A. EXISTING CONDITIONS

This section provides an overview of the traffic study area and traffic conditions within it. (Appendix D presents back-up data and more detailed information on study area intersections.) The study area contains six subareas, or zones—East Harlem, the Upper East Side, East Midtown, Gramercy Park/Union Square, the Lower East Side, and Lower Manhattan—and each has different street and roadway characteristics along its length. A regular street grid characterizes East Harlem, the Upper East Side, East Midtown, and Gramercy Park/Union Square, with avenues running north-south and streets running east-west. Each of the major north-south avenues—First, Second, Third, Lexington, Park, Madison, and Fifth Avenues—are major traffic carriers. There is also one limited-access roadway, the FDR Drive, which extends around the eastern edge of the study area from its northern end to its southern end.

East Harlem is mostly residential, and traffic moves through the area to employment points located farther south in Manhattan. The key roadway is the 125th Street corridor, lined with Harlem's largest concentration of commercial stores, and connected to points east via the Triborough Bridge at Second Avenue. Travel along 125th Street is slowed due to frequent shopper-related double parking, which often reduces street capacity to a single moving lane. Metro-North's Harlem-125th Street Station is situated at Park Avenue.

Trucks making deliveries to the many retail and commercial establishments lining the avenues typically slow north-south traffic flows within the Upper East Side. Central Park transverse roads at 96th, 86th, 79th, and 65th/66th Streets serve east-west travel and are also heavily used by NYCT bus routes. Significant land uses of note in the area that generate the bulk of traffic trips are high-density residential uses and the Museum Mile on Fifth Avenue.

East Midtown contains the eastern portion of Manhattan's CBD and carries the highest traffic volumes in the study area. Each of the area's north-south avenues has slightly different functions in processing vehicular traffic. Fifth and Madison Avenues act as a one-way pair for a significant amount of commuter and local bus traffic traveling directly into Manhattan's center. Park Avenue carries a significant amount of taxicabs destined to and from Grand Central Terminal (GCT) at 42nd Street. Lexington and Third Avenues are used as a north-south pair for a number of NYCT buses, and First and Second Avenues, situated to the east and out of the densest commercial areas, process a significant volume of through traffic, including the heavily utilized M15 bus route. There are also key east-west arterials (e.g., 57th, 42nd, 34th Streets) that carry vehicles across the borough. Major traffic generators in East Midtown include: the Queensboro Bridge, the United Nations, Grand Central Terminal at 42nd Street, and the Queens-Midtown Tunnel. Along the entrance routes to both the Queensboro Bridge and Queens-Midtown Tunnel, vehicles queue, often requiring traffic enforcement agents to prevent gridlock.

Traffic volumes in the Gramercy Park/Union Square area are lower than in the East Midtown area since the neighborhoods in this study zone (e.g., Stuyvesant Town, Peter Cooper Village,

and Gramercy Park) are more residential in nature. The major traffic generators in this area are hospitals, such as Bellevue Hospital, NYU Medical Center, the Veterans Administration Hospital, Beth Israel Medical Center, Cabrini Medical Center, and the Hospital for Joint Diseases.

A regular street grid north of Houston Street characterizes the primarily residential Lower East Side zone. However, the area to the south is marked by irregular and odd-angled intersections that are difficult to travel through. This part of the study area processes large amounts of through traffic between the East River crossings and commercial areas north and south. Key travel corridors include: First and Second Avenues, which act as a one-way street pair through the area; Broadway, Manhattan's central southbound spine; Allen Street; the Williamsburg Bridge; and the FDR Drive.

Lower Manhattan is characterized by an irregular grid pattern south of Canal Street. Except for a few major arterials, most streets within the area are narrow with usually just one moving lane. Travel is time-consuming and slow along them. Pedestrian traffic often overflows into the street, further impeding vehicular traffic flow. Water Street and Broadway are the two key north-south streets in this area, and each carries two or more effective travel lanes; yet they are often difficult to negotiate due to frequent double-parked truck traffic. The FDR Drive begins its path to the northern tip of Manhattan along the East River at the Battery.

The Wall Street/Financial District commercial hub, City Hall, and the Staten Island Ferry at Manhattan's southern tip are the most significant activity generators affecting traffic flow in Lower Manhattan. The "superblock" configuration of City Hall cuts off east-west through flow on Warren Street, Murray Street, and Park Place, and renders travel through this area difficult. During the morning rush hours, the Staten Island Ferry unloads from 4,000 to 6,000 pedestrians into the immediate area, causing vehicular traffic to come to a standstill for minutes at a time.

Traffic volumes entering Manhattan have continued to increase since the 1940s and these increases are occurring during periods just before and after the normal commuter peak periods when the roadways have additional reserve capacity. Many of the approach roads to and from the river crossings operate at or near capacity during the AM and PM peak commuter hours and cannot accommodate a significant increase in traffic. On an average weekday, a total of 1.68 million vehicles enter and leave the CBD (Manhattan south of 60th Street), with over 45 percent of the traffic entering or exiting the area crossing 60th Street.

The analysis of existing traffic conditions focuses on the capacity of urban streets, defined as the maximum number of vehicles that can pass through their intersections with other streets. Signalized intersection capacities are typically calculated on an hourly basis and are based on three sets of inputs: geometric, traffic, and signalization conditions. Level of service (LOS) for signalized intersections is defined in terms of delay, and according to generally accepted practice, LOS A, B, and C reflect the existence of delays within an acceptable-to-tolerable range, and LOS D and E suggest delays increasing into often unacceptable or breakdown conditions (LOS F). According to the City of New York's *City Environmental Quality Review (CEQR) Technical Manual* a mid-LOS D or better is considered an acceptable condition.

Level of service analyses for nearly 300 intersections in the study area were collected from a variety of traffic impact studies and environmental impact statements conducted over the past 6 years. Table 5D-1 summarizes the number of intersections with one or more approaches operating at LOS E or F, as reported in these previous studies. In both the AM and PM peak

Table 5D-1
Number of Intersections at Level of Service E or F

Zone	No LOS E/F Approaches	One LOS E/F Approach	More Than One LOS E/F Approach	Total Intersections
AM Peak Hour				
East Harlem	20	3	1	24
Upper East Side	32	12	5	49
East Midtown	89	28	6	123
Lower East Side	9	1	2	12
Lower Manhattan	35	5	2	42
TOTAL	**185**	**49**	**16**	**250**
PM Peak Hour				
East Harlem	50	6	1	57
Upper East Side	26	15	8	49
East Midtown	98	28	5	131
Lower East Side	10	0	2	12
Lower Manhattan	38	4	0	42
TOTAL	**222**	**53**	**16**	**291**

Source: EIS documents on file at AKRF, Inc., and Eng-Wong, Taub & Associates, 1995-2001.

hours, approximately 25 percent of the intersections reviewed have at least one approach operating at LOS E or F. However, most motorists experience poor operating conditions on many streets within the study area. At some locations, mid-block delays due to deliveries and illegal parking on both the avenues and crosstown streets limit the number of vehicles that can travel through a downstream intersection. At other locations, reasonably good operating conditions may be found for several blocks before delays occur at major signalized intersections (e.g., the intersections of avenues with major crosstown streets).

A major problem encountered by motorists entering, leaving, or just traveling through Manhattan is the volume of traffic and resulting congestion on the approach roads for the river crossings. This congestion occurs not just during the AM and PM peak periods, but also throughout the day. Figure 5D-1 depicts some significant areas of severe congestion in the study area, including the approach roads to and from the Queensboro Bridge, the Queens-Midtown Tunnel, and the Brooklyn Bridge. In addition, many of the primary roads within each part of the study area are subject to periods of congestion, particularly in the peak periods.

Near the Queensboro Bridge, congestion on southbound Second Avenue extends north from 60th Street and can reach to 72nd Street. Vehicles on First and York Avenues also experience congestion, but generally to a lesser extent than vehicles on Second Avenue. Near the Queens-Midtown Tunnel, both 36th and 34th Streets experience severe congestion, as does the Second Avenue approach to the tunnel.

Motorists traveling to and from the East River bridges in the Lower East Side and Lower Manhattan (i.e., the Williamsburg, Manhattan, and Brooklyn Bridges) are also subject to severe congestion. Delancey Street and Chambers Street experience severe congestion in the immediate vicinity of the Williamsburg and Brooklyn Bridges, respectively. This congestion is not limited to the peak periods; during the middle of the day, both Delancey and Chambers Streets are

congested due to truck delivery activity, illegal parking, and conflicts with pedestrian movements. Chambers Street is also congested east of Broadway because of the vehicular trips attracted to the various government buildings in the area, including City Hall and the Municipal Building. Canal Street, which connects the Manhattan Bridge with the Holland Tunnel, experiences severe congestion for its entire length.

In East Harlem, congestion is focused primarily on the 125th Street commercial corridor and at 125th Street and Second Avenue where the Triborough Bridge funnels significant volumes of traffic into and out of Manhattan. At the northern boundary of the Upper East Side, 96th Street also experiences congestion. In addition to local and bus traffic, 96th Street is used for access to both directions of the FDR Drive. This through traffic contributes to the congestion on eastbound 96th Street during the PM peak period and even later into the evening. Pedestrian activity contributes to the congestion along most of the avenues and major cross streets on the Upper East Side, in East Midtown (particularly near GCT), and on the Lower East Side. In addition to pedestrians, the cross streets accommodate two-way traffic, bus routes, local deliveries, and through traffic. Within East Midtown, 57th, 42nd, 34th, and 23rd Streets share these operational characteristics and the congestion they cause. In Lower Manhattan, there are congested sections due to narrow streets, turns made at angled intersections, and pedestrian activity.

The congestion in the study area impacts bus operations. When an auto, taxi, or truck uses the curb lane, which is a designated bus lane, either for a delivery or for turns, buses swing out into general traffic. Because of the length of the bus, this maneuver into general traffic disrupts operations in the two lanes adjacent to the curb lane. The "shock wave" caused by repeated traffic stoppages in three lanes (curb lane and next two adjacent lanes) can travel upstream and disrupt the traffic flow along an entire section of an avenue or street.

B. FUTURE CONDITIONS COMMON TO ALL ALTERNATIVES

Areawide traffic volumes are projected to increase by about 0.5 percent per year according to New York City Environmental Quality Review (CEQR) guidelines. In addition to this increase in background traffic levels, some localized increases will also occur as a result of new development (for more information, see Chapter 6, "Social Conditions"). For example, substantial new development is projected in the East 30s on properties being sold by Con Edison. These localized increases as well as background growth were accounted for in the analysis. No major new roadway improvements are expected through the study area that would significantly increase roadway traffic capacity. Although there has recently been some discussion by New York City officials regarding the possibility of implementing a toll system on all of the East River crossings, this action has not been assumed for any of the Second Avenue Subway analyses. Some roadway construction projects are proposed that could result in construction activities occurring at the same time in the same vicinity as Second Avenue Subway construction work. Although the timing of these plans and of the Second Avenue work is not yet clear, the possibility of cumulative effects from combinations of projects in construction at the same time is considered in Chapter 19, "Indirect and Cumulative Effects" in this FEIS.

C. CONSTRUCTION IMPACTS OF THE PROJECT ALTERNATIVES

NO BUILD ALTERNATIVE

With the No Build Alternative, the Second Avenue Subway would not be built. Therefore, there would be no vehicular traffic impacts caused by the construction of the subway.

SECOND AVENUE SUBWAY

INTRODUCTION

This section analyzes possible impacts from construction of the Second Avenue Subway on traffic conditions. As is typical of other mass transit projects in dense urban areas like Manhattan, construction of the Second Avenue Subway would create traffic impacts during its construction. These impacts would result from lost roadway capacity along Second Avenue as up to half the roadway width would need to be closed during part of the construction period, as some traffic on the Second Avenue corridor diverts to other parallel routes, and as construction vehicles are added to the street network. Once the construction phases have been completed and the subway line is operational, these traffic impacts would no longer exist, and traffic conditions would be the same or slightly better than those that would occur without the Second Avenue Subway.

For the Second Avenue Subway, although the vast majority of the construction work would occur below ground via tunneling, disruption at street level would occur where cut-and-cover excavation, slurry wall construction, and other surface activities are required at station locations, access shafts, and tunnel boring machine (TBM) insertion locations. Impacts on vehicular and pedestrian traffic would be significant at these locations. Accordingly, MTA/NYCT has committed to developing an Interagency Traffic Management Task Force to develop, implement, and monitor a comprehensive traffic mitigation plan that will address such impacts throughout construction. To ensure that this plan is as inclusive as possible, the Interagency Traffic Management Task Force will include such agencies as NYCDOT, NYSDOT, and MTA Bridges and Tunnels. As the traffic mitigation plan is being developed, NYCT will maintain regular communication with local elected officials and affected community groups regarding the work of the Interagency Task Force, and the traffic mitigation plan will be refined as needed to accommodate traveler and community needs while maintaining the safe and efficient construction of the subway in as timely a manner as possible.

The anticipation of significant traffic impacts during the periods, and at the locations, of surface construction activities are based on a detailed analysis of projected conditions at some of the most potentially critical impact locations. Detailed projections are presented in the remainder of this section of the Transportation chapter.

As described previously in this FEIS, Second Avenue Subway construction is expected to start in 2004, and depending upon the construction sequencing, method, and cash flow, it could continue until sometime between 2016 and 2020. The peak construction activity would occur within the first half of the construction duration; therefore, a construction year near the midpoint of construction duration, in this case 2010, was conservatively selected for analysis. During these periods, more than one station or access site could be excavated simultaneously, resulting in multiple spoils removal and material delivery truck trips to adjacent station locations.

The remainder of this section provides: 1) an overview of construction conditions along the corridor; 2) a description of the traffic impact analysis methodology; 3) detailed traffic analysis results for the station and shaft/access sites analyzed in detail; and 4) an extrapolation of findings at the detailed analysis locations applied to the full East Side study area, including a broad outline of the mitigation plan that will be developed to minimize impacts during the construction period.

Traffic volumes for the 2010 baseline condition were estimated by: 1) increasing existing traffic volumes by the standard traffic growth rate of 0.5 percent per year for Manhattan, per NYC CEQR guidelines; 2) adding traffic that would be generated by major developments on the East Side of Manhattan (e.g., Con Edison's First Avenue properties between 34th and 42nd Streets, the new United Nations Building on 42nd Street, and the potential office/trading facility at 55 Water Street); and 3) conservatively adding an extra 1 percent of existing traffic volumes to account for other possible developments in each study zone.

OVERVIEW OF CONSTRUCTION CONDITIONS ALONG THE SECOND AVENUE CORRIDOR

As detailed in Chapter 3, "Description of Construction Methods and Activities," constructing the Second Avenue Subway tunnels, stations, and other underground spaces would result in a large volume of excavated materials that would need to be removed to an off-site location. This process is referred to as "spoils removal." In addition, it would be necessary to deliver a large quantity of construction materials and supplies to the various construction sites.

A total of nearly 6.3 million loose cubic yards of spoils would be excavated along the alignment. This is a substantial increase from the 3 million cubic yards estimated in the SDEIS. Of this amount, about 2.4 million cubic yards would come from tunnels and associated launch sites, with the remaining 3.9 million cubic yards coming from stations. The reasons for this increase are described in Chapter 3.

Despite this increase in the overall amount of spoils that would need to be removed throughout the project's construction period, construction impacts from trucking and other operations would not be more intense than those identified in the SDEIS and described below. The analysis below includes conservative assumptions about construction duration at tunnel shaft sites and about the number of trucks that would be required daily at each construction activity site to remove spoils. Consequently, the new trucking numbers and durations are within the ranges included in the SDEIS to conduct traffic, air quality, and other analyses. While the number of trucks that would be generated project-wide would increase, the daily volumes at any spoils removal site would not increase beyond volumes assessed in the SDEIS and described below. Therefore, construction impacts from trucking and other operations would not be more intense than those identified in the SDEIS. However, the overall duration of the activities in each location would increase.

Construction of the subway could result in significant traffic impacts due to lane closures along the alignment, diversion of through traffic away from congested construction areas, and an increase of traffic from construction vehicles. Lane closures would be expected at station construction locations and at shaft/access sites that may be constructed within or adjacent to Second Avenue, as described in Chapter 3, "Description of Construction Methods and Activities." Preliminary engineering estimates indicate that up to half of the Second Avenue roadway width would be needed at station locations to accommodate subway construction activities. This would reduce the width of Second Avenue adjacent to construction zones, to three 12-foot lanes for traffic at most station locations. Where stations are constructed on two-

way streets, such as 125th Street and Water Street, the roadway would be narrowed to one travel lane per direction, with provision available for two travel lanes at some locations (i.e., at approaches to some key intersections).

The length of the station construction and staging area would be four to five block lengths at each location. On the major cross streets, generally all six travel lanes would remain open for traffic, but during specific short-term construction operations, a minimum of one lane in each direction would be open for traffic. For minor cross streets that intersect a construction zone, at least two of the three east/west travel lanes are expected to remain open for traffic. On the minor cross streets, one of the three possible east/west travel lanes could be used for a few years to serve as a lay down or storage area for the construction on Second Avenue.

At an early stage of the construction process, the capacity of cross streets would be reduced for a short duration to allow the initial excavation, construction of the roadway supports, and installation of roadway decking, so that station construction could continue beneath the roadway without affecting roadway capacity above. The traffic analyses that follow do not examine this short-term roadway capacity reduction, but concentrate on the longer-term traffic conditions that would be expected at a construction area, specifically the closure of half of Second Avenue.

The duration of construction at locations that would be used as the insertion point for mechanized boring machines, and eventually as access shafts to remove tunnel spoils and supply construction materials, could take up to 5 years; as described in Chapter 3, in some cases, activity at these sites could be prolonged because station construction would occur subsequent to tunnel construction. The initial 5-year duration includes the time needed to perform the initial excavation at the TBM insertion location, remove spoils from two TBM runs (assuming that spoils from both tunnels would not be removed simultaneously), and inserting precast concrete liners.

The following locations have been identified as potential shaft sites/spoils removal areas:

- 125th Street and Third Avenue;
- Second Avenue between 97th and 92nd Streets;
- Tunnel spur connection shaft site at Second Avenue and 66th Street;
- St. Vartan Park and Kips Bay Plaza service road area on Second Avenue at 36th and 33rd Streets, respectively;
- Houston Street Station; and
- Water Street at Hanover Square Station area.

The duration of a station's construction could also last up to 5 years. The first stage of station construction would be the initial excavation, which could last about 2 to 3 years. The second stage includes the construction of station structures (i.e., platforms, stairwells, etc.) and finishes (i.e., tiling, electrical, etc.), which could require 2 more years to complete. All stations—whether constructed by cut-and-cover technology or mining—would also have shafts at which spoils would be removed and materials would be delivered.

For the traffic analysis of the construction phase, it has been assumed that Second Avenue would be reduced to three travel lanes through the four- to five-block construction zone. Curbside parking would be prohibited through the construction zone so that three moving lanes could be maintained. Bus routes would be maintained, but some bus stops would need to be relocated up to two to three blocks away from the construction locations to maintain moving lanes through the construction zones.

In addition to lane closures, the Second Avenue Subway construction would generate a significant volume of truck traffic through the East Side of Manhattan for spoils removal from and materials delivery to the construction sites. As determined in Chapter 3, spoils may be removed with a conveyor system to a barge site, trucked to a barge site, or trucked out of Manhattan via one of the East River crossings. The traffic analyses that follow conservatively assume that trucks would remove all spoils.

The proposed subway alignment is generally within close proximity to the Harlem/East River crossings and the regional highway network within the Bronx, Queens, and Brooklyn on the other side of the rivers. For the purpose of this construction analysis, it has reasonably been assumed that most truck trips for spoils removal would be made via these Harlem/East River crossings instead of traveling westward across Manhattan and potentially experiencing additional travel delays. In addition, use of a barging operation in Lower Manhattan is also being evaluated, to eliminate some of the truck trips generated by the project. This analysis conservatively assumes all trips are made by truck. The 129th Street barge site on the East River was eliminated.

Construction material required for the Second Avenue Subway could be manufactured or distributed from any location in the metropolitan area. As a result, material delivery truck trips could be arriving at Second Avenue from all possible directions.

The various truck trips through a given study area can be separated into four basic categories, namely: 1) spoils removal truck trips from construction sites within the analysis study zone; 2) material delivery truck trips to construction sites within the analysis study zone; 3) spoils removal truck trips that pass through the analysis study zone from construction sites outside the study zone area; and 4) material delivery truck trips that pass through the analysis study zone to construction sites outside the study zone.

Based on preliminary engineering estimates, the peak trucking activity would occur during the cut-and-cover excavation and slurry wall construction phases of the stations. During this phase, an average of 160 truck trips to and from each station would be made daily during a 16-hour work period to remove spoils from the site. The excavations would occur on a continuous basis during the 16-hour period; therefore, on average, about 10 truck trips per direction per hour would be made from each site. For this study, a 20 percent peaking factor was applied to this average, resulting in 12 truck trips in and out of each construction site during the AM and PM peak hours. The traffic impact analysis conservatively assumes that the peak construction vehicle activity period would occur during peak traffic hours. Trucking estimates have been based upon average hourly trucking rates; therefore, if some construction activities were to occur over a 24-hour period instead of a 16-hour period, the volume of truck trips during the peak hours would be the same. The only difference would be the duration of the trucking activity in months.

Concurrent with the spoils removal would be material delivery truck trips that total between 20 and 45 additional daily truck trips in and out of each station site. For the traffic analyses, a higher percentage of truck trips were assigned to the AM peak hour since most material delivery trips would typically be made in the morning hours so that the material could be used during the day. Therefore, 25 percent of the total daily material truck trips to each construction site were assumed to arrive in the AM peak hour and 10 percent of the daily total in the PM peak hour.

The estimated volume of construction trucks on any one bridge or tunnel would peak at approximately 60 vehicles per hour (vph) per direction and average between 30 and 40 vph per

direction. After leaving Manhattan, trucks would likely use a number of different routes, depending on the location of their final destination. It is possible that, for certain construction activities, such as spoils removal, many trucks could head through or to one point. If so, there could be a localized traffic impact at that location. However, it is not yet possible to determine those impacts, because neither contractors, locations for spoils disposal nor reuse as fill material has been identified. Once this information has been determined, an assessment of conditions at these locations would be undertaken as part of the comprehensive areawide traffic management and mitigation plan that will be developed by NYCT. This plan would be reviewed by and coordinated with appropriate city, county, or state agencies—designated by the Interagency Traffic Management Task Force—as the spoils may be trucked out of the city or state. As part of the traffic-monitoring program within New York City, the task force would ensure that these concentrations of truck traffic do not cause significant impacts and that appropriate controls or mitigation measures are implemented.

With the exception of the 96th to 92nd Street area during Phase 1, construction of the tunnels would not occur at the same time as construction of the stations in any given project segment. Generally, rock tunnels would be bored before station areas would be excavated to allow the TBM to pass through without conflict with station work and to take advantage of the excavation of the TBM before any additional excavation occurs. For soft ground TBM tunnels, the station cut-and-cover excavation would occur prior to boring the tunnels. The limited segments where tunnels would be constructed using cut-and-cover technology are adjacent to stations, and that work would likely be constructed in coordination with the station work. Therefore, except as noted in the 96th Street area, there would typically not be a cumulative effect between construction vehicles associated with tunneling and spoils removal and those associated with station construction. Several stations could be under construction at the same time, however. In that case, trucks might travel on major truck routes near Second Avenue (e.g., Second Avenue, First Avenue and Third Avenue) to and from several construction sites. The analyses included in this chapter consider the potential for traffic from other construction sites to pass through the construction area being assessed. This is described in more detail in the specific discussions below.

During construction, vehicles needed to build the subway have the potential to affect neighborhoods surrounding the construction zones, especially as they circulate between southbound Second Avenue and northbound First or Third Avenues. Hence, there could be localized traffic impacts in those neighborhoods. An assessment of conditions in those affected neighborhoods would be undertaken as part of the comprehensive areawide traffic management and mitigation plan that will be developed by NYCT. This plan would be reviewed, approved, and monitored by the Interagency Traffic Task Force, which will include such agencies as the NYCDOT, NYSDOT, and MTA Bridges and Tunnels. As part of the traffic-monitoring program, the task force would ensure construction-related truck traffic does not cause significant impacts in those neighborhoods and that appropriate mitigation measures are implemented.

The peak hours for the construction phase traffic analysis are the 8 to 9 AM and 5 to 6 PM hours, when traffic volumes are the highest in Manhattan. Shift hours for construction employees typically do not coincide with the standard 9 AM to 5 PM hours. Also, most construction employees would be expected to travel to and from work by public transportation, since parking for most workers will not be provided at the various construction sites. As a result, employee trips have not been included in the construction peak hour volumes. Furthermore, based upon the high volume of truck trips that have been assumed to arrive and depart each construction zone during the peak hours, an employee shift change occurring simultaneously

would be unrealistic. The volume of truck traffic and their operating characteristics would have a greater influence on traffic level of service than employee vehicle trips and, consequently, govern the traffic analyses.

The construction of the Second Avenue Subway would reduce roadway capacity adjacent to construction zones, resulting in congestion and slower travel speeds. These conditions would lead some motorists who travel along the subway construction alignment to seek alternative routes, resulting in some percentage of vehicles diverting to parallel routes. To determine the volume of trips that may divert to parallel roadways, estimates were based on several factors, such as: 1) the amount of lost capacity on Second Avenue; 2) the proximity of alternative parallel routes; and 3) the attractiveness and available capacity on those routes.

IMPACT ANALYSIS METHODOLOGY

The traffic impact analysis methodology follows standard assessment procedures. First, existing conditions and future conditions without any subway construction activities are assessed. Next is an analysis of future conditions with subway construction underway; this analysis considers the changes to the road network that would result from the addition of construction vehicle traffic to the roadway network, the narrowing of the Second Avenue corridor's roadway to accommodate construction zone needs, and the likely diversion of at least some Second Avenue corridor traffic to parallel routes because the width and capacity of Second Avenue would be significantly decreased at construction zone locations. Afterwards, significant traffic impacts are defined, and the measures that would be needed to mitigate these impacts are then defined and evaluated.

For this FEIS, significant traffic impacts have been defined as the following: a) No Build LOS A, B, C, or D deteriorating to LOS E or F under the Build Alternative, providing that the average vehicle delay increase is 10 seconds or more; b) No Build LOS E deteriorating to LOS F for the Build Alternative, providing that the average vehicle delay increases by 10 seconds or more. Also, deterioration from the No Build Alternative to the Build Alternative within either LOS E or F with 10 seconds or more of additional delay is defined for the purposes of this study as a significant impact. Mitigation measures were then examined to alleviate significant impacts. This definition of a significant traffic impact has been approved previously for use on several other large transportation improvement projects in New York City that must rely on long-term traffic forecasts from travel demand models. These projects included the Route 9A Reconstruction Project and the LIRR's East Side Access Project. While this definition differs from the significant traffic impact criteria set forth in New York City's *CEQR Technical Manual*, a guidance document used by City agencies to assess impacts of localized development projects proposed in New York City, it is appropriate for a transportation project of this scope and duration.

To examine the potential traffic impacts of the construction phase, seven representative study area construction zones were selected along the alignment for a detailed traffic impact analysis:

- 125th Street Station and Second Avenue spoils removal area;
- 96th Street Station and shaft/access site;
- 66th Street shaft/access site;
- 55th Street Station;
- 34th Street Station and shaft/access site;
- Houston Street Station and shaft/access site; and
- Water Street/Hanover Square Station and shaft/access site.

Collectively, the six construction zones were selected for analysis since each of these study areas, except for the 55th Street Station location, include both a potential shaft site/spoils removal area and a new subway station. Consequently, construction activities in these areas would result in longer construction durations, a potentially larger construction area, and more trucking activity than the other sites. The 125th, 55th, 34th, and Water Street construction areas were also selected for analysis because access to potential spoils removal areas and/or Harlem River/East River bridge or tunnel crossings are provided within these zones. As a result, these study areas would experience higher truck traffic volumes due to the additional truck trips from other nearby station construction sites that would also pass through these study areas to access the barges or crossings. The individual traffic studies analyze the effect of increased truck traffic, loss of roadway capacity, and assumed traffic diversions in each subarea. The results of these individual construction zone analysis locations were then reviewed and extrapolated to define potential impacts within the East Side as a whole, as well as to determine areawide mitigation needs.

The detailed traffic impact analysis assumes that a percentage of the traffic using the Second Avenue corridor would divert to other parallel routes, such as Lexington Avenue. Such diversions are a routine occurrence in New York City during construction projects—particularly during long-term construction projects—where many drivers voluntarily choose alternative travel routes to avoid congestion-related delays on affected streets. Once construction of the Second Avenue Subway begins, the actual amount of traffic that would divert is very difficult to predict, because it would vary based on the nature, proximity, and capacity of these parallel routes. Generally, drivers can be expected to seek out alternative routes until some degree of equilibrium results between conditions on the diversion routes and the Second Avenue corridor itself. The traffic impact analyses that follow are based on current plans for construction, which assume that three travel lanes would be available for use on Second Avenue at all times. The traffic analysis further assumes a particular level of diversion to alternate routes, and then identifies where significant impacts can be expected and where mitigation is needed.

The traffic mitigation analyses begin with the application of standard low-cost and readily implementable transportation system management (TSM) measures, such as signal phasing and timing changes, lane re-striping, prohibition of curb parking, enforcement of prevailing traffic and parking prohibitions, etc., and then proceed to more intensive measures. At several key locations, narrowing the sidewalks to 5 feet in order to provide a fourth travel lane would be the most beneficial mitigation measure. A 5-foot sidewalk is the typical width of sidewalks adjacent to construction sites in New York City. Figures 5D-2 and 5D-3 present schematic depictions of typical three-lane and four-lane construction zone configurations. (Although an average Second Avenue Subway construction zone would span approximately 5 blocks, the figures show a smaller area to allow for a clearer presentation of details.) A fourth travel lane may not be needed if sufficient traffic diverts to other routes once construction commences. In the end, it will be necessary to develop a comprehensive traffic-monitoring plan as part of the Second Avenue Subway's overall construction traffic management and mitigation plan. This monitoring plan would continuously assess traffic conditions not only along the Second Avenue corridor and in the areas surrounding and approaching each construction zone, but also along parallel routes that may be used by traffic diverting from the Second Avenue corridor. This monitoring program can also be used to inform an Interagency Task Force, consisting of representatives from affected and responsible agencies, whether the traffic management and mitigation plan is working as designed, and whether additional measures need to be employed to minimize traffic impacts in each area and the region as a whole.

RESULTS OF THE ANALYSIS

As noted previously, the construction of the Second Avenue Subway would reduce roadway capacity at proposed station locations and other construction work zones, divert a percentage of vehicles to parallel roadways, and increase the volume of truck traffic through the East Side of Manhattan. Following is the detailed traffic analysis for each representative study area construction zone. (Please note that these analyses account for traffic levels expected in the area in the future No Build condition, including background growth and traffic added by major development projects.)

In the representative construction zone study areas that follow, it was initially estimated that a total of 15 to 25 percent of the southbound traffic on Second Avenue would divert to alternate routes, such as Park Avenue, Lexington Avenue, and the FDR Drive. Where this initial level of diversion was not sufficient to eliminate traffic impacts on Second Avenue due to reduced roadway capacity at construction zones, a more aggressive traffic diversion plan was considered. This more aggressive plan would divert sufficient additional traffic from Second Avenue to alternate routes, so as to eliminate the identified impacts. This additional diversion could range from 20 to 60 percent of the Second Avenue traffic to alternate routes during the AM and PM peak hours.

While an aggressive diversion plan may be feasible in the construction zone's immediate study area, the adverse impact of this diverted traffic upstream or downstream, especially if a major portion would pass through the East Midtown area, could be significant. Therefore, for the FEIS it was concluded that aggressive traffic diversions that could impact East Midtown would not likely provide an acceptable mitigation measure, which is a change from the SDEIS. Instead, aggressive traffic diversions would only be considered as part of a managed traffic diversion plan developed by NYCT and approved by the Interagency Traffic Management Task Force.

125th Street Station Area

The 125th Street Station study area would encompass nearly all of the intersections in East Harlem bounded by the Harlem River to the north and east, 124th Street to the south, and Park Avenue to the west. A relatively large study area was selected for analysis to include the intersections through which trucks from the three river crossings (Third Avenue, Willis Avenue, and Triborough Bridges) would pass, as well as covering routes that truck trips would use between the East Harlem and the Upper East Side construction sites and the East River bridges. Along 125th Street, loss of roadway capacity due to station cut-and-cover construction was analyzed, and the reserve capacity along possible east/west diversion routes of 126th and 124th Streets was determined. (As described in Chapter 3, the amount of cut-and-cover construction on 125th Street beginning in Phase 2 of the project has been reduced since the SDEIS was published and a TBM is now proposed for construction west of Park Avenue and east of Third Avenue.) Similarly, intersections along Second Avenue north of 125th Street that would lose capacity during cut-and-cover construction of the possible 129th Street underground train storage tracks were studied, and intersections along Lexington and Park Avenues were analyzed to determine the potential impact of trips that might divert from Second Avenue.

Second Avenue south of 125th Street would experience the highest increment of new truck traffic, approximately 30 to 40 vph in the peak hours. Peak trucking activity in the East Harlem study area would occur during the cut-and-cover excavation of the 125th Street Station, which would generate 12 truck trips in and out during the peak hours. No definitive destination has been determined for the spoils, but in this area, spoils would likely be transported out of

Manhattan via the Triborough Bridge or Willis Avenue Bridge. Material delivery trips could arrive from a larger geographical area and, consequently, have been assumed to approach the 125th Street construction site from the north and east via the Triborough and Third Avenue Bridges, from the west via 125th Street, and from the south along First Avenue.

During the excavation of the 125th Street Station, open-cut excavations (12 truck trips per hour per direction per location) could also occur at the 116th Street Station and 106th Street Station construction zones, and mining operations could occur at the 86th and 72nd Street Stations. Mining is a slower excavation procedure and would only generate an average of one truck trip to and from the construction site per hour. These truck trips were also conservatively assigned through the 125th Street study area to the possible East Harlem destinations (Triborough Bridge or Willis Avenue/Third Avenue Bridges). Similarly, material delivery trips to the 116th, 106th, 86th, 72nd, and 66th Street construction sites could pass through the 125th Street study area to access the Triborough or Willis Avenue/Third Avenue Bridges.

It was estimated that 20 percent of the eastbound and westbound traffic on 125th Street between Second Avenue and Madison Avenue (approximately 100 vph per direction) would divert to 126th Street westbound and 124th Street eastbound to avoid the construction zone along 125th Street during the AM and PM peak hours. This would result in a 10 to 20 percent increase in traffic along 124th and 126th Streets.

For southbound Second Avenue traffic, it was estimated that between 5 and 10 percent of Second Avenue traffic might divert to each southbound alternative route, namely, Park Avenue, Lexington Avenue, and the FDR Drive. On average, this would amount to a traffic volume increase of approximately 150 to 175 vph on each roadway.

In the 125th Street Station construction area, 125th Street would be narrowed to one travel lane per direction from Third to Park Avenue to accommodate the construction of the 125th Street Station. Also, Second Avenue between 126th and 127th Streets would be narrowed to three travel lanes southbound and one travel lane northbound in order to accommodate the construction of two underground storage tracks. For each of these construction zones, it was assumed that curbside parking, stopping, and bus stops within the construction areas along Second Avenue and 125th Street would be prohibited during the construction phase. Taxis that currently queue on 125th Street at Park Avenue, near the Metro-North Railroad Harlem-125th Street Station, would therefore have to be relocated temporarily. These prohibitions alone would not prevent southbound Second Avenue or eastbound and westbound 125th Street traffic from deteriorating to unacceptable LOS E and F conditions during the AM and PM peak hours. More detailed level of service summary tables for this location and all other study areas are provided in Appendix D.3, "Supporting Tables and Diagrams for Transportation Analysis."

Significant traffic impacts caused by the roadway narrowing could be fully mitigated with signal timing improvements with two exceptions—impacts at 125th Street intersections at Lexington and Second Avenues.

At Lexington Avenue and 125th Street, traffic impacts could be fully mitigated by adjusting the signal timing and maximizing the available roadway width on 125th Street to provide a 10-foot through lane and a 10-foot right-turn lane eastbound, and a 10-foot through lane and a 10-foot left-turn lane westbound (a 10- to 11-foot through lane is a typical width for a travel lane adjacent to construction in New York City). Alternative measures would include signal timing adjustments in conjunction with providing a 10-foot through lane and a 10-foot left-turn lane for

the westbound approach and providing a southbound right-turn lane by shifting the Lexington Avenue bus stop from the north side of 125th Street to the south side.

The Second Avenue intersection at 125th Street could be partially mitigated by shifting the bus stop on the eastbound approach to the east side of Second Avenue to provide an exclusive eastbound right-turn lane and by making signal timing adjustments. Full mitigation would require providing a fourth southbound moving lane on Second Avenue by narrowing the sidewalks to 5 feet.

If four travel lanes cannot be provided through the construction zone, then other mitigation would need to be evaluated, including a more aggressive traffic diversion, as part of the traffic management plan that would be developed by NYCT and reviewed, approved, and monitored by the Interagency Traffic Management Task Force. Special consideration would be given to the potential for diverted through traffic to continue southward and impact key intersections downstream.

An aggressive traffic diversion plan was considered at the 125th Street construction zone that could also be applicable to other East Harlem subway stations. This plan would divert an additional 15 to 25 percent of the Second Avenue traffic (about 200 to 300 vph) to alternate routes during the AM and PM peak hours with the objective of fully mitigating traffic impacts on Second Avenue. Initially, it was estimated that a total of 20 to 25 percent of the southbound traffic on Second Avenue would divert to Park Avenue, Lexington Avenue, or the FDR Drive to avoid the construction zones on Second Avenue.

The traffic analyses indicate that Lexington Avenue intersections at 129th, 128th, and 127th Streets and Park Avenue intersections at 126th and 124th Streets would experience significant traffic impacts due to the aggressive diversion of additional southbound traffic from Second Avenue. For the initial diversion estimate, each of these intersections could be mitigated with standard traffic engineering improvements, such as signal timing adjustments and parking restrictions. With the additional traffic diversion, southbound Park and Lexington Avenues would require additional measures to increase their capacity during the AM peak hour. It was determined that all of the additional diverted traffic could be accommodated on Lexington Avenue during the AM and PM peak periods, provided that one lane of curb parking is prohibited on Lexington Avenue between 129th to 127th Streets. This would provide an additional southbound moving lane. The intersection of Second Avenue at 127th Street currently operates with three travel lanes southbound and would continue to operate with three southbound lanes in the construction phase.

In addition, for a short duration, lane capacity across Second Avenue north of 125th Street may be reduced during the cut-and-cover excavation of the storage tracks. Once the excavation is complete and the roadway decking installed, it is anticipated that the number of cross-street travel lanes and ramp lanes to/from the Triborough Bridge would remain the same as existing conditions for the majority of the construction period. Similarly, lane capacity across 125th Street in the station construction area would be reduced for a short duration, but once excavation is complete and the roadway decked over, the north/south avenues are expected to have the same lane capacity as existing conditions for the majority of the construction period.

The effects of diversions from crosstown 125th Street to the nearest east- and westbound streets (124th and 126th Streets) were also analyzed. For the 125th Street construction area, it was estimated that a total of about 20 percent of the eastbound and westbound 125th Street traffic would divert to 124th Street eastbound and 126th Street westbound around the station

construction. The analyses indicated that these diversions would not result in significant adverse traffic impacts at 126th or 124th Street between Second and Park Avenues.

The First Avenue intersection at 125th Street and the Third Avenue intersections between 127th and 124th Streets would not experience significant traffic impacts due to the additional truck trips in the study area.

Although the other East Harlem stations at 116th and 106th Streets were not analyzed quantitatively, it is possible to extrapolate the findings of the detailed analyses of the 96th and 86th Street Stations that follow to these other stations. It appears that Second Avenue traffic at the 116th and 106th Street Stations is most similar to the 96th Street Station and would most likely experience similar traffic impacts during the construction phase and require standard traffic engineering improvement measures, such as signal timing adjustments.

96th Street and Upper East Side Station Areas

On the Upper East Side, the 96th Street Station area was selected since this area would be both a station construction zone and possible TBM insertion and spoils removal location beginning in Phase 1 of the project. The study area includes Second Avenue from 97th Street to 92nd Street, 96th and 97th Streets at First and Third Avenues, the intersection of Lexington Avenue at 96th Street, and the 86th Street intersections at First, Second, and Third Avenues. This study area was used to analyze the effect of reduced roadway capacity along Second Avenue from 97th to 92nd Streets for the 96th Street Station and a potential access shaft, and at 86th Street for station construction at that intersection. The intersections along First and Third Avenues were selected to analyze the effect of additional truck trips, and the Lexington Avenue intersection was selected to determine potential impacts of southbound traffic that might divert from Second Avenue.

Second Avenue in this area could experience a truck volume increase of approximately 40 to 50 vph in the AM and PM peak hours. According to preliminary engineering estimates, open-cut excavations from 95th to 92nd Streets and from 97th to 95th Streets may occur simultaneously and result in 12 truck trips in and out per site per hour. Therefore, this simultaneous excavation condition was conservatively analyzed for the traffic analysis. Spoils truck trips from the 96th Street area have been assumed to go north through East Harlem to the Triborough Bridge or Willis Avenue Bridge.

An estimated 45 material truck trips would be made to each construction site daily. Material delivery trips could arrive at the construction sites from a larger geographical area than the spoils trips and, consequently, could approach the study area from the north via the Triborough Bridge or Third Avenue Bridge and from the south via the Lincoln and Queens-Midtown Tunnels.

Depending on how construction is sequenced, mining operations at the 86th and 72nd Street Stations could occur simultaneously with aspects of the 96th Street Station area construction. These spoils trucks (approximately one truck trip in and out per hour per site) were assigned through the 96th Street Station study area to the three possible northern destinations. Similarly, material delivery trips to the construction sites at 86th, 72nd, and 63rd Streets could originate from the north and pass through the 96th Street study area, and in the opposite direction, material delivery trips to the 125th, 116th, and 106th Street construction sites could originate from the south and pass through the 96th Street study area as well. Therefore, these truck trips were also added to the 96th Street study area network.

Traffic diversion estimates for the 96th Street Station area assumed that 5 to 10 percent of the southbound Second Avenue traffic might divert to each of the three southbound alternative routes, namely, Park Avenue, Lexington Avenue, and the FDR Drive. These diversions would amount to about 100 to 175 vph on each roadway during the AM and PM peak hours.

The narrowing of Second Avenue to three southbound lanes to accommodate the construction of the 96th Street Station, 86th Street Station, and the possible insertion of a TBM at 92nd Street would have significant impacts on southbound traffic during the AM and PM peak hours. It is estimated that the construction zone could extend from 97th to 92nd Streets and from 87th to 83rd Streets on Second Avenue and that curbside parking, stopping, and bus stops within the construction area along Second Avenue would be prohibited during the construction phase. These prohibitions would not prevent southbound traffic from deteriorating to unacceptable LOS E and F conditions at selected intersections during the AM and PM peak hours.

As shown in the tables and diagrams provided in Appendix D.3, these analyses indicate that the construction phase of the Second Avenue Subway in the 96th Street Station area would generate significant traffic impacts, all of which could be fully mitigated using standard traffic engineering improvements.

Most of the significant traffic impacts caused by the narrowing of Second Avenue during the AM and PM peak hours could be fully mitigated with standard signal timing improvements. One exception is the intersection of Second Avenue at 96th Street. At this location, traffic mitigation would include restriping the westbound 96th Street approach to provide a left-turn lane and two through lanes, and the bus stop at the eastbound approach would need to be relocated to the east side of the intersection to provide an exclusive eastbound right-turn lane at the approach. The additional east/west capacity that these improvements provide would allow for green time to be shifted from 96th Street to Second Avenue.

An alternative mitigation measure that would successfully mitigate the traffic impacts would be to provide four southbound through lanes at the 96th Street intersection during the AM and PM peak periods. With this mitigation measure, the construction zone, which would normally encompass half of the Second Avenue roadway width, would be narrowed at 96th Street to ease traffic congestion.

For a short duration, lane capacity across Second Avenue may be reduced during cut-and-cover excavation. Once the excavation is complete and roadway decking installed, the number of cross-street travel lanes is expected to remain the same as existing conditions for the rest of the construction period. Therefore, three travel lanes could be utilized per direction on 96th Street, if needed for mitigation, for the majority of the construction period at this location.

It was estimated that a total of 15 to 20 percent of southbound Second Avenue traffic would divert to Park Avenue, Lexington Avenue, or the FDR Drive to avoid construction zones on Second Avenue. The traffic analyses indicate that the Lexington Avenue intersection at 96th Street would be able to accommodate the diverted southbound traffic.

The First and Third Avenue intersections at 97th, 96th, and 86th Streets were analyzed to determine the possible traffic impacts due to additional truck trips in the study area. Results indicate that the eastbound left-turn movement at First Avenue and 96th Street would deteriorate within LOS F during the PM peak hour and the eastbound left-turn movement at First Avenue and 86th Street would deteriorate from LOS C to E in the AM peak hour. Both of these impacts could be mitigated with signal timing improvements, such as shifting green time from the avenue to the cross street.

Although the other Upper East Side station at 72nd Street was not analyzed quantitatively, it is possible to extrapolate the findings of the detailed analyses of the 96th and 86th Street Stations, which would also be constructed using the mining method. Traffic impacts and potential mitigation measures at the 72nd Street Station during the construction of Phase 1 of the project would likely be most similar to those identified at the 96th and 86th Street Stations. Standard traffic engineering improvements may mitigate most but not all significant traffic impacts at the 72nd Street intersection.

66th Street Shaft Site. To construct the connection between the Second Avenue and 63rd Street Lines in Phase 1 of the project, a shaft/access site would be required at the intersection of Second Avenue and 66th Street for 3½ to 4 years (for more information, see Chapter 3). This would require closing a portion of Second Avenue as well as most of the easternmost end of 66th Street between Second and Third Avenues including the eastbound lane.

On the west side of Second Avenue, 66th Street is wider and allows for two-way traffic that is separated by a raised planted median. During the construction phase, eastbound through traffic access to Second Avenue on 66th Street would be prohibited by the construction area, thereby necessitating that a new U-turn roadway be provided through the center island just before the construction area so that locally destined vehicles could exit and return to Third Avenue. Therefore, all eastbound traffic needing to access this block between Second and Third Avenues would need to enter the block via Third Avenue and U-turn and exit the block at Third Avenue. Since the SDEIS, it has been determined that it is possible to maintain a westbound traffic lane to proceed across Second Avenue and enter the 66th Street block between Second and Third Avenues.

For the SDEIS, traffic impacts at the 66th Street shaft site north of the 57th Street Station were not analyzed quantitatively due to the lack of available existing traffic count data and the inability to perform new traffic counts because of the atypical traffic conditions in this area after September 11, 2001. However, a significant adverse impact on vehicular traffic headed southbound was predicted during construction operations at the 66th Street shaft site, based on the analysis in the East Midtown subarea.

For the FEIS, in the area of the 66th Street shaft site, 25 signalized intersections were counted and analyzed north of 59th Street and south of 68th Street to determine the specific project impacts associated with construction activities in this area. Those intersections were along Park, Lexington, Third, Second, First, and York Avenues. It is estimated that volumes of about 315 vph and 355 vph would divert from Second Avenue to other southbound avenues during the AM and PM peak hours, respectively. This diversion would occur in the vicinity of 66th Street during the 3½ to 4 years of construction.

The analysis concludes that no significant adverse impacts on vehicular traffic would be created north of 63rd Street during construction at the 66th Street shaft site, if a minimum of four travel lanes can be maintained through the construction zone. However, the analysis also demonstrated, because of the presence of the Queensboro Bridge at 59th Street, that the intersection at 59th Street and Second Avenue is critical, and significant adverse impacts on traffic would be created if Second Avenue were narrowed to only four lanes between 63rd and 59th Streets. Therefore, it is necessary to maintain five travel lanes on Second Avenue—clear of any parking, delivery, or bus stop activity within the construction zone—for the four blocks between 63rd and 59th Streets in order to mitigate potential construction-related traffic impacts in this area.

55th Street Station Area

The 55th Street Station study area includes the intersections from 59th Street to 53rd Street on Second Avenue, the 57th and 59th Street intersections along First, Third, and Lexington Avenues, and the Sutton Place at 57th Street intersection. The intersections along Second Avenue were selected to study the effect of reduced roadway capacity along Second Avenue for the 55th Street Station construction zone. The First and Third Avenue intersections were chosen to determine the potential impact of additional truck trips, and the Sutton Place and Lexington Avenue intersections were analyzed to gauge their ability to accommodate southbound trips that might divert from Second Avenue.

Truck traffic volumes along Second Avenue would increase by approximately 15 vph in the peak hours through this study area during Phase 3 of the project. These spoils trips would mostly be transported out of Manhattan via the Queensboro Bridge, the nearest East River crossing to the construction site. As noted previously, material delivery trips could originate from a broader area and could arrive at the 55th Street study area from the north, south, or east via the Queensboro Bridge.

No spoils removal trips from adjacent construction sites were assigned through this study area. The spoils from the northernmost 63rd Street Connector Tunnel in Phase 1 of the project would be removed at 66th Street and trucks would mostly use the Queensboro Bridge to exit Manhattan. The spoils from the next station to the south, 42nd Street, would most likely be assigned to the Queens-Midtown Tunnel during Phase 3 of the project. It is possible that material delivery trips to the 42nd Street Station could originate from the north (possibly from the Queensboro Bridge) and pass through the 55th Street Station study area.

It was estimated that up to 5 percent of Second Avenue's traffic (approximately 165 vph in the AM peak hour and 125 vph in the PM peak hour) might divert to each southbound alternative—Park Avenue, Lexington Avenue, and the FDR Drive. These diversions would result in a 10 percent increase of No Build traffic along Lexington Avenue. Potential diversions to Sutton Place were assumed to be much lower (50 to 75 vph during peak hours, which can be considered a modest increase) since Sutton Place is a two-way street with less capacity, and also ends at 53rd Street.

The narrowing of Second Avenue during Phase 3 of the project to three southbound lanes to accommodate the construction of the 55th Street Station would have significant impacts on southbound traffic during the AM and PM peak hours. It is estimated that the construction zone would extend from 57th to 53rd Streets on Second Avenue and that curbside parking, stopping, and bus stops within the construction area along Second Avenue would be prohibited during the construction phase. These prohibitions alone would not prevent southbound traffic from operating at an unacceptable LOS F between 57th and 53rd Streets in the AM peak hour and at the 57th, 55th, and 54th Street intersections in the PM peak hour. Please see Appendix D.3 for more detailed information.

Most of the AM and PM peak hour significant traffic impacts caused by the narrowing of Second Avenue could be mitigated with signal timing improvements, such as shifting green time from the cross street to Second Avenue. One exception is that parking would need to be prohibited at the westbound approach of 53rd Street to Second Avenue in the AM peak hour to provide an additional travel lane. Another exception is the intersection of 57th Street, which could not be fully mitigated using standard traffic engineering improvements. Providing a fourth

southbound moving lane on Second Avenue by narrowing the sidewalks to 5 feet would mitigate the impacts successfully.

If four moving lanes cannot be provided through the construction zone, then other mitigation would need to be developed in this critical area in the East 50s. This would be done as part of the traffic management plan that would be developed by NYCT and reviewed, approved, and monitored by the Interagency Traffic Management Task Force. Special consideration would be given to the potential for diverted traffic to adversely impact key intersections downstream in East Midtown, such as Lexington Avenue and 42nd Street. A more aggressive traffic diversion plan was considered but found not to be practicable at this construction zone for the reasons described below.

A plan to divert an additional 20 to 30 percent of the Second Avenue traffic to alternate routes during the AM and PM peak hours was considered. An analysis at the critical intersection of Lexington Avenue and 59th Street indicated that this intersection could only handle additional diversion volume on southbound Lexington Avenue, provided that the exclusive bus lanes were eliminated, thereby allowing through traffic to use these lanes. This would not be considered desirable mitigation, since it would significantly affect transit riders, motorists, and some local land uses (such as storefront businesses) along an additional corridor beyond Second Avenue.

For a short duration, lane capacity across Second Avenue may be reduced during the cut-and-cover excavation. Once the excavation is complete and the roadway decking installed, the number of cross-street travel lanes is expected to remain the same as existing conditions for the remainder of the construction period. Therefore, three travel lanes per direction would be maintained on 57th Street for the majority of the construction period at this station location.

Second Avenue intersections at 59th and 58th Streets are projected to experience an overall intersection level of service improvement in the construction phase. During the construction phase, some traffic would be diverted off of Second Avenue, but the roadway width at these two intersections would not be reduced since they are located north of the construction zone, resulting in improved traffic conditions.

The First and Third Avenue intersections at 57th and 59th Streets would not experience significant traffic impacts during Phase 3 of the project due to the additional truck trips in the study area.

34th Street Station Area and Other East Midtown Station Areas

The 34th Street study area is slightly larger than the 55th Street area since, in addition to the 34th Street Station, additional spoils removal locations and staging areas may be located at two possible locations in the study area. One potential access site/staging area could be at St. Vartan Park, located on the east side of Second Avenue between 36th and 35th Streets; the other site is the service road area of Kips Bay Plaza between 33rd and 32nd Streets. Therefore, all intersections along Second Avenue from 36th to 30th Streets were analyzed to determine the effect of reduced roadway capacity throughout this potential construction zone. First Avenue intersections at 37th, 35th, 34th, and 30th Streets, and Third Avenue intersections at 34th and 30th Streets were chosen to evaluate the impacts of additional truck trips. The Lexington Avenue intersection at 34th Street was selected to determine the potential impact of southbound trips diverting from Second Avenue.

Truck traffic volumes along Second Avenue through the 34th Street study area would increase by about 30 vph in the peak hours during Phase 3 of the project. All of the spoils truck trips from

the open-cut excavation at the 34th Street Station would most likely be transported out of Manhattan via the Queens-Midtown Tunnel (QMT). Material delivery truck trips to the 34th Street Station could arrive from a broader range of locations; therefore, in addition to the QMT, delivery trips were assumed to arrive from the south via southern Manhattan crossings or from the west via the Lincoln Tunnel.

Spoils removal truck trips from mining operations at the 42nd, 23rd, and 14th Street Stations would most likely travel to/from the QMT as well during Phase 3 of the project, and would pass through the 34th Street study area. Similarly, material delivery trips to/from the 42nd 23rd, and 14th Street Stations and the QMT were assigned through the 34th Street study area.

Potential Second Avenue diversion routes in the 34th Street area include Park Avenue, Lexington Avenue, and the FDR Drive. The initial diversion estimates assumed that up to 5 percent of Second Avenue's traffic (approximately 150 vph in the AM peak hour and 100 vph in the PM peak hour) might divert to each southbound alternative. For Lexington Avenue, which currently processes about 1,300 vph during the peak hours at 34th Street, the diversion would increase No Build traffic volumes by an average of approximately 10 percent. An analysis of the Lexington Avenue intersection at 34th Street indicated that the initial diversion estimates would not cause significant impacts on Lexington Avenue.

The narrowing of Second Avenue to three southbound lanes to accommodate the construction of the 34th Street Station and the possible insertion of a TBM in Second Avenue adjacent to St. Vartan Park and Kips Bay Plaza would have significant impacts on southbound traffic during the AM and PM peak hours. Curbside parking, stopping, and bus stops within the construction area along Second Avenue would be prohibited during the construction phase, but would not be sufficient to prevent southbound traffic from operating at an unacceptable LOS F between 36th and 31st Streets in the AM peak hour and at 34th Street in the PM peak hour. Appendix D.3 provides more detailed information on level of service changes in this area.

This narrowing of Second Avenue would cause significant traffic impacts at several intersections during the AM peak hour, which could not be mitigated with standard traffic engineering improvements. Narrowing the moving lanes to 10 feet and the sidewalks to 5 feet to provide a fourth southbound moving lane on Second Avenue would significantly, but not fully, mitigate the traffic impacts along Second Avenue by itself.

Therefore, significant adverse impacts would not be fully mitigated in the 34th Street area during Phase 3 of the project. Hence, other mitigation would need to be developed in this critical area near the Queens-Midtown Tunnel. This would be done as part of the traffic management plan that would be developed by NYCT and reviewed, approved and monitored by the Interagency Traffic Management Task Force. Special consideration would be given to the potential for diverted through traffic to adversely impact key intersections upstream in East Midtown. A more aggressive traffic diversion plan was considered but would not be practicable at this construction zone for the reasons described below.

A more aggressive diversion plan was evaluated, which would divert an additional 40 to 60 percent of the Second Avenue traffic to alternate routes during the AM and PM peak hours. Southbound Lexington Avenue at 34th Street would operate at an acceptable level of service for this scenario. However, an analysis at the critical intersection of Lexington Avenue and 42nd Street indicated that, if all of this traffic were to be diverted to Lexington Avenue, southbound Lexington Avenue could continue to operate without significant impacts, but would require several improvement measures. Collectively, these measures would likely be undesirable and

unacceptable. First, parking would need to be prohibited and enforced along both the east and west curbs of Lexington Avenue to provide two additional through travel lanes. These lanes would have to be kept clear of stopped vehicles to provide five continuous southbound moving lanes. Currently, the west side of Lexington Avenue is used for taxi and other vehicle loading and unloading activities at Grand Central Terminal; the east side is signed "No Standing Anytime," but vehicles do use this lane for deliveries in the peak periods. Furthermore, in order to shift necessary green time from 42nd Street to Lexington Avenue, the 42nd Street bus lanes would need to be eliminated to provide an additional travel lane in the east and westbound directions. Due to the serious impact on transit riders and on truck loading and unloading, this combination of mitigation measures would not likely be implemented.

This area and the area between 72nd to 57th Streets would be a primary focus of the comprehensive, areawide traffic management and mitigation plan that will be established for the Second Avenue Subway's construction in Phases 1, 2, and 3 of the project. This is because construction activities in these two areas would significantly affect motorists entering and leaving Manhattan via the two major East River crossings, the Queens-Midtown Tunnel and Queensboro Bridge. Any plans developed for the 34th Street tunnel area could result in motorists diverting to the Queensboro Bridge. The overall plan would need to include at least the following core components:

- A traffic monitoring program that ascertains actual traffic conditions throughout the area on primary and secondary detour routes on a real-time basis, so as to minimize traffic impacts, modify traffic improvement measures (such as signal timings), and to regulate the volume of diverting traffic. This program would help inform motorists of traffic conditions on these and alternate routes. To be effective, this "intelligent transportation system" must also be able to direct motorists to optimal routes for their destinations;
- Maintenance and protection of traffic plans would have to be developed to identify appropriate detour routes; these routes would then need to be adequately signed and marked throughout the construction influence area to safely and efficiently guide motorists around the construction zone; and
- Media advisories that continually advise the traveling public of alternate travel modes and that keep travelers well informed about possible closures, delays, and alternative routes. This distribution of public information could be accomplished through regular newspaper and television construction updates, and via variable message sign travel advisories posted along the highways approaching Manhattan, especially at the approaches to the Queens-Midtown Tunnel and Queensboro Bridge.

Delays through the construction areas could be lessened through the implementation of work zone mobility measures, such as 1) stationing traffic enforcement agents to prevent vehicles from blocking intersections; 2) providing on-site tow trucks to immediately remove disabled vehicles within the construction zones; and 3) distributing updated construction, detour, and traffic information to the public via variable message signs. The combination of these traffic improvement measures would not fully mitigate the traffic conditions in the construction traffic influence areas, but would help to alleviate the magnitude of the impacts.

The intersection of Second Avenue and 37th Street would be just north of the construction zone. In this area, the width of Second Avenue would need to be reduced, to allow a gradual reduction in the number of travel lanes north of the construction zone to four lanes at the construction zone. Even with the diversion of some traffic to other routes during the construction phase,

traffic congestion and slower speeds would occur as traffic merged into fewer lanes. However, appropriate channelization, signage, and maintenance and operation plans would be developed to reduce congestion, spillback, and poor levels of service.

For a short duration, lane capacity across Second Avenue may be reduced during the cut-and-cover excavation. Once the excavation is complete and the roadway decking installed, the number of cross-street travel lanes is expected to remain the same as existing conditions for the remainder of the construction period. Therefore, three travel lanes per direction would be maintained on 34th Street for the majority of the construction period at this station location.

First Avenue intersections at 30th, 34th, and 37th Streets, Third Avenue intersections at 31st and 36th Streets, and the Tunnel Approach Street intersection at 35th Street would not experience significant traffic impacts due to additional truck traffic through these intersections.

Traffic impacts within the 34th Street Station construction area would not differ if the site were to be used exclusively for a lay down area or a tunnel spoils removal location, because regardless of the site's operation, an open cut excavation would still need to occur at this location to construct the 34th Street Station. (As previously described, the peak trucking activity would occur during the cut-and-cover and slurry wall construction phases of the stations.) For analysis purposes, the activities required to construct the station would continue to govern the assumed volume of trucking activity, and would still require the same narrowing of roadway width on Second Avenue. If the station area were used to install a TBM or to remove tunnel spoils, the only difference in traffic impacts would be the length of time that the impacts would occur. If the site were to be used for spoils removal, traffic impacts would occur for an additional 2 to 3 years beyond the normal station construction process.

Although the other East Midtown stations at 42nd, 23rd, and 14th Streets were not analyzed quantitatively, it is possible to extrapolate the findings of the detailed analyses of the 55th and 34th Street Stations to these other stations. Traffic impacts during Phase 3 of the project at the 42nd Street Station would appear to be similar to those expected at the 34th Street Station. Southbound Second Avenue at 42nd Street may require a narrower construction zone to provide an additional through lane of capacity on Second Avenue. Similar to the AM peak period condition at 34th Street, other critical intersections may also need an extra lane of capacity; otherwise additional mitigation may be needed.

Significant traffic impacts could be expected at the 23rd and 14th Street Stations during Phase 3 of the project and standard traffic engineering mitigation measures, such as signal timing adjustments, reconfiguration of lane assignments, or parking prohibitions, could probably be successfully employed at most of the significantly impacted intersections. At the Second Avenue intersections of 23rd and 14th Streets, four southbound travel lanes may be needed, as per the analysis findings at 55th and 34th Streets.

Houston Street and Other East Village/Lower East Side/Chinatown Station Areas

The area between approximately 4th and Houston Streets would be a station construction zone and could also be used for insertion or removal of a TBM and for the removal of spoils during Phase 3 of the project. In Phase 4 of the project, the intersection of Chrystie and Houston Streets could be used for TBM removal only. The study area includes the intersections from 6th Street to Houston Street on Second Avenue, the Houston Street intersections at the Bowery, Forsyth Street, and Allen Street/First Avenue, and the Delancey Street intersections at Chrystie Street and Allen Street. The intersections along Second Avenue were selected to study the effect of reduced roadway capacity along Second Avenue; the other Houston and Delancey Street

intersections were selected to determine the potential impact of additional truck trips in the study area, and the Bowery/Houston Street intersection was analyzed to gauge its ability to accommodate southbound trips that might divert from Second Avenue.

It is estimated that truck traffic volumes would increase by approximately 20 to 30 vph along Second Avenue during the peak periods. No definitive spoils destination has been determined for the Houston Street Station area, but the Holland Tunnel and Williamsburg Bridge are the closest Manhattan crossings to the Houston Street Station and the ones most likely to be used as truck routes out of Manhattan. Material delivery trips could arrive from a broader range of locations; consequently, in addition to the Williamsburg Bridge and Holland Tunnel origins, deliveries could also arrive from the north via the Queens-Midtown Tunnel or Lincoln Tunnel.

Spoils removal truck trips from other station construction sites would most likely not travel through the Houston Street study area. The spoils from the station to the north (14th Street) would most likely be transported to the Queens-Midtown Tunnel, and spoils from the station to the south (Grand Street) would most likely go to the Manhattan Bridge or Holland Tunnel and not through the Second Avenue/Houston Street area.

Second Avenue diversion routes through the Lower East Side include the Bowery to the west and the north/south Avenues A through D to the east. It was estimated that 10 percent of the southbound traffic (approximately 120 vph for the AM and PM peak hours) would divert to the Bowery and 5 percent (about 60 vph per peak hour) to the avenues to the east. The Bowery is a two-way avenue that provides two travel lanes per direction. Existing southbound traffic volumes on the Bowery range between 650 and 850 vph during the peak hours.

Traffic analyses of the above-mentioned locations indicate that the construction phase of the Second Avenue Subway would generate some significant traffic impacts that could generally be fully mitigated. (Please see Appendix D.3 for more detailed information.) However, an impact at the intersection of Second Avenue/Chrystie Street and Houston Street may only be partially mitigated using standard traffic engineering improvements.

The narrowing of Second Avenue to three southbound lanes to accommodate the construction of the Houston Street Station and the possible insertion or removal of a TBM would have significant impacts on southbound traffic during the AM and PM peak hours. Curbside parking, stopping, and bus stops within the construction area along Second Avenue and Chrystie Street would be prohibited during the construction phase to help maximize capacity along Second Avenue, but these measures alone would not prevent traffic from operating at an unacceptable level of service at the Houston Street intersection.

North of Houston Street, Second Avenue currently provides three through travel lanes, a parking lane on the east and west curbs, and an exclusive bike lane adjacent to the eastern parking lane. Even with narrowing the roadway for the construction zone, the three southbound travel lanes could be maintained at the expense of curbside parking and the bike lane. Since the effective number of lanes through the construction zone would remain unchanged from 4th to 1st Streets, significant impacts would not be expected. At some intersections, such as Second Avenue at 3rd and 2nd Streets, the overall level of service during construction may improve from No Build conditions due to the removal of bus stops and curbside parking activities. Bicyclists through the construction zone would lose their exclusive bike lane and be required to share the roadway with vehicular traffic.

Similarly, south of Houston Street, Chrystie Street currently provides two travel lanes per direction and curbside parking on both sides of the street. The Chrystie Street construction zone

at the proposed Houston Street Station would eliminate curbside parking and provide two northbound lanes and only one southbound lane. Since the number of northbound lanes would not change during the construction phase, significant traffic impacts would not be expected at this approach.

The Second Avenue intersection at Chrystie Street/Houston Street would deteriorate to an overall intersection LOS E and F during the AM and PM peak hours, respectively. The southbound right-turn movement would deteriorate from LOS D to F in the AM peak hour, and all southbound movements would worsen to LOS F in the PM peak hour. This critical location could only be partially mitigated in the PM peak hour with standard traffic engineering improvements such as "daylighting" the eastbound approach (i.e., prohibiting parking at the approach) to provide an exclusive right-turn lane, thereby increasing capacity so that green time could be shifted to southbound Second Avenue. Providing a fourth southbound lane on Second Avenue by narrowing the sidewalks was investigated and could successfully mitigate traffic impacts.

If four travel lanes cannot be provided through the construction zone, then other mitigation measures would need to be evaluated, including a more aggressive traffic diversion, as part of the traffic management plan that would be developed by NYCT and reviewed, approved, and monitored by the Interagency Traffic Management Task Force.

A more aggressive traffic diversion plan was evaluated, which would divert an additional 35 percent of the Second Avenue traffic to alternate routes during the PM peak hours. If all the additional traffic were to be diverted to the Bowery, southbound Bowery at Second Avenue would require curbside truck loading and unloading activities to be prohibited along the west curb during the PM peak period in order to provide an additional travel lane.

For a short duration, lane capacity across Second Avenue may be reduced during cut-and-cover excavation. Once excavation is complete and roadway decking installed, the number of cross-street travel lanes is expected to remain the same as existing conditions for the remainder of the construction period. Therefore, the number of travel lanes per direction would be maintained on Houston Street for the majority of the construction period at this location.

Traffic analyses, which assumed the aggressive East Village traffic diversion plan, indicate that the additional southbound traffic on Bowery would deteriorate the shared southbound through/right-turn movement at the intersection with Houston Street from LOS C to E in the PM peak hour. Standard signal timing improvements could mitigate this impact. The traffic analyses also determined that the additional truck trips to and from the construction site and the Williamsburg Bridge and Holland Tunnel would not significantly impact traffic conditions through the analysis intersections.

Similar to the 34th Street Station construction zone, traffic impacts at the Houston Street Station area would not differ if the TBM were to be inserted or removed or if spoils were to be extracted at this location. In all cases, the initial open cut excavation would be required, which governs the volume of truck traffic and requires half of the Second Avenue roadway width during construction. The only difference is that the duration of construction activities in the Houston Street Station area would be 2 to 3 years longer than if only a station were constructed at this location.

Although the other Lower East Side stations at Grand Street and Chatham Square were not analyzed quantitatively, it is possible to extrapolate the findings of the detailed analyses of the Houston Street Station to these other stations.

At the Grand Street Station, cut-and-cover construction is required between approximately Delancey and Hester Streets. In this area, roadway closings similar to those described above for Houston Street would be required during Phase 4 of the project. In addition, some of the Grand Street roadway between Chrystie and Forsyth Streets would be affected by construction of a new station entrance there. With this construction, significant impacts could be expected along the construction zone on Chrystie Street. At the minor cross-street intersections, these impacts could potentially be mitigated using standard traffic engineering improvements. At the major cross streets, such as Delancey Street, significant traffic impacts may require provision of an additional travel lane through the construction zone. If an additional moving lane cannot be provided through the construction zone, then other mitigation measures would need to be evaluated. This would include a more aggressive traffic diversion, as part of the traffic management plan that would be developed by NYCT and reviewed, approved, and monitored by the Interagency Traffic Management Task Force.

Traffic impacts and possible mitigation measures at the Chatham Square Station during Phase 4 of the project would be most similar to those at the Houston Street Station. Standard traffic mitigation measures would most likely be needed at the East Broadway intersection with Worth Street.

Hanover Square Station Area and Other Lower Manhattan Construction Areas

In Lower Manhattan, the Hanover Square Station area was selected for analysis since it would be a station construction zone and could also serve as a potential TBM insertion and spoils removal location. The traffic study area for this construction zone encompasses Water Street intersections from Maiden Lane to Whitehall Street, South Street intersections at Old Slip, Gouverneur Lane and Wall Street, and Pearl Street intersections at Maiden Lane, Pine Street, and Wall Street. The Water Street intersections were selected to study the effect of reduced roadway capacity along Water Street adjacent to the Hanover Square Station construction zone. The South Street and Pearl Street intersections were selected for analysis to determine the effect of possible traffic diversions and additional truck traffic through the Lower Manhattan study area.

During Phase 4 of the project, Water and South Streets could experience an average estimated increase of truck traffic of 15 to 30 vph per direction during the AM and PM peak hours. One component of this truck volume is spoils removal from the Hanover Square Station open-cut excavation, which could potentially be transported to a barge site at Pier 6. In this case, the trucks would loop eastbound on Gouverneur Lane to South Street and then westbound on Old Slip to Water Street. On South Street, the trucks would proceed southbound to Whitehall Street, where they could turn left across the FDR Drive to the northbound side of Water Street and Pier 6. In addition to spoils removal, material delivery truck trips to the Hanover Square Station site could approach the study area from the Brooklyn-Battery Tunnel via South Street or from the north via Water or South Streets.

Spoils and material delivery trips to the nearby Seaport Station at Water Street and Peck Slip would also pass through the Hanover Square traffic analysis study area during Phase 4 of the project. Therefore, truck trips to and from the Seaport Station were added to the traffic analysis locations cited above. Spoils from the Seaport Station would be transported to Pier 6 along South Street, and material delivery trips to the Seaport Station from the Brooklyn-Battery Tunnel would travel along South Street. No spoils or material delivery trips would be expected in the study area from the Chatham Square Station during the Hanover Square Station construction since the two stations would not be constructed simultaneously.

Some background traffic on Water Street can be expected to divert off of Water Street in expectation of delays at the Hanover Square Station construction area. The primary diversion route from Water Street in Lower Manhattan is South Street, which has one travel lane northbound and southbound. An estimated 10 percent of the north and southbound traffic from Water Street might divert to South Street to avoid the Water Street construction zone. South Street currently carries 200 to 400 vph per hour per direction during the AM and PM peak hours, and the diversion would increase these volumes by approximately 50 vph per direction.

Narrowing Water Street to one lane per direction between Maiden Lane and Whitehall Street to accommodate construction of the Hanover Square Station and the possible insertion of a TBM would have significant impacts on northbound and southbound traffic as shown in the tables and figures provided in Appendix D.3. Curbside parking, bus stops, and stopping to pick up and drop off passengers within the construction area along Water Street would be prohibited during the construction phase in order to minimize traffic impacts, but these measures would not completely prevent traffic from operating at an unacceptable level of service.

Overall intersection LOS F conditions would be expected at the intersections of Water Street at Pine Street, Wall Street, Old Slip, and Broad Street during the AM peak hour. At each of these locations, the northbound and/or southbound approaches would deteriorate to LOS F conditions. The intersection of Water Street and Maiden Lane would deteriorate to an unacceptable LOS E in the AM peak hour, and the northbound approach would operate at LOS F. At the intersection of Water and Whitehall Streets, the intersection would deteriorate to LOS D in the AM peak hour and the eastbound left-turn movement would deteriorate to LOS F due to the narrowing of Water Street.

In the PM peak hour, traffic impacts would be less severe as only the intersection of Water Street and Broad Street would deteriorate to an overall LOS E condition, as the northbound and southbound approaches would be operating at LOS F. At Water Street and Wall Street, the southbound approach would deteriorate to a LOS E in the PM peak hour and the eastbound left-turn movement at Water and Whitehall Streets would worsen to an unacceptable LOS E.

These significant impacts could be successfully mitigated with the implementation of standard signal timing adjustments or other readily implementable capacity improvements, such as lane reconfigurations or peak period parking prohibitions. The analyses indicate the significantly impacted intersection of Water and Broad Streets could be mitigated by reallocating the available 30 feet of roadway width from one shared left-/through/right-turn lane in each direction to one 10-foot shared through/right-turn lane and one 10-foot left-turn lane in each direction, plus signal timing adjustments. The left-turn lanes would use the middle 10 feet of available roadway width and be located directly opposite each other at the intersection.

An alternative measure for this intersection would be to prohibit parking on the eastbound and westbound approaches to widen the two westbound travel lanes and to provide a second lane on the eastbound approach to increase capacity eastbound and westbound and shift green time to the northbound and southbound approaches.

Similar mitigation strategies could be utilized at the intersection of Water Street and Maiden Lane. The only difference from the Broad Street intersection is that the 30-foot Water Street roadway width would be marked to provide two 10-foot northbound lanes and one 10-foot southbound lane.

An estimated total of 10 percent of the northbound and southbound traffic on Water Street would divert to South Street around the construction zone. Traffic analyses indicate that South Street

would continue to operate at an acceptable level of service with the addition of the diverted traffic from Water Street plus the additional truck traffic expected to use South Street between the Brooklyn Battery Tunnel or Pier 6 and the Lower Manhattan station construction sites.

Although the other Lower Manhattan station, the Seaport Station, was not analyzed quantitatively, it is possible to extrapolate the findings from the detailed analyses of the Hanover Square Station. The Seaport Station is close to the Hanover Square Station, and it appears that it would experience a similar level of traffic impacts and could require similar mitigation measures during the construction phase.

SUMMARY OF CONCLUSIONS

Construction of the Second Avenue Subway would reduce roadway capacity at proposed station locations and construction work zones, divert a percentage of vehicles to parallel roadways during construction of the Second Avenue alignment, and increase the volume of truck traffic through the East Side of Manhattan. Construction impact analyses focused on seven construction zones considered representative of the whole corridor. The broad overall findings are as follows:

- The volume of construction trucks on roadways through each zone would range from a peak of 15 trucks per hour in the 55th Street Station area during Phase 3 to approximately 50 trucks per hour in the 96th Street Station area during Phase 1. The estimated construction truck volume on any one bridge or tunnel crossing would peak at approximately 60 vehicles per hour (vph) per direction and average between 30 and 40 vph per direction.
- After leaving Manhattan, construction related trucks would likely use a number of different routes, depending on the location of their final destination. It is possible that, for certain construction activities, such as spoils removal, many trucks could head through or to one point. If so, there could be a localized traffic impact at that location. Once the necessary information is available, an assessment of conditions at these locations would be undertaken as part of the comprehensive areawide traffic management and mitigation plan that will be developed by NYCT. This plan would be reviewed by appropriate city, county or state agencies designated by the Interagency Traffic Management Task Force, as the spoils may be trucked out of the city or state.
- During construction, vehicles needed to build the subway have the potential to affect neighborhoods surrounding the construction zones, especially as they circulate between southbound Second Avenue and northbound First or Third Avenues. Hence, there could be localized traffic impacts in neighborhoods surrounding the construction zones. An assessment of conditions in those affected neighborhoods would be undertaken as part of the comprehensive areawide traffic management and mitigation plan that will be developed by NYCT and reviewed, approved and monitored, by the Interagency Traffic Task Force. The task force would ensure that this construction-related truck traffic does not cause significant impacts in those neighborhoods and that appropriate controls or mitigation measures are implemented.
- The influence of a reduced number of travel lanes adjacent to the construction zones would have a far more significant impact on roadway capacity than the volume of trucks that would be added to the East Side street network.
- Most intersections at major cross streets along the Second Avenue subway alignment (i.e., 125th, 96th, 86th, 72nd, 57th, 23rd, 14th, Houston, Delancey, Fulton, and Wall Streets and

East Broadway) would deteriorate to LOS F conditions during the AM and PM peak hours when the capacity of Second Avenue would be reduced to three lanes, typically 11 feet wide, to accommodate the construction zone at future station locations. Narrowing the sidewalks to 5 feet to provide a fourth southbound moving lane on Second Avenue was determined to successfully mitigate the traffic impacts at the key intersections that were quantitatively analyzed—i.e., 96th, 57th, and Houston Streets. Hence, it is expected that this measure would also successfully mitigate the impacts at other major cross street intersections outside the East Midtown neighborhood.

- If four travel lanes cannot be provided through the construction zone, then other mitigation would need to be evaluated, including a more aggressive traffic diversion, as part of the traffic management plan that would be developed by NYCT and reviewed, approved and monitored by the Interagency Traffic Management Task Force.

- More aggressive traffic diversion was found not to be practicable at East Midtown construction zones, including the 55th Street, 42nd Street and 34th Street Stations, because of significant adverse impacts on Lexington Avenue. Other construction zones immediately north and south would need to be evaluated carefully as part of the MPT plans.

- Nearly all of the Second Avenue intersections with minor cross streets that experience significant impacts could be mitigated with standard traffic engineering improvements. These standard improvements are generally low-cost and readily implementable; they include measures such as adjusting signal phasing and green time, re-striping lanes and/or installing pavement lane markings, prohibiting curb parking, and enforcing prevailing traffic and parking prohibitions. These improvement measures may not fully mitigate the impacts at the minor cross-street intersections between 72nd and 30th Streets during Phases 1 and 3 of the project, due to the high directional volumes these streets process for traffic approaching or leaving the Queensboro Bridge and Queens-Midtown Tunnel. In this portion of East Midtown, Second Avenue may require a fourth travel lane through the construction zones or other measures identified by NYCT and reviewed, approved, and monitored by the Interagency Traffic Management Task Force. More aggressive diversion of Second Avenue traffic to alternate southbound routes during the AM and PM peak hours is not likely to be practicable in this area.

- The most severely impacted intersection of those analyzed in this FEIS is 34th Street at Second Avenue during Phase 3 of the project. Providing a fourth southbound lane through the construction zone would partially mitigate the impacts. Hence, other measures may need to be identified by the NYCT and reviewed, approved, and monitored by the Interagency Traffic Management Task Force. A more aggressive diversion plan was found not to be practicable in this area. This impact may be indicative of traffic conditions during construction that may be expected at the normally congested East Midtown locations approaching the 42nd Street Station area on Second Avenue.

- Narrowing 125th Street between Third and Park Avenues to one lane per direction to accommodate the construction of the station during Phase 2 of the project would deteriorate 125th Street to unacceptable conditions. Providing turning lanes, relocating bus stops, and making signal-timing adjustments could mitigate these potential impacts. In addition, taxis that currently queue on 125th Street at Park Avenue near Metro-North's Harlem-125th Street Station would have to be relocated temporarily to accommodate construction.

- The initial diversion of southbound traffic to alternative southbound routes and the increase in truck traffic through the East Side of Manhattan would cause some significant traffic impacts, which could be mitigated using standard traffic engineering improvements. For more aggressive diversion plans, unmitigatable significant impacts might be created in the East Midtown area along the alternate routes, especially Lexington Avenue.
- In the area of the 66th shaft site, the intersection at 59th Street and Second Avenue is critical. During Phase 1 of the project, it would be necessary to maintain five travel lanes on Second Avenue—clear of any parking, delivery, or bus stop activity within the construction zone—for the four blocks between 63rd and 59th Streets in order to mitigate potential construction-related traffic impacts in this area. Maintaining a minimum of four travel lanes north of 63rd Street through the construction zone would be acceptable.

As noted above in the discussions of particular analysis locations, the results of the quantified analyses of traffic impacts during construction were performed for specific locations that are representative of all the locations along the alignment that would be affected during construction (see Appendix D). These results can therefore be extrapolated to other locations along the alignment not specifically noted above.

NYCT would develop a comprehensive areawide traffic management and mitigation plan, which would be reviewed by an Interagency Traffic Management Task Force comprised of affected and responsible agencies (e.g., MTA/NYCT, NYCDOT, NYSDOT, MTA Bridges and Tunnels). These plans would be reviewed with local community boards and would coordinate traffic related not only to construction of the Second Avenue Subway, but also to other projects that are under construction in the same vicinity at the same time as the new subway. An important component of this plan would be a comprehensive traffic monitoring program, which would continually evaluate traffic conditions and ensure that traffic detours and mitigation measures responded effectively to traffic patterns as they change.

Since construction of the Second Avenue Subway would affect travel patterns throughout at least the East Side of Manhattan, if not the larger borough and its East River crossings, the traffic monitoring plan should also consider all of the East River crossings, all of the major north-south routes on the East Side, and the major north-south routes on Manhattan's West Side. The regional traffic system is an integrated system that provides many options for travelers entering or exiting both Manhattan and the Second Avenue corridor, including non-auto options, such as express buses, other subway lines, and even ferries. Since it is not possible to predict which diversions drivers would choose so far in advance of construction, NYCT would ensure that traffic volumes and operating conditions would be monitored prior to any construction activities to provide a baseline that would be used to assess changes in traffic conditions throughout all of the construction phases. Doing so will help project planners and engineers understand the nature, extent, and impacts of traffic diversions that would occur as a result of construction along the Second Avenue corridor.

A detailed maintenance and protection of traffic (MPT) plan would be developed by NYCT, as engineering design work on the Second Avenue Subway continues. This MPT plan would be provided to NYCDOT for that agency's review and approval consistent with other construction projects in New York City. These plans would need to provide for the safe, efficient, and timely completion of the subway construction work, while also taking the needs of local residents, businesses, and the traveling public into account. Since Second Avenue is the East Side's primary southbound truck route, plans would also have to consider the needs of those entering and exiting the corridor in trucks.

MPT plans would need to be flexible at both the regional and local levels, and must be able to be modified when and if local traffic conditions and needs warrant modifications. Such flexibility is essential for a number of reasons. First, different travelers may choose different travel modes and routes to reach their destinations; travelers may even vary their modes and routes throughout the construction period. Second, NYCT has not yet developed a detailed MPT plan for sequencing construction activities within a construction phase; once this MPT plan is developed, it would influence how much traffic may divert to other routes. It is possible that less (or more) traffic would divert to other routes than is currently expected.

In addition, the Interagency Traffic Management Task Force would need to be kept regularly up to date on the findings of the ongoing monitoring plan. Further, the Task Force would need to be in regular communication with local officials and affected community groups to get feedback on the plan and any necessary refinements.

It would be within the purview of the Interagency Traffic Management Task Force and the engineering team to identify and consider a long list of measures that could help mitigate local impacts beyond those identified within this FEIS. Delays throughout the construction areas could be lessened through the implementation of work zone mobility measures mandated as part of the MPT plans, such as: stationing traffic enforcement agents to prevent vehicles from blocking intersections; providing on-site tow trucks to immediately remove disabled vehicles within the construction zones; and distributing updated construction, detour, and traffic information to the public via variable message signs. In a few critical areas, the combination of these traffic improvement measures would not fully mitigate the traffic conditions, but would help to alleviate the magnitude of the impacts.

D. PERMANENT IMPACTS OF THE PROJECT ALTERNATIVES

This section identifies possible changes to traffic conditions that could result from operation of the project alternatives. Typically, transit projects are built to relieve roadway traffic congestion and to shift people from automobile to transit use. The Second Avenue Subway project is different in that its objective is to relieve existing transit congestion on the Lexington Avenue subway line and to improve access to transit for residents of the Far East Side. In addition to Lexington Avenue subway riders shifting to the new subway, bus passengers and some taxi patrons would shift to the Second Avenue Subway, resulting in fewer bus passengers and taxi trips through the East Side and a modest diversion of peak hour trips from auto to transit with a modest level of benefits. Because the project would result in vehicular transportation benefits as opposed to significant adverse impacts, a detailed quantitative traffic analysis was not performed with the Second Avenue Subway. Nevertheless, it is important to recognize that the air quality improvements that would result from removal of vehicles from the street network, the reduction of on-street congestion, and the addition of a new mass transit service within Manhattan would all work together to improve mobility and quality of life for residents, workers and visitors to Manhattan's East Side.

NO BUILD ALTERNATIVE

Significant deterioration in traffic levels of service can be expected with the No Build Alternative in the year 2025. Traffic volumes are projected to increase by about 9 percent by the year 2025, or about 0.25 to 0.50 percent per year over 25 years. This traffic volume increase would most likely deteriorate intersections operating at or above capacity (LOS E or F) in the existing condition further within these unacceptable conditions in the No Build condition.

Intersections operating just below capacity or at marginally acceptable LOS D in the existing condition could deteriorate to unacceptable LOS D, E, or F in the No Build condition.

SECOND AVENUE SUBWAY

A principal goal of the Second Avenue Subway is to reduce crowding on the Lexington Avenue Line. Besides attracting some Lexington Avenue riders and reducing crowding on that line, the full-length Second Avenue Subway from 125th Street in the north to the Wall Street area in Lower Manhattan would also divert some peak hour trips from auto and taxi modes to subway. As a result, auto travel would be reduced by 93,130 vehicle miles on an average weekday and areawide traffic volumes would be reduced by about 8,300 vehicle trips per day. This reduction assumes the following vehicle occupancy rates: 1.6 for taxis (2,605 person-trips), 2.2 for shared ride (3,510 person-trips), and 1.0 for drive-alone (5,100 person-trips). A reduction of about 20 to 30 vph would occur on the major north-south avenues in East Midtown, and a 10 vph reduction on Water Street in the lower half of the study area.

Preliminary Engineering studies are still under way regarding station access locations at Chatham Square. Several locations are being evaluated for stairwell and ADA access, and may entail some redesign or reconfiguration of curb lines in the area, such as extension of the sidewalk along the west side of the Bowery/Park Row by taking the curb lane that is presently used for vehicular drop-offs. Any such design changes to the street network would be implemented only with the completion of a traffic analysis indicating that either there would be no significant impacts to traffic flow or that such impacts could be mitigated.

E. SUMMARY OF SIGNIFICANT ADVERSE IMPACTS AND MITIGATION MEASURES

SIGNIFICANT ADVERSE IMPACTS DURING CONSTRUCTION

Subway construction would result in significant traffic impacts due to reduced roadway capacity from lane closures along the alignment, diversion of through traffic away from congested construction areas, and an increase of truck traffic from construction vehicles. Lane closures would be expected at station construction locations and at shaft/access sites within or adjacent to Second Avenue. Subway construction activities would reduce the width of Second Avenue to three typically 11-foot lanes at most station locations. Stations located on two-way streets would cause those streets to be narrowed to one travel lane per direction.

The broad overall findings from these analyses indicate that project construction would result in significant traffic impacts in all station areas: specifically, at most Second Avenue intersections at major cross streets (i.e., 125th, 57th, 42nd, 34th, Houston Streets, etc.), at many of the Second Avenue intersections with minor cross street intersections (especially within East Midtown), and at intersections along the two-way streets of 125th, Chrystie, Pearl, and Water Streets.

Impacts within certain areas of Manhattan would be similar to each other because of the similarity of existing traffic patterns within these areas. Following is a list of stations grouped to show areas where similar impacts are expected:

- The 116th, 106th, 96th, 86th, and 72nd Street Stations;
- The 66th Street shaft site/spoils removal area and 55th Street Station;
- The 42nd Street, 34th Street, 23rd Street, and 14th Street Station areas;

- The Houston Street and Chatham Square Station areas; and
- The Seaport and Hanover Square Station areas.

Most of the impacts at the representative locations analyzed and elsewhere could be fully mitigated with standard traffic engineering improvement measures (e.g., signal timing adjustments, lane reconfigurations or parking restrictions), with the following exceptions:

- 125th Street at Lexington Avenue;
- 125th Street at Second Avenue;
- 96th Street at Second Avenue;
- 72nd Street at Second Avenue;
- 66th Street shaft site/spoils removal area;
- 57th Street at Second Avenue;
- 53rd Street at Second Avenue;
- 42nd/34th/23rd/14th Street Station areas;
- Second Avenue/Chrystie Street and Houston Street;
- Chatham Square Station area;
- Water and Broad Streets; and
- Water Street and Maiden Lane.

Where mitigation other than standard traffic engineering improvement measures would be required for impacts at specific intersections, mitigation measures are described below in "Summary of Mitigation Measures."

In addition, diverted southbound traffic from Second Avenue would also cause significant impacts on Lexington Avenue at 129th, 128th, 127th, and 59th Streets; Park Avenue at 126th and 124th Streets; and the Bowery at Houston Street. These impacts could be mitigated by signal retiming and parking restrictions. Additional truck trips on First Avenue and 96th and 86th Streets would also cause significant impacts that could be mitigated by signal timing changes.

SUMMARY OF MITIGATION MEASURES DURING CONSTRUCTION

As described above, many of the significantly impacted intersections could be mitigated using standard traffic engineering improvements (e.g., low-cost and readily implementable measures such as adjusting signal phasing and green time, re-striping lanes and/or installing pavement lane markings, prohibiting curb parking, and enforcing prevailing traffic and parking prohibitions). As described below, standard traffic engineering improvements would not fully mitigate the traffic impacts at many of the major cross-streets, but several of these intersections could be successfully mitigated by narrowing sidewalks to 5 feet to provide a fourth southbound moving lane on Second Avenue (south of the potential 66th Street shaft site/spoils removal area, five southbound moving lanes would be needed between 63rd and 59th Streets). At the most severely impacted intersections, such as 34th Street, these measures and other measures identified by the MTA/NYCT's Interagency Traffic Management Task Force would be needed to further improve traffic conditions.

A comprehensive areawide traffic management and mitigation plan would need to be developed by NYCT and reviewed by an Interagency Traffic Management Task Force comprised of affected and responsible agencies (e.g., MTA/NYCT, NYCDOT, NYSDOT, MTA Bridges and Tunnels), which would consult with local Community Boards. An important component of this plan would be a comprehensive traffic monitoring program, which would continually evaluate

traffic conditions and ensure that traffic detours and mitigation measures responded effectively to traffic patterns as they change.

The following are suggested mitigation measures for specific intersections/locations where standard traffic engineering improvements would not fully mitigate the expected traffic impacts.

- *125th Street and Lexington Avenue*: The traffic impact at this location could be fully mitigated in Phase 2 by adjusting the signal timing and maximizing the available roadway width on 125th Street to provide a 10-foot through lane and a 10-foot right-turn lane eastbound, and a 10-foot through lane and a 10-foot left-turn lane westbound. Another measure would include signal-timing adjustments in conjunction with a 10-foot through lane and a 10-foot left-turn lane for the westbound approach and providing a southbound right-turn lane by shifting the Second Avenue bus stop from the north side of 125th Street to the south side.

- *125th Street and Second Avenue*: The impact at this intersection could be partially mitigated in Phase 2 by adjusting the signal timing and shifting the bus stop on the eastbound approach to the east side of Second Avenue to provide an exclusive eastbound right-turn lane. Narrowing the construction zone to provide a fourth southbound moving lane on Second Avenue—either by narrowing the construction area or by narrowing the moving lanes to 10 feet and the sidewalks to 5 feet—would also mitigate the impact. Other mitigation, including more aggressive traffic diversion, would need to be evaluated in this critical area as part of the traffic management plan that would be developed by NYCT and reviewed, approve, and monitored by the Interagency Traffic Management Task Force.

- *96th Street at Second Avenue*: Mitigation measures for this intersection in Phase 1 could include restriping the westbound 96th Street approach pavement markings to provide a left-turn lane and two through lanes, and relocating the bus stop at the eastbound approach to the east side of the intersection to provide an exclusive eastbound right-turn lane at the approach. Alternatively, if feasible, four southbound through lanes could be provided at the 96th Street intersection during the AM and PM peak periods. With this mitigation measure, the sidewalk would be narrowed at 96th Street to ease traffic congestion.

- *72nd Street and Second Avenue*: During Phase 1, other measures in addition to standard traffic engineering improvement measures may be necessary to mitigate impacts at this intersection, including providing four southbound travel lanes in the vicinity of the 72nd Street construction zone.

- *66th Street Shaft Site:* During Phase 1, it is necessary to maintain five travel lanes on Second Avenue—clear of any parking, delivery, or bus stop activity within the construction zone—for the four blocks between 63rd and 59th Streets, and to maintain four clear travel lanes north of 63rd Street through the construction zone in order to mitigate potential construction-related traffic impacts.

- *55th Street and Second Avenue:* Narrowing the construction zone to provide a fourth southbound moving lane on Second Avenue by narrowing the sidewalks to 5 feet could mitigate the impact at this location during Phase 3. If a fourth moving lane is not feasible, other mitigation may need to be developed in this critical area as part of the traffic management plan that would be developed by NYCT and reviewed by the Interagency Traffic Management Task Force.

- *53rd Street and Second Avenue*: Prohibiting parking at the westbound approach of 53rd Street to Second Avenue in the AM peak hour to provide an additional travel lane could mitigate the impact at this location during Phase 3.
- *42nd Street/23rd Street/14th Street and Second Avenue*: Mitigation of project-related traffic impacts could require narrower sidewalks to provide a fourth travel lane on Second Avenue in these locations during Phase 3.
- *34th Street and Second Avenue*: Providing a fourth southbound moving lane on Second Avenue would significantly, but not fully, mitigate the traffic impacts along Second Avenue during Phase 3. Therefore, significant adverse impacts would not be fully mitigated. Hence, other mitigation measures would need to be evaluated as part of a comprehensive traffic management and mitigation plan developed by NYCT.
- *Chrystie Street/Houston Street and Second Avenue*: The impact on this location during Phases 3 and 4 could only be partially mitigated in the PM peak hour through "daylighting" the eastbound approach (i.e., prohibiting parking at the approach) to provide an exclusive right-turn lane. This would increase capacity, so that green time could be shifted to southbound Second Avenue. Alternatively, providing a fourth southbound lane on Second Avenue by narrowing the sidewalks could successfully mitigate traffic impacts. If a fourth lane were not feasible, other mitigation measures, including more aggressive traffic diversion, would need to be evaluated as part of a comprehensive traffic management and mitigation plan developed by NYCT.
- *Grand Street and Chatham Square Station Areas*: Mitigation of impacts during Phase 4 at the major cross streets in these station areas (East Broadway and Delancey Streets) could require that sidewalks be narrowed to provide an additional travel lane. If an additional lane is not feasible, other mitigation measures, including more aggressive traffic diversion, would need to be evaluated as part of a comprehensive traffic management and mitigation plan developed by NYCT.
- *Water and Broad Streets:* During Phase 4, adjusting signal timing and reallocating roadway width could mitigate the impact at this intersection. The available 30 feet of roadway width should be reallocated from one shared left-/ through/right-turn lane in each direction to one 10-foot shared through/right-turn lane and one 10-foot left-turn lane in each direction. Alternatively, parking could be prohibited on the eastbound and westbound approaches to widen the two westbound travel lanes and to provide a second lane on the eastbound approach.
- *Water Street and Maiden Lane*: The impact at this intersection could be mitigated during Phase 4 using the same measures as at Water and Broad Streets, except the 30-foot Water Street roadway width could be marked to provide two 10-foot northbound lanes and one 10-foot southbound lane.

SUMMARY OF IMPACTS DURING OPERATION

- No significant adverse impacts on vehicular traffic would continue once the Second Avenue Subway is operational. Instead, the project would result in a reduction in areawide traffic volumes of approximately 8,300 vehicular trips per day in year 2025 as some peak hour auto and taxi trips are diverted to the subway.
- This daily trip reduction would translate into a reduction of about 20 to 30 vph on the major north-south avenues in East Midtown, and a 10 vph reduction on Water Street in the lower half of the study area. ✷