here could be particularly disruptive to the mosque and school immediately west of the site.

36th-38th Street Yard

Construction work at the existing subway yard in Brooklyn could result in temporary inconveniences to nearby uses. This work would be relatively short in duration, however, and would not involve major excavation or construction activities. Uses near the yard (illustrated in Figure G-21 in Appendix G) are a mix of low-rise residences and industrial and auto-related uses. Adjacent to the entire yard on the north is the Greenwood Cemetery.

BUILD ALTERNATIVE 2

In addition to the construction impacts discussed above for Build Alternative 1, this alternative would also have the temporary impacts associated with construction of the LRT. Construction of the LRT would be potentially disruptive to surrounding uses located along the project corridor, particularly where cut and cover excavation would be required. This includes the locations along Canal and Frankfort Streets and Delancey Street South where connection between at-grade and tunnel portions of the LRT would be made, and at the site proposed for the LRT storage and maintenance yard. (Figures G-13 through G-20 in Appendix G provide photographs of the areas around each of these sites.) Other construction activities would also be disruptive, but would be of shorter duration and smaller scope.

Frankfort Street

The area to be excavated using cut-and-cover construction on Frankfort Street is adjacent to the Brooklyn Bridge and ramps on the north. Uses on the south side of Frankfort Street consist of Southbridge Towers, a complex of 27-story apartment buildings; the 10-story office building at 100 Gold Street; and Pace University. (See Figures G-13 and G-14 in Appendix G for photographs of this area.)

Canal Street

The area of cut-and-cover construction along Canal Street extends from Christie to Ludlow Street. This area includes commercial and industrial loft space and residential buildings, all with ground-floor retail space. In addition, a firehouse is located near the corner of Allen and Canal Streets. (See Figures G-15 through G-17 in Appendix G for photographs of this area.)

Delancey Street South and LRT Yard

The route of the LRT between Avenue D and the proposed yard location is along Delancey Street South, adjacent to the Williamsburg Bridge. (Figures G-18 through G-20 provide photographs of the surrounding area.) The bridge is immediately to the north of the alignment and effectively buffers any uses on the north side of the bridge from the alignment and any associated construction disruption. Uses on the south side of Delancey Street South, facing the alignment include residential and institutional uses east of Pitt Street. West of Pitt Street, a school, firehouse, and police precinct share the block between Pitt and Ridge Streets. To the west of those institutional uses, a 23-story residential building on the south side of Delancey Street South abuts the east side of the yard site.
As described earlier, the site of the proposed yard is largely vacant and occupied by shoppers’ parking. The western end of the yard is occupied by the vacant Essex Street Market building, which would be underpinned to remain in place above the new yard. North of the yard, Delancey Street is a wide and busy thoroughfare, so that construction activities at the yard are unlikely to disturb any uses on the north side of that artery. Uses on the west side of the yard site, across Essex Street from the market building, include a health care center and the Seward Park High School. Uses to the south of the yard site, on the south side of Broome Street, include a high-rise residential building, synagogue, low-rise industrial buildings, and a parking garage as well as vacant land.

MITIGATION

Specific mitigation measures (discussed later in this chapter) are proposed to ameliorate, to the extent possible, the traffic congestion, noise and vibration, and dust associated with construction of the new subway under Build Alternative 1 and 2. Mitigation for displacement of uses is described below under “Economic Conditions.” No other mitigation is available for the inconveniences and disruptions that would result to surrounding land uses during construction.

Similar to the new subway, the specific mitigation measures discussed later in this chapter for displacement as well as traffic, air quality, noise, and vibration would mitigate to the extent possible the disruptions associated with construction of the LRT under Build Alternative 2. No other mitigation is available for the conflicts with surrounding land uses that would occur during construction.

SOCIAL CONDITIONS

Under any of the alternatives, temporary impacts would occur to community facilities near the construction activities. These would include limitations to access, general inconvenience, additional noise and dust, and loss of on-street parking. Issues specific to each alternative are described below.

TSM ALTERNATIVE

Short-term and minor impacts related to the loss of on-street parking would occur to community facilities along the route of the TSM Alternative.

BUILD ALTERNATIVE 1

Build Alternative 1 would cause inconvenience and disruption to community facilities near the cut-and-cover construction areas and the access shaft site selected. Community facilities near the potential access shaft sites include the New York Blood Center on 66th Street, and several resources near the 97th Street site: a mosque and related school on 96th Street west of Second Avenue; a park, playground, and the High School for Cooperative Technical Education and the Young Adult Learning Center on 96th Street east of Second Avenue; Metropolitan Hospital Center on the east side of Second Avenue at 97th Street; a community center and day care center at George Washington Houses on 97th Street west of Second Avenue; two schools on the west side of Second Avenue near 109th Street; and several houses of worship on Second Avenue near the 106th Street station site. Access to these facilities would be maintained at all times. Cut and cover construction would also have the potential to temporarily affect...
neighborhood character along Second Avenue by altering traffic patterns and inhibiting access to local retail stores.

**BUILD ALTERNATIVE 2**

Because it would include the same East Side subway extension as Build Alternative 1, construction impacts related to the subway would be the same under Build Alternative 2.

No displacement of residents would occur during construction of the light rail transit component of this alternative. Construction of the at-grade portion of the light rail system would result in temporary disruptions to traffic in the surrounding neighborhood and in dust, noise, and vibration. These effects could be annoying to neighborhood residents and intrusive to surrounding community facilities. However, they would not be expected to result in significant adverse impacts to population and housing, community facilities, or to neighborhood character.

The cut-and-cover construction activities associated with the LRT under Build Alternative 2 would be more disruptive to surrounding neighbors and community facilities. This construction work could be disruptive to traffic patterns and potentially noisier and dustier than the at-grade work. This could affect Pace University, which is adjacent to the construction area on Frankfort Street. The cut and cover section along Canal Street would be adjacent to a firehouse on Canal Street at the corner of Allen Street. Travel lanes would be maintained at all times for firetrucks exiting and entering the firehouse. The extensive cut and cover construction activities associated with the LRT’s storage and maintenance yard would be near several community facilities, and could be potentially disruptive to them. These include the Beth Hamedras Hagadol Synagogue on the south side of Broome Street between Norfolk and Suffolk Streets, the Seward Park High School (at the southwest corner of Broome and Essex Streets), and the Beth Jacob School, police precinct, and fire station on the south side of Delancey Street just west of Pitt Street. Travel lanes would be maintained at all times for these uses.

**MITIGATION**

During construction of the cut-and-cover portions of the new subway (Build Alternative 1 and 2) or the new LRT (Build Alternative 2), as well as during construction activities at the subway construction shaft site (Build Alternative 1 or 2), dust suppression and noise and vibration mitigation measures would be employed to minimize these construction-related nuisances to surrounding community facilities. These mitigation measures are discussed in more detail below. In addition, as discussed under “Transportation,” traffic protection plans would be implemented under both Build Alternatives 1 and 2 to minimize traffic disruptions to the extent possible and to ensure that pedestrian and vehicular access remains available to nearby community facilities at all times.

**ECONOMIC CONDITIONS**

Construction of the TSM Alternative or Build Alternative 1 or 2 would result in economic activity induced by the construction expenditures throughout the construction period, but would also introduce the potential for adverse effects to businesses near the construction sites, as described below. The No Build Alternative would not involve new construction and therefore would not result in economic benefits or potential adverse effects.
CONSTRUCTION EMPLOYMENT AND ECONOMIC ACTIVITY

The public expenditure required for any of the project alternatives would translate directly into jobs associated with construction labor itself, as well as services as materials. In addition to these jobs, the project would also result in indirect or secondary economic benefits, representing secondary-level expenditures by material suppliers, construction workers, and other employees involved with the project. These indirect costs include the purchase of other goods and services within the region. The secondary expenditures support economic activity in the project area. This, in turn, has the potential to generate new employment.

To assess the total economic activity generated by the alternatives’ construction activity on the city’s and state’s economy, the Regional Input-Output Modeling System (RIMS II), developed by the U.S. Department of Commerce, Bureau of Economic Analysis, was used. The model contains data for New York City on more than 470 economic sectors, showing how each sector affects every other sector as a result of a change in the quantity of its product or service. A similar RIMS II model for New York State, also developed by the U.S. Department of Commerce, has been used to trace the effects on the state economy. The models have been adjusted to reflect the most recent changes in the New York metropolitan area price level. Using these models and the specific characteristics of the project, the total effect has been projected for New York City and State. As described below, the economic benefits and jobs created are proportional to the cost for constructing each alternative (construction costs are detailed in Chapter 20). For the projection of benefits, the range of construction costs presented in Chapter 20 for each alternative were used. The capital cost of the tunnel boring machine was excluded, however, since benefits associated with construction of that machine might not accrue to New York City or State, depending on where the machine is originally assembled.

Table 15-1 summarizes the effects on the economy of New York State and New York City from construction of each Build alternative. As shown in the table, the construction jobs required for the project alternatives would range from 216-270 person-years with the TSM Alternative to 20,930-24,682 with Build Alternative 2 (a person-year is the equivalent of one employee working full time for one year). The table also shows the indirect employment that would be generated by construction expenditures, including jobs in business establishments providing goods and services to the contractors. Construction of the project alternatives would generate additional employment in both New York City and elsewhere in the state.

The construction activity would also generate tax revenues. Based on the U.S. Bureau of Economic Analysis’s RIMS II model for New York City and State, the total economic activity (including both direct construction expenditures and indirect expenditures) that would result from construction of project alternatives would range from $66.4 million to $7,589 million, depending on which alternative is selected. Of those amounts, the majority would occur in New York City (see Table 15-1).

Although materials used in constructing the project would be exempt from sales tax, the construction activity would generate other tax revenues for New York City, the Metropolitan Transportation Authority, and New York State (see Table 15-1). Of these, the largest portion would come from sales tax, personal income taxes, and corporate, business, and related taxes on direct and induced economic activity.
### Table 15-1

Range of Projected Employment and Fiscal Benefits During Construction
For Each Build Alternative
(1997 Dollars in Millions)

<table>
<thead>
<tr>
<th></th>
<th>TSM</th>
<th>Build 1</th>
<th>Build 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New York City Share</td>
<td>Total New York City and State</td>
<td>New York City Share</td>
</tr>
<tr>
<td><strong>Total Economic Output</strong>¹</td>
<td>$52.8 - 65.9</td>
<td>$66.4 - 83.0</td>
<td>$3,404.2 - 4,300.2</td>
</tr>
<tr>
<td><strong>Tax Revenues</strong>²</td>
<td>$0.8 - 1.1</td>
<td>$2.6 - 3.3</td>
<td>$54.1 - 68.3</td>
</tr>
<tr>
<td>**Employment (person-years)**³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Construction</td>
<td>216 - 270</td>
<td>216 - 270</td>
<td>13,939 - 17,608</td>
</tr>
<tr>
<td>Generated Secondary</td>
<td>115 - 144</td>
<td>419 - 524</td>
<td>7,413 - 9,364</td>
</tr>
</tbody>
</table>

**Notes:**

1. The economic output or total effect on the local economy derived from the direct construction spending. All numbers are rounded and expressed in constant (uninflated) 1997 dollars. Construction costs exclude the costs of the Tunnel Boring Machine.
2. Assumes that construction materials would be exempt from tax. Includes sales tax, personal income taxes, corporate and business taxes, and numerous other taxes on construction and secondary expenditures.
3. A person-year is the equivalent of one person working full-time for one year.

**Sources:** The characteristics and construction cost for the project alternatives; the Regional Input-Output Modeling System (RIMS II), U.S. Department of Commerce, Bureau of Economic Analysis; and the tax rates by applicable jurisdiction.
POTENTIAL ADVERSE ECONOMIC EFFECTS DURING CONSTRUCTION

TSM Alternative

The reconstruction activities associated with this alternative would be short-term and would not result in adverse impacts on economic activity.

Build Alternative 1

As described above, a Special Transit Land Use zoning district was established in the 1970's to provide easements for the anticipated Second Avenue subway. Since its designation in 1974, any new development or enlargement involving ground-level construction has been obliged to provide an easement, if required, for subway-related uses and public access. Five easements have been obtained to date. At these locations and at any other properties where New York City Transit obtains easements, subway entrances can be placed within existing buildings rather than via external staircases. At all other locations, entrances would be on the sidewalk. Consequently, no permanent takings of private property are required for the subway line.

However, acquisition of private property may be required for use during construction as a staging area and shaft site. This is described below under “Access Shaft and Construction Staging Site.” In addition, in areas immediate to cut-and-cover work and the access shaft and staging site, construction activities could affect economic conditions. This is described below under “Cut-and-Cover Construction.” Photographs of the areas surrounding potential cut-and-cover work and potential construction shaft sites are provided in Appendix G, Figures G-1 through G-12. The tunneling or mining operations along the entire length of the proposed subway would not affect economic conditions in the study area.

Cut-and-Cover Construction. Several potential sources of disturbance may affect economic conditions near areas of cut-and-cover construction, in particular the operation of businesses that front on Second Avenue. 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. While any one of these conditions may have little impact on economic activities, in combination they may have a substantial effect 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 each cut-and-cover area along Second Avenue, the substantial reduction in sidewalk width during the construction period combined with the dust, noise, and vibration of construction and the elimination of on-street parking spaces is likely to reduce the number of shoppers in the area. In addition, elimination of parking lanes and reduction in the number of through lanes are likely to make deliveries to stores 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. Businesses that provide a unique product or service are less likely to be affected during the construction process, and if these businesses
are large enough (for example, a supermarket), they may act as an anchor for the greater business strip, continuing to draw customers to the area. In contrast, smaller businesses—particularly those that have competitors nearby (for example, deli, grocery, and fruit markets)—may lose customers who might prefer to shop in a quieter and more comfortable environment. In some cases, the construction activities associated with the new subway could lead to a potential decrease in sales, perhaps with a concurrent increase in operating expenses, that could result in the closing of some retail and neighborhood service establishments in the construction zone. The specific effects in each cut-and-cover area are described below.

**72nd Street Station.** Businesses along Second Avenue in the construction zone (from 69th Street to 72nd Street) generally include convenience retailers, such as a supermarket, grocery store, and drug store; neighborhood services, such as a dry cleaner and shoe repair; and restaurants. (See Figure G-1 in Appendix G for photographs of this area.) In general, small businesses selling products and providing services that are also available on First and/or Third Avenues would probably experience some decrease in sales during the construction period. However, larger stores, such as the supermarket, would probably continue to attract their regular customers, despite the temporary construction impediments. The anchoring effect of the supermarket may help some convenience retailers to continue to attract customers.

During the approximately 2½-year construction period in this area, significant economic impacts may occur for some marginal businesses. In some cases, a potential decrease in sales, perhaps with a concurrent increase in operating expenses, may cause some retail and neighborhood service establishments in the construction zone to close.

**86th Street Station.** Businesses along Second Avenue from 83rd Street to 86th Street generally include destination restaurants, such as Jackson Hole and Dorrian’s; destination retailers, such as Schaller & Webber; and a number of convenience retailers, including a deli, drug store, and video store. In addition, there are several neighborhood services in the construction zone, including a large branch of Chase Bank. (See Figures G-2 and G-3 in Appendix G for photographs of this area.) Because of the reputation and unique nature of the destination restaurants, retailers, and larger neighborhood service establishments, it is unlikely that construction activities would deter regular customers from patronizing these establishments.

However, while Schaller & Webber may act as a retail anchor for the construction zone, there is potential for some of the smaller convenience retailers located south of 86th Street to experience a decrease in sales. Retailers may also see an increase in operating costs associated with the elimination of on-street parking. Consequently, while the unique character of many of the businesses in the 86th Street construction zone would help avoid or minimize potential decreases in sales during construction, the potential does exist for smaller retailers and service establishments to experience a decline in revenue that may result in involuntary closing of one or more businesses.

**96th Street Station.** The construction zone around the 96th Street station would extend from 92nd Street to 99th Street. Businesses along Second Avenue in the construction zone generally include convenience goods retailers, such as supermarkets and a drug store; destination retailers, such as women’s and children’s clothing; neighborhood service establishments, such as a dry cleaner and beauty salon; and a number of small fast food restaurants. The construction zone also includes a large institutional use, Metropolitan Hospital, and a large building supply store.
North of 96th Street, the business inventory in the construction zone is less continuous than in other construction zones, because of the presence of Metropolitan Hospital and George Washington Houses as well as a number of vacant storefronts. (See Figures G-4 and G-5 in Appendix G for photographs of this area.)

South of 96th Street, two large convenience goods retailers, Key Food and Rite Aid, have little competition in the surrounding area, and are likely to continue to generate pedestrian traffic along Second Avenue, helping to minimize potential declines in sales that may result from construction activities. North of 96th Street, convenience goods retailers and fast food restaurants are not likely to experience a significant decline in their revenues, because of their proximity to the hospital and public housing.

106th Street Station. The construction zone for the 106th Street station would extend from 105th Street to 111th Street. Businesses in this construction zone are generally more convenience-oriented and the less densely developed than in other station areas. Both sides of Second Avenue between 106th and 108th Streets are primarily occupied by the Benjamin Franklin Houses, with a few retail and neighborhood services on the northwest corner of 106th Street and Second Avenue; most of the retail uses in this area are located between 108th and 111th Streets. They include such convenience goods retailers as delis, grocery, and liquor stores, as well as several destination retailers (a clothing store and discount general merchandise store), and such neighborhood service establishments as a bank, shoe repair, laundromat, and beauty supply store. There are also several fast food restaurants in the construction zone. (See Figure G-6 in Appendix G for photographs of this area.)

Businesses immediately north and south of 106th Street are not likely to sustain significant economic declines during construction, due to the proximity of the public housing and the spillover of shoppers from larger stores on 106th Street west of Second Avenue. However, the convenience stores and fast food restaurants between 109th and 111th Streets may experience some decrease in sales as a result of construction activities, particularly the elimination of on-street parking and reduction in sidewalk width. Marginal businesses among these establishments may close involuntarily during the 2½-year construction period.

116th Street Station (Potential). If a new station at 116th Street is added to the project, local retailers in the area could experience similar effects to those described for other stations. This will be examined in detail in the FEIS if this station is added.

125th Street Station. As described earlier, small areas of cut-and-cover construction would be required on 124th and 125th Street just east of Lexington Avenue. Business activity would likely be marginally interrupted, since the extent and duration of the cut-and-cover operations would be minimal.

Access Shaft and Construction Staging Site. As described earlier, several potential locations are being considered for the required access shaft site. Two of these sites—one on the west side of Second Avenue between 96th and 97th Streets and one on the east side of the avenue between 65th and 66th Streets—would require acquisition of private property. Use of any of the sites could disrupt economic activities in the surrounding area, if truck traffic, dust, and noise disrupt pedestrian traffic and daily operations such as loading customers’ purchases and unloading deliveries. Specific impacts would be as follows:
Chapter 15: Construction and Construction Impacts

At the site proposed for possible use as the shaft site and construction staging area for the MTA/LIRR East Side Access Project. If it is feasible, use of this site (on the east side of Second Avenue between 63rd and 62nd Streets) would not require displacement of any active uses, since the site is controlled by the Metropolitan Transportation Authority and the garden supply retailer is to be displaced in any case by the East Side Access Project. (See Figures G-7 and G-8 in Appendix G for photographs of this area.)

On private property at the south end of the tunnel. Use of the site on the east side of Second Avenue between 65th and 66th Streets would require acquisition and displacement of a one-story bank branch, the Beekman movie theater, and a two-story building used by Memorial Sloan-Kettering Cancer Center for offices. (See Figures G-9 and G-10 in Appendix G for photographs of this area.)

On private property at the north end of the tunnel. If the one-story building supply store at 97th Street and Second Avenue is acquired for use as the construction site, this would require displacement of that use. Use of this site could also be disruptive to nearby businesses, which are small neighborhood service stores. (See Figures G-11 and G-12 in Appendix G for photographs of this area.)

Build Alternative 2

In addition to the potential impacts associated with the subway construction, this alternative could result in additional economic impacts associated with construction of the LRT. Since all of the construction activity would occur within the public right-of-way, no acquisition or condemnation of private property is anticipated. Rather, potential impacts are associated with the disruption and changes to traffic patterns that would result during construction, as described below.

**Lower Manhattan.** Construction activities are not likely to affect businesses located in the office towers along Water Street. Employees would continue to have uninterrupted access to the buildings. Pedestrian flows to and from the South Street Seaport may be occasionally interrupted during construction, but access to the shopping and entertainment complex would be maintained at all times.

Cut-and-cover activities on Frankfort Street that would tie the LRT into the existing subway tunnel would not affect any businesses. Sidewalks are very wide on the south side of Frankfort Street, and would continue to serve pedestrian movement between the stairs to the subway at Brooklyn Bridge and office buildings on Gold Street to the east. (See Figures G-13 and G-14 in Appendix G for photographs of this area.)

**Lower East Side.** Impacts on economic activities on the Lower East Side are likely to be more substantial than in Lower Manhattan, due to the type of business activity and the width of the streets where the LRT would be constructed. In the southern portion of the Lower East Side (in Chinatown), where the LRT would travel from the portal on Canal Street along East Broadway, impacts are likely to range from moderate to significant.

The portion of Canal Street where cut-and-cover construction is proposed (from just east of Christie Street to Ludlow Street) is very narrow and lined with small businesses, including appliance stores, electronics stores, a beauty salon, and funeral parlor. (See Figures G-15 through G-17 in Appendix G for photographs of this area.) Cut-and-cover activities are likely to
significantly reduce an already narrow sidewalk. On-street parking would be eliminated, and the accessibility for pick-ups and deliveries severely constrained. Therefore, accessibility to businesses in this area would be reduced. Customers arriving by foot and by car would probably find these blocks inaccessible, and shopping especially inconvenient. Businesses in these blocks are likely to experience a substantial loss in revenues during the construction period.

Some effects could also occur to businesses along East Broadway during the construction period, although these are not likely to be as significant as along Canal Street. East Broadway is wider, and would not require cut-and-cover activities. However, the majority of businesses on East Broadway south of Grand Street, including a lumber store, restaurants, and trading companies, appear to require a substantial amount of pick-ups and deliveries by truck. As parking would be prohibited on East Broadway during construction, curbside pick-ups and deliveries would be significantly constrained, adding to the time and cost of doing business.

Economic impacts along Avenue D would be limited to the same potential problems with pick-ups and deliveries anticipated in Chinatown. However, impacts on businesses are not likely to be as significant because of the added width of Avenue D, lower traffic volumes, more convenience-oriented businesses, and generally lower density of economic activities. Except for a supermarket between 8th and 9th Streets and a large drugstore between 6th and 7th Streets, business activity along Avenue D is typically pedestrian-oriented, and does not require frequent deliveries from large trucks. There is not likely to be a significant change in pedestrian or shopping patterns, nor substantial reduction in revenues.

Business activity along 14th Street in the study area extends from Avenue B to Union Square, and is nearly uniformly dense along the entire corridor. The commercial uses include a mix of destination retail and convenience goods stores. Destination retail ranges from large national chains in the Union Square area, including Bradlees, Footlocker, Strawberry, and PC Richard’s, to smaller general merchandise, gift and jewelry, bicycle, and furniture stores as far east as First Avenue. Between First Avenue and Avenue C, retail is found only on the south side of 14th Street, with residential uses on the north side. The retail mix also includes a range of convenience goods stores, including groceries, news and magazine stands, and several family and fast food restaurants. In addition, there are a number of institutional uses, including the New York Eye and Ear Infirmary. Like Avenue D, construction impacts along 14th Street are likely to be limited to problems with pick-ups and deliveries. Pedestrian flows and shopping patterns are not likely to be significantly disturbed by construction, which would be generally limited to the center of the street. While there may be some minor interference with pedestrians crossing from one side of the street to the other, the construction activity is not likely to create significant changes in the overall convenience, accessibility, or shopping environment. Sidewalks would not be disturbed, permitting continuous pedestrian traffic and window shopping. Since construction activities would be segmented, i.e., generally limited to 1- to 3-block segments, it is anticipated that curbside pick-ups and deliveries and on-street parking would be interrupted for approximately 6 months in any given segment. Overall, these impacts are not likely to result in a significant loss in revenues for most businesses along the 14th Street corridor. Further, since the northern terminus of the LRT would be located on 14th Street and does not require any construction activities in Union Square, no impacts are anticipated on the Union Square Greenmarket.
Cut-and-cover construction associated with the creation of an underground storage facility for the LRT would temporarily remove shopper parking from the existing (but temporary) parking lot on the south side of Delancey Street between Essex and Clinton Streets. During the period prior to installing a new deck, shoppers would have to look for other on-street and off-street parking resources in the neighborhood. While this is likely to cause some inconvenience for shoppers along Delancey Street, it would be only temporary and is not expected to have a significant impact on businesses in the area. (See Figures G-18 through and G-20 in Appendix G for photographs of this area.)

**MITIGATION**

For any properties that would have to be acquired for either Build Alternative 1 or Build Alternative 2—including properties used for a construction shaft site and any properties required for easements to allow new station entrances—owners would be compensated at fair market value and relocation benefits would be provided for displaced businesses.

Relocation benefits would also be provided for businesses that are indirectly displaced as a result of construction activities nearby. This is most likely to occur for businesses along Canal Street near the construction work, but could occur in other locations as well.

For any necessary relocation, relocation assistance offices would be established to facilitate the appropriate activities. Relocation assistance would include the following guarantees:

- As part of the preparation procedure during the acquisition stage, all site occupants would be personally interviewed to determine their specific relocation needs.
- The acquisition and relocation assistance programs would be conducted in accordance with the requirements and standards of the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 as amended. This Act governs property acquisitions whenever they are carried out by the federal government or when property acquisition involves the use of federal funds.
- All site occupants would be furnished a copy of New York State’s informational booklet and would be fully informed of all benefits to which they may be entitled.
- No site occupant would be required to move from his or her property without at least 90 days’ notice.
- The relocation program would be carried out in an orderly, humane, and timely fashion.
- Relocation assistance would be offered to all being relocated without discrimination.

**VISUAL AND AESTHETIC CONDITIONS**

Construction activities would introduce incongruous visual elements, but generally these changes would be relatively short-term and not significant. The construction staging site required for the new subway (Build Alternatives 1 and 2) would be potentially inconsistent in appearance with the surrounding neighborhood, no matter which site is selected. This construction site would be surrounded by a barrier, reducing its visibility to the surrounding neighborhood, but would remain visible from above. The visual effect of the construction of Build Alternative 2’s LRT would be
the temporary construction barricades erected at the construction sites as well as any temporary reroutings of adjacent sidewalks.

HISTORIC RESOURCES

The TSM Alternative would not result in any potential for significant adverse impacts to historic resources. Potential impacts under Build Alternatives 1 and 2 are described below.

BUILD ALTERNATIVE 1

For the northern subway, two buildings near 125th Street and Lexington Avenue that have been determined eligible for the State and National Registers of Historic Places would require underpinning. As described below under “Mitigation,” this work would be done to ensure that no significant adverse impacts would result. At all other locations, appropriate care would also be taken to ensure that the construction not result in any structural impacts to buildings (see the discussion below).

An access shaft and construction staging site will be selected for Build Alternative 1 if this alternative is chosen as the preferred alternative. If the site between 65th and 66th Streets is selected, the potential historic resource located on this site would be demolished. If this resource is found to be Register-eligible or merit Landmark status, another site could be selected or appropriate mitigation would be proposed through consultation with the State Historic Preservation Office (SHPO) to avoid an adverse impact.

BUILD ALTERNATIVE 2

The Essex Street Market Building, which has been determined eligible for the State and National Registers of Historic Places, would require underpinning, as it would be above the western end of the proposed LRT maintenance and storage yard. Similar to the work to be undertaken for the northern subway, proper care would be given to ensuring that this underpinning would not result in any adverse impacts to the building fabric (see the discussion of mitigation below). As with construction of the proposed subway, appropriate care would be taken to ensure that any construction activities for the LRT not result in any structural impacts to buildings.

Should it be necessary to affix wiring to buildings along the route of the light rail transit line, care would be taken to avoid affixing such lines to historic resources. If the use of a historic resource be unavoidable, this work would be coordinated with SHPO and/or LPC to avoid any significant adverse impacts (see discussion below under “Mitigation”).

MITIGATION

Proper care would be given to ensuring that required underpinning at the 125th Street station (under Build Alternatives 1 and 2) and, for the LRT (under Build Alternative 2), at the Essex Street Market, would not result in any adverse impacts to the fabric of the buildings above; a construction protection plan would be prepared by qualified engineers and implemented by qualified personnel, including an independent engineer authorized to stop work if damage is found at the buildings. This plan would be submitted to the SHPO for review and approval prior to the start of construction. At all other locations (for both the subway and the new LRT), appropriate care would also be taken to ensure that the construction not result in any structural impacts to buildings. This would include precautions necessary to prevent damage to both historic and all
other types of structures in the vicinity of the proposed construction, including potential damage due to ground-borne vibrations. A plan for handling any special requirements for historic buildings would be submitted to SHPO prior to construction. (Additional information about vibration mitigation is provided later in this chapter.)

In addition, if the 65th Street shaft site is selected for the subway proposed as part of Build Alternatives 1 and 2 and if the theater on that site is determined to be eligible for the State and National Registers or to merit designation as a New York City Landmark, another site could be selected or appropriate mitigation could be developed through consultation with SHPO to avoid an adverse effect.

If it is necessary to affix wiring to any historic buildings when constructing the LRT under Build Alternative 2, the planned alterations would be designed in consultation with SHPO and/or LPC to prevent any damage—either physical or contextual—to the historic fabric. To avoid adverse impacts, a construction protection plan would be prepared regarding the proper procedures for installation of the wiring to protect historic resources from damage. The construction protection plan would be prepared by qualified engineers and implemented by qualified personnel, including an independent engineer authorized to stop work if damage is found in the historic resource. This plan would be submitted to the SHPO for review and approval prior to the start of construction.

As project plans proceed after selection of a preferred alternative, and as additional project elements are defined, the ongoing consultation process with SHPO and the Advisory Council on Historic Preservation will continue to avoid direct and indirect impacts to historic resources, including any resources that could be affected by project elements that are not yet defined for the DEIS. The consultation process will include execution of Memorandum of Agreement and/or a Programmatic Agreement by New York City Transit, the Metropolitan Transportation Authority, the Federal Transit Administration, the SHPO, and if necessary, the Advisory Council on Historic Preservation.

ARCHAEOLOGICAL RESOURCES

As described in Chapter 8 (“Archaeological Resources”), potential archaeological resources were identified at 124th Street and throughout the Lower East Side and Lower Manhattan. Potential impacts would be as follows:

! Build Alternative 1 could affect archaeological resources at the proposed construction staging sites, if those sites are found to be sensitive for archaeological resources after further research.

! Build Alternative 1 could affect archaeological resources, if present, on 124th Street where cut-and-cover construction is proposed.

! Build Alternative 2 could affect archaeological resources throughout the LRT route, including locations on Water Street, Pearl Street, Frankfort Street, Canal Street, East Broadway, and Kazan Street/Columbia Street. The African Burial Ground in Lower Manhattan would not be affected by this alternative.

Once a preferred alternative is selected, additional research will be conducted to define further the extent of potential impacts. Consultation with review agencies is now under way regarding the identification of potential archaeological sites, the assessment of potential impacts to the
sites, and appropriate mitigation measures, if required. For the subway portion of the alternatives, once vent shaft, fan plant, and construction staging sites are known, it will be necessary to determine whether they could affect potentially sensitive archaeological resources and take steps to avoid impact (move the vent shaft to a different location) or mitigate impact (archaeological testing or excavation). The LRT component of Build Alternative 2 would be routed through six areas of the Lower East Side and Lower Manhattan that are considered potentially sensitive for archaeological resources. Should this component be included in the preferred alternative, additional archaeological study would be required to help avoid or mitigate significant impacts on archaeological resources. In addition, this alternative requires electrical substations that could affect archaeological resources. Once these locations are known, similar to the vent shafts and fan plants for the subway, it will be necessary to determine whether they might affect potentially sensitive archaeological resources and take steps to avoid or mitigate the impact.

As project plans proceed after selection of a preferred alternative, and as additional project elements are defined, the ongoing consultation process with SHPO and the Advisory Council on Historic Preservation will continue to avoid direct and indirect impacts to archaeological resources, including any resources that could be affected by project elements that are not yet defined for the DEIS. The consultation process will include execution of Memorandum of Agreement and/or a Programmatic Agreement by New York City Transit, the Metropolitan Transportation Authority, the Federal Transit Administration, the SHPO, and if necessary, the Advisory Council on Historic Preservation.

TRANSPORTATION

TSM ALTERNATIVE

As described earlier, the New York Bus Lanes would likely be constructed in short segments of three to four blocks. For two-lane New York Bus Lane treatments between 14th and 96th Streets, construction zones would encompass about half the street, i.e., the curb lane and the two adjacent lanes. This would generally leave three to four lanes for general traffic if all curb parking and deliveries are prohibited, which is the likely scenario. For one-lane bus lane treatments between Houston and 14th Streets, the construction zone would encompass the curb lane and the one adjacent lane.

For some segments of First and Second Avenues where there is ample capacity within the available travel lanes, there would be little impact during construction. There would be some additional traffic delays due to the “necking down” of the existing five to six moving travel lanes to just three or four lanes, but for short durations (each construction segment could be completed within a 3-month period). At some more critical avenue segments where all or nearly all of the avenues’ six to seven travel lanes are needed by moving traffic (e.g., First and Second Avenues near the Queensboro Bridge), there would be impacts of a short-term nature. The construction process and its impacts would be similar to other New York City Department of Transportation street reconstruction programs, under which half of an avenue is typically closed for reconstruction at a time. Pedestrian flows would not be materially impacted as their movements would be accommodated under the maintenance and protection of traffic schemes. Pedestrians would cross First and Second Avenues just as they cross other major avenues when those avenues are being reconstructed.
Chapter 15: Construction and Construction Impacts

There would be no major impacts to bus service while the TSM Alternative is under construction. Bus routes would be maintained on First and Second Avenues, although general congestion during construction of the bus lanes would affect bus travel times, just as street openings due to underground emergency utility work do today. For blocks with bus stops that are being rebuilt, the bus stops affected would need to be temporarily relocated one or two blocks away on the same avenue for the short-term condition.

**BUILD ALTERNATIVE 1**

**Effects on Subway Service**

As described earlier, construction work would be required on existing subway tracks to connect the new service to existing lines at 63rd Street and to accommodate required changes at the Canal Street and City Hall stations on the N and R lines. Construction work would also be required near the Lexington Avenue line tracks at 125th Street related to pedestrian connections between the new (Second Avenue line) and existing (Lexington Avenue line) stations there. While this work is under way, subway service would be affected during late night hours and on weekends. Specific effects would be as follows:

1. **63rd Street/Lexington Avenue station (B and Q lines).** At 63rd Street, the East Side subway extension would connect to existing tracks, the southbound connecting at the upper level and the northbound connecting at the lower level. Construction work would include modifications at the bell mouth, removal of a block wall, platform restoration/renovation, signal work and tunnel lighting. Some of this work would require track outages. Service on the B and Q lines would be suspended on approximately 10 weeknights (10 PM to 5 AM) and 7 weekends (10 PM Friday to 5 AM Monday). These services would be rerouted via the 53rd Street Tunnel.

2. **125th Street station (Lexington Avenue 4, 5, 6 lines).** Work at this station would involve connecting the new mezzanine to the existing station by construction of two transfer passageways, one each located below 124th and 125th Streets. Additional work includes the construction of seven escalators/stairways and two ADA-compliant elevators. As much of this construction would be immediately under existing, active tracks, service adjustments would need to be made. Work at this station would affect service on the Lexington Avenue line at this station during late nights and weekends for approximately one year. Specifically, service would be partially suspended on an estimated 325 weeknights and 65 weekends. During these periods, service would be rerouted from the local to express tracks and vice versa.

3. **Canal Street station (N and R lines).** As discussed in section B, above, the “Canal Street flip” would involve switching the connections of the express and local tracks on the N and R lines. To achieve this, 3,450 feet of track would need to be reconstructed near the Canal Street station. Other construction activities would be required related to the widening of two side platforms, relocation of columns, two new crossovers, and signalization and tunnel lighting modifications. Due to complex construction issues, such as steep grades and confined work areas, a significant number of track outages would be required. To construct the “Canal Street flip,” service on the N and R lines at Canal Street would be suspended on weeknights and weekends for approximately 1 year—an estimated 280 weeknights and 65 weekends.
City Hall station (N and R lines). The lower level of the City Hall station, presently unused, would be reactivated as a short-turn location for Second Avenue trains. The tracks and platforms would be upgraded and lengthened and tail tracks would be provided. Underpinning of the upper tracks would be required, as well as modifications to signals and tunnel lighting. A moderate amount of track outages would be necessary to achieve these goals. Service on the N and R lines at City Hall (on the upper level) would be suspended on an estimated 45 weeknights and 11 weekends to perform the required construction there.

Effects on Traffic Conditions

As described earlier, the majority of the subway alignment under Build Alternative 1 would be constructed via deep-bore tunneling or mining, with no disturbance at street level. Since there would be no need to open up the majority of Second Avenue’s length for construction, there would be no substantive traffic impacts for most of this length. At all of the new stations (as well as adjacent to the 96th and 106th Street stations), cut-and-cover construction methods would be used and there would be some short term impacts for a period of 1 to 2 years per station area (about two to three blocks per station). The new 125th Street station would be built just east of Lexington Avenue, so there would be no construction-related traffic impacts within Second Avenue or Lexington Avenue, but some of the station’s cut-and-cover construction could extend into 124th and 125th Streets.

Traffic conditions are not anticipated to be greatly affected by construction of the 63rd Street connection, the Canal Street flip, or the City Hall station work, since all of this work would take place below ground. These sites would require access to the street for the movement of materials and workers, but the access would be located to minimize traffic congestion.

At the four stations along Second Avenue, two of Second Avenue's six lanes north of 63rd Street would generally be closed to traffic, although this could be reduced to a one-lane closure during peak periods. Most likely, parking would be prohibited in the construction zone so that four moving lanes could be maintained. Since the reduction in the number of available traffic lanes would extend over a period of 1 to 2 years, a level of service analysis was conducted at three of the station locations—near the proposed 70th, 86th, and 96th Street stations (i.e., where traffic data are available). The analysis shows that with the implementation of traffic mitigation measures such as curb parking prohibitions and signal timing modifications, sufficient capacity can be provided along Second Avenue to accommodate vehicle traffic past the station construction zones at levels of service comparable to what they would be without the construction in place, although probably at slower speeds than currently prevail. NYCT would coordinate with the Fire and Police Departments and affected hospitals to ensure that access for emergency service is maintained at all times.

Some diversion of traffic to parallel streets and avenues can be expected. Cross-street traffic flows will occasionally be cut off across the construction zone, and as a result some traffic would divert to other east-west streets. Some Second Avenue traffic may also divert to other parallel southbound routes.

In the construction zones, sidewalk widths would be reduced from the existing 20 feet on each side of Second Avenue to 10 feet, with possible reductions to 5 feet at some locations. Pedestrian circulation paths would be maintained throughout the construction process.
Bus routes would be maintained at all times and there would be no significant impacts to bus service, although traffic delays would occur near stations being constructed due to the narrowing of available street width for all vehicle traffic. Some bus stops may need to be relocated one or two blocks north or south on First and Second Avenues, away from locations where station construction zones require such relocations.

In addition to the cut-and-cover construction work, this alternative would require use of a site along Second Avenue for the access site to the tunnel below, and for construction staging activities. These activities would be confined to the access shaft and staging site, but would require approximately 5 to 10 truck trips per hour for deliveries and to remove excavated materials. Use of an off-street site for this purpose would not be significantly disruptive to traffic flows on Second Avenue or adjacent cross streets. It should be noted, however, that use of the potential site at 63rd Street or 65th Street and Second Avenue would introduce additional traffic in an area where substantial delays can already occur because of the influence of the Queensboro Bridge.

**BUILD ALTERNATIVE 2**

Impacts during construction of the subway component of Build Alternative 2 would be identical to those described above for Build Alternative 1. Under Build Alternative 2, there would also be some additional short-term impacts to subway service at Chambers Street as well as to traffic and parking conditions and to bus service while the LRT alignment is under construction.

**Effects on Subway Service**

The new LRT would use the existing Chambers Street subway station of the J, M, and Z lines. Tracks to the station from the south would need to be constructed for the LRT. This may affect subway service to some degree. In addition, north of the station, the existing third and fourth tracks would require reconstruction, possibly requiring some track outages. Subway service at the Chambers Street station would be suspended for approximately 45 weeknights and 11 weekends.

**Effects on Traffic Conditions**

Construction of the LRT tracks on Water and Pearl Streets in Lower Manhattan would require dedication of a 30- to 35-foot-wide overall construction zone. One LRT track could be built at a time, so a 20-foot-wide section would be lost to moving traffic at any one time during construction. A few blocks of rail track would be built at a time, after which the other track would be built. Assuming that curb use by parkers and delivery vehicles would be prohibited during the construction period on at least one side of the street, there would generally be just one lane available to moving traffic in each direction. Left turns from northbound or southbound Water and Pearl Streets would generally need to be prohibited to avoid major delays and conflicts with track construction work. Intersections would remain open to cross-street traffic during the peak periods of the day, and would be closed during weekends or off-peak periods to link together the individual blocks of track (this is true for all segments of LRT track construction). There would still be substantial delays to Water Street and Pearl Street traffic during the construction period, unless some traffic chooses to divert to alternate routes.
Two-way bus service could probably be maintained on Water and Pearl Streets since LRT construction would leave one lane available per direction. Bus stops would need to be temporarily relocated one or two blocks to the north or south when a block with a bus stop is being constructed. Traffic delays would affect bus travel times during construction but service could be maintained.

Construction of the LRT tracks and the south portal on Frankfort Street would require a 35-foot-wide construction zone. During construction, just one lane of traffic can be maintained (in the eastbound direction, which is the most significant flow direction), and for short periods, Frankfort Street may be closed to traffic altogether. At the northern portal on Canal Street east of Allen Street, a 35-foot-wide construction zone would also be needed. Eastbound traffic would be maintained on Canal Street, with westbound traffic diverted to other streets. This would be similar to the condition in effect after the LRT line is operational. Orchard Street traffic would not be able to cross Canal Street, which is also similar to the condition when the LRT system is fully operational.

On East Broadway, construction of the LRT would require closure of a 15- to 20-foot width of the street’s paved area, as one track of LRT line is built at a time. On-street parking and deliveries would need to be prohibited, and one lane of moving traffic could be maintained in each direction. With signal phasing and timing modifications in place, there would be no major impacts to traffic flows or levels of service during construction of the East Broadway segment. In all likelihood, bus service could be maintained, since the M9 is the only route operating on this segment of East Broadway.

Construction of the LRT on the east side of Columbia Street and Avenue D would require closure of a 22- to 25-foot width for construction-related activities. Within this segment, both LRT tracks would be built simultaneously. The remaining width of Columbia Street/Avenue D would operate one-way southbound, as it would once the LRT is operating. Parking and deliveries could be retained on the west side of the street during the construction period, with the one lane available for southbound traffic generally sufficient to accommodate moving traffic; signal phasing and timing changes would be needed. Access to parking lots within the housing complexes on the east side of the street would be maintained throughout the construction period. Avenue D service on the M14 route would likely need to be re-routed.

Construction of the LRT on 14th Street would require a 20-foot-wide construction zone for each segment of rail track, followed by a construction zone encompassing the track section in the opposite direction. The construction plan would be similar to that described above for Water and Pearl Streets, since both 14th Street and Water/Pearl Streets have generally similar street widths and each would have their respective LRT tracks separated by a center platform. On-street parking, all curbside deliveries, and left turns from 14th Street would need to be prohibited, and signal phasing and timing changes would be implemented. With these measures in place, one lane of traffic maintained in each direction could be sufficient to accommodate traffic volumes at some intersections, with substantially increased delays prevalent at other locations. Some traffic currently using 14th Street can also be expected to divert to other crosstown streets during the construction period, too. If crosstown 14th Street bus service is maintained, any bus stop located on a block within the construction zone would need to be relocated to the next adjacent block so that a bus stopped to pick up or discharge riders does not block the one lane available to moving traffic.
In addition, cut-and-cover work would be required on Delancey Street South to connect the light rail line with the new yard to be constructed at Essex Street. This would involve some minor disruptions to traffic along that lightly traveled street.

**Effects on Parking**

As with any construction project, temporary parking restrictions would have to be instituted, primarily to permit cut-and-cover work to take place and to allow for maintenance of traffic flow.

**Effects on Pedestrian Conditions**

On or near work zones, pedestrian paths would be clearly marked, separated from work areas and protected as necessary. Necessarily, some temporary restrictions, narrowing, and detours to pedestrian flow will have to be instituted.

**MITIGATION**

During construction of the TSM Alternative, maintenance and protection of traffic plans would be implemented to preserve pedestrian, vehicular traffic, and bicycle flows through the construction areas. In some locations, bus stops would be temporarily relocated one or two blocks away until construction in that area is complete.

For the new subway under Build Alternatives 1 and 2, construction work that affects existing subway service would be carefully timed to minimize necessary track outages to the extent possible and to limit those disruptions to subway service to nights and weekends. Maintenance and protection of traffic plans would be implemented to preserve pedestrian, vehicular traffic, and bicycle flows through areas affected by cut-and-cover construction work for subway stations and the area around the access shaft site.

Similarly, for construction of the LRT under Build Alternative 2, maintenance and protection of traffic plans would be implemented to preserve pedestrian, vehicular traffic, and bicycle flows through the construction areas. In some locations, bus stops would be temporarily relocated one or two blocks away until construction in the area is complete. Construction work that affects existing subway service at Chambers Street would be carefully timed to minimize the necessary track outages to the extent possible.

**AIR QUALITY**

Possible impacts on local air quality during construction of the proposed Build alternatives may result from fugitive dust (particulate) emissions from construction of the New York Bus Lanes (TSM Alternative), LRT tracks (Build Alternative 2), and cut-and-cover construction associated with the new subway stations (Build Alternatives 1 and 2), and tunnel/portal sections of the LRT (Build Alternative 2). Air quality may also be affected by mobile source emissions—including VOCs, NOx, and CO emissions—from construction workers’ private vehicles, disruptions in traffic due to construction, 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 the 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.

MOBILE SOURCE EMISSIONS

The CO emissions from construction workers driving to the segments being constructed, trucks driving to and from the construction area, and construction equipment operating on-site would not significantly affect air quality conditions. Construction vehicles are typically diesel-powered and therefore emit relatively low amounts of CO. Localized increases in mobile source emissions, including PM$_{10}$ concentrations, would not be significant and would be minimized by incorporating traffic maintenance requirements to ensure that:

- Construction requiring temporary street closings for the relocation of utilities and for other purposes in heavily traveled areas would be performed, to the maximum extent possible, during off-peak hours;
- The reduction in the number of traffic lanes would be minimized to the maximum extent possible; and
- Idling of delivery trucks or other equipment would not be permitted during periods when they are being unloaded or are not in active use.

The number of trucks traveling to and from the construction staging area (5 to 10 per hour) would not be large enough to result in any significant adverse air quality impacts. With respect to the effect of traffic diversions and potential reductions in the number of available traffic lanes due to construction activities on mobile source emissions, these impacts would be of a temporary nature and would not affect long-term air quality at any specific locations in the study area. It should be noted that use of either of the construction staging sites at the southern end of the new subway tunnel (i.e., 65th or 63rd Street) would likely result in greater congestion and therefore greater emissions than a northern site.

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 possible, the vehicular congestion and associated air quality problems.

**NOISE AND VIBRATION**

As for most major projects, construction of any of the Build alternatives 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 15-2. 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.

All tunneling operations would comply with provisions of the New York City Noise Code, Subchapter 7, which specifically regulates noise from tunneling operations.

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 areas. Specific issues related to each alternative are described below.

**TSM Alternative**

Temporary noise increases would occur at sensitive receptors throughout the area while the road reconstruction work associated with the TSM Alternative is under way, similar to other road surface reconstruction projects in New York City. Construction equipment used for road surface reconstruction include air compressors, asphalt spreader (paver), asphalt trucks, backhoes, bulldozers, diamond saws, dump trucks, front-end loaders, jackhammers, paving breakers, and steamrollers. Noise 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 road surface reconstruction activity. Traffic diversions to side streets may occur near any road surface reconstruction activity, and would also cause noise increases. The temporary construction noise from road surface reconstruction activity would be readily noticeable.

**Build Alternative 1**

The noise associated with the different construction elements for the new subway—including the tunnel boring machine, work at the construction shaft and staging area, other tunneling
activities, blasting, cut-and-cover construction, and work at the 36th-38th Street Yard in Brooklyn—is described below.

**Tunnel Boring Machine(s).** As described above, most of the new subway tunnel would be constructed with underground TBMs. Noise from the TBMs is not anticipated to be discernible in most areas along Second Avenue, as most noise would be contained underground.

**Construction Shaft and Staging Area.** When the access shaft is under construction, noise from excavation activities would include noise from such construction equipment as backhoes, bulldozers, cranes, delivery trucks, dump trucks, and jackhammers. Pile driving and blasting would also be required (the noise associated with these activities is described separately below). Once the TBM begins tunnel boring operations, soil, rock, and other material would be removed through the work shaft and carried away by truck. Concrete batching operations may occur at the shaft site to prepare the concrete rings needed for the tunnel, or concrete would be delivered to the work shaft area for use in the tunnel. A wall would be constructed around the shaft site for safety purposes. This barrier would have limited effectiveness in reducing noise levels, however. It would help to reduce noise effects only where it would block the line-of-sight between the noise source and the receptor (e.g., noise from equipment lower than the height of the wall would be blocked for pedestrians on nearby sidewalks). For any receptors that maintain a line of sight to the noise source, no abatement would be provided. Noise from construction activities at the shaft site would result in significant noise impacts to surrounding receptors throughout the construction period.
### Table 15-2

**Typical Noise Emission Levels for Construction Equipment**

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

**Notes:**

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

The enclosure would not provide any attenuation for noise resulting from trucks entering and exiting the shaft area. The large volumes of traffic on Second Avenue would partially mask the additional noise produced from heavy delivery trucks, but increases in noise levels from the additional trucks would be perceptible. If a side street is used for trucks to reach Second Avenue, noise increases from trucks would be more noticeable.

**Other Tunneling Activities.** North of 115th Street, the new tunnel would be constructed using mining techniques, with such construction equipment as jackhammers, line drills, and blasting. Noise from mining activity is not anticipated to be discernible, as most noise would be contained underground. Noise from any potential blasting operations is discussed below.

**Blasting.** Where limited blasting is required to construct the new tunnel north of 115th Street, the work would be entirely contained deep below ground and there are no proposed openings to the surface through which noise would propagate. Therefore, blasting north of 115th Street would not result in any discernible increases in noise levels.

Limited blasting may also be required in some of the cut-and-cover areas and to construct the access shaft. 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 less than 10 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 subway station, or tunnel entrance).

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. Blasting is most likely to occur in the early phases of construction, and would only occur for a limited time period with a well-defined frequency of occurrence.

**Cut-and-Cover Construction.** 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. Cut-and-cover activities may also include blasting (discussed above).

At excavation sites, retaining walls would be constructed using pile driving or sheet pile driving techniques. The impulsive noise produced from the hammering of piles or sheet piles into soil 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.

At times, plywood barriers would be constructed around portions of each subway station construction area for safety and noise abatement purposes. These barriers would have limited effectiveness in reducing noise levels from construction of the subway stations. In general, as
discussed earlier, such barriers help reduce noise at receptors which are shielded from the line of sight, but not at those that maintain a line of sight (such as receptors above the height of the wall, or when equipment extends above the wall).

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, but would not be considered significant because of the relatively short duration of this work. The uses that would be affected by this noise include the surrounding residences as well as Metropolitan Hospital at 97th Street and Second Avenue.

**Work at 36th-38th Street Yard in Brooklyn.** The construction work required to alter the existing subway yard at Fourth Avenue and 36th-38th Streets in Brooklyn for use by the MESA project would be less extensive than work at one of the cut-and-cover locations required for the new subway stations. Construction work would result in temporary increases in noise at nearby residences.

**Build Alternative 2**

The noise impacts associated with construction of the new subway included in Build Alternative 2 are the same as those described for Build Alternative 1. In addition, the following noise impacts would occur due to construction of the LRT portion of Build Alternative 2.

**At-Grade Portions.** At-grade portions of the LRT would be constructed using methods similar to road surface reconstruction (and similar to those described above for the TSM Alternative). As described for the TSM Alternative, temporary noise increases would occur along the construction route. Traffic diversions to nearby streets during construction of at-grade segments could also result in localized noise increases on those streets. Altogether, the temporary increases in noise resulting from construction of this portion of the alternative would be discernible, and may be considered intrusive and annoying.

**Tunneling Activities.** As described at the beginning of this chapter, the new Canal Street tunnel would be constructed using mining techniques west of Allen Street. Limited mining could also be required at the western end of the new storage yard, beneath the Essex Street Market. Mining activity would include the use of construction equipment such as jackhammers, dump trucks, cranes, backhoes, line drills, and may include blasting. This would result in discernible increases in noise levels that may be considered intrusive and annoying, especially if blasting is required. Noise from any potential blasting operations would be the same as discussed above for Build Alternative 1. As noted there, blasting noise is unlikely to affect average hourly noise levels, because of its short duration, but 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.
**Cut-and-Cover Construction.** In areas of the LRT that require cut-and-cover construction (on Canal Street, Frankfort Street, and at the new storage and maintenance yard), noise associated with the excavation would include noise from construction equipment such as backhoes, bulldozers, cranes, concrete mixers, concrete delivery trucks, delivery trucks, dump trucks, front-end loaders, and jackhammers. Pile driving would also be required to support the excavation site’s retaining walls. In addition, construction activities on Frankfort and Canal Streets would cause traffic diversions to other streets nearby, resulting in some localized increases in traffic-related noise on those streets. As described earlier, plywood barriers around the excavation areas would provide some limited reductions in noise levels. Overall, noise from cut-and-cover construction could be intrusive and annoying, but would not be considered a significant impact because of the relatively short duration of the work. Uses that would be affected include residences and Pace University.

**Noise Mitigation Measures**

At the site of the construction shaft and staging area, noise from construction activities would result in significant noise impacts at surrounding receptors. A barrier would be constructed around the shaft site, but this would reduce noise levels only at street level.

As described above, the plywood barriers to be constructed around any open excavation areas in Build Alternatives 1 and 2 would partially reduce noise levels from construction activities at cut-and-cover sites.

To reduce the noise associated with blasting, the contractor would be required to use modern blasting techniques—such as timed multiple charges, blastmats, etc.—which tend to lessen the severity of blasting noise levels.

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**

Blasting, pile driving, and pavement-breaking operations would create the most noticeable change in vibration levels. The effects of ground-borne vibration include discernible movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings.

Vibrations consist of rapidly fluctuating motions in which there is no “net” movement. When an object vibrates, any point on the object is displaced from its initial “static” position equally in both directions so that the average of all its motion is zero. Any object can vibrate differently in three mutually independent directions: vertical, horizontal, and lateral. Vibration levels are often described in terms of velocity, which represents the instantaneous speed at a point on the object that is displaced. The Federal Transit Administration (FTA) has set vibration damage thresholds at a Peak Particle Velocity (PPV) of 0.20 inches per second for fragile buildings and 0.12 inches per second for extremely fragile buildings. This analysis uses a damage threshold of 0.12 inches per second for all buildings as a conservative limit for vibration levels resulting from construction of the alternatives.
FTA guidance documents provide vibration levels and methods for calculating the resulting vibration levels at a specified distance, for various pieces of construction equipment. However, the documents do not address two primary sources of vibration that are common to the alternatives of this project: blasting and pavement-breaking operations. Based on FTA methodology and other sources, vibration-induced risk distance criteria were defined for various construction activities. The risk distance criteria were used for screening purposes near construction areas of the project alternatives. Table 15-3 shows PPV vibration levels for various construction activity at a reference distance (25 feet), as well as damage risk and perceptibility distances for fragile (based on damage threshold of 0.20 inches per second) and extremely fragile (based on damage threshold of 0.12 inches per second) structures in close proximity to the types of construction activities that would occur during construction of the proposed project.

The potential for vibration impacts as a result of construction of the project alternatives is described below, and generalized vibration mitigation measures to avoid any potential construction-related vibration impacts are identified. A more detailed vibration analysis will be included as part of the final design work, once a final alternative is chosen. The detailed vibration analysis will account for specific geological conditions, foundation assessment of all structures near vibration-causing construction activities, and will include specific vibration mitigation measures, based on this information.

TSM Alternative

Buildings in the area of road reconstruction would experience temporary increases in vibration levels, which would be similar to other road surface reconstruction projects in New York City. The primary source of vibrations from this type of work would be pavement-breaking operations. To avoid any 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 those buildings. Deep saw cuts would create discontinuities in the soil nearest the pavement breaking, minimizing the transmission of vibrations from pavement-breaking operations to the foundations of nearby buildings. With this technique, ground-borne vibration levels should be below 0.12 inches per second at the foundations of most buildings and no damage is anticipated. Nonetheless, vibrations from road surface reconstruction may be perceptible for distances of 210 feet from pavement-breaking operations.

Build Alternative 1

The vibration associated with the different construction elements for the new subway—including the tunnel boring machine, work at the construction shaft and staging area, blasting, cut-and-cover construction, and work at the 36th-38th Street Yard in Brooklyn—is described below.
### Table 15-3

Vibration-Induced Risk Criteria for Buildings

<table>
<thead>
<tr>
<th>Activity</th>
<th>PPV Vibration Levels @ 25' (in/sec)</th>
<th>Perceptible Distance (feet)</th>
<th>Damage Potential Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blasting</td>
<td>6.700</td>
<td>1,000</td>
<td>260</td>
</tr>
<tr>
<td>Pile Driving/Sheet Pile Driving (Impact)</td>
<td>1.518</td>
<td>375</td>
<td>100</td>
</tr>
<tr>
<td>Pile Driving/Sheet Pile Driving (Vibratory)</td>
<td>0.734</td>
<td>230</td>
<td>60</td>
</tr>
<tr>
<td>Pavement Breaking</td>
<td>0.644</td>
<td>210</td>
<td>55</td>
</tr>
<tr>
<td>Bulldozing</td>
<td>0.089</td>
<td>60</td>
<td>15</td>
</tr>
<tr>
<td>Heavy Truck Traffic</td>
<td>0.076</td>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>Jackhammers</td>
<td>0.035</td>
<td>30</td>
<td>8</td>
</tr>
</tbody>
</table>

**Sources:**

**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 along Second Avenue 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 may produce a perceptible rumbling sound in some nearby buildings.

**Construction Shaft and Staging Area.** For excavation of the access shaft, earthmoving, pile driving, and possible blasting (discussed below) would produce the strongest vibrations expected at the shaft site. However, this activity is not expected produce vibration levels that would be strong enough to cause any vibration impacts in areas nearby. As precautionary measures, earthmoving and ground-impacting operations (such as pile driving or sheet pile driving) would be scheduled so as not to occur at the same time. The total vibration level produced can be reduced significantly when each vibration source operates separately. Vibration levels caused by trucks traveling to and from the shaft site would be barely perceptible, and are not anticipated to cause any potential vibration impacts near the work shaft area.

**Blasting.** As described earlier, several project components associated with Build Alternative 1 may require blasting. To avoid vibration-induced damage from any potential blasting operations, monitoring programs and a variety of control measures (discussed below under “Vibration Mitigation Measures”) would be instituted. Vibration control measures would ensure that vibration levels at the foundations of nearby buildings remain below the FTA vibration damage
threshold of 0.12 inches per second during all blasting operations. Blasting operations are anticipated to create perceptible vibrations for a distance of approximately 1,000 feet from the immediate blasting site. Affected locations include nearby residences and, if blasting is required at the access shaft site and if one of the sites north of 96th Street is selected, Metropolitan Hospital Center.

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 the strongest 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 0.12 inches per second at the foundations of nearby buildings. Vibrations from pavement-breaking operations during subway station construction may be perceptible for distances of 210 feet from pavement-breaking operations.

Once the pavement is removed, the excavation activities at cut-and-cover sites are not anticipated to produce vibration levels that would be strong enough to cause significant impacts. As precautionary measures, earthmoving and ground-impacting operations (such as pile driving or sheet pile driving) would be scheduled so as not to occur at the same time period. Vibration levels caused by trucks traveling to and from the construction areas would be barely perceptible, and are not anticipated to cause any potential damage to buildings nearby.

In order to avoid vibration-induced damage from pile driving, vibration control measures would ensure that vibration levels at the foundations of nearby buildings remain below the FTA vibration damage threshold of 0.12 inches per second. Pile driving would create perceptible vibrations for a distance of approximately 375 feet.

Work at 36th-38th Street Yard in Brooklyn. The construction work required to alter the existing subway yard at Fourth Avenue and 36th-38th Streets in Brooklyn for use by the MESA project would be less extensive than work at one of the cut-and-cover locations required for the new subway stations. Construction work would result in temporary increases in vibration at nearby residences.

Build Alternative 2

In addition to the vibration effects associated with the northern subway, described above, construction of Build Alternative 2 would also result in vibration associated with the construction of the LRT, described below.

At-Grade Portions. Similar to other road surface reconstruction projects in the city, this work would cause temporary increases in vibration levels at buildings nearby. The primary source of vibrations from this work would be pavement-breaking operations. Similar to the TSM Alternative and Build Alternative 1, in areas where buildings are within 80 feet of the LRT’s route, deep saw cuts would be made between areas of pavement breaking and the sidewalk areas in front of buildings to minimize the transmission of vibrations from pavement-breaking operations to the foundations of nearby buildings. With this measure, ground-borne vibration levels should be below 0.12 inches per second at the foundations of nearby buildings, and no damage is
anticipated. Vibrations from road surface reconstruction for the TSM Alternative may be perceptible for distances of 210 feet from pavement breaking operations.

**Blasting.** In areas where blasting would be required—particularly on Canal and Frankfort Streets—monitoring programs and control measures would be employed to avoid vibration-induced damage. These measures would ensure that vibration levels at the foundations of nearby buildings (within 365 feet of immediate blasting activity) remain below the FTA vibration damage threshold of 0.12 inches per second during all blasting operations. Blasting operations are anticipated to create perceptible vibrations for a distance of approximately 1,000 feet from the immediate blasting site. Affected locations would include nearby residences, Pace University, and New York Downtown Hospital.

**Cut-and-Cover Construction.** At areas that require cut-and-cover construction (portions of the Canal Street tunnel, the Frankfort Street tunnel, and the new storage and maintenance yard), pavement breaking, earth moving, and pile driving would cause discernible vibration levels. Any blasting (discussed above) would also result in vibration.

The techniques discussed above to minimize vibrations associated with pavement breaking would be employed for cut-and-cover-activities associated with Build Alternative 2 as well, so that ground-borne vibration levels remain below 0.12 inches per second at the foundations of nearby buildings. Vibrations from pavement breaking operations during cut-and-cover construction may be perceptible for distances of 210 feet.

As described above for Build Alternative 1, the pile driving or sheet pile driving used to construct retaining walls at cut-and-cover locations would result in increased vibration levels. The impulses produced from the hammering of piles or sheet piles into soil near the proposed areas would produce vibration levels that would be perceptible for distances of 375 feet. Pile driving/sheet pile driving would be temporary, and is expected to occur during the early phases of each construction area. To avoid vibration-induced damage from pile driving, control measures would be instituted to ensure that vibration levels at the foundations of nearby buildings (within 135 feet of pile driving operations) remain below the FTA vibration damage threshold of 0.12 inches per second.

Other activities associated with cut-and-cover construction would not be expected to result in vibration levels strong enough to cause impacts nearby. As a precaution, earthmoving and ground-impacting activities (such as pile driving) would be scheduled so as not to occur at the same time. Trucks traveling to and from the construction sites would result in vibration that would be barely perceptible and would not cause any potential damage to buildings along the route.

**Vibration Mitigation Measures**

**Pavement Breaking.** To avoid any 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, ground-borne vibration levels should be below 0.12 inches per second at the foundations of most buildings and no damage is anticipated.

**Pile Driving.** There are no mitigation techniques that fully reduce vibration from pile driving operations. In areas where geological conditions permit their use, vibratory pile drivers would be
used to reduce the vibrations associated with this activity. In addition, earthmoving and pile driving operations would be scheduled so as not to occur at the same time period. Unlike noise, the total vibration level produced can be significantly reduced when each vibration source operates separately. In addition, at locations near fragile historic resources, additional measures would be followed to ensure that no damage occurs (see the discussion below).

**Blasting.** 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 program to protect nearby structures from damage.

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 shall 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 would be used to reduce ground vibration. Modern blasting techniques such as timed multiple charges, which lessen the severity of vibration levels, would be implemented.

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 (within 365 feet of immediate blasting operations) during all blasting activities. Blasting activities resulting in peak particle vibration levels in excess of 0.12 inches per second 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 contractor 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 FTA 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 buildings, are located within the risk distance criteria listed in Table 15-3, above, 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 during nearby 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 and the Advisory Council on Historic Preservation.

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 0.12 inches per second 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. In addition, the contractor would carry insurance to cover the expense of restoration caused by any damage that might occur despite this precaution.

UTILITIES AND SUBSURFACE STRUCTURES

As described in detail in Chapter 13, “Utilities and Subsurface Structures,” some utilities would have to be relocated as part of the construction of any of the Build Alternatives. 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.

HAZARDOUS MATERIALS

As detailed in Chapter 14 (“Hazardous Materials”), construction activities associated with the TSM Alternative would not result in potential impacts related to hazardous materials. Potential impacts of Build Alternatives 1 and 2 are described below.

BUILD ALTERNATIVE 1

As discussed in Chapter 14, construction of either Build Alternative 1 has the potential to expose contaminated soil and/or groundwater during the cut-and-cover sections of construction and during excavation of the access shaft site for the new subway. In addition, construction at the 36th-38th Street Yard in Brooklyn also has the potential to expose contaminants.

BUILD ALTERNATIVE 2

In addition to the potential impacts associated with construction of a new subway, described above, Build Alternative 2 could also result in potential hazardous materials impacts during construction of the LRT. Specifically, the construction of the LRT has potential to expose contaminated soil and/or groundwater during both cut-and-cover excavation for the tunnel portals and new yard and surface construction operations for the at-grade portion of the LRT route.
Chapter 15: Construction and Construction Impacts

MITIGATION

To eliminate any potential health concerns, prior to the commencement of construction a thorough investigation would be undertaken of each segment where potential impacts were identified and site-specific remediation plans and worker Health and Safety Plans would be developed. This investigation would include on-site testing and reviews of the files of agencies that regulate the use, storage, disposal, or transport of hazardous materials, as well as regulatory records related to underground storage tanks, to identify more accurately the locations and extent of potential contamination. A thorough investigation for underground tanks would be made for each segment of the construction during preliminary engineering, and site-specific remediation plans would be made in accordance with all applicable federal, state, and local regulations. Based on this investigation, a site-specific Health and Safety Plan would be developed for each phase of the construction to limit the potential for worker and public contact with any contamination found in either the soil or groundwater. The provisions of the Health and Safety Plan would be mandatory for the contractors and subcontractors engaged in any on-site construction activities that have the potential to expose their personnel to the existing soils on the site. In addition, all on-site personnel would be required to follow all applicable local, state, and OSHA construction codes and regulations. During construction, any unusual conditions—such as odors or discoloration of the soil—that may indicate unexpected contamination would be specifically checked for at all times. 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 Health and Safety Plan.

SUMMARY OF CONSTRUCTION IMPACTS AND MITIGATION

The specific impacts associated with construction of each of the project alternatives, and the required mitigation measures, are summarized below and in Table 15-4.

NO BUILD ALTERNATIVE

Without any new construction, this alternative would not result in any significant adverse impacts during construction. No mitigation measures would be required.

TSM ALTERNATIVE

During construction of the TSM Alternative, short-term, temporary inconveniences would occur. These disruptions and associated mitigation measures to avoid them, to the extent possible, would be as follows:

- Traffic. Generally, construction would encompass about half the street and would lead to traffic delays, particularly at critical avenue segments (e.g., First and Second Avenues near the Queensboro Bridge). The construction process and its impacts would be similar to other city street reconstruction programs. Maintenance and protection of traffic plans would be implemented to preserve pedestrian, vehicular traffic, and bicycle flows through the construction areas. Some bus stops may have to be relocated during construction.

- Noise. Temporary noise increases would occur at sensitive receptors throughout the area while the road reconstruction work associated with this alternative is under way, similar to
other road surface reconstruction projects in New York City. Traffic diversions to side streets would also cause noise increases.

Vibration. Buildings in the area of road reconstruction would experience temporary increases in vibration levels, which would be similar to other road surface reconstruction projects in New York City. The primary source of vibrations from this type of work would be pavement-breaking operations. To avoid any 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 those buildings. These would create discontinuities in the soil nearest the pavement breaking, minimizing the transmission of vibrations from pavement-breaking operations to the foundations of nearby buildings.

BUILD ALTERNATIVE 1

Impacts associated with construction of the new East Side subway extension would be as follows:

Land Use. This alternative would result in temporary disruptions and inconveniences in the areas near cut and cover excavation areas for new subway stations and near the access shaft and staging area. Mitigation measures such as dust suppression and noise and vibration control would be employed to minimize impacts on land use.

Social Conditions. This alternative would cause inconvenience and disruption to community facilities near the cut and cover construction and the access shaft site, and would temporarily affect neighborhood character in those areas. Dust suppression and noise and vibration mitigation measures would be employed to minimize these nuisances. Access would be maintained at all times to community facilities.

Economic Conditions. In cut and cover construction areas, businesses could experience certain temporary economic impacts—potential decrease in sales, possible increase in operating expenses and closing of some retail and neighborhood service establishments. Relocation benefits would be provided for businesses that are indirectly displaced as a result of construction activities nearby. For any properties that would have to be acquired for a construction shaft site or as easements, owners would be compensated at fair market value and relocation benefits would be provided for displaced business.

Visual and Aesthetic Conditions. The construction staging site required for the new subway would be potentially inconsistent in appearance with the surrounding neighborhood. This site would be surrounded by a barrier, reducing its visibility to the surrounding neighborhood, but would remain visible from above.

Historic Resources. For the two buildings that have been determined eligible for that State and National Registers of Historic Places, proper care would be given to ensure that the required underpinning is performed at the 125th Street Station. All such plans would be submitted to the SHPO for review and approval prior to the start of construction. Further, at all other locations, appropriate care would also be taken to ensure that construction would not result in significant impacts to historic resources. If the 65th Street shaft site is selected for the subway, and if the theater on that site is determined to be eligible for the landmark
status by the city, or by the State and National Registers, another site could be selected or appropriate mitigation could be developed through consultation with SHPO.

Archaeological Resources. This alternative could affect archaeological resources at the proposed construction staging sites and on 124th Street where cut and cover is proposed. As project plans proceed, additional research will be conducted to define the extent of potential impacts, and the ongoing consultation process with SHPO and the Advisory Council on Historic Preservation will continue, to avoid direct and indirect impacts to archaeological resources.

Transportation. Construction would affect subway service during late night hours and on weekends on the Lexington Avenue line at 125th Street, on the B and Q lines at 63rd Street, and on the N and R lines at Canal Street and City Hall. Such construction work would be carefully timed to minimize necessary track outages to the extent possible and to limit those disruptions to subway service to nights and weekends.

Traffic. In the construction zone for the new stations, parking would be prohibited, sidewalk widths would be reduced, and some diversion of traffic to parallel streets would occur. Maintenance and protection of traffic plans would be implemented to preserve pedestrian, vehicular traffic and bicycle flows through areas affected by cut and cover construction work and shaft site work.

Air Quality. Impacts to air quality may occur from construction-related fugitive dust (particulate) emissions. All excavation and construction work would be conducted with care, and all appropriate fugitive dust control measures would be employed to minimize effects to nearby people or buildings. The traffic maintenance and protection plans would minimize vehicular congestion and associated air quality problems.

Noise. With this alternative, noise from such construction equipment as backhoes, bulldozers, cranes, delivery trucks, dump trucks, and jackhammers would occur. Some pile driving and blasting would also be required. Decking materials used as temporary cover for the excavated areas could also cause increases in noise.

At the site of construction shaft, noise from such sources would result in a significant impact. A barrier around the site would not remove this significant impact.

Similarly, plywood barriers to be constructed around any open excavation areas would partially reduce noise levels from construction activities at cut-and-cover sites; this noise, however, would not constitute a significant impact because it would be of shorter duration.

To reduce the noise associated with blasting, the contractor would be required to use modern blasting techniques—such as timed multiple charges, blastmats, etc.—which tend to lessen the severity of blasting noise levels. There are no cost-effective mitigation techniques that effectively reduce noise from pile driving operations. In certain geological conditions, however, vibratory pile drivers that produce lower noise levels can be used.

The construction work required to alter the existing subway yard in Brooklyn would be less extensive than work required for new subway stations, and would result in temporary increases in noise at nearby residences.
Vibration. With this alternative, vibrations from tunnel boring machines, excavation of the access sites, pile driving and blasting, pavement breaking, and earthmoving (digging) operations would occur. To avoid any architectural damage (e.g., cracked plaster) to extremely fragile buildings within 80 feet of the pavement breaking work, deep saw cuts would be made between areas of pavement breaking and the sidewalk areas in front of buildings. During pile driving, vibration control measures would ensure that vibration levels at the foundations of nearby buildings remain below FTA vibration damage threshold. In areas where geological conditions permit their use, vibratory pile drivers would be used to reduce the vibrations associated with this activity. In addition, earthmoving and pile driving operations would be scheduled so as not to occur at the same time period. A specification would be inserted into construction contracts with regard to blasting operations requiring the contractor to implement a program to protect nearby structures from damage.

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 buildings, are located, construction contractors would be required to implement special vibration protection measures.

Hazardous Materials. This alternative has the potential to expose contaminated soil and/or groundwater during the cut and cover sections of construction and during excavation of the access shaft site for the new subway. Construction at the 36th-38th Street Yard in Brooklyn also has the potential to expose contaminants. To eliminate any potential health concerns, a thorough investigation would be undertaken of each segment where potential impacts were identified and site-specific remediation plans and worker Health and Safety Plans would be developed.

BUILD ALTERNATIVE 2

In addition to the impacts associated with the new East Side subway extension (described above under “Build Alternative 1,”) this alternative would have additional potential impacts, requiring additional mitigation, associated with construction of its light rail transit component, as follows.

Land Use. Construction activities would cause temporary disruptions to surrounding uses, particularly where cut and cover excavation would be required for the new yard and tunnel portals. Mitigation measures would be employed for traffic, air quality, noise, and vibration concerns during construction, as described below.

Social Conditions. The disruptions associated with cut and cover construction activities would cause inconveniences at some community facilities. To mitigate these disruptions, dust suppression and noise and vibration mitigation measures would be employed. Traffic protection plans would be implemented to minimize traffic disruptions to the extent possible, and to ensure that pedestrian and vehicular access remains available to nearby community facilities at all times.

Economic Conditions. With this alternative, cut and cover activities would reduce accessibility to businesses in the area, particularly around Canal Street, and some significant adverse impacts could result. For any businesses that are indirectly displaced, relocation benefits would be provided.
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Visual and Aesthetic Conditions. The visual effect of the construction of the LRT would be the temporary construction barricades erected at the construction sites as well as any temporary reroutings of adjacent sidewalks.

Historic Resources. The Essex Street Market Building, which has been determined eligible for the State and National Registers of Historic Places, would require underpinning, as it would be above the western end of the proposed LRT maintenance and storage yard. A construction protection plan would be prepared and implemented and subject to approval by SHPO. If it is necessary to affix wiring to any historic buildings when constructing the LRT, the planned alterations would be designed in consultation with SHPO and/or LPC. Further, at all other locations, appropriate care would also be taken to ensure that construction would not result in significant impacts to historic resources.

Archaeological Resources. This alternative could affect archaeological resources throughout the LRT route. The African Burial Ground in Lower Manhattan would not be affected by this alternative. As project plans proceed after selection of a preferred alternative, and as other project elements are defined, additional research will be conducted to define the extent of potential impacts, and the ongoing consultation process with SHPO and the Advisory Council on Historic Preservation will continue, to avoid direct and indirect impacts to archaeological resources.

Transportation. This alternative would disrupt J, M, and Z subway service at Chambers Street during weeknights and weekends for a limited period of time. This would be a temporary, impact, carefully timed to minimize the necessary track outages to the extent possible.

Traffic. Because of the traffic delays that would occur with the alternative, maintenance and protection of traffic plans would be implemented to preserve pedestrian, vehicular traffic, and bicycle flows through the construction areas. In some locations, bus stops would be temporarily relocated one or two blocks away until construction is complete.

Air Quality. All construction would be conducted with care, and all appropriate fugitive dust control measures would be employed. The traffic maintenance and protection plans would be designed to minimize, to the extent possible, the vehicular congestion and associated air quality problems.

Noise. The noise impacts that would result with this alternative would stem from at-grade construction, tunneling activities, and cut and cover construction. Mitigation measures for this noise would be the same as for construction elements of the new subway, described above.

Vibration. The at-grade construction work, blasting, and cut and cover construction associated with this alternative would result in vibrations. The mitigation measures for vibration would be the same as described for the subway, above.

Hazardous Materials. Construction of the LRT has the potential to expose contaminated soil and/or groundwater during both cut-and-cover excavation for the tunnel portals and new yard and surface construction operations for the at-grade portion of the LRT route. To eliminate any potential health concerns, a thorough investigation would be undertaken of each segment where potential impacts were identified and site-specific remediation plans and worker Health and Safety Plans would be developed.