Chapter 21: Construction

A. INTRODUCTION

This chapter summarizes the Proposed Actions' construction plan and considers the potential for adverse impacts during the construction periods. Construction stages for the proposed rezoning area and Academic Mixed-Use Area (together, the "Project Area") are described, and followed by the types of activities likely to occur during construction. Next, an assessment of potential impacts of construction activity and the methods that may be employed to minimize these potential impacts are discussed. The DEIS conservatively predicted that there would be non-Columbia construction in Subdistrict B. Since the issuance of the DEIS, CPC has proposed a modification of the rezoning with respect to Subdistrict B. As a result of that modification, there would not be new non-Columbia development in Subdistrict B. See Chapter 29, "Modifications to the Proposed Actions." However, the analyses in this chapter include the predicted non-Columbia development in Subdistrict B.

B. PRINCIPAL CONCLUSIONS

LAND USE AND NEIGHBORHOOD CHARACTER

The Proposed Actions would result in construction in Subdistrict A over a 22-year period, with successive phases of construction generally moving from the south to the north. Development of the below-grade space would require that West 130th and West 131st Streets be closed for a period of two to three years (but not at the same time, except in situations where overlapping closures may occur for no more than a day or so), and that West 132nd Street be closed for a period of approximately five years; a major sewer relocation would require that West 129th Street also be closed for less than one year. The inconvenience and disruption arising from these closures would include diversions of pedestrians, vehicles, and construction truck traffic to other streets. With slurry wall construction required for most of the below-grade space and then the buildings above, each construction area in Subdistrict A (see Figure 21-2) would be under construction for several years (up to eight years within the Phase 1 construction area, and up to six years on each of the two Phase 2 construction areas), and the inconveniences of construction traffic, noise, and dust would continue in the general vicinity of that construction area for that period of time. No one location would be in construction for the full 22 years; however, some portion of the Project Area and the surrounding primary study area would be subject to the inconveniences and disruptions of construction throughout this period. Throughout the construction period, access to surrounding residences, businesses, institutions, and waterfront uses in the Project Area and primary study area would be maintained. In addition, throughout the construction period, measures would be implemented to control noise, vibration, and dust on construction sites, including the erection of construction fencing and, in some areas, fencing incorporating sound-reducing measures. Because none of these impacts would be continuous in any one location or ultimately permanent, they would not create significant impacts on land use patterns or neighborhood character in the area.

In addition to the activity associated with construction, some properties not yet in construction would be used for construction staging and for interim use, such as parking. These uses are considered "industrial" and would not conflict with the primarily light industrial, warehouse and storage, transportation and utilities, and auto-related uses that would remain in Subdistrict A on an interim basis or with uses in Subdistrict B.

Construction activities would not significantly affect neighborhood character in the primary or secondary study areas, although there would be some inconvenience to neighboring land uses, as with any construction. There would be no significant adverse impacts on land use or neighborhood character from construction in Subdistrict B or the Other Area east of Broadway.

HISTORIC RESOURCES

ARCHITECTURAL RESOURCES

A construction protection plan (CPP) outlining how Columbia would avoid adverse construction-related impacts on architectural resources in the vicinity of a construction site in the Academic Mixed-Use Area has been provided to the New York State Office of Parks, Recreation and Historic Preservation (OPRHP) and the New York City Landmarks Preservation Commission (LPC). In a letter dated November 14, 2007, OPRHP concurred with the protection measures contained in the CPP. In comments dated November 8, 2007, LPC accepted the CPP. Adjacent construction is defined as any construction activity that would occur within 90 feet of an architectural resource, as defined in the New York City Department of Buildings (DOB)'s *Technical Policy and Procedure Notice* (TPPN) #10/88. Architectural resources located more than 90 feet from the Project Area are outside the area of potential physical impacts. Implementation of the CPP would avoid adverse construction-related impacts on architectural resources located in this area. As described in Chapter 8, "Historic Resources," DOB's *TPPN #10/88* would provide protection measures for historic resources within 90 feet of the projected development site in Subdistrict B and the Other Area east of Broadway while these projected development sites are under construction. Therefore, the potential for construction period damage to these resources would be eliminated, and no adverse impacts are anticipated.

ARCHAEOLOGICAL RESOURCES

The Project Area was determined by OPRHP and LPC not to be sensitive for archaeological resources, and therefore, construction activities would not cause significant adverse impacts on archaeological resources.

SOCIOECONOMIC CONDITIONS

Construction activities associated with the Proposed Actions would, in some instances, temporarily affect pedestrian and vehicular access within, and in the vicinity of, the Project Area. However, these lane and/or sidewalk closures are not expected to obstruct entrances to any existing businesses, or obstruct major thoroughfares used by customers, and businesses are not expected to be significantly affected by any temporary reductions in the amount of pedestrian foot traffic or vehicular delays that could occur as a result of construction activities. Utility service would be maintained to all businesses, although very short term interruptions (duration in hours) may occur when new equipment (e.g., a transformer, or a sewer or water line) is put into operation. Overall, construction of the Proposed Project is not expected to result in any significant adverse impacts on surrounding businesses.

During the installation of the new sewer mains, West 129th Street would be closed for less than a year, but would remain open during all other construction activities. In addition, during major sewer relocation/construction activities in 2008, it is possible that some parking and travel lane closures would occur on Broadway southbound between West 130th and West 129th Streets, West 125th Street between West 129th Street and Twelfth Avenue, and Twelfth Avenue between West 125th Street and St. Clair Place. Because such closures would occur along streetfronts that would no longer contain operating businesses, the closures would not adversely affect pedestrian or vehicular access to any businesses.

HAZARDOUS MATERIALS

Potential contaminants identified in the Academic Mixed-Use Area on lots owned or controlled by Columbia University at the time of construction would be remediated (cleaned up) as part of the development of this area by Columbia University. Contaminated soil, historic fill, and demolition debris would be either disposed of off-site in accordance with all applicable regulations or capped (i.e., covered by a building, paving, or other impervious material). Potential impacts during construction and development activities would be avoided by implementing a Construction Health and Safety Plan (CHASP). The CHASP would ensure that there would be no significant adverse impacts on public health, workers' safety, or the environment as a result of potential hazardous materials exposed by or encountered during construction. Following construction, any remaining contamination would be isolated from the environment, and it is expected that there would be no further potential for exposure. In addition, to address the remediation of known or potential environmental conditions that may be encountered during proposed construction and development activities, a Remedial Action Plan (RAP) has been prepared. (Both the RAP and CHASP have been approved by the New York City Department of Environmental Protection [DEP] and would be approved by the New York State Department of Environmental Conservation [DEC], if necessary, in response to a reported petroleum spill.) To ensure the implementation of these measures, Restrictive Declarations will be placed against Columbia-owned properties, as required by DEP.

An E-designation would be placed on lots comprising development sites in the Academic Mixed-Use Area not owned by Columbia University at the time the proposed zoning is approved and for the remainder of the Project Area, pursuant to Section 11-15 of the New York City Zoning Resolution. An E-designation is a mechanism to ensure that properties that are subject to an area-wide rezoning, but cannot be investigated as part of the City Environmental Quality Review (CEQR) process in connection with a rezoning because they are not owned or controlled by the applicant, are properly investigated and remediated, if necessary, before redevelopment. The owner and developer of a lot with an E-designation must prepare a Phase I Environmental Site Assessment (Phase I ESA) and, if necessary, implement a testing and sampling protocol and Health and Safety Plan (HASP) to the satisfaction of DEP before DOB issues a building permit. Based on the results of the sampling protocol, if remediation is necessary, a RAP and CHASP must be submitted and approved by DEP.

With these measures in place (i.e., where necessary, DEP-approved RAPs and CHASPs for all lots to be developed in the Project Area), no significant adverse impacts related to hazardous materials are expected to occur as a result of the Proposed Actions.

INFRASTRUCTURE

As described in more detail in Chapter 14, "Infrastructure," the Proposed Actions would involve a major sewer relocation/construction activity, and removal and replacement of other utilities during construction in Subdistrict A.

The sewer lines would be designed and constructed to DEP standards, and DEP would approve the design before the sewer lines are installed. New water connections would be made before the old water pipes are removed. Removal of the utility lines would be coordinated with DEP and the private utility companies to ensure that service to customers in nearby areas is not disrupted. DEP and the private utilities would have to review and approve the temporary measures. All new utility lines would be located either in the streetbed or within the below-grade space. Residents and workers in nearby buildings are not expected to experience any major disruptions to water supply or wastewater removal. Any disruption to service that may occur when new equipment (e.g., a transformer, or a sewer or water line) is put into operation is expected to be very short term (i.e., hours).Therefore, the construction of the infrastructure improvements would not cause any significant adverse impacts on the users of these services.

TRAFFIC

In 2008, the sewer improvement work would result in intermittent lane and roadway closures, resulting in temporary, short term capacity constraints at numerous intersections along the sewer improvement route and traffic diversions during the closure of West 129th Street between Broadway and West 125th Street. The analysis results show that temporary, short term traffic impacts would occur at one intersection during the AM commuter peak hour, one intersection during the midday peak hour, and three intersections during PM commuter peak hour. Because these temporary impacts would be of short durations and would not occur simultaneously, no specific traffic mitigation measures are recommended. Rather, appropriate maintenance and protection of traffic (MPT) strategies, as stipulated by NYCDOT, are expected to be employed to maintain adequate traffic flow. For peak Phase 1 construction in 2011, when West 130th Street is closed (except to construction-related trucks), significant adverse traffic impacts were identified at one and five study area intersections during the 6:00–7:00 AM and 3:00–4:00 PM analysis hours, respectively. All projected impacts could be mitigated with either an early implementation of proposed operational mitigation measures (see Chapter 23, "Mitigation") or applying other traffic mitigation measures described herein.

In 2022 when West 131st Street is closed (except to construction-related trucks), significant adverse traffic impacts were identified at one and two study area intersections during the 6:00–7:00 AM and 3:00–4:00 PM analysis hours, respectively. All projected impacts could be mitigated with either an early implementation of project improvements or mitigation strategies described in Chapter 23, "Mitigation," or applying other operational mitigation measures described herein.

For peak Phase 2 construction in 2027, when West 132nd Street is closed (except to construction-related trucks), significant adverse traffic impacts were identified at two and four study area intersections during the 6:00–7:00 AM and 3:00–4:00 PM analysis hours, respectively. For the most part, the projected impacts could be fully mitigated with either an early implementation of the mitigation strategies described in Chapter 23, "Mitigation," or by the application of other standard traffic engineering measures described herein. However, at the intersection of Broadway and West 130th Street during the 3:00–4:00 PM analysis hour, additional operational strategies involving lane channelization and the deployment of a traffic control officer (TCO) would be required to fully mitigate the projected significant adverse traffic impact.

PARKING

Construction worker parking would be accommodated off-street throughout construction. While there may be occasions when the total construction worker parking demand may not be met, such occasions would be infrequent and at short durations. Even on those infrequent occasions where construction worker parking demand exceeds the off-street supply, or when there would be limited curb lane disruptions, the effect of construction on neighborhood parking supply and its location is not expected to be significant due to the short-term nature of the shortfall. Therefore, these temporary parking shortfall situations would not constitute a significant adverse parking impact.

TRANSIT

With the projected construction workers distributed among the various subway and bus routes, station entrances, and bus stops near the Project Area, only nominal increases in transit demand would be experienced along each of these routes and at each of the transit access locations during hours outside of the typical commuter peak periods. Hence, there would not be a potential for significant adverse transit impacts attributable to the projected construction worker transit trips. While there are likely to be temporary bus stop relocations along bus routes that operate adjacent to the Project Area, adequate access to transit service would be maintained through coordination with the New York City Department of Transportation (NYCDOT) and New York City Transit (NYCT).

PEDESTRIANS

Considering that pedestrian trips generated by construction workers would occur during off-peak hours and would be distributed among numerous sidewalks and crosswalks in the area, there would not be a potential for significant adverse pedestrian impacts attributable to the projected construction worker pedestrian trips. During construction, for limited periods of time, some sidewalks and crosswalks would be closed. However, pedestrian circulation and access, including access to the waterfront, would be available at all times through alternate routes.

AIR QUALITY

Under both SEQRA and CEQR, the determination of the significance of impacts is based on an assessment of the predicted intensity, duration, geographic extent, and the number of people who would be affected by the predicted impacts. In most cases, the predicted increments on air quality from construction of both Columbia University and non-Columbia University construction would be limited in extent, duration, and severity.

Columbia University construction under the Proposed Actions would not result in predicted significant adverse impacts on air quality. Columbia University would implement an emissions reduction program that would exceed that of any large-scale private project constructed in New York City to date, and substantially reduce $PM_{2.5}$ emissions due to Columbia University construction. E-designations on non-Columbia University projected development sites would be implemented as necessary to reduce $PM_{2.5}$ concentrations resulting from construction at these locations. With these measures in place, no significant adverse air quality impacts would occur from the projected development sites.

For both Columbia University construction (in Subdistrict A) and construction at non-Columbia University projected development sites, concentrations of particulate matter, CO, and NO_2 could increase at locations near the areas of construction, but would not result in significant adverse impacts.

Columbia University Construction

$PM_{2.5}$ concentrations would increase the greatest in areas immediately adjacent to the construction; for the most part, these elevated concentrations would occur on sidewalks and covered walkways along the construction fences and in some cases across the street and would not be significant. In no instances were $PM_{2.5}$ annual increments greater than 0.3 µg/m^3 and 24-hour increments greater than 2 µg/m^3 at nearby residences or schools.

Localized elevated CO concentrations were predicted in a few limited cases. In the area of the Columbia University construction (Subdistrict A), a limited number of discrete events were predicted during the 2008 construction period when predicted CO levels that would exceed the CO NAAQS level might occur on a very small area of sidewalk immediately adjacent to certain gasoline engines if those engines were functioning on up to three days each year when specific meteorological conditions leading to higher concentrations might exist, and if those engines were located immediately adjacent to the construction fence. In the unlikely event that these engines would be used and would be located in the same spot during one of these events, CO levels would exceed the NAAQS level. Based on the limited duration and extent of these predicted exceedances, the low likelihood of occurrence, and the limited potential for exposure, this would not result in significant adverse impacts.

Non-Columbia University Construction

For construction in Phase 1 on the non-Columbia University projected development sites in Subdistrict B and the Other Areas, elevated $PM_{2.5}$ concentrations were predicted to occur during construction in the near vicinity of the projected development sites in Subdistrict B and Other Area east of Broadway both with respect to annual average and 24-hour average $PM_{2.5}$ levels. However, since the publication of the DEIS, project modifications have been identified, which would result in no new development taking place in Subdistrict B (see Chapter 29, “Modifications to the Proposed Actions”); the only non-Columbia University sites which may still be expected to be developed as a result of this rezoning action are Sites 24 and 25. An emission reduction program would be instituted for any construction on those sites, implemented through E-designations. The program would include early electrification to ensure that large generators are not used on the sites, the use of ULSD for all diesel engines, and the use of Tier 2 certified engines or cleaner equipped with DPF tailpipe controls. With these measures in place, no significant adverse $PM_{2.5}$ impact would occur as a result of construction on Sites 24 and 25.

Local elevated CO concentrations were predicted in a few limited cases. At sidewalk locations adjacent to the projected development sites, 1-hour average CO concentration may exceed the NAAQS level during up to three discrete hourly events, and 8-hour average CO concentration may exceed the NAAQS level up to two days per site if certain gasoline-powered engines are functioning during the discrete events when specific meteorological conditions exist. Based on the limited duration, the low likelihood of occurrence, the limited potential for exposure, and limited extent of these predicted exceedances, this would not result in predicted significant adverse impacts.

NOISE

With regard to noise, during Phase 1, construction activities would be expected to result in significant noise impacts at:

- Residences at elevated locations of Riverside Park Community (3333 Broadway) which have a direct line-of-sight to areas of Phase 1 construction (receptor Sites 5,and 5b); and
- Residences at 560 Riverside Drive which have a direct line-of-sight to the areas of Phase 1 construction (receptor Sites 7 and 8)

During Phase 2, construction activities would be expected to result in significant noise impacts at:

- Residences at Riverside Park Community (3333 Broadway) which have a direct line-of-sight to areas of Phase 2 construction (receptor Sites 1, 4, 5, 5a, and 5b);
- Residences at 560 Riverside Drive (receptor Site 8[1]); and
- Residences at two buildings at Manhattanville Houses—95 Old Broadway and 1430 Amsterdam Avenue—which have a direct line-of-sight to the areas of Phase 2 construction (receptor Site 14).

Construction activities at the other locations near the proposed construction sites would at times produce noise levels that are noisy and intrusive, but due to their limited duration, they would not produce significant noise impacts.

With regard to vibration, measures would be taken to prevent structural or architectural damage to nearby fragile buildings and structures, such as the former Warren Nash Service Station building, the Studebaker Building, the Claremont Theater building, and the Riverside Drive and the Manhattan Valley IRT viaducts. At all other locations, the distance between construction equipment and receiving buildings or structures is sufficiently large to avoid vibratory levels that would result in architectural or structural damage. However, for limited periods of time, pile driving and other construction activities would produce vibration levels that are perceptible and annoying. However, because they would be of limited duration, the impacts they produce would not be considered significant adverse impacts. In addition, where rock removal is necessary, and where other rock excavation methods (e.g., mechanical excavators, rock splitters, and expansive chemical rock-splitting methods) could not practicably be employed, some amount of blasting would be necessary. All blasting would be performed to conform to regulations of the New York City Fire Department (FDNY) and any other applicable regulations, and would use timed multiple charges of limited intensity, and blastmats, to limit potential impacts. With these measures, blasting would result in vibration levels that are below the impact criteria, and the limited amount of blasting would not result in any significant adverse vibration impacts.

PUBLIC HEALTH

See Chapter 22, "Public Health."

[1] The impact at this location during Phase 2 is principally due to the installation of a traffic light midblock on West 125th Street between Broadway and Twelfth Avenue, and not due to Phase 2 construction-related activities.

RODENT CONTROL

Construction contracts would include provisions for a rodent (mouse and rat) control program. Before the start of construction, the contractor would survey and bait the appropriate areas and provide for proper site sanitation. During the construction phase, as necessary, the contractor would carry out a maintenance program. Coordination would be maintained with appropriate public agencies. Only U.S. Environmental Protection Agency (EPA) and DEC-registered rodenticides would be permitted, and the contractor would be required to perform rodent control programs in a manner that avoids hazards to persons, domestic animals, and non-target wildlife.

C. CONSTRUCTION OF BUILDINGS AND BELOW-GRADE SPACE

INTRODUCTION

If the Proposed Actions are approved, construction would occur over a number of years, with complete build-out assumed, for reasonable worst-case analysis purposes, in 2030. This section of the chapter first describes the schedule and sequencing of the construction, and then provides a detailed description of each type of construction activity. The activities discussed include abatement and demolition, slurry wall installation, excavation, foundations, below-grade construction, construction of the buildings, interior fit-out (both above- and below-grade), and installation of infrastructure upgrades. General construction practices, including those associated with deliveries and access, hours of work, and sidewalk and lane closures, are then presented. Following the discussion of construction techniques, individual sections of this chapter discuss potential impacts with regard to land use and neighborhood character, historic resources, socioeconomic conditions, hazardous materials, infrastructure, traffic and transportation, air quality, noise and vibration, and rodent control.

SCHEDULE AND SEQUENCING

OVERVIEW

Construction of the Academic Mixed-Use Development in Subdistrict A would begin along the north side of West 125th/West 129th Streets to complement Columbia's as-of-right development on the south side of West 125th Street and to activate the streetscape along West 125th Street. During this time, Columbia would also use property it currently owns on a portion of Sites 8, 9, 15, and 17 for interim parking.

Generally, the construction sequence would move from south to north, starting at West 125th and ending at the block between West 132nd and West 133rd Streets. The first step on a particular block would be abatement of asbestos and other hazardous materials within the existing buildings. Next, the existing utilities would be disconnected, after which the buildings would be demolished. When a block is cleared, in most cases, a slurry wall would be installed around the perimeter of the below-grade construction area, and the soils within the construction area would be excavated. Where slurry walls are not constructed, buildings would be built with conventionally shored basements that would be connected to the remainder of the below-grade space. The underground facilities would be constructed and the buildings erected.

Columbia University construction would occur solely within the Academic Mixed-Use Area (in Subdistrict A). Non-Columbia University construction would occur in Subdistrict B and the Other Areas. <u>Since the issuance of the DEIS, modifications have been made to the proposed</u>

scheduling and sequencing of construction within the Academic Mixed-Use Area. These include changes in sequencing of slurry wall construction, staging areas, equipment location, and the sequencing of street closures and building construction. With these modifications, Phase I below and at-grade construction activities would extend an additional block to the north, resulting in the construction of a larger portion of the proposed below grade space in Phase I. With the refined construction assumptions the same Phase 1 buildings (i.e., the buildings on Sites 1, 2, 3, 4, and 7) within Subdistrict A would be completed by the year 2015 that were assumed in the DEIS. In addition, this schedule would allow for:

- Earlier public access to the proposed open space (the Square). With the modified construction schedule, this open space would be constructed earlier, and accessible to the public in 2016 (during the Phase 2 construction period), earlier than with the construction schedule assumed in the DEIS.
- An accelerated building construction schedule for two of the proposed sites (i.e., Sites 6 and 6b). These two buildings could be occupied and operational early during Phase, 2 construction, earlier than assumed in the DEIS.
- The below-grade parking facility and the central truck loading area would be accessible by 2015, approximately two years earlier than assumed in the DEIS.

To take a conservative approach to the analysis of potential construction impacts, it was assumed both in the DEIS and FEIS that the non-Columbia University construction in Subdistrict B and the Other Area east of Broadway would also be completed by 2015. In addition it was also assumed that the underground space on the blocks between West 131st and West 133rd Streets would be completed by 2030. An overview of the conceptual construction schedule is shown in Figures 21-1 and 21-2. Figure 21-3 shows the location and numbering of the development sites.

CONSTRUCTION SEQUENCING

Phase 1 Construction—2008-2015

Between West 125th /West 129th and West 131st Streets

The reasonable worst-case development scenario assumes that the project's Phase 1 construction (slated for completion in 2015) would occur on the three blocks between West 125th and West 131st Streets and Broadway and Twelfth Avenue.

Several activities would begin in 2008: sewer relocation, and abatement and demolition of above-grade structures on the blocks bounded by West 129th and West 131st Streets, and West 125th and West 129th Streets.

Sewer relocation activities would last approximately one year. (Further details of the infrastructure replacement are presented later in this section.) The sewer relocation activities would occur along the west side of Broadway (south of West 130th Street), on West 129th Street between Broadway and 125th Street, along West 125th Street between 129th Street and Twelfth Avenue, and along Twelfth Avenue south to St. Clair Place. The existing combined sewer lines (requiring the upgrade) under these streets would be removed and replaced with an upgraded sewer to accommodate the upstream flow that currently flows into the combined sewer under West 130th Street. Therefore, at certain times in 2008, depending on the location of the activity, some parking and travel lane closures along these streets would occur. During sewer construction activities on West 129th Street, the entire street would be closed.

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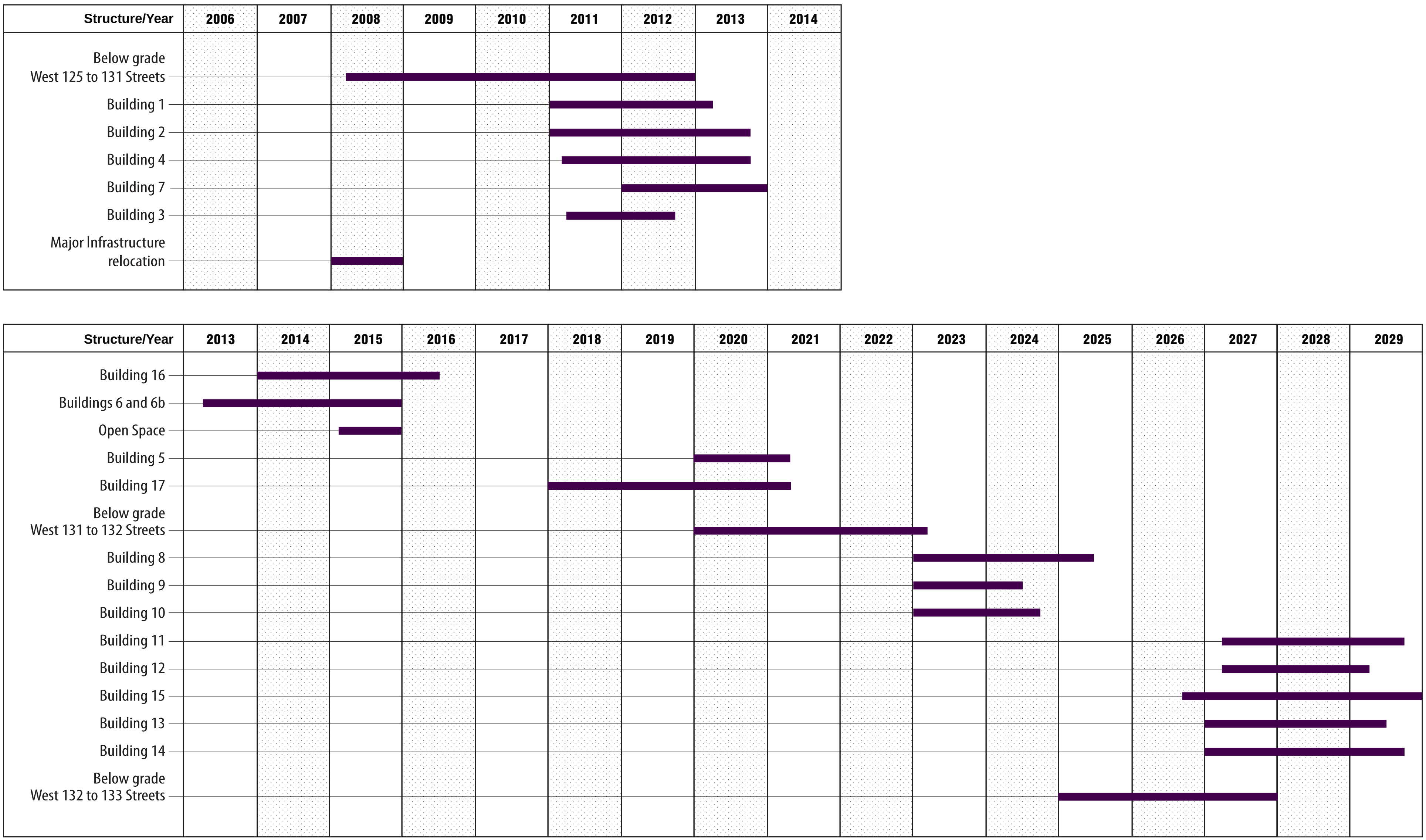


MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Figure 21-1
Conceptual Construction Schedule

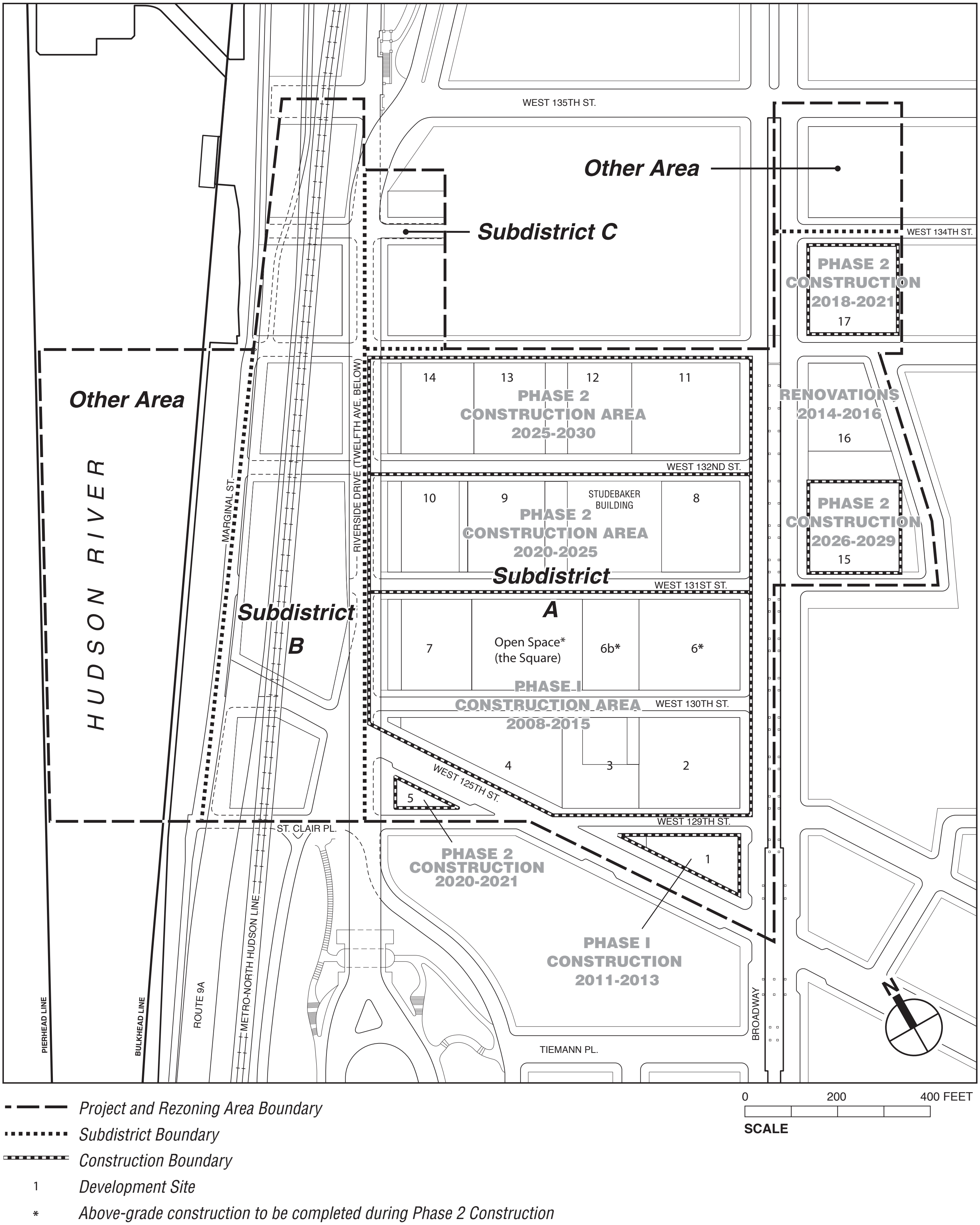
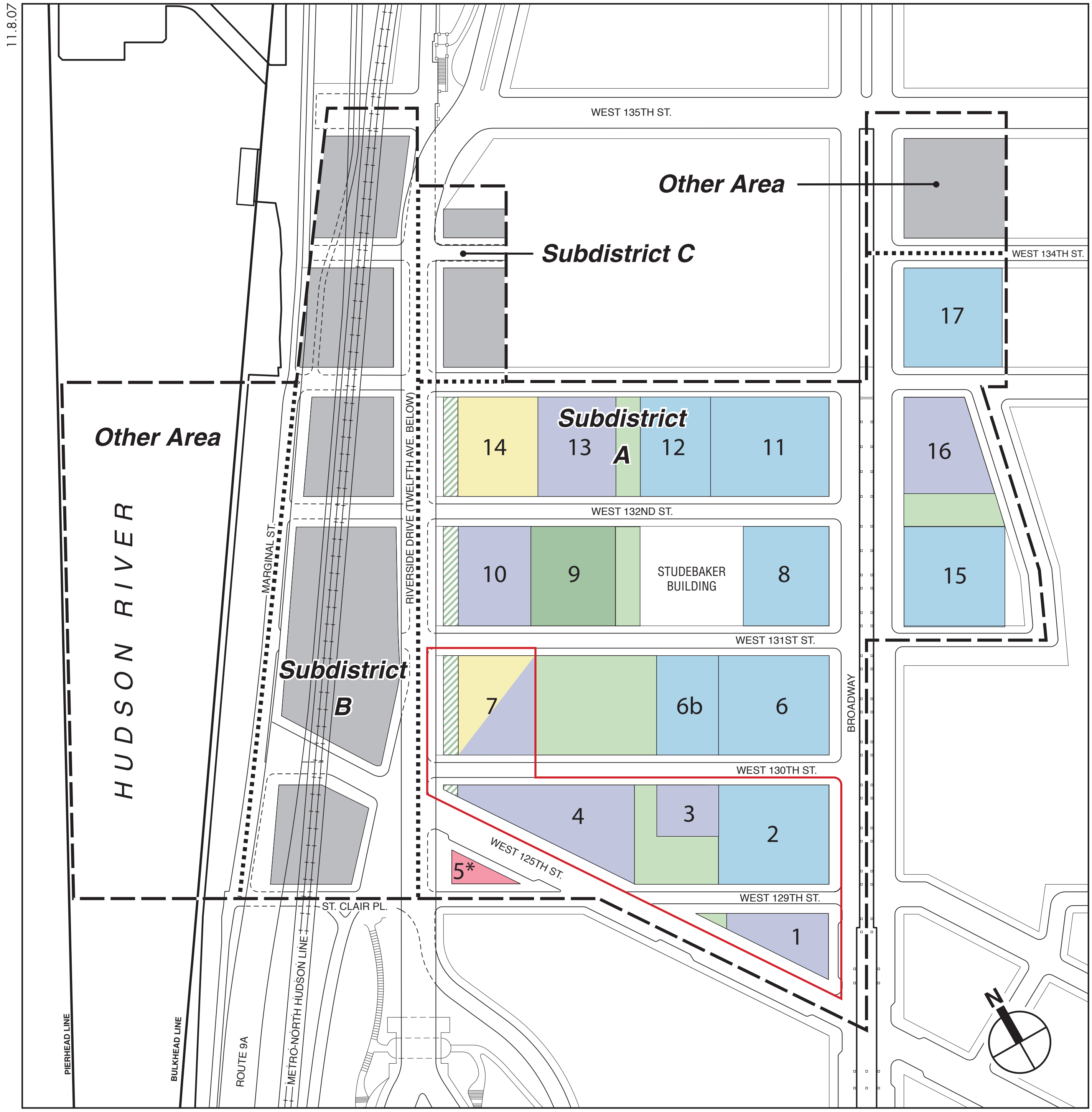


Figure 21-2

Subdistrict A: Reasonable Worst-Case Construction Scenario for Sequencing



Project and Rezoning Area Boundary
Subdistrict Boundary
2015 Development
Academic Research
Academic
Housing for Graduate Students, Faculty, and Other Employees
Streetfront/Retail
Recreation Facility
Open Space
Twelfth Avenue 30-foot Widened Sidewalk with Open Market Area
Subdistricts B,C, and the Other Areas
1 Development Site

* NOTE: Public Open Space to be developed as partial open space mitigation (see Chapter 23)

Figure 21-3
Development Site

While sewer relocation activities are taking place in 2008, abatement and demolition of the above-grade structures on the blocks bounded by West 129th and 131st Streets, and West 125th and 129th Streets, would begin. Portions of the block bounded by West 131st and West 132nd Streets would also be abated and demolished. During this time, West 130th Street would be closed to traffic and pedestrians. West 131st Street would remain open. Following abatement and demolition on these blocks, a slurry wall would be constructed to enclose the two blocks from the north side of West 129th Street to the south side of West 131st Street. While the slurry wall is being completed, soil excavation would begin. Then, the below-grade structures would be constructed. The slurry wall construction, bracing, excavation, foundations, and the below-grade structure are expected to take just over three to four years. During construction of the below-grade facility, the eastern and western sides of the block to the north (between West 131st Street and West 132nd Street) would be used for truck marshalling, laydown and stockpiling.

Following significant completion of the below-grade facility, construction would commence on the first new buildings. The above-ground construction of Buildings 1, 2, 3 and 4 is expected to start in 2011. Building 7 would be constructed starting in 2012. Construction would also begin on the properties to the east of Site 7 on the block between West 130th and West 131st Streets (the Square—an approximately 40,000-sf privately owned, publicly accessible open space, the midblock open area, and Sites 6 and 6b). Based on this Phase 1 construction schedule, the buildings on Sites 1, 2, 3, 4, and 7 would be operational by 2015. As mentioned earlier, although construction of buildings on sites 6 and 6b would commence earlier than described in the DEIS, those building would not be completed and operational until 2016 or later.

While West 130th Street is closed to traffic and undergoing construction, the existing utilities—including the existing combined sewer under West 130th Street—would be removed, the below-grade facility would be built, and new utility lines and a new separate stormwater sewer would be placed under West 130th Street. Following these activities, West 130th Street and the sidewalks would be restored and re-opened to traffic and pedestrians.

Renovations to allow for the reuse of the former Warren Nash Service Station building (Building 16) would begin in 2014.

As mentioned above, the reasonable worst-case analysis conservatively assumes that the non-Columbia University construction of individual buildings (Buildings 18–25) in Subdistrict B[1] and the Other Area east of Broadway would also be completed by 2015. Construction of these individual buildings would not involve any street or sidewalk closures.

Phase 2 Construction—2015-2030

Construction Between West 131st Street and West 132nd Street

Construction of the remaining Academic Mixed-Use Area would continue over time with a similar sequence. The below-grade construction on the block between West 131st and West 132nd Streets is expected to start in 2020 and be completed early in 2023. For most of this

[1] CPC is contemplating certain modifications to Subdistrict B. The proposed modifications would rezone Subdistrict B to a modified M1-2 light manufacturing district to support light manufacturing and retail uses. It is anticipated that this modification would not result in any projected development sites in Subdistrict B. The proposed modifications are more fully described in Chapter 29, "Modifications to the Proposed Actions." Chapter 29 also analyzes the potential environmental impacts that could result from the proposed modifications.

period (2020 to 2022), West 131st Street between Broadway and Twelfth Avenue would be closed to vehicular traffic and pedestrians. During this time, abatement and demolition of the block would occur, a slurry wall would be extended around a portion of the block (from the south side of West 131st Street to the south side of West 132nd Street, and west of the Studebaker Building). East of the Studebaker Building, the area would be too small for cost-effective slurry wall construction, and subsurface conditions would permit more conventional construction of this portion of deep basement; underpinning may be required along the eastern edge of the Studebaker Building. The existing utilities—including the existing combined sewer under West 131st Street—would be removed, the below-grade facility would be built, and the utility lines and a new separate stormwater sewer would be placed under West 131st Street. Following these activities, West 131st Street and the sidewalks would be restored and reopened to traffic and pedestrians.

Once West 131st Street is restored and operational, West 132nd Street would be closed for this stage of construction from approximately two to three years (2023 to 2025). During this time, the slurry walls along Twelfth Avenue would be extended northward to incorporate the western portion of this block (because bedrock is higher on the eastern half and the underground space can be built without a slurry wall), to the north side of West 132nd Street. The existing utilities under this street (including the existing combined sewer) would be removed, the below-grade structure under this street would be completed, the utility lines and new separate stormwater sewer would be installed, and the street would be partially reconstructed to accommodate construction-related trucks in the next stage of construction.

Construction staging would initially take place on the eastern portion of the block. After slurry wall construction is completed and reconstruction of West 131st Street is completed, staging would be relocated to a portion of West 131st Street (which would remain open to vehicular traffic and pedestrians).

As mentioned above, the below-grade construction on the block between West 131st Street and West 132nd Street would occur between 2020 and 2023. While the below-grade construction is occurring, Building 5, on the block bounded by Twelfth Avenue, St. Clair Place, and West 125th Street, would be constructed. In 2018, construction of the building on Site 17 would begin.

Construction of the new buildings (Buildings 8, 9, and 10) would follow, with completion of building construction expected in mid 2025.

Construction Between West 132nd Street and West 133rd Street

The last block to be constructed would be between West 132nd Street and West 133rd Street. Abatement, demolition, extension of the slurry wall around the western portion of the block, and excavation of the block is expected to start in 2025 and be completed approximately three years later. During this time, West 132nd Street between Broadway and Twelfth Avenue would be closed to vehicular traffic and pedestrians, but would be open to construction-related trucks, for other construction staging purposes, and emergency vehicles. Overall, therefore, West 132nd Street would be closed for approximately a five-year period, first from approximately 2023 to 2025, then from approximately 2026 to 2029. West 132nd Street would be fully restored and reopened to vehicular traffic and pedestrians after 2027. Construction of the new buildings above ground (Buildings 11, 12, 13, and 14) would follow starting in 2027. Construction of Building 15, east of Broadway, would start toward the end of 2026.

All proposed buildings are expected to be completed by 2030[1].

ABATEMENT AND DEMOLITION

The first step for construction of any of the buildings would be disconnection of existing utilities and demolition of the existing buildings to clear the site. Prior to demolition, a New York City-certified asbestos investigator would inspect the building for asbestos-containing materials (ACMs). If ACMs are found, these materials must be removed by a New York State Department of Labor (DOL)-licensed asbestos abatement contractor prior to building demolition. Asbestos abatement is strictly regulated by DEP, DOL, EPA, and the U. S. Occupational Safety and Health Administration (OSHA) to protect the health and safety of construction workers and nearby residents and workers. Depending on the extent and type of ACMs, these agencies would be notified of the asbestos removal project and may inspect the abatement site to ensure that work is being performed in accordance with applicable regulations. These regulations specify abatement methods, including wet removal of ACMs that minimize asbestos fibers from becoming airborne. The areas of the buildings with ACMs would be isolated from the rest of the buildings and surrounding area with a containment system and a decontamination system. The types of these systems would depend on the type and quantity of ACMs, and may include hard barriers, isolation barriers, critical barriers, and caution tape. Specially trained and certified workers, wearing personal protective equipment, would remove the ACMs and place them in bags or containers lined with plastic sheeting for disposal at an asbestos-permitted landfill. Depending on the extent and type of ACMs, an independent third-party air-monitoring firm would collect air samples before, during, and after the asbestos abatement. These samples would be analyzed in a laboratory to ensure that regulated fiber levels are not exceeded. After the abatement is completed and the work areas have passed a visual inspection and monitoring, if applicable, the general demolition work can begin.

Depending on the amount of ACMs to be removed and project phasing, 10 to 20 workers can be on site, and about one or two truckloads of material can be removed per day. This phase can last about a month per building.

The next step in general demolition is to remove any economically salvageable materials, and then large equipment is used to deconstruct the building. Typical demolition requires solid temporary walls around the building to prevent accidental dispersal of building materials into areas accessible to the general public. After the building is deconstructed, bulldozers and front-end loaders would be used to load materials into dump trucks. The demolition debris would be sorted prior to being disposed at landfills to maximize recycling opportunities. Depending on the size of the building demolished, about 10 to 20 workers are expected to be on site, and typically two to four truckloads of debris would be removed per hour. The general demolition phase can last one to three months per building.

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[1] As noted in Chapter 2, “Procedural and Analytical Framework,” it is possible that construction on this block would be delayed, if the building at 3291 Broadway on the corner of West 133rd Street and Broadway, which was constructed under federal and City agreements that remain in force until 2015 and 2029, respectively, cannot be demolished until after that year. The description of construction activities would remain the same no matter when the construction takes place.

EXCAVATION, FOUNDATIONS, AND BELOW-GRADE CONSTRUCTION

As part of the Proposed Actions, Columbia would build approximately 2 million square feet of support facilities below grade. These support facilities would be contiguous under almost all of the Academic Mixed-Use Area, and excavation for these areas would be at a depth ranging from approximately 70 to 80 feet below grade. Slurry walls would be built extending from the existing grade to a depth ranging from less than 50 feet to approximately 120 feet below grade or more (depending on geological conditions). Figures 21-4 and 21-5 show typical cross sections at Broadway and at Twelfth Avenue.

Deep below-grade structures extending well below the groundwater table are not uncommon in New York City. As outlined in Appendix K.5, the Proposed Actions' below-grade facility would be designed to consider both groundwater-induced water pressures and the potential for flooding. The Proposed Actions' below grade facility would be designed to resist pressure from both the permanent groundwater levels and temporary flood conditions. To address groundwater pressure, the bottom slab of the below-grade facility would provide a horizontal groundwater cut-off, and will be designed to resist uplift pressures. Sufficient studies have been conducted to confirm that design elements can address potential flooding conditions. In addition, probabilistic risk-based analysis will be performed to evaluate risk levels associated with different flood hazard levels, and will include considerations of rising sea levels. The analysis will also address the potential future change to 100-year and 500-year flood levels. Once design groundwater and flood levels are established through these studies, they will be incorporated, into the final foundation designs of the Proposed Actions' below-grade facility, and will be achieved using standard engineering techniques. This final design will also accommodate flooding risk from hurricane events.

The New York City Building Code contains specific seismic design requirements which must be adhered to for the design of any new building structures in New York City. As described in Appendix K.5, seismicity studies have been conducted that confirm that construction will at minimum, meet the standards of the The New York City Building Code. In addition, a site-specific probabilistic analysis of the seismicity potential in Subdistrict A will be undertaken for inclusion in final design documents for the proposed development. The combination of these design requirements and the seismic parameters from the site-specific investigations being undertaken will be incorporated into the final design of the Proposed Actions to ensure these concerns are addressed.

Foundation construction would begin with construction of the slurry wall, followed by excavation for the foundation and below-grade work. The foundations may be built using either of two different techniques, bottom up (which would involve conventional construction techniques) or top down (which is a faster technique utilizing mining construction techniques). Each of these foundation construction techniques is discussed below. (For purposes of analysis of construction impacts relating to traffic, parking, air quality, and noise, top down foundation construction was assumed since this was more likely to result in significant adverse impacts than bottom up foundation construction). Blasting may occur in those areas where rock removal is necessary. Foundation work would include the use of cranes, drill rigs, excavators, backhoes, rockbreakers, loaders, pumps, motorized concrete buggies, concrete pumps, jackhammers, pneumatic compressors, a variety of small tools, and dump trucks and concrete trucks. The proposed plans place many functions, such as central energy plants, parking, truck loading, and storage, in underground spaces.

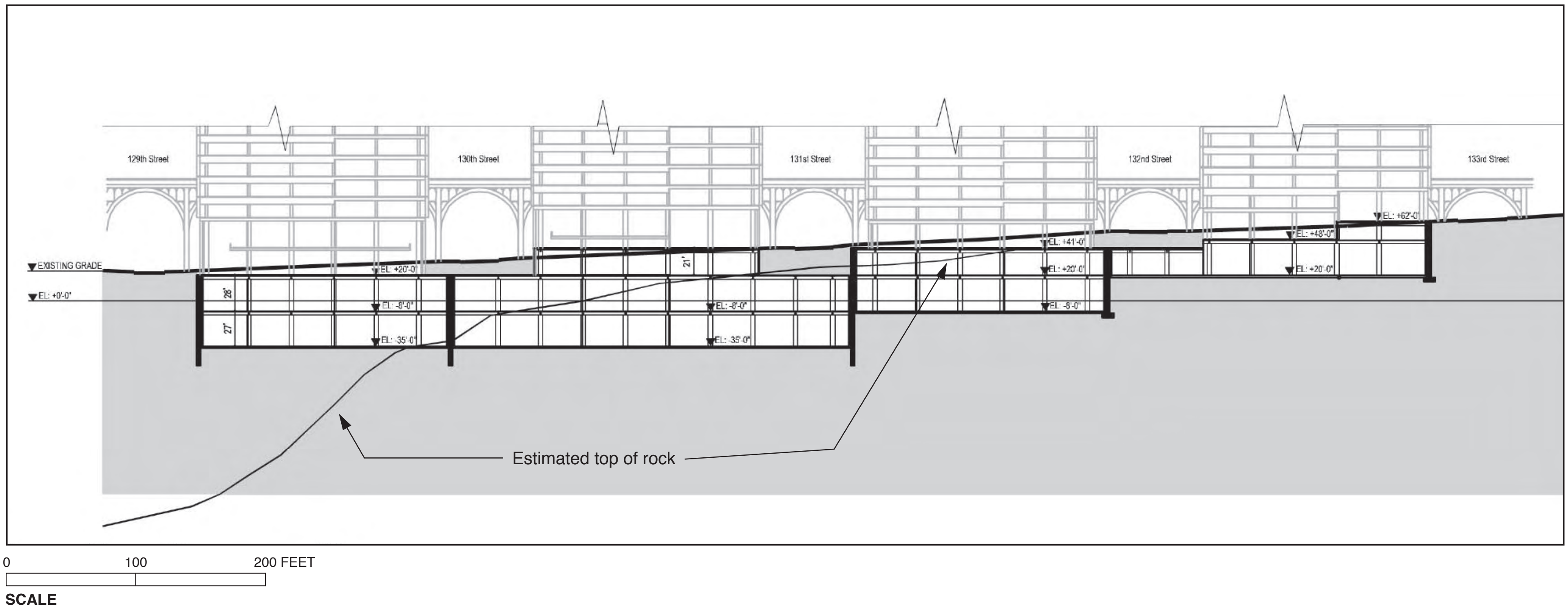


Figure 21-4
Typical Cross Section, West 129th - West 133rd Street at Broadway

Figure 21-5
Typical Cross Section,
West 130th - West 133rd Street at Twelfth Avenue

BLASTING

In the limited areas where rock removal is necessary, and where other rock excavation methods (e.g., mechanical excavators, rock splitters, and expansive chemical rock-splitting methods) could not practicably be employed, some blasting is likely to occur for short periods of time. Blasting in New York City is tightly regulated and restricted. All blasting would conform to FDNY regulations and any other applicable regulations. Blasting would involve the use of timed multiple charges with limited blast intensity, which would reduce potential impacts. Blastmats would be placed over the blasting areas. The regulations are intended to prevent endangering the public and to minimize vibrations that could affect nearby buildings. In addition, some of work would be near the elevated subway, and NYCT also regulates blasting.

In areas where a controlled drill-and-blast method would be used, there would typically be one or two controlled blasting periods per day, each lasting for only a few seconds. More frequent blasting using smaller charges could also occur. Properties near these activities would be documented and monitored before, during, and following each blasting period, and strict parameters would be established and maintained by a safety officer at all times. Blasting would not occur at night. The time between controlled blasts is required to remove debris and setup for the next blast. Some vibrations at the street and inside adjacent properties may be detected due to drilling and blasting activities. The extent of vibrations would vary based on the density of the material being mined, with hard rock the most efficient in transmitting vibrations; how deep below-ground blasting occurs; proximity to structures; the foundation configuration of the adjacent structures; and the response to vibration of the adjacent structures.

Based on current available information, no blasting is expected at locations south of West 131st Street, except possibly under Site 6, which is located between West 130th and West 131st Street. Blasting is expected to be used in limited areas on the other blocks within the Academic Mixed-Use Area.

DEWATERING

Because below-grade structures extend below groundwater levels, and because of the proximity to the Hudson River and the depth of the underground space, the excavation would have to be dewatered. The water would be sent to an on-site sedimentation tank so that the suspended solids could settle out. Depending on the building site, the decanted water would be discharged into either the New York City sewer system or the Hudson River, and the settled sediment conveyed to a licensed disposal area. Discharge in the sewer system is governed by DEP regulations, and discharge into the Hudson River is governed by DEC regulations.

For water discharged into the City sewerage, DEP regulations specify the following maximum concentration of pollutants.

- Petroleum hydrocarbons 50 parts per million
- Cadmium 2 parts per million
- Hexavalent chromium 5 parts per million
- Copper 5 parts per million
- Amenable cyanide 0.2 parts per million
- Lead 2 parts per million
- Mercury 0.05 parts per million
- Nickel 3 parts per million
- Zinc 5 parts per million

In addition, DEP limits other pollutants, such as total suspended particles, in the discharge water. DEP also imposes project specific limits, depending on the location of the project and contamination that has been found in nearby areas. For large-volume discharges into the sewer system, DEP samples and tests the discharge water.

SLURRY WALLS

To minimize dewatering, slurry walls would be built around portions of the below-grade structure. Slurry walls reduce the horizontal groundwater seepage into the open excavation and reduce the volume of water that must be pumped out of the excavation and discharged. For locations where slurry walls would be constructed, a long, narrow section, or “panel,” is excavated along the perimeter of the basement. The excavation would be filled with slurry, a bentonite clay and water mixture that can be pumped. For each section or panel, a steel reinforcement cage, carefully measured to match the width and depth of the panel, would either be fabricated on the site or brought to the site in smaller sections for assembly. Each such reinforcement cage is likely to measure between 60 and 80 feet long, though some may reach 120 feet. Once completed, the reinforcement cages would be lowered into the clean slurry-filled panels. The panels would then be filled with concrete from the bottom up, which would be poured down tubes lowered to the panels’ base. The rising level of concrete in the panel would displace the slurry, which would be pumped into a recycling facility on site, within the active construction zone. The recycling facility would likely consist of a pump, a mixer, several silos, and a separator, known as a “desander.” At the recycling facility, suspended soil and sand would be removed from the slurry, so that the clean slurry could be reused for another panel.

Slurry wall construction would occur in stages. Slurry wall panels are constructed in a staggered configuration, so that no two adjacent panels are worked on consecutively. The concreting operation is very time sensitive, and panels have to be completed quickly (typically within 15 hours or less). In total, it may take two to three days to complete excavation and concreting of each individual panel. The work would begin with construction of concrete guide walls adjacent to the locations where the final wall would be. These concrete walls, each measuring approximately 2 feet wide by 4 feet deep, would be installed along a portion of the sidewalk. Next, the trench for the permanent wall would be dug between these guide walls, using a clamshell shovel suspended from a crane and/or trench cutter (hydromill) machines. The trench would be excavated in 10- to 20-foot-long segments, or panels. The trench would be 2 to 4 feet wide and range in depth from less than 50 feet, to approximately 120 feet. Slurry walls may extend or be keyed into bedrock. Percussion equipment (e.g., air-powered drills) would be employed to excavate rock or penetrate cobbles and boulders. The soil and rock excavated by the clamshell or hydromill would be placed on the ground to allow the soil to drain. Where there is a potential for contamination, the moist soil and rock would be first tested, then loaded onto trucks for transport out of Manhattan to a licensed disposal facility.

As each panel is completed, another would be constructed (but not immediately adjacent to the constructed segment, to allow time for the panel to harden), and this process would continue until the outside perimeter of the excavation is completed. Work on each 10- to 20-foot panel would take about three days.

The excavation and placement of reinforcing cages would take place during normal working hours. On occasion, the pouring of the slurry walls panels would require extended work hours. Slurry wall construction would require work crews of up to 50 workers at any point, assuming several areas are constructed at once. During the busiest phases of slurry wall construction, approximately 40 truck trips per day would be needed to deliver materials and remove excavated soil (including spent slurry) and rock.

In general, the analysis assumes that during construction of a particular block in the Project Area, the northern and southern boundaries of the slurry wall would extend from the south side of the street (on the south side of the block), to the south side of the street (on the north side of the block). For example, during construction between West 131st Street and West 132nd Street between Broadway and Twelfth Avenue, the slurry wall would extend north from the south side of West 131st Street (during which time West 131st Street would be closed), along the eastern and western perimeters (Broadway and Twelfth Avenue), and along the south side of West 132nd Street (which would be open to vehicular traffic and pedestrians).

EXCAVATION, FOUNDATIONS, AND BELOW-GRADE STRUCTURES

Bottom Up Foundation Construction

The following describes the conventional bottom up manner of foundation construction where the below grade space is completely excavated before the foundation is constructed. The construction of the foundation starts at the bottom of the excavation and works up to the surface, so it is referred to as bottom up construction. When the foundations reach ground level, then the construction of the buildings can begin.

Excavation of the below-grade areas would start as the slurry wall is being completed, and upon reaching the underlying water table, construction-dewatering operations would be implemented and maintained. Soil and rock would be excavated and stockpiled for drying. After drying, the soil and rock would be loaded onto trucks for carting from the site. If any unreported underground tanks are uncovered, they would be removed in accordance with applicable DEC regulations. As the excavation becomes deeper, a temporary ramp would be built to provide access for the dump trucks to the work site. In addition, internal steel bracing and/or external soil/rock anchors (i.e., tiebacks) would be installed on, against, or through the slurry wall to ensure its stability. As the soil is excavated from the basin formed by the slurry wall, the soil on the outside exerts a large force trying to bend the walls inward. The steel braces and/or tiebacks are designed to resist this force until the below-grade foundations and structures are built. These structures then resist the inward force on the slurry wall. The excavation would involve excavators, bulldozers, and backhoes. This phase of the work would have several hundred workers employed on this task, and over 100 trucks would enter and exit the site daily at the peak of work.

As the excavation is being completed, deep foundation elements would be installed into competent bearing material (e.g., drilled caissons, drilled or driven piles, or load bearing elements excavated using slurry wall equipment). Up to about four drill rigs, excavating tools, or pile drivers could be used simultaneously. If competent bearing materials are shallow, a foundation mat (a reinforced concrete slab, bearing directly on soil and/or rock, with no deep foundation elements) would be used, replacing deep foundation elements. Concrete trucks would be used to pour the foundation and the below-grade structures. These trucks would use the closest parking lane, generally on the side streets, where they would pump the concrete. Typically, several trucks would be pumping concrete at the same time. Additional concrete trucks would be waiting in truck marshalling areas, or where necessary, on the side streets within the active construction site.

Because planned excavations would be undertaken below the underlying water table, construction of planned building and below-grade structure foundations would be subject to substantial uplift loads. To resist said uplift loads, the proposed building and below-grade structure foundations would likely require permanent, pre-stressed, vertical tie-down rock anchors to increase the total weight of the structures. In particular, these vertical tie-down rock anchors may be required within all proposed open spaces directly overlying the planned below-grade support facilities.

Utility connections would also be installed during this phase. During this phase of a building's construction, about 40 construction workers would be on site. Construction of the below-grade structures would entail the use of heavy-duty construction equipment. Pile drivers and large cranes would be used to build the below-grade structures. After 12 months, the foundation and lower walls would be constructed, and the building would begin at ground level.

Top Down Foundation Construction

In top down construction, caissons, piles or other load bearing elements are installed after the slurry wall in the area has been constructed. The caissons may extend to bedrock and act as the foundation supporting the building. After the caissons are installed, excavation of the soil under where the building would be located begins. The excavation proceeds downward until reaching the level of the first basement. Then bracing is installed and the floor plates of the first or highest level basement are installed. The excavation continues downward until reaching the second level of the basement, and again bracing and the floor plates are installed. The excavation and construction of the underground levels continues downward until the final bottom elevation is reached. Because the highest level of the underground space is built first, this method of construction is called top down.

Top down construction allows the buildings to be erected while the underground space is being created. Two construction activities are underway at the same time; construction of the buildings and creation of the underground. This condenses the construction time, allowing a shortened schedule.

FIT-OUT OF THE ENERGY CENTER

Steam and hot water would be generated to service the Academic Mixed-Use Area's heating demand and to drive mechanical air-conditioning equipment. The equipment would be installed in two phases, Phase 1 and Phase 2. By 2015, the first of the two central energy plants would be constructed in the below-grade facilities between West 129th and West 130th Streets to serve the development anticipated to be operational in Phase 1. By 2030, the first central energy plant would be expanded to serve the additional development that would be operational south of West 132nd Street in Phase 2. A second central energy plant would be constructed on the block between West 132nd Street and West 133rd Street, to serve the buildings on that block.

These energy centers would use large pieces of equipment, such as boilers, and they would require special transport to the site and special equipment for their installation. Certain pieces of equipment may exceed the normal weight limits for New York City roads. In that case, permits from NYCDOT and New York State DOT would be required. Usually, the large pieces of equipment are brought by train or barge to a location close to the installation site to minimize the distance the equipment must be transported over the road. The roads and, if necessary, bridges for the route are selected to ensure they can support the weight of the trucks and equipment. Transport of large and/or overweight items by truck is normally allowed late at night, when traffic is the lightest. Escort vehicles are required to warn other vehicles, and stringent speed limits are imposed to prevent shock loads from truck tire impacts on the street. Because the over-the-road transport is done at time of the lightest traffic, few other vehicles are affected. At the site of the energy center, large cranes would be used to lift the equipment off the truck and lower it through hatches into the energy center. The large cranes would be on-site for a short period of time to unload and place the large equipment.

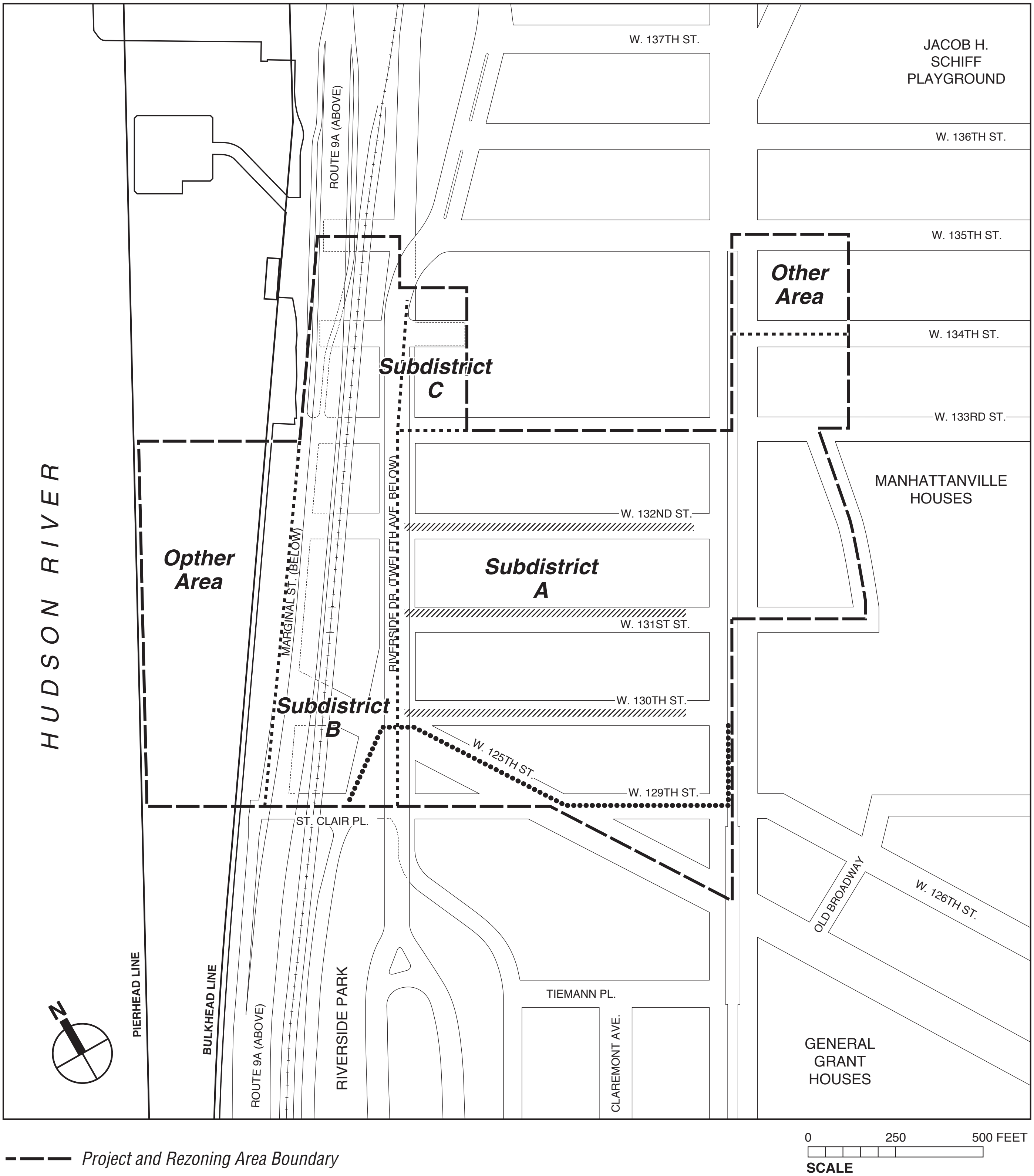
CONSTRUCTION OF INFRASTRUCTURE IMPROVEMENTS

The Proposed Actions involve an increase in sewage flows that are expected to exceed the capacity of a number of existing sewers. Therefore, an amendment to the New York City drainage plan was developed and is currently being reviewed by DEP (see Chapter 14). As part of the Proposed Actions, Columbia University would upgrade the water and wastewater lines in the Project Area. Figure 21-6 shows the sewer lines to be removed and upgraded or replaced. The existing combined sewer lines under Broadway, West 129th Street, West 125th Street, and Twelfth Avenue would be removed and replaced with sewer lines with the capacity to convey the existing and expected new flows. In addition, as part of the amended drainage plan, the existing combined sewers under West 130th, West 131st, and West 132nd Streets would be removed and replaced with separate stormwater sewers. Other utility lines, including water, electrical, and telecommunications, would also be removed and replaced as construction proceeds through the Academic Mixed-Use Area. The major sewer relocation/construction in Phase 1 is scheduled for 2008. Some of the infrastructure improvements in the vicinity of West 125th Street and Twelfth Avenue could be completed in conjunction with the West 125th Street Streetscape Project, which is being undertaken by the New York City Economic Development Corporation (EDC).

MAJOR SEWER RELOCATION/CONSTRUCTION

Currently, the upstream flow from the two combined sewers on either side of Broadway (north of West 130th Street) is collected by a combined sewer under West 130th Street, which then conveys the flow to the existing combined sewer on Twelfth Avenue. As mentioned above, the existing sewers would not have sufficient capacity to carry the expected flows resulting from the Proposed Actions. Therefore, the major infrastructure rehabilitation would involve redirecting the upstream flow that currently flows into the combined sewer under West 130th Street into an upgraded sewer which would be placed along Broadway between West 130th Street and West 129th Street, along West 129th Street between Broadway and West 125th Street, along West 125th Street between West 129th Street and Twelfth Avenue, then across Twelfth Avenue and south to the regulator at St. Clair Place and Twelfth Avenue. To accommodate these upgraded sewers, the existing lines under these streets requiring the upgrade (which currently convey sewage from an area south of 129th Street) would be removed, or where removal is not required, would be disconnected and abandoned in place. The sewer lines would be designed and constructed to DEP standards, and DEP would approve the design before the sewer lines are installed.

Sewer construction work primarily is a “cut-and-cover” technique. A trench would be excavated in the street, and short piles may need to be driven through the bottom of the trench. Concrete cradles would be installed to hold the sewer pipe. The trench would then be backfilled and the pavement replaced. While the new sewers are being constructed, temporary flumes may have to be installed to handle the existing sewer flows. The temporary flumes or existing sewer would be



Project and Rezoning Area Boundary

Existing Combined Sewers to be Upgraded

Existing Combined Sewers to be Removed and Replaced with Stormwater Sewers

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Figure 21-6

Upgraded Combined and New Stormwater Sewers

removed when the new sewer is operational. The new sewer would be connected to the system at manholes. DEP regularly performs this task at sites throughout the City.

Because of the size of the new sewer, the trench would be about 12 to 14 feet wide. Between the trench and the need for space for the construction equipment to lay the sewer pipe, up to two lanes in the streets (Broadway southbound between West 130th and West 129th Streets, West 129th Street between Broadway and West 125th Street, West 125th Street between West 129th Street and Twelfth Avenue, Twelfth Avenue between West 125th Street and St. Clair Place) are expected to be closed. Depending on the locations of the existing sewer line, it is possible that some parking and travel lane closures would occur. During construction on West 129th Street (for less than a year), the entire street would be closed because the sewer runs down the middle of the street.

The entire sewer relocation/construction activity is expected to occur in 2008 and last for approximately one year. The sewer construction would disrupt traffic locally. While the sewer construction would be disruptive, it would be temporary and would not cause long-term significant adverse impacts.

OTHER UTILITY AND SEWER CONSTRUCTION UNDER THE SIDE STREETS

Land under mapped streets and sidewalks, where almost all utility lines are placed, is typically owned and maintained by New York City. Within the Academic Mixed-Use Area, the Empire State Development Corporation (ESDC) would override the City map with respect to the space that is under the first 8 to 10 feet below street grade. Columbia University would acquire this area and use it for parking and other below-grade support uses. The space from the street surface to approximately 8 to 10 feet below the street surface would continue to be owned by New York City as mapped streets. This space holds the utility lines, which include water, sewer, electrical, and telecommunications.

During the time a street is closed for construction activities, the street would be excavated, and the existing utility lines (including the existing combined sewers under the street) would be disconnected and removed to allow for the construction of the below-grade facility. These activities would occur along West 130th Street, West 131st Street, and West 132nd Street between Broadway and Twelfth Avenue, at different times as activities proceed northward (see description of scheduling and sequencing above). The removal of the utility lines would be coordinated with DEP and the private utilities to ensure that service is not disrupted to other nearby users. DEP and the private utilities would have to review and approve the temporary measures before they could be implemented. The review process would include evaluation to ensure that service to users would not be disrupted or impaired while the temporary measures are in place.

The removal of the water main in the bed of West 130th Street could adversely affect the water supply and pressure to the North River WPCP because the water main in the bed of West 125th Street would become the sole source of water supply to the WPCP. This potential adverse effect could be averted by extending the water main in the bed of West 129th Street and connecting it to the water main in the bed of St. Clair Place. This connection would provide a second source of water supply to the North River WPCP. Therefore, during the major sewer relocation/construction that is slated to occur in 2008, this water main in the bed of West 129th Street would be extended and connected to the water main in the bed of St. Clair Place to avoid this potential adverse effect. In addition, the water main in the bed of West 129th Street was installed in 1912, and it would be replaced with a new water main that meets DEP current standards.

After construction of the below-grade space on any one street, the utility lines would be replaced before reconstruction of the street. New water lines would be connected, and the new separate stormwater sewers would be placed under West 130th, West 131st, and West 132nd Streets (stormwater from these streets would be conveyed through a separate stormwater line which would run south along Twelfth Avenue, west along West 125th Street, south along Marginal Street to St. Clair Place, to an existing CSO outfall at St. Clair Place and the Hudson River. See Chapter 14 for a detailed description of the proposed separate stormwater system). Sanitary sewage from buildings along these streets would be connected to the City sewers under Broadway or Twelfth Avenue. The new water and separate stormwater sewer lines would be designed and constructed to DEP standards (DEP would approve the design before installation). The sequencing of the installation of the new lines and removal of the old lines would also be approved by DEP. The water lines may be upgraded at DEP's direction to ensure that adequate service is provided to all users, including fire hydrants.

Three options (with no material difference with respect to environmental impacts) were considered for accommodating the utility lines. The preferred approach is to fill the whole approximately 8 to 10 feet under the streets and sidewalk with soil, with the utility lines buried in the soil. Maintenance of the utility lines would be done by opening the street or sidewalk in the traditional manner. The other two options are not preferred but may occur. In the second option, the bridge-type structure could be a truss under the street and sidewalks, with the utility lines attached to the truss. The utility lines would be accessed via openings in the sidewalks. The third option is a hybrid of the first two options. The approximately 8 to 10 feet below the sidewalks would be filled with soil, and the area under the streets would be a truss. In this option, the majority of the utility lines would be buried under the sidewalk, and stormwater drainage would be under the streets in between the structural members of the truss. At the time of final design, a selection would be made subject to DEP and NYCDOT approval.

A new utility connection may be made to a Columbia University building within the Academic Mixed-Use Area. This connection would be under West 129th Street to provide energy to Site 1. Revocable consent from NYCDOT would be required to place utility lines under New York City streets. This connection typically takes several weeks and does not cause long-term disruptions.

STREET RECONSTRUCTION

During construction of the below-grade facility (which, after completion, would extend from the north side of West 129th Street to the south side of West 133rd Street), West 130th, West 131st, and West 132nd Streets between Broadway and Twelfth Avenue would be systematically demolished and excavated, then reconstructed above the new below-grade space. These streets would appear and function as a typical New York street, but would be supported by bridge structures placed below-grade, designed to carry the loads imposed by the vehicular and truck traffic. The streets would be rebuilt to NYCDOT standards and specifications and would be able to accommodate the largest vehicles normally allowed on New York City streets. The space from the ground surface to approximately 8 to 10 feet below grade would be owned by New York City as mapped streets and would hold the utility lines, which include water, sewage, energy, and telecommunications. As described in Chapter 1, "Project Description," ESDC would override the City map with respect to the underground space below the mapped streets (i.e., below the initial 8 to 10 feet below grade) to the bottom of the foundation; ownership of this area would then be transferred to Columbia University. The below-grade street support would likely be comprised of trusses, like those found on many bridges, and would be constructed of steel and/or concrete.

ABOVE-GRADE BUILDING CONSTRUCTION

Typical construction stages for a building do not vary greatly and generally last approximately 24 to 36 months. Some of the smaller buildings may be completed in about 18 months. Building construction would generally involve two phases: core and shell construction, and fit-out and finishing. The below-grade structures would act as the foundations for the buildings. The building structure and the interior finishing stages would overlap one another, as the upper parts of the structure would be under construction while finishing of the lower floors would be completed.

CORE AND SHELL

In general, core and shell construction of a building would last approximately 10 to 16 months. Construction of the core and shell of the building would include construction of the building's framework (installation of beams and columns), floor decks, façade (exterior walls and cladding), and roof construction. These activities would require the use of the tower crane, compressors, personnel and material hoists, concrete pumps, on-site reinforcing bar bending jigs, welding equipment, and a variety of hand-held tools, in addition to the delivery trucks that would bring construction materials to the site. Each day, about 100 to 150 workers would be required for the construction of each building.

INTERIOR FIT-OUT AND FINISHING

This stage would include the construction of interior partitions, installation of lighting fixtures, and interior finishes (flooring, painting, etc.), and mechanical and electrical work, such as the installation of elevators. Mechanical and other interior work would overlap for 4 to 6 months with the tower building core and shell construction. This activity would employ the greatest number of construction workers: up to 250 to 300 per building during the active periods, and up to 500 workers could be on-site during periods of maximum activity. Equipment used during interior construction would include exterior hoists, pneumatic equipment, delivery trucks, and a variety of small hand-held tools. However, this stage of construction is the quietest and does not generate fugitive dust.

GENERAL CONSTRUCTION PRACTICES

Certain activities would apply throughout the project. Columbia University would have a field team on-site throughout the entire construction period. This team would serve as the contact point for the community and local leaders to voice any concerns about construction activities. Members of the team would be available to meet and work with the community to resolve any concerns or problems that arise during the construction process. A telephone hotline would be set up so that 24-hour-a-day contact could be made with field team. In addition, an Internet Web site would be set up to provide the details of construction progress and expected next steps in the construction process. As appropriate, presentations would be made to community groups and the Community Board to keep them informed about the progress of the construction. Once demolition activities begin in Subdistrict A, Columbia would employ security staff that would be on the specific construction site 24 hours a day, 365 days a year. This security provision will be specified in the agreements with the construction managers for the construction of all projects in Subdistrict A.

The following describes typical construction practices in New York City. In certain instances, specific practices may vary from those described below. However, the typical practices are expected to be used because they have been developed over many years and have been found to be necessary to successfully complete large projects in a confined urban area. All deliveries, material removals, and hoist uses have to be tightly scheduled to maintain an orderly work area and to keep the construction on schedule and within budget.

DELIVERIES AND ACCESS

Because of site constraints, the presence of large equipment, and the type of work, access to the construction sites would be tightly controlled. The work areas would be fenced off, and limited access points for workers and trucks would be provided. Typically, worker vehicles would not be allowed into the construction area. Security guards and flaggers would be posted, and all persons and trucks would have to pass through security points. Workers or trucks without a need to be on the site would not be allowed entry. After work hours, the gates would be closed and locked. Security guards would patrol the construction sites after work hours and over the weekends to prevent unauthorized access.

As is the case with almost all large urban construction sites, material deliveries to the site would be highly regimented and scheduled. Because of the high level of construction activity and constrained space, unscheduled or haphazard deliveries would not be allowed. For example, during excavation, each dump truck would be assigned a specific time that it must arrive on the site and a specific allotment of time to receive its load. If a truck is late for its turn, it would be accommodated if possible, but if not, the delivery would be assigned to a later time. A similar regimen would be instituted for concrete deliveries, but the schedule would be even stricter. If a truck is late, it would be accommodated if possible, but if on-time concrete trucks are in line, the late truck would not be allowed on site. Because contract documents specify a short period of time within which concrete must be poured (typically 90 minutes), the load would be rejected if this time limit is exceeded.

During the finishing of the building interiors, individual deliveries would be scheduled to the maximum extent possible. Studs for the partitions, drywall, electrical wiring, mechanical piping, ductwork, and other mechanical equipment are a few of the myriad materials that must be delivered and moved within each building. Each building under construction would have one or two hoists, and the available time for the hoist would be fully and tightly scheduled. A trade, such as the drywall subcontractor, would be assigned a specific time to have its materials delivered and hoisted into the building. If the delivery truck arrives outside its assigned time slot, it would be accommodated if possible without disrupting the schedule of other deliveries. However, if other scheduled deliveries would be disrupted, the out-of-turn truck would be turned away. This is a penalty for the subcontractor, because if its materials are not on-site, it cannot complete the task. Therefore, the contractor has a strong incentive to stay on schedule.

To aid in adhering to the delivery schedules, as is normal for buildings such as those included in the Academic Mixed-Use Area, flaggers would be employed at each of the gates. The flaggers could be supplied by the subcontractor on-site at that time or by the construction manager. The flaggers would control trucks entering and exiting the site, so that they would not interfere with one another. In addition, they would provide an additional traffic aid as the trucks enter and exit the on-street traffic streams.

HOURS OF WORK

Construction activities for the buildings would generally take place Monday through Friday, with exceptions that are discussed separately below. In accordance with City laws and regulations, construction work would generally begin at 7:00 AM on weekdays, with some workers arriving to prepare work areas between 6:00 AM and 7:00 AM. Normally, work would end at 3:30 PM, but it can be expected that to meet the construction schedule, the workday would be extended to complete some specific tasks beyond normal work hours. The work could include such tasks as completing the drilling of piles, finishing a concrete pour for a floor deck, or completing the bolting of a steel frame erected that day. The extended workday would generally last until about 6:00 PM and would not include all construction workers on-site, but just those involved in the specific task requiring additional work time. Limited extended workdays are expected to occur on weekdays over the course of construction.

At limited times over the course of constructing a building, weekend work would be required. Again, the numbers of workers and pieces of equipment in operation would be limited to those needed to complete the particular task at hand. For extended weekday and weekend work, the level of activity would be reduced from the normal workday. The typical weekend workday would be on Saturday from 7:00 AM with worker arrival and site preparation to 5:00 PM for site cleanup.

A few tasks may have to be completed without a break, and the work can extend more than a typical 8-hour day. For example, in certain situations, concrete must be poured continuously to form one structure without joints. If the concrete is poured and then stopped for a period of time before more concrete is poured, a weak joint is formed. This weak joint may not be structurally sound and would weaken the building. This type of concrete pour is usually associated with foundations.

An example of this is pouring concrete for the mat slabs and foundations, which would be poured in sections. Those sections would require a minimum of 100 concrete trucks per day, which would necessitate at least 12 hours to complete. These long concrete pours often begin late on a Saturday, when traffic is light, and continue into Sunday. The plans for each long concrete pour would be coordinated with NYCDOT. In addition, a noise mitigation plan would be developed and implemented to minimize intrusive noise emanating into nearby areas and affecting sensitive receptors. A copy of the noise mitigation plan would be kept on-site for compliance review by DEP and DOB.

It would take about five months to complete each mat foundation. Forms to hold the fluid concrete in place would be erected. Reinforcing bars would be positioned within the form works, and then the concrete poured. After the concrete hardened, the forms would be removed and reused.

SIDEWALK AND LANE CLOSURES

During the course of construction, traffic lanes and sidewalks would have to be closed or protected for varying periods of time. Bus stops may have to be temporarily relocated and crosswalks redirected. Other street lanes and sidewalks would be continuously closed for several months to over a year, and some lanes and sidewalks would be closed only intermittently to allow for certain construction activities. This work would be coordinated with and approved by the appropriate governmental agencies.

As discussed above, streets between Broadway and Twelfth Avenue would have to be closed to vehicular traffic and pedestrians when the slurry walls and below-grade facilities are being constructed. West 130th Street is expected to be closed from 2008 to 2011, West 131st Street from 2020 to 2022, and West 132nd Street from 2023 to 2025 to all traffic and pedestrians, and from 2026 to 2029 to traffic and pedestrians with the exception of construction-related trucks. These closures would cause diversion of vehicular traffic, the potential impacts of which are discussed later in the impacts section of this chapter.

When construction is under way on a block, when necessary for pedestrian safety, pedestrians would be guided around the construction area in safe, protected routes. Generally, construction vehicle access is expected to be on the streets that are closed to vehicular traffic and pedestrians. However, because of the configuration of the below-grade space on the blocks between West 132nd and West 133rd Streets, construction vehicles may have to access the excavation from either Broadway or Twelfth Avenue. After the excavation is completed and the buildings are being constructed, construction vehicle access is expected to be from the side streets.

During construction of the underground space, as much as possible, storage of construction materials would be on the building sites with as little as possible on curb lanes. In some cases, to further minimize laydown and storage on the street, portions of the building block to the north of a construction area would be used for laydown of materials and placement of construction trailers to the maximum extent possible. For example, during the Phase 1 construction of the underground space between West 129th and West 131st Streets, portions of the block between West 131st and West 132nd Streets would be used for truck marshalling, laydown, and stockpiling. This would minimize the use of the curb lanes on the south side of West 131st Street (immediately north of the construction area) for laydown and storage.

During the construction of above-grade buildings, curb lanes on the side streets would be closed to allow for deliveries and laydown of materials that are to be used at some point in time during the construction. NYCDOT review and approval would be obtained before any lanes or sidewalks are temporarily closed for construction purposes.

As mentioned earlier, during major sewer relocation/construction activities in 2008, up to two lanes in the streets (Broadway southbound between West 130th and West 129th Streets, West 129th Street between Broadway and West 125th Street, West 125th Street between West 129th Street and Twelfth Avenue, Twelfth Avenue between West 125th Street and St. Clair Place) are expected to be closed. Depending on the locations of the existing sewer line, it is possible that some parking and travel lane closures would occur. During construction on West 129th Street (for less than a year), the entire street would be closed because the sewer runs down the middle of the street.

After 2008, as construction proceeds through Subdistrict A, sidewalks and vehicular lanes on streets along the perimeter (e.g., West 125th Street, Broadway, Twelfth Avenue, and West 133rd Street) would remain open, with some temporary sidewalk and curb-lane disruptions.

Intermittent lane closures would also be expected during the installation of the separate stormwater system along Twelfth Avenue from West 133rd Street to West 125th Street, west along West 125th Street to Marginal Street, and south on Marginal Street to St. Clair Place.

STORMWATER POLLUTION PREVENTION PLAN

A construction stormwater pollution prevention plan (SWPPP) would be developed for the overall project construction activity in accordance with the requirements of DEC’s State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (Permit No. GP-02-01). The SWPPP would include fully designed and engineered stormwater management practices with all necessary maps, plans, and construction drawings, providing the site-specific erosion and sediment control plan and best management practices. The SWPPP would include designation of responsible parties and personnel who would have a role in management of construction stormwater runoff. The SWPPP would outline a routine site inspection and reporting program for identification and prompt repair of any deficiencies for the erosion and sediment control structures or practices.

Stormwater management during construction activities would be performed through implementation of a site-specific erosion and sedimentation control plan. In accordance with DEC guidance, the SWPPP would include both structural and non-structural components. The structural components are expected to consist of hay-bale barriers/silt fencing, inlet protection, and installation of a stabilized construction entrance or other appropriate means to limit potential off-site transport of sediment. The non-structural “best management practices” would include routine inspection, dust control, cleaning, and maintenance programs; instruction on the proper management, storage, and handling of potentially hazardous materials; and identification of parties responsible for implementation and ongoing maintenance programs. All temporary control measures would be maintained until disturbed areas of the site are stabilized.

RELOCATION OF ELECTRIC COOLING FACILITY AND TRANSMISSION LINES

A Con Edison transmission line cooling station is located between West 131st and West 132nd Streets and Broadway and Twelfth Avenue. It cools two major transmission lines that bring electricity from the Sprainbrook Substation in Westchester County to the West 49th Street Substation in Manhattan (see Chapter 16, “Energy,” for a more detailed description of the facility). Construction of the new Columbia buildings in Subdistrict A on this block would be contingent upon Columbia entering into an agreement with Con Edison for relocating the cooling station; this agreement has not been reached. Such an agreement would require the approval of the New York State Public Service Commission (PSC) pursuant to Public Service Law (PSL) Section 70, and such approval by PSC would be subject to review under SEQRA. It is possible that the cooling equipment and transmission lines could be upgraded to be more efficient during this relocation. The cost of relocating the cooling station would be paid by Columbia University and not by Con Edison or its ratepayers. To ensure that the 345-kilowatt electric transmission lines remain operational, cooling would be maintained either by a temporary cooling station or full operation of the new cooling station, prior to disconnecting the lines from the existing cooling station.

Columbia University and Con Edison are considering relocation sites within the Academic Mixed-Use Area (Subdistrict A), and have preliminarily identified a portion of the former Warren Nash Service Station building as a potential location. The equipment can operate either on an open site or within an enclosed space. In the event that a relocation site outside Subdistrict A is later selected, the environmental impact of the relocation will be assessed in the PSC SEQRA review. The relocation is expected to occur prior to the start of construction activities on the block where the cooling station is currently located (i.e., prior to the below-grade facility construction between West 131st Street and West 132nd Street, in 2020).

Relocation of the cooling lines would be similar to the installation of new small sewer and water lines. A trench would be dug, gravel placed in the bottom of the trench, electric cooling lines placed in the trench, and the trench backfilled and closed. Unlike the large sewers discussed above, short pilings and cradles are not needed to support the cooling lines. Shallow utility work in the street adjacent to the relocated cooling station would temporarily block a parking or traffic lane.

D. FUTURE WITHOUT THE PROPOSED ACTIONS

If the Proposed Actions are not approved, no major changes in the Project Area are expected.

E. FUTURE WITH THE PROPOSED ACTIONS

Similar to many large development projects in New York City, construction can be disruptive to the surrounding area for limited periods of time throughout the construction period. The following analyses describe potential construction impacts on land use and neighborhood character, historic resources, socioeconomics, hazardous materials, infrastructure, traffic and transportation, air quality, noise and vibration, and rodent control.

LAND USE AND NEIGHBORHOOD CHARACTER

As described above, construction in the Project Area would consist of a variety of activities. In Subdistrict A, the entire area would be rebuilt with large structures, most of which would stand atop a large central underground service area that would be built beneath both buildings and streets. In Subdistrict B and the Other Area east of Broadway, smaller new buildings would be constructed and others might be enlarged. Activities in these latter areas would resemble typical Manhattan construction, with new buildings taking anywhere from 18 months to three years to construct, depending on their size. Enlargement of buildings would typically take less time. There would be some inconvenience to neighboring land uses, as with any construction, but there would be no significant adverse impacts on land use or neighborhood character from construction in Subdistrict B or the Other Area east of Broadway.

The Proposed Actions would result in construction in Subdistrict A over a 22-year period, with successive phases of construction generally moving from the south to the north. Development of the below-grade space would require that West 130th and West 131st Streets be closed for a period of two to three years (but not at the same time, except in situations where overlapping closures may occur for no more than a day or so), and that West 132nd Street be closed for a period of approximately five years; a major sewer relocation would require that West 129th Street also be closed for less than one year. The inconvenience and disruption arising from these closures would include diversions of pedestrians, vehicles, and construction truck traffic to other streets. With slurry wall construction required for most of the below-grade space and then the buildings above, each construction area in Subdistrict A (see Figure 21-2) would be under construction for several years (up to eight years within the Phase 1 construction area, and up to six years on each of the two Phase 2 construction areas), and the inconveniences of construction traffic, noise, and dust would continue in the general vicinity of that construction area for that period of time. No one location would be in construction for the full 22 years; however, some portion of the Project Area and the surrounding primary study area would be subject to the inconveniences and disruptions of construction throughout this period. Throughout the construction period, access to surrounding residences, businesses, institutions, and waterfront uses in the Project Area and primary study area would be maintained (see discussion below in "Traffic and Transportation"). In addition, throughout the construction period, measures would be implemented to control noise, vibration, and dust on construction sites, including the erection of construction fencing and, in some areas, fencing incorporating sound-reducing measures. Because none of these impacts would be continuous in any one location or ultimately permanent, they would not create significant impacts on land use patterns or neighborhood character in the area.

In addition to the activity associated with construction, some properties not yet in construction would be used for construction staging and for interim use, such as parking. These uses are considered "industrial" and would not conflict with the primarily light industrial, warehouse and storage, transportation and utilities, and auto-related uses that would remain in Subdistrict A on an interim basis or with uses in Subdistrict B.

Construction activities would not significantly affect neighborhood character in the primary or secondary study areas, although there would be some inconvenience to neighboring land uses, as with any construction. There would be no significant adverse impacts on land use or neighborhood character from construction in Subdistrict B or the Other Area east of Broadway.

HISTORIC RESOURCES

ARCHITECTURAL RESOURCES

During construction, an architectural resource could be damaged from vibration (e.g., from blasting or pile driving), and additional damage from adjacent construction could occur from falling objects, subsidence, collapse, or construction machinery. Adjacent construction is defined as any construction activity that would occur within 90 feet of an architectural resource, as defined in DOB's *Technical Policy and Procedure Notice* (TPPN) #10/88.[1]

A construction protection plan (CPP) outlining how Columbia would avoid adverse construction-related impacts on architectural resources in the vicinity of a construction site in the Academic Mixed-Use Area has been provided to the New York State Office of Parks, Recreation and Historic Preservation (OPRHP) and the New York City Landmarks Preservation Commission (LPC). In a letter dated November 14, 2007, OPRHP concurred with the protection measures contained in the CPP. In comments dated November 8, 2007, LPC accepted the CPP. The CPP would be implemented prior to any demolition or construction activities in the Academic Mixed-Use Area. As described in Chapter 8, DOB's *TPPN #10/88* would provide protection measures for historic resources within 90 feet of the projected development site in Subdistrict B and the Other Area east of Broadway while these projected development sites are under construction. Therefore, the potential for construction period damage to these resources would be eliminated, and no adverse impacts are anticipated. Architectural resources located more than 90 feet from the Project Area are outside the area of potential physical impacts.

ARCHAEOLOGICAL RESOURCES

As discussed in Chapter 8, the Project Area was determined by OPRHP and LPC not to be sensitive for archaeological resources. Therefore, construction in the Project Area would not cause significant adverse impacts on archaeological resources.

SOCIOECONOMIC CONDITIONS

Construction activities associated with the Proposed Actions would, in some instances, temporarily affect pedestrian and vehicular access within, and in the vicinity of, the Project

[1] TPPN #10/88 was issued by DOB on June 6, 1988, to supplement Building Code regulations with regard to historic structures. TPPN #10/88 outlines procedures for the avoidance of damage to historic structures resulting from adjacent construction, defined as construction within a lateral distance of 90 feet from the historic resource.

Area. However, lane and/or sidewalk closures are not expected to obstruct entrances to any existing businesses, or obstruct major thoroughfares used by customers, and businesses are not expected to be significantly affected by any temporary reductions in the amount of pedestrian foot traffic or vehicular delays that could occur as a result of construction activities. Utility service would be maintained to all businesses, although very short term interruptions (i.e., hours) may occur when new equipment (e.g., a transformer, or a sewer or water line) is put into operation. Overall, construction of the Proposed Project is not expected to result in any significant adverse impacts on surrounding businesses.

As detailed above in "Construction Schedule and Sequencing," construction in Subdistrict A would generally occur on a block-by-block basis, starting with the three blocks between West 125th and West 131st Streets and Broadway and Twelfth Avenue. During the installation of the new sewer mains, West 129th Street would be closed for less than a year, but would remain open during all other construction activities. In addition, during major sewer relocation/construction activities in 2008, it is possible that some parking and travel lane closures would occur on Broadway southbound between West 130th and West 129th Streets, West 125th Street between West 129th Street and Twelfth Avenue, and Twelfth Avenue between West 125th Street and St. Clair Place. Because such closures would occur along streetfronts that no longer contain operating businesses, the closures would not adversely affect pedestrian or vehicular access to any businesses.

After 2008, as construction proceeds northward through Subdistrict A, sidewalks and vehicular lanes on streets along the perimeter (e.g., West 125th Street, Broadway, Twelfth Avenue, and West 133rd Street) would remain open, with some temporary sidewalk and curb lane disruptions. These temporary disruptions would not significantly affect surrounding businesses (i.e., businesses located on the opposite side of the street); vehicular and pedestrian access to businesses surrounding Subdistrict A would not be impeded, nor would signage be restricted.

During the below-grade construction period for any specific construction area in Subdistrict A (see Figure 21-2), one street would be closed (between Broadway and Twelfth Avenue) to vehicular traffic and pedestrians. (i.e., during Phase 1 construction activities, West 130th Street would be closed, during the first stage of Phase 2 activities West 131st Street would be closed, and during the last stage of Phase 2 construction activities West 132nd Street would be closed). Since there would be no active commercial uses along a closed street during below-grade construction, street closings would not directly affect access to any businesses. Project Area businesses still in operation on adjacent blocks, and businesses immediately surrounding the Project Area, would experience construction noise and some vehicular delays that are typical of construction projects throughout New York City. However, access to the businesses for customers, employees, and deliveries would not be significantly affected. In addition, the streets between Broadway and Twelfth Avenue are not currently used as primary access routes to or from businesses surrounding the Project Area, and therefore, closure of the streets during construction would not adversely affect pedestrian or vehicular access to those commercial uses. As with above-grade construction activities, sidewalks and vehicular lanes on streets along the perimeter would remain open, with some temporary sidewalk and curb lane disruptions. These temporary disruptions would not significantly affect surrounding businesses (i.e., businesses located on the opposite side of the street); vehicular and pedestrian access to businesses surrounding Subdistrict A would not be impeded, nor would signage be restricted.

Within Subdistrict B and the Other Area, construction activity on projected development sites could result in some interruptions to activities in the surrounding area and would include various land and/or sidewalk disruptions. However, the construction would not obstruct entrances to any existing businesses, nor would it disrupt major throughways used by customers. Access to all adjacent businesses would be maintained via temporary walkways and driveways according to regulations established by DOB.

The businesses surrounding the Project Area consist primarily of neighborhood-oriented retail and services that cater to local residents, and—unlike destination retail—do not rely heavily on a large influx of customers from elsewhere. These businesses would not be likely to experience a decline in business due to construction. Businesses such as eating and drinking establishments may experience a small decline in foot traffic from area residents and permanent workers, but this decline would be offset by the presence of several hundred construction workers, who would likely patronize local businesses. In addition, pedestrian traffic generated by the subway station at West 125th and the numerous bus stops would not be significantly affected by the construction activity.

Construction would create direct benefits resulting from expenditures on labor, materials, and services, and indirect benefits created by expenditures by material suppliers, construction workers, and other employees involved in the direct activity. Construction also would contribute to increased tax revenues for the City and State, including those from personal income taxes. For more information on the direct and indirect economic and fiscal benefits of construction, see Section E in Chapter 4, "Socioeconomic Conditions."

HAZARDOUS MATERIALS

As more fully described in Chapter 12, "Hazardous Materials," potential contaminants identified in the Academic Mixed-Use Area on lots owned or controlled by Columbia University when construction activities begin would be remediated (cleaned up) as part of the development of this area by Columbia University. Contaminated soil, historic fill, and demolition debris would be either disposed of off-site in accordance with all applicable regulations or capped (i.e., covered by a building, paving, or other impervious material). Potential impacts during construction and development activities would be avoided by implementing a CHASP. The CHASP would ensure that there would be no significant adverse impacts on public health, workers' safety, or the environment as a result of potential hazardous materials exposed by or encountered during construction. Following construction, any remaining contamination would be isolated from the environment, and it is expected that there would be no further potential for exposure. In addition, to address the remediation of known or potential environmental conditions that may be encountered during proposed construction and development activities, a Remedial Action Plan (RAP) has been prepared. (Both the RAP and CHASP have been approved by the New York City Department of Environmental Protection [DEP] and would be approved by the New York State Department of Environmental Conservation [DEC], if necessary, in response to a reported petroleum spill.) To ensure the implementation of these measures, Restrictive Declarations will be placed against Columbia-owned properties, as required by DEP.

An E-designation would be placed on lots comprising development sites in the Academic Mixed-Use Area not owned by Columbia University at the time the proposed zoning is approved and for the remainder of the Project Area, pursuant to Section 11-15 of the New York City Zoning Resolution. An E-designation is a mechanism to ensure that properties that are subject to an area-wide rezoning, but cannot be investigated as part of the CEQR process in connection with a rezoning because they are not owned or controlled by the applicant, are properly investigated and remediated, if necessary, before redevelopment. The owner and developer of a lot with an E-designation must prepare a Phase I Environmental Site Assessment (Phase I ESA) and, if necessary, implement a testing and sampling protocol and HASP to the satisfaction of DEP before DOB issues a building permit. Based on the results of the sampling protocol, if remediation is necessary, an RAP and CHASP must be submitted and approved by DEP.

With these measures in place (i.e., where necessary, DEP-approved RAPs and CHASPs for all lots to be developed in the Project Area), no significant adverse impacts related to hazardous materials are expected to occur as a result of the Proposed Actions.

INFRASTRUCTURE

As described above under "Construction of Infrastructure Improvements," the Proposed Actions would involve a major sewer relocation/construction activity, and removal and replacement of other utilities during construction in Subdistrict A.

The major infrastructure rehabilitation would involve redirecting the upstream flow that currently flows into the combined sewer under West 130th Street into an upgraded sewer which would be placed along Broadway between West 130th Street and West 129th Street, along West 129th Street between Broadway and West 125th Street, along West 125th Street between West 129th Street and Twelfth Avenue, then across Twelfth Avenue and south to the regulator at St. Clair Place and Twelfth Avenue. To accommodate these upgraded sewers, the existing lines requiring the upgrade under these streets (which currently convey sewage from an area south of 129th Street) would be removed, or where removal is not required, would be disconnected and abandoned in place. This activity is expected to occur in 2008 and last for approximately one year. The sewer lines would be designed and constructed to DEP standards, and DEP would approve the design before the sewer lines are installed.

In addition, during the time a street is closed for construction activities, the street would be excavated, and the existing utility lines (including the existing combined sewers under the street) would be disconnected and removed to allow for the construction of the below-grade facility. These activities would occur along West 130th Street, West 131st Street, and West 132nd Street between Broadway and Twelfth Avenue at different times as activities proceed northward

After construction of the below-grade space on any one street, the utility lines would be replaced before reconstruction of the street. New water lines would be connected, and the new separate stormwater sewers would be placed under West 130th, West 131st, and West 132nd Streets (stormwater from these streets would flow into a new stormwater line under Twelfth Avenue, and sanitary sewage from buildings along these streets would be connected to the City sewers under Broadway or Twelfth Avenue).

The new water connections would be made before the old water pipes are removed. Removal of the utility lines would be coordinated with DEP and the private utility companies to ensure that service to customers in nearby areas is not disrupted. DEP and the private utilities would have to review and approve the temporary measures before they could be implemented. The review process would include evaluation to ensure that service to users would not be disrupted or impaired while the temporary measures are in place. All utility lines would be located either in the streetbed or within the below-grade space. Residents and workers in nearby buildings are not expected to experience any major disruptions to water supply or wastewater removal. Any disruption to service that may occur when new equipment (e.g., a transformer, or a sewer or water line) is put into operation is expected to be very short term (i.e., hours). Therefore, the construction of the infrastructure improvements would not cause any significant adverse impacts on the users of these services.

TRAFFIC AND TRANSPORTATION

The construction of various components of the Proposed Actions is expected to result in surface disruptions and construction worker and truck traffic for a 22-year period, from 2008 to 2030. Because of the lengthy duration of these activities, a detailed traffic analysis was conducted to assess the potential construction-related traffic impacts. As discussed below, since the projected construction-generated traffic would be less than the project operational traffic and, for the most part, would occur outside of the area's peak travel hours, the overall construction traffic impacts and required mitigation measures are expected to be within the envelope established for the Proposed Actions' operational traffic analysis, as described in Chapter 17, "Traffic and Parking," and Chapter 23, "Mitigation." The analysis presented in this chapter focuses on localized effects of construction activities and determines the level of long-term project improvement or mitigation measures that may be required during construction. In addition, it addresses specific roadway conditions surrounding the development area resulting from the sewer improvement work, which includes major sewer relocation and the construction of a separate stormwater system, during the first year of construction and the closure of West 130th, West 131st, and West 132nd Streets between Broadway and Twelfth Avenue over different years of construction.

CONSTRUCTION TRAFFIC PROJECTIONS

Average daily construction worker and truck activities by month, quarter, and rolling annual average were projected for the full 22 years of construction. These projections were further refined to account for worker modal splits and vehicle occupancy, arrival and departure distribution, and the passenger car equivalent (PCE) factor for truck traffic.

Daily Workforce and Truck Deliveries

For a conservative reasonable worst-case analysis of potential construction traffic impacts, the peak one-month levels of construction were used as the basis for estimating peak hour construction traffic volumes. Based on the current schedule of commencing construction in the beginning of 2008, it was determined that peak activities for constructing Phase 1, which is anticipated for completion in 2015, would occur in October 2011 (peak Phase 1 construction). The daily averages of construction workers and truck traffic during peak Phase 1 construction were estimated at 954 daily workers and 374 daily trucks. For the remaining build-out, which is anticipated for completion in 2030, peak construction activities were projected to occur in June 2027 (peak Phase 2 construction). The corresponding peak Phase 2 construction estimates are 1,223 daily workers and 268 daily trucks. Concurrent with the peak Phase 1 and Phase 2 construction are the closure of West 130th and West 132nd Streets, respectively, between Broadway and Twelfth Avenue. In the first year of construction when the sewer improvement work would be necessary, peak construction worker and truck activities were projected to occur in October 2008, yielding 493 daily workers and 180 daily trucks. Between the peak Phase 1 and Phase 2 construction periods, when West 131st Street between Broadway and Twelfth Avenue would be closed, peak construction worker and truck activities, yielding 721 projected daily workers and 361 daily trucks, would occur in February 2022. These estimates of daily construction activities are further discussed below.

Construction Worker Modal Splits

According to the U.S. Census reverse journey-to-work (RJTW) data, commuting to work via auto in New York City is more prevalent among workers in the fields of construction and excavation than for workers in other occupations. The census data showed that approximately 59 percent of construction workers would commute to the Project Area via auto, with an average auto-occupancy of 1.20. Recent experience and surveys conducted at actual construction sites showed that the census information on worker modal split is generally comparable to what actually takes place. However, carpooling has become substantially more prevalent, particularly at large construction sites. The likely reasons for this trend include: 1) more opportunities are available within a large workforce for workers to commute together; 2) parking spaces have become more difficult to find; and 3) the cost of driving has escalated in recent years as a result of increases in tolls and the price of gasoline and parking.

Although it is likely that the travel behaviors of future construction workers at the Project Area would resemble those described above, the detailed construction traffic analysis conservatively applied the census statistics of 59 percent traveling via auto at an average auto-occupancy of 1.20.

Peak Hour Construction Worker Vehicle and Truck Trips

The construction schedule assumed that all site activities would take place during the typical construction shift of 7:00 AM to 3:30 PM. While construction truck trips would be made throughout the day (with more trips made during the early morning), and trucks would remain in the area for shorter durations, construction worker travel would typically take place during the hours before and after the work shift. For analysis purposes, each worker vehicle was assumed to arrive in the morning and depart in the afternoon, while each truck delivery was assumed to result in two truck trips during the same hour. Furthermore, in accordance with the *CEQR Technical Manual*, the traffic analysis assumed that each truck has a PCE of 2. Hence, a truck delivery to the Project Area would result in an equivalent of four vehicle trips (two entering and two exiting) during the same hour of analysis.

The estimated daily vehicle trips were distributed to various hours of the day based on projected work shift allocations and conventional arrival/departure patterns of construction workers and trucks. For construction workers, the majority (80 percent) of the arrival and departure trips would take place during the hour before and after each shift. For construction trucks, deliveries would occur throughout the time period while the construction site is active. However, to avoid traffic congestion, construction truck deliveries would often peak also during the hour before the regular day shift (25 percent of shift total), overlapping with construction worker arrival traffic. Based on these assumptions, the peak hour construction traffic was estimated for the entire construction period. Since each truck delivery would account for four passenger car trip-ends during the same hour, the cumulative totals represent the total PCEs projected during different periods of construction. Summaries of the construction traffic by month, quarter, and rolling annual average, and its temporal distribution, are provided in Appendix K.2.

As shown in these summaries, in the first year of Phase 1 construction (2008), 194 construction worker vehicles would arrive the hour before (6–7 AM) and depart the hour after (3–4 PM[1]) the typical construction day shift. With 25 percent of the truck deliveries anticipated to also occur

[1] Although the typical day shift would end at 3:30 PM, the analysis assumes that peak worker departure would take place between 3:00 PM and 4:00 PM.

during the early morning, before the regular day shift, the 6–7 AM hour would have the highest increment of construction traffic. Approximately 45 truck deliveries (or 180 PCEs) were projected for this peak hour during the first year of Phase 1 construction. Overall, the early morning peak hour construction vehicle trip increment would be 374 PCEs. In the afternoon peak hour, there would not be any truck deliveries; therefore, construction-related traffic would solely be resulting from the 194 departing construction worker vehicles. During peak Phase 1 construction in 2011, the morning and afternoon peak hour construction worker traffic would total 375 vehicles during each hour. With an estimated 93 truck deliveries anticipated for the 6–7 AM hour, the early morning peak hour construction vehicle trip increment would be 747 PCEs. For the first Phase 2 construction analysis year of 2022, the morning and afternoon peak hour construction worker traffic would total 284 vehicles during each hour. With an estimated 90 truck deliveries anticipated for the 6–7 AM hour, the early morning peak hour construction vehicle trip increment would be 644 PCEs. During peak Phase 2 construction in 2027, the morning and afternoon peak hour construction worker traffic would total 481 vehicles during each hour. With an estimated 67 truck deliveries anticipated for the 6–7 AM hour, the early morning peak hour construction vehicle trip increment would be 749 PCEs.

Analysis Time Periods

In determining the appropriate time periods for analysis, consideration was given to the projected construction trip generation and background traffic levels. Based on the information described above, it was concluded that quantitative traffic analyses would be appropriate for the weekday morning worker arrival and the afternoon worker departure time periods. A comparison of the projected construction and operational traffic during various critical hours and years of analysis is presented in Table 21-1.

Table 21-1
Construction and Operational Traffic Comparison

Scenario	Hour			
	6–7 AM [a]	8–9 AM [b]	3–4 PM [c]	4–5 PM [d]
2008 Phase 1 Construction	374	72	194	24
2011 Phase 1 Construction	747	148	375	47
2015 Phase 1 Operational	0	59	92	289
2022 Phase 2 Construction	644	144	284	35
2022 Partial Phase 2 Operational	1	541	156	516
Total 2022 Phase 2 [e]	645	685	440	551
2027 Phase 2 Construction	749	108	481	60
2027 Partial Phase 2 Operational	1	714	204	678
Total 2027 Phase 2 [e]	750	822	685	738
2030 Phase 2 Operational	1	1,064	296	1,016

Notes:
Construction-generated traffic was converted to PCEs.
The 2022 and 2027 "Partial" Phase 2 Operational conditions reflect the completion and occupancy of several proposed Columbia University buildings.
[a] Weekday construction arrival peak hour.
[b] Weekday operational AM peak hour.
[c] Weekday construction departure peak hour.
[d] Weekday operational PM peak hour.
[e] Total of 2022 or 2027 Phase 2 Const. & Partial Phase 2 Operational during those years.

This comparison shows that, in all cases, traffic levels generated during construction would be of lower magnitudes than what the overall project would generate when completed in 2030. Therefore, the maximum potential traffic impacts attributable to the Proposed Actions have been fully addressed in the operational analysis presented in Chapter 17, and it is appropriate for the construction impact assessment to focus on those locations expected to be more affected by construction-related activities.

CONSTRUCTION SEQUENCING

Aside from the construction trips described above, area roadway conditions would change as a result of the sequencing of various construction elements. Detailed maintenance and protection of traffic (MPT) plans would be developed for approvals by NYCDOT Office of Construction Mitigation and Coordination (OCMC).

Generally, the construction of the Proposed Actions would progress from south to north, with most activities contained within the construction sites and their adjacent sidewalks and curb lanes. During the first year of construction, the sewer improvement work would result in intermittent lane and roadway closures on Broadway southbound between West 130th and West 129th Streets, West 129th Street between Broadway and West 125th Street, West 125th Street between West 129th Street/St. Clair Place and Marginal Street, and Twelfth Avenue between West 132nd Street and St. Clair Place. A discussion of the potential short-term traffic impacts associated with this construction is provided below. As the sewer improvement work is being completed with final connections made on the west side of the Broadway and West 130th Street intersection, the roadway segment west of this point would be closed for continuing below-grade construction. The closure of West 130th Street between Broadway and Twelfth Avenue would last approximately 3 years and overlap with peak Phase 1 construction projected in October 2011. During Phase 2 construction, when Phase 1 components of the Proposed Actions would be operational, both above- and below-grade construction would occur between West 130th and West 133rd Streets west of Broadway, and between West 131st and West 134th Streets east of Broadway. Throughout this phase of construction, lane and roadway closures west of Broadway would also be necessary to accommodate the construction of the below-grade facilities. It is anticipated that the West 131st Street closure between Broadway and Twelfth Avenue would occur between 2020 and 2023. During this time, peak construction traffic levels would occur in February 2022. In the 2027 peak Phase 2 construction analysis year, West 132nd Street between Broadway and Twelfth Avenue would be closed off to general traffic and gated on both ends for limited access for construction-related vehicles. This closure is expected to occur from 2023 to 2025 and again from 2026 to 2029. Detailed analyses of 2011, 2022, and 2027 conditions, accounting for projected construction traffic and the anticipated roadway closures, were conducted to identify potential traffic impacts during construction. The analysis results are presented below and, where appropriate, measures to mitigate projected impacts are identified.

SEWER IMPROVEMENTS DURING PHASE 1 CONSTRUCTION

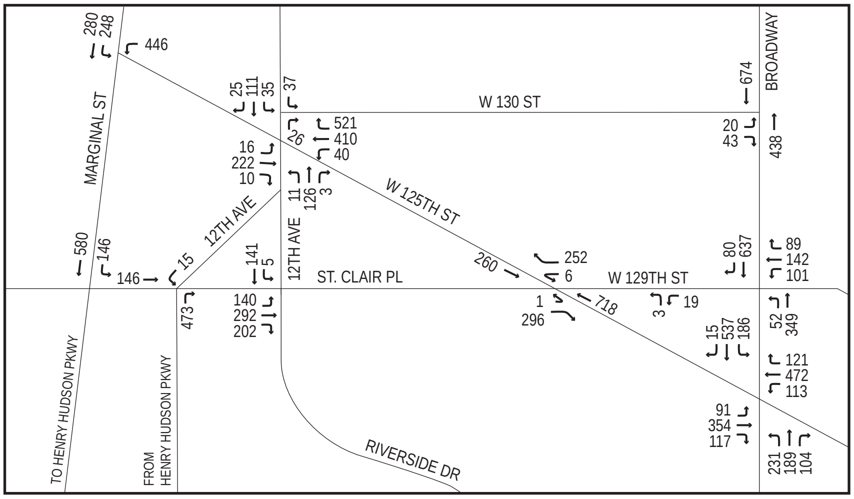
Because construction-related trips projected for the first year of construction are substantially lower than those during the peak Phase 1 construction analysis year of 2011, the 2008 traffic analysis focuses on conditions during the operational peak hours when lane and roadway closures along the sewer improvement route are likely to have the greatest effects. The MPT during the sewer improvement work would be coordinated with NYCDOT to ensure that roadway disruptions would be minimized to the extent practicable. However, some reductions in roadway capacities and temporary roadway closures are anticipated for various locations over an approximate one-year period. Based on the work schedule and required work zones described above, West 129th Street between Broadway and West 125th Street would be closed entirely for approximately six months. During this time, traffic would be diverted to the Broadway intersection with West 125th Street. At other times, all traffic movements would be maintained but there would be capacity constraints at numerous intersections along the sewer improvement route. Conceptual sequencing and MPT of the sewer improvement work are shown in Appendix K.2.

To evaluate the potential temporary impacts associated with the sewer improvement work, 2008 baseline traffic networks encompassing the affected intersections for the AM (8-9), midday (1-2), and PM (4-5) peak hours were developed, as shown in Figure 21-7. Construction-generated traffic volumes at these intersections are depicted in Figure 21-8. Although conditions at each intersection would be affected differently over the course of the sewer improvement work, the traffic volumes within these peak hour networks would remain constant, as shown in Figure 21-9, except when West 129th Street between Broadway and West 125th Street needs to be closed for work on that portion of the sewer improvement route. Figure 21-10 depicts the peak hour volumes under this scenario when projected vehicle trips on West 129th Street would be diverted to the Broadway and West 125th Street intersection. Table 21-2 compares the 2008 No Build and construction traffic conditions during various stages of construction with West 129th Street between Broadway and West 125th Street remained open to traffic, while Table 21-3 summarizes the analysis results for those intersections affected by the closure of this roadway segment.

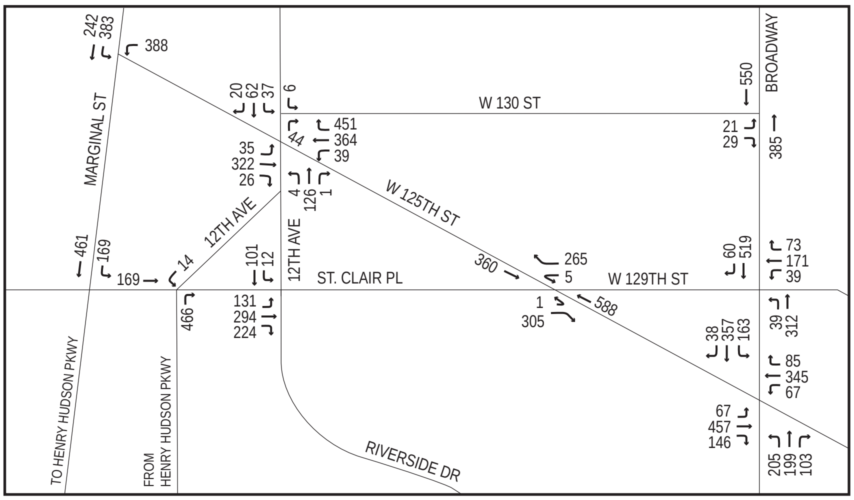
The analysis results show that temporary, short term traffic impacts would result at the following locations:

- Marginal Street and West 125th Street—With the stormwater system extended along West 125th Street towards the waterfront, a reduction in the width of West 125th Street at this location, together with some construction traffic, is expected to deteriorate the operation of the westbound left-turn movement from LOS C to LOS D during the PM peak hour, with average delay increasing from 25.2 to 45.8 seconds (v/c ratio increasing from 0.46 to 0.88).
- West 125th Street and West 129th Street/St. Clair Place—With the sewer relocation work taking place at this intersection and some construction traffic still present in the PM peak hour, the westbound West 129th Street right-turn movement would deteriorate within LOS F, with average delay increasing from 144.1 to 150.1 seconds (v/c ratio increasing from 1.20 to 1.21).
- Broadway and West 125th Street—With West 129th Street closed during the sewer relocation work along this roadway segment, construction traffic together with diversion of westbound through, northbound left, and southbound right-turn traffic at the Broadway and West 129th Street intersection to this intersection would result in temporary traffic impacts. In particular, the southbound left-through-right movements would deteriorate from LOS D to LOS F during all three analysis time periods, with average delay increasing from 53.0 to 209.2 seconds (v/c ratio increasing from 0.93 to 1.37) during the AM peak hour, from 53.0 to 209.2 seconds (v/c ratio increasing from 0.93 to 1.37) during the midday peak hour, and from 53.0 to 209.2 seconds (v/c ratio increasing from 0.93 to 1.37) during the PM peak hour. In addition, the eastbound left-turn movement would deteriorate within LOS D, with average delay increasing from 47.9 to 54.2 seconds (v/c ratio increasing from 0.68 to 0.74) during the AM peak hour. At this intersection, it is likely that during construction, the MPT plan would stipulate the use of the parking lane for traffic to increase capacity for the detour route. Furthermore, because the West 129th Street through traffic from east of Broadway could also select other parallel streets to travel west, the amount of detoured traffic to the southbound movement at Broadway and West 125th Street is likely to be less, thereby resulting in better operating levels than those depicted.

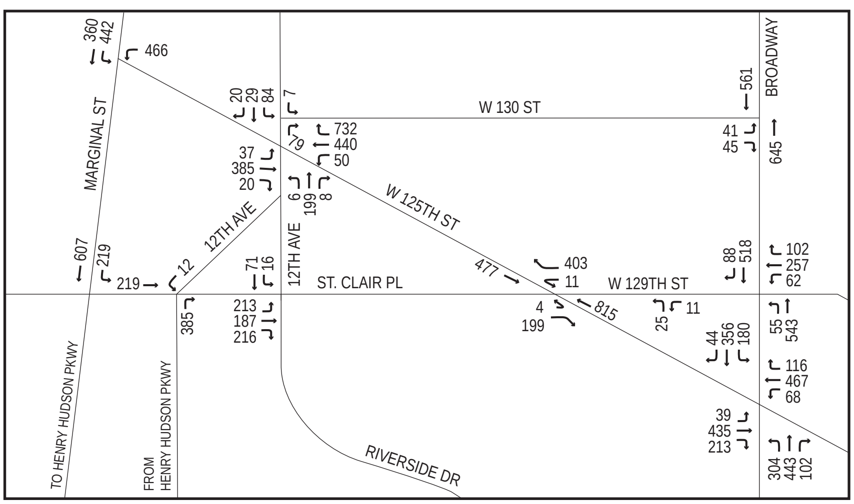
Because the impacts associated with the sewer improvement work discussed above would be of short durations, no specific traffic mitigation measures are recommended. Rather, it is expected that the appropriate MPT strategies, as stipulated by NYCDOT, would be employed to maintain adequate traffic flow during the one-year period during which sewer improvement work would be undertaken.



AM PEAK HOUR



MIDDAY PEAK HOUR

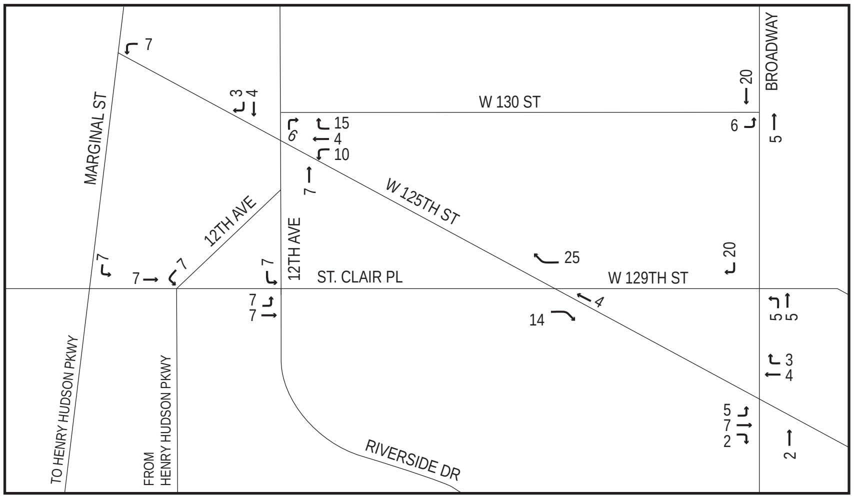


PM PEAK HOUR

NOT TO SCALE

Figure 21-7
2008 No Build Traffic Volumes

11.8.07



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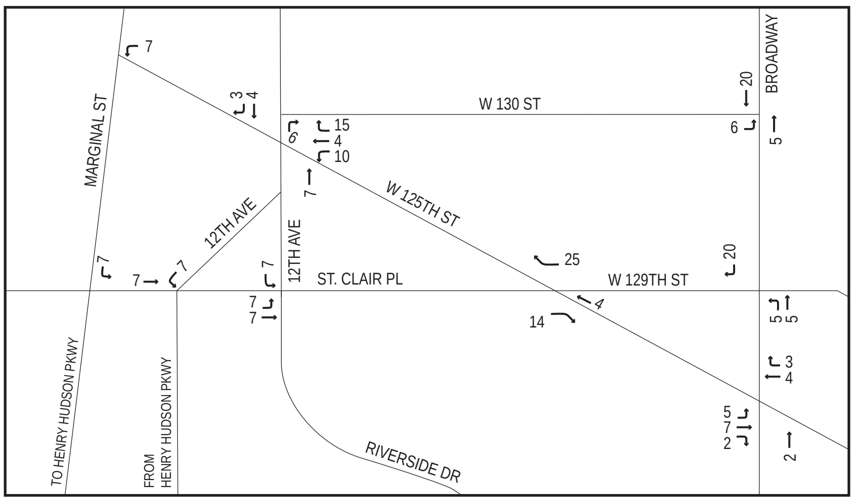
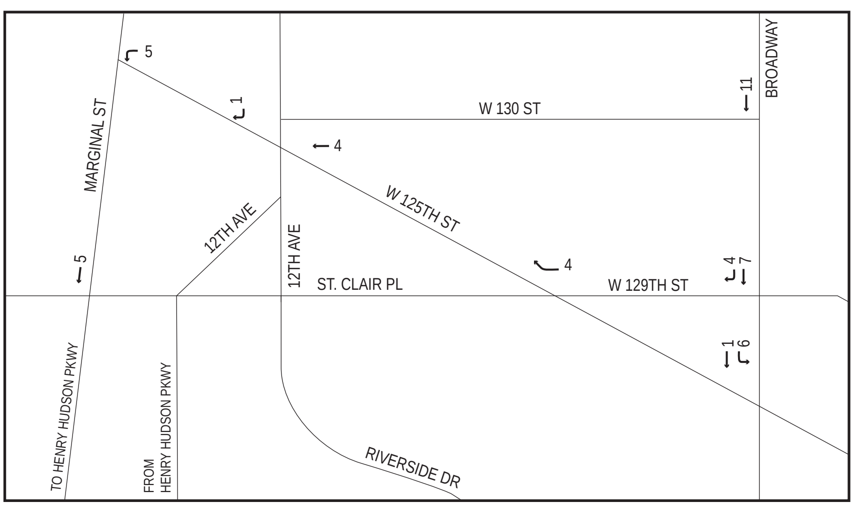


MIDDAY PEAK HOUR

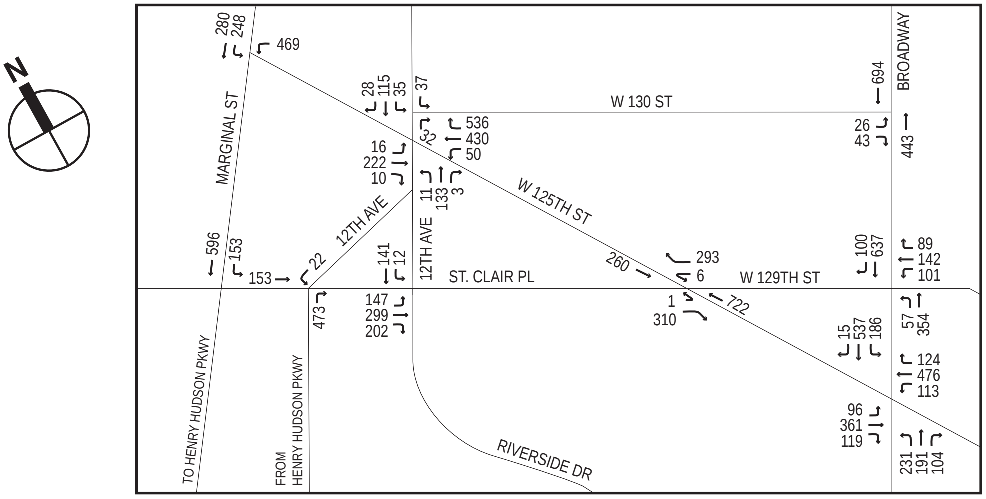


PM PEAK HOUR

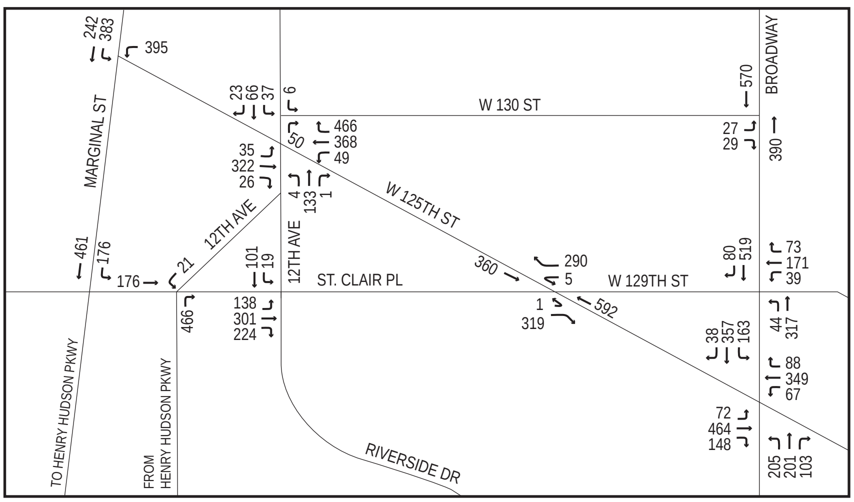
NOT TO SCALE

Figure 21-8
2008 Construction-Generated Traffic Volumes

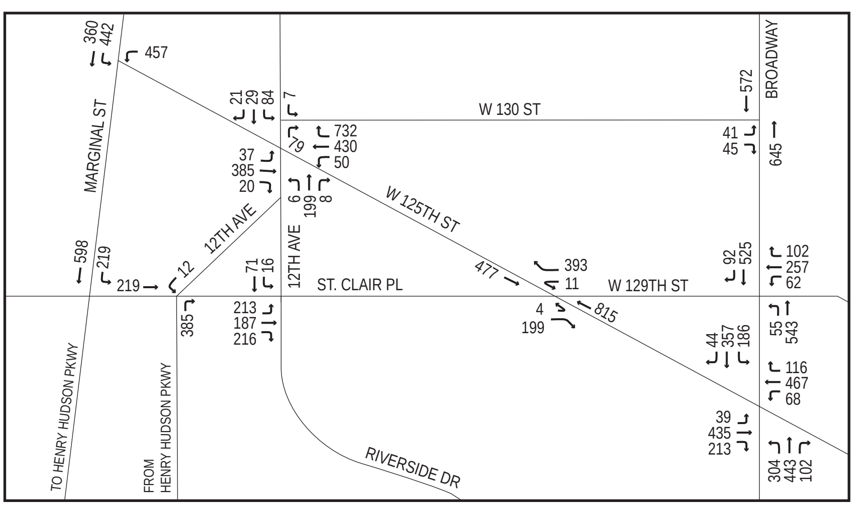
11.8.07



AM PEAK HOUR



MIDDAY PEAK HOUR

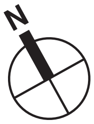


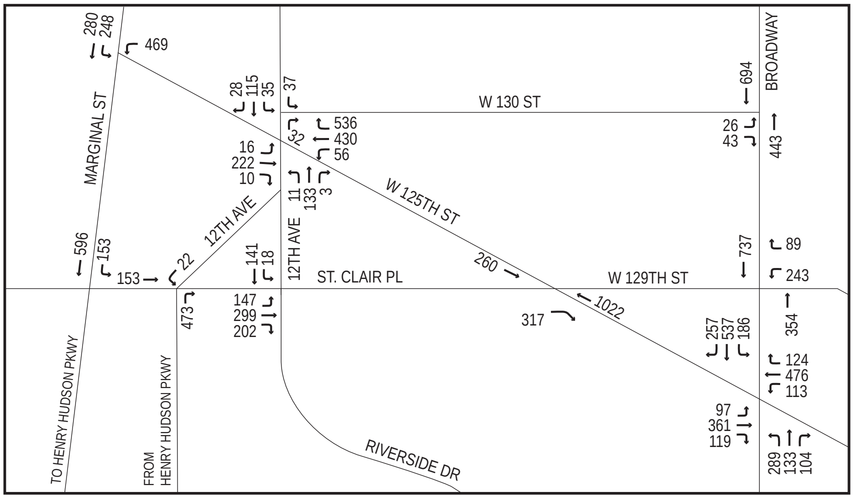
PM PEAK HOUR

NOT TO SCALE

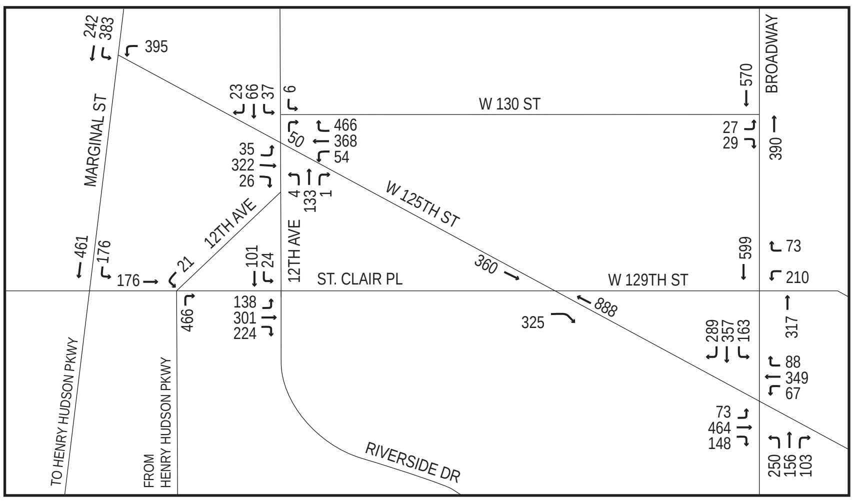
Figure 21-9
2008 Construction Traffic Volumes

11.8.07

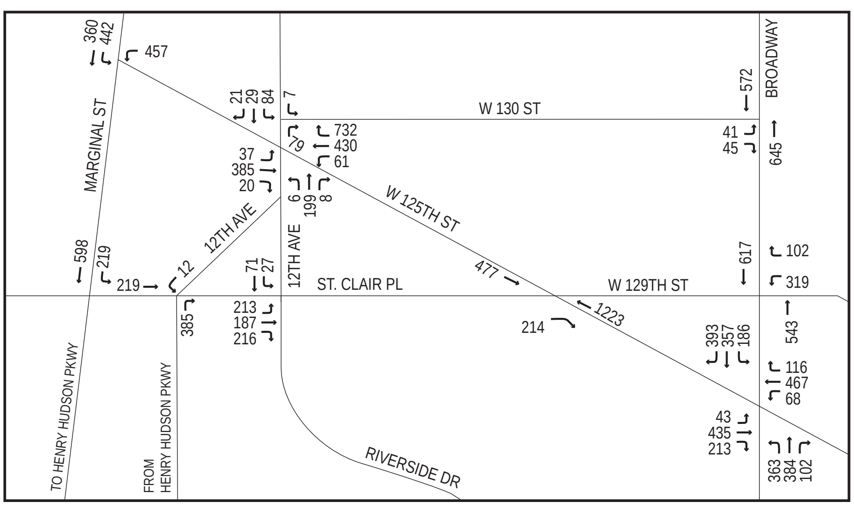




AM PEAK HOUR



MIDDAY PEAK HOUR



PM PEAK HOUR

NOT TO SCALE

Figure 21-10
2008 Construction Traffic Volumes with 129th Street Closure

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Table 21-2
2008 No Build and Construction Level-of-Service Analysis: Sewer Improvement Work with West 129th Street Open

Int.	AM Peak Hour								Midday Peak Hour								PM Peak Hour							
	2008 No Build				2008 Construction				2008 No Build				2008 Construction				2008 No Build				2008 Construction			
	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS
Marginal Street @ West 125th Street: 1 moving lane on westbound approach, 2 moving lanes on southbound approach																								
WB	L	0.42	24.6	C	L	0.86	43.8	D	L	0.37	24.0	C	L	0.74	34.6	C	L	0.46	25.2	C	L	0.88	45.8	D+
SB	L	0.26	12.3	B	L	0.36	13.7	B	L	0.37	13.7	B	L	0.53	16.4	B	L	0.42	14.5	B	L	0.60	18.1	B
	LT	0.26	11.9	B	T	0.41	14.4	B	LT	0.26	11.9	B	T	0.36	13.6	B	LT	0.35	12.9	B	T	0.53	16.6	B
	Int.		17.8	B	Int.		27.9	C	Int.		17.0	B	Int.		22.8	C	Int.		17.9	B	Int.		28.0	C
Twelfth Avenue @ West 125th Street: 1 moving lane on eastbound approach																								
EB	LTR	0.20	12.8	B	LTR	0.36	15.0	B	LTR	0.30	13.7	B	LTR	0.53	17.9	B	LTR	0.33	14.1	B	LTR	0.59	19.2	B
WB	L	0.12	12.7	B	L	0.16	13.2	B	L	0.13	12.8	B	L	0.17	13.5	B	L	0.17	13.5	B	L	0.18	13.7	B
	T	0.61	19.7	B	T	0.64	20.5	C	T	0.52	17.6	B	T	0.52	17.7	B	T	0.63	20.3	C	T	0.62	20.0	B
	R	0.88	35.6	D	R	0.90	38.7	D	R	0.87	34.6	C	R	0.90	37.9	D	R	1.03	62.6	E	R	1.03	62.6	E
NB	LTR	0.25	19.6	B	LTR	0.26	19.7	B	LTR	0.23	19.4	B	LTR	0.25	19.5	B	LTR	0.37	21.3	C	LTR	0.37	21.3	C
SB	LT	0.35	21.5	C	LT	0.36	21.7	C	LT	0.22	19.3	B	LT	0.22	19.4	B	LT	0.29	20.7	C	LT	0.30	20.8	C
	Int.		23.8	C	Int.		25.4	C	Int.		22.4	C	Int.		24.6	C	Int.		34.7	C	Int.		35.7	D
Twelfth Avenue @ West 125th Street: 1 moving lane on southbound approach																								
EB	LTR	0.20	12.8	B	LTR	0.36	15.0	B	LTR	0.30	13.7	B	LTR	0.53	17.9	B	LTR	0.33	14.1	B	LTR	0.59	19.2	B
WB	L	0.12	12.7	B	L	0.16	13.2	B	L	0.13	12.8	B	L	0.17	13.5	B	L	0.17	13.5	B	L	0.18	13.7	B
	T	0.61	19.7	B	T	0.64	20.5	C	T	0.52	17.6	B	T	0.52	17.7	B	T	0.63	20.3	C	T	0.62	20.0	B
	R	0.88	35.6	D	R	0.90	38.7	D	R	0.87	34.6	C	R	0.90	37.9	D	R	1.03	62.6	E	R	1.03	62.6	E
NB	LTR	0.25	19.6	B	LTR	0.26	19.8	B	LTR	0.23	19.4	B	LTR	0.25	19.5	B	LTR	0.37	21.3	C	LTR	0.37	21.3	C
SB	LT	0.35	21.5	C	LTR	0.41	22.6	C	LT	0.22	19.3	B	LTR	0.27	20.0	C	LT	0.29	20.7	C	LTR	0.34	21.4	C
	Int.		23.8	C	Int.		25.5	C	Int.		22.4	C	Int.		24.6	C	Int.		34.7	C	Int.		35.6	D
Twelfth Avenue @ West 125th Street Southbound Right Turn: closed																								
SB	R	0.04	10.7	B					R	0.03	10.1	B					R	0.03	10.4	B				
Twelfth Avenue @ St. Clair Place: Intersection under construction																								
EB	T	-	9.4	A	T	-	9.5	A	T	-	9.9	A	T	-	10.1	B	T	-	10.4	B	T	-	10.4	B
NB	R	-	11.2	B	R	-	11.4	B	R	-	12.0	B	R	-	12.2	B	R	-	10.8	B	R	-	10.8	B
SB	L	-	8.9	A	L	-	9.0	A	L	-	8.7	A	L	-	8.8	A	L	-	8.7	A	L	-	8.7	A
	Int.		10.7	B	Int.		10.9	B	Int.		11.4	B	Int.		11.6	B	Int.		10.6	B	Int.		10.6	B
Twelfth Avenue @ West 125th Street: 2 moving lane on westbound approach; northbound traffic redirected																								
EB	LTR	0.20	12.8	B	LTR	0.20	12.8	B	LTR	0.30	13.7	B	LTR	0.30	13.8	B	LTR	0.33	14.1	B	LTR	0.33	14.2	B
WB	L	0.12	12.7	B	LT	0.79	27.5	C	L	0.13	12.8	B	LT	0.68	22.5	C	L	0.17	13.5	B	LT	0.81	28.7	C
	T	0.61	19.7	B					T	0.52	17.6	B					T	0.63	20.3	C				
	R	0.88	35.6	D	R	0.90	38.7	D	R	0.87	34.6	C	R	0.90	37.9	D	R	1.03	62.6	E	R	1.03	62.6	E
NB	LTR	0.25	19.6	B	LT	0.23	19.3	B	LTR	0.23	19.4	B	LT	0.21	18.9	B	LTR	0.37	21.3	C	LT	0.32	20.4	C
					R	0.01	16.9	B					R	0.00	16.8	B					R	0.02	17.0	B
SB	LT	0.35	21.5	C	LT	0.36	21.7	C	LT	0.22	19.3	B	LT	0.22	19.4	B	LT	0.29	20.7	C	LT	0.34	21.8	C
	Int.		23.8	C	Int.		27.5	C	Int.		22.4	C	Int.		25.0	C	Int.		34.7	C	Int.		36.9	D
West 125th Street @ West 129th Street/St. Clair Place: Intersection under construction																								
WB	L	0.07	50.0	E					L	0.03	24.5	C					L	0.35	160.3	F				
	R	0.61	24.3	C	R	0.73	31.2	D	R	0.47	15.0	C	R	0.53	16.2	C	R	1.20	144.1	F	R	1.21	150.1	F+
EB	L	0.01	33.8	D					L	0.01	27.1	D					L			F				
	R	0.48	15.1	C	R	0.52	15.8	C	R	0.43	13.1	B	R	0.46	13.6	B	R	0.54	23.2	C	R	0.58	24.8	C
Broadway @ West 130th Street: 2 moving lanes on southbound approach with no curbside parking																								
EB	LR	0.20	24.6	C	LR	0.21	24.9	C	LR	0.14	23.8	C	LR	0.16	24.1	C	LR	0.26	25.6	C	LR	0.26	25.6	C
NB	T	0.22	5.5	A	T	0.22	5.5	A	T	0.18	5.3	A	T	0.19	5.3	A	L	0.29	5.8	A	T	0.29	5.8	A
SB	T	0.32	6.0	A	T	0.48	7.5	A	T	0.26	5.7	A	T	0.39	6.7	A	L	0.28	5.8	A	T	0.42	6.9	A
	Int.		6.8	A	Int.		7.8	A	Int.		6.5	A	Int.		7.1	A	Int.		7.1	A	Int.		7.6	A
Broadway @ West 129th Street: 2 moving lanes on southbound approach with no curbside parking																								
WB	LT	0.38	18.3	B	LT	0.38	18.3	B	LT	0.36	18.0	B	LT	0.36	18.0	B	LT	0.48	20.0	B	LT	0.48	20.0	B
	R	0.19	16.0	B	R	0.19	16.0	B	R	0.16	15.6	B	R	0.16	15.6	B	R	0.23	16.5	B	R	0.23	16.5	B
NB	LT	0.38	17.6	B	LT	0.39	17.8	B	LT	0.31	16.8	B	LT	0.33	17.0	B	LT	0.59	21.1	C	LT	0.61	21.4	C
SB	TR	0.50	16.2	B	TR	0.76	22.6	C	TR	0.39	17.4	B	TR	0.59	21.1	C	TR	0.41	17.8	B	TR	0.61	21.5	C
	Int.		16.9	B	Int.		20.2	C	Int.		17.3	B	Int.		19.0	B	Int.		19.4	B	Int.		20.9	C

Notes: L: Left Turn; T: Through; R: Right Turn; Int.: Intersection
V/C: Volume to Capacity; spv: Seconds per Vehicle; LOS: Level of Service
+ Temporary traffic impacts

Table 21-3
2008 No Build and Construction Level-of-Service Analysis: Sewer Improvement Work with West 129th Street Closed

	AM Peak Hour								Midday Peak Hour								PM Peak Hour							
	2008 No Build				2008 Construction				2008 No Build				2008 Construction				2008 No Build				2008 Construction			
Int.	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS	Ln Grp	V/C	Delay (spv)	LOS
West 125th Street @ West 129th Street/St. Clair Place: Westbound approach closed																								
WB	L	0.07	50.0	E					L	0.03	24.5	C					L	0.35	160.3	F				
	R	0.61	24.3	C					R	0.47	15.0	C					R	1.20	144.1	F				
EB	L	0.01	33.8	D					L	0.01	27.1	D					L			F				
	R	0.48	15.1	C	R	0.52	15.8	B	R	0.43	13.1	B	R	0.46	13.6	C	R	0.54	23.2	C	R	0.58	24.8	C
Broadway @ West 129th Street: Western leg closed; 2 moving lanes on southbound approach with no curb side parking																								
WB	LT	0.38	18.3	B	L	0.48	20.5	C	LT	0.36	18.0	B	L	0.42	19.2	B	LT	0.48	20.0	B	L	0.64	24.8	C
	R	0.19	16.0	B	R	0.19	16.0	B	R	0.16	15.6	B	R	0.16	15.6	B	R	0.23	16.5	B	R	0.23	16.5	B
NB	LT	0.38	17.6	B	T	0.39	17.9	B	LT	0.31	16.8	B	T	0.35	17.4	B	LT	0.59	21.1	C	T	0.66	23.2	C
SB	TR	0.50	16.2	B	T	0.74	21.8	C	TR	0.39	17.4	B	T	0.56	20.5	C	TR	0.41	17.8	B	T	0.58	20.9	C
	Int.		16.9	B	Int.		20.3	C	Int.		17.3	B	Int.		19.1	B	Int.		19.4	B	Int.		22.2	C
Broadway @ West 125th Street: Detour of West 129th Street traffic onto southbound right-turn movement																								
EB	L	0.68	47.9	D	L	0.74	54.2	D+	L	0.38	27.7	C	L	0.42	29.2	C	L	0.31	27.6	C	L	0.35	28.9	C
	TR	0.61	27.8	C	TR	0.62	28.1	C	TR	0.74	31.6	C	TR	0.75	32.0	C	TR	0.88	40.7	D	TR	0.88	40.7	D
WB	L	0.75	52.7	D	L	0.76	54.8	D	L	0.58	42.9	D	L	0.59	43.9	D	L	0.75	66.0	E	L	0.75	66.0	E
	TR	0.77	32.7	C	TR	0.78	33.2	C	TR	0.59	27.3	C	TR	0.60	27.6	C	TR	0.73	31.0	C	TR	0.73	31.0	C
NB	L	0.44	32.3	C	L	0.51	33.9	C	L	0.38	31.2	C	L	0.47	33.1	C	L	0.69	40.4	D	L	0.72	41.9	D
	LT	0.43	30.7	C	LT	0.38	30.0	C	LT	0.43	30.9	C	LT	0.38	30.0	C	LT	0.78	40.1	D	LT	0.75	38.9	D
	R	0.56	40.5	D	R	0.56	40.5	D	R	0.55	40.0	D	R	0.55	40.0	D	R	0.52	38.4	D	R	0.52	38.4	D
SB	L	0.35	30.4	C	L	0.50	33.5	C	L	0.29	29.4	C	L	0.42	31.6	C	L	0.39	30.6	C	L	0.40	30.8	C
	LTR	0.93	53.0	D	LTR	1.37	209.2	F+	LTR	0.72	37.4	D	LTR	1.15	120.5	F+	LTR	0.68	36.4	D	LTR	1.48	257.7	F+
	Int.		38.1	D	Int.		84.2	F	Int.		32.3	C	Int.		54.4	D	Int.		37.6	D	Int.		91.6	F

Notes: L: Left Turn; T: Through; R: Right Turn; Int.: Intersection
V/C: Volume to Capacity; spv: Seconds per Vehicle; LOS: Level of Service
+ Temporary traffic impacts

PHASE 1 AND PHASE 2 CONSTRUCTION TRAFFIC ANALYSES

As discussed above, detailed analyses of 2011, 2022, and 2027 conditions, accounting for projected construction traffic and the anticipated roadway closures, were conducted to identify potential traffic impacts during construction. The analysis approach, data application, and analysis results are presented below.

Peak Hour Traffic Volumes

To assess the potential impacts resulting from construction-generated traffic and the temporary roadway changes anticipated during different stages of construction, the appropriate baseline conditions were developed with which conditions during construction could be compared. Using the existing automatic traffic recorder (ATR) data and the future No Build peak period traffic volumes projected for the operational traffic analysis, baseline conditions were established for the weekday morning 6:00–7:00 AM and weekday afternoon 3:00–4:00 PM construction peak analysis hours for the 2011, 2022, and 2027 construction analysis years, as shown in Figures 21-11 to 21-16. The extrapolation of traffic volumes for these baseline traffic networks is conservatively based on the 2015 and 2030 No Build traffic volumes, although the construction years analyzed are earlier, and will not have experienced the same degree of background growth.

Auto and truck traffic volumes were assigned to the study area traffic network based on travel patterns established in the operational traffic analysis, adjusted for likely origins and destinations of construction-related trips, and following NYCDOT-designated truck routes for delivery vehicles. These traffic assignments are presented in Figures 21-17 to 21-25 for construction worker vehicle trips and construction truck trips. For the construction worker vehicle trips, off-street parking facilities would be provided during construction. A more detailed discussion of

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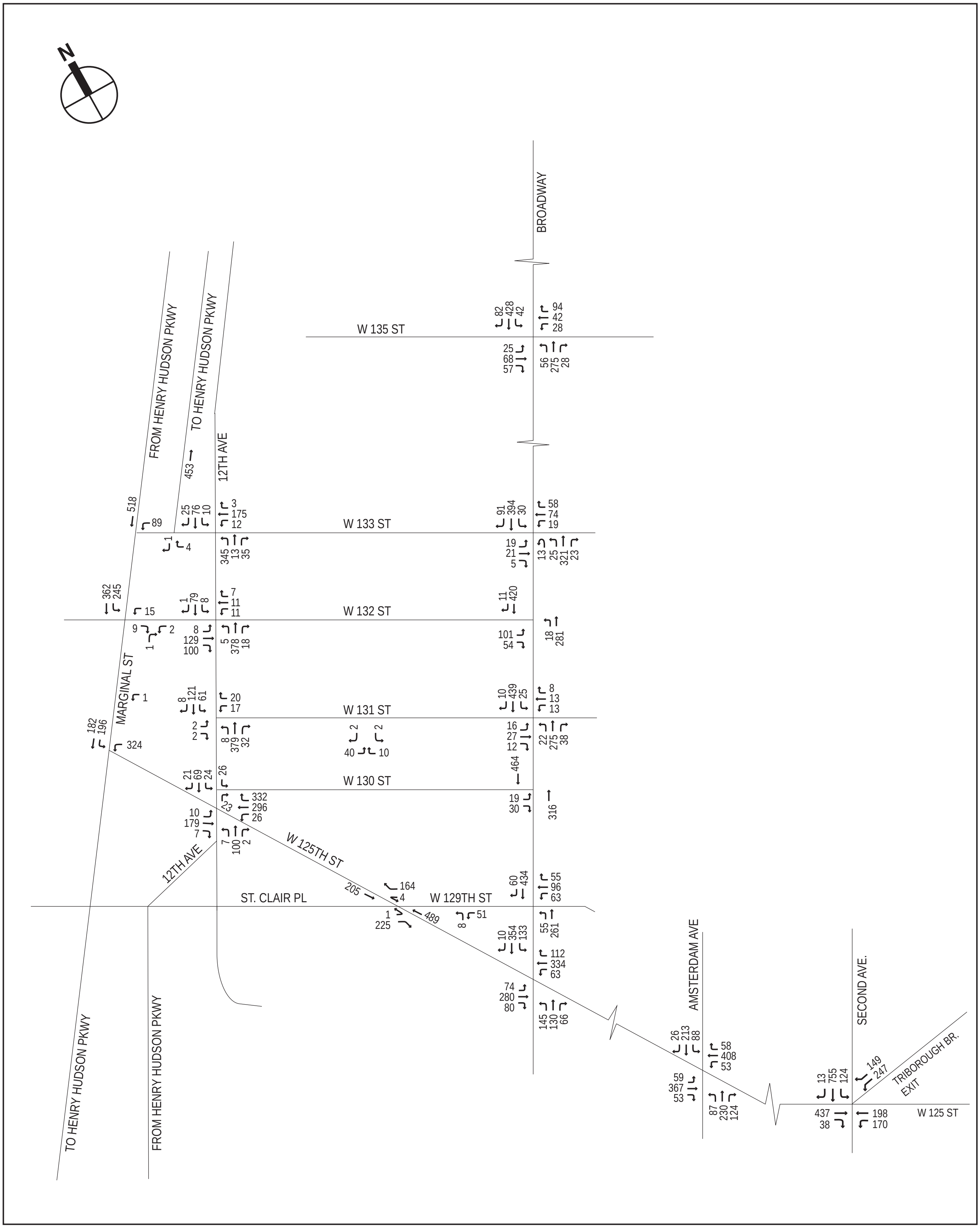

NOT TO SCALE

Figure 21-11

2011 No Build Traffic Volumes
6-7 AM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

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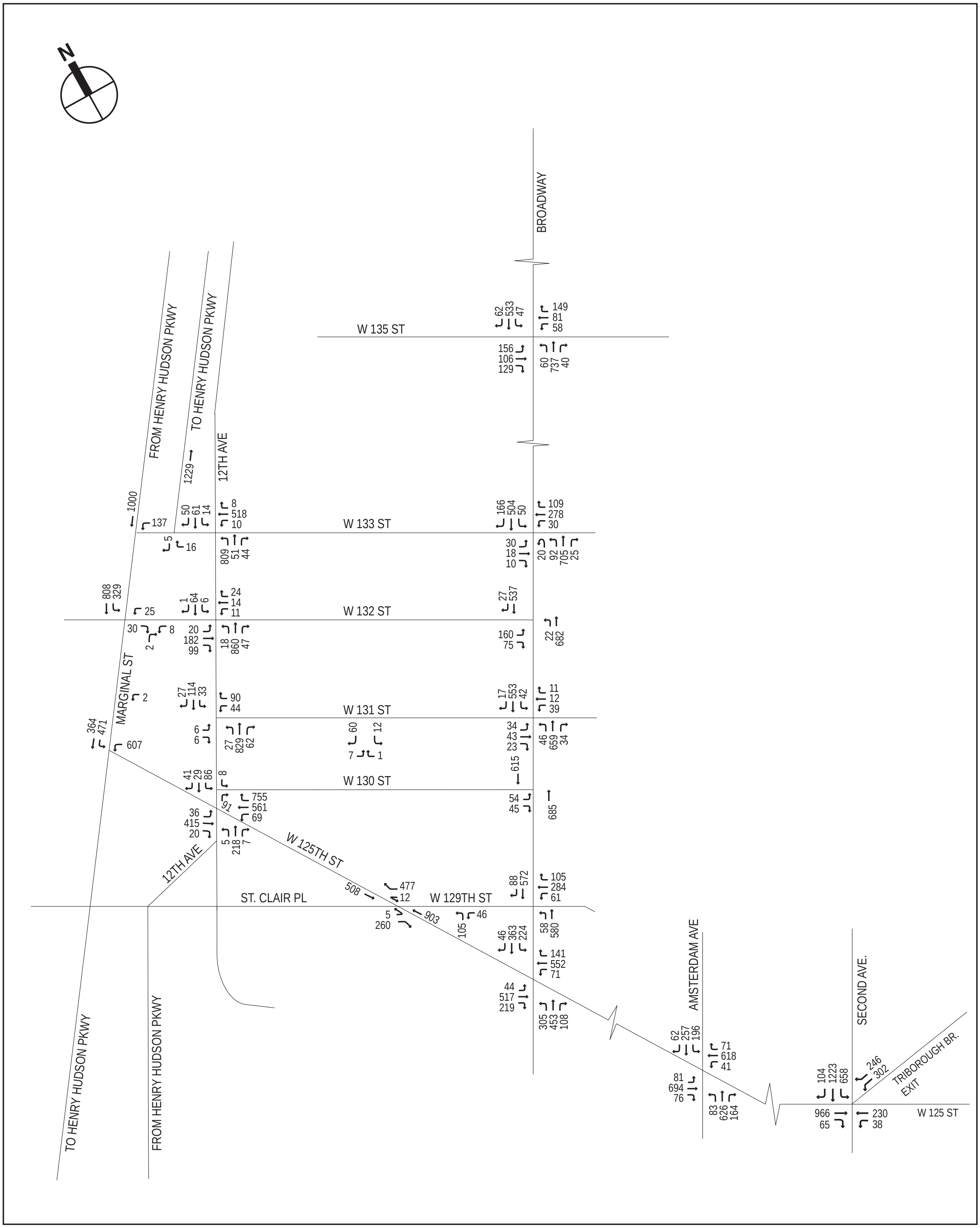

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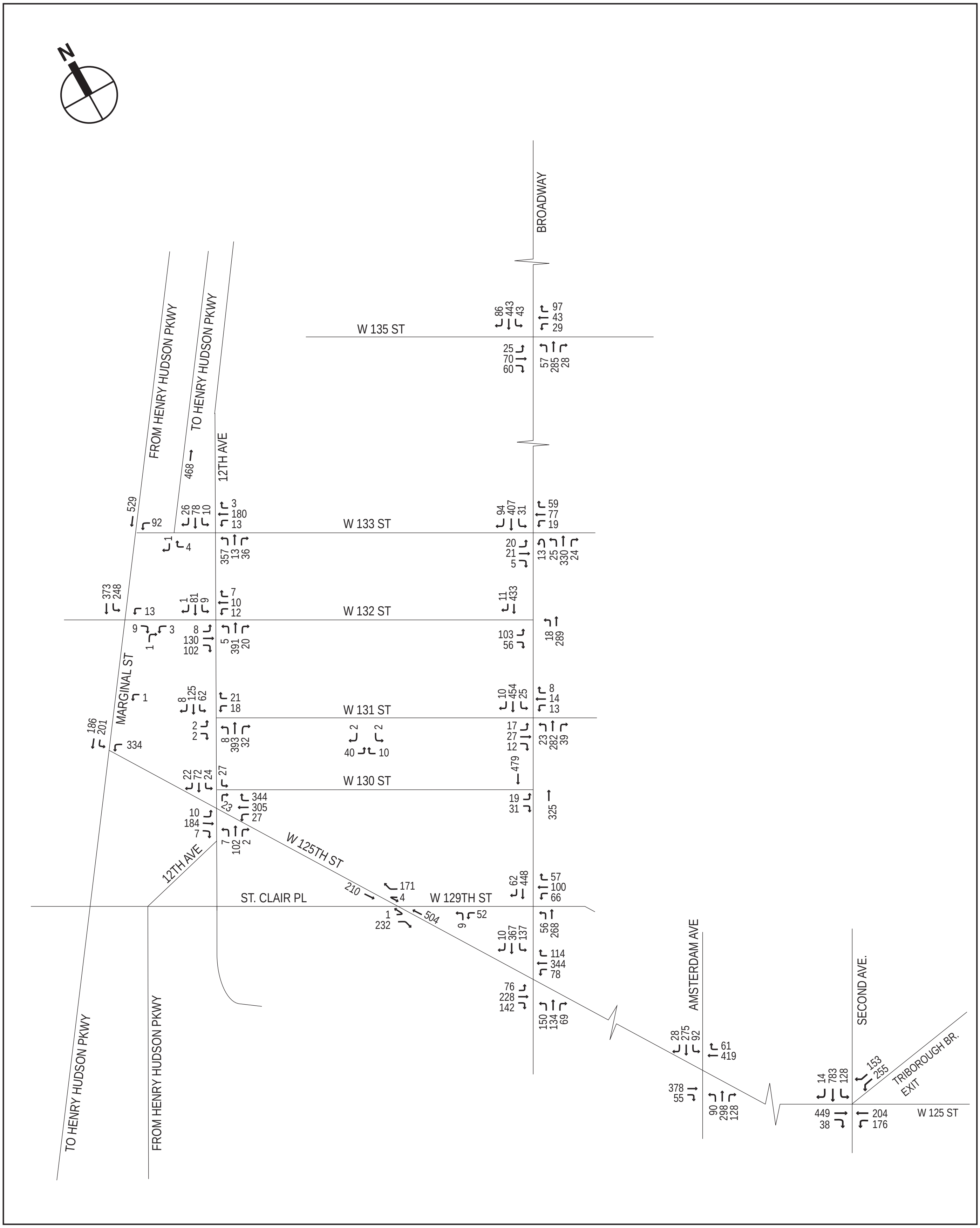
Figure 21-12
2011 No Build Traffic Volumes
3-4 PM Peak Hour

11.8.07



NOT TO SCALE

Figure 21-13
2022 No Build Traffic Volumes
6-7 AM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

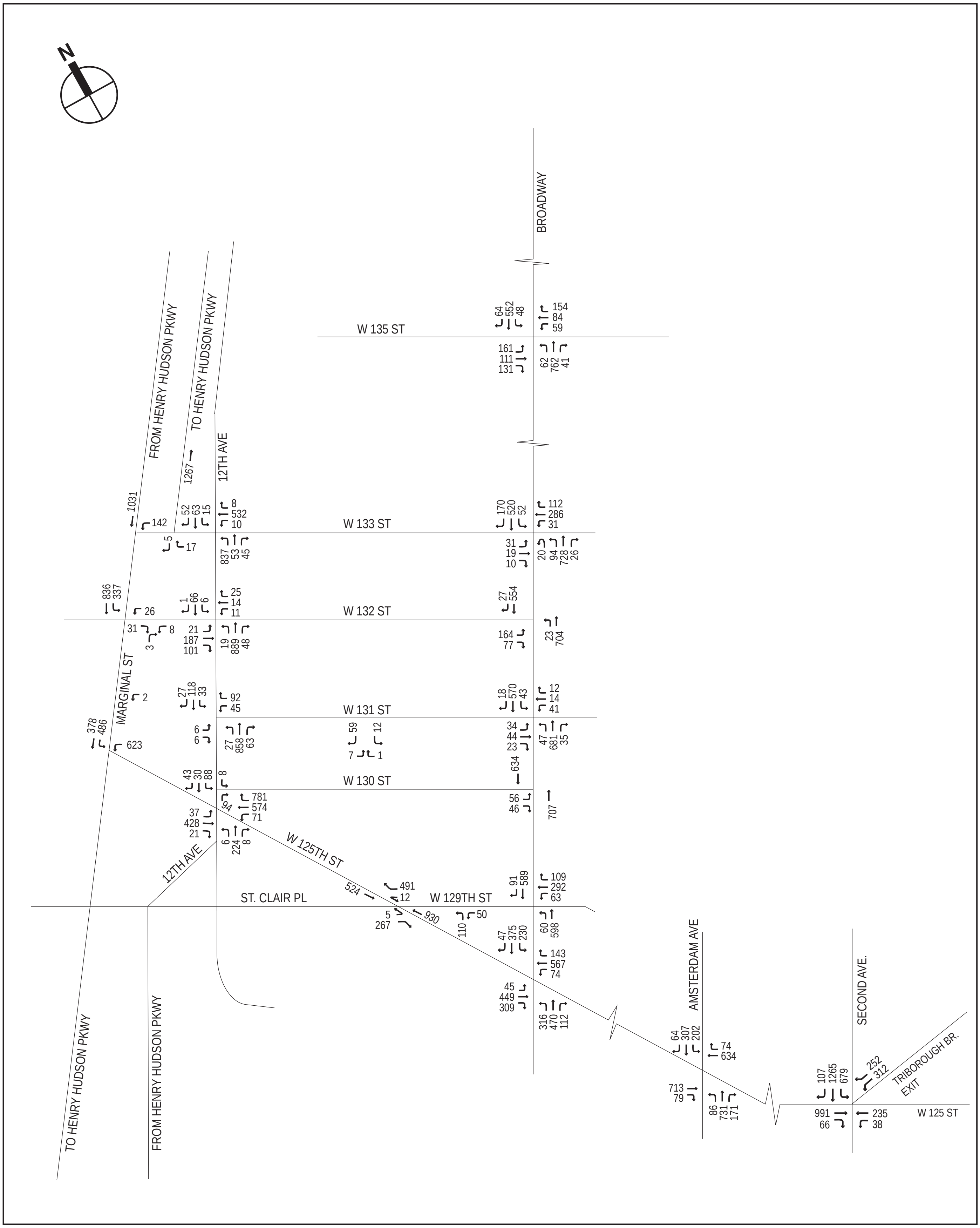


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Figure 21-14
2022 No Build Traffic Volumes
3-4 PM Peak Hour

11.8.07

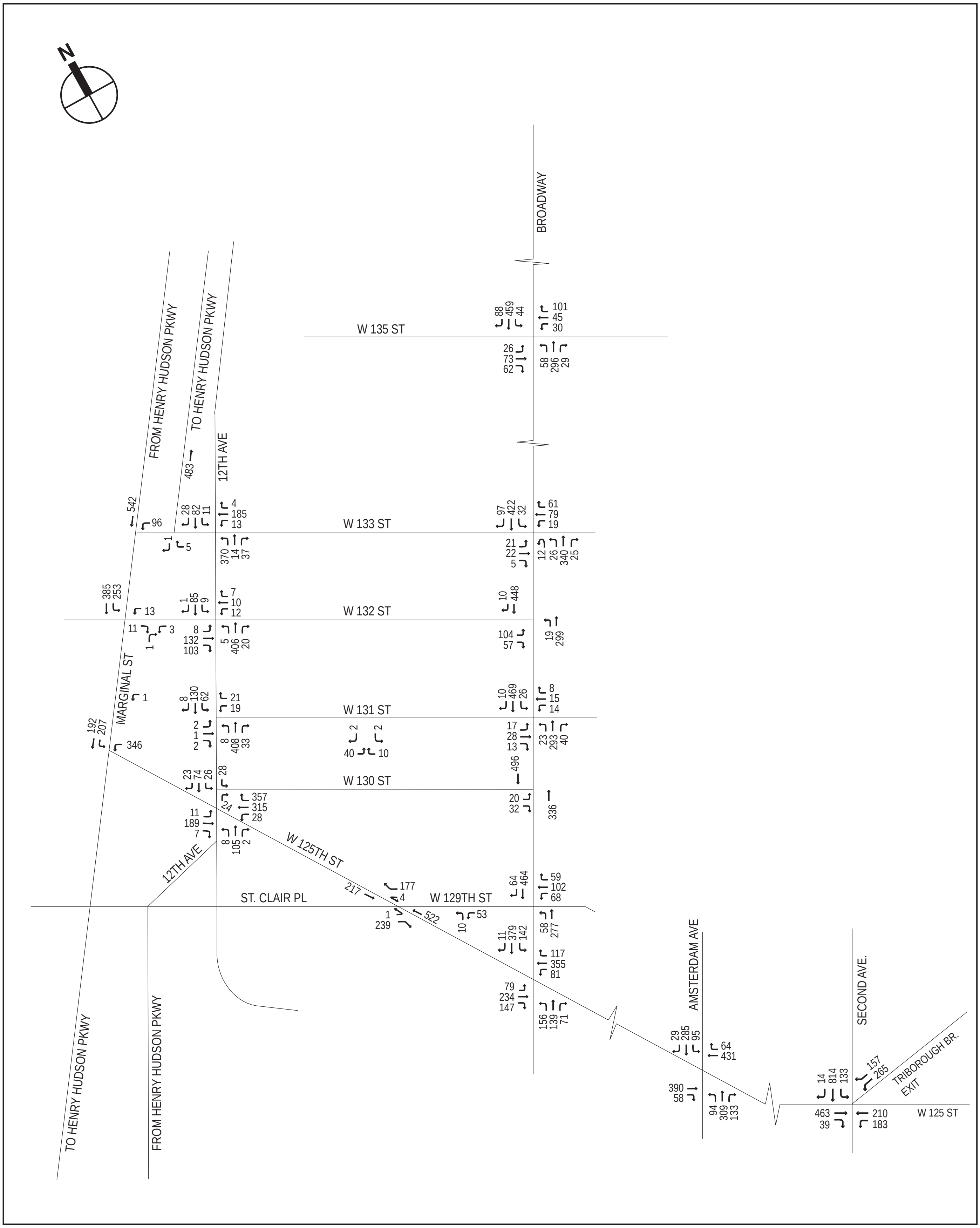

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Figure 21-15
2027 No Build Traffic Volumes
6-7 AM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

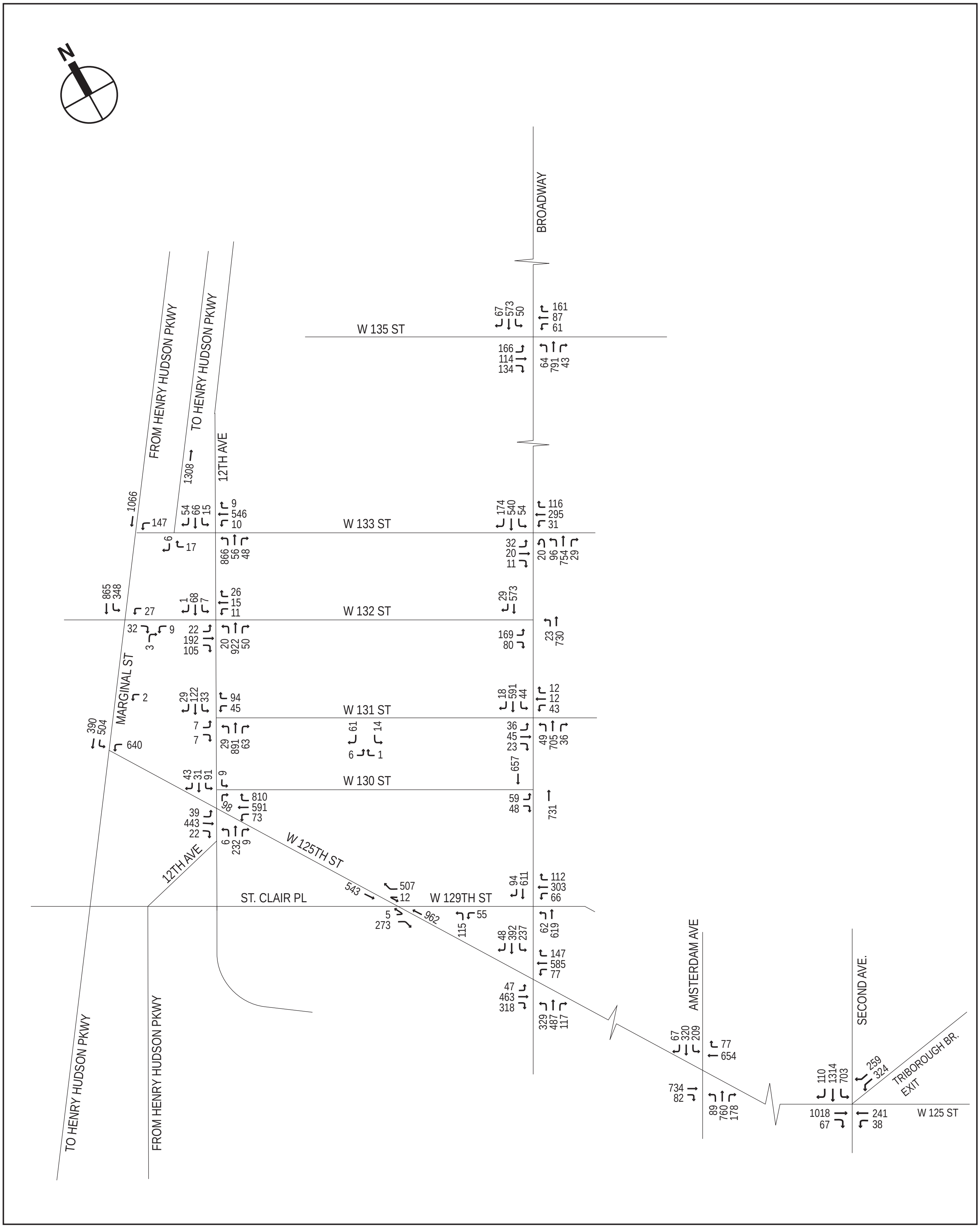

Figure 21-16
2027 No Build Traffic Volumes
3-4 PM Peak Hour

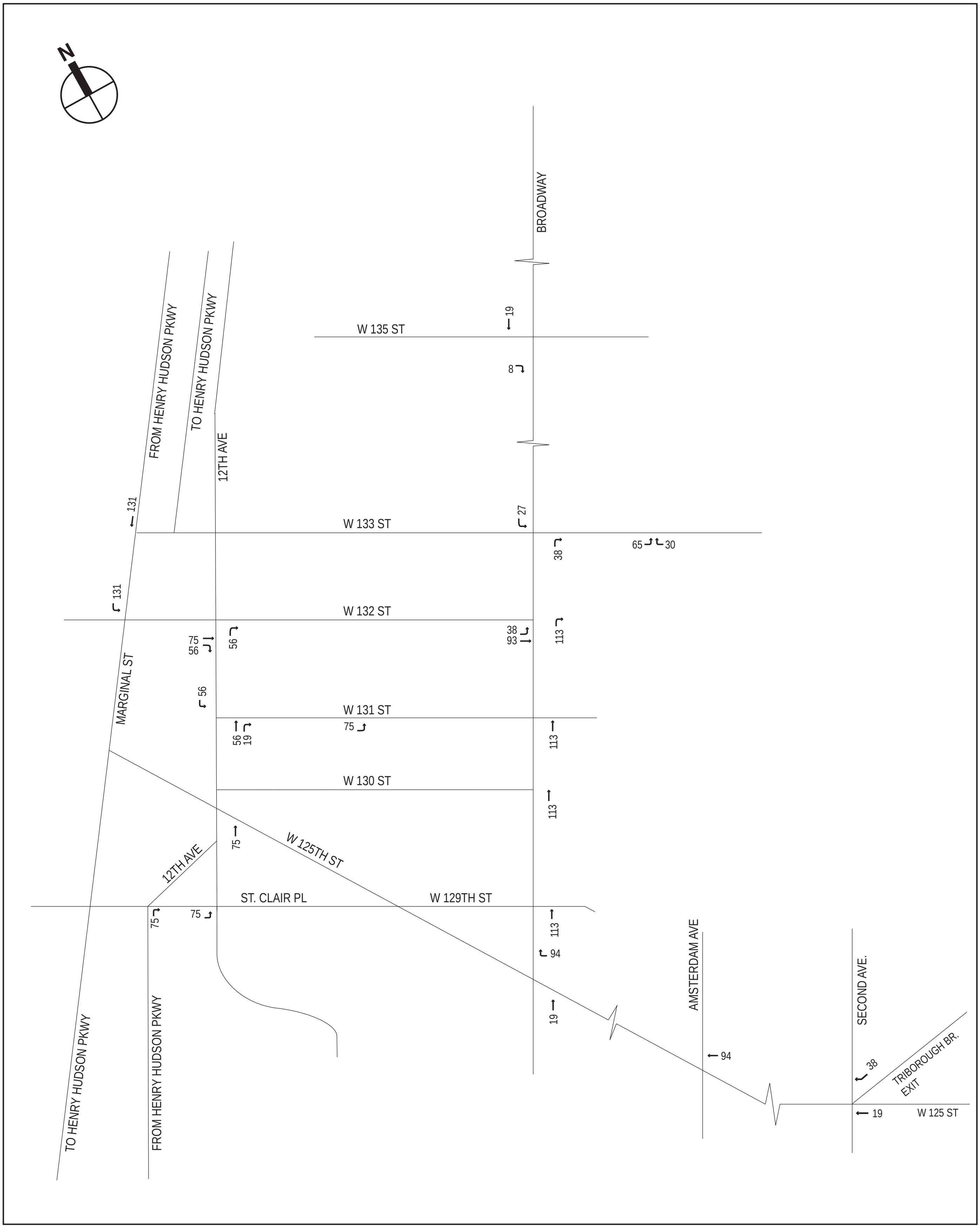

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Figure 21-17

2011 Construction-Generated Worker Traffic Volumes 6-7 AM Peak Hour

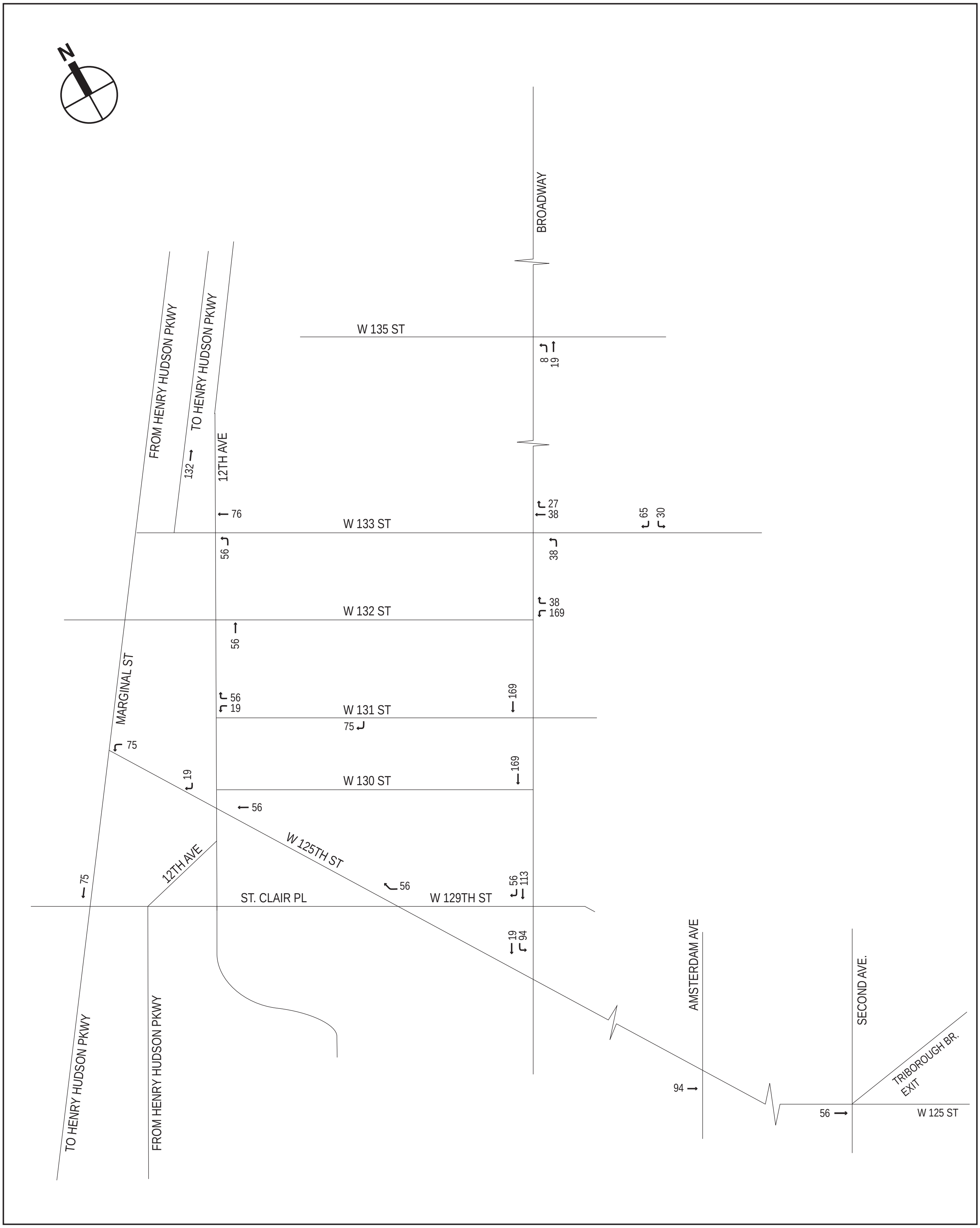

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Figure 21-18
2011 Construction-Generated Worker Traffic Volumes 3-4 PM Peak Hour

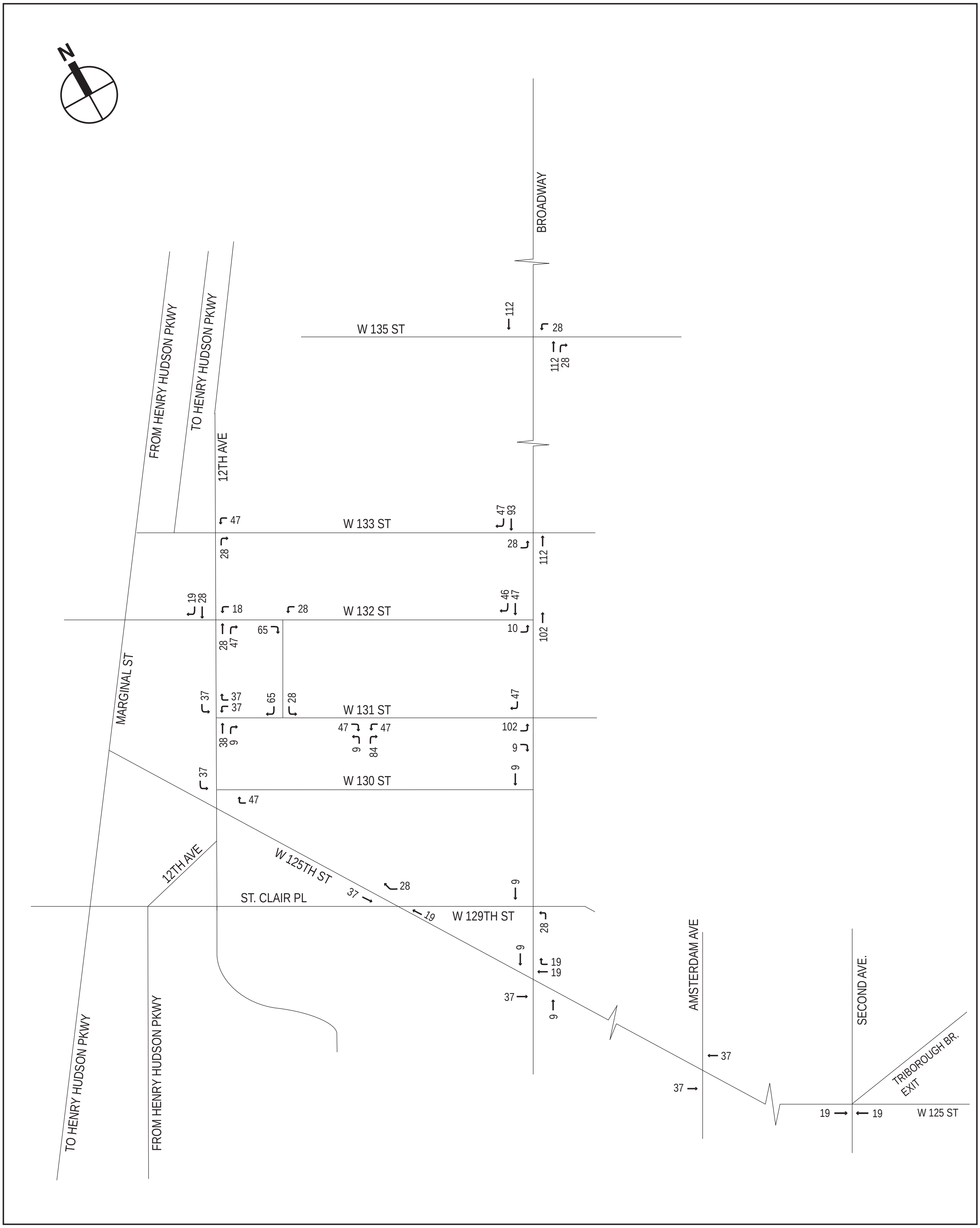

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Figure 21-19
2011 Construction-Generated Truck Traffic Volumes (PCEs) 6-7 AM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

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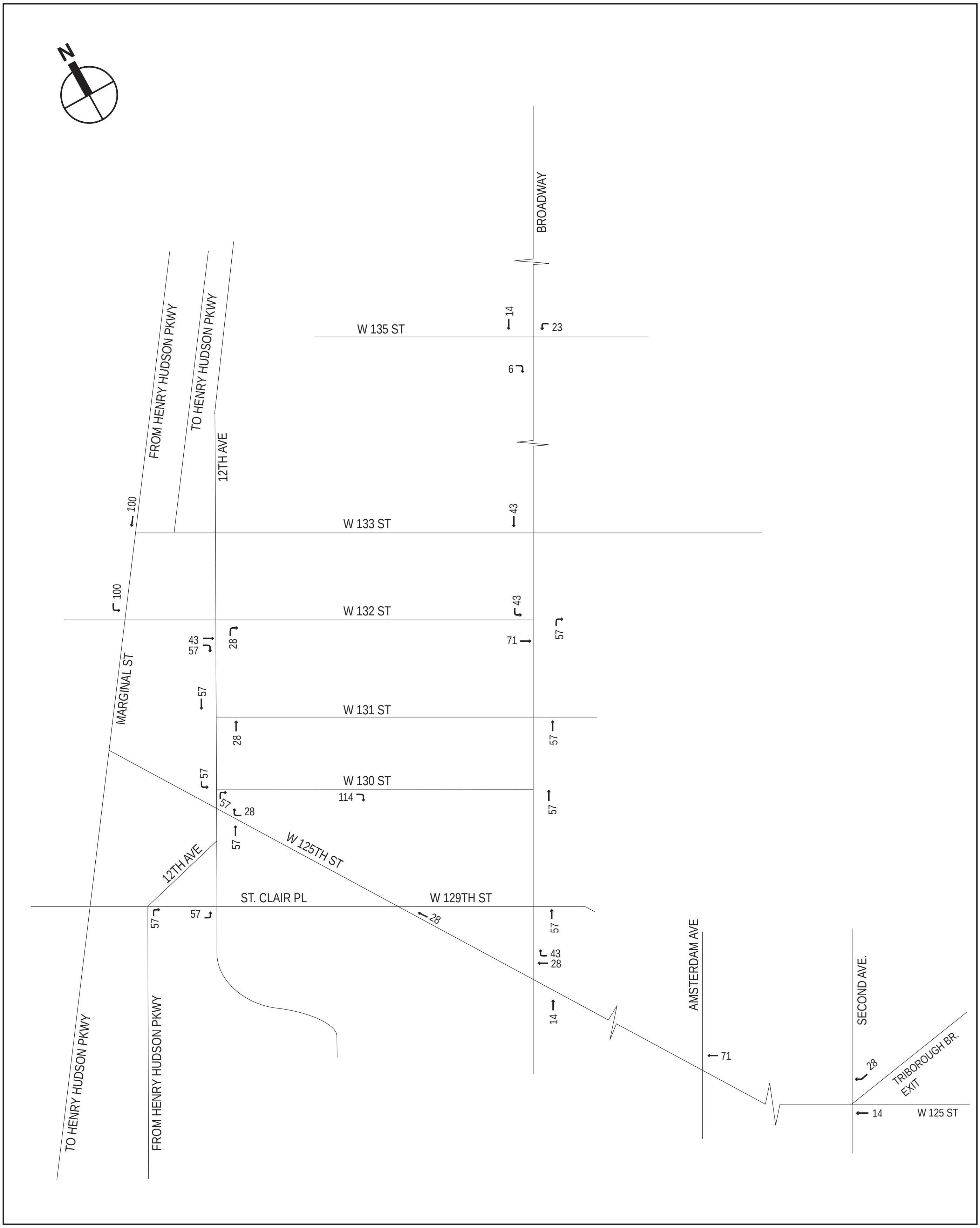

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Figure 21-20
2022 Construction-Generated Worker Traffic Volumes 6-7 AM Peak Hour

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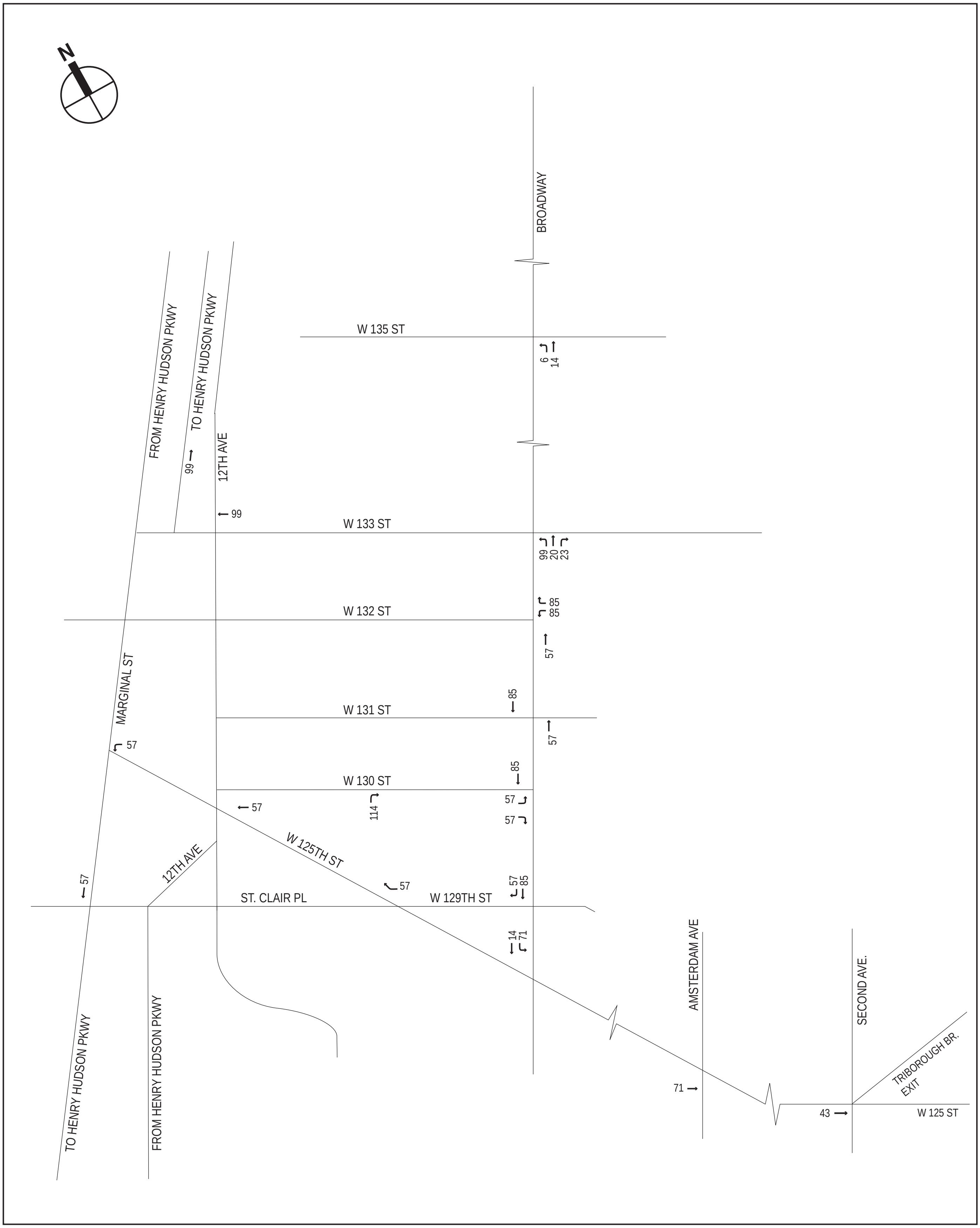

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Figure 21-21
2022 Construction-Generated Worker Traffic Volumes 3-4 PM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

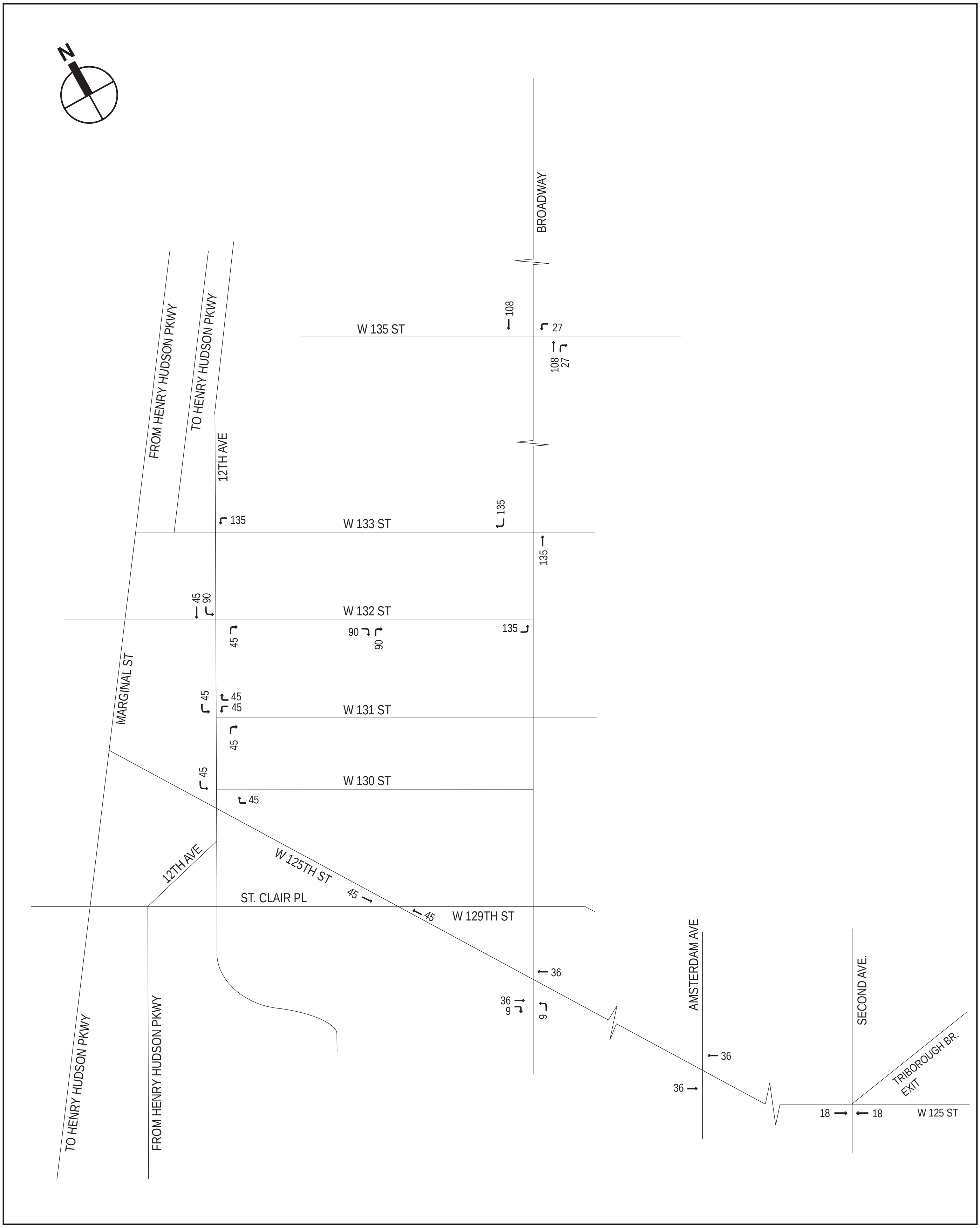

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Figure 21-22
2022 Construction-Generated Truck Traffic Volumes (PCEs) 6-7 AM Peak Hour

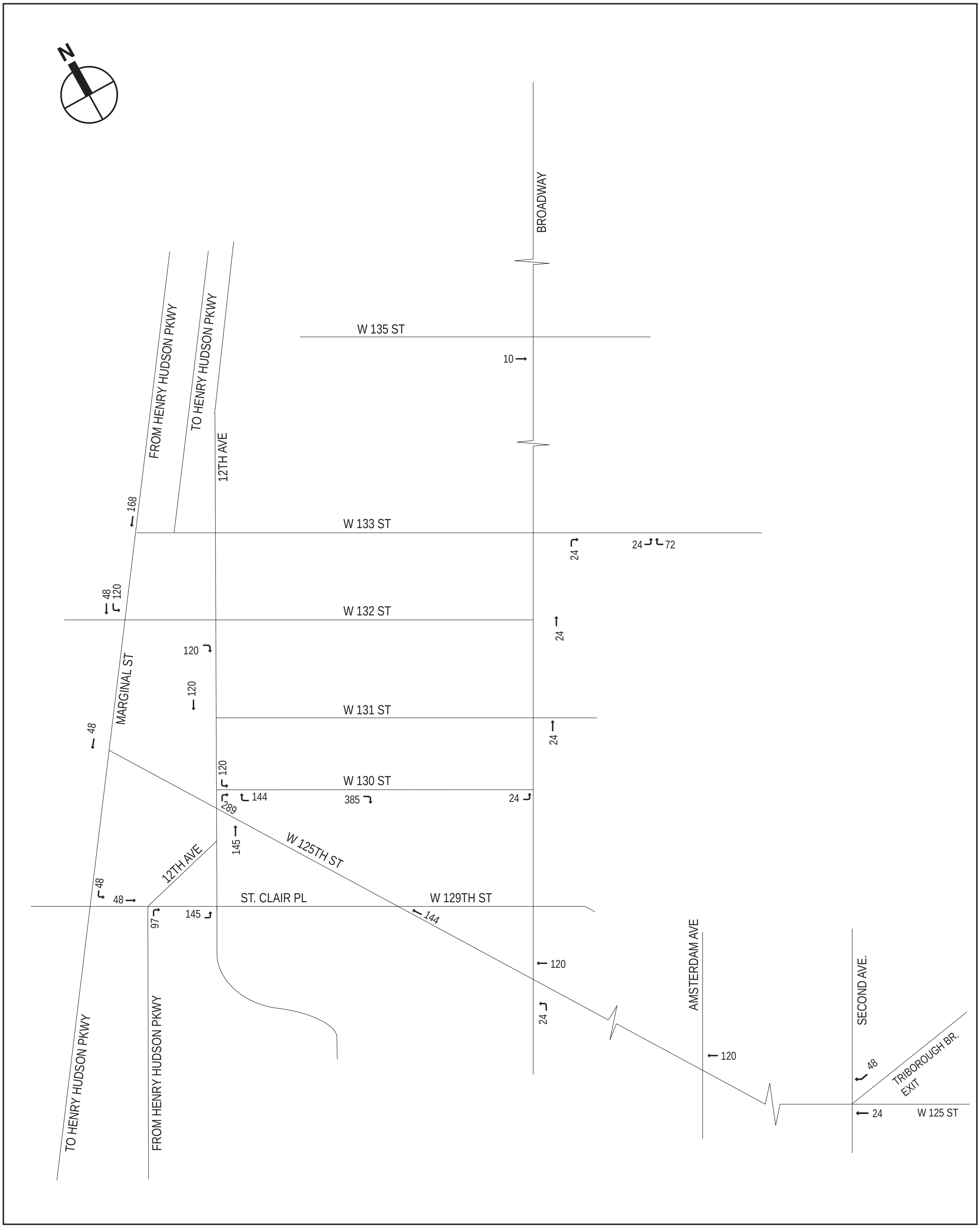

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Figure 21-23
2027 Construction-Generated Worker Traffic Volumes 6-7 AM Peak Hour

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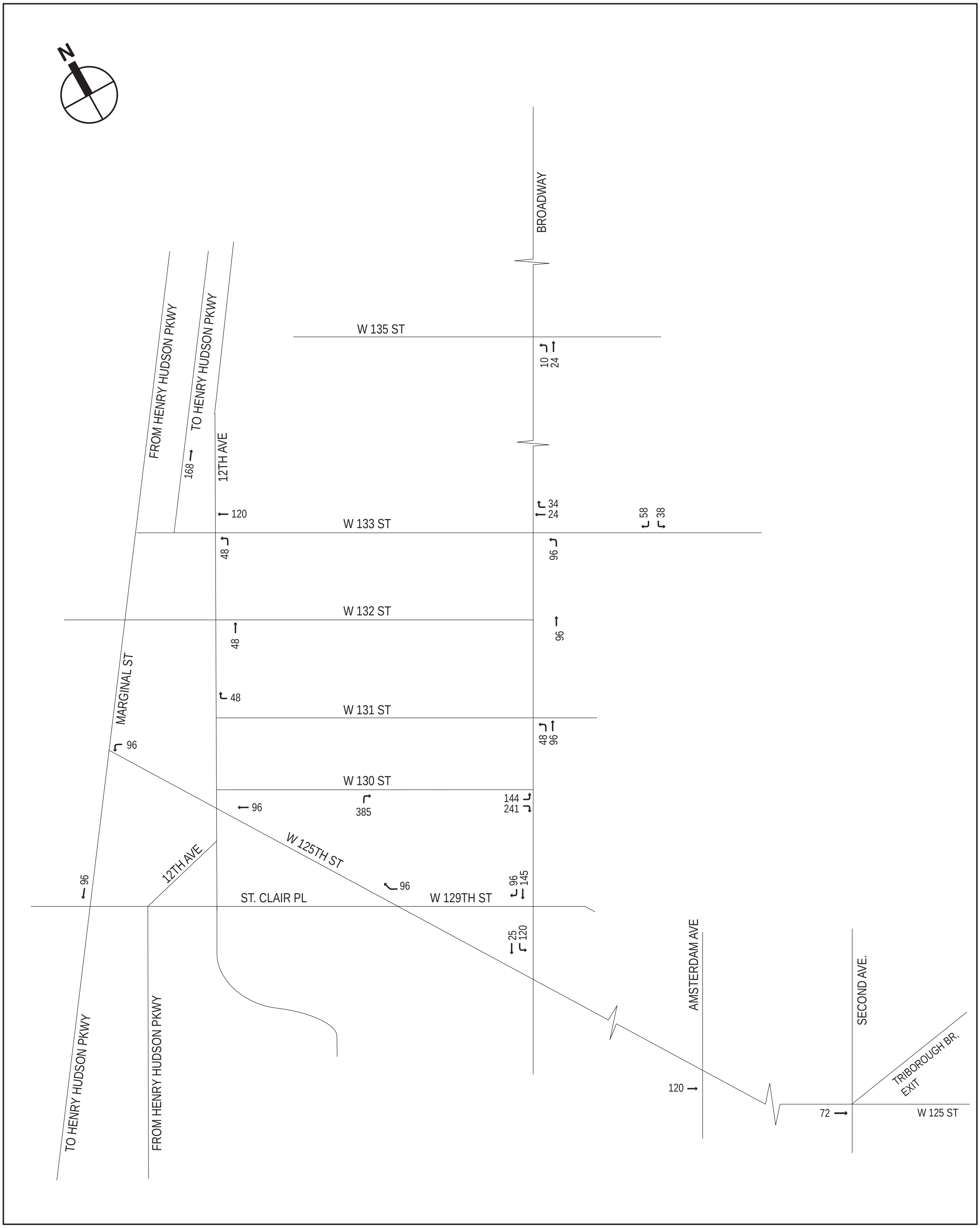

Figure 21-24

2027 Construction-Generated Worker Traffic Volumes 3-4 PM Peak Hour

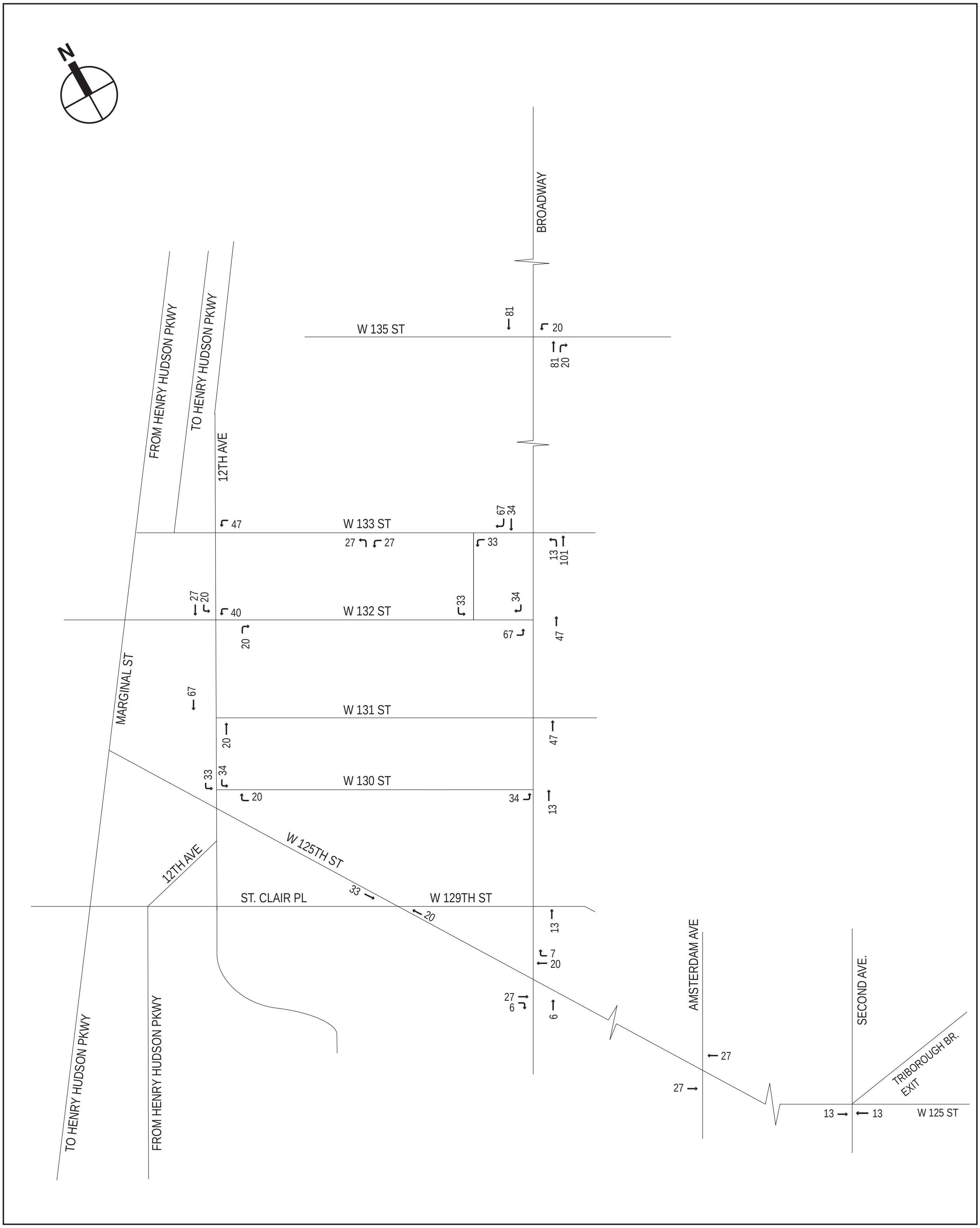

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Figure 21-25
2027 Construction-Generated Truck Traffic Volumes (PCEs) 6-7 AM Peak Hour

construction worker parking issues is provided below, in "Parking." The resulting construction traffic networks, accounting for specific diversions, incremental construction-related vehicle trips, and doubling of projected truck traffic to account for PCEs, are shown in Figures 21-26 to 21-31. For the Phase 2 construction traffic analyses, the project-generated traffic volumes from the operation of the completed Phase 1 development and partially completed Phase 2 development were also incorporated into the construction traffic network for impact assessment.

Traffic Study Areas

Based on the assignment patterns and projected construction traffic volumes, 18 intersections, situated along the perimeters of the Project Area and a remote location at Second Avenue and East 125th Street, were selected for analysis. As discussed above and illustrated in Table 21-1, since potential traffic impacts at locations beyond the immediate area of the construction activities were addressed for the operational analysis, which considered higher peak hour project-generated and background traffic volumes, a further analysis of these locations to address potential construction traffic impacts would not be necessary. However, the Second Avenue and East 125th Street intersection was selected for analysis because it represents the portal location where a substantial number of construction-related trips and significant adverse impacts associated with the Proposed Actions have been projected. The construction traffic study area intersections are listed below.

- Marginal Street and West 133rd Street (new post-2015 signalized intersection)
- Marginal Street and West 132nd Street (new post-2015 signalized intersection)
- Marginal Street and West 125th Street (new post-2015 signalized intersection)
- Twelfth Avenue and West 133rd Street
- Twelfth Avenue and West 132nd Street
- Twelfth Avenue and West 131st Street (new post-2015 signalized intersection)
- Twelfth Avenue and West 130th Street (new post-2015 signalized intersection)
- Twelfth Avenue and West 125th Street
- Broadway and West 135th Street
- Broadway and West 133rd Street
- Broadway and West 132nd Street
- Broadway and West 131st Street
- Broadway and West 130th Street
- Broadway and West 129th Street
- Broadway and West 125th Street
- Amsterdam Avenue and West 125th Street
- West 125th Street and West 129th Street/St. Clair Place (new post-2015 signalized intersection)
- Second Avenue and East 125th Street

Traffic

A detailed analysis of the study area intersections was conducted for the time periods and analysis scenarios described above. For peak Phase 1 construction in 2011 when West 130th Street between

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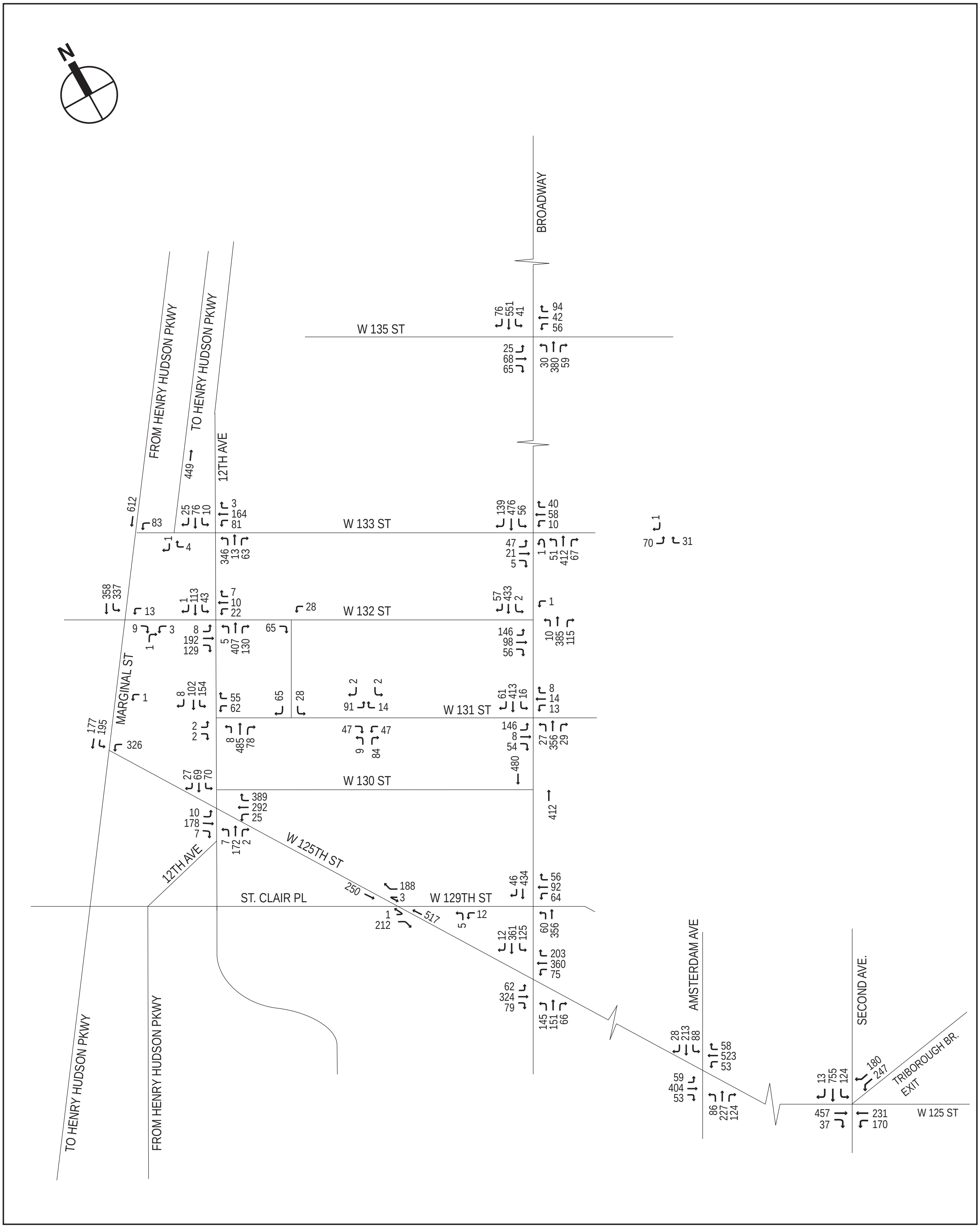

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Figure 21-26
2011 Construction Traffic Volumes
6-7 AM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

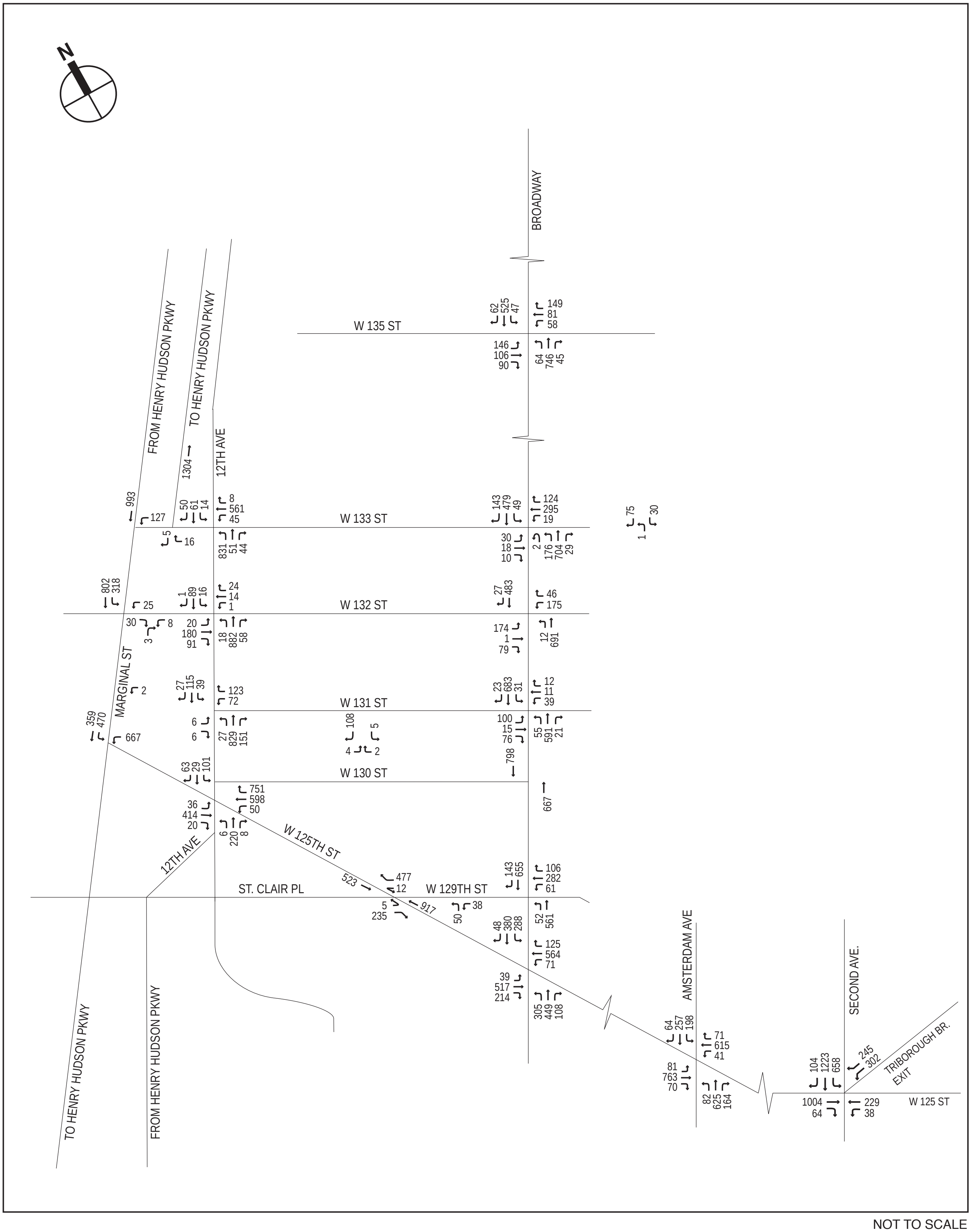

Figure 21-27
2011 Construction Traffic Volumes
3-4 PM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

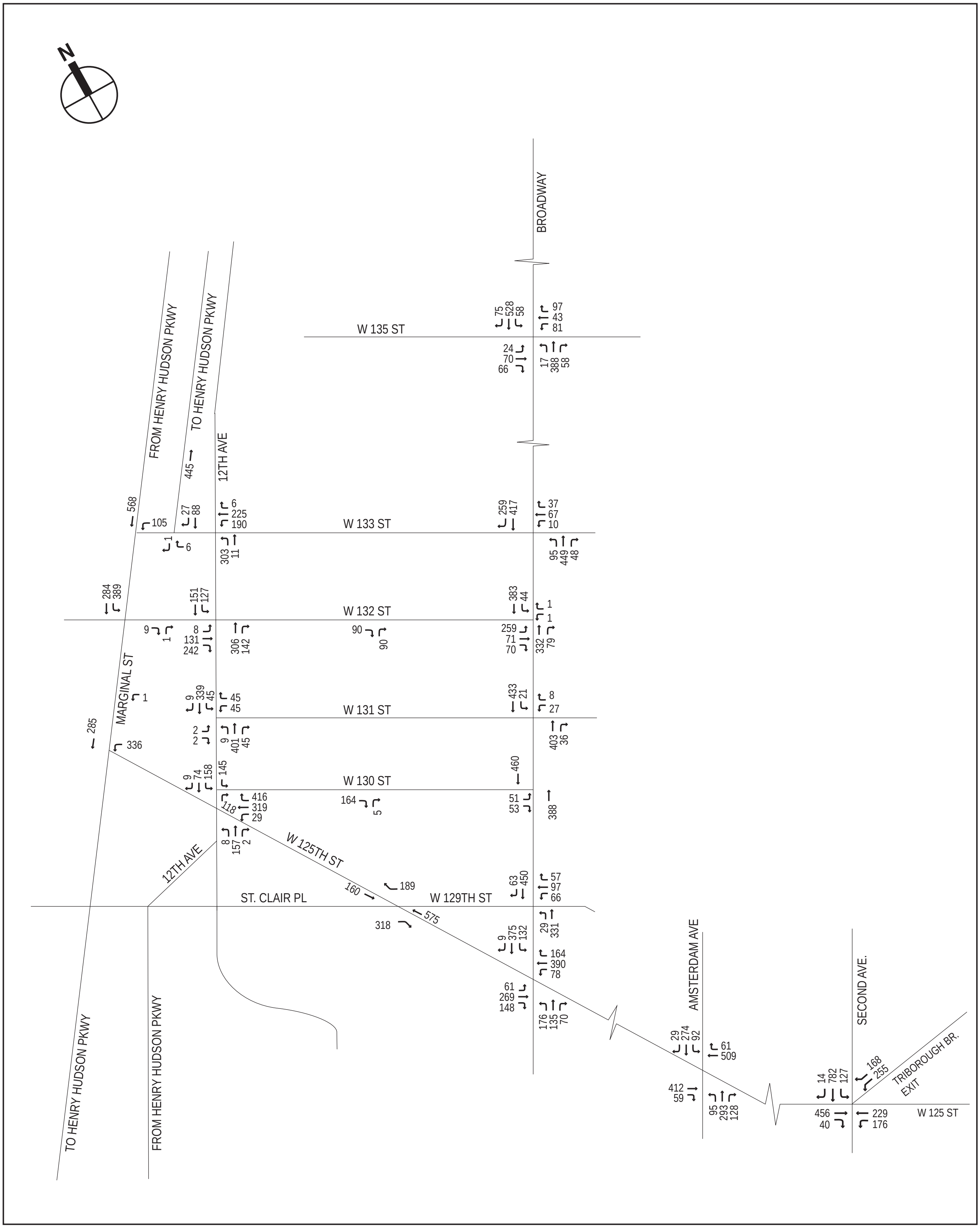

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Figure 21-28
2022 Construction Traffic Volumes
6-7 AM Peak Hour

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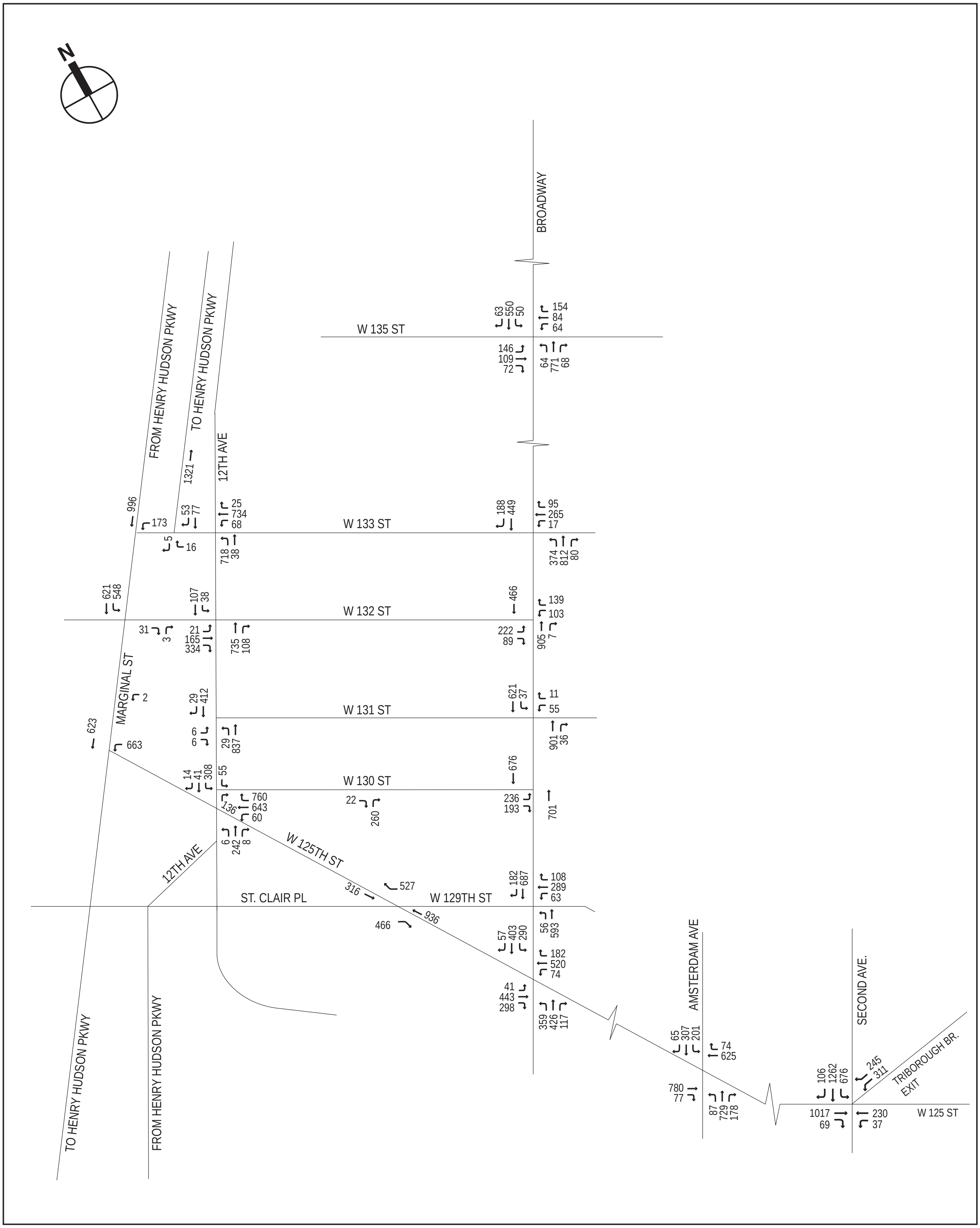

Figure 21-29
2022 Construction Traffic Volumes
3-4 PM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

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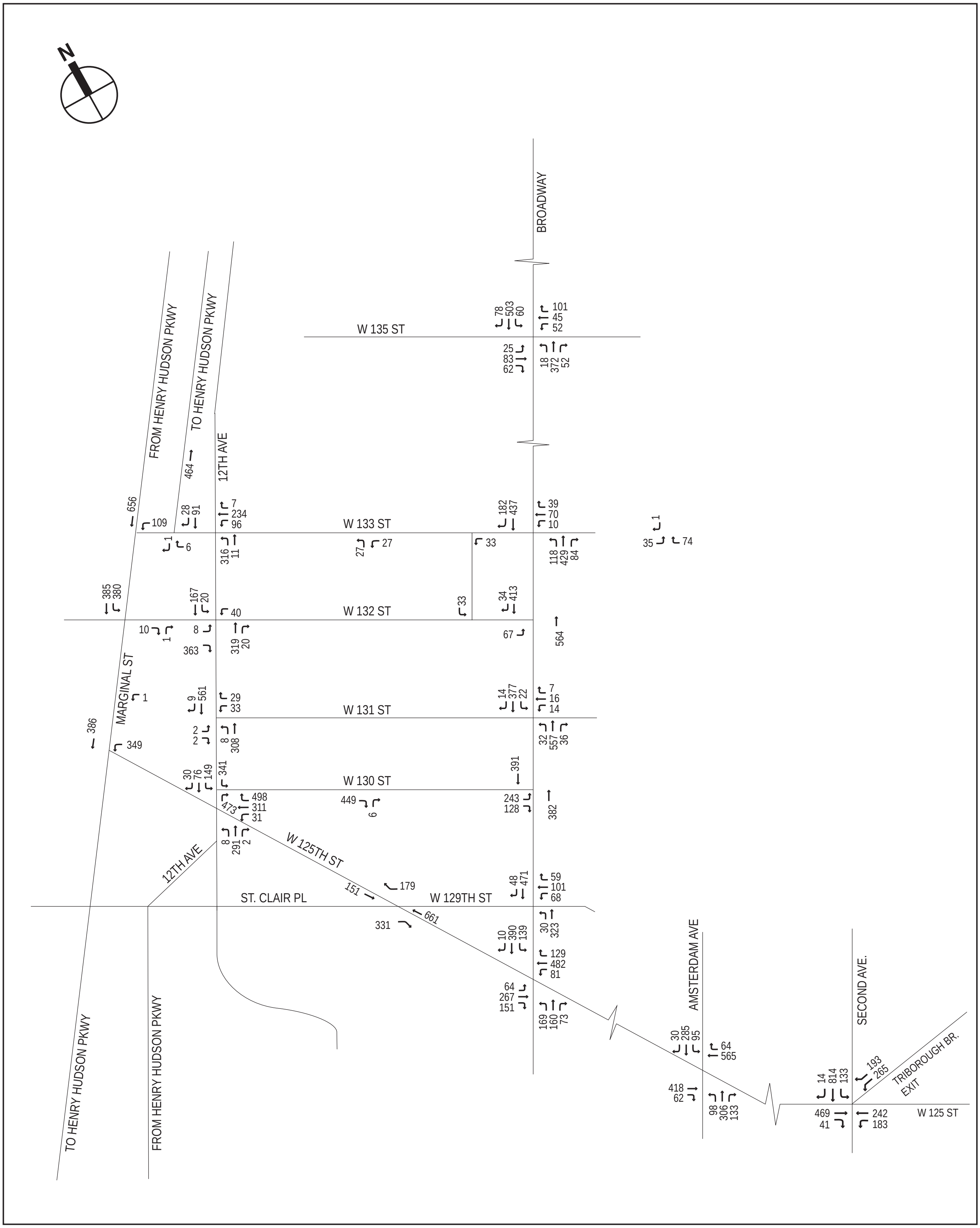

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Figure 21-30
2027 Construction Traffic Volumes
6-7 AM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING
AND ACADEMIC MIXED-USE DEVELOPMENT

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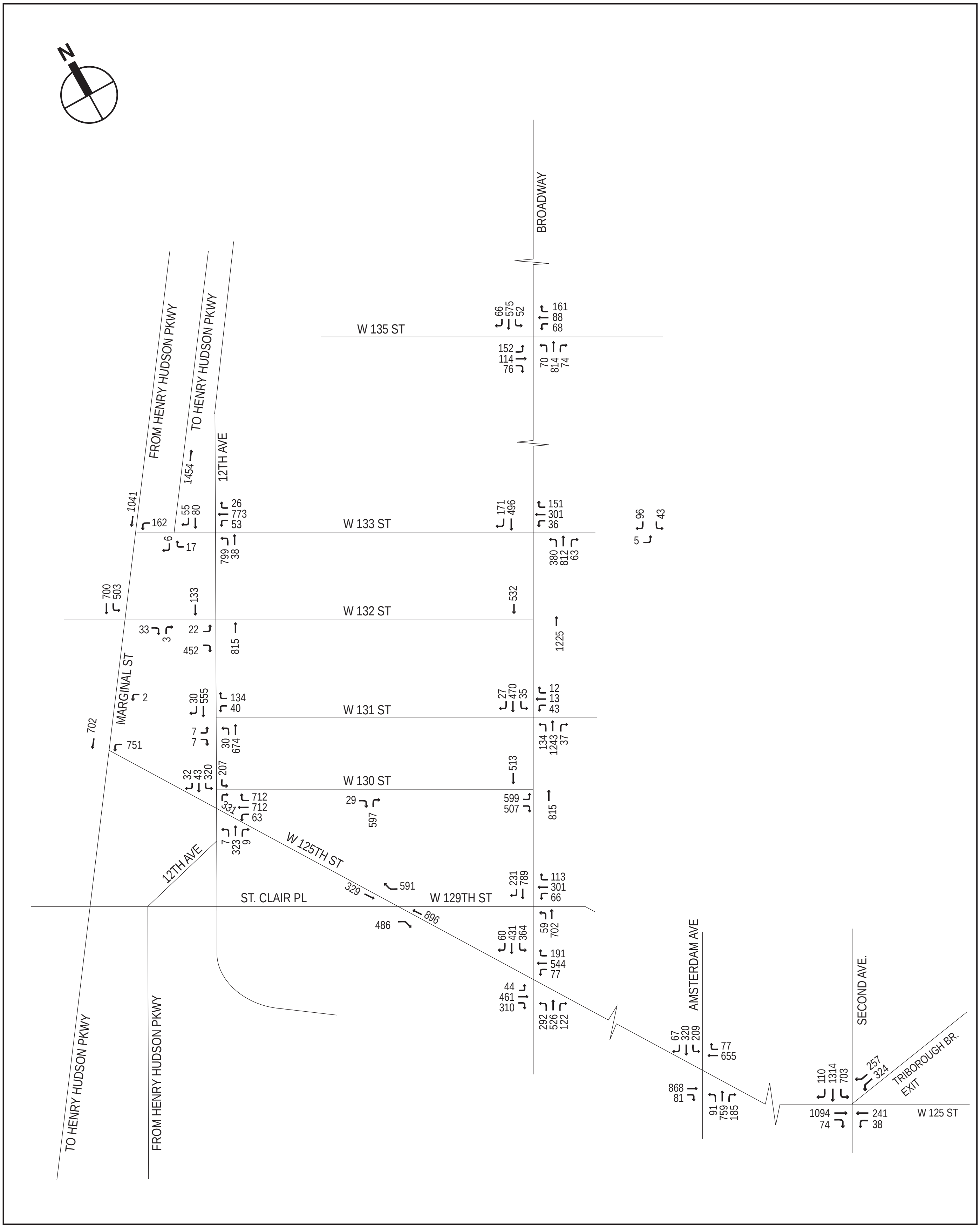

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Figure 21-31
2027 Construction Traffic Volumes
3-4 PM Peak Hour

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Broadway and Twelfth Avenue would also be closed to traffic, significant adverse traffic impacts were identified at one and five study area intersections during the 6:00–7:00 AM and 3:00–4:00 PM analysis hours, respectively. All projected impacts could be mitigated with either an early implementation of project improvements or mitigation strategies described in Chapter 23, "Mitigation," or applying other operational mitigation measures.

In 2022 when Phase 1 and some Phase 2 development would have been completed and West 131st Street between Broadway and Twelfth Avenue would also be closed to traffic, significant adverse traffic impacts were identified at one and two study area intersections during the 6:00–7:00 AM and 3:00–4:00 PM analysis hours, respectively. All projected impact could be mitigated with either an early implementation of project improvements or mitigation strategies described in Chapter 23, "Mitigation," or applying other operation mitigation measures.

For peak Phase 2 construction in 2027 when West 132nd Street between Broadway and Twelfth Avenue would also be closed to traffic, significant adverse traffic impacts were identified at two and four study area intersections during the 6:00–7:00 AM and 3:00–4:00 PM analysis hours, respectively. For the most part, the projected impacts could be fully mitigated with either an early implementation of mitigation strategies described in Chapter 23, "Mitigation," or by applying other standard traffic engineering measures. However, at the intersection of Broadway and West 130th Street during the 3:00–4:00 PM analysis hour, additional operational strategies involving lane channelization and the deployment of a traffic control officer (TCO) would be required to fully mitigate the projected significant adverse traffic impact.

Peak Phase 1 2011 Construction Analysis

The traffic analysis conducted for peak Phase 1 construction in 2011 encompasses a study area of 17 intersections and assumes that none of the project-related roadway improvements would be in place. For this analysis, construction worker vehicles were assigned to designated off-street parking facilities in the area, while construction trucks were assigned to driveways located along the perimeters of the construction site, including the West 130th Street intersection with Twelfth Avenue. A summary of the analysis results, comparing the 2011 No Build and construction traffic conditions, is presented in Table 21-4.

During the 6:00–7:00 AM analysis hour, projected construction activities are expected to result in significant adverse traffic impacts at one study area intersection, as follows.

- Second Avenue and West 125th Street—The eastbound through movement would deteriorate from LOS D to LOS E, with average vehicle delay increasing from 51.8 to 56.9 seconds (v/c ratio increasing from 0.88 to 0.92). The westbound through movement would deteriorate within LOS E, with average vehicle delay increasing from 56.4 to 77.9 seconds (v/c ratio increasing from 0.81 to 0.95).

During the 3:00–4:00 PM analysis hour, significant adverse traffic impacts were identified at five study area intersections, as follows.

Table 21-4
2011 Peak Phase 1 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Marginal Street @ West 133rd Street (Unsignalized)																
Westbound	L	0.12	10.1	B	L	0.11	10.1	B	L	0.19	10.4	B	L	0.17	10.3	B
Southbound	T	0.69	18.9	C	T	0.81	26.0	D	T	1.09	75.4	F	T	1.08	73.0	F
Marginal Street @ West 132nd Street (Unsignalized)																
Westbound	L	-	9.0	A	L	-	9.2	A	L	-	9.9	A	L	-	9.9	A
Southbound	LT	-	14.6	B	LT	-	19.9	C	LT	-	54.4	F	LT	-	49.9	E
	T	-	7.6	A	T	-	7.6	A	T	-	9.8	A	T	-	9.8	A
	Int.		13.3	B	Int.		17.9	C	Int.		40.8	E	Int.		37.6	E
Marginal Street @ West 125th Street																
Westbound	L	0.31	23.2	C	L	0.31	23.2	C	L	0.60	27.6	C	L	0.66	28.8	C
Southbound	LT	0.28	12.2	B	LT	0.28	12.1	B	LT	0.60	16.5	B	LT	0.60	16.4	B
	Int.		17.2	B	Int.		17.2	B	Int.		21.2	C	Int.		22.0	C
Twelfth Avenue @ West 133rd Street																
Westbound	LTR	0.45	26.0	C	LTR	0.60	30.0	C	LTR	1.23	150.6	F	LTR	1.41	226.9	F+
Northbound	L	0.35	13.2	B	L	0.35	13.2	B	L	0.81	28.6	C	L	0.81	27.9	C
	LTR	0.31	12.4	B	LTR	0.35	12.9	B	LTR	0.74	23.0	C	LTR	0.79	25.6	C
Southbound	LTR	0.09	9.9	A	LTR	0.09	9.9	A	LTR	0.10	10.0	A	LTR	0.10	10.0	A
	Int.		16.0	B	Int.		18.1	B	Int.		67.9	E	Int.		100.4	F
Twelfth Avenue @ West 132nd Street																
Eastbound	LTR	0.47	26.0	C	LTR	0.65	30.7	C	LTR	0.57	28.0	C	LTR	0.55	27.5	C
Westbound	LTR	0.07	20.1	C	LTR	0.11	20.6	C	LTR	0.11	20.5	C	LTR	0.08	20.2	C
Northbound	LTR	0.29	11.6	B	LTR	0.43	13.1	B	LTR	0.66	16.8	B	LTR	0.68	17.4	B
Southbound	LTR	0.08	9.9	A	LTR	0.16	10.5	B	LTR	0.06	9.7	A	LTR	0.09	10.0	A
	Int.		16.3	B	Int.		18.5	B	Int.		19.1	B	Int.		19.1	B
Twelfth Avenue @ West 131st Street (Unsignalized)																
Northbound	LT	0.01	7.6	A	LT	0.01	7.5	A	LT	0.02	7.7	A	LT	0.02	7.7	A
Southbound	LT	0.07	9.0	A	LT	0.21	10.5	B	LT	0.06	11.6	B	LT	0.08	12.3	B
Westbound	LTR	0.10	14.5	B	LTR	0.60	43.7	E	LTR	0.75	63.0	F	LTR	1.29	222.6	F+
Eastbound	LTR	0.01	11.8	B	LTR	0.01	15.5	C	LTR	0.04	17.9	C	LTR	0.05	20.7	C
Twelfth Avenue @ West 125th Street																
Eastbound	LTR	0.15	12.4	B	LTR	0.15	12.4	B	LTR	0.37	14.6	B	LTR	0.38	14.8	B
Westbound	L	0.08	12.1	B	L	0.07	12.1	B	L	0.25	14.8	B	L	0.18	13.6	B
	T	0.44	16.2	B	T	0.44	16.1	B	T	0.80	27.6	C	T	0.86	31.5	C
	R	0.57	19.6	B	R	0.67	22.8	C	R	1.08	79.5	E	R	1.08	77.3	E
Northbound	LTR	0.19	18.9	B	LTR	0.32	20.5	C	LTR	0.40	21.8	C	LTR	0.41	21.9	C
Southbound	LT	0.22	19.5	B	LT	0.41	23.3	C	LT	0.32	21.2	C	LT	0.38	22.7	C
	Int.		17.0	B	Int.		18.9	B	Int.		41.6	D	Int.		41.8	D
West 125th Street @ West 129th Street/St. Clair Place (Unsignalized)																
Westbound	L	0.03	34.0	D	L	0.03	35.8	E	L	1.18	792.4	F	L	0.93	574.3	F
	R	0.37	16.7	C	R	0.44	18.3	C	R	1.77	390.4	F	R	1.80	401.4	F+
Eastbound	L	0.00	18.5	C	L	0.00	21.9	C	L			F	L			F
	R	0.36	13.2	B	R	0.35	13.3	B	R	0.77	39.1	E	R	0.70	34.0	D
Broadway Northbound @ West 135th Street																
Eastbound	LT	0.21	23.8	C	LT	0.21	23.8	C	DefL	0.88	68.1	E	DefL	0.82	59.4	E
									T	0.39	27.3	C	T	0.39	27.3	C
Westbound	TR	0.30	25.4	C	TR	0.33	25.9	C	TR	0.51	29.1	C	TR	0.51	29.1	C
Northbound	LTR	0.30	6.1	A	LTR	0.41	6.9	A	LTR	0.62	9.1	A	LTR	0.63	9.4	A
	Int.		14.4	B	Int.		14.2	B	Int.		21.6	C	Int.		20.4	C
Broadway Southbound @ West 135th Street																
Eastbound	TR	0.25	24.7	C	TR	0.27	25.0	C	TR	0.64	31.7	C	TR	0.54	29.2	C
Westbound	LT	0.20	23.7	C	LT	0.24	24.3	C	LT	0.37	26.3	C	LT	0.37	26.1	C
Southbound	L	0.06	4.9	A	L	0.06	4.9	A	L	0.07	5.0	A	L	0.07	5.0	A
	TR	0.42	7.1	A	TR	0.50	7.8	A	TR	0.48	7.6	A	TR	0.48	7.5	A
	Int.		12.9	B	Int.		13.0	B	Int.		18.2	B	Int.		16.9	B

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Table 21-4 (Continued)
2011 Peak Phase 1 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Broadway Northbound @ West 133rd Street																
Eastbound	**LT**	**0.12**	**16.4**	**B**	**LT**	**0.23**	**17.6**	**B**	**LT**	**0.20**	**17.4**	**B**	**LT**	**0.21**	**17.5**	**B**
Westbound	**TR**	**0.30**	**20.5**	**C**	**TR**	**0.22**	**19.3**	**B**	**TR**	**0.82**	**36.9**	**D**	**TR**	**0.87**	**41.5**	**D**
Northbound	**LT**	**0.34**	**11.2**	**B**	**LT**	**0.44**	**12.2**	**B**	**LT**	**0.74**	**17.6**	**B**	**LT**	**0.79**	**19.4**	**B**
	R	**0.06**	**9.2**	**A**	**R**	**0.18**	**10.5**	**B**	**R**	**0.06**	**9.2**	**A**	**R**	**0.07**	**9.3**	**A**
	Int.		**14.0**	**B**	**Int.**		**13.9**	**B**	**Int.**		**23.2**	**C**	**Int.**		**25.7**	**C**
Broadway Southbound @ West 133rd Street																
Eastbound	**TR**	**0.07**	**17.5**	**B**	**TR**	**0.12**	**18.0**	**B**	**TR**	**0.09**	**17.7**	**B**	**TR**	**0.09**	**17.7**	**B**
Westbound	**LT**	**0.25**	**17.9**	**B**	**LT**	**0.21**	**17.4**	**B**	**LT**	**0.70**	**27.0**	**C**	**LT**	**0.79**	**30.8**	**C**
Southbound	**LTR**	**0.31**	**10.7**	**B**	**LTR**	**0.41**	**11.6**	**B**	**LTR**	**0.45**	**12.0**	**B**	**LTR**	**0.42**	**11.6**	**B**
	Int.		**12.6**	**B**	**Int.**		**13.0**	**B**	**Int.**		**17.5**	**B**	**Int.**		**19.6**	**B**
Broadway Northbound @ West 132nd Street																
Eastbound	**L**	**0.24**	**18.0**	**B**	**LT**	**0.53**	**25.2**	**C**	**L**	**0.30**	**18.5**	**B**	**LT**	**0.61**	**30.4**	**C**
Westbound					**TR**	**0.00**	**16.8**	**B**					**TR**	**0.34**	**20.6**	**C**
Northbound	**LT**	**0.24**	**10.2**	**B**	**LTR**	**0.41**	**11.8**	**B**	**LT**	**0.54**	**13.2**	**B**	**LTR**	**0.54**	**13.2**	**B**
	Int.		**12.2**	**B**	**Int.**		**16.2**	**B**	**Int.**		**14.2**	**B**	**Int.**		**17.5**	**B**
Broadway Southbound @ West 132nd Street																
Eastbound	**TR**	**0.37**	**21.8**	**C**	**TR**	**0.69**	**30.8**	**C**	**TR**	**0.43**	**22.5**	**C**	**TR**	**0.47**	**23.2**	**C**
Westbound	**LT**	**0.04**	**15.6**	**B**	**LT**	**0.02**	**15.4**	**B**	**LT**	**0.04**	**15.5**	**B**	**LT**	**0.74**	**37.4**	**D**
Southbound	**LTR**	**0.31**	**10.7**	**B**	**LTR**	**0.37**	**11.3**	**B**	**LTR**	**0.41**	**11.7**	**B**	**LTR**	**0.37**	**11.3**	**B**
	Int.		**13.8**	**B**	**Int.**		**18.8**	**B**	**Int.**		**14.9**	**B**	**Int.**		**19.6**	**B**
Broadway @ West 131st Street																
Eastbound	**LTR**	**0.12**	**20.6**	**C**	**LTR**	**0.53**	**28.1**	**C**	**LTR**	**0.20**	**21.6**	**C**	**LTR**	**0.46**	**26.2**	**C**
Westbound	**LT**	**0.06**	**20.0**	**C**	**LT**	**0.07**	**20.1**	**C**	**LT**	**0.15**	**21.2**	**C**	**LT**	**0.15**	**21.3**	**C**
	R	**0.02**	**19.6**	**B**	**R**	**0.02**	**19.6**	**B**	**R**	**0.03**	**19.7**	**B**	**R**	**0.04**	**19.8**	**B**
Northbound	**LTR**	**0.21**	**7.6**	**A**	**LTR**	**0.26**	**7.9**	**A**	**LTR**	**0.45**	**9.3**	**A**	**LTR**	**0.42**	**9.1**	**A**
Southbound	**LTR**	**0.29**	**8.1**	**A**	**LTR**	**0.31**	**8.2**	**A**	**LTR**	**0.40**	**8.9**	**A**	**LTR**	**0.45**	**9.4**	**A**
	Int.		**9.1**	**A**	**Int.**		**12.1**	**B**	**Int.**		**10.5**	**B**	**Int.**		**11.7**	**B**
Broadway @ West 130th Street																
Eastbound	**LR**	**0.15**	**24.0**	**C**	**LR**	**0.00**	**22.0**	**C**	**LR**	**0.30**	**26.3**	**C**	**LR**	**0.00**	**22.0**	**C**
Northbound	**LT**	**0.16**	**5.2**	**A**	**T**	**0.21**	**5.4**	**A**	**LT**	**0.31**	**5.9**	**A**	**T**	**0.30**	**5.9**	**A**
Southbound	**LT**	**0.22**	**5.5**	**A**	**T**	**0.23**	**5.5**	**A**	**LT**	**0.31**	**5.9**	**A**	**T**	**0.40**	**6.5**	**A**
	Int.		**6.5**	**A**	**Int.**		**5.5**	**A**	**Int.**		**7.4**	**A**	**Int.**		**6.2**	**A**
Broadway @ West 129th Street																
Westbound	**LT**	**0.25**	**16.5**	**B**	**LT**	**0.25**	**16.4**	**B**	**LT**	**0.51**	**20.6**	**C**	**LT**	**0.51**	**20.5**	**C**
	R	**0.12**	**15.2**	**B**	**R**	**0.12**	**15.2**	**B**	**R**	**0.26**	**16.9**	**B**	**R**	**0.26**	**16.9**	**B**
Northbound	**LT**	**0.30**	**16.7**	**B**	**LT**	**0.39**	**17.7**	**B**	**LT**	**0.65**	**22.4**	**C**	**LT**	**0.63**	**22.0**	**C**
Southbound	**TR**	**0.36**	**14.6**	**B**	**TR**	**0.34**	**14.4**	**B**	**TR**	**0.46**	**18.5**	**B**	**TR**	**0.58**	**20.3**	**C**
	Int.		**15.6**	**B**	**Int.**		**16.0**	**B**	**Int.**		**20.2**	**C**	**Int.**		**20.7**	**C**
Broadway @ West 125th Street																
Eastbound	**L**	**0.41**	**28.5**	**C**	**L**	**0.44**	**31.7**	**C**	**L**	**0.48**	**38.5**	**D**	**L**	**0.42**	**34.6**	**C**
	TR	**0.48**	**25.1**	**C**	**TR**	**0.53**	**26.0**	**C**	**TR**	**1.02**	**67.2**	**E**	**TR**	**1.01**	**64.5**	**E**
Westbound	**L**	**0.43**	**29.5**	**C**	**L**	**0.46**	**31.5**	**C**	**L**	**0.99**	**126.5**	**F**	**L**	**0.99**	**126.5**	**F**
	TR	**0.59**	**27.3**	**C**	**TR**	**0.78**	**33.4**	**C**	**TR**	**0.88**	**39.9**	**D**	**TR**	**0.87**	**38.7**	**D**
Northbound	**L**	**0.28**	**29.3**	**C**	**L**	**0.30**	**29.6**	**C**	**L**	**0.73**	**42.7**	**D**	**L**	**0.71**	**41.4**	**D**
	LT	**0.29**	**28.7**	**C**	**LT**	**0.31**	**29.0**	**C**	**LT**	**0.77**	**39.7**	**D**	**LT**	**0.78**	**40.1**	**D**
	R	**0.37**	**33.4**	**C**	**R**	**0.37**	**33.4**	**C**	**R**	**0.58**	**41.5**	**D**	**R**	**0.58**	**41.5**	**D**
Southbound	**L**	**0.31**	**29.5**	**C**	**L**	**0.29**	**29.2**	**C**	**L**	**0.46**	**31.9**	**C**	**L**	**0.62**	**35.9**	**D**
	LTR	**0.57**	**32.9**	**C**	**LTR**	**0.58**	**33.3**	**C**	**LTR**	**0.73**	**38.1**	**D**	**LTR**	**0.74**	**38.7**	**D**
	Int.		**28.8**	**C**	**Int.**		**30.9**	**C**	**Int.**		**48.1**	**D**	**Int.**		**47.2**	**D**

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Table 21-4 (Continued)
2011 Peak Phase 1 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Amsterdam Avenue @ West 125th Street																
Eastbound	**L**	**0.44**	**32.3**	**C**	**L**	**0.56**	**42.5**	**D**	**L**	**0.91**	**100.5**	**F**	**L**	**0.91**	**97.7**	**F**
	TR	**0.60**	**28.3**	**C**	**TR**	**0.64**	**29.5**	**C**	**TR**	**1.02**	**66.8**	**E**	**TR**	**1.09**	**90.1**	**F+**
Westbound	**L**	**0.35**	**28.6**	**C**	**L**	**0.38**	**29.8**	**C**	**L**	**0.57**	**51.5**	**D**	**L**	**0.57**	**51.5**	**D**
	TR	**0.61**	**28.4**	**C**	**TR**	**0.75**	**32.8**	**C**	**TR**	**0.91**	**44.7**	**D**	**TR**	**0.91**	**44.1**	**D**
Northbound	**L**	**0.19**	**11.0**	**B**	**L**	**0.19**	**11.0**	**B**	**L**	**0.21**	**16.1**	**B**	**L**	**0.21**	**16.1**	**B**
	TR	**0.44**	**21.8**	**C**	**TR**	**0.43**	**21.7**	**C**	**TR**	**0.86**	**34.5**	**C**	**TR**	**0.86**	**34.3**	**C**
Southbound	**L**	**0.28**	**14.1**	**B**	**L**	**0.28**	**14.0**	**B**	**L**	**0.69**	**39.6**	**D**	**L**	**0.69**	**39.8**	**D**
	TR	**0.26**	**19.3**	**B**	**TR**	**0.26**	**19.4**	**B**	**TR**	**0.77**	**35.8**	**D**	**TR**	**0.78**	**36.2**	**D**
	Int.		**24.4**	**C**	**Int.**		**26.7**	**C**	**Int.**		**47.0**	**D**	**Int.**		**53.5**	**D**
Second Avenue @ East 125th Street																
Eastbound	**T**	**0.88**	**51.8**	**D**	**T**	**0.92**	**56.9**	**E+**	**T**	**1.27**	**167.2**	**F**	**T**	**1.33**	**188.8**	**F+**
	R	**0.22**	**32.2**	**C**	**R**	**0.22**	**32.0**	**C**	**R**	**0.31**	**31.3**	**C**	**R**	**0.31**	**31.2**	**C**
Westbound	**DefL**	**0.68**	**45.3**	**D**	**DefL**	**0.68**	**45.3**	**D**	**LT**	**0.85**	**54.9**	**D**	**LT**	**0.85**	**54.6**	**D**
	T	**0.81**	**56.4**	**E**	**T**	**0.95**	**77.9**	**E+**								
Southbound	**LTR**	**0.35**	**18.0**	**B**	**LTR**	**0.35**	**18.0**	**B**	**LTR**	**0.84**	**28.6**	**C**	**LTR**	**0.84**	**28.6**	**C**
Southwestbound	**TR**	**0.73**	**40.8**	**D**	**TR**	**0.79**	**44.1**	**D**	**TR**	**1.00**	**73.2**	**E**	**TR**	**1.00**	**72.8**	**E**
	Int.		**35.2**	**D**	**Int.**		**39.7**	**D**	**Int.**		**70.8**	**E**	**Int.**		**77.2**	**E**

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

- Twelfth Avenue and West 133rd Street—The westbound approach would deteriorate within LOS F, with average vehicle delay increasing from 150.6 to 226.9 seconds (v/c ratio increasing from 1.23 to 1.41).
- Twelfth Avenue and West 131st Street—The westbound approach would deteriorate within LOS F, with average vehicle delay increasing from 63.0 to 222.6 seconds (v/c ratio increasing from 0.75 to 1.29).
- West 125th Street and West 129th Street/St. Clair Place—The westbound right-turn movement would deteriorate within LOS F, with average vehicle delay increasing from 390.4 to 401.4 seconds (v/c ratio increasing from 1.77 to 1.80).
- Amsterdam Avenue and West 125th Street—The eastbound through-right movement would deteriorate from LOS E to LOS F, with average vehicle delay increasing from 66.8 to 90.1 seconds (v/c ratio increasing from 1.02 to 1.09).
- Second Avenue and East 125th Street—The eastbound through movement would deteriorate within LOS F, with average vehicle delay increasing from 167.2 to 188.8 seconds (v/c ratio increasing from 1.27 to 1.33).

Although the left-turn movements from West 129th Street and St. Clair Place at West 125th Street are denoted as exceeding the CEQR impact threshold in Table 21-4, they are not considered significant adverse traffic impacts, as no incremental construction traffic volumes were assigned to these two movements. Potential measures to mitigate these impacts, including project-specific improvements, Build condition mitigation strategies, and other operational mitigation measures, are discussed below.

2022 Construction Analysis

The traffic analysis conducted for Phase 2 construction in 2022 encompasses a study area of 18 intersections and assumes that project-related roadway improvements as part of the Phase 1 Proposed Actions would be in place, and accounts for operational traffic from completed and occupied buildings. For this analysis, construction worker vehicles were assigned to designated areas within the completed on-site below-grade parking facility west of Broadway, which would be accessible via West 130th Street, as well as, to temporary off-street parking east of Broadway at West 132nd Street. Construction trucks were assigned to driveways located along the perimeters of the construction site, including the West 131st Street intersection with Twelfth Avenue and the West 132nd Street access between Broadway and Twelfth Avenue. A summary of the analysis results, comparing the 2022 No Build and construction traffic conditions, is presented in Table 21-5.

During the 6:00–7:00 AM analysis hour, significant adverse traffic impacts were identified at one study area intersection, as follows:

- Second Avenue and East 125th Street—The westbound through movement would deteriorate within LOS E, with average vehicle delay increasing from 59.4 to 75.6 seconds (v/c ratio increasing from 0.84 to 0.94).

During the 3:00–4:00 PM analysis hour, significant adverse traffic impacts were identified at two study area intersections, as follows:

- Amsterdam Avenue and West 125th Street—The eastbound through-right movement would deteriorate from LOS E to LOS F, with average vehicle delay increasing from 76.8 to 108.1 seconds (v/c ratio increasing from 1.05 to 1.14).
- Second Avenue and East 125th Street—The eastbound through movement would deteriorate within LOS F, with average vehicle delay increasing from 133.5 to 141.9 seconds (v/c ratio increasing from 1.20 to 1.22).

Potential measures to mitigate these impacts, including project-specific improvements, proposed mitigation strategies, and other operational mitigation measures, are discussed below.

Table 21-5
2022 Phase 2 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Marginal Street @ West 133rd Street (Unsignalized in No Build)																
Westbound	L	0.13	10.1	B	L	0.30	29.1	C	L	0.19	10.5	B	L	0.50	35.1	D
Southbound	T	0.70	19.4	C	T	0.57	11.8	B	T	1.12	87.2	F	T	0.83	17.5	B
					Int.		14.5	B					Int.		20.2	C
Marginal Street @ West 132nd Street (Unsignalized in No Build)																
Westbound	L	-	8.6	A					L	-	9.9	A				
Southbound	LT	-	14.6	B	LT	0.46	12.9	B	LT	-	63.3	F	LT	0.75	18.5	B
	T	-	7.6	A					T	-	10.0	A				
	Int.		13.3	B	Int.		12.9	B	Int.		47.0	E	Int.		18.5	B
Marginal Street @ West 125th Street																
Westbound	L	0.32	23.3	C	L	0.38	24.2	C	L	0.62	27.9	C	L	0.77	32.8	C
Southbound	LT	0.29	12.2	B	T	0.20	11.4	B	LT	0.63	16.9	B	T	0.45	14.0	B
	Int.		17.3	B	Int.		18.2	B	Int.		21.6	C	Int.		23.7	C
Twelfth Avenue @ West 133rd Street																
Westbound	LTR	0.47	26.4	C	L	0.45	26.0	C	LTR	1.26	163.4	F	L	0.17	21.3	C
					TR	0.28	22.1	C					TR	0.87	38.6	D
Northbound	L	0.39	13.9	B	L	0.40	14.1	B	L	0.81	28.1	C	L	0.84	31.5	C
	LTR	0.30	12.2	B	LT	0.21	11.5	B	LTR	0.79	25.7	C	LT	0.77	28.2	C
Southbound	LTR	0.09	10.0	A	TR	0.08	9.9	A	LTR	0.10	10.0	B	TR	0.10	10.0	A
	Int.		16.3	B	Int.		18.1	B	Int.		73.0	E	Int.		32.0	C
Twelfth Avenue @ West 132nd Street																
Eastbound	LTR	0.48	26.1	C	LTR	0.41	23.7	C	LTR	0.58	28.4	C	LTR	0.56	26.1	C
Westbound	LTR	0.07	20.1	C					LTR	0.11	20.6	C				
Northbound	LTR	0.30	11.7	B	TR	0.38	12.6	B	LTR	0.68	17.3	B	TR	0.61	15.8	B
Southbound					L	0.42	15.8	B					L	0.16	12.0	B
	LTR	0.08	9.9	A	LT	0.25	11.7	B	LTR	0.06	9.7	A	LT	0.17	10.8	B
	Int.		16.3	B	Int.		16.7	B	Int.		19.6	B	Int.		18.9	B
Twelfth Avenue @ West 131st Street (Unsignalized in No Build)																
Northbound	LT	0.01	7.5	A	LTR	0.35	12.2	B	LT	0.02	7.8	A	LT	0.68	17.4	B
Southbound	LT	0.08	9.4	A	LTR	0.33	12.0	B	LT	0.06	11.5	B	TR	0.30	11.6	B
Westbound	LTR	0.12	16.0	C	L	0.11	20.6	C	LTR	0.75	62.7	F	L	0.00	19.3	B
					LTR	0.03	19.6	B					LTR	0.00	19.3	B
					R	0.13	21.1	C					R	0.00	19.3	B
Eastbound	LTR	0.01	11.8	B	LR	0.01	19.4	B	LTR	0.04	17.7	C	LR	0.03	19.6	B
					Int.		13.0	B					Int.		15.5	B
Twelfth Avenue @ West 130th Street (New Signalized Intersection)																
Northbound					T	0.34	0.8	A					T	0.65	2.6	A
					R	0.36	2.9	A					R	0.57	8.8	A
Southbound					L	0.35	2.4	A					L	0.18	1.4	A
					T	0.17	9.6	A					T	0.28	10.0	B
					Int.		3.5	A					Int.		5.0	A
Twelfth Avenue @ West 125th Street																
Eastbound	LTR	0.16	12.4	B					LTR	0.39	14.9	B				
Westbound	L	0.08	12.1	B	LT	0.42	25.2	C	L	0.26	15.0	B	LT	0.83	37.2	D
	T	0.45	16.5	B					T	0.82	28.9	C				
	R	0.60	20.3	C	R	0.60	12.6	B	R	1.12	94.2	F	R	0.97	37.2	D
Northbound	LTR	0.20	18.9	B	LTR	0.28	29.4	C	LTR	0.42	22.0	C	LTR	0.49	34.2	C
Southbound	LT	0.23	19.6	B	L	0.70	27.8	C	LT	0.33	21.5	C	L	0.78	25.1	C
					TR	0.07	8.9	A					TR	0.04	8.3	A
	Int.		17.3	B			20.7	C	Int.		47.2	D			34.4	C
West 125th Street @ West 129th Street/St. Clair Place (Unsignalized in No Build)																
Westbound	L	0.04	37.7	E					L	2.17	1676	F				
	R	0.41	17.8	C	R	0.28	25.0	C	R	1.95	468.7	F	R	0.94	57.4	E
Eastbound	L	0.00	19.8	C					L			F				
	R	0.38	13.6	B	R	0.48	27.9	C	R	0.85	52.2	F	R	0.89	50.9	D
Northbound					T	0.54	25.0	C					T	0.89	34.8	C
Southbound					T	0.19	20.4	C					T	0.30	18.5	B
					Int.		25.1	C					Int.		41.1	D

Notes: L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Table 21-5 (Cont'd)
2022 Phase 2 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Broadway Northbound @ West 135th Street																
Eastbound	LT	0.21	23.9	C	LT	0.24	24.2	C	DefL	0.92	77.1	E	DefL	0.84	62.4	E
									T	0.41	27.6	C	T	0.40	27.3	C
Westbound	TR	0.31	25.6	C	TR	0.38	26.5	C	TR	0.53	29.4	C	TR	0.53	29.5	C
Northbound	LTR	0.31	6.2	A	LTR	0.41	7.0	A	LTR	0.64	9.5	A	LTR	0.68	10.2	B
	Int.		14.5	B	Int.		15.1	B	Int.		22.9	C	Int.		21.0	C
Broadway Southbound @ West 135th Street																
Eastbound	TR	0.26	24.9	C	TR	0.27	25.0	C	TR	0.66	32.4	C	TR	0.50	28.4	C
Westbound	LT	0.20	23.8	C	DefL	0.40	30.4	C	LT	0.39	26.6	C	LT	0.39	26.5	C
					T	0.15	23.5	C								
Southbound	L	0.06	4.9	A	L	0.09	5.0	A	L	0.07	5.0	A	L	0.08	5.0	A
	TR	0.44	7.2	A	TR	0.48	7.6	A	TR	0.50	7.8	A	TR	0.50	7.8	A
	Int.		13.0	B	Int.		13.5	B	Int.		18.5	B	Int.		16.6	B
Broadway Northbound @ West 133rd Street																
Eastbound	LT	0.13	16.4	B					LT	0.22	17.6	B				
Westbound	TR	0.31	20.6	C	TR	0.25	19.8	B	TR	0.86	40.9	D	TR	0.71	31.1	C
Northbound	LT	0.35	11.2	B	L	0.17	12.8	B	LT	0.76	18.3	B	L	0.61	15.9	B
					TR	0.49	12.9	B					TR	0.82	19.8	B
	R	0.07	9.3	A					R	0.05	9.1	A				
	Int.		14.1	B	Int.		14.0	B	Int.		24.9	C	Int.		21.4	B
Broadway Southbound @ West 133rd Street																
Eastbound	TR	0.08	17.5	B					TR	0.10	17.7	B				
Westbound	LT	0.26	18.0	B	LT	0.11	7.0	A	LT	0.72	27.7	C	LT	0.34	6.2	A
Southbound	LTR	0.32	10.8	B	TR	0.70	28.1	C	LTR	0.46	12.1	B	TR	0.72	32.4	C
	Int.		12.6	B	Int.		23.7	C	Int.		17.8	B	Int.		19.1	B
Broadway Northbound @ West 132nd Street																
Eastbound	L	0.24	18.0	B	L	0.55	25.3	C	L	0.30	18.6	B	L	0.58	29.3	C
					LT	0.42	22.5	C					LT	0.36	23.1	C
Westbound					TR	0.00	16.8	B					TR	0.50	24.1	C
Northbound	LT	0.25	10.3	B	TR	0.26	10.3	B	LT	0.56	13.5	B	TR	0.54	12.9	B
	Int.		12.2	B	Int.		16.8	B	Int.		14.4	B	Int.		17.2	B
Broadway Southbound @ West 132nd Street																
Eastbound	TR	0.37	21.9	C	TR	0.73	32.0	C	LT	0.45	22.8	C	TR	0.56	25.7	C
					R	0.29	21.8	C					R	0.16	19.3	B
Westbound	LT	0.04	15.6	B	L	0.00	16.9	B	LT	0.04	15.6	B	L	0.49	27.9	C
Southbound	LTR	0.32	10.8	B	LT	0.34	11.1	B	LTR	0.42	11.8	B	LT	0.37	11.4	B
	Int.		13.9	B	Int.		20.6	C	Int.		15.0	B	Int.		18.1	B
Broadway @ West 131st Street																
Eastbound	LTR	0.12	20.6	C					LTR	0.21	21.6	C				
Westbound	LT	0.07	20.1	C					LT	0.16	21.4	C				
	R	0.02	19.6	B					R	0.04	19.8	B				
Northbound	LTR	0.22	7.6	A					LTR	0.46	9.5	A				
Southbound	LTR	0.30	8.1	A					LTR	0.41	9.1	A				
	Int.		9.2	A					Int.		10.6	B				
Broadway Northbound @ West 131st Street																
Eastbound					T	0.05	19.9	B					T	0.08	20.2	C
Westbound					TR	0.05	19.8	B					TR	0.09	20.1	C
Northbound					TR	0.27	8.0	A					TR	0.52	10.0	B
					Int.		9.3	A					Int.		11.1	B
Broadway Southbound @ West 131st Street																
Westbound					L	0.03	19.6	B					L	0.06	19.9	B
Southbound					LT	0.32	8.4	A					LT	0.46	9.6	A
					Int.		9.1	A					Int.		10.4	B

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Table 21-5 (Cont'd)
2022 Phase 2 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Broadway @ West 130th Street																
Eastbound	LR	0.16	24.1	C	L	0.08	22.8	C	LR	0.31	26.4	C	L	0.31	23.3	C
					R	0.19	24.8	C					R	0.59	31.9	C
Northbound	LT	0.16	5.2	A	T	0.21	5.4	A	LT	0.32	6.0	A	T	0.36	8.0	A
Southbound	LT	0.23	5.5	A	LT	0.31	6.1	A	LT	0.32	6.0	A	LT	0.50	9.4	A
	Int.		6.5	A	Int.		7.8	A	Int.		7.4	A	Int.		13.1	B
Broadway @ West 129th Street																
Westbound	LT	0.26	16.6	B	LT	0.29	17.1	B	LT	0.54	21.1	C	LT	0.60	24.9	C
	R	0.12	15.2	B	R	0.15	15.7	B	R	0.25	16.8	B	R	0.36	21.1	C
Northbound	LT	0.31	16.8	B	LT	0.30	16.7	B	LT	0.67	23.1	C	LT	0.64	20.3	C
Southbound	TR	0.37	14.7	B	TR	0.53	17.2	B	TR	0.48	18.7	B	TR	0.81	26.3	C
	Int.		15.7	B	Int.		16.9	B	Int.		20.6	C	Int.		23.8	C
Broadway @ West 125th Street																
Eastbound	L	0.43	29.4	C	L	0.34	27.3	C	L	0.34	27.6	C	L	0.37	33.0	C
	TR	0.52	26.0	C	T	0.32	23.3	C	TR	1.07	79.6	E	T	0.59	29.3	C
					R	0.44	14.9	B					R	0.98	63.7	E
Westbound	L	0.45	30.6	C	L	0.49	33.2	C	L	1.02	136.7	F	L	0.72	60.0	E
	TR	0.61	27.7	C	T	0.46	25.3	C	T	0.60	26.2	C	T	0.65	30.7	C
					R	0.43	14.3	B	R	0.55	30.8	C	R	0.52	18.4	B
Northbound	L	0.29	29.4	C	L	0.38	34.7	C	L	0.72	41.9	D	L	0.75	45.1	D
	LT	0.30	28.8	C	T	0.18	22.4	C	LT	0.82	42.8	D	T	0.49	24.8	C
	R	0.39	34.2	C	R	0.41	30.1	C	R	0.61	43.3	D	R	0.60	35.7	D
Southbound	L	0.30	29.4	C	L	0.28	33.3	C	L	0.49	33.5	C	L	0.53	37.0	D
	LTR	0.60	33.6	C	T	0.43	25.3	C	LTR	0.78	41.8	D	T	0.47	24.3	C
					R	0.07	22.0	C					R	0.30	24.9	C
	Int.		29.4	C	Int.		25.0	C	Int.		49.5	D	Int.		34.0	C
Amsterdam Avenue @ West 125th Street																
Eastbound	TR	0.68	33.1	C	TR	0.75	35.9	D	TR	1.05	76.8	E	TR	1.14	108.1	F+
Westbound	TR	0.71	33.4	C	TR	0.83	39.4	D	TR	0.94	48.3	D	TR	0.95	49.8	D
Northbound	L	0.19	10.0	A	L	0.22	10.3	B	L	0.24	18.4	B	L	0.26	18.9	B
	TR	0.47	20.4	C	TR	0.47	20.3	C	TR	0.97	49.5	D	TR	0.98	50.3	D
Southbound	L	0.28	13.3	B	L	0.28	13.3	B	L	0.75	47.1	D	L	0.74	46.9	D
	TR	0.30	17.9	B	TR	0.31	18.0	B	TR	0.89	47.8	D	TR	0.90	49.4	D
	Int.		25.6	C	Int.		28.5	C	Int.		54.8	D	Int.		64.4	E
Second Avenue @ East 125th Street																
Eastbound	T	0.90	54.6	D	T	0.91	56.6	E	T	1.20	133.5	F	T	1.22	141.9	F+
	R	0.22	32.2	C	R	0.24	32.4	C	R	0.29	29.1	C	R	0.28	28.7	C
Westbound	DefL	0.71	46.9	D	DefL	0.71	46.9	D	LT	0.79	46.0	D	LT	0.77	44.4	D
	T	0.84	59.4	E	T	0.94	75.6	E+								
Southbound	L	0.30	21.9	C	L	0.30	21.8	C	L	1.72	363.5	F	L	1.71	359.6	F
	TR	0.40	20.1	C	TR	0.40	20.1	C	TR	0.76	29.2	C	TR	0.76	29.1	C
Southwestbound	TR	0.68	37.1	D	TR	0.70	37.5	D	TR	0.98	66.8	E	TR	0.96	62.4	E
	Int.		36.4	D	Int.		38.9	D	Int.		120.4	F	Int.		121.2	E

Notes: L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Peak Phase 2 2027 Construction Analysis

The traffic analysis conducted for peak Phase 2 construction in 2027 encompasses a study area of 18 intersections and assumes that project-related roadway improvements as part of the Phase 1 Proposed Actions would be in place and accounts for operational traffic from completed and occupied buildings. For this analysis, construction worker vehicles were assigned to designated areas within the on-site below-grade parking facilities, while construction trucks were assigned to driveways located along the perimeters of the construction site, including the West 132nd Street intersections with Broadway and Twelfth Avenue. In addition, because future driveway locations along West 132nd and West 133rd Street between Broadway and Twelfth Avenue would not be available by the 2027 analysis year, all vehicles destined for the below-grade parking west of Broadway were assigned to the West 130th Street access location. A summary of the analysis results, comparing the 2027 No Build and construction traffic conditions, is presented in Table 21-6.

During the 6:00–7:00 AM analysis hour, significant adverse traffic impacts were identified at two study area intersections, as follows:

- Amsterdam Avenue and West 125th Street—The westbound through-right movement would deteriorate from LOS C to LOS D, with average vehicle delay increasing from 34.3 to 47.1 seconds (v/c ratio increasing from 0.73 to 0.91).
- Second Avenue and East 125th Street—The westbound through movement would deteriorate from LOS E to LOS F, with average vehicle delay increasing from 62.4 to 88.3 seconds (v/c ratio increasing from 0.86 to 0.99)

During the 3:00–4:00 PM analysis hour, significant adverse traffic impacts were identified at four study area intersections, as follows:

- Broadway Northbound and West 133rd Street—The westbound approach would deteriorate from LOS D to LOS E, with average vehicle delay increasing from 44.0 to 70.3 seconds (v/c ratio increasing from 0.88 to 0.99).
- Broadway and West 130th Street—The eastbound right-turn movement would deteriorate from a No Build LOS C (left-right shared movement) to LOS F, with an average vehicle delay of 295.0 seconds and a v/c ratio of 1.56.
- Amsterdam Avenue and West 125th Street—The eastbound through-right movement would deteriorate within LOS F, with average vehicle delay increasing from 87.2 to 155.0 seconds (v/c ratio increasing from 1.08 to 1.26).
- Second Avenue and East 125th Street—The eastbound through movement would deteriorate within LOS F, with average vehicle delay increasing from 147.1 to 181.0 seconds (v/c ratio increasing from 1.23 to 1.31).

Potential measures to mitigate these impacts, including project-specific improvements, proposed mitigation strategies, and other operational mitigation measures, are discussed below.

Table 21-6
2027 Peak Phase 2 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Marginal Street @ West 133rd Street (Unsignalized in No Build)																
Westbound	L	0.13	10.2	B	L	0.32	29.3	C	L	0.20	10.5	B	L	0.47	34.3	C
Southbound	T	0.72	20.2	C	T	0.66	13.7	B	T	1.16	101.7	F	T	0.87	19.8	B
					Int.		16.0	B					Int.		21.9	C
Marginal Street @ West 132nd Street (Unsignalized in No Build)																
Westbound	L	-	8.6	A					L	-	9.9	A				
Southbound	LT	-	15.2	C	LT	0.52	13.6	B	LT	-	75.5	F	LT	0.77	19.0	B
	T	-	7.7	A					T	-	10.2	B				
	Int.		13.8	B	Int.		13.6	B	Int.		55.5	F	Int.		19.0	B
Marginal Street @ West 125th Street																
Westbound	L	0.33	23.4	C	L	0.39	24.4	C	L	0.63	28.2	C	L	0.87	38.6	D
Southbound	LT	0.30	12.3	B	T	0.27	12.1	B	LT	0.65	17.3	B	T	0.50	14.7	B
	Int.		17.4	B	Int.		17.8	B	Int.		22.0	C	Int.		27.1	C
Twelfth Avenue @ West 133rd Street																
Westbound	LTR	0.48	26.7	C	L	0.23	22.1	C	LTR	1.30	178.0	F	L	0.13	20.8	C
					TR	0.29	22.2	C					TR	0.92	43.4	D
Northbound	L	0.41	14.2	B	L	0.42	14.4	B	L	0.84	30.9	C	L	0.92	42.3	D
	LTR	0.31	12.4	B	LT	0.22	11.6	B	LTR	0.83	28.2	C	LT	0.88	38.7	D
Southbound	LTR	0.10	10.0	B	TR	0.09	9.9	A	LTR	0.10	10.0	B	TR	0.10	10.0	B
	Int.		16.5	B	Int.		16.8	B	Int.		79.2	E	Int.		39.0	D
Twelfth Avenue @ West 132nd Street																
Eastbound	LTR	0.49	26.2	C	LTR	0.43	24.2	C	LTR	0.60	29.0	C	LTR	0.56	26.3	C
Westbound	LTR	0.07	20.1	C	LR	0.13	21.1	C	LTR	0.12	20.6	C	LR	0.00	19.3	B
Northbound	LTR	0.31	11.8	B	TR	0.25	11.2	B	LTR	0.71	18.0	B	TR	0.56	14.9	B
Southbound					L	0.06	9.9	A					L	0.00	9.3	A
	LTR	0.08	9.9	A	LT	0.27	12.0	B	LTR	0.06	9.7	A	LT	0.19	11.0	B
	Int.		16.3	B	Int.		16.9	B	Int.		20.1	C	Int.		18.4	B
Twelfth Avenue @ West 131st Street (Unsignalized in No Build)																
Northbound	LT	0.01	7.5	A	LT	0.24	11.2	B	LT	0.02	7.8	A	LT	0.56	15.1	B
Southbound	LT	0.08	9.5	A	TR	0.44	13.2	B	LT	0.06	11.7	B	TR	0.42	13.0	B
Westbound	LTR	0.13	16.5	C	L	0.07	20.2	C	LTR	0.81	73.7	F	L	0.08	20.3	C
					LTR	0.04	19.8	B					LTR	0.09	20.4	C
					R	0.08	20.3	C					R	0.30	23.4	C
Eastbound	LTR	0.01	13.3	B	LR	0.01	19.4	B	LTR	0.05	18.6	C	LR	0.03	19.6	B
					Int.		13.1	B					Int.		15.2	B
Twelfth Avenue @ West 130th Street (New Signalized Intersection)																
Northbound					T	0.23	0.5	A					T	0.53	1.6	A
					R	1.43	210.8	F					R	1.38	196.7	E
Southbound					L	0.83	16.9	B					L	0.62	7.9	A
					T	0.18	9.7	A					T	0.30	10.3	B
					Int.		78.1	E					Int.		43.8	D
Twelfth Avenue @ West 125th Street																
Eastbound	LTR	0.16	12.5	B					LTR	0.41	15.2	B				
Westbound	L	0.08	12.2	B	LT	0.41	25.1	C	L	0.27	15.3	B	LT	0.91	44.7	D
	T	0.47	16.7	B					T	0.85	30.8	C				
	R	0.62	21.0	C	R	0.72	16.4	B	R	1.16	110.3	F	R	0.91	27.3	C
Northbound	LTR	0.20	19.0	B	LTR	0.51	32.8	C	LTR	0.43	22.3	C	LTR	0.65	37.8	D
Southbound	LT	0.24	19.7	B	L	0.61	21.4	C	LT	0.35	21.9	C	L	0.80	26.6	C
					TR	0.09	9.0	A					TR	0.06	8.4	A
	Int.		17.6	B			22.2	C	Int.		53.5	D			34.2	C

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Table 21-6 (Cont'd)
2027 Peak Phase 2 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
West 125th Street @ West 129th Street/St. Clair Place (Unsignalized in No Build)																
Westbound	**L**	**0.04**	**39.6**	**E**					**L**	**3.25**	**2665**	**F**				
	R	**0.43**	**18.4**	**C**	**R**	**0.26**	**24.8**	**C**	**R**	**2.07**	**524.0**	**F**	**R**	**1.05**	**85.3**	**F**
Eastbound	**L**	**0.00**	**20.7**	**C**					**L**			**F**				
	R	**0.40**	**13.9**	**B**	**R**	**0.50**	**28.3**	**C**	**R**	**0.89**	**58.4**	**F**	**R**	**0.93**	**56.3**	**E**
Northbound					**T**	**0.63**	**26.6**	**C**					**T**	**0.85**	**31.8**	**C**
Southbound					**T**	**0.17**	**20.3**	**C**					**T**	**0.31**	**18.6**	**B**
					Int.		**26.0**	**C**					**Int.**		**48.7**	**D**
Broadway Northbound @ West 135th Street																
Eastbound	**LT**	**0.22**	**24.0**	**C**	**LT**	**0.26**	**24.4**	**C**	**DefL**	**0.96**	**86.8**	**F**	**DefL**	**0.90**	**73.3**	**E**
									T	**0.42**	**27.8**	**C**	**T**	**0.41**	**27.6**	**C**
Westbound	**TR**	**0.32**	**25.7**	**C**	**TR**	**0.35**	**26.1**	**C**	**TR**	**0.55**	**30.0**	**C**	**TR**	**0.56**	**30.1**	**C**
Northbound	**LTR**	**0.32**	**6.3**	**A**	**LTR**	**0.39**	**6.8**	**A**	**LTR**	**0.66**	**9.9**	**A**	**LTR**	**0.72**	**11.1**	**B**
	Int.		**14.6**	**B**	**Int.**		**15.1**	**B**	**Int.**		**24.3**	**C**	**Int.**		**22.6**	**C**
Broadway Southbound @ West 135th Street																
Eastbound	**TR**	**0.27**	**25.0**	**C**	**TR**	**0.28**	**25.1**	**C**	**TR**	**0.67**	**32.9**	**C**	**TR**	**0.52**	**28.8**	**C**
Westbound	**LT**	**0.21**	**23.8**	**C**	**DefL**	**0.26**	**26.8**	**C**	**LT**	**0.41**	**27.0**	**C**	**LT**	**0.42**	**27.1**	**C**
					T	**0.16**	**23.6**	**C**								
Southbound	**L**	**0.06**	**4.9**	**A**	**L**	**0.09**	**5.1**	**A**	**L**	**0.08**	**5.0**	**A**	**L**	**0.08**	**5.0**	**A**
	TR	**0.45**	**7.4**	**A**	**TR**	**0.46**	**7.5**	**A**	**TR**	**0.52**	**8.0**	**A**	**TR**	**0.52**	**8.0**	**A**
	Int.		**13.1**	**B**	**Int.**		**12.9**	**B**	**Int.**		**18.8**	**B**	**Int.**		**17.0**	**B**
Broadway Northbound @ West 133rd Street																
Eastbound	**LT**	**0.13**	**16.5**	**B**					**LT**	**0.24**	**17.9**	**B**				
Westbound	**TR**	**0.32**	**20.7**	**C**	**TR**	**0.26**	**19.9**	**B**	**TR**	**0.88**	**44.0**	**D**	**TR**	**0.96**	**55.6**	**E+**
Northbound	**LT**	**0.36**	**11.3**	**B**	**L**	**0.21**	**13.3**	**B**	**LT**	**0.79**	**19.2**	**B**	**L**	**0.63**	**16.1**	**B**
					TR	**0.53**	**13.7**	**B**					**TR**	**0.79**	**18.5**	**B**
	R	**0.07**	**9.3**	**A**					**R**	**0.06**	**9.1**	**A**				
	Int.		**14.2**	**B**	**Int.**		**14.6**	**B**	**Int.**		**26.4**	**C**	**Int.**		**28.2**	**C**
Broadway Southbound @ West 133rd Street																
Eastbound	**TR**	**0.08**	**17.6**	**B**					**TR**	**0.10**	**17.8**	**B**				
Westbound	**LT**	**0.26**	**18.0**	**B**	**LT**	**0.12**	**7.1**	**A**	**LT**	**0.74**	**28.4**	**C**	**LT**	**0.38**	**6.4**	**A**
Southbound	**LTR**	**0.33**	**10.9**	**B**	**TR**	**0.60**	**25.6**	**C**	**LTR**	**0.48**	**12.3**	**B**	**TR**	**0.74**	**32.8**	**C**
	Int.		**12.7**	**B**	**Int.**		**21.0**	**C**	**Int.**		**18.1**	**B**	**Int.**		**19.1**	**B**
Broadway Northbound @ West 132nd Street																
Eastbound	**L**	**0.25**	**18.1**	**B**	**L**	**0.08**	**15.8**	**B**	**L**	**0.31**	**18.7**	**B**	**L**	**0.00**	**16.8**	**B**
Northbound	**LT**	**0.26**	**10.4**	**B**	**T**	**0.36**	**11.1**	**B**	**LT**	**0.57**	**13.8**	**B**	**T**	**0.74**	**16.4**	**B**
	Int.		**12.3**	**B**	**Int.**		**11.6**	**B**	**Int.**		**14.7**	**B**	**Int.**		**16.4**	**B**
Broadway Southbound @ West 132nd Street																
Eastbound	**TR**	**0.38**	**22.0**	**C**	**TR**	**0.12**	**18.1**	**B**	**LT**	**0.46**	**23.0**	**C**	**TR**	**0.00**	**16.8**	**B**
Westbound	**LT**	**0.04**	**15.6**	**B**					**LT**	**0.04**	**15.6**	**B**				
Southbound	**LTR**	**0.33**	**10.9**	**B**	**LTR**	**0.38**	**11.6**	**B**	**LTR**	**0.44**	**12.0**	**B**	**LTR**	**0.43**	**12.0**	**B**
	Int.		**14.0**	**B**	**Int.**		**12.4**	**B**	**Int.**		**15.2**	**B**	**Int.**		**12.0**	**B**
Broadway @ West 131st Street																
Eastbound	**LTR**	**0.12**	**20.7**	**C**					**LTR**	**0.21**	**21.7**	**C**				
Westbound	**LT**	**0.08**	**20.2**	**C**					**LT**	**0.16**	**21.4**	**C**				
	R	**0.02**	**19.6**	**B**					**R**	**0.04**	**19.8**	**B**				
Northbound	**LTR**	**0.23**	**7.7**	**A**					**LTR**	**0.48**	**9.7**	**A**				
Southbound	**LTR**	**0.31**	**8.2**	**A**					**LTR**	**0.43**	**9.2**	**A**				
	Int.		**9.3**	**A**					**Int.**		**10.8**	**B**				
Broadway Northbound @ West 131st Street																
Eastbound					**T**	**0.05**	**19.9**	**B**					**T**	**0.08**	**20.1**	**C**
Westbound					**TR**	**0.05**	**19.8**	**B**					**TR**	**0.09**	**20.2**	**C**
Northbound					**LTR**	**0.39**	**8.9**	**A**					**LTR**	**0.82**	**15.7**	**B**
					Int.		**9.8**	**A**					**Int.**		**16.0**	**B**
Broadway Southbound @ West 131st Street																
Westbound					**LT**	**0.08**	**20.0**	**C**					**LT**	**0.22**	**21.4**	**C**
Southbound					**LTR**	**0.32**	**8.5**	**A**					**LTR**	**0.42**	**9.2**	**A**
					Int.		**10.0**	**B**					**Int.**		**12.4**	**B**

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Table 21-6 (Cont'd)
2027 Peak Phase 2 Construction: LOS Analysis Results

Intersection	6–7 AM Construction Peak Hour								3–4 PM Construction Peak Hour							
	No Build				Construction				No Build				Construction			
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS
Broadway @ West 130th Street																
Eastbound	**LR**	**0.16**	**24.2**	**C**	**L**	**0.39**	**26.6**	**C**	**LR**	**0.32**	**26.7**	**C**	**L**	**0.80**	**35.2**	**D**
					R	**0.47**	**30.8**	**C**					**R**	**1.56**	**295.0**	**F+**
Northbound	**LT**	**0.17**	**5.2**	**A**	**T**	**0.21**	**5.4**	**A**	**LT**	**0.33**	**6.0**	**A**	**T**	**0.42**	**8.4**	**A**
Southbound	**LT**	**0.24**	**5.6**	**A**	**LT**	**0.26**	**5.8**	**A**	**LT**	**0.33**	**6.1**	**A**	**LT**	**0.38**	**8.3**	**A**
	Int.		**6.6**	**A**	**Int.**		**13.0**	**B**	**Int.**		**7.5**	**A**	**Int.**		**75.4**	**E**
Broadway @ West 129th Street																
Westbound	**LT**	**0.27**	**16.7**	**B**	**LT**	**0.30**	**17.2**	**B**	**LT**	**0.56**	**21.5**	**C**	**LT**	**0.63**	**25.6**	**C**
	R	**0.13**	**15.3**	**B**	**R**	**0.16**	**15.8**	**B**	**R**	**0.26**	**16.9**	**B**	**R**	**0.38**	**21.5**	**C**
Northbound	**LT**	**0.32**	**16.9**	**B**	**LT**	**0.30**	**16.6**	**B**	**LT**	**0.70**	**23.8**	**C**	**LT**	**0.78**	**25.0**	**C**
Southbound	**TR**	**0.38**	**14.9**	**B**	**TR**	**0.53**	**17.1**	**B**	**TR**	**0.50**	**18.9**	**B**	**TR**	**0.97**	**42.4**	**D**
	Int.		**15.8**	**B**	**Int.**		**16.9**	**B**	**Int.**		**21.1**	**C**	**Int.**		**32.7**	**C**
Broadway @ West 125th Street																
Eastbound	**L**	**0.46**	**30.9**	**C**	**L**	**0.43**	**31.0**	**C**	**L**	**0.37**	**28.9**	**C**	**L**	**0.42**	**35.8**	**D**
	TR	**0.53**	**26.3**	**C**	**T**	**0.32**	**23.3**	**C**	**TR**	**1.10**	**89.8**	**F**	**T**	**0.61**	**29.9**	**C**
					R	**0.45**	**15.2**	**B**					**R**	**1.02**	**74.6**	**E**
Westbound	**L**	**0.48**	**31.6**	**C**	**L**	**0.50**	**33.8**	**C**	**L**	**1.08**	**151.6**	**F**	**L**	**0.78**	**69.8**	**E**
	TR	**0.63**	**28.2**	**C**	**T**	**0.57**	**27.2**	**C**	**T**	**0.62**	**26.6**	**C**	**T**	**0.68**	**31.5**	**C**
					R	**0.34**	**12.6**	**B**	**R**	**0.57**	**31.3**	**C**	**R**	**0.55**	**19.2**	**B**
Northbound	**L**	**0.30**	**29.6**	**C**	**L**	**0.36**	**34.5**	**C**	**L**	**0.75**	**44.2**	**D**	**L**	**0.61**	**39.6**	**D**
	LT	**0.31**	**29.0**	**C**	**T**	**0.21**	**22.8**	**C**	**LT**	**0.85**	**44.7**	**D**	**T**	**0.61**	**27.1**	**C**
	R	**0.40**	**34.6**	**C**	**R**	**0.42**	**30.6**	**C**	**R**	**0.63**	**44.8**	**D**	**R**	**0.62**	**37.4**	**D**
Southbound	**L**	**0.33**	**29.8**	**C**	**L**	**0.29**	**33.5**	**C**	**L**	**0.51**	**33.8**	**C**	**L**	**0.67**	**40.3**	**D**
	LTR	**0.61**	**33.9**	**C**	**T**	**0.44**	**25.5**	**C**	**LTR**	**0.82**	**44.0**	**D**	**T**	**0.50**	**24.8**	**C**
					R	**0.07**	**22.2**	**C**					**R**	**0.32**	**25.4**	**C**
	Int.		**29.8**	**C**	**Int.**		**25.8**	**C**	**Int.**		**53.3**	**D**	**Int.**		**35.5**	**D**
Amsterdam Avenue @ West 125th Street																
Eastbound	**TR**	**0.71**	**33.9**	**C**	**TR**	**0.77**	**36.7**	**D**	**TR**	**1.08**	**87.2**	**F**	**TR**	**1.26**	**155.0**	**F+**
Westbound	**TR**	**0.73**	**34.3**	**C**	**TR**	**0.91**	**47.1**	**D+**	**TR**	**0.97**	**54.5**	**D**	**TR**	**0.99**	**59.3**	**E**
Northbound	**L**	**0.20**	**10.2**	**B**	**L**	**0.22**	**10.6**	**B**	**L**	**0.25**	**19.3**	**B**	**L**	**0.27**	**19.8**	**B**
	TR	**0.49**	**20.7**	**C**	**TR**	**0.49**	**20.6**	**C**	**TR**	**1.01**	**58.7**	**E**	**TR**	**1.02**	**60.0**	**E**
Southbound	**L**	**0.30**	**13.8**	**B**	**L**	**0.30**	**13.8**	**B**	**L**	**0.77**	**49.7**	**D**	**L**	**0.77**	**49.9**	**D**
	TR	**0.31**	**18.1**	**B**	**TR**	**0.32**	**18.1**	**B**	**TR**	**0.93**	**54.0**	**D**	**TR**	**0.94**	**55.7**	**E**
	Int.		**26.1**	**C**	**Int.**		**31.3**	**C**	**Int.**		**62.6**	**E**	**Int.**		**84.1**	**F**
Second Avenue @ East 125th Street																
Eastbound	**T**	**0.93**	**58.5**	**E**	**T**	**0.94**	**60.6**	**E**	**T**	**1.23**	**147.1**	**F**	**T**	**1.31**	**181.0**	**F+**
	R	**0.23**	**32.3**	**C**	**R**	**0.25**	**32.7**	**C**	**R**	**0.29**	**29.2**	**C**	**R**	**0.30**	**29.1**	**C**
Westbound	**DefL**	**0.73**	**48.6**	**D**	**DefL**	**0.73**	**48.6**	**D**	**LT**	**0.81**	**47.6**	**D**	**LT**	**0.81**	**47.8**	**D**
	T	**0.86**	**62.4**	**E**	**T**	**0.99**	**88.3**	**F+**								
Southbound	**L**	**0.31**	**22.1**	**C**	**L**	**0.31**	**22.1**	**C**	**L**	**1.78**	**390.2**	**F**	**L**	**1.78**	**390.2**	**F**
	TR	**0.41**	**20.3**	**C**	**TR**	**0.41**	**20.3**	**C**	**TR**	**0.79**	**30.0**	**C**	**TR**	**0.79**	**30.0**	**C**
Southwestbound	**TR**	**0.71**	**37.9**	**D**	**TR**	**0.75**	**39.8**	**D**	**TR**	**1.02**	**74.9**	**E**	**TR**	**1.01**	**72.8**	**E**
	Int.		**37.8**	**D**	**Int.**		**41.7**	**D**	**Int.**		**130.0**	**F**	**Int.**		**138.5**	**F**

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

Construction Traffic Mitigation

Potential measures to mitigate these impacts are discussed below.

Although only one significant adverse construction traffic impact was identified for the peak Phase 1 construction during the 6:00–7:00 AM analysis hour, conditions at the two intersections proposed for signalization to mitigate projected impacts during the 3:00–4:00 PM analysis hour were evaluated and are also presented in Table 21-7 and discussed below.

- Second Avenue and West 125th Street—An early implementation of the proposed operational mitigation measures, including shifting 2 seconds of green time to the southwestbound phase and 2 seconds of green time to the eastbound/westbound phase, and restriping the eastbound approach, as well as shifting an additional second of green time to the eastbound/westbound phase, would fully mitigate the projected significant adverse impacts at the eastbound through movement (LOS E, 56.9 seconds of delay, and v/c ratio of 0.92) and the westbound through movement (LOS E, 77.9 seconds of delay, and v/c ratio of 0.95). The impacted eastbound through movement would improve to LOS C, with a delay of 33.8 seconds (v/c ratio of 0.63) while the westbound through movement would improve to LOS D, with a delay of 52.7 seconds (v/c ratio of 0.82).

Table 21-7
2011 Peak Phase 1 Construction: AM Analysis Hour Mitigation

Intersection	6–7 AM Construction Peak Hour												Mitigation Measures
	No Build				Construction				Mitigation				
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	
Twelfth Avenue @ West 131st Street (Unsignalized)													
Northbound	**LT**	**0.01**	**7.6**	**A**	**LT**	**0.01**	**7.5**	**A**	**LTR**	**0.45**	**13.5**	**B**	**Early implementation of 2015 project improvement – Signalize intersection (West 131st Street converted to one-way WB under 2015 Build).**
Southbound	**LT**	**0.07**	**9.0**	**A**	**LT**	**0.21**	**10.5**	**B**	**DefL**	**0.53**	**19.2**	**B**	
									TR	**0.16**	**10.7**	**B**	
Westbound	**LTR**	**0.10**	**14.5**	**B**	**LTR**	**0.60**	**43.7**	**E+**	**LTR**	**0.30**	**23.3**	**C**	
Eastbound	**LTR**	**0.01**	**11.8**	**B**	**LTR**	**0.01**	**15.5**	**C**	**LTR**	**0.01**	**19.4**	**B**	
									Int.		**15.4**	**B**	
West 125th Street @ West 129th Street/St. Clair Place (Unsignalized)													
Westbound	**L**	**0.03**	**34.0**	**D**	**L**	**0.03**	**35.8**	**E**					**Early implementation of 2015 project improvement – Signalize intersection.**
	R	**0.37**	**16.7**	**C**	**R**	**0.44**	**18.3**	**C**	**R**	**0.28**	**25.0**	**C**	
Eastbound	**L**	**0.00**	**18.5**	**C**	**L**	**0.00**	**21.9**	**C**					
	R	**0.36**	**13.2**	**B**	**R**	**0.35**	**13.3**	**B**	**R**	**0.36**	**26.2**	**C**	
Northbound									**T**	**0.59**	**26.3**	**C**	
Southbound									**T**	**0.28**	**21.4**	**C**	
									Int.		**25.0**	**C**	
Second Avenue @ East 125th Street													
Eastbound	**T**	**0.88**	**51.8**	**D**	**T**	**0.92**	**56.9**	**E+**	**TR**	**0.63**	**33.8**	**C**	**Early implementation of 2015 operational mitigation – signal retiming and lane restriping. Shift 1 second from SB phase to EB/WB phase.**
	R	**0.22**	**32.2**	**C**	**R**	**0.22**	**32.0**	**C**					
Westbound	**DefL**	**0.68**	**45.3**	**D**	**DefL**	**0.68**	**45.3**	**D**	**DefL**	**0.59**	**37.6**	**D**	
	T	**0.81**	**56.4**	**E**	**T**	**0.95**	**77.9**	**E+**	**T**	**0.82**	**52.7**	**D**	
Southbound	**LTR**	**0.35**	**18.0**	**B**	**LTR**	**0.35**	**18.0**	**B**	**LTR**	**0.41**	**22.7**	**C**	
Southwestbound	**TR**	**0.73**	**40.8**	**D**	**TR**	**0.79**	**44.1**	**D**	**TR**	**0.71**	**38.0**	**D**	
	Int.		**35.2**	**D**	**Int.**		**39.7**	**D**	**Int.**		**32.4**	**C**	

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

For the 3:00–4:00 PM analysis hour, five intersections were identified to result in significant adverse impacts. The proposed mitigation measures and analysis results are summarized in Table 21-8 and described below. These measures would be required to address projected traffic impacts attributable to anticipated construction traffic activities.

- Twelfth Avenue and West 133rd Street—By shifting 5 seconds of green time from the northbound/southbound phase to the westbound phase, the westbound approach would improve within LOS F and reduce delay from 226.9 to 139.6 seconds (v/c ratio from 1.41 to 1.22). Upon the completion of Phase 1 development, this intersection would be reconfigured, as part of the proposed project improvements, to accommodate the conversion of West 133rd Street between Broadway and Twelfth Avenue to one-way travel under different operating conditions.
- Twelfth Avenue and West 131st Street—An early implementation of the proposed project improvements, which involves signalizing the intersection, would fully mitigate the projected significant adverse impacts, resulting in all intersection movements operating at LOS C or better. It should be noted that the proposed project improvements would also include the conversion of West 131st Street between Broadway and Twelfth Avenue to one-way travel; this analysis of peak Phase 1 construction assumes that this street would remain two-ways during peak Phase 1 construction.
- West 125th Street and West 129th Street/St. Clair Place—An early implementation of the proposed project improvements, which involves reconfiguring the intersection approaches, signalizing the intersection (with a minor adjustment to the proposed signal timing), and providing a pedestrian-only phase for a new wide crosswalk, would fully mitigate the projected significant adverse impacts and eliminate the illegal left-turn movements from the West 129th Street and St. Clair Place approaches.
- Amsterdam Avenue and West 125th Street—An early implementation of the proposed operational mitigation measures would fully mitigate the projected significant adverse impacts at the eastbound through-right movement (LOS F, 90.1 seconds of delay, and v/c ratio of 1.09). By restriping the northbound approach to add a right-turn-only lane, daylighting the southbound approach, and shifting 4 seconds of green time from the northbound/southbound phase to the eastbound/westbound phase, the impacted movement would improve to LOS D, with a delay of 44.7 seconds (v/c ratio of 0.94).
- Second Avenue and East 125th Street—An early implementation of the proposed operational mitigation measures, including shifting 1 second of green time from the southbound phase to the eastbound/westbound phase and 2 seconds of green time from southbound phase to southwestbound phase, and restriping the eastbound approach, would fully mitigate the projected significant adverse impacts at the eastbound through movement (LOS F, 188.8 seconds of delay, and v/c ratio of 1.33). The impacted movement would improve to LOS E, with a delay of 68.5 seconds (v/c ratio of 1.03).

Table 21-8
2011 Peak Phase 1 Construction: PM Analysis Hour Mitigation

Intersection	3–4 PM Construction Peak Hour												Mitigation Measures
	No Build				Construction				Mitigation				
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	
Twelfth Avenue @ West 133rd Street													
Westbound	LTR	1.23	150.6	F	LTR	1.41	226.9	F+	LTR	1.22	139.6	F	Shift 5 seconds of green time from NB/SB phase to WB phase.
Northbound	L	0.81	28.6	C	L	0.81	27.9	C	L	0.90	42.2	D	
	LTR	0.74	23.0	C	LTR	0.79	25.6	C	LTR	0.88	38.0	D	
Southbound	LTR	0.10	10.0	A	LTR	0.10	10.0	A	LTR	0.11	12.6	B	
	Int.		67.9	E	Int.		100.4	F	Int.		75.2	E	
Twelfth Avenue @ West 131st Street (Unsignalized)													
Northbound	LT	0.02	7.7	A	LT	0.02	7.7	A	LTR	0.81	22.1	C	Early implementation of 2015 project improvement – Signalize intersection (West 131st Street converted to one-way WB under 2015 Build).
Southbound	LT	0.06	11.6	B	LT	0.08	12.3	B	LTR	0.18	10.7	B	
Westbound	LTR	0.75	63.0	F	LTR	1.29	222.6	F+	LTR	0.49	27.1	C	
Eastbound	LTR	0.04	17.9	C	LTR	0.05	20.7	C	LTR	0.03	19.6	B	
									Int.		21.3	C	
West 125th Street @ West 129th Street/St. Clair Place (Unsignalized)													
Westbound	L	1.18	792.4	F	L	0.93	574.3	F					Early implementation of 2015 project improvement – Signalize intersection and shift 1 second from EB/WB to NB/SB.
	R	1.77	390.4	F	R	1.80	401.1	F+	R	0.80	40.3	D	
Eastbound	L			F	L			F					
	R	0.77	39.1	E	R	0.70	34.0	D	R	0.44	29.6	C	
Northbound									T	0.93	41.1	D	
Southbound									T	0.53	23.0	C	
									Int.		35.3	D	
Amsterdam Avenue @ West 125th Street													
Eastbound	L	0.91	100.5	F	L	0.91	97.7	F	L	0.72	55.4	E	Early implementation of 2015 operational mitigation – Restripe to add a NB right-turn-only lane; daylight SB approach; and shift 4 seconds from NB/SB phase to EB/WB phase.
	TR	1.02	66.8	E	TR	1.09	90.1	F+	TR	0.94	44.7	D	
Westbound	L	0.57	51.5	D	L	0.57	51.5	D	L	0.56	47.0	D	
	TR	0.91	44.7	D	TR	0.91	44.1	D	TR	0.81	32.5	C	
Northbound	L	0.21	16.1	B	L	0.21	16.1	B	L	0.22	14.8	B	
	TR	0.86	34.5	C	TR	0.86	34.3	C	T	0.69	29.3	C	
									R	0.57	31.1	C	
Southbound	L	0.69	39.6	D	L	0.69	39.8	D	L	0.67	37.2	D	
	TR	0.77	35.8	D	TR	0.78	36.2	D	TR	0.42	24.1	C	
	Int.		47.0	D	Int.		53.5	D	Int.		34.7	C	
Second Avenue @ East 125th Street													
Eastbound	T	1.27	167.2	F	T	1.33	188.8	F+	TR	1.03	68.5	E	Early implementation of 2015 operational mitigation – signal retiming and lane restriping.
	R	0.31	31.3	C	R	0.31	31.2	C					
Westbound	LT	0.85	54.9	D	LT	0.85	54.6	D	LT	0.76	44.4	D	
Southbound	LTR	0.84	28.6	C	LTR	0.84	28.6	C	LTR	0.90	33.3	C	
Southwestbound	TR	1.00	73.2	E	TR	1.00	72.8	E	TR	0.90	51.3	D	
	Int.		70.8	E	Int.		77.2	E	Int.		46.1	D	

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

For 2022 construction, projected construction activities and operational traffic from completed and occupied buildings are expected to result in significant adverse impacts at one intersection during the 6:00–7:00 AM analysis hour. The proposed mitigation measures and analysis results are summarized in Table 21-9 and described below.

- Second Avenue and East 125th Street—An early implementation of the proposed operational mitigation measures, including shifting 2 seconds of green time to the eastbound/westbound phase and 3 seconds of green time to the southwestbound phase, and restriping the eastbound approach, would fully mitigate the projected significant adverse impacts at the westbound through movement (LOS E, 75.6 seconds of delay, and v/c ratio of 0.94). The impacted movement would improve to LOS D, with a delay of 54.7 seconds (v/c ratio of 0.83).

Table 21-9
2022 Phase 2 Construction: AM Analysis Hour Mitigation

Intersection	6–7 PM Construction Peak Hour												Mitigation Measures
	No Build				Construction				Mitigation				
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	
Second Avenue @ East 125th Street													
Eastbound	T	0.90	54.6	D	T	0.91	56.6	E	TR	0.66	35.4	D	Early implementation of 2030 operational mitigation – signal retiming and lane restriping.
	R	0.22	32.2	C	R	0.24	32.4	C					
Westbound	DefL	0.71	46.9	D	DefL	0.71	46.9	D	DefL	0.64	41.0	D	
	T	0.84	59.4	E	T	0.94	75.6	E+	T	0.83	54.7	D	
Southbound	L	0.30	21.9	C	L	0.30	21.8	C	L	0.35	26.3	C	
	TR	0.40	20.1	C	TR	0.40	20.1	C	TR	0.47	25.3	C	
Southwestbound	TR	0.68	37.1	D	TR	0.70	37.5	D	TR	0.61	32.5	C	
	Int.		36.4	D	Int.		38.9	D	Int.		33.1	C	

Notes: L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

For the 3:00–4:00 PM analysis hour, two intersections were identified to result in significant adverse impacts. The proposed mitigation measures and analysis results are summarized in Table 21-10 and described below.

Table 21-10
2022 Phase 2 Construction: PM Analysis Hour Mitigation

Intersection	3–4 PM Construction Peak Hour												Mitigation Measures
	No Build				Construction				Mitigation				
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	
Amsterdam Avenue @ West 125th Street													
Eastbound	TR	1.05	76.8	E	TR	1.14	108.1	F+	TR	0.75	30.8	C	Early implementation of 2030 operational mitigation – daylight and restripe EB and WB approaches.
Westbound	TR	0.94	48.3	D	TR	0.95	49.8	D	TR	0.62	27.6	C	
Northbound	L	0.24	18.4	B	L	0.26	18.9	B	L	0.26	18.9	B	
	TR	0.97	49.5	D	TR	0.98	50.3	D	TR	0.98	50.3	D	
Southbound	L	0.75	47.1	D	L	0.74	46.9	D	L	0.74	46.9	D	
	TR	0.89	47.8	D	TR	0.90	49.4	D	TR	0.90	49.4	D	
	Int.		54.8	D	Int.		64.4	E	Int.		38.7	D	
Second Avenue @ East 125th Street													
Eastbound	T	1.20	133.5	F	T	1.22	141.9	F+	TR	1.05	73.6	E	Early implementation of 2030 operational mitigation – Signal retiming (shift 1 second to SW and 1 second to SB), restriping EB and daylighting WB.
	R	0.29	29.1	C	R	0.28	28.7	C					
Westbound	LT	0.79	46.0	D	LT	0.77	44.4	D	LT	0.67	38.6	D	
Southbound	L	1.72	363.5	F	L	1.71	359.6	F	L	1.65	332.7	F	
	TR	0.76	29.2	C	TR	0.76	29.1	C	TR	0.73	27.6	C	
Southwestbound	TR	0.98	66.8	E	TR	0.96	62.4	E	TR	0.92	53.3	D	
	Int.		120.4	F	Int.		121.2	F	Int.		97.9	F	

Notes: L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

- Amsterdam Avenue and West 125th Street—An early implementation of the proposed operational mitigation measures would fully mitigate the projected significant adverse impacts at the eastbound through-right (LOS F, 108.1 seconds of delay, and v/c ratio of 1.14) movements. By daylighting and restriping the eastbound and westbound approaches to provide additional moving lanes, the eastbound through-right movement would improve to LOS C, with a delay of 30.8 seconds (v/c ratio of 0.75).
- Second Avenue and East 125th Street—An early implementation of the proposed operational mitigation measures, including shifting 1 second of green time to the southbound phase and 1 second of green time to the southwestbound phase, and restriping the eastbound

approach, would fully mitigate the projected significant adverse impacts at the eastbound through movement (LOS F, 141.9 seconds of delay, and v/c ratio of 1.22). The impacted movement would improve to LOS E, with a delay of 73.6 seconds (v/c ratio of 1.05).

For the peak Phase 2 construction, the projected construction activities and operational traffic from completed and occupied buildings are expected to result in significant adverse impacts at two intersections during the 6:00–7:00 AM analysis hour. The proposed mitigation measures and analysis results are summarized in Table 21-11 and described below.

Table 21-11
2027 Peak Phase 2 Construction: AM Analysis Hour Mitigation

Intersection	6–7 AM Construction Peak Hour												Mitigation Measures
	No Build				Construction				Mitigation				
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	
Amsterdam Avenue @ West 125th Street													
Eastbound	**TR**	**0.71**	**33.9**	**C**	**TR**	**0.77**	**36.7**	**D**	**TR**	**0.50**	**27.7**	**C**	**Early implementation of 2030 operational mitigation – daylight and restripe EB and WB approaches.**
Westbound	**TR**	**0.73**	**34.3**	**C**	**TR**	**0.91**	**47.1**	**D+**	**TR**	**0.60**	**29.3**	**C**	
Northbound	**L**	**0.20**	**10.2**	**B**	**L**	**0.22**	**10.6**	**B**	**L**	**0.22**	**10.6**	**B**	
	TR	**0.49**	**20.7**	**C**	**TR**	**0.49**	**20.6**	**C**	**TR**	**0.49**	**20.6**	**C**	
Southbound	**L**	**0.30**	**13.8**	**B**	**L**	**0.30**	**13.8**	**B**	**L**	**0.30**	**13.8**	**B**	
	TR	**0.31**	**18.1**	**B**	**TR**	**0.32**	**18.1**	**B**	**TR**	**0.32**	**18.1**	**B**	
	Int.		**26.1**	**C**	**Int.**		**31.3**	**C**	**Int.**		**23.7**	**C**	
Second Avenue @ East 125th Street													
Eastbound	**T**	**0.93**	**58.5**	**E**	**T**	**0.94**	**60.6**	**E**	**TR**	**0.68**	**36.0**	**D**	**Early implementation of 2030 operational mitigation – Signal retiming (shift 2 seconds to EB/WB phase and 3 seconds to SW phase) and lane restriping.**
	R	**0.23**	**32.3**	**C**	**R**	**0.25**	**32.7**	**C**					
Westbound	**DefL**	**0.73**	**48.6**	**D**	**DefL**	**0.73**	**48.6**	**D**	**DefL**	**0.66**	**42.1**	**D**	
	T	**0.86**	**62.4**	**E**	**T**	**0.99**	**88.3**	**F+**	**T**	**0.88**	**61.0**	**E**	
Southbound	**L**	**0.31**	**22.1**	**C**	**L**	**0.31**	**22.1**	**C**	**L**	**0.37**	**26.7**	**C**	
	TR	**0.41**	**20.3**	**C**	**TR**	**0.41**	**20.3**	**C**	**TR**	**0.49**	**25.5**	**C**	
Southwestbound	**TR**	**0.71**	**37.9**	**D**	**TR**	**0.75**	**39.8**	**D**	**TR**	**0.66**	**33.8**	**C**	
	Int.		**37.8**	**D**	**Int.**		**41.7**	**D**	**Int.**		**34.4**	**C**	

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

- Amsterdam Avenue and West 125th Street—An early implementation of the proposed operational mitigation measures would fully mitigate the projected significant adverse impacts at the westbound through-right movement (LOS D, 47.1 seconds of delay, and v/c ratio of 0.91). By daylighting and restriping the eastbound and westbound approaches to provide additional moving lanes, the impacted movement would improve to LOS C, with a delay of 29.3 seconds (v/c ratio of 0.60).
- Second Avenue and East 125th Street—An early implementation of the proposed operational mitigation measures, including shifting 2 seconds of green time to the eastbound/westbound phase and 3 seconds of green time to the southwestbound phase, and restriping the eastbound approach, would fully mitigate the projected significant adverse impacts at the westbound through movement (LOS F, 88.3 seconds of delay, and v/c ratio of 0.99). The impacted movement would improve to LOS E, with a delay of 61.0 seconds (v/c ratio of 0.88).

For the peak Phase 2 construction, the projected construction activities and operational traffic from completed and occupied buildings are expected to result in significant adverse impacts at four intersections during the 3:00–4:00 PM analysis hour. The proposed mitigation measures and analysis results are summarized in Table 21-12 and described below.

Table 21-12
2027 Peak Phase 2 Construction: PM Analysis Hour Mitigation

Intersection	3–4 PM Construction Peak Hour												Mitigation Measures
	No Build				Construction				Mitigation				
	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	Lane Group	V/C Ratio	Delay (sec)	LOS	
Broadway Northbound @ West 133rd Street													
Eastbound	**LT**	**0.24**	**17.9**	**B**									**Shift 2 seconds from NB phase to WB phase.**
Westbound	**TR**	**0.88**	**44.0**	**D**	**TR**	**0.96**	**55.6**	**E+**	**TR**	**0.90**	**44.3**	**D**	
Northbound	**LT**	**0.79**	**19.2**	**B**	**L**	**0.63**	**16.1**	**B**	**L**	**0.65**	**18.6**	**B**	
					TR	**0.79**	**18.5**	**B**	**TR**	**0.83**	**21.9**	**C**	
	R	**0.06**	**9.1**	**A**									
	Int.		**26.4**	**C**	**Int.**		**28.2**	**C**			**27.3**	**C**	
Broadway @ West 130th Street													
Eastbound	**LR**	**0.32**	**26.7**	**C**	**L**	**0.80**	**35.2**	**D**	**L**	**0.68**	**26.5**	**C**	**Eliminate one SB lane upstream via traffic cones to create channelization, allowing EB right-turn on red; shift 5 seconds from NB/SB to EB; deploy TCO.**
					R	**1.56**	**295.0**	**F+**	**R**	**0.85**	**43.3**	**D**	
Northbound	**LT**	**0.33**	**6.0**	**A**	**T**	**0.42**	**8.4**	**A**	**T**	**0.46**	**12.1**	**B**	
Southbound	**LT**	**0.33**	**6.1**	**A**	**LT**	**0.38**	**8.3**	**A**	**LT**	**0.45**	**12.2**	**B**	
	Int.		**7.5**	**A**	**Int.**		**75.4**	**E**	**Int.**		**20.6**	**C**	
Amsterdam Avenue @ West 125th Street													
Eastbound	**TR**	**1.08**	**87.2**	**F**	**TR**	**1.26**	**155.0**	**F+**	**TR**	**0.82**	**33.9**	**C**	**Early implementation of 2030 operational mitigation – daylight and restripe EB and WB approaches.**
Westbound	**TR**	**0.97**	**54.5**	**D**	**TR**	**0.99**	**59.3**	**E**	**TR**	**0.65**	**28.3**	**C**	
Northbound	**L**	**0.25**	**19.3**	**B**	**L**	**0.27**	**19.8**	**B**	**L**	**0.27**	**19.8**	**B**	
	TR	**1.01**	**58.7**	**E**	**TR**	**1.02**	**60.0**	**E**	**TR**	**1.02**	**60.0**	**E**	
Southbound	**L**	**0.77**	**49.7**	**D**	**L**	**0.77**	**49.9**	**D**	**L**	**0.77**	**49.9**	**D**	
	TR	**0.93**	**54.0**	**D**	**TR**	**0.94**	**55.7**	**E**	**TR**	**0.94**	**55.7**	**E**	
	Int.		**62.6**	**E**	**Int.**		**84.1**	**F**	**Int.**		**43.3**	**D**	
Second Avenue @ East 125th Street													
Eastbound	**T**	**1.23**	**147.1**	**F**	**T**	**1.31**	**181.0**	**F+**	**TR**	**1.12**	**101.5**	**F**	**Early implementation of 2030 operational mitigation – Signal retiming (shift 1 second to SW and 1 second to SB), restriping EB and daylighting WB.**
	R	**0.29**	**29.2**	**C**	**R**	**0.30**	**29.1**	**C**					
Westbound	**LT**	**0.81**	**47.6**	**D**	**LT**	**0.81**	**47.8**	**D**	**LT**	**0.73**	**41.8**	**D**	
Southbound	**L**	**1.78**	**390.2**	**F**	**L**	**1.78**	**390.2**	**F**	**L**	**1.72**	**362.2**	**F**	
	TR	**0.79**	**30.0**	**C**	**TR**	**0.79**	**30.0**	**C**	**TR**	**0.76**	**28.3**	**C**	
Southwestbound	**TR**	**1.02**	**74.9**	**E**	**TR**	**1.01**	**72.8**	**E**	**TR**	**0.96**	**60.5**	**E**	
	Int.		**130.0**	**F**	**Int.**		**138.5**	**F**	**Int.**		**111.9**	**F**	

Notes: **L = Left Turn; T = Through; R = Right Turn; DefL = Defacto Left Turn; Int. = Intersection**
V/C = Volume to Capacity; LOS = Level of Service; "+" = Exceeds CEQR Impact Threshold.

- Broadway Northbound and West 133rd Street—By shifting 2 seconds of green time from the northbound phase to the westbound phase, the westbound approach would improve from LOS E, with a delay of 55.6 seconds (v/c ratio of 0.96), to LOS D, with a delay of 44.3 seconds (v/c ratio of 0.90).

- Broadway and West 130th Street—Prior to the completion of the northern block, which is bounded by Broadway, Twelfth Avenue, West 132nd Street, and West 133rd Street, access to the below-grade parking would be available only on West 130th Street. With both project-generated and construction traffic departing from this location during the afternoon departure period, significant adverse impacts were projected for the eastbound right-turn movement to Broadway. No standard traffic engineering measures were determined to be viable for mitigating this projected construction impact. However, implementing standard measures along with certain peak period traffic-management strategies could achieve a level of effectiveness that would fully mitigate the projected construction impact. First, a 5-second shift in green time from the northbound/southbound phase to the eastbound phase would be required. Since the intersection's west crosswalk would operate at favorable levels under the 2030 full build-out, it would operate at even more favorable levels in 2027, when several buildings to the north of this location are not yet completed. With the deployment of a TCO, the heavy eastbound right-turn traffic could be relieved by allowing right turns on red for approximately one-third of the red phase. To ensure traffic safety, the upstream southbound through traffic, which would travel through the intersection at the same time as these right-turn-on-red vehicles, must be channelized away from the rightmost lane south of West 130th Street. Since southbound traffic levels during the PM peak period were projected to operate well within the available capacity, an approach lane could be eliminated via coning-off of the rightmost approach lane to the intersection. As shown in Table 21-12, the above traffic management strategies would improve the eastbound right-turn operation to LOS D, with an average delay of 43.3seconds and a v/c ratio of 0.85, while not impacting any other intersection movements. It should be noted that these measures should be implemented during the afternoon departure period, during the period of construction when access to the below-grade parking west of Broadway is available only via West 130th Street.

- Amsterdam Avenue and West 125th Street—An early implementation of the proposed operational mitigation measures would fully mitigate the projected significant adverse impacts at the eastbound through-right (LOS F, 155.0 seconds of delay, and v/c ratio of 1.26) movements. By daylighting and restriping the eastbound and westbound approaches to provide additional moving lanes, the eastbound through-right movement would improve to LOS C, with a delay of 33.9 seconds (v/c ratio of 0.82).
- Second Avenue and East 125th Street—An early implementation of the proposed operational mitigation measures, including shifting 1 second of green time to the southbound phase and 1 second of green time to the southwestbound phase, daylighting the westbound approach, and restriping the eastbound approach, would fully mitigate the projected significant adverse impacts at the eastbound through movement (LOS F, 181.0 seconds of delay, and v/c ratio of 1.31). The impacted movement would improve within LOS F, with a delay of 101.5 seconds (v/c ratio of 1.12).

CONSTRUCTION TRUCK MOVEMENTS

Numerous gates and openings to various blocks of the construction site would be available for delivery vehicle access. Flaggers are expected to be present at each active driveway to manage the access and movements of trucks. Furthermore, because of the size of the construction site, these vehicles are not likely to have to undertake disruptive back-in maneuvers and would be able to enter the site head-in. The departure maneuvers are also expected to be head-out. Some of the site deliveries may also occur along the perimeters of the construction site within delineated closed-off areas for concrete pour or steel delivery. As with any other construction projects, these activities would take place in accordance with NYCDOT-approved MPT plans and would be managed by on-site flag-persons.

PARKING

Based on the projected construction worker parking demand, Columbia University has developed a year-by-year parking program for these vehicles and is committed to allocating the necessary number of parking spaces to the extent practicable to keep construction worker vehicles off-street. This approach was undertaken in consideration of the projected off-street parking shortfall, as detailed in Chapter 17, and the anticipated elevated use of on-street spaces by future developments in the Project Area.

During peak Phase 1 construction in 2011, four off-street facilities in the area would be available for construction worker parking, as listed below.

- 635 West 131st Street—122 spaces;
- 603 West 131st Street—75 spaces;
- 553 West 133rd Street—205 spaces; and
- Broadway and West 132nd Street—250 spaces.

In total, 652 spaces would be available with the above off-street facilities. This supply would be adequate in accommodating the projected peak construction parking demand of 469 construction worker vehicles.

During peak Phase 2 construction in 2027, all the above off-street facilities would be replaced by components of the Proposed Actions (the existing parking facility east of Broadway at West 132nd Street would be under construction). However, portions of the below-grade parking facilities are anticipated to be completed by this time, providing up to 1,820 spaces (1,454 spaces west of Broadway accessed at West 130th Street, and 366 spaces east of Broadway accessed at West 133rd Street). While the parking spaces in these facilities would be allocated primarily to future Columbia University students and staff, sections of these facilities would be temporarily reconfigured to also accommodate construction worker parking. In total, the projected parking demand from the completed buildings of the Proposed Actions and the ongoing construction efforts analyzed above would be approximately 1,100 and 600 spaces, respectively. This total demand of 1,700 spaces could be fully accommodated off-street. While small shortfalls could occur for a few months in the latter portion of 2027 due to slightly higher projected construction workforce, the projected parking shortfall would be temporary and would not constitute a significant adverse parking impact.

While construction worker parking demand could largely be accommodated off-street, there is expected to be some temporary loss of on-street parking spaces throughout construction to accommodate curb lane and roadway closures. Because construction would take place in stages over many years on various sites, the loss of on-street parking spaces would vary and occur at different locations. Nonetheless, because there would be a surplus of available on-street spaces in and surrounding the Project Area, as demonstrated in the analysis results summarized in Chapter 17, the effect of construction on neighborhood parking supply and utilization is not expected to be significant.

TRANSIT

With nearly 60 percent of the construction workers projected to travel via auto, the bulk of the remaining 40 percent would travel to and from the Project Area via transit. During peak Phase 1 construction, this distribution would represent fewer than 400 workers traveling by subway, bus, or commuter rail. With 80 percent of these workers commuting during the peak travel hour (6–7 AM arrival and 3–4 PM departure), the total estimated number of peak hour transit trips would be approximately 305. Similarly, during peak Phase 2 construction, approximately 490 workers would travel via transit, resulting in 390 peak hour transit trips during each of the morning and afternoon analysis peak hours. Distributed among the various subway and bus routes, station entrances, and bus stops near the Project Area, only nominal increases in transit demand would be experienced along each of these routes and at each of the transit access locations during hours outside of the typical commuter peak periods. Hence, there would not be a potential for significant adverse transit impacts attributable to the projected construction worker transit trips.

While there are likely to be temporary bus stop relocations along bus routes that operate adjacent to the Project Area, adequate access to transit service would be maintained through coordination with NYCDOT and NYCT.

PEDESTRIANS

For the same reasons provided on transit operations, a detailed pedestrian analysis would also not be warranted to address the projected demand from the travel of construction workers to and from the Project Area. Considering that these pedestrian trips would primarily occur outside of peak hours and be distributed among numerous sidewalks and crosswalks in the area, there would not be a potential for significant adverse pedestrian impacts attributable to the projected construction worker pedestrian trips.

During construction, where sidewalk closures are required, adequate protection or temporary sidewalks would be provided in accordance with NYCDOT requirements. Since complete street closures would only occur along West 130th, West 131st, and West 132nd Streets between Broadway and Twelfth Avenue over different stages of construction, pedestrian circulation and access, including access to the waterfront, would be available at all times.

AIR QUALITY

INTRODUCTION

During construction of the Proposed Project, emissions from on-site construction equipment and on-road construction-related vehicles, and their effect on background traffic congestion, have the potential to impact air quality. The analysis of potential impacts on air quality from the construction of the Proposed Project includes a quantitative analysis of both on-site and on-road sources of air emissions, and the overall combined impact of both sources where applicable.

In general, most construction engines are diesel-powered, and produce relatively high levels of nitrogen oxides (NO_x) and particulate matter (PM). Construction activities also emit fugitive dust. Although diesel engines emit much lower levels of CO than gasoline engines, the stationary nature of construction emissions and the large quantity of engines could lead to elevated CO concentrations, and impacts on traffic could increase mobile source-related emissions of CO as well. Therefore, the pollutants analyzed for the construction period are NO_2, CO, particles with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}), and particles with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$). Since ultra-low-sulfur diesel (ULSD) would be used for all diesel engines used for the construction on the Columbia University development sites (Subdistrict A, the Academic Mixed-Use Area), sulfur oxides (SO_x) emitted from those construction activities would be negligible; the small quantity of emissions from construction from non-Columbia sites would not result in a significant impact on sulfur dioxide (SO_2) concentrations. For more details on air pollutants, see Chapter 19, "Air Quality."

Construction activity in general, and large-scale construction in particular, has the potential to adversely affect air quality as a result of diesel emissions. The main component of diesel exhaust that has been identified as having an adverse effect on human health is fine PM. To ensure that the construction of the Columbia University development sites results in the lowest practicable diesel particulate matter (DPM) emissions, Columbia University has committed to implementing a state-of-the-art emissions reduction program for all of its construction activities (Subdistrict A), consisting of the following components:

1. *Diesel Equipment Reduction.* The construction of the Columbia University development sites would minimize the use of diesel engines and use electric engines operating on grid power instead, to the extent practicable. To that end, Columbia University has contacted Con Edison to seek the early connection of grid power to the sites by the start of construction. Construction contracts would specify the use of electric engines where practicable and ensure the distribution of power connections throughout the Project Area as needed. Equipment that would use grid power instead of diesel engine power would include, but may not be limited to, tower cranes, personnel/material hoists, and small compressors. This would also eliminate some generators that would normally be needed for construction equipment. All forklifts would be either electric powered or natural gas.

2. *Clean Fuel.* ULSD would be used exclusively for all diesel engines throughout the Columbia University development sites. This would enable the use of tailpipe reduction technologies (see below) and would directly reduce DPM and SO_x emissions.

3. *Best Available Tailpipe Reduction Technologies.* Nonroad diesel engines with a power rating of 50 horsepower (hp) or greater and controlled truck fleets (i.e., truck fleets under long-term contract with Columbia University, such as concrete mixing and pumping trucks) would utilize the best available tailpipe technology for reducing DPM emissions. Columbia University has identified diesel particle filters (DPFs) as being the tailpipe technology currently proven to have the highest reduction capability. Columbia University's construction contracts would specify that all diesel nonroad engines rated at 50 hp or greater would utilize DPFs, either original equipment manufacturer (OEM) or retrofit technology that would result in emission reductions of DPM of at least 90 percent (when compared with equivalent uncontrolled diesel engines). 90 percent reduction has been verified by a study of actual reductions of $PM_{2.5}$ emissions from comparable engines used at a New York City construction site. Controls may include active DPFs,[1] if necessary.

4. *Utilization of Tier 2 or Newer Equipment.* In addition to the tailpipe controls commitments, Columbia's construction program would mandate the use of Tier 2[2] or later construction equipment for nonroad diesel engines with a power output of 50 hp or greater. (Since Tier 3 engines do not address PM emissions, and Tier 4 engines are not yet available, the use of additional tailpipe emissions reduction technology is required, at least in early years, as stated in item 3 above. In later years, the use of a Tier 4 engine is akin to the use of a Tier 2 engine with a DPF.) For engines with a power output of less than 50 hp, Tier 2 certification

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[1] There are two types of DPFs currently in use: passive and active. Most DPFs currently in use are the "passive" type, which means that the heat from the exhaust is used to regenerate (burn off) the PM to eliminate the buildup of PM in the filter. Some engines do not maintain temperatures high enough for passive regeneration. In such cases, "active" DPFs can be used (i.e., DPFs that are heated either by an electrical connection from the engine, by plugging in during periods of inactivity, or by removal of the filter for external regeneration).

[2] The first federal regulations for new nonroad diesel engines were adopted in 1994, and signed by EPA into regulation in a 1998 Final Rulemaking. The 1998 regulation introduces Tier 1 emissions standards for all equipment 50 hp and greater and phases in the increasingly stringent Tier 2 and Tier 3 standards for equipment manufactured in 2000 through 2008. The Tier 1 through 3 standards regulate the EPA criteria pollutants, including particulate matter (PM), hydrocarbons (HC), oxides of nitrogen (NO_x) and carbon monoxide (CO). Prior to 1998, emissions from nonroad diesel engines were unregulated. These engines are typically referred to as Tier 0.

would also be required in earlier years, and Tier 4 would be required for contracts that start work in later years when engines with that certification level are readily available. Gasoline powered nonroad engines would also be required to meet the latest emissions standards for newly manufactured engines.

The use of newer engine models with cleaner emissions standards, such as Tier 2, is expected to reduce the likelihood of DPF plugging due to soot loading (i.e., clogging of DPF filters by accumulating particulate matter). Each Tier emissions standard is lower than the previous one for all criteria pollutants, including PM. Additionally, while all engines undergo some deterioration over time, newer as well as better maintained engines will emit less PM than their older Tier or unregulated counterparts. Therefore, restricting site access to equipment with lower tailpipe PM emission values would enhance this emissions reduction program and implementation of DPF systems as well as reduce maintenance frequency due to soot loading (i.e., less downtime for construction equipment to replace clogged DPF filters). The inclusion of cleaner small engines and gasoline engines would further reduce emissions.

5. *Source Location.* In addition, in order to reduce the resulting concentration increments at residential and school locations, large emissions sources and activities, such as concrete trucks and pumps, would be located away from residential buildings, schools, and playgrounds, to the extent practicable.

6. *Dust Control.* Strict fugitive dust control plans will be required as part of contract specifications. For example, stabilized truck exit areas would be established for washing off the wheels of all trucks that exit the large construction sites. Truck routes within the sites would be either watered as needed or, in cases where such routes would remain in the same place for an extended duration, the routes would be stabilized, covered with gravel, or temporarily paved to avoid the resuspension of dust. All trucks hauling loose material will be equipped with tight fitting tailgates and covered prior to leaving the sites. In addition to regular cleaning by the City, area roads adjacent to the sites would be cleaned as frequently as needed. Chutes would be used for material drops during demolition. An on-site vehicular speed limit of 5 mph would be imposed. Water sprays will be used for all excavation, demolition, and transfer of spoils to ensure that materials are dampened as necessary to avoid the suspension of dust into the air. Loose materials will be watered, stabilized with a biodegradable suppressing agent, or covered. The fugitive emissions reduction program would reduce dust emissions by at least 50 percent for demolition, excavation, stockpiles, and handling of materials.

7. *Illuminated Traffic Control Signals and Signs.* All illuminated traffic control signals and signs will be solar powered or connected to the electrical power grid.

All of Columbia University's commitments will be included in a Restrictive Declaration. Additional measures would be taken to reduce pollutant emissions during construction of the Proposed Project in accordance with all applicable laws, regulations, and building codes. These include the restriction of on-site vehicle idle time to three minutes for all vehicles that are not using the engine to operate a loading, unloading, or processing device (e.g., concrete mixing trucks).

This program to reduce air pollutant emissions from construction would exceed that of any large-scale private project constructed in New York City to date. Overall, this program is expected to significantly reduce DPM emissions by more than what would be achieved by applying only the currently defined best available control technologies under New York City Local Law 77 of 2005, which are required only for publically funded city projects.

As noted earlier, the DEIS conservatively predicted that there would be non-Columbia construction in Subdistrict B. Since the issuance of the DEIS, CPC has proposed a modification of the rezoning which would result in no new construction in Subdistrict B (see Chapter 29, “Modifications to the Proposed Actions”). As in the DEIS, the following air quality analyses conservatively present results which include proposed non-Columbia development in Subdistrict B. The analysis also addresses construction emission reduction measures for $PM_{2.5}$ that would be implemented by means of an E designation for construction on Sites 24 and 25 in the Other Area east of Broadway. Those would be the only two sites with non-Columbia construction under the proposed modification presented in Chapter 29.

Since the publication of the DEIS, the following changes have been made which affect the results presented in this section:

1. Although the Columbia University emissions reduction program calls for the best available technologies to be used, the conservative assumption in the DEIS regarding the level of engine emissions certification was that all diesel engines would be at least at a Tier 1 level. It has since been determined that the higher Tier 2 level engines are readily available for all engine types and therefore it is assumed, for analysis purposes, that all engines will be at that level;
2. As described in detail above, Columbia University has identified an accelerated construction program for construction in Phase 1, which incorporates simultaneous construction activities on the blocks between West 129th/125th Street and West 131st Street. The analysis assumes “top down” construction techniques, which would incorporate simultaneous construction of buildings and below-grade areas. The Phase 1 analyses are based on this proposed construction program.
3. The DEIS included a very conservative assumption regarding the predicted emissions from truck-mounted concrete pumps. The mobile source emission factors for idling trucks would underestimate emissions for this type of activity, since they do not include the additional engine load needed for pumping concrete. The generic non-road emission factors representative of this type of activity are much higher because non-road engines have higher emissions than truck engines. Therefore, the higher non-road emission factors were used in the DEIS. Since the publication of the DEIS, to refine the analysis with a more appropriate emission factor for this type of source, a study was commissioned to test emissions from truck-mounted concrete pumps currently in use (the study methodology was approved by DEP). Based on the tested results, appropriate emission factors were developed for use in the analysis. The emission factors obtained from that study were applied to all new analyses in this FEIS.

METHODOLOGY

Additional details relevant only to the construction air quality analysis methodology are presented in the following section. A review of the pollutants for analysis; applicable regulations, standards, and benchmarks; and general methodology for stationary and mobile source air quality analyses can be found in Chapter 19; NAAQS are presented in Table 19-1. EPA has recently revised the $PM_{2.5}$ NAAQS, effective December 18, 2006. The revisions include lowering the 24-hour average standard from the previous level of 65 μg/m^3 to 35 μg/m^3 and revoking the annual standard for PM_{10}.

SEQRA regulations and the *CEQR Technical Manual* state that the significance of a likely consequence (i.e., whether it is material, substantial, large, or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected. In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the NAAQS, or increase the concentration of $PM_{2.5}$ above the interim guidance thresholds, would be deemed to have a potential significant adverse impact. In such an event, the factors identified above would then be considered in determining the significance of the potential impact.

See Chapter 19 for a full discussion of the standards and impact criteria.

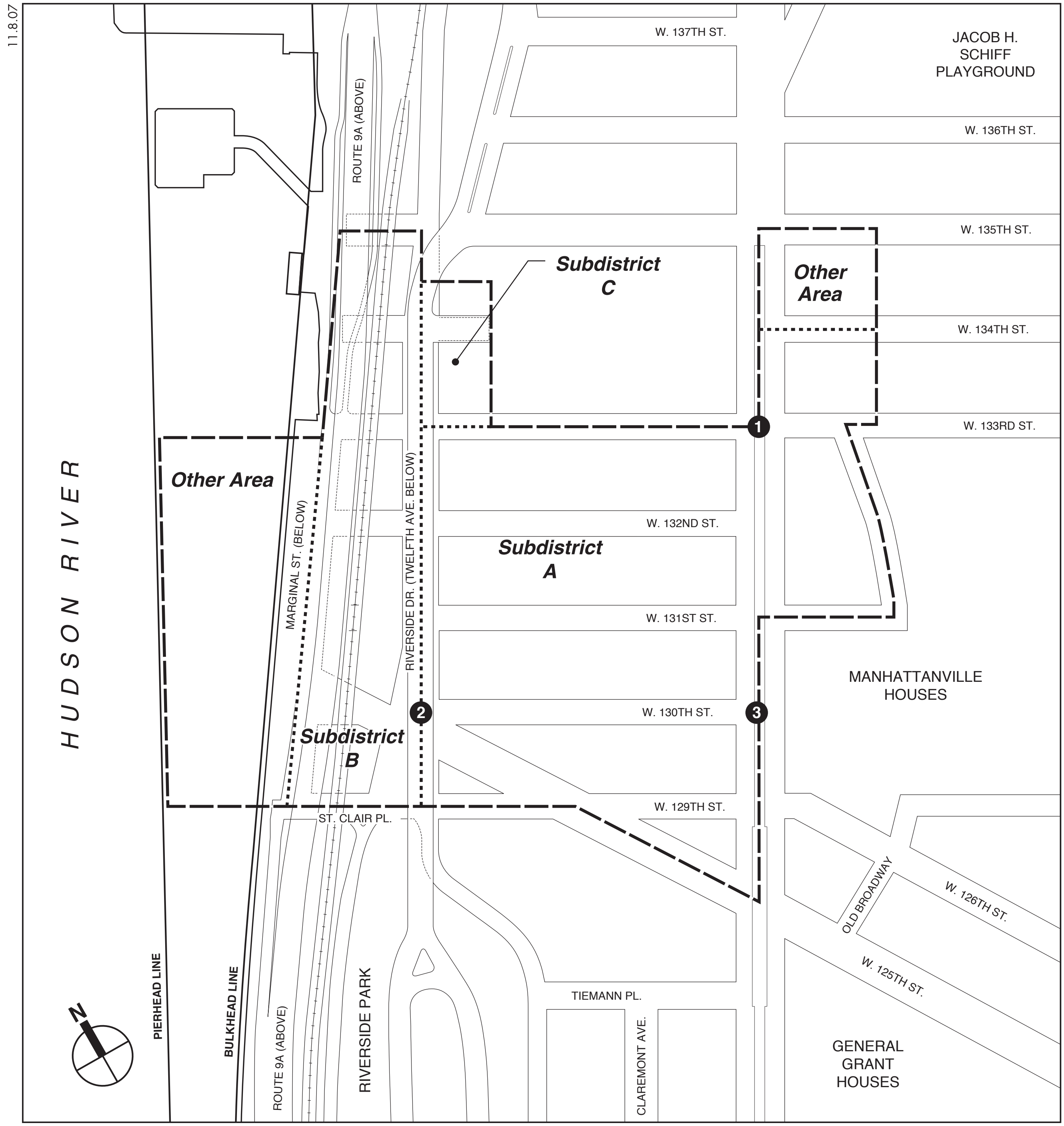
Mobile Source Assessment

The general methodology for mobile source modeling presented in Chapter 19 was followed for intersection modeling during the construction period.

As described in the introduction above, Columbia University has committed to requiring that all concrete mixing and pumping trucks used for construction on the Columbia University development sites be equipped with DPFs. The emission factors for the concrete truck portion of the construction trucks used in the on-site analysis were conservatively reduced by only 90 percent to reflect the application of DPFs for these vehicles. It was assumed that conventional equipment would be used for projected development within Subdistrict B and the Other Areas.

Based on the predicted traffic conditions, the traffic scenarios for October 2011 in Phase 1 and June 2027 in Phase 2 were determined to demonstrate the highest overall volume of construction-related vehicles as well as traffic disruptions, such as street or lane closures; these periods would generally represent the highest potential for air quality impacts. In Phase 1, the highest daily truck increment and the highest overall vehicle peak hour increment was predicted for October 2011. PM emissions would be highest during peak truck activity, and CO emissions would be highest during peak total vehicle activity. The 2011 scenario was used for the mobile source CO and PM analysis since the peaks coincide for Phase 1. During Phase 2 these peaks also coincide in June 2027. These worst-case periods were also used to demonstrate the highest predicted mobile source CO and PM increments for all other construction periods when added to the concurrent on-site emissions from construction equipment and activity; this is a conservative assumption, since concentration increments from mobile sources during periods with lower vehicle increments would be lower.

Sites for mobile source analysis were selected based on the air quality results reported for the operational phase in Chapter 19, and on the construction model scenarios and truck trip assignments analyzed for the assessment of traffic impacts during construction. The sites were chosen with the objective of capturing the highest construction-related concentration increment, the highest expected increments at locations where background concentrations were predicted to be high in the No Build condition, and the mobile source increments in areas near the project site at intersections where relatively high increments are predicted from on-site construction activity. Based on those criteria, PM and CO concentrations were analyzed for Phase 1 and Phase 2 at three intersections, as presented in Table 21-13 and shown in Figure 21-32. Site 1 was selected as the location with highest predicted construction truck volume increments, and which is also near the location where the highest potential increase in concentrations from on-site emissions was



Proposed Special Manhattanville Mixed-Use District / Project Area

Subdistrict Boundary

1 Broadway/133rd Street

2 Twelfth Avenue /125th Street/130th Street

3 Broadway/130th Street

Figure 21-32
Air Quality Mobile Source Analysis Sites

predicted during Phase 2. In Phase 1, Site 2 is a location where the highest short-term and annual increases in air quality concentrations were predicted from on-site construction emissions. Site 2 is also a location with the greatest number of predicted construction worker vehicles in Phase 2. Site 3 is the intersection in Phase 2 with the greatest number of vehicle diversions.

Table 21-13
Mobile Source Analysis Sites

Analysis Site	Intersection	Analysis
1	Broadway and West 133rd Street	Phase 1; Phase 2
2	Twelfth Avenue, West 125th Street, and West 130th Street	Phase 1; Phase 2 CO only
3	Broadway and West 130th Street	Phase 1 CO only; Phase 2 CO only

On-Site Construction Activity Assessment

Overall, construction of the Proposed Project is conservatively assumed to occur over a period of 22 years, although it may take longer, resulting in lower peak emissions and impacts. To determine which construction periods constitute the worst-case periods for the pollutants of concern (PM, CO, NO_2), construction-related emissions were calculated throughout the duration of construction on an annual and peak-day basis for $PM_{2.5}$. $PM_{2.5}$ was selected as the worst-case pollutant, because $PM_{2.5}$ has the highest ratio of emissions to impact criteria as compared with other pollutants. Therefore, initial estimates of relative $PM_{2.5}$ emissions for each calendar month were used for determining the worst-case periods for analysis of all pollutants. After determining the worst-case periods, detailed assessments of the estimated $PM_{2.5}$ emissions with the planned control measures were undertaken. Generally, emission patterns of PM_{10} and NO_2 would follow $PM_{2.5}$ emissions, since they are related to diesel engines by horsepower (hp). CO emissions may have a somewhat different pattern but generally would also be highest during periods when the most activity would occur. Based on the resulting multi-year profiles of annual average and peak day average emissions of $PM_{2.5}$, a worst-case year and a worst-case short-term period for Phase 1 and Phase 2 were identified for the modeling of annual and short-term (i.e., 24-hour, 8-hour, and 1-hour) averaging periods. Dispersion of the relevant air pollutants from the site during these periods was then analyzed, and the highest resulting concentrations are presented in the following sections. Broader conclusions regarding predicted concentrations during other periods, which were not modeled explicitly, are presented as well, based on the multi-year emissions profiles and the worst-case period results.

The general methodology for stationary source modeling (regarding model selection, receptor placement, and meteorological data) presented in Chapter 19 was followed for modeling dispersion of pollutants from on-site sources during the construction period.

The sizes, types, and number of construction equipment were estimated based on the construction activity schedule. Emission factors for nitrogen oxides (nitrogen oxide and NO_2, collectively referred to as NO_x), CO, PM_{10}, and $PM_{2.5}$, from on-site construction engines were developed using the EPA's NONROAD2005 Emission Model (NONROAD). The model is based on source inventory data accumulated for specific categories of nonroad equipment. The emission factors for each type of equipment were calculated from the NONROAD output files (i.e., calculated from regional emissions estimates). With respect to trucks, emission rates for NO_X, CO, PM_{10}, and $PM_{2.5}$ for on-site truck engines were developed using the EPA MOBILE6.2 Emission Model (MOBILE6).

As described in the introduction above, Columbia University has committed to a number of measures to substantially reduce air pollutant emissions during construction of the Columbia University development sites (Subdistrict A), with special attention given to DPM. These measures include the use of electric-powered engines instead of diesel engines where practicable; the exclusive use of ULSD for all construction engines; and the use of Tier 2 or later equipment with DPFs (OEM or the equivalent tailpipe controls to reduce DPM emissions by at least 90 percent compared with normal private construction practices) on all nonroad construction engines with an engine output rating of 50 hp or greater. Forklifts would be powered by electricity or natural gas. In addition, controlled truck fleets (i.e., truck fleets under long-term contract, such as concrete trucks) would only use trucks equipped with DPFs. These reduction measures were not assumed for the projected development of sites in Subdistrict B and the Other Areas that may be developed under the Proposed Actions, since the construction of those parcels would not be under the control of Columbia University.

Based on Columbia University's commitments, emission factors for the construction of the Columbia University development sites were calculated assuming the exclusive use of ULSD, diesel engines of Tier 2 or cleaner certification, the use of electrically powered engines where practicable, and the application of DPFs on all nonroad diesel engines 50 hp or greater and on concrete delivery and pumping trucks; other trucks were assumed to have emissions consistent with the general truck fleet (all on-road diesel vehicles currently use ULSD, as mandated by federal regulations). For construction in Subdistrict B and the Other Areas, which is not part of the Columbia University construction program, DPF reductions were not applied for the initial emissions profile, and ULSD was assumed beginning in June 2010, as mandated by federal regulations for land-based nonroad use. For this initial assessment, relative $PM_{2.5}$ emission factors for engines retrofit with a DPF (i.e., all nonroad engines with a power output of 50 hp or greater and all concrete delivery trucks) were calculated as 10 percent of the 2006 NONROAD baseline emissions for all construction years; in cases where NONROAD future year fleet-average emission factor was lower than the reduced DPF emission factor, indicating that future technologies were predicted to achieve higher reductions, the lower factor was used for future years. For all other engines and for pollutants other than $PM_{2.5}$, MOBILE6 and NONROAD fleet-average emissions were used based on the first year of construction for each building[1]. Since emission factors for concrete pumps are not available from either MOBILE6 or NONROAD, emission factors specifically developed for this type of application were used.[2] All tower cranes, personnel/material hoists, and most small compressors would be electric and would therefore have no associated emissions. In addition, fugitive dust emissions from operations (e.g., grading, excavation, loading excavated materials into dump trucks, and demolition) were calculated based on EPA procedures delineated in AP-42 Table 13.2.3-1 (EPA, 1995-2006). It was estimated that the planned control of fugitive emissions would reduce PM emissions from such processes by 50 percent. Vehicle speeds on-site would be limited to 5 miles per hour to avoid the resuspension of

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[1] Generally, fleet-average emission factors diminish by year as new engines conforming to lower emission standards enter the fleet. However, the conservative assumption was made that for a given task, engine emissions would not change throughout construction. This is true even in cases where certain engines do not begin construction on-site until a later year than the start of the task.

[2] Concrete pumps are truck mounted and use the truck engine to power the pumps at high load. This application of truck engines is not addressed by the MOBILE6 model, and since it is not a non-road engine, it is not included in the NONROAD model. Emission factors were obtained from a study which developed factors specifically for this type of activity. See Appendix K.3 for further details.

dust, and a robust watering program would be implemented for all demolition, excavation, and transfer of loose materials to and from trucks. The resulting engine emission factors were used for the emissions and dispersion analyses.

Average annual (running 12-month averages) and peak-day $PM_{2.5}$ emissions profiles for the entire duration of the construction were prepared by multiplying the above emission rates by the number of engines, the work hours per day, and fraction of the day each engine would be expected to work during each month. The construction activity details are presented in Appendix K.1, and details of the emissions calculations are presented in Appendix K.3. The predicted peak day and annual emissions from the potential projected redevelopment at sites in Subdistrict B and the Other Areas are presented in Figure 21-33 and Figure 21-34, respectively, and the peak day and annual profiles of emissions from the Columbia University development are presented in Figures 21-35 and 21-36, respectively. Since there is no schedule for potential projected redevelopment of the sites in Subdistrict B and the Other Areas, those emissions are presented by location.

Based on the $PM_{2.5}$ construction emissions profiles, peak short-term and annual periods were selected for modeling in each construction phase. June 2008 and the calendar year 2008 were identified as the worst-case short-term and annual periods for Phase 1, respectively, since the highest project-wide emissions were predicted in these periods, and since sewer and stormwater relocation will take place in close proximity to residential locations during these periods. In addition, one short-term period, March 2011, and one annual period the calendar year 2011, were also analyzed for Phase 1. Although overall construction emissions during this secondary period would be lower than the overall peak year in 2008 and peak day in June 2008, this period would include more intense construction activities on the blocks between West 125th Street and West 131 Street (where the bulk of emissions are expected to originate) and would also include construction on the block bounded by West 125th Street, West 129th Street, and Broadway, which is directly across the street from a proposed school. A worst-case assumption was made for all analysis years that construction at the nearest non-Columbia University sites, Sites 18 and 19, could occur simultaneously with the Columbia University development. Although overall emissions from Site 20 are predicted to be somewhat higher, the larger size of Site 20 and the distance of Site 20 from areas that could be affected by the Columbia University construction would result in an overall lower combined impact. However, since the issuance of the DEIS, project modifications have been identified, which would result in no new construction taking place in Subdistrict B (see Chapter 29, "Modifications to the Proposed Actions"); the only non-Columbia University sites which may still be expected to be under construction as a result of this rezoning action are projected development Sites 24 and 25, which were therefore also investigated in detail. Sites 24 and 25 are distant from the Columbia University development west of Broadway; therefore, cumulative impacts of construction in Subdistrict B or Other Areas and Columbia University construction are not expected.

Almost all emissions would be near ground level, and the nearest receptors are at ground level; therefore, the highest impacts would be expected at ground level. because all the emissions in the 2026 peak are in the block immediately to the south of a school and residential buildings on West 133rd Street, resulting in a higher impact.

The dispersion of pollutants during the worst-case short-term and annual periods was then modeled in detail to predict resulting maximum concentration increments from construction activity and total concentrations (including background concentrations) in the surrounding area. The results for construction on the Columbia University development sites during the two worst-case scenarios and for the construction in Sites 18 and 19 are presented separately, and the

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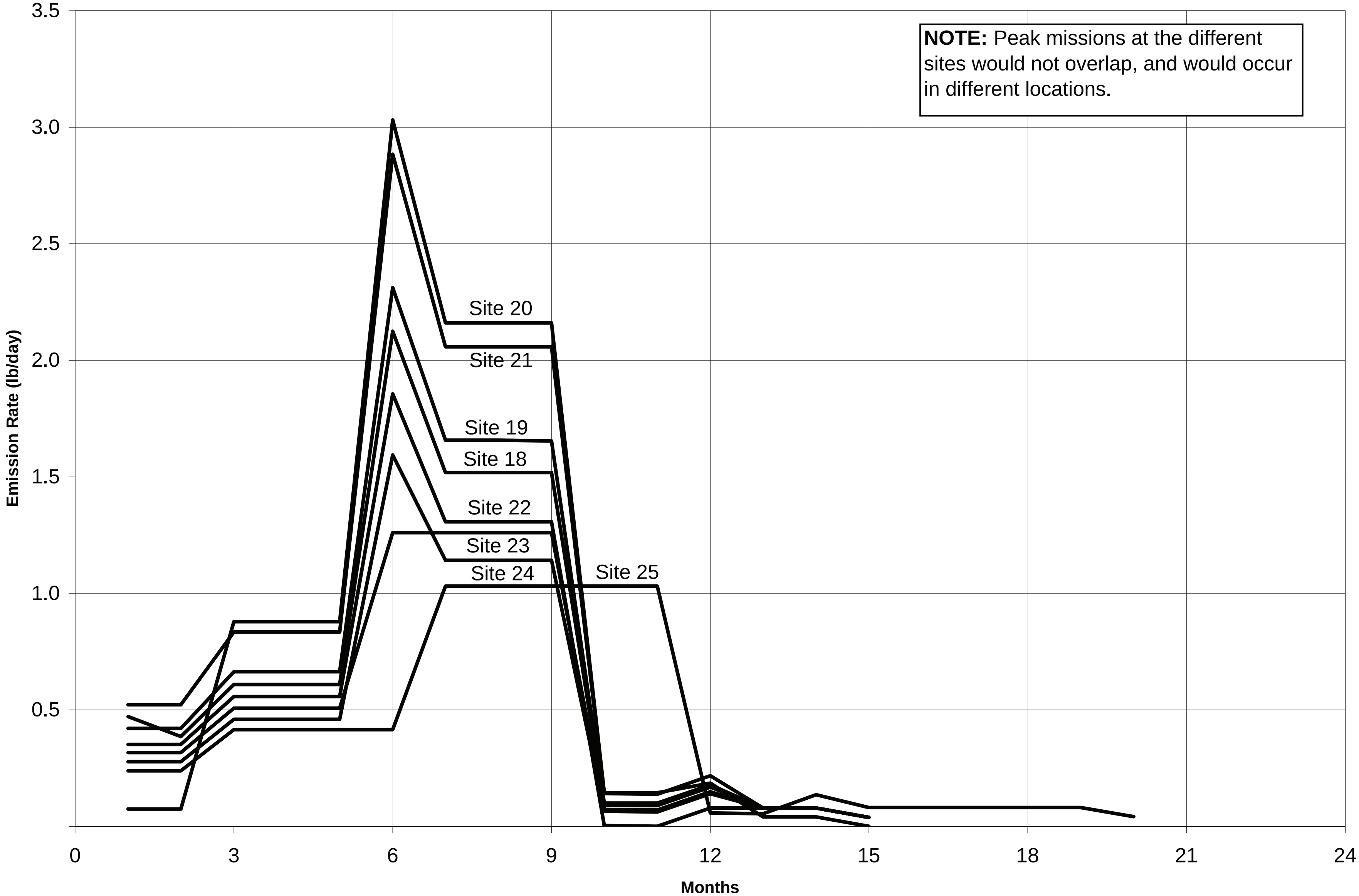


Figure 21-33

Potential Projected Redevelopment at Sites in Subdistricts B and Other Areas Peak (24-Hour Average) Construction $PM_{2.5}$ Emissions Profile

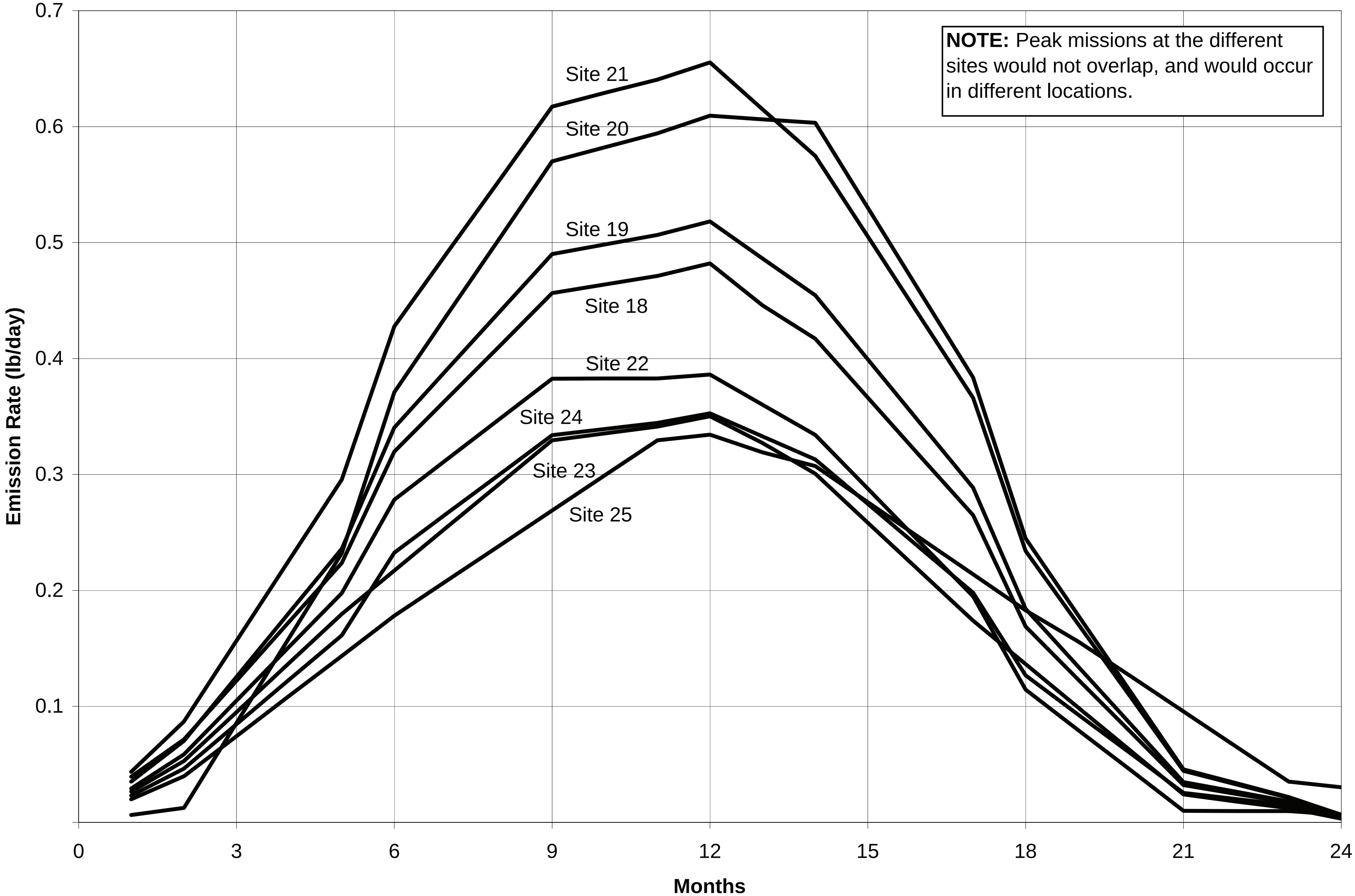
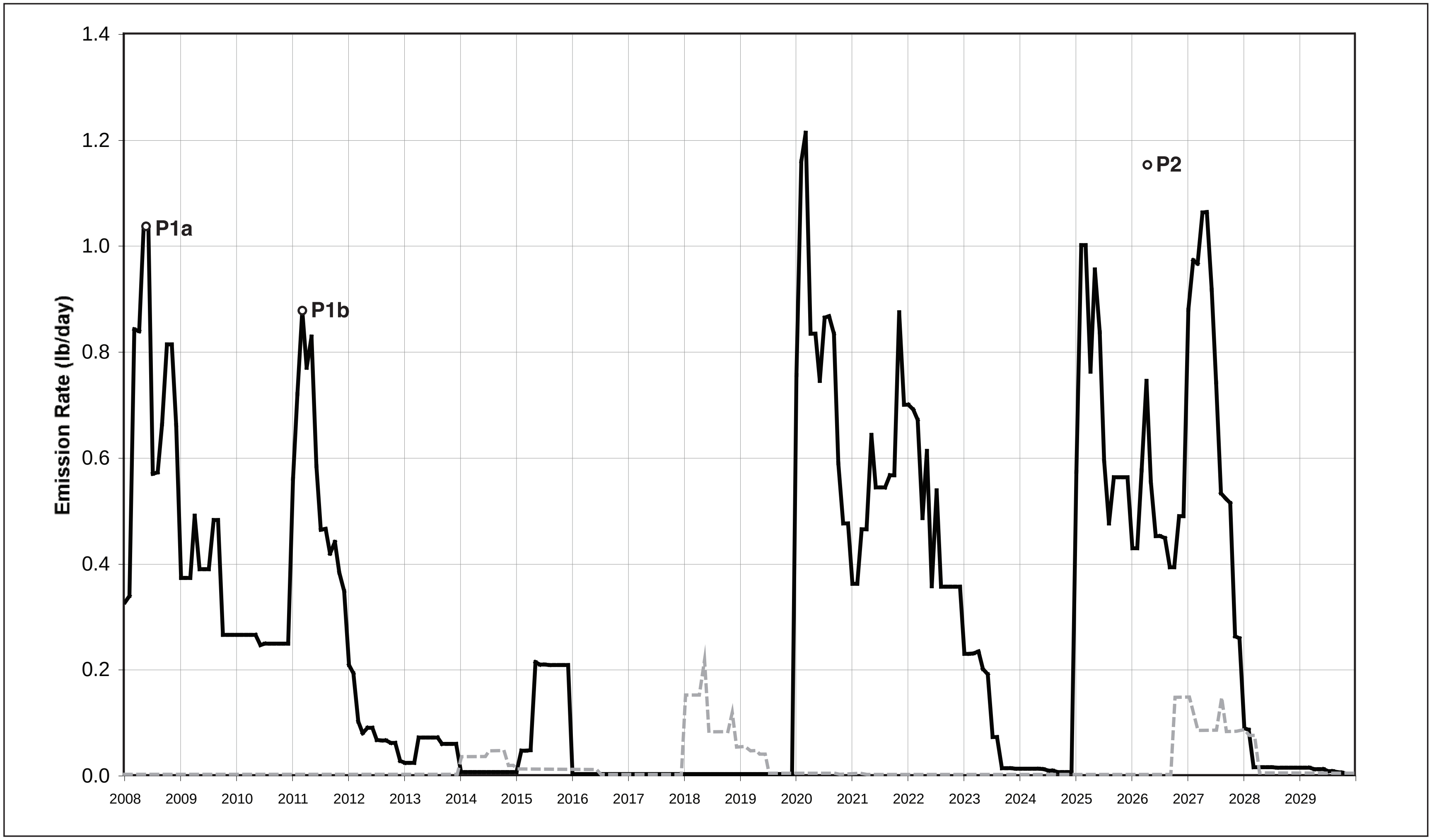


Figure 21-34

Potential Projected Redevelopment at Sites in Subdistricts B and Other Areas Annual (Moving 12-Month Average) Construction $PM_{2.5}$ Emissions Profile



P1a *Phase 1 Scenario, 2008*

P1b *Phase 1 Scenario, 2011*

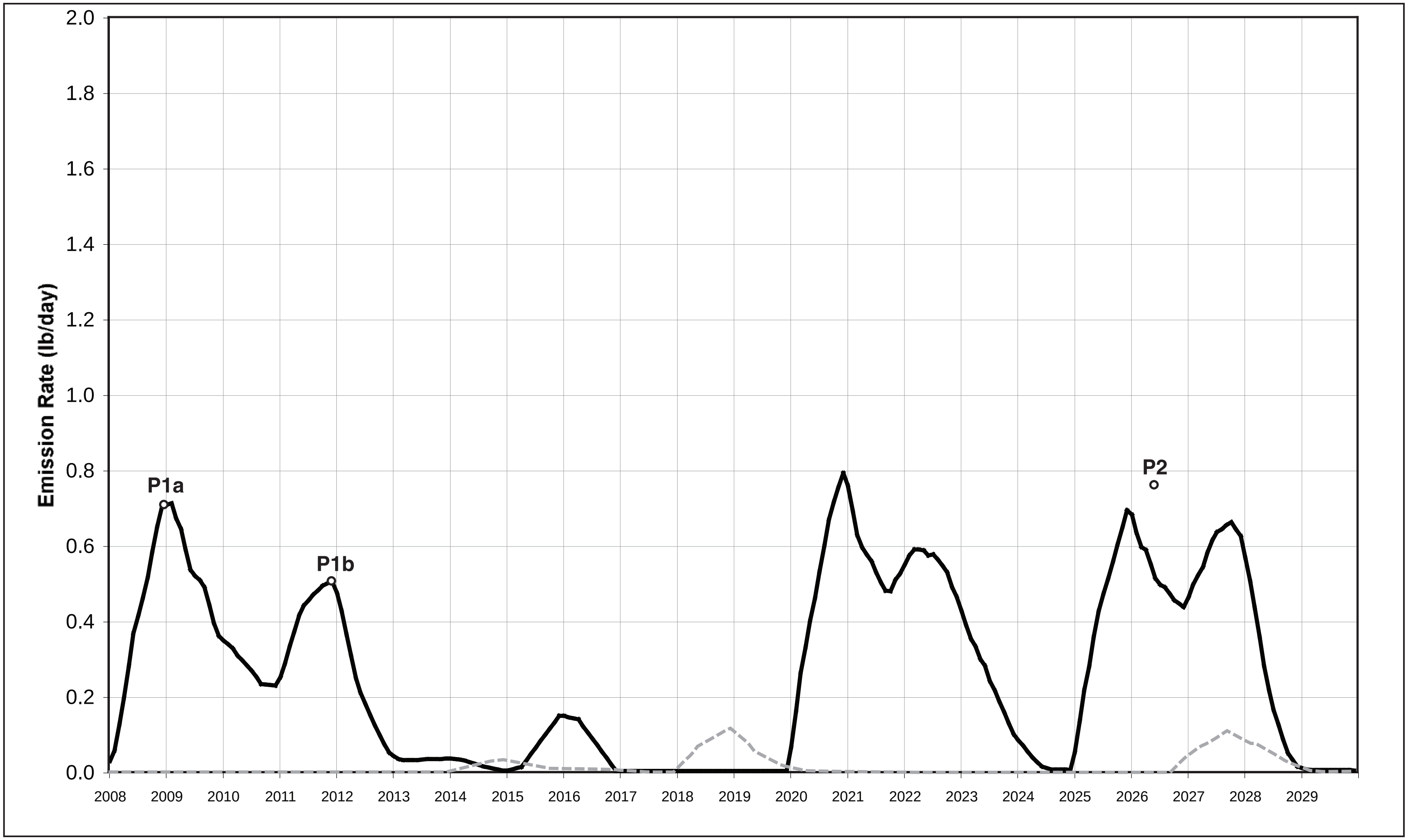
P2 *Phase 2, NOTE: Phase 2 was run for the DEIS*

Emissions Profile - Main Site

Emissions Profile - Sites 15,16,17

Figure 21-35

Columbia University Peak (24-hr Average) Construction $PM_{2.5}$ Emissions Profile



P1a *Phase 1 Scenario, 2008*

P1b *Phase 1 Scenario, 2011*

P2 *Phase 2, NOTE: Phase 2 was run for the DEIS*

Emissions Profile - Main Site

Emissions Profile - Sites 15,16,17

Figure 21-36

Columbia University Annual (Moving 12-Month Average) Construction $PM_{2.5}$ Emissions Profile

highest results from all sources combined (on-site construction, operational stationary and mobile sources) are presented in the cumulative section.

Although the modeled results are based on construction scenarios for specific sample periods, conclusions regarding other periods were derived based on the fact that lower concentration increments from construction would generally be expected during periods with lower construction emissions, and that the periods with the highest emissions nearest to sensitive receptor locations were analyzed. As presented in Figures 21-35 and 21-36, emissions during other periods would be lower, often much lower, than the peak emissions. However, since the worst-case short-term results may often be indicative of very local impacts, similar maximum local impacts may occur at any stage at various locations but would not persist in any single location, since emission sources would not be located continuously at any single location throughout construction. Equipment would move throughout the site as construction progresses.

For the short-term model scenarios, predicting concentration averages for periods of 24 hours or less, all stationary sources, such as compressors, pumps, or concrete trucks, which idle in a single location while unloading, were simulated as point sources. Other engines, which would move around the site on any given day, were simulated as area sources. For periods of 8 hours or less (less than the length of a shift), it was assumed that all engines would be active simultaneously. Since all sources would move around the site throughout the year, all sources were simulated as area sources in the annual analyses (tower cranes would be stationary, but since these would be electric and therefore not emit any pollutants, they are not represented in the model). During the construction on the block between West 132 Street and West 133rd Street, concrete delivery would not be staged on West 133rd Street due to the proximity to residential and school buildings on that block. Concrete trucks and pumps would be staged either on West 132nd Street or within the site

Receptors (locations in the model where concentrations are predicted) were placed along the sidewalks surrounding the construction sites on both sides of the street at all locations that would be publicly accessible, at residential and other sensitive uses at both ground-level and elevated locations (e.g., residential windows), and at publicly accessible open spaces. In addition, a ground-level receptor grid was placed to enable extrapolation of concentrations throughout the entire area at locations more distant from the construction sites. For the modeling of Phase 2 conditions, receptors were also placed on completed elements of the Columbia University development adjacent to the construction.

Detailed modeling parameters for sources and the location of sources and receptors are presented in Appendix K.3.

Cumulative Assessment

Since there are various source types (mobile, construction, operational heating, central energy plant, and cooling towers) that may contribute to concentration increments concurrently, a cumulative assessment of all sources related to the Proposed Actions during construction was undertaken to determine the potential maximum effect of all sources combined. During Phase 1 of construction, this would include on-site construction and on-road mobile sources. Since some permanent stationary operational sources completed under Phase 1, such as the central energy plant and package boilers at Site 1, would be operational while Phase 2 is under construction, the combined effect for the Phase 2 construction period includes the effect of these additional operational sources.

Total cumulative concentration increments were estimated by adding the highest results from the mobile source analysis, the construction analysis, and, for the Phase 2 construction scenario, the operational stationary source analysis, by location. Mobile sources included construction vehicles for Phase 1 and operational and construction vehicles during Phase 2 of construction. The mobile source and stationary source analyses are performed separately with different dispersion models, as appropriate for the different types of analyses. The combination of the highest results is therefore a conservatively high estimate of potential impacts, since it is likely that the highest results from different sources would occur under different meteorological conditions (e.g., different wind direction and speed) and would not actually occur simultaneously.

FUTURE WITH AND WITHOUT THE PROPOSED ACTIONS—PHASE 1

Mobile Source Assessment

Maximum predicted total pollutant concentrations (including background concentrations) and increments at all analysis sites for the worst-case mobile source conditions during Phase 1 of construction are presented in Table 21-14. The total concentrations are equal to the sum of the background and the predicted contributions from mobile sources. For $PM_{2.5}$, monitored concentrations are not added to modeled concentrations from sources, since impacts are determined by comparing the predicted changes between the Proposed Actions and the No Build with the interim guidance criteria. For PM_{10} and CO, the Proposed Actions total includes both monitored background and contributions from background traffic.

Table 21-14
Maximum Predicted Concentrations from Mobile Sources—Phase 1 ($\mu g/m^3$)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Site 1						
$PM_{2.5}$	24-hour[2]	0.77	1.00	0.23	2 [3]	35 [1]
	Annual[2]— Local	0.27	0.35	0.08	0.3	15
	Neighborhood-scale	0.10	0.13	0.03	0.1	
PM_{10}	24-hour	65.8	66.2	0.4	—	150
CO	8-hour	3.1 ppm	3.1 ppm	0.0 ppm	—	9 ppm
Site 2						
$PM_{2.5}$	24-hour[2]	0.59	0.63	0.04	2 [3]	35 [1]
	Annual[2]— Local	0.21	0.22	0.01	0.3	15
	Neighborhood-scale	0.17	0.17	0.00	0.1	
PM_{10}	24-hour	68.9	68.9	0.0	—	150
CO	8-hour	3.8 ppm	3.8 ppm	0.0 ppm	—	9 ppm
Site 3						
CO	8-hour	3.1 ppm	3.3 ppm	0.2 ppm	—	9 ppm

Notes: Results for any other time period during Phase 1, or locations other than these sites, would be lower.
The CO increments reflect the highest of all peak periods.
$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.

[1] EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."

[2] Monitored concentrations are not added to modeled $PM_{2.5}$ values.

[3] DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. For temporary impacts such as those caused by construction activities, the significance of any concentration increment greater than 2 $\mu g/m^3$ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.

Concentration increments due to Phase 1 construction-related mobile sources were predicted to be small, compared with the NAAQS and the applicable interim guidance thresholds for $PM_{2.5}$. Other than $PM_{2.5}$ concentrations, which are currently greater than the NAAQS and still could be in the future background condition, total concentrations would not exceed the NAAQS. In any other locations than those analyzed, maximum predicted increments and total concentrations would be lower than those presented here.

Overall, the mobile source effect from the Proposed Actions on pollutant concentrations would be small, compared with the NAAQS and interim guidance threshold levels. At any areas along the access routes that are not adjacent to the construction sites, mobile sources would be the only cause for pollutant increments due to the Proposed Actions during Phase 1 of construction; at those locations, total concentrations and increments would be lower than those predicted for the selected sites and would not result in any predicted significant adverse impacts from mobile sources. For total combined impact of all sources, see "Cumulative Assessment," below.

Assessment of Columbia University On-Site Construction Activity (Subdistrict A)

Maximum predicted concentration increments from Columbia University construction during Phase 1, and overall concentrations, which include maximum background concentrations, are presented in Table 21-15 for 2008, and Table 21-16 for 2011. The maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments and total 1-hour and 8-hour average CO concentrations at all locations are presented in isopleth form (lines representing constant concentration) in Figures 21-37 through 21-40 for 2008, and Figures 21-41 through 21-44 for 2011. The total concentrations in Tables 21-15, and 21-16 are the sum of background concentrations and Columbia University construction increments. The total maximum combined concentrations, including mobile sources and construction, are presented in the "Cumulative Assessment" section, below. (Since the numbers presented in the tables include significant figures only, there may be some rounding differences.)

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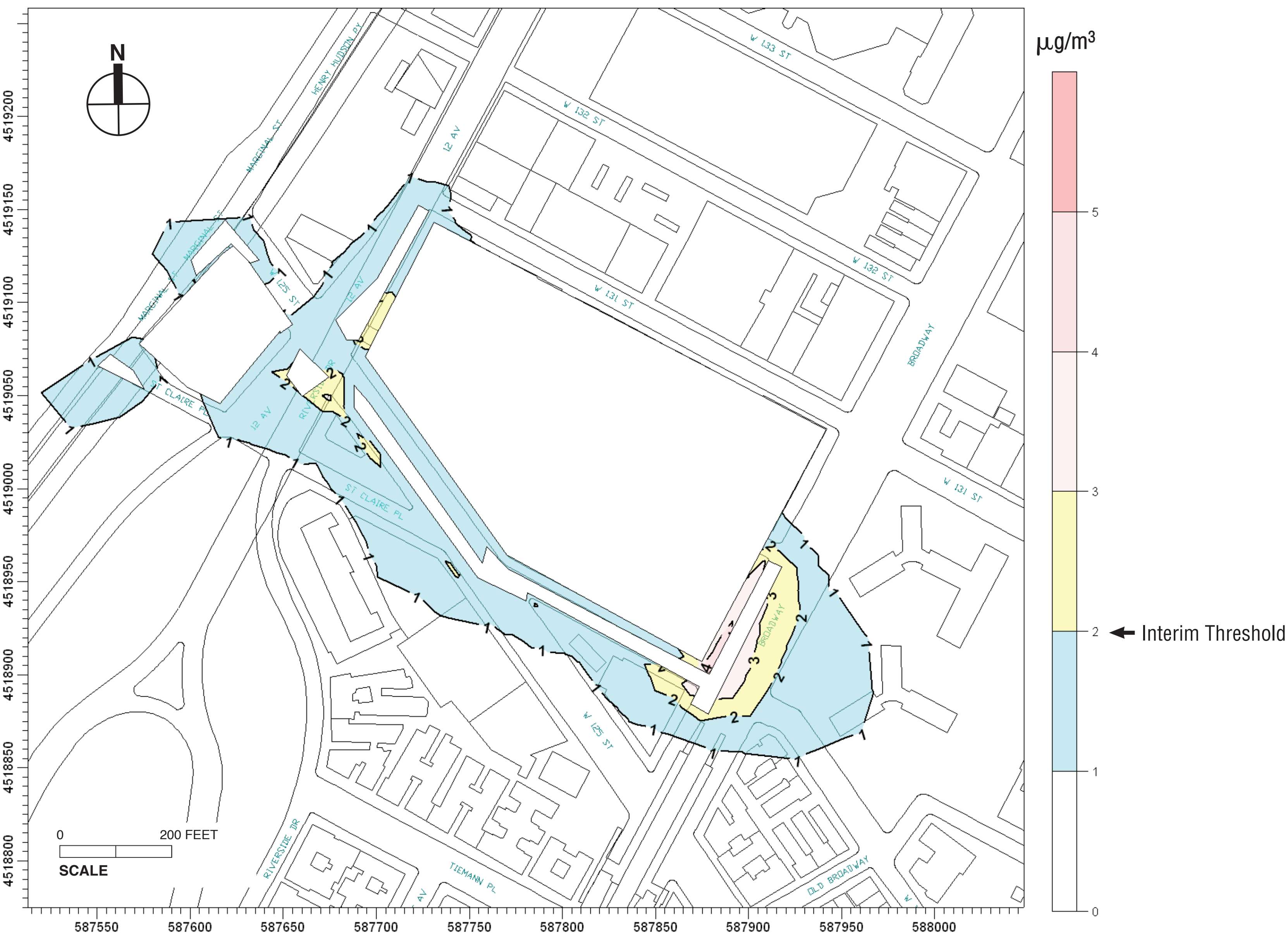

Figure 21-37

Maximum Predicted 24-Hour Average Increase in $PM_{2.5}$ Concentration
Columbia University Construction, Phase 1, 2008

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

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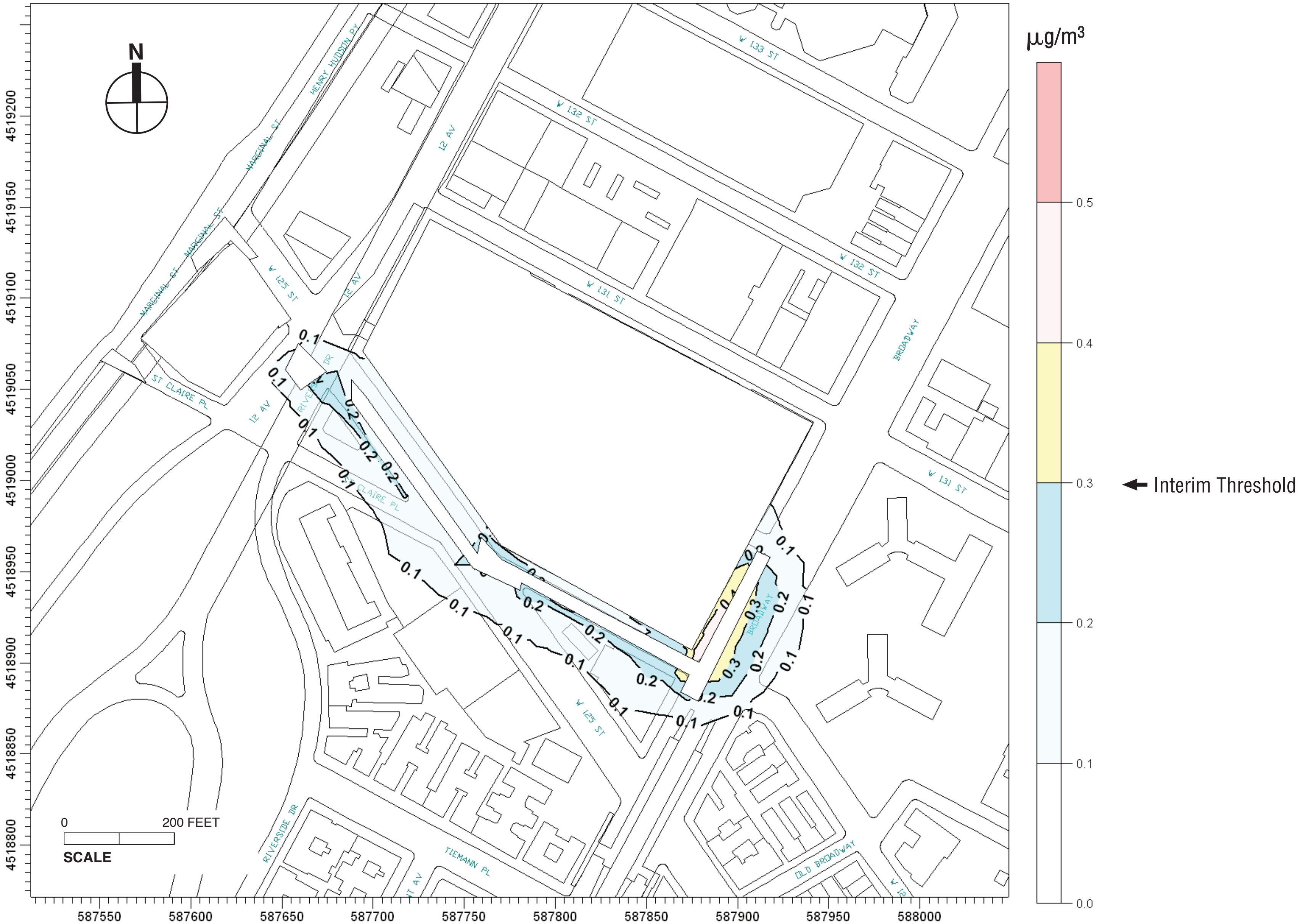

Figure 21-38

Maximum Predicted Annual Average Increase in $PM_{2.5}$ Concentration
Columbia University Construction, Phase 1, 2008

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

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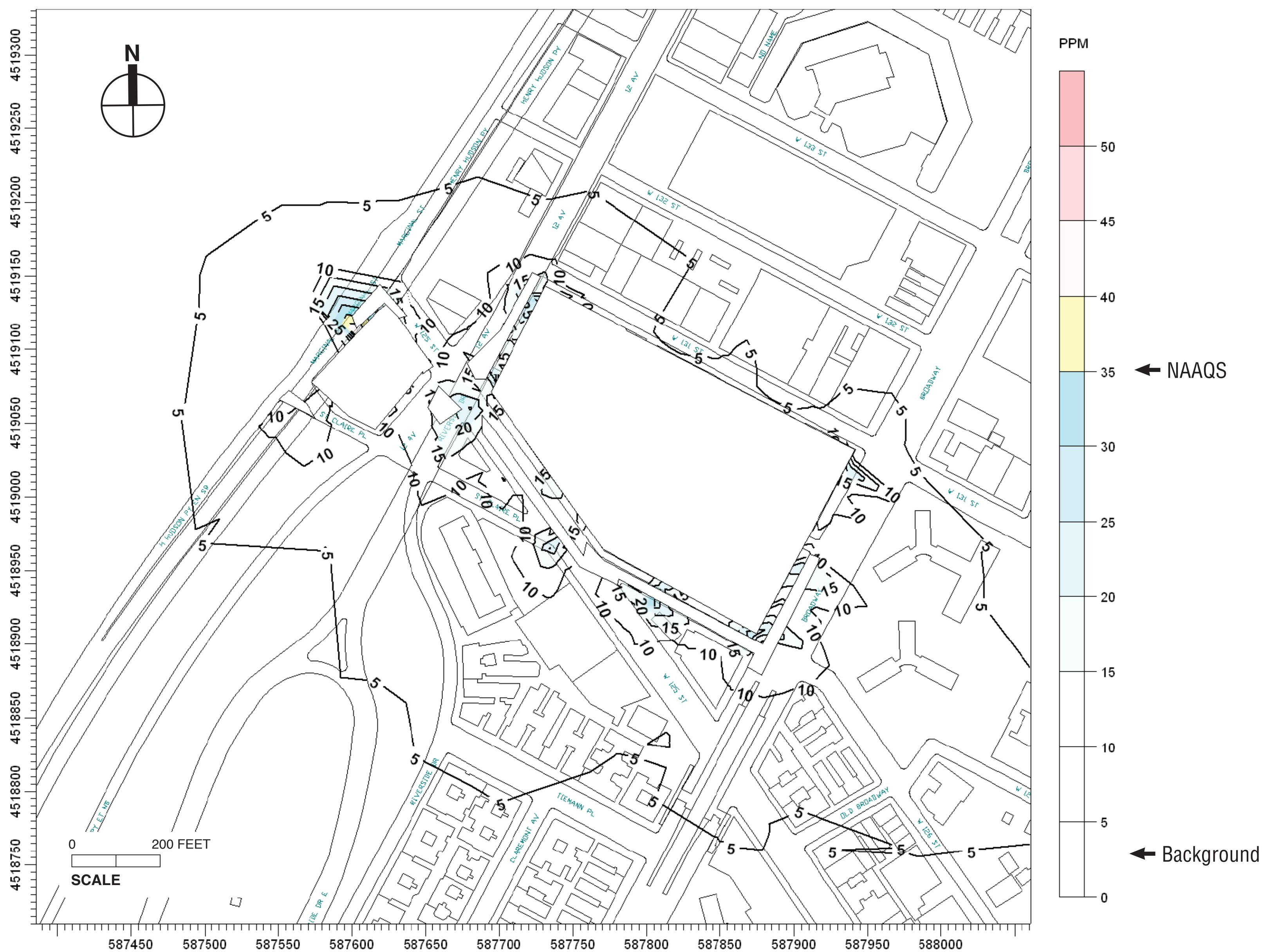
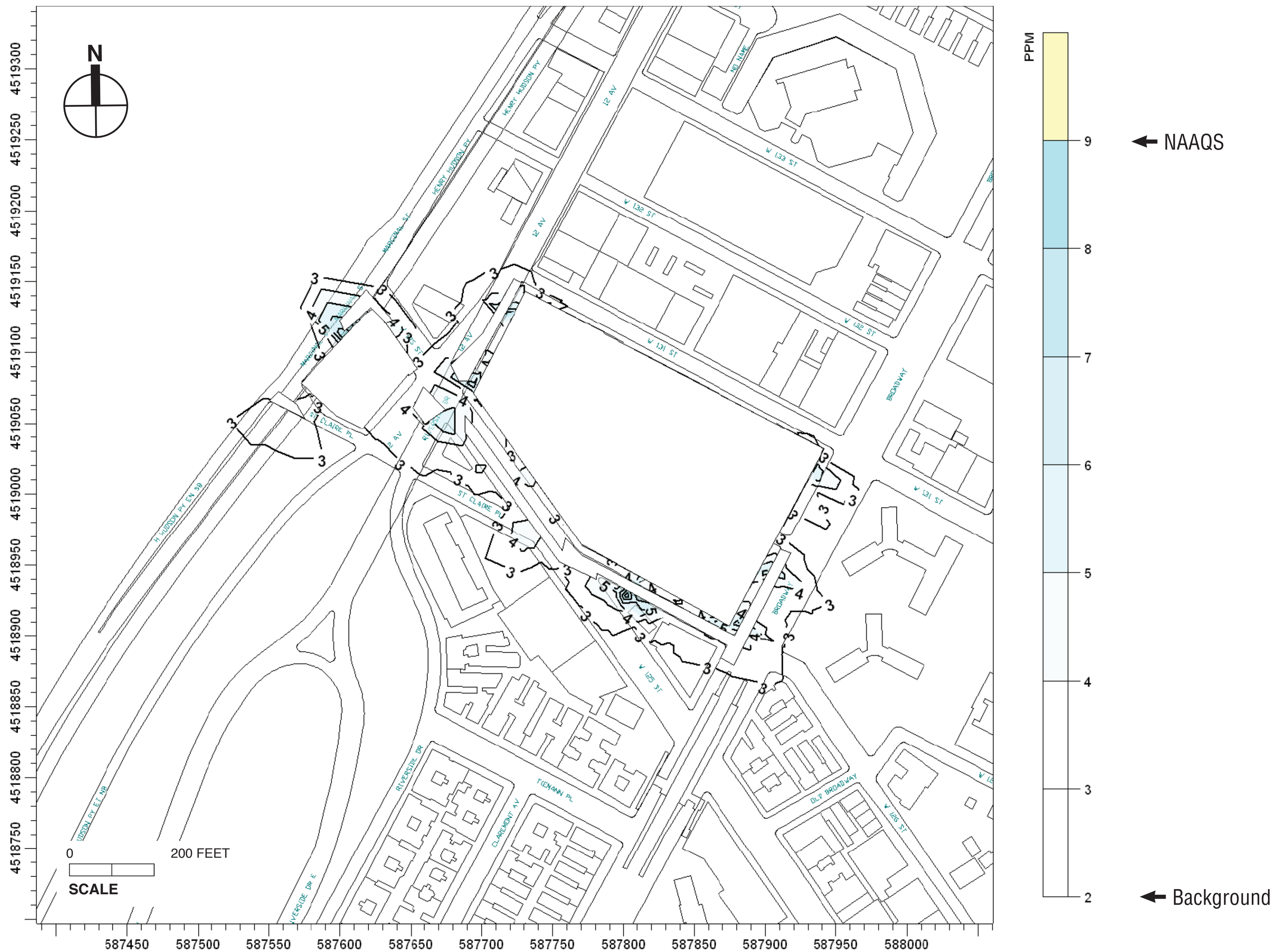


Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

Figure 21-39
Total Maximum Predicted 1-Hour Average CO Concentration Columbia University Construction, Phase 1, 2008



Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

Figure 21-40

Total Maximum Predicted 8-Hour Average CO Concentration Columbia University Construction, Phase 1, 2008

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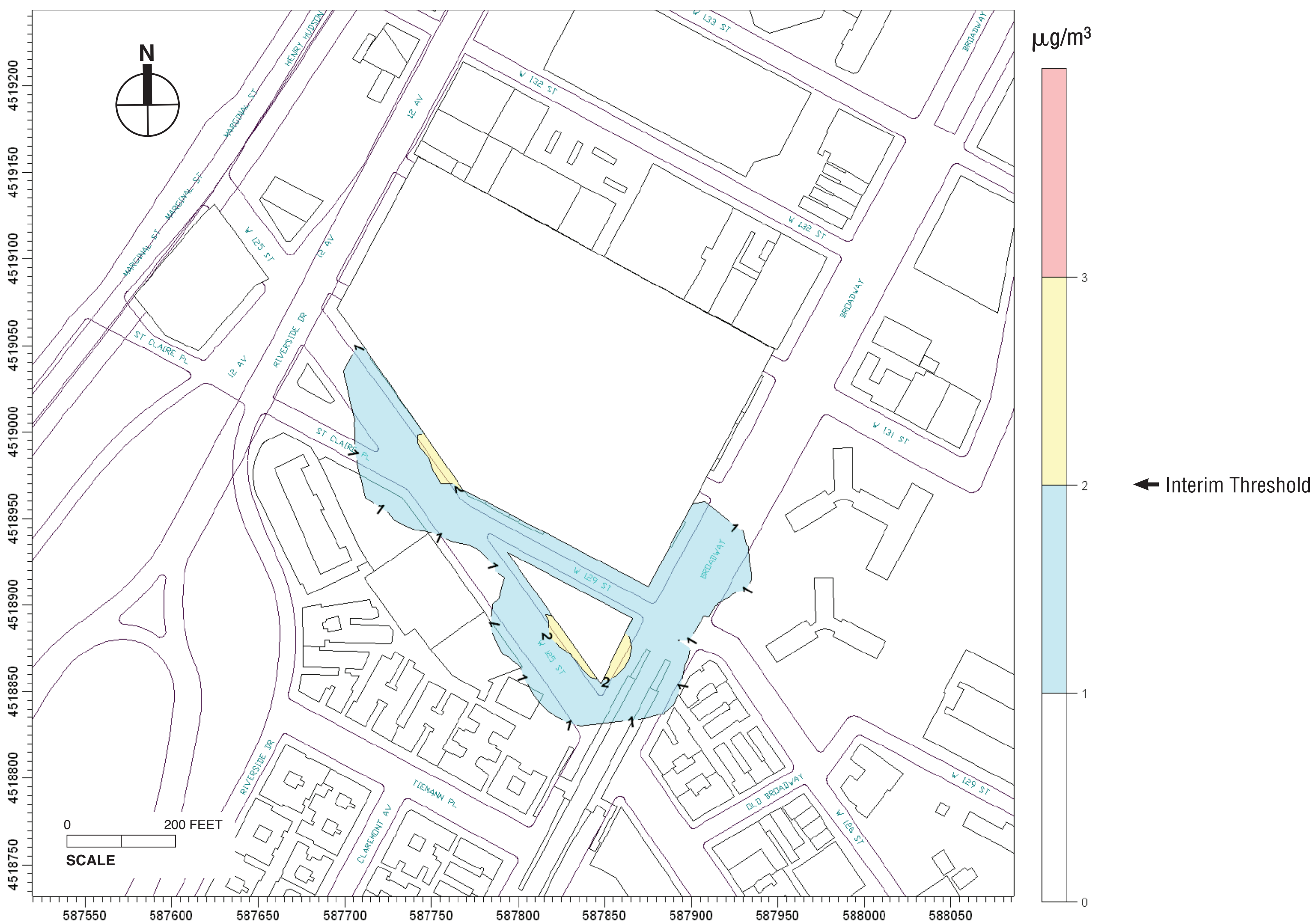

Figure 21-41

Maximum Predicted 24-Hour Average Increase in $PM_{2.5}$ Concentration
Columbia University Construction, Phase 1, 2011

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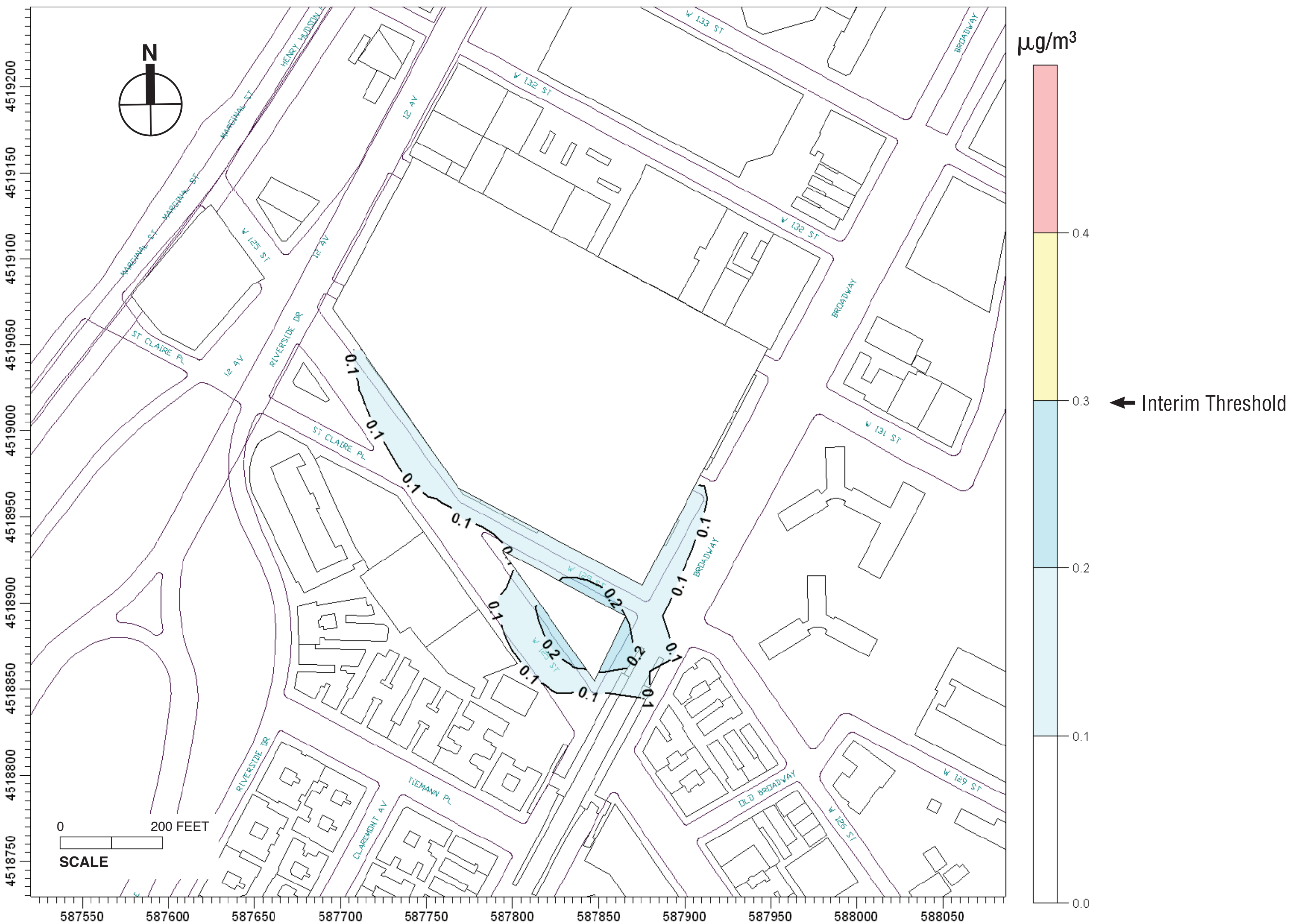

Figure 21-42

Maximum Predicted Annual Average Increase in $PM_{2.5}$ Concentration

Columbia University Construction, Phase 1, 2011

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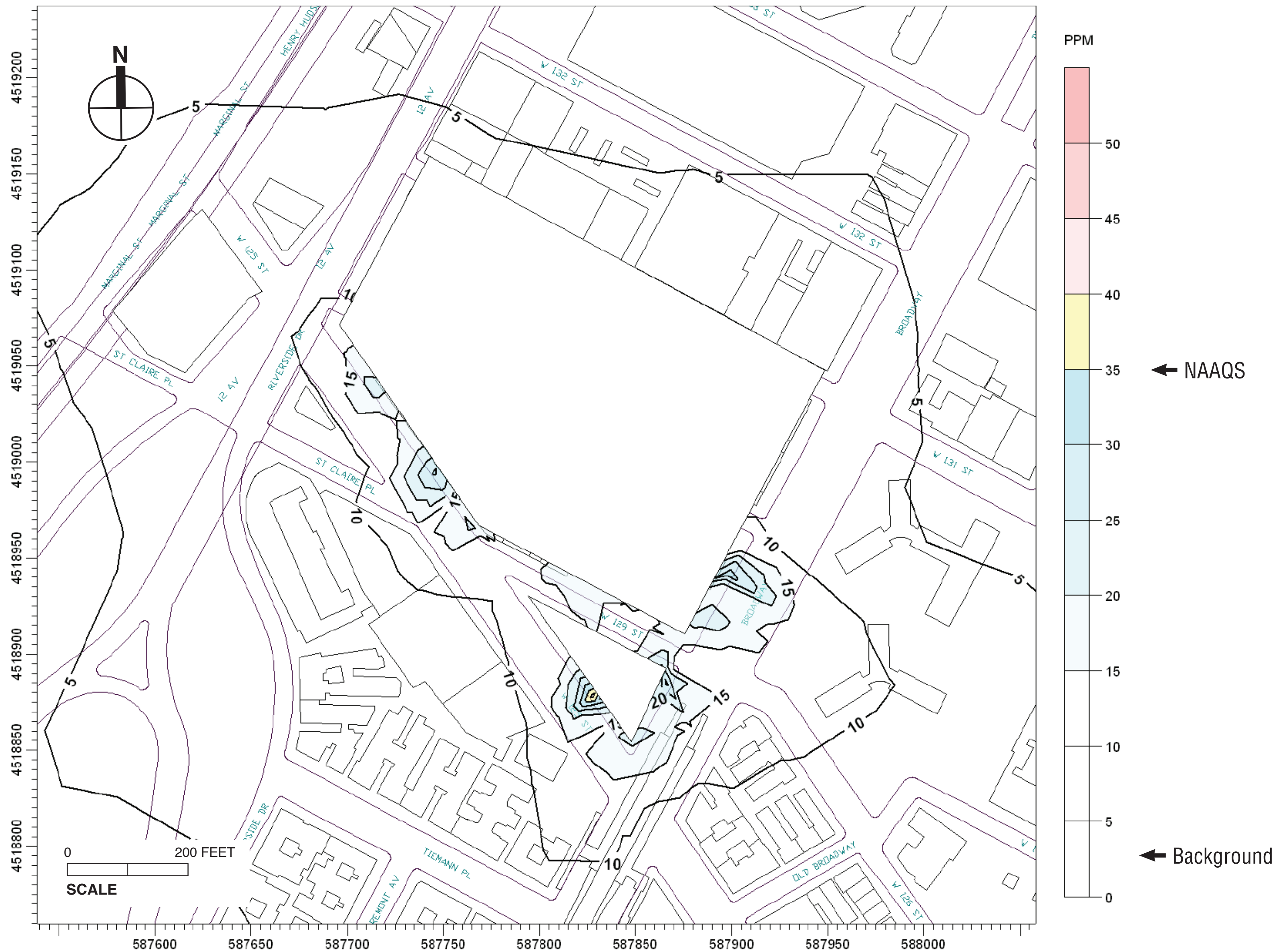

Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Figure 21-43

Total Maximum Predicted 1-Hour Average CO Concentration Columbia University Construction, Phase 1, 2011

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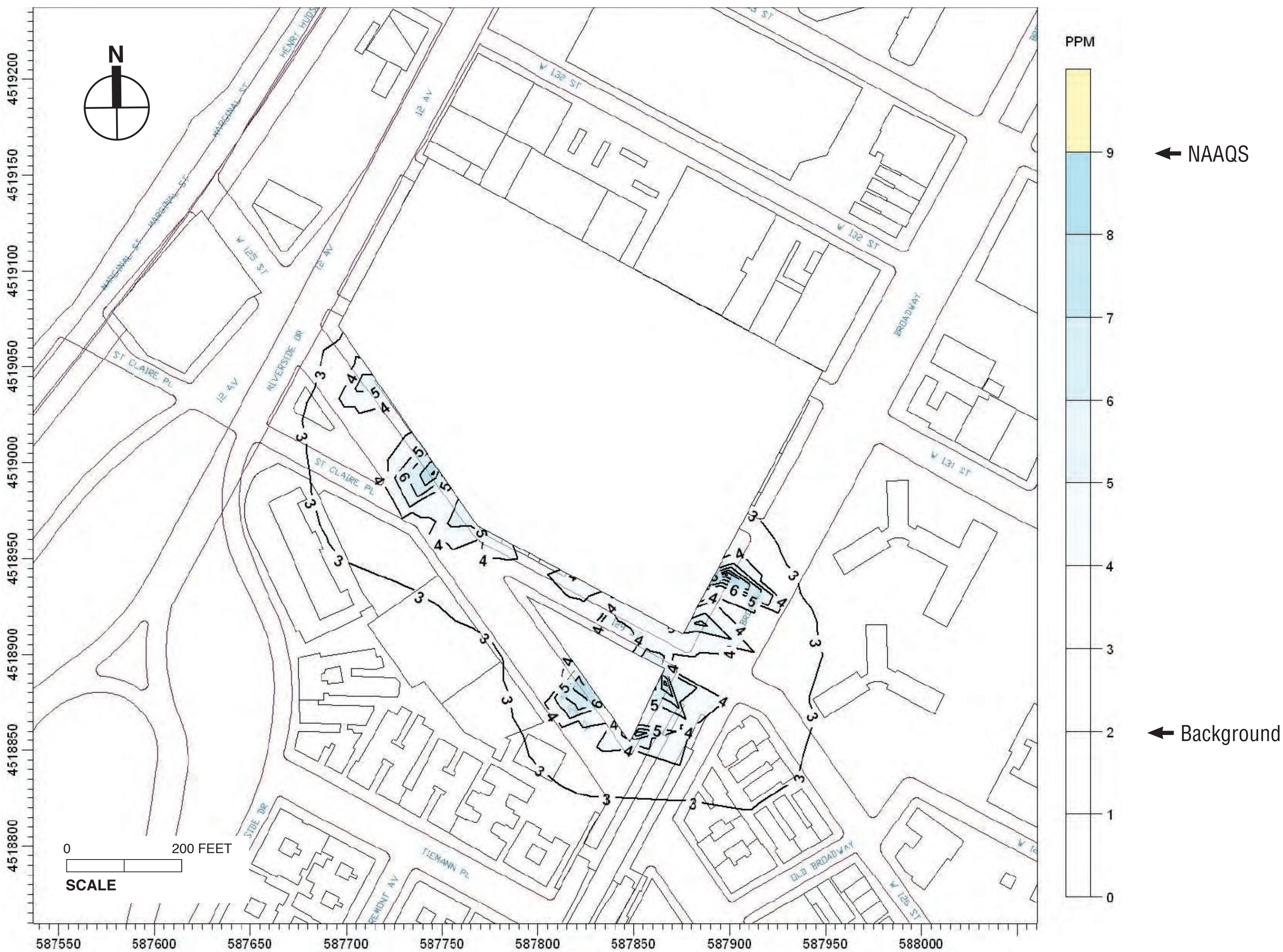

Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

Figure 21-44
Total Maximum Predicted 8-Hour Average CO Concentration Columbia University Construction, Phase 1, 2011

Table 21-15
Maximum Predicted Pollutant Concentrations from Columbia University Construction Phase 1, 2008 (µg/m³)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Residence or School						
$PM_{2.5}$	24-hour[2]	—	—	1.8	2 [3]	35 [1]
	Annual Local[2]	—	—	0.17	0.3	15
PM_{10}	24-hour	60	82	22	—	150
NO_2	Annual	68	75	7	—	100
CO	1-hour	2.6 ppm	20.0 ppm	17.4 ppm	—	35 ppm
	8-hour	2.0 ppm	4.3 ppm	2.3 ppm	—	9 ppm
Sidewalk						
$PM_{2.5}$	24-hour[2]	—	—	3.6[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.34[4]	0.3	15
PM_{10}	24-hour	60	98	38	—	150
NO_2	Annual	68	80	12	—	100
CO	1-hour	2.6 ppm	25.1 ppm	22.5 ppm	—	35 ppm
	8-hour	2.0 ppm	5.7 ppm	3.7 ppm	—	9 ppm
Sidewalks and Covered Walkways Adjacent to Construction						
$PM_{2.5}$	24-hour[2]	—	—	4.6[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.46[4]	0.3	15
PM_{10}	24-hour	60	116	56	—	150
NO_2	Annual	68	84	16	—	100
CO	1-hour	2.6 ppm	44.1 ppm [5]	41.5 ppm	—	35 ppm
	8-hour	2.0 ppm	8.6 ppm	6.6 ppm	—	9 ppm

Notes: Results for any other time period during Phase 1, or locations other than these sites, would be lower.

$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.

[1] EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 µg/m³ to 35 µg/m³ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."

[2] Monitored concentrations are not added to modeled $PM_{2.5}$ values.

[3] DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 µg/m³ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.

[4] This value exceeds the interim guidance threshold level. See text for further discussion.

[5] This value, exceeding the 1-hour NAAQS , was predicted at a single location for the 1-hour standard on the sidewalk immediately adjacent to the construction during the sewer relocation. This exceedance was predicted to occur only twice in a single year at most. See text for full discussion of these results.

Table 21-16
Maximum Predicted Pollutant Concentrations from Columbia University Construction Phase 1, 2011 (μg/m³)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Residence or School						
$PM_{2.5}$	24-hour[2]	—	—	1.2	2 [3]	35 [1]
	Annual Local[2]	—	—	0.09	0.3	15
PM_{10}	24-hour	60	96	36	—	150
NO_2	Annual	68	74	6	—	100
CO	1-hour	2.6 ppm	13.3 ppm	10.7 ppm	—	35 ppm
	8-hour	2.0 ppm	3.5 ppm	1.5 ppm	—	9 ppm
Sidewalk						
$PM_{2.5}$	24-hour[2]	—	—	1.3	2 [3]	35 [1]
	Annual Local[2]	—	—	0.10	0.3	15
PM_{10}	24-hour	60	100	40	—	150
NO_2	Annual	68	74	6	—	100
CO	1-hour	2.6 ppm	14.8 ppm	12.2 ppm	—	35 ppm
	8-hour	2.0 ppm	3.7 ppm	1.7 ppm	—	9 ppm
Sidewalks and Covered Walkways Adjacent to Construction						
$PM_{2.5}$	24-hour[2]	—	—	2.3[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.25	0.3	15
PM_{10}	24-hour	60	110	50	—	150
NO_2	Annual	68	83	15	—	100
CO	1-hour	2.6 ppm	41.2 ppm[5]	38.6 ppm	—	35 ppm
	8-hour	2.0 ppm	8.9 ppm	6.9 ppm	—	9 ppm

Notes: Results for any other time period during Phase 1, or locations other than these sites, would be lower.

$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.

1 EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 μg/m³ to 35 μg/m³ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."

2 Monitored concentrations are not added to modeled $PM_{2.5}$ values.

3 DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 μg/m³ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.

4 This value exceeds the interim guidance threshold level. See text for further discussion.

5 This value, exceeding the 1-hour NAAQS , was predicted at a single location for the 1-hour standard on the sidewalk immediately adjacent to the construction. This exceedance was predicted to occur only twice in a single year at most. See text for full discussion of these results.

The construction on Columbia University development sites alone would not cause any exceedance of the NO_2, or PM_{10} NAAQS. The highest predicted 1-hour average CO concentrations in the 2008 and 2011 periods, presented in Table 21-15 and 21-16, exceed the NAAQS level. Since 8-hour average CO exceedances would also occur when combined with mobile source increments, a full discussion of potential exceedances of the CO NAAQS can be found in the "Cumulative Assessment" section, below.

The highest $PM_{2.5}$ concentration increments from Columbia University construction activity would occur at protected sidewalk locations immediately adjacent to the construction fence. The location of the maximum 24-hour average increments would vary based on the location of the sources, which would move throughout the site. Continuous, daily and annual exposures would not be likely to occur at these locations.

From the on-site sources related to the construction of the Columbia University sites in Phase 1, there were no predicted $PM_{2.5}$ concentration increments greater than the interim guidance thresholds at residences where exposure for periods of 24 hours or more can be reasonably expected. Maximum predicted annual average $PM_{2.5}$ concentrations on a neighborhood scale were much less than the applicable interim guidance. However, since neighborhood scale annual average $PM_{2.5}$ concentrations are not a localized result related only to a specific site, those results are discussed in "Cumulative Assessment," below.

Assessment of On-Site Construction Activity on Projected Redevelopment Sites (Sites Not Constructed by Columbia University)

Maximum predicted concentration increments from the potential construction of Sites 18 and 19 during Phase 1, and overall concentrations, which include maximum background concentrations, are presented in Table 21-17. The maximum predicted $PM_{2.5}$ concentration increments and total 1-hour and 8-hour average CO concentrations at all locations are presented in isopleth form in Figures 21-45 through 21-48. The total concentrations in Table 21-17 are the sum of background concentrations and construction increments from the redevelopment Sites 18 and 19. These results are also indicative of potential concentrations that could occur in the vicinity of similar redevelopment sites in Subdistrict B and the Other Areas during construction at each site. Since Sites 18 and 19 are small, similar activity which may occur on larger sites would result in lower concentrations in the adjacent area, since emissions would be spread throughout a larger area. The total maximum combined concentrations, including mobile sources and concurrent construction on both Columbia University development sites and projected redevelopment sites 18 and 19, are presented in the "Cumulative Assessment" section, below. (Since the numbers presented in the tables include significant figures only, there may be some rounding differences.)

As described above in "Methodology," construction on projected redevelopment sites would only last for a single year at any given location. Any impacts related to uncontrolled emissions from those sites would be limited to one year and could occur simultaneously with either 2008, 2009-2010, or 2011 construction on the Columbia University development sites, but not all three.

It should be noted that the maximum increments, predicted at sidewalks and covered walkways adjacent to construction, are overstated, since they do not include the effect of the fence on mixing, and the peak (24-hour or less) increments would not persist in any single location, since the engines would be moved around the site. Exposure would not occur at these levels at such locations for long durations (24 hours or annual), since people would not linger at sidewalks and covered walkways adjacent to construction sites.

Although local $PM_{2.5}$ increments at adjacent sidewalks would be greater than those projected for the Columbia University construction sites, these increments would be temporary, limited to the single year of construction, and would not impact residences or school receptor locations. The highest annual average neighborhood-scale $PM_{2.5}$ increment would potentially be 0.02 $\mu g/m^3$, which is lower than the threshold level of 0.1 $\mu g/m^3$.

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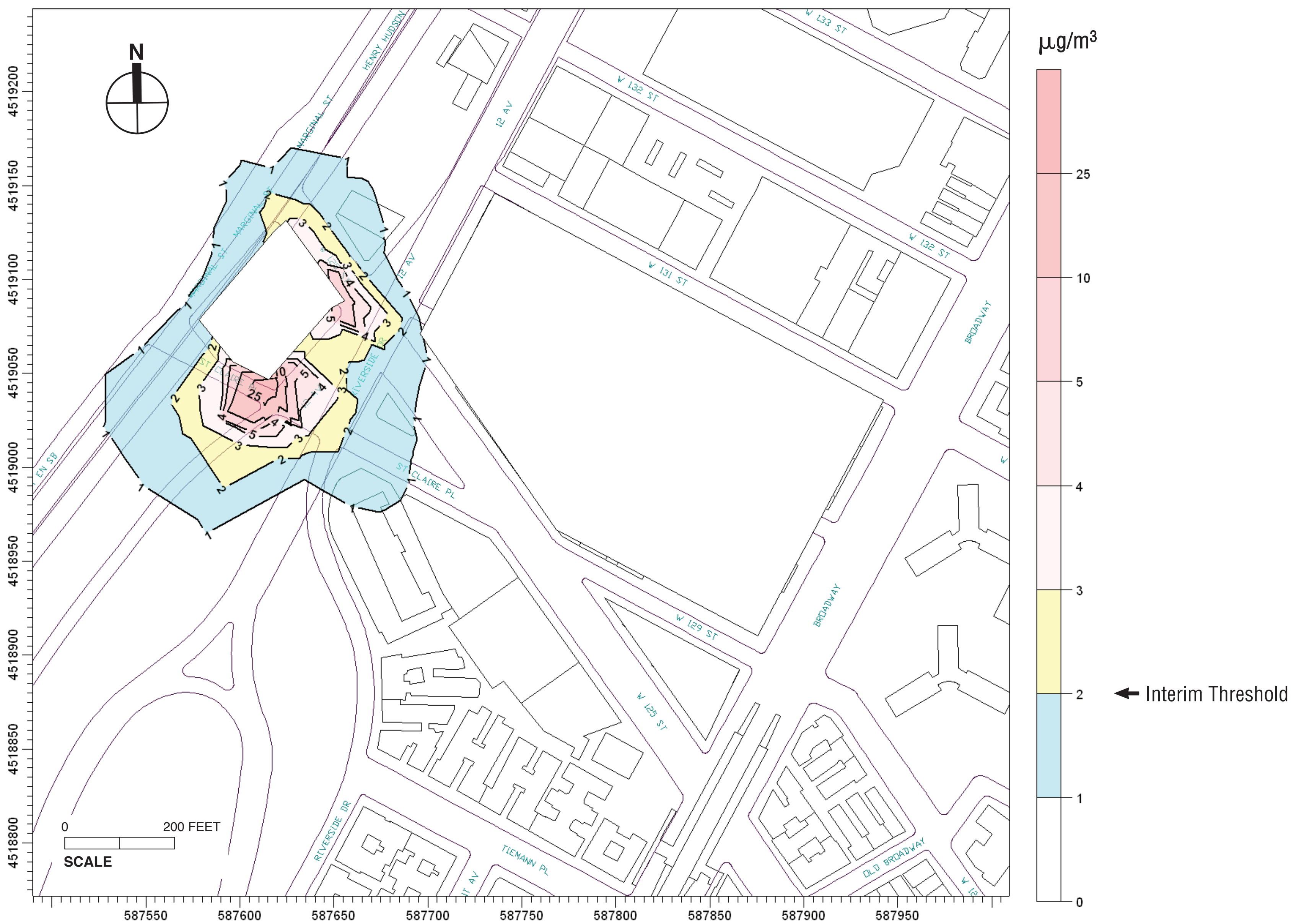

Figure 21-45

Maximum Predicted 24-Hour Average Increase in $PM_{2.5}$ Concentration
Projected Redevelopment Sites – Site 18 and Site 19, Phase 1

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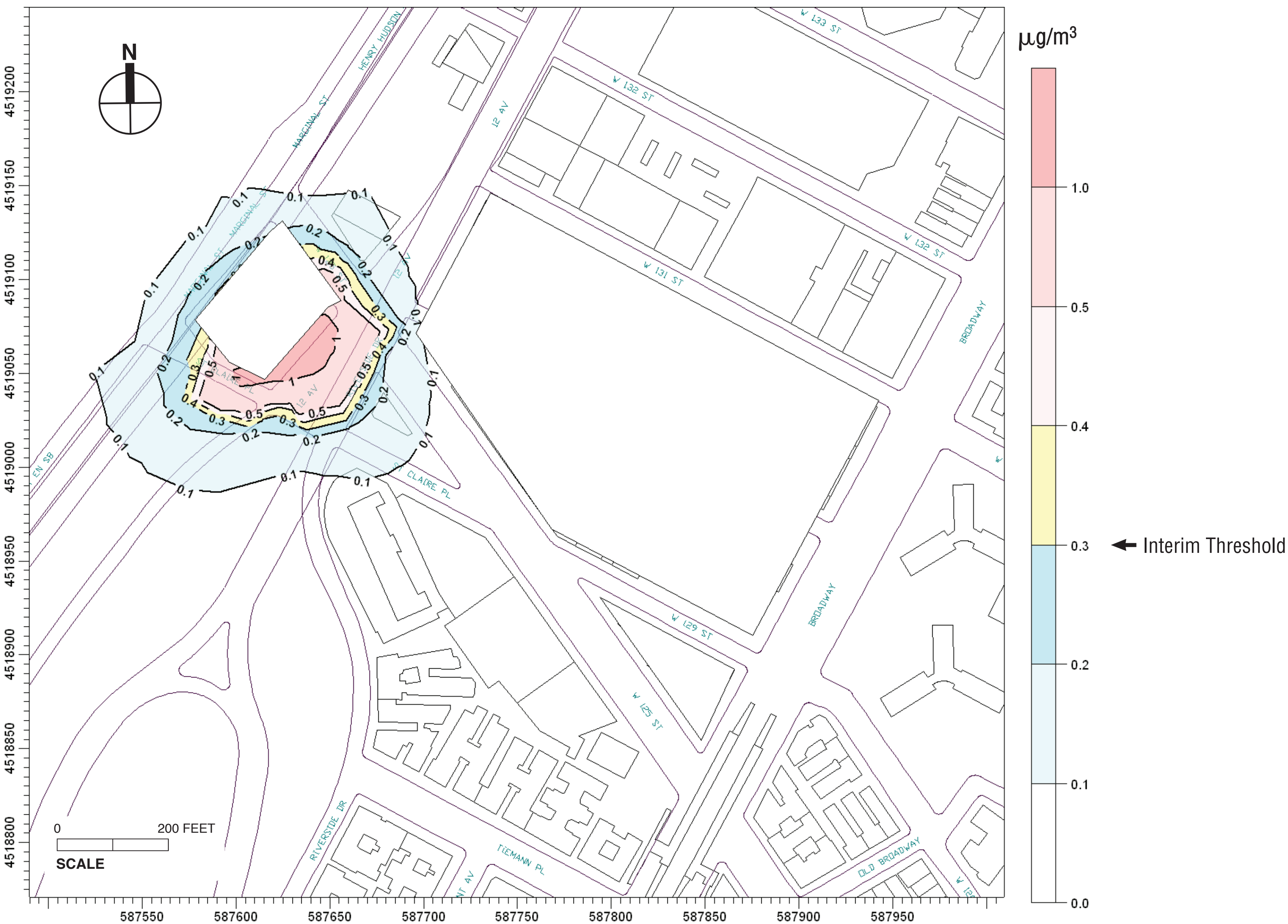

Figure 21-46
Maximum Predicted Annual Average Increase in $PM_{2.5}$ Concentration
Projected Redevelopment Sites – Site 18 and Site 19, Phase 1

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

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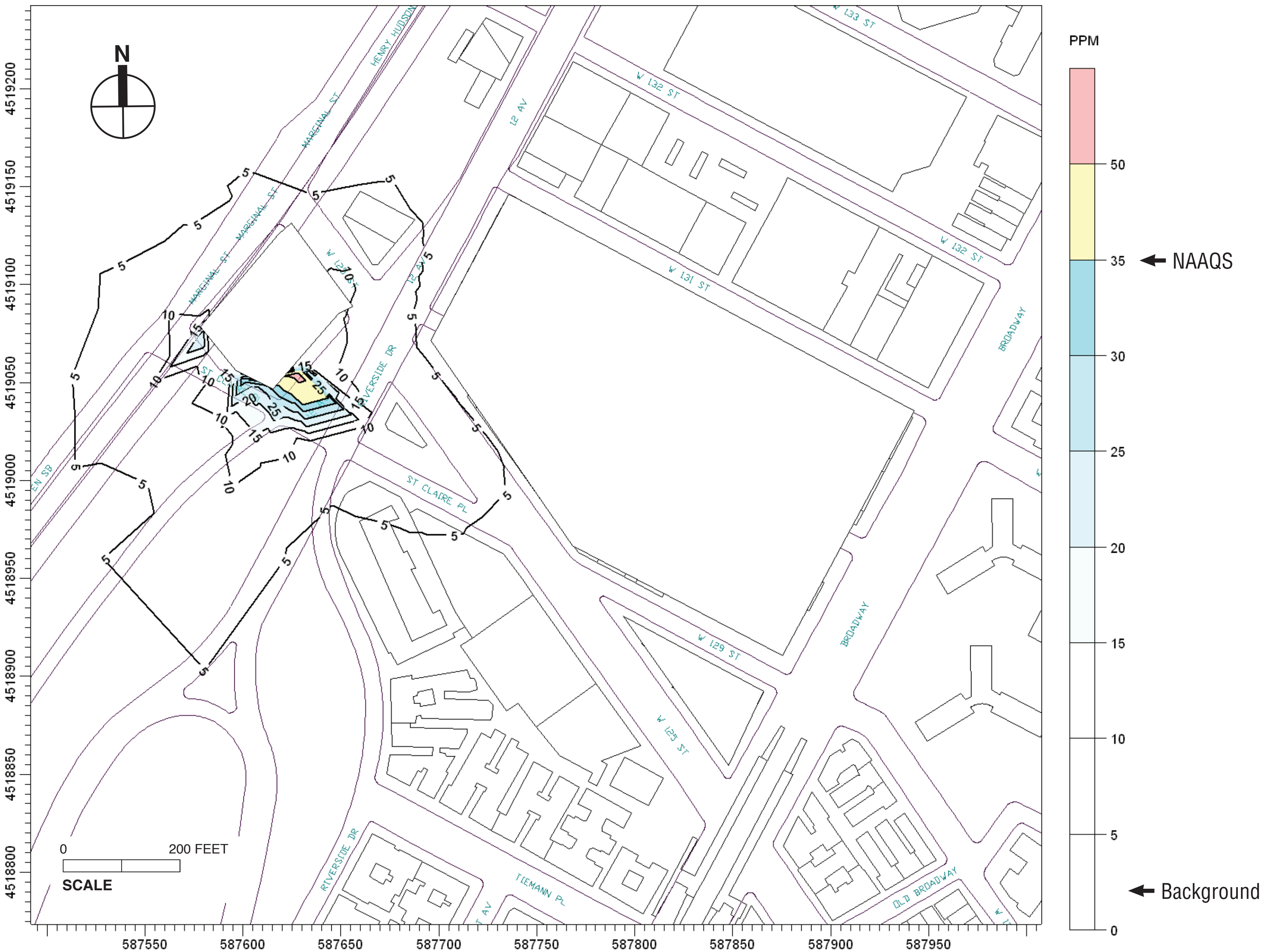

Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Figure 21-47
Total Maximum Predicted 1-Hour Average CO Concentration Projected Redevelopment Sites – Site 18 and Site 19, Phase 1

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Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Figure 21-48

Total Maximum Predicted 8-Hour Average CO Concentration Projected Redevelopment Sites – Site 18 and Site 19, Phase 1

Table 21-17
Maximum Predicted Pollutant Concentrations from Construction Activity at Projected Redevelopment Sites—Subdistrict B and the Other Areas, Phase 1 (μg/m³)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Residence or School						
$PM_{2.5}$	24-hour[2]	—	—	1.1	2 [3]	35 [1]
	Annual Local[2]	—	—	0.08	0.3	15
PM_{10}	24-hour	60	62	2	—	150
NO_2	Annual	68	69	1	—	100
CO	1-hour	2.6 ppm	5.5 ppm	2.9 ppm	—	35 ppm
	8-hour	2.0 ppm	2.5 ppm	0.5 ppm	—	9 ppm
Sidewalk or Open Space						
$PM_{2.5}$	24-hour[2]	—	—	4.9[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.26	0.3	15
PM_{10}	24-hour	60	72	12	—	150
NO_2	Annual	68	71	3	—	100
CO	1-hour	2.6 ppm	14.2 ppm	11.6 ppm	—	35 ppm
	8-hour	2.0 ppm	3.2 ppm	1.2 ppm	—	9 ppm
Sidewalks and Covered Walkways Adjacent to Construction						
$PM_{2.5}$	24-hour[2]	—	—	45.5[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	1.3[4]	0.3	15
PM_{10}	24-hour	60	121	61	—	150
NO_2	Annual	68	79	11	—	100
CO	1-hour	2.6 ppm	54.6 ppm [5]	52.0 ppm	—	35 ppm
	8-hour	2.0 ppm	8.0 ppm	6.0 ppm	—	9 ppm

Notes: Results for any other time period during Phase 1, or locations other than these sites, would be lower.

$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.

1 EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 μg/m³ to 35 μg/m³ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, “Air Quality.”

2 Monitored concentrations are not added to modeled $PM_{2.5}$ values.

3 DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 μg/m³ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.

4 This value exceeds the interim guidance threshold level. See text for further discussion.

5 This value, exceeding the NAAQS level, was predicted at a single location on the sidewalk immediately adjacent to the construction fence. Levels exceeding the standard could occur during three hours throughout the entire construction period near each of the projected development sites if gasoline powered generators and compressors operate during the three hours when meteorological conditions would lead to such high levels. Such occurrences are unlikely, and would be limited to an area approximately 40 feet long on the sidewalk adjacent to the construction fence.

In the vicinity of the non-Columbia University projected development sites in Subdistrict B and the Other Areas, impacts could occur for one year of construction near any single site during Phase 1. Elevated annual average and 24-hour average $PM_{2.5}$ concentrations were predicted during construction at these sites. Absent measures which would substantially reduce emissions, $PM_{2.5}$ increments at these levels at these locations could have the potential to result in significant air quality impacts. An emissions control program could be implemented via E-designations to ensure that significant impacts on air quality do not occur during construction on these sites. However, since the publication of the DEIS, project modifications have been identified, which would result in no new development taking place in Subdistrict B (see Chapter 29, "Modifications to the Proposed Actions"); the only non-Columbia University sites which may still be expected to be under construction as a result of this rezoning action are Sites 24 and 25. Therefore, a detailed analysis of $PM_{2.5}$ during the construction on Sites 24 and 25 was performed, including an emissions control program for those sites (see below).

The analysis of Sites 24 and 25 was based on the assumption that an emission reduction program would be instituted for any construction on those sites, implemented via E-designations. The program would include early electrification to ensure that large generators are not used on the sites, the use of ULSD for all diesel engines, and the use of Tier 2 certified engines or cleaner equipped with DPF tailpipe controls. The predicted maximum potential 24-hour average and annual-average $PM_{2.5}$ concentrations are presented in Figures 21-49 and 21-50, respectively. The highest predicted 24-hour average $PM_{2.5}$ concentrations at the adjacent residential locations to the south and east of site 25 could reach a maximum of 1.8 $\mu g/m^3$ and 1.9 $\mu g/m^3$, respectively, and annual average concentrations could reach a maximum concentration of 0.1 $\mu g/m^3$—in both cases, lower than the applicable threshold levels. Therefore, no significant adverse $PM_{2.5}$ impact would occur as a result of construction on Sites 24 and 25 with the emission control program described above.

Maximum predicted total PM_{10} and NO_2 concentrations are not expected to exceed the NAAQS. Total 1-hour average CO concentrations at a single location near Site 18, immediately adjacent to high emitting point sources, could exceed NAAQS levels should those sources be placed adjacent to the fence line. Similar occurrences would be possible adjacent to other non-Columbia University sites in Subdistrict B and the Other Area east of Broadway (Sites 24 and 25). Up to three 1-hour meteorological events could occur throughout the duration of construction at any given site in Subdistrict B and the Other Area east of Broadway during which the potential would exist for CO levels to exceed the NAAQS. If these meteorological conditions occur at a time when such an engine does not happen to be operating or is operating but is not located immediately adjacent to the site boundary, exceedances would not occur. These CO exceedances are overstated, since they do not include the effect of the fence on mixing and are restricted to a very small area. Based on the limited duration and extent of these predicted exceedances, the low likelihood of occurrence, and the limited potential for exposure, this is not predicted would not result in significant adverse impacts.

Cumulative Assessment

Maximum predicted combined concentration increments from on-site construction—including the highest increments from Columbia University development sites combined with increments from mobile sources during Phase 1, as well as overall combined concentrations, which include background concentrations—are presented in Table 21-18. Since the publication of the DEIS, project modifications have been identified, which would result in no new construction taking place in Subdistrict B (see Chapter 29, "Modifications to the Proposed Actions"); the only non-Columbia University sites which may still be expected to be under construction as a result of the rezoning action are Sites 24 and 25. Sites 24 and 25 are distant from the large Columbia University sites; therefore, cumulative impacts of construction in Subdistrict B or Other Areas and Columbia University are not expected. The cumulative increments presented in Table 21-18 are a sum of the

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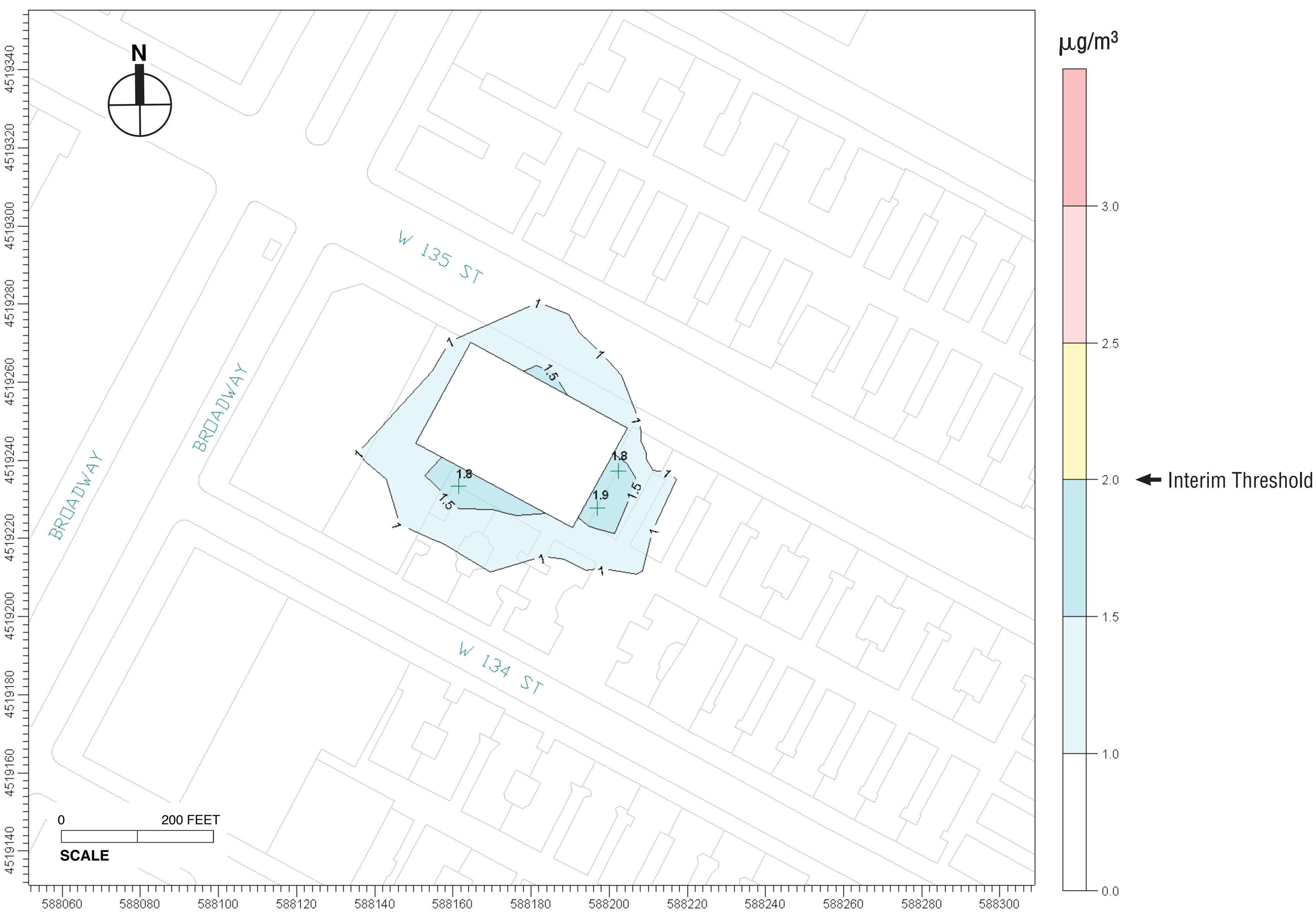

Figure 21-49

Maximum Predicted 24-Hour Average Increase in $PM_{2.5}$ Concentration
Projected Redevelopment – Site 25

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

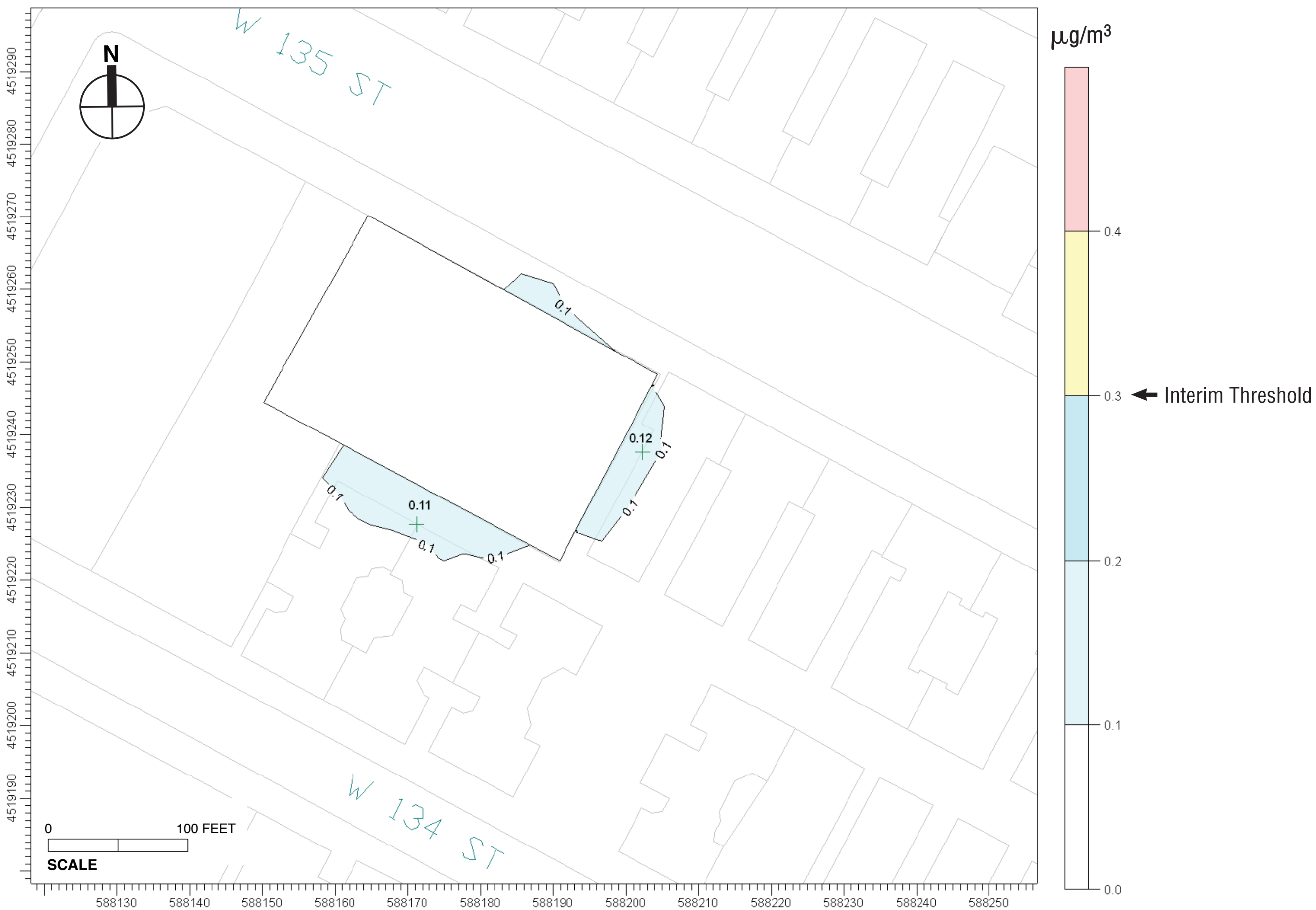

Figure 21-50

Maximum Predicted Annual Average Increase in $PM_{2.5}$ Concentration
Projected Redevelopment – Site 25

maximum combined Phase 1 construction on-site increments (the highest increments from all periods analyzed) and the maximum construction-related mobile-source increments from the mobile source site closest to the location of the maximum on-site increment. In some cases the predicted mobile-source increments near the maximum on-site increments are lower than the maximums presented in Table 21-h2.

Table 21-18
Maximum Predicted Cumulative Pollutant Concentrations During Construction—Phase 1 (μg/m³)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Residence or School						
$PM_{2.5}$	24-hour[2]	—	—	1.9	2 [3]	35 [1]
	Annual Local[2]	—	—	0.18	0.3	15
PM_{10}	24-hour	69	105	36	—	150
NO_2	Annual	68	75	7	—	100
CO	1-hour	5.1 ppm	22.6 ppm	17.5 ppm	—	35 ppm
	8-hour	3.8 ppm	6.1 ppm	2.3 ppm	—	9 ppm
Sidewalk						
$PM_{2.5}$	24-hour[2]	—	—	3.6[4]	2	35 [1]
	Annual Local[2]	—	—	0.35[4]	0.3	15
PM_{10}	24-hour	69	109	40	—	150
NO_2	Annual	68	80	12	—	100
CO	1-hour	5.1 ppm	27.7 ppm	22.6 ppm	—	35 ppm
	8-hour	3.8 ppm	7.5 ppm	3.7 ppm	—	9 ppm
Sidewalks and Covered Walkways Adjacent to Construction						
$PM_{2.5}$	24-hour[2]	—	—	4.6[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.47[4]	0.3	15
PM_{10}	24-hour	69	124	56	—	150
NO_2	Annual	68	84	16	—	100
CO	1-hour	5.1 ppm	46.7 ppm[5]	41.6 ppm	—	35 ppm
	8-hour	3.8 ppm	10.7 ppm[5]	6.9 ppm	—	9 ppm

Notes: Results for any other time period during Phase 1, or locations other than these sites, would be lower.
$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.

[1] EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 μg/m³ to 35 μg/m³ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."

[2] Monitored concentrations are not added to modeled $PM_{2.5}$ values.

[3] DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 μg/m³ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.

[4] This value exceeds the interim guidance threshold level. See text for further discussion.

[5] Values, exceeding the CO NAAQS, were predicted at one sidewalk location immediately adjacent to the sewer relocation construction activity and at a single location adjacent to the projected redevelopment Sites 24 and 25. Levels exceeding the 1-hour and the 8-hour standards could occur during one or two events at two locations on the sidewalk immediately adjacent to the sewer relocation construction. Such occurrences are unlikely, would be limited to a small area adjacent to specific engines, and would only occur if these engines were working if and when certain meteorological conditions occur.

The cumulative assessment conservatively adds together the highest predicted effect of on-site and mobile-source emissions. Since the highest short-term increments for each component are predicted under different meteorological conditions, these results are conservatively high.

Since the mobile source contribution is minor, and since the impacts from the separate components do not occur in the same locations, the cumulative results are similar to the results presented above for the Columbia University sites.

Under this analysis scenario, maximum predicted PM_{10} and NO_2 concentrations would not exceed the NAAQS under any predicted conditions. Values exceeding the CO NAAQS were predicted at one sidewalk location immediately adjacent to the sewer relocation construction activity and at a single location adjacent to the projected redevelopment Sites 24 and 25. Levels exceeding the 1-hour and the 8-hour standards could occur during two events at two locations on the sidewalk immediately adjacent to the sewer relocation construction. At the location adjacent to the projected redevelopment Sites 24 and 25, the 8-hour and 1-hour standards could be exceeded during three or four discrete events throughout the construction period if gasoline-powered generators and compressors are used during the three or four hours when meteorological conditions would lead to such high levels. By analogy, this could also occur near any of the projected development sites. Such occurrences are unlikely, and would be limited to an area approximately 40 feet long on the sidewalk adjacent to the construction fence.

Maximum predicted 24-hour average $PM_{2.5}$ concentration increments in this cumulative analysis do not exceeded 2 $\mu g/m^3$ at any residential location.

The maximum predicted neighborhood-scale annual average $PM_{2.5}$ concentration would be 0.02 $\mu g/m^3$—lower than the interim guidance threshold level of 0.1 $\mu g/m^3$, and the maximum predicted local annual average $PM_{2.5}$ concentration at a residential or school receptor location would be less than the applicable interim guidance threshold.

FUTURE WITH AND WITHOUT THE PROPOSED ACTIONS—PHASE 2

Mobile Source Assessment

Maximum predicted total pollutant concentrations (including background concentrations) and increments at all analysis sites for the worst-case mobile source conditions during Phase 2 of construction are presented in Table 21-19. The total concentrations are equal to the sum of the maximum background and the predicted contributions from mobile sources, including trips related to both construction and the permanent operations that will be online in the peak construction year. The Proposed Actions total includes both monitored background and contributions from background traffic.

Concentration increments due to mobile sources related to the Proposed Actions were predicted to be small, compared with the NAAQS and the applicable interim guidance thresholds for $PM_{2.5}$. Other than $PM_{2.5}$ concentrations, which are currently greater than the NAAQS and still could be in the future background condition, total concentrations would not exceed the NAAQS.

In any other locations than those analyzed, maximum predicted increments and total concentrations would be lower than those presented here.

Table 21-19
Maximum Predicted Concentrations from Mobile Sources—Phase 2 ($\mu g/m^3$)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Site 1						
$PM_{2.5}$	24-hour[2]	0.51	0.76	0.25	2 [3]	35 [1]
	Annual— Local[2] Neighborhood-scale[2]	 0.18 0.07	 0.24 0.08	 0.06 0.01	 0.3 0.1	15
PM_{10}	24-hour	66.08	66.79	0.71	—	150
CO	8-hour	2.8 ppm	3.0 ppm	0.2 ppm	—	9 ppm
Site 2						
CO	8-hour	3.6 ppm	3.5 ppm	-0.1 ppm	—	9 ppm
Site 3						
CO	8-hour	2.8 ppm	3.1 ppm	0.3 ppm	—	9 ppm

Notes: Results for any other time period during Phase 2, or locations other than these sites, would be lower.

The CO increments reflect the highest of all peak periods.

$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.

1 EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."

2 Monitored concentrations are not added to modeled $PM_{2.5}$ values.

3 DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 $\mu g/m^3$ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.

Overall, the mobile source effect on pollutant concentrations from the Proposed Actions would be small, compared with the NAAQS and interim guidance threshold levels. At any areas along the access routes that are not adjacent to the construction sites and not affected by operational stationary sources, mobile sources would be the only cause for pollutant increments due to the Proposed Actions during Phase 2 of construction; at those locations, total concentrations and increments would be lower than those predicted for the selected sites and would not result in any predicted significant adverse impacts from mobile sources. For the total combined impact of all sources, see "Cumulative Assessment," below.

On-Site Construction Activity Assessment

Maximum predicted concentration increments from Columbia University construction during Phase 2, and overall concentrations including background concentrations, are presented in Table 21-20. The maximum predicted $PM_{2.5}$ concentration increments and total CO concentrations at all locations for the various construction model scenarios are presented in isopleth form (lines representing constant concentration) in Figures 21-51 through 21-54. The total concentrations in Table 21-20 are the sum of background concentrations and construction increments. (Since the numbers presented in the tables are significant figures only, there may be some rounding differences.)

11.8.07

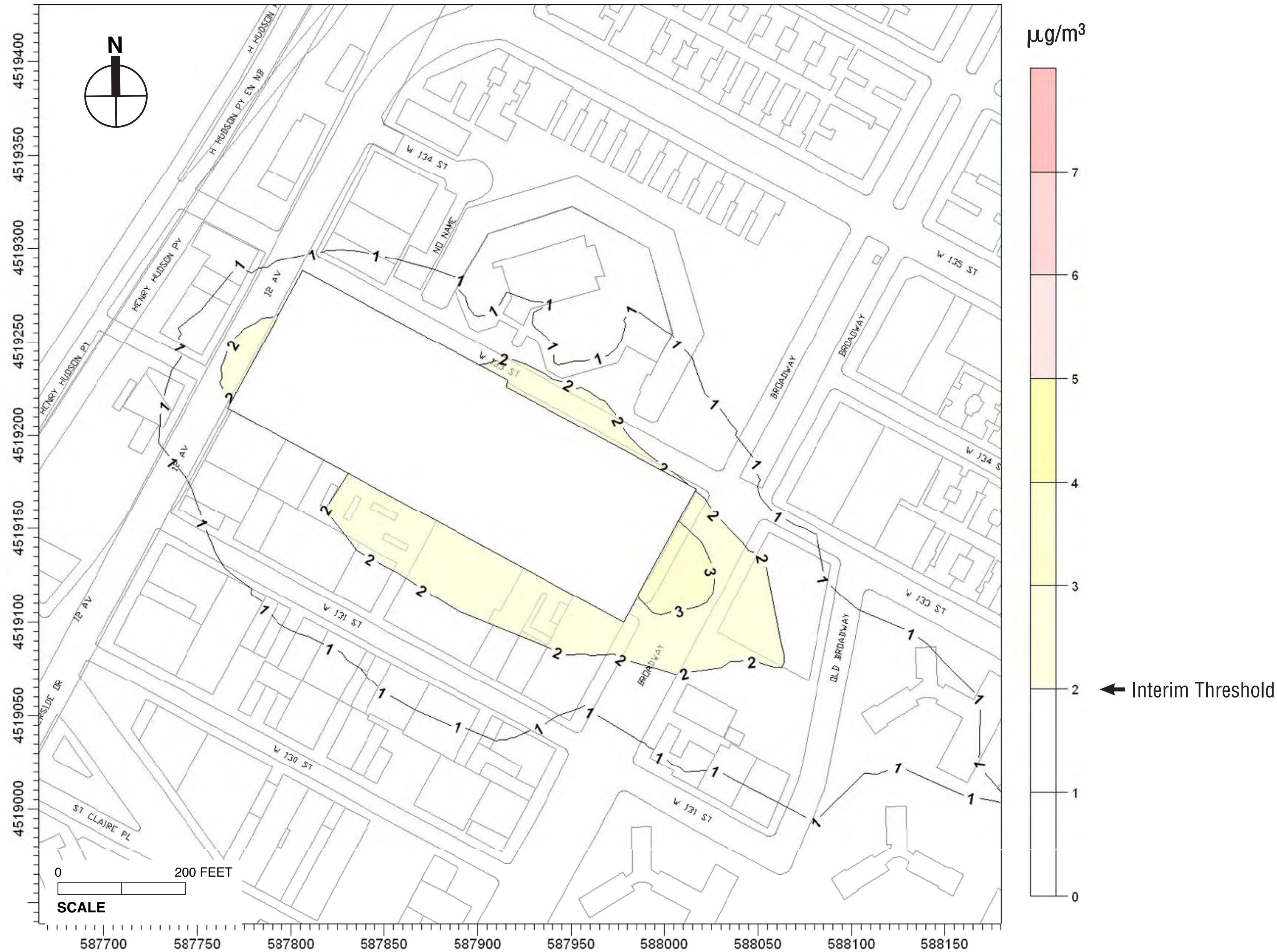

Figure 21-51

Maximum Predicted 24-Hour Average Increase in $PM_{2.5}$ Concentration
Columbia University Construction, Phase 2

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

11.8.07

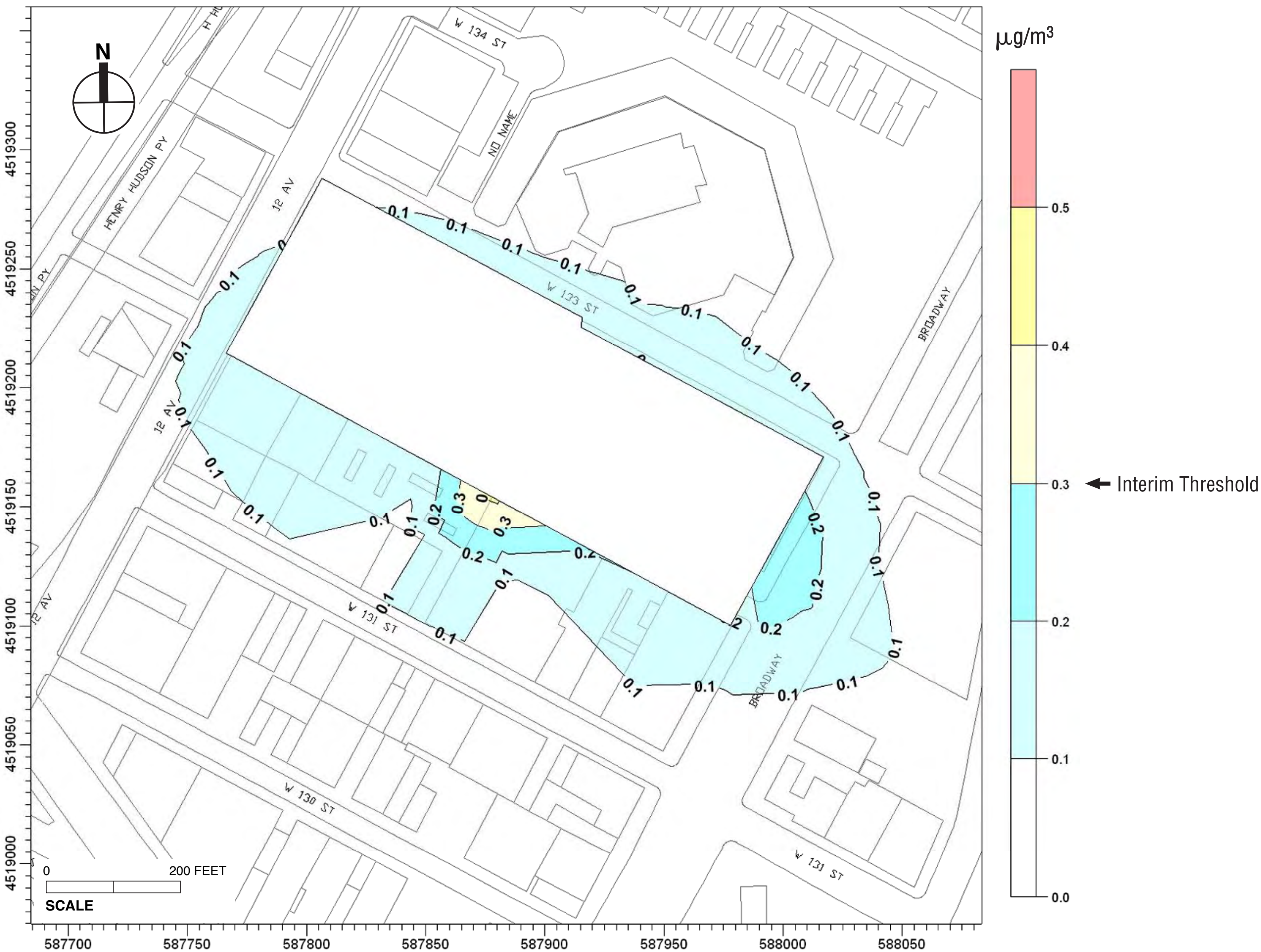

Figure 21-52

Maximum Predicted Annual Average Increase in $PM_{2.5}$ Concentration
Columbia University Construction, Phase 2

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

11.8.07

Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

Figure 21-53
Total Maximum Predicted 1-Hour Average CO Concentration
Columbia University Construction, Phase 2

11.8.07

Note: Concentrations presented include maximum background concentrations and on-site increments, but do not include contributions from local on-street traffic.

MANHATTANVILLE IN WEST HARLEM REZONING AND ACADEMIC MIXED-USE DEVELOPMENT

Figure 21-54

Total Maximum Predicted 8-Hour Average CO Concentration Columbia University Construction, Phase 2

Table 21-20
Maximum Predicted Pollutant Concentrations from Construction Site Sources—Phase 2 ($\mu g/m^3$)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Residence or School						
$PM_{2.5}$	24-hour[2]	—	—	1.9	2 [3]	35 [1]
	Annual Local[2]	—	—	0.16	0.3	15
PM_{10}	24-hour	60	101	41	—	150
NO_2	Annual	68	70	2	—	100
CO	1-hour	2.6 ppm	8.9 ppm	6.3 ppm	—	35 ppm
	8-hour	2.0 ppm	2.7 ppm	0.7 ppm	—	9 ppm
Sidewalk						
$PM_{2.5}$	24-hour[2]	—	—	2.8[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.18	0.3	15
PM_{10}	24-hour	60	123	63	—	150
NO_2	Annual	68	71	3	—	100
CO	1-hour	2.6 ppm	14.0 ppm	11.4 ppm	—	35 ppm
	8-hour	2.0 ppm	3.0 ppm	1.0 ppm	—	9 ppm
Sidewalks and Covered Walkways Adjacent to Construction						
$PM_{2.5}$	24-hour[2]	—	—	3.5[4]	2 [3]	35 [1]
	Annual Local[2]	—	—	0.24	0.3	15
PM_{10}	24-hour	60	123	63	—	150
NO_2	Annual	68	72	4	—	100
CO	1-hour	2.6 ppm	20.9 ppm	18.3 ppm	—	35 ppm
	8-hour	2.0 ppm	3.8 ppm	1.8 ppm	—	9 ppm

Notes: Results for any other time period during Phase 2, or locations other than these sites, would be lower.
$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.
[1] EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."
[2] Monitored concentrations are not added to modeled $PM_{2.5}$ values.
[3] DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 $\mu g/m^3$ is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.
[4] This value exceeds the interim guidance threshold level. See text for further discussion.

Similar to the Phase 1 analysis results, the highest predicted concentration increments occurred adjacent to the construction fence. Maximum predicted annual average $PM_{2.5}$ increments were less than 0.3 $\mu g/m^3$.

It should be noted that the predicted concentrations in covered walkways are conservatively overstated, since the 16-foot construction wall would cause additional turbulence, and concentrations on the outside of the wall would be lower than predicted by the model, which cannot simulate the impact of a barrier. Columbia would seek to close sidewalks if practicable.

The highest annual average neighborhood-scale $PM_{2.5}$ increment was computed at 0.03 $\mu g/m^3$, which is lower than the threshold level of 0.1 $\mu g/m^3$.

On-site emissions related to the construction of the Columbia University sites in Phase 2 were not predicted to result in 24-hour average $PM_{2.5}$ concentration increments greater than 2 $\mu g/m^3$ at residences or other locations where exposure for periods of 24 hours or more can be reasonably expected.

The maximum predicted total concentrations of PM_{10}, CO, and NO_2 are not expected to exceed the NAAQS.

Cumulative Assessment

Maximum predicted combined concentration increments from on-site construction, mobile sources, and stationary sources from the operational portions of the Proposed Project in 2026, and overall combined concentrations, including background concentrations, are presented in Table 21-21. The maximum predicted neighborhood scale annual average $PM_{2.5}$ concentration would be 0.03 µg/m^3—lower than the interim guidance threshold level of 0.1 µg/m^3. The cumulative increments are a sum of the Phase 2 construction on-site increments from Table 21-20, the maximum increment predicted from the operational stationary sources at the same location as the construction on-site maximum increments (see Chapter 19), and the maximum construction-related mobile-source increments from the mobile source site closest to the location of the maximum on-site increments. Note that in some cases the predicted stationary-source and mobile-source increments near the maximum on-site increments are lower than the maximums presented in Chapter 19 and in Table 21-19.

Table 21-21
Maximum Predicted Cumulative Pollutant Concentrations During Construction—Phase 2 (µg/m^3)

Pollutant	Averaging Period	No Build	Proposed Actions	Increment	Interim Guidance Threshold	NAAQS
Residence or School						
$PM_{2.5}$	24-hour[2]	—	—	2.0	5/2 [3]	35 [1]
	Annual Local[2]	—	—	0.16	0.3	15
PM_{10}	24-hour	63.2	105	42	—	150
NO2	Annual	68	70	2	—	100
CO	1-hour	3.7 ppm	10.3 ppm	6.6 ppm	—	35 ppm
	8-hour	2.8 ppm	3.6 ppm	0.9 ppm	—	9 ppm
Sidewalk						
$PM_{2.5}$	24-hour[2]	—	—	2.9[4]	5/2 [3]	35 [1]
	Annual Local[2]	—	—	0.22	0.3	15
PM_{10}	24-hour	63.2	127	64	—	150
NO_2	Annual	68	71	3	—	100
CO	1-hour	3.7 ppm	15.4 ppm	11.7 ppm	—	35 ppm
	8-hour	2.8 ppm	3.9 ppm	1.2 ppm	—	9 ppm
Sidewalks and Covered Walkways Adjacent to Construction						
$PM_{2.5}$	24-hour[2]	—	—	3.6[4]	5/2 [3]	35 [1]
	Annual Local[2]	—	—	0.26	0.3	15
PM_{10}	24-hour	63	127	64	—	150
NO_2	Annual	68	72	4	—	100
CO	1-hour	3.7 ppm	22.3 ppm	18.6 ppm	—	35 ppm
	8-hour	2.8 ppm	4.8 ppm	2.0 ppm	—	9 ppm

Notes: Results for any other time period during Phase 2, or locations other than these sites, would be lower.
$PM_{2.5}$ concentration increments should be compared with threshold values. Total concentrations should be compared with the NAAQS.
1 EPA has reduced the 24-hour $PM_{2.5}$ standard from 65 µg/m^3 to 35 µg/m^3 and revoked the annual PM_{10} standard, effective December 18, 2006. A full discussion of the NAAQS can be found in Chapter 19, "Air Quality."
2 Monitored concentrations are not added to modeled $PM_{2.5}$ values.
3 DEP is currently applying threshold criteria for assessing the significance of 24-hour average $PM_{2.5}$ impacts. The significance of temporary concentration increments greater than 2 µg/m^3 is assessed in the context of the magnitude, frequency, duration, location and size of area affected by the concentration increment.
4 This value exceeds the interim guidance threshold level. See text for further discussion.

The cumulative results are similar to those presented in Table 21-21 for on-site construction impacts. When adding the highest predicted $PM_{2.5}$ increments from on-site and mobile sources, which were not predicted to occur under the same meteorological conditions, the highest predicted increment at a residential receptor was 2.0 μg/m^3, predicted at the Manhattanville Houses building located at West 131st Street. This conservatively highest predicted increment in $PM_{2.5}$ concentrations does not exceed the interim guidance level. The predicted increments from the elevated operational stationary sources at the ground level locations where maximum predicted impacts from on-site and mobile source impacts were predicted were negligible under the meteorological conditions which produce the highest concentration from ground-based sources such as construction.

CONCLUSIONS

Under both SEQRA and CEQR, the determination of the significance of impacts is based on an assessment of the predicted intensity, duration, geographic extent, and the number of people who would be affected by the predicted impacts. In most cases, the predicted increments on air quality from construction of both Columbia University and non-Columbia University construction would be limited in extent, duration, and severity.

Columbia University construction under the Proposed Actions would not result in predicted significant adverse impacts on air quality. Columbia University would implement an emissions reduction program that would exceed that of any large-scale private project constructed in New York City to date, and substantially reduce $PM_{2.5}$ emissions due to Columbia University construction. E-designations on non-Columbia University projected development sites would be implemented as necessary to reduce $PM_{2.5}$ concentrations resulting from construction at these locations. With these measures in place, no significant adverse air quality impacts would occur from the projected development sites.

For both Columbia University construction (in Subdistrict A) and construction at non-Columbia University projected development sites, concentrations of particulate matter, CO, and NO_2 could increase at locations near the areas of construction, but would not result in significant adverse impacts.

Columbia University Construction

$PM_{2.5}$ concentrations would increase the greatest in areas immediately adjacent to the construction; for the most part, these elevated concentrations would occur on sidewalks and covered walkways along the construction fences and in some cases across the street and would not be significant. In no instances were $PM_{2.5}$ annual increments greater than 0.3 μg/m^3 and 24-hour increments greater than 2 μg/m^3 at nearby residences or schools.

Localized elevated CO concentrations were predicted in a few limited cases. In the area of the Columbia University construction (Subdistrict A), a limited number of discrete events were predicted during the 2008 construction period when predicted CO levels that would exceed the CO NAAQS level might occur on a very small area of sidewalk immediately adjacent to certain gasoline engines if those engines were functioning on up to three days each year when specific meteorological conditions leading to higher concentrations might exist, and if those engines were located immediately adjacent to the construction fence. In the unlikely event that these engines would be used and would be located in the same spot during one of these events, CO levels would exceed the NAAQS level. Based on the limited duration and extent of these predicted exceedances, the low likelihood of occurrence, and the limited potential for exposure, this would not result in significant adverse impacts.

Non-Columbia University Construction

For construction in Phase 1 on the non-Columbia University projected development sites in Subdistrict B and the Other Areas, elevated $PM_{2.5}$ concentrations were predicted to occur during construction in the near vicinity of the projected development sites in Subdistrict B and Other Area east of Broadway both with respect to annual average and 24-hour average $PM_{2.5}$ levels. However, since the publication of the DEIS, project modifications have been identified, which would result in no new development taking place in Subdistrict B (see Chapter 29, “Modifications to the Proposed Actions”); the only non-Columbia University sites which may still be expected to be developed as a result of this rezoning action are Sites 24 and 25. An emission reduction program would be instituted for any construction on those sites, implemented through E-designations. The program would include early electrification to ensure that large generators are not used on the sites, the use of ULSD for all diesel engines, and the use of Tier 2 certified engines or cleaner equipped with DPF tailpipe controls. With these measures in place, no significant adverse $PM_{2.5}$ impact would occur as a result of construction on Sites 24 and 25.

Local elevated CO concentrations were predicted in a few limited cases. At sidewalk locations adjacent to the projected development sites, 1-hour average CO concentration may exceed the NAAQS level during up to three discrete hourly events, and 8-hour average CO concentration may exceed the NAAQS level up to two days per site if certain gasoline-powered engines are functioning during the discrete events when specific meteorological conditions exist. Based on the limited duration, the low likelihood of occurrence, the limited potential for exposure, and limited extent of these predicted exceedances, this would not result in predicted significant adverse impacts.

NOISE AND VIBRATION

NOISE

Introduction

Impacts on community noise levels during construction of the Proposed Project can result from noise from construction equipment operation, and from construction vehicles and delivery vehicles traveling to and from the site. Noise and vibration levels at a given location are dependent on the kind and number of pieces of construction equipment being operated, the acoustical utilization factor of the equipment (i.e., the percentage of time a piece of equipment is operating), the distance from the construction site, and any shielding effects (from structures such as buildings, walls, or barriers). Noise levels caused by construction activities would vary widely, depending on the phase of construction and the location of the construction relative to receptor locations. While a small amount of blasting is anticipated (based on current available information), blasting is not anticipated to result in significant noise impacts, and the most significant construction noise sources are expected to be impact equipment such as jackhammers, pile drivers, and paving breakers, as well as the movements of trucks and cranes. (All blasting would be performed to conform to regulations of FDNY and any other applicable regulations. Typically, two blasts would occur on any given day, and timed multiple charges of limited intensity, and blastmats, would be utilized to limit potential impacts. With these measures, the limited amount of blasting would not result in any significant adverse noise impacts.)

Noise from construction activities and some construction equipment is regulated by the New York City Noise Control Code and by EPA. The New York City Noise Control Code, as amended December 2005 and effective July 1, 2007, requires the adoption and implementation of a noise mitigation plan for each construction site, limits construction (absent special circumstances as described below) to weekdays between the hours of 7:00 AM and 6:00 PM, and sets noise limits for certain specific pieces of construction equipment. Construction activities occurring after hours (weekdays between 6:00 PM and 7:00 AM, and on weekends) may be authorized in the following circumstances: (1) emergency conditions; (2) public safety; (3) construction projects by or on behalf of City agencies; (4) construction activities with minimal noise impacts; and (5) where there is a claim of undue hardship resulting from unique site characteristics, unforeseen conditions, scheduling conflicts and/or financial considerations. EPA requirements mandate that certain classifications of construction equipment meet specified noise emissions standards.

Given the scope and duration of construction activities for the Proposed Project, a quantified construction noise analysis was performed. The purpose of this analysis was to determine if it was likely that significant adverse noise impacts would occur during construction, and if so, to examine the feasibility of implementing mitigation measures to reduce or eliminate such impacts.

Construction Noise Impact Criteria

The *CEQR Technical Manual* states that significant noise impacts due to construction would occur “only at sensitive receptors that would be subjected to high construction noise levels for an extensive period of time.” In general, this has been interpreted to mean that such impacts would occur only at sensitive receptors where high noise levels would occur for two years or longer. In addition, the *CEQR Technical Manual* states that impact criteria for vehicular sources, using existing noise levels as the baseline, should be used for assessing construction impacts. See Chapter 20, “Noise,” for an explanation of noise measurement and sound levels. The criteria are as follows:

> If the existing noise levels are less than 60 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period, the threshold for a significant impact would be an increase of at least 5 dBA $L_{eq(1)}$. For the 5 dBA threshold to be valid, the resulting proposed action condition noise level with the proposed action would have to be equal to or less than 65 dBA. If the existing noise level is equal to or greater than 62 dBA $L_{eq(1)}$, or if the analysis period is a nighttime period (defined in the CEQR criteria as being between 10:00 PM and 7:00 AM), the incremental significant impact threshold would be 3 dBA $L_{eq(1)}$. (If the existing noise level is 61 dBA $L_{eq(1)}$, the maximum incremental increase would be 4 dBA, since an increase higher than this would result in a noise level higher than the 65 dBA $L_{eq(1)}$ threshold.)

The impact criteria contained in the *CEQR Technical Manual* was used for assessing impacts from mobile and on-site construction activities.

Noise Analysis Methodology

Construction activities for the Proposed Project would be expected to result in increased noise levels as a result of: (1) the operation of construction equipment on-site; and (2) the movement of construction-related vehicles (i.e., worker trips, and material and equipment trips) on the surrounding roadways. The effect of each of these noise sources was evaluated. The results presented below show the effects of construction activities (i.e., noise due to both on-site construction equipment and construction-related vehicles operation) and the total cumulative impacts due to operational effects (caused by project-generated vehicular trips as various components of the total project begin to function after the completion of Phase 1) and construction effects (as construction proceeds on uncompleted components of the project).

Noise due to the operation of construction equipment on-site at a specific receptor location near a construction site is calculated by computing the sum of the noise produced by all pieces of equipment operating at the construction site. For each piece of equipment, the noise level at a receptor site is a function of:

- the noise emission level of the equipment;
- a usage factor, which accounts for the percentage of time the equipment is operating;
- the distance between the piece of equipment and the receptor;
- topography and ground effects; and
- shielding.

Similarly, noise levels due to construction-related traffic are a function of:

- the noise emission levels of the type of vehicle (e.g., auto, light-duty truck, heavy-duty truck, bus, etc.);
- vehicular speed;
- the distance between the roadway and the receptor;
- topography and ground effects; and
- shielding.

Construction Noise Modeling

Noise effects due to construction activities were evaluated using the Cadna A model, a computerized model developed by DataKustik for noise prediction and assessment. The model can be used for the analysis of a wide variety of noise sources, including stationary sources (e.g., construction equipment, industrial equipment, power generation equipment, etc.), transportation sources (e.g., roads, highways, railroad lines, busways, airports, etc.), and other specialized sources (e.g., sporting facilities, etc.). The model takes into account the noise power levels of the noise sources, attenuation with distance, ground contours, reflections from barriers and structures, attenuation due to shielding, etc. The Cadna A model is based on the acoustic propagation standards promulgated in International Standard ISO 9613-2. This standard is currently under review for adoption by the American National Standards Institute (ANSI) as an American Standard. The Cadna A model is a state-of-the-art analysis for noise analysis.[1]

Geographic input data used with the Cadna A model included CAD drawings that defined site work areas, adjacent building footprints and heights, locations of streets, and locations of sensitive receptors. For each analysis period, the geometric location and operational characteristics, including equipment usage rates (percentage of time equipment is used) for each piece of construction equipment operating at the project site, as well as noise control measures, were input to the model. In addition, reflections and shielding by barriers erected on the construction site, and shielding due to both adjacent buildings and project buildings as they were constructed, were accounted for in the model. In addition, construction-related vehicles were

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[1] Prior to use the Cadna A model for this project a screening analysis was performed to compare the results obtained using the Cadna A model with a simple spreadsheet model for construction equipment. Both models yielded $L_{eq(1)}$ values that were within 0-2 dBA. Similarly, a screening analysis was performed to compare the results obtained using the Cadna A model with the TNM model for construction truck traffic. Again, both models yielded $L_{eq(1)}$ values that were within 0-2 dBA.

assigned to the adjacent roadways. The model produced A-weighted $L_{eq(1)}$ noise levels at each receptor location, for each analysis period, which showed the noise level at each receptor location, as well as the contribution from each noise source.

Determination of Existing and Non-Construction Noise Levels

Existing and non-construction (i.e., operational) noise levels were calculated using the methodology discussed in Chapter 20. As discussed in that chapter, operational noise was calculated using the TNM model (the Federal Highway Administration [FHWA] *Traffic Noise Model* version 2.5) to calculate noise from traffic on adjacent and nearby streets and roadways, and the Federal Transit Administration (FTA) model contained in FTA May 2006 guidance manual, *Transit Noise and Vibration Impact Assessment,* to calculate train noise from the elevated No. 1 subway line.

Analysis Years

A screening analysis was performed to determine the years during the Phase 1 construction (i.e., between 2008 and 2015) and during the Phase 2 construction (i.e., between 2015 and 2030) when the maximum potential for significant noise impacts would occur. A construction schedule was prepared by Bovis Lend Lease, which showed the workers, equipment, and construction vehicles anticipated to be operating during each month of the construction period. Based upon this screening analysis, on-site construction activities were estimated to produce maximum noise levels during the years 2008, 2009, 2010, 2011, 2012, 2013, and 2014 (for the Phase 1 construction), and during the years 2024, 2025, 2026, 2027, and 2028 (for the Phase 2 construction). To be conservative, the noise analysis assumed that both peak on-site construction activities and peak construction-related traffic conditions occurred simultaneously:

Noise Reduction Measures

The construction noise analysis for this project assumed a proactive approach by Columbia University in construction related to Subdistrict A. This approach employed a wide variety of measures that exceeded standard construction practices, but whose implementation was deemed feasible and practicable to minimize construction noise and reduce potential noise impacts. Columbia University is committed to implementing this program to reduce impacts on the surrounding community. This commitment will be contained in the noise mitigation plan required as part of the New York City Noise Control Code and, to the extent necessary, will be included in the Restrictive Declaration for the Academic Mixed-Use Area. This program includes:

- source controls;
- path controls; and
- receptor controls.

In terms of source controls (i.e., reducing noise levels at the source or during most sensitive time periods), Columbia University will implement the following measures for construction within the Academic Mixed Use Area (Subdistrict A) which go beyond typical construction techniques:

- The project sponsors have committed to utilizing equipment that meets the sound level standards for equipment (specified in Subchapter 5 of the New York City Noise Control Code) from the start of construction activities and using a wide range of equipment, including construction trucks, that produces lower noise levels than typical construction equipment (Table 21-22 shows the noise levels for typical construction equipment and the mandated noise levels for the equipment that would be used for construction of the Proposed Project).

Table 21-22
Construction Equipment Noise Emission Levels

Equipment	FTA (or FHWA) Typical Noise Level (dBA) at 50 feet	Proposed Project-mandated Noise Level (dBA) at 50 feet
Arc Welder	73	73
Asphalt Pavers	85	80**
Asphalt laying equipment	85	80**
Backhoe	80	75**
Bulldozer	85	80**
Compactor	80	77*
Compressors	80	75*
Cement Mixer	85	85
Concrete Pumps	82	82
Concrete Trucks	85	80*
Delivery Trucks	84	80*
Dual Hoist	85	85
Crane (Crawler Crane)	85	75**
Crane (Hydraulic Crane)	85	75**
Crane (Tower Crane)	85	75**
Crane (Rubber Tire Crane)	83	78**
Drill Rigs	85	75**
Dump Trucks	84	80*
Excavators	85	80**
Forklift	85	63*
Generators	82	70*
Impact Wrenches	85	75**
Jack Hammers	85	71**
Pavers Cutter	85	71*
Pile driving rig	95	85**
Rebar Bender	80	80
Roller	85	80**
Saw (Chain Saw)	85	75**
Saw (Circular Saw)	76	76
Saw (Table Saw)	76	76
Scissor Lift	85	65*
Slurry supply system	85	85
Tamper	85	85
Trailers	85	80*
Toweling Machine	85	75**
Water Pumps	77	77

Notes:
* The reduced values from the FTA/FHWA values for the DEIS analysis.
** The reduced values for this FEIS analysis.

Sources:
Transit Noise and Vibration Impact Assessment, FTA, May 2006, and
FHWA Roadway Construction Noise Model (FHWA RCNM), 2006.

- Where feasible, the project sponsors would use quiet construction procedures and equipment (such as generators, concrete trucks, delivery trucks, asphalt pavers, backhoe, bulldozer, cranes, excavator, roller, and trailers) quieter than that required by the New York City Noise Control Code.
- As early in the construction period as practicable, diesel-powered equipment would be replaced with electrical-powered equipment, such as electric scissor lifts and electric articulating forklifts (i.e., early electrification).

- The project sponsors would require all contractors and subcontractors to properly maintain their equipment and have quality mufflers installed.

In terms of path controls (e.g., placement of equipment, implementation of barriers between equipment and sensitive receptors), Columbia University will implement the following measures for construction within the Academic Mixed-Use Area (Subdistrict A), which go beyond typical construction techniques to the extent feasible:

- Noisy equipment, such as generators, cranes, trailers, concrete pumps, concrete trucks, and dump trucks, would be located away from and shielded from sensitive receptor locations. For example, during the early construction phases of work, delivery and dump trucks, as well as many construction equipment operations, would be located and take place below grade to take advantage of shielding benefits. Once building foundations are completed, delivery trucks would operate behind noise barriers.
- Noise barriers would be utilized to provide shielding (e.g., the construction sites would have a minimum 8-foot barrier, with a 16-foot barrier adjacent to residential and other sensitive locations [e.g., along 133rd Street adjacent to the Riverside Park Community residences and I.S. 195], and truck deliveries would take place behind these barriers once building foundations are completed).
- Where feasible, portable noise barriers and acoustical tents would be utilized to break the line-of-sight between sensitive receptors and noise sources, i.e., drill rigs, impact wenches, jack hammers, pavement cutters, pile drivers, chain saws, and toweling machines.
- Noise curtains and equipment enclosures would be utilized to break the line-of-sight between sensitive receptors and the major noise-generating elements of significant noise sources, i.e., tower cranes.[1]

In terms of receptor controls (i.e., measures at sensitive receptors to reduce sound levels at these locations), a preliminary survey indicates that I.S. 195 and all of the residences that are located immediately adjacent to the proposed Subdistrict A construction sites contain double-glazed windows. The school and a large number of the residences also contain alternative ventilation (e.g., air conditioning). At this time, no additional receptor controls are proposed as part of this project.

In terms of construction within the other areas rezoned as part of the Proposed Actions, it was assumed that standard construction equipment and procedures would be used.

Receptor Sites

Fifteen receptor locations close to the project site were selected as discrete noise receptor sites for the construction noise analysis. These sites are located directly adjacent to the project site where construction activities would be taking place. Each receptor site is the location of a residence or other noise sensitive use. At most locations, noise receptors were selected at multiple elevations—one receptor location was selected at street level, and several receptor locations were selected at upper-story elevations. Figure 21-55 shows the location of the 15 noise receptor locations, and Table 21-23 lists the noise receptor locations, the approximate location of the receptor sites, and the associated land use at the receptor locations. The 15 receptor sites selected for detailed analysis

[1] Although temporary noise curtains and barriers would be employed where feasible and practicable, no credits where taken for the attenuation provided by this measure in terms of the noise analysis.

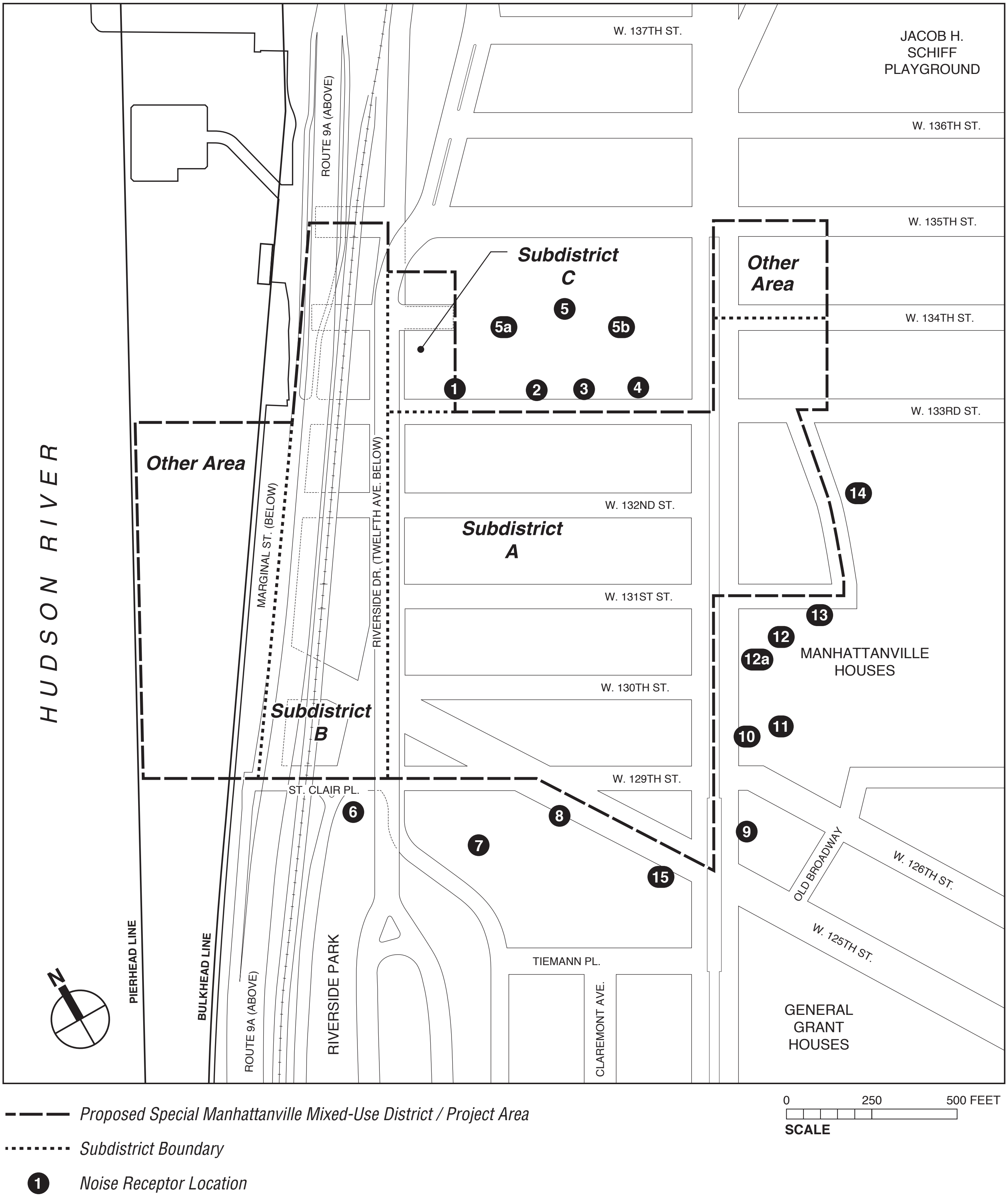

Figure 21-55
Construction Noise Receptor Locations

are representative of other noise receptors in the immediate Project Area, and are the locations where maximum project impacts due to construction noise would be expected.

Table 21-23
Construction Noise Receptor Locations

Receptor	Location	Associated Land Use
1	Riverside Park Community	Residential
2	P.S. 195	School
3	Open Space	Open Space
4	Riverside Park Community	Residential
5, 5a, 5b	Riverside Park Community	Residential
6	Riverside Park	Open Space
7	560 Riverside Drive	Residential
8	560 Riverside Drive	Residential
9	Bway betw. W. 125th & 129th Streets	Residential
10	Manhattanville Houses	Open Space
11	Manhattanville Houses	Residential
12, 12a	Manhattanville Houses	Residential
13	Manhattanville Houses	Residential
14	Manhattanville Houses	Residential
15	New School-125th Street w of Bway	Institutional

These 15 receptor sites were not the only locations analyzed in the nearby community. In addition to these 15 site-specific noise receptor sites, noise contours depicting the incremental noise due to construction activities (both on-site construction equipment operation and construction-related traffic) were developed for the area surrounding the project site and are presented in Appendix K.4.

Construction Noise Analysis Results

Using the methodology described above, and utilizing the noise abatement measures described for source and path controls above, noise analyses were performed to determine maximum one-hour equivalent ($L_{eq(1)}$) noise levels that would be expected to occur during the Phase 1 and Phase 2 construction periods. Table 21-24 (a) shows the following for each receptor site for each of the Phase 1 analysis years, and Table 21-24 (b) shows comparable analysis results for each receptor site for each of the Phase 2 analysis years:

- existing noise levels;
- maximum predicted noise level due to construction activities alone (i.e., noise generated by on-site construction activities [assuming maximum construction activities during the analysis time period], and noise generated by construction vehicles traveling to and from the project site during the hour which generated the maximum number of construction vehicles);
- maximum predicted total noise levels (i.e., cumulative noise levels), which are the sum of noise due to construction activities and noise due to traffic on the adjacent street; and
- maximum predicted increases in noise levels based upon comparing the total noise levels with existing noise levels.

Elevated receptor information is provided in Tables 21-24 (a) and 21-24 (b) for only one representation elevated receptor location on a specified building. However, construction effects have been analyzed for several elevated receptor locations on each building, and the values shown are only representative values of the highest noise levels at elevated receptor locations. (Additional details of the construction analysis are presented in Appendix K.4.)

In Tables 21-24 (a) and 21-24 (b), locations where noise levels exceed the CEQR impact criteria (i.e., results in an increase of more than 3 dBA comparing the total noise level with existing noise level) are shown in bold.

The Phase 1 noise analysis results show that maximum predicted noise levels would exceed the CEQR impact criteria at the following locations: receptor Site 5 (at elevations of Riverside Park Community which are high enough to have a direct line-of-site to the Phase 1 construction site) during three analysis years (2008, 2009 and 2011); receptor 5a (at elevations of Riverside Park Community which are high enough to have a direct line-of-site to the Phase 1 construction site) during 2011; receptor Site 5b (at elevations of Riverside Park Community which are high enough to have a direct line-of-site to the Phase 1 construction site) during five analysis years (2008 through 2012); receptor Site 6 (located in Riverside Park) during two analysis years (2008 and 2011); receptor Site 7 (at elevated locations of 560 Riverside Drive) during six analysis years (2008 through 2013); receptor 8 (at elevated locations of 560 Riverside Drive) during all seven analysis years (2008 through 2014); receptor Sites 9 and 10 (at locations of Broadway between 125th & 129th Streets) during 2008; receptor Site 11 (at locations of Manhattanville Houses which have a direct line-of-sight to the Phase 1 construction site) during 2008; receptor 12a (at locations of Manhattanville Houses which have a direct line-of-sight to the Phase 1 construction site) during two analysis years (2008 and 2011); receptor 14 (at locations of Manhattanville Houses which have a direct line-of-sight to the Phase 1 construction site) during two analysis years (2011 and 2014); and receptor Site 15 (at the new school at Broadway and West 125th Street at locations which have a direct line-of-site to the Phase 1 construction) during 2011. At the remaining receptor sites, noise levels during the Phase 1 construction would not exceed the CEQR impact criteria. At most locations cited above, the exceedance of the 3 dBA CEQR impact criteria is due principally to noise generated by construction activities; however, at some locations—Site 15, for example—the exceedance is due to a combination of construction activities and traffic generated by No Build projects.

Table 21-24(a)
Construction Noise Analysis Results for Phase 1 (Leq(1) values in dBA)

Noise Receptor	Receptor Height	Existing	Phase 1-2008 Analysis Year			Phase 1-2009 Analysis Year			Phase 1-2010Analysis Year			Phase 1-2011 Analysis Year			Phase 1-2012 Analysis Year		
			Construction	Total	Increase	Construction	Total	Increase	Construction	Total	Increase	Construction	Total	Increase	Construction	Total	Increase
1	1st floor	70.7	43.3	70.8	0.1	43.8	70.9	0.2	42.9	71.0	0.3	47.2	71.1	0.4	57.1	71.4	0.7
	12th floor	69.3	61.1	70.0	0.7	63.6	70.5	1.2	62.2	70.4	1.1	65.0	71.0	1.7	61.8	70.5	1.2
2	1st floor	70.7	46.5	70.8	0.1	47.2	70.9	0.2	46.5	71.0	0.3	54.7	71.2	0.5	53.9	71.3	0.6
	3rd floor	70.6	54.4	70.8	0.2	54.6	70.9	0.3	52.6	71.0	0.4	62.9	71.7	1.1	57.9	71.3	0.7
3	5 feet	70.4	59.1	70.8	0.4	60.2	71.0	0.6	58.5	71.0	0.6	63.5	71.6	1.2	59.5	71.2	0.8
4	1st floor	71.7	50.0	71.9	0.2	50.1	72.0	0.3	52.0	72.1	0.4	58.0	72.4	0.7	54.6	72.4	0.7
	25th floor	68.3	64.0	69.8	1.5	62.9	69.6	1.3	63.7	69.9	1.6	66.9	71.0	2.7	63.4	70.1	1.8
5	5th floor	63.8	55.7	64.5	0.7	56.4	64.7	0.9	54.4	64.5	0.7	60.9	65.8	2.0	55.4	64.8	1.0
	20th floor	63.4	62.8	66.2	2.8	63.4	66.5	**3.1**	62.4	66.1	2.7	65.3	67.6	**4.2**	60.8	65.6	2.2
5a	5th floor	63.2	54.1	63.8	0.6	53.9	63.8	0.6	53.9	63.9	0.7	61.5	65.7	2.5	55.7	64.3	1.1
	21st floor	63.9	61.0	65.8	1.9	62.2	66.3	2.4	61.9	66.2	2.3	65.7	68.1	**4.2**	62.0	66.4	2.5
5b	5th floor	65.1	60.1	66.4	1.3	60.6	66.6	1.5	58.2	66.1	1.0	65.1	68.3	**3.2**	60.4	66.7	1.6
	20th floor	64.9	65.1	68.1	**3.2**	66.4	68.8	**3.9**	65.4	68.3	**3.4**	68.8	70.4	**5.5**	65.2	68.3	**3.4**
6	5 feet	69.7	70.9	73.5	**3.7**	61.5	70.6	0.9	65.5	71.5	1.8	69.6	73.1	**3.4**	66.7	72.1	2.4
7	7th Floor	60.6	65.2	66.5	**5.9**	66.3	67.4	**6.8**	67.4	68.3	**7.7**	70.8	71.2	**10.6**	67.2	68.2	**7.6**
	20th floor	63.1	73.6	74.0	**10.9**	71.4	72.1	**9.0**	71.2	71.9	**8.8**	73.9	74.3	**11.2**	69.7	70.8	**7.7**
8	1st floor	68.6	78.1	78.7	**10.1**	67.0	71.9	**3.3**	69.3	73.3	**4.7**	73.5	75.8	**7.2**	69.7	74.4	**5.8**
	7th floor	68.4	76.9	77.6	**9.2**	72.5	74.4	**6.0**	72.9	74.9	**6.5**	78.1	78.9	**10.5**	74.6	76.5	**8.1**
9	1st floor	75.8	79.7	81.2	**5.4**	60.2	76.2	0.4	61.7	76.3	0.5	65.3	76.6	0.8	59.9	76.5	0.7
	3rd floor	75.5	79.7	81.1	**5.6**	63.0	76.0	0.5	63.8	76.1	0.6	65.1	76.3	0.8	62.4	76.3	0.8
10	5 feet	76.7	82.6	83.6	**6.9**	59.7	77.0	0.3	60.2	77.2	0.5	69.2	77.8	1.1	62.0	77.4	0.7
11	1st floor	72.3	77.3	78.5	**6.2**	58.1	72.7	0.4	57.4	72.8	0.5	67.4	73.9	1.6	62.1	73.3	1.0
	20th floor	71.4	69.3	73.5	2.1	65.6	72.6	1.2	67.3	73.0	1.6	69.9	74.0	2.6	65.0	72.7	1.3
12	1st floor	69.9	49.8	70.0	0.1	48.0	70.1	0.2	46.9	70.1	0.2	49.6	70.2	0.3	47.6	70.3	0.4
	20th floor	70.6	56.7	70.8	0.2	55.6	70.8	0.2	55.9	70.8	0.2	62.0	71.2	0.6	56.9	70.9	0.3
12a	1st floor	74.9	77.4	79.4	**4.5**	61.8	75.5	0.6	61.7	75.7	0.8	67.9	76.3	1.4	62.5	76.1	1.2
	15th floor	74.3	70.5	75.9	1.6	69.1	75.7	1.4	71.6	76.5	2.2	73.3	77.3	**3.0**	67.7	75.9	1.6
13	1st floor	69.3	54.4	69.5	0.2	54.4	69.6	0.3	54.5	69.6	0.3	55.5	69.7	0.4	49.9	69.7	0.4
	20th floor	70.0	61.5	70.6	0.6	61.0	70.5	0.3	62.1	70.7	0.7	64.5	71.1	1.1	58.3	70.3	0.3
14	1st floor	63.1	52.3	63.4	0.3	52.1	63.4	1.0	50.5	63.3	0.2	59.7	64.7	1.6	55.6	63.8	0.7
	20th floor	63.2	61.3	65.4	2.2	61.8	65.6	2.4	62.4	65.8	2.6	64.3	66.8	**3.6**	59.3	64.7	1.5
15	1st floor	73.5	68.0	74.7	1.2	65.3	74.4	0.9	63.9	74.4	0.9	69.1	75.4	1.9	64.2	74.8	1.3
	5th floor	73.4	71.1	75.5	2.1	67.1	74.5	1.1	67.6	74.7	1.3	74.1	77.0	**3.6**	68.8	75.1	1.7

Table 21-24(a) (cont'd)
Construction Noise Analysis Results for Phase 1 (Leq(1) values in dBA)

Noise Receptor	Receptor Height	Existing	Phase 1-2013 Analysis Year			Phase 1-2014 Analysis Year		
			Construction	Total	Increase	Construction	Total	Increase
1	1st floor	70.7	57.0	71.5	0.8	51.0	71.5	0.8
	12th floor	69.3	59.9	70.4	1.1	57.5	70.3	1.0
2	1st floor	70.7	53.2	71.4	0.7	59.8	71.7	1.0
	3rd floor	70.6	60.5	71.6	1.0	62.0	71.8	1.2
3	5 feet	70.4	60.0	71.4	1.0	58.4	71.4	1.0
4	1st floor	71.7	54.4	72.5	0.8	63.2	73.1	1.4
	25th floor	68.3	61.4	69.8	1.5	62.3	70.1	1.8
5	5th floor	63.8	59.0	65.4	1.6	51.3	64.6	0.8
	20th floor	63.4	60.2	65.4	2.0	55.0	64.5	1.1
5a	5th floor	63.2	59.8	65.2	2.0	51.1	64.0	0.8
	21st floor	63.9	60.0	65.9	2.0	54.2	65.0	1.1
5b	5th floor	65.1	61.9	67.2	2.1	53.4	66.0	0.9
	20th floor	64.9	62.0	67.1	2.2	57.2	66.1	1.2
6	5 feet	69.7	61.2	71.3	1.6	50.2	71.0	1.3
7	7th floor	60.6	61.4	64.4	**3.8**	45.2	61.5	0.9
	20th floor	63.1	66.7	68.8	**5.7**	53.9	65.3	2.2
8	1st floor	68.6	64.3	73.9	**5.3**	57.6	74.3	**5.7**
	7th floor	68.4	72.1	75.5	**7.1**	55.4	73.6	**5.2**
9	1st floor	75.8	56.9	76.6	0.8	56.4	76.7	0.9
	3rd floor	75.5	56.3	76.3	0.8	55.4	76.4	0.9
10	5 feet	76.7	62.4	77.6	0.9	60.4	77.7	1.0
11	1st floor	72.3	60.2	73.3	1.0	61.6	73.5	1.2
	20th floor	71.4	65.5	72.9	1.5	64.5	72.8	1.4
12	1st floor	69.9	47.4	70.4	0.5	51.0	70.5	0.6
	20th floor	70.6	54.7	70.8	0.2	64.3	71.6	1.0
12a	1st floor	74.9	66.1	76.5	1.6	58.6	76.3	1.4
	15th floor	74.3	68.7	76.2	1.9	63.1	75.8	1.5
13	1st floor	69.3	51.4	69.8	0.5	51.3	69.8	0.5
	20th floor	70.0	56.8	70.2	0.2	65.8	71.4	1.4
14	1st floor	63.1	55.4	63.8	0.7	65.3	67.3	**4.2**
	20th floor	63.2	59.7	64.8	1.6	71.3	71.9	**8.7**
15	1st floor	73.5	58.7	74.7	1.2	56.7	74.8	1.3
	5th floor	73.4	60.2	74.2	0.8	55.2	74.2	0.8

Table 21-24 (b)
Construction Noise Analysis Results for Phase 2 (Leq(1) values in dBA)

Noise Receptor	Receptor Height	Existing	Phase 2-2024 Analysis Year			Phase 2-2025 Analysis Year			Phase 2-2026 Analysis Year			Phase 2-2027 Analysis Year			Phase 2-2028 Analysis Year		
			Construction	Total	Increase	Construction	Total	Increase	Construction	Total	Increase	Construction	Total	Increase	Construction	Total	Increase
1	1st floor	70.7	58.4	72.6	1.9	60.5	66.7	-4.0	56.5	66.0	-4.7	70.2	71.5	0.8	68.9	70.5	-0.2
	12th floor	69.3	60.3	71.6	2.3	74.2	74.8	**5.5**	73.5	74.2	**4.9**	77.6	77.9	**8.6**	69.2	70.8	1.5
2	1st floor	70.7	56.7	72.5	1.8	65.7	68.7	-2.0	58.4	66.4	-4.3	74.7	75.2	**4.5**	69.4	70.9	0.2
	3rd floor	70.6	57.2	72.6	2.0	74.4	75.0	**4.4**	66.6	69.3	-1.3	78.4	78.6	**8.0**	69.3	71.0	0.4
3	5 feet	70.4	58.4	72.3	1.9	71.0	72.2	1.8	65.7	69.0	-1.4	73.5	74.2	**3.8**	68.2	70.3	-0.1
4	1st floor	71.7	56.4	73.9	2.2	62.8	70.8	-0.9	59.0	70.4	-1.3	70.5	73.3	1.6	66.2	71.5	-0.2
	25th floor	68.3	59.2	71.0	2.7	73.4	74.6	**6.3**	72.8	74.2	**5.9**	71.5	73.3	**5.0**	63.2	69.7	1.4
5	5th floor	63.8	56.0	65.7	1.9	56.5	64.1	0.3	51.3	63.5	-0.3	68.4	69.6	**5.8**	64.9	67.2	**3.4**
	20th floor	63.4	58.5	65.8	2.4	71.2	71.8	**8.4**	66.2	67.9	**4.5**	72.0	72.5	**9.1**	63.6	66.3	2.9
5a	5th floor	63.2	52.0	64.9	1.7	56.6	63.1	-0.1	51.5	62.4	-0.8	68.6	69.5	**6.3**	65.6	67.2	**4.0**
	21st floor	63.9	57.5	66.4	2.5	70.5	71.1	**7.2**	66.4	67.9	**4.0**	72.2	72.6	**8.7**	65.3	67.1	**3.2**
5b	5th floor	65.1	57.9	67.2	2.1	60.7	66.2	1.1	54.4	65.2	0.1	71.6	72.4	**7.3**	68	69.7	**4.6**
	20th floor	64.9	60.0	67.3	2.4	74.0	74.4	**9.5**	70.3	71.3	**6.4**	74.1	74.5	**9.6**	66.5	68.5	**3.6**
6	5 feet	69.7	53.1	71.4	1.7	51.0	71.4	1.7	50.6	71.4	1.7	57.9	71.5	1.8	58.4	71.6	1.9
7	7th Floor	60.6	45.0	61.0	0.4	44.6	61.0	0.4	44.3	60.9	0.3	48.2	60.9	0.3	47.6	60.9	0.3
	20th floor	63.1	54.1	65.7	2.6	53.7	65.6	2.5	53.6	65.7	2.6	54.2	65.7	2.6	54.1	65.7	2.6
8	1st floor	68.6	63.9	75.9	**7.3**	63.8	75.9	**7.3**	63.8	76.0	**7.4**	63.9	76.0	**7.4**	63.9	76.1	**7.5**
	7th floor	68.4	61.5	75.0	**6.6**	61.4	75.0	**6.6**	61.4	75.1	**6.7**	61.5	75.2	**6.8**	61.4	75.2	**6.8**
9	1st floor	75.8	61.0	77.2	1.4	61.0	77.2	1.4	61.0	77.3	1.5	61.2	77.3	1.5	61.3	77.3	1.5
	3rd floor	75.5	59.6	76.8	1.3	59.7	76.9	1.4	59.7	76.9	1.4	60.0	76.9	1.4	60.1	77.0	1.5
10	5 feet	76.7	57.7	77.9	1.2	57.8	77.9	1.2	57.7	77.9	1.2	59.1	78.0	1.3	59.9	78.0	1.3
11	1st floor	72.3	50.2	73.5	1.2	50.4	73.5	1.2	50.3	73.5	1.2	51.4	73.5	1.2	51.7	73.5	1.2
	20th floor	71.4	51.9	72.3	0.9	52.2	72.4	1.0	52.0	72.4	1.0	53.1	72.4	1.0	57.2	72.5	1.1
12	1st floor	69.9	48.9	70.6	0.7	50.3	70.6	0.7	49.7	70.6	0.7	61.5	71.1	1.2	66.5	72.0	2.1
	20th floor	70.6	55.5	70.8	0.2	59.2	71.0	0.4	55.3	70.8	0.2	68.3	72.7	**2.1**	63.9	71.5	0.9
12a	1st floor	74.9	59.1	76.7	1.8	59.3	76.7	1.8	59.2	76.7	1.8	60.6	76.7	1.8	60.7	76.8	1.9
	15th floor	74.3	60.7	76.0	1.7	61.6	76.0	1.7	59.6	76.0	1.7	63.2	76.1	1.8	61.4	76.0	1.7
13	1st floor	69.3	55.8	70.1	0.8	51.9	70.0	0.7	47.3	70.0	0.7	59.9	70.4	1.1	65.2	71.2	1.9
	20th floor	70.0	64.9	71.2	1.2	62.7	70.8	0.8	54.9	70.2	0.2	68.7	72.5	2.5	64.8	71.2	1.2
14	1st floor	63.1	48.3	63.8	0.7	53.8	64.1	1.0	51.9	64.1	1.0	63.0	66.5	**3.4**	66.5	68.4	**5.3**
	20th floor	63.2	54.8	63.8	0.6	67.7	69.0	**5.8**	64.1	66.7	**3.5**	72.2	72.7	**9.5**	72.8	73.3	**10.1**
15	1st floor	73.5	63.4	75.7	2.2	63.4	75.7	2.2	63.4	75.8	2.3	63.4	75.8	2.3	63.4	75.9	2.4
	5th floor	73.4	61.7	74.9	1.5	61.7	75.0	1.6	61.7	75.0	1.6	61.8	75.1	1.7	61.8	75.1	1.7

The Phase 2 noise analysis results show that maximum predicted noise levels would exceed the CEQR impact criteria at the following locations: receptor Sites 1 and 4 (at elevated locations of Riverside Park Community which are high enough to have a direct line-of-sight to the Phase 2 construction site) during 2025, 2026, and 2027; receptor Sites 5, 5a, and 5b (at locations of Riverside Park Community which are high enough to have a direct line-of-sight to the Phase 2 construction site) during 2025 through 2028; receptor Site 2 (at I.S. 195) during 2025 and 2027; receptor Site 3 (located in the open space on top of I.S. 195) during 2027; receptor Site 7 (at locations of 560 Riverside Drive along West 125th Street) during two analysis years (2024 and 2028); receptor Site 8 (at locations of 560 Riverside Drive along West 125th Street) during all five analysis years; receptors Site 12 and 13 (at elevations of Manhattanville Houses which are high enough to have a direct line-of-sight to the Phase 2 construction site) during 2027; and receptor Site 14 (located at Manhattanville Houses) during 2025 through 2028. At the remaining receptor sites, noise levels during the Phase 2 construction would not exceed the CEQR impact criteria. (The projected decrease in noise levels at some locations at receptor Sites 1, 2, 3, and 4 are due to the elimination of noise at the lower level from the exhausts from the adjacent bus maintenance facility.) With the exception of receptor Site 8, the increases are due principally to on-site construction activities. At receptor Site 8, the increase is not due to construction activities, but to the midblock traffic signal installed on West 125th Street between Broadway and Twelfth Avenue and to project-generated traffic.

At upper locations on buildings where exceedances of the CEQR impact criteria are predicted to occur, exceedances would also be expected to occur at other locations which also have a direct of line-of-sight to the construction sites.

For impact determination purposes, significant adverse noise impacts are based on whether maximum predicted incremental noise levels at sensitive receptor locations off-site would be greater than the impact criteria suggested in the *CEQR Technical Manual* for two consecutive years or more. While increases exceeding the CEQR impact criteria for one year or less may be noisy and intrusive, they are not considered to be significant adverse noise impacts. An assessment was made of the duration of exceedances of the CEQR impact criteria.

During Phase 1, construction activities would be expected to result in significant noise impacts at locations facing the Phase 1 construction sites at:

- receptor Site 5 (3333 Broadway), at approximately the 21st and the 22nd floor, and Site 5b (3333 Broadway), from approximately the 17th floor to the 27th floor; and
- receptor Sites 7 and 8[1] (560 Riverside Drive), at all residential elevations.

Phase 1 construction activities at the remaining receptor sites would at times produce noise levels which are noisy and intrusive, but due to their limited duration, they would not produce significant noise impacts.

During Phase 2, construction activities would be expected to result in significant noise impacts at locations facing the Phase 2 construction sites at:

- receptor Site 1 (3333 Broadway), from approximately the 10th floor to the top residential floor;

[1] Receptor Site 8 includes both 560 Broadway and Prentis Hall, in institution building owned by Columbia University.

- receptor Site 4 (3333 Broadway), from approximately the 7th floor to the top residential floor;
- receptor Sites 5, 5a, and 5b (3333 Broadway), from approximately the 5th floor to the top residential floor;
- receptor Site 8 (560 Riverside Drive), at all elevations; and
- receptor Site 14 (two buildings at Manhattanville Houses—95 Old Broadway and 1430 Amsterdam Avenue), at all elevations.

Noise levels at Site 8 would exceed the CEQR significant impact threshold for construction impacts. However, the increase at this location is not due to construction activities, but to the midblock traffic signal installed on West 125th Street between Broadway and Twelfth Avenue, and project-generated traffic.

Phase 2 construction activities at the remaining receptor sites would at times produce noise levels which are noisy and intrusive, but due to their limited duration, they would not produce significant noise impacts.

In addition to the construction noise analysis presented above, a separate analysis was prepared to look at noise effects due to pile driving. Impact pile drivers would be used at all locations requiring pile driving, except for construction on the block bounded by West 132nd Street, Broadway, West 133rd Street, and Twelfth Avenue. On that block, because of the proximity of sensitive land uses (e.g., I.S. 195 and the residences at Riverside Park Community), non-impact pile drivers, such as sonic pile drivers, would be used. Only a limited amount of pile driving would take place at any location, the pile drivers would be located approximately 40-80 feet below grade, and pile driving on any block would be completed within four months. Two separate analyses of pile driving were performed. The first analysis assumed four impact pile drivers operating on the block bounded by West 129th Street, Broadway, West 130th Street, Twelfth Avenue, and West 125th Street, and looked at noise levels at lower and upper level receptor locations of Manhattanville Houses. That analysis indicated $L_{eq(1)}$ noise levels ranging from approximately 65 to 75 dBA (with the higher noise levels at the upper locations, which have a direct line-of-sight to the pile driving equipment). Existing $L_{eq(1)}$ noise levels at this location range from approximately 77 to 79 dBA. Therefore, while pile driving would produce peak noise levels which would be noticeable and intrusive, pile driving would not significantly increase $L_{eq(1)}$ noise levels at this location. The second analysis assumed 2 pile drivers operating on the western portion of the block bounded by West 132nd Street, Broadway, West 133rd Street, and Twelfth Avenue, and looked at noise levels at lower and upper level receptor locations of I.S. 195 and the Riverside Park Community. That analysis indicated $L_{eq(1)}$ noise levels ranging from approximately 67 to 77 dBA (with the higher noise levels at the upper locations, which have a direct line-of-sight to the pile driving equipment). Existing $L_{eq(1)}$ noise levels range from approximately 69 to 72 dBA. Therefore, at this location, pile driving would produce peak noise levels which would be noticeable and intrusive. In addition, pile driving would increase $L_{eq(1)}$ noise levels at this location above the 3 dBA CEQR impact criteria. However, because pile driving would only occur for a limited time period, pile driving itself would not result in significant noise impacts.

Conclusions

As previously described, construction activities would result in significant noise impacts at sensitive receptors (i.e., residences) when noise levels increase by 3 dBA or more for two or more consecutive years. At some locations where significant impacts are predicted to occur, the buildings already contain double-glazed windows and/or alternative ventilation (e.g., air conditioning). These measures would significantly reduce interior noise levels compared with exterior noise levels and may result in interior noise levels of 45 dBA or less. However, significant noise impacts would still occur at these locations.

With regard to the residential locations identified above where significant noise impacts are predicted to occur—3333 Broadway (Riverside Park Community), 95 Old Broadway and 1430 Amsterdam Avenue (two building at Manhattanville Houses), and 560 Riverside Drive—all of these residences have double-glazed windows, which with a closed window condition would produce approximately 30-35 dBA of noise attenuation. Riverside Park Community contains sleeves for air-conditioning units, and some, but not all, of the units contain air conditioning; Manhattanville Houses does not contain sleeves for air-conditioning units, but some units do contain window air-conditioning units; and 560 Riverside Drive, a Columbia University-owned building, contains packaged air-conditioning units. At 560 Riverside Drive, the combination of double-glazed windows and air-conditioning units would provide approximately 35 dBA of attenuation. While the building construction at all of the residential structures cited above would provide a significant amount of sound attenuation during cold weather months when windows are closed, except for 560 Riverside Drive and the units in the other buildings with air conditioning, the buildings would provide only limited attenuation (i.e., approximately 10 dBA) during time periods when windows are open for ventilation.

To partially mitigate significant noise impacts to residents at the 3333 Broadway (Riverside Park Community) and 95 Old Broadway and 1430 Amsterdam Avenue (Manhattanville Houses), the buildings with direct line-of-sight to the Subdirect A construction, Columbia University will provide air conditioning units (e.g. sleeve units for residents of 3333 Broadway and window units for residents of 95 Old Broadway and Amsterdam Avenue), at no cost cost to the residents for the units, as mitigation for construction impacts (see Chapter 23, "Mitigation."

However, even with these units, for some periods of time, construction noise may result in noise levels which would be above the 45 dBA L_{10} noise level recommended by CEQR for residences, and are noisy and intrusive. In addition, some residents in buildings either with existing air conditioning units or with air conditioning units provided as mitigation by Columbia University, which have a direct line-of-sight to the areas of construction may be significantly impacted because of insufficient window/wall attenuation.

With regard to the one institutional location where significant noise impacts are predicted to occur—Prentis Hall the design for this building will incorporate sufficient sound attenuation measures (e.g., double-glazed windows and alternative ventilation [air conditioning]), to mitigate the significant impacts due to construction activities for users of this facility.

VIBRATION

Introduction

Construction activities have the potential for resulting in vibration levels that may result in structural or architectural damage, and/or annoyance or interference with vibration-sensitive activities. In general, vibratory levels at a receiver are a function of the source strength (which in turn is dependent upon the construction equipment and methods utilized), the distance between the equipment and the receiver, the characteristics of the transmitting medium, and the receiver building construction. Construction equipment operation causes ground vibrations which spread through the ground and decrease in strength with distance. Vehicular traffic, even in locations close to major roadways, typically does not result in perceptible vibration levels, unless there are discontinuities in the roadway surface. With the exception of the case of fragile, typically historically significant structures or buildings, generally construction activities do not reach the levels that can cause architectural or structural damage, but they can achieve levels that may be perceptible and annoying in buildings very close to a construction site. An assessment has been prepared to quantitatively access potential vibration impacts of construction activities on structures and residences near the project site.

Construction Vibration Criteria

For purposes of assessing potential structural or architectural damage to historic structures or other fragile buildings that may be susceptible to vibration damage, the vibration impact criteria used by LPC of a PPV (peak particle velocity) of 0.50 inches/second would constitute a significant impact. For non-fragile buildings, vibration levels below 2.0 inches/second would not be expected to result in any structural or architectural damage.

For purposes of evaluating potential annoyance or interference with vibration-sensitive activities, vibration levels greater than 65 VdB would have the potential to result in impacts. While levels exceeding this limit may result in perceptible vibration, such levels would only be considered significant if they were to occur for a prolonged period of time.

Analysis Methodology

For purposes of assessing potential structural or architectural damage, the following formula was used:

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

where: PPV_{equip} is the peak particle velocity in in/sec of the equipment at the receiver location;

PPV_{ref} is the reference vibration level in in/sec at 25 feet; and

D is the distance from the equipment to the received location in feet.

For purposes of assessing potential annoyance or interference with vibration sensitive activities, the following formula was used:

$$L_v(D) = L_v(ref) - 30\log(D/25)$$

where: $L_v(D)$ is the vibration level in VdB of the equipment at the receiver location

$L_v(ref)$ is the reference vibration level in VdB at 25 feet; and

D is the distance from the equipment to the receiver location in feet.

Table 21-25 shows vibration source levels for construction equipment.

Table 21-25
Vibration Source Levels for Construction Equipment

Equipment	PPV_{ref} (in/sec)	Approximate L_v (ref) (VdB)
Pile Driver (impact)	0.644	104
Pile Driver (sonic)	0.170	93
Clam Shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall in rock)	0.017	75
Vibratory Roller	0.210	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drilling	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58
Source: *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, May 2006.		

Analysis Results

The buildings and structures of most concern with regard to the potential for structural or architectural damage due to vibration are the former Warren Nash Service Station building, the Studebaker Building, the Claremont Theater building, and the Riverside Drive and the Manhattan Valley IRT viaducts, all of which are immediately adjacent to the project construction sites, and are considered fragile buildings. Vibration levels at these buildings and structures would be kept below the 0.50 inches/second PPV limit. In addition, the project sponsors would implement a monitoring program to ensure that this limit is not exceeded, and that no architectural or structural damage would occur. At all other locations, the distance between construction equipment and receiving buildings or structures is sufficiently large to avoid vibratory levels that would result in architectural or structural damage.

In terms of potential vibration levels that would be perceptible and annoying, pile driving using impact pile drivers would have the most potential for producing levels which exceed the 65 VdB limit. Pile driving would produce perceptible vibration levels (i.e., vibration levels exceeding 65 VdB) at receptor locations within approximately 525 feet of an impact pile driver. However, pile driving would only occur for limited periods of time (i.e., less than four months) at a particular construction site. While the vibration levels produced during pile driving may be annoying, due to the limited period of time that this operation would take place, at locations that are more than 150 feet from the pile driver, vibration impacts due to pile driving would not be considered to be significant. However, at locations within 125 feet of any residence or sensitive land use—principally for construction on the block between West 132nd and West 133rd Streets—sonic, rather than impact, pile drivers would be used. Sonic pile drivers would produce perceptible vibration levels at receptor locations within approximately 200 feet of a sonic pile driver. This would be estimated to occur in less than a four-month period in the year 2026. With this type of pile driver, while nearby locations would have perceptible vibration levels, the magnitude of the vibration would be less than with an impact pile driver, and due to the limited duration of pile driving, these impacts would not be considered to be significant. Similarly, for limited periods of time, other construction activities would produce vibration levels which would be perceptible within approximately 200 feet of the location where construction is taking place. While these activities may be perceptible, they would be of limited duration, and the impacts they produce would not be considered significant adverse impacts.

As mentioned previously, based on current available information, in the limited areas where rock removal is necessary, and where other rock excavation methods (e.g., mechanical excavators, rock splitters, and expansive chemical rock-splitting methods) could not practicably be employed, some amount of blasting would be necessary. No blasting is expected at locations south of West 131st Street, except possibly at the site under Site 6. All blasting would be performed in conformance with regulations of FDNY and any other applicable regulations, and would use timed multiple charges of limited intensity, and blastmats, to limit potential impacts. With these measures, blasting would result in PPV levels that are below the impact criteria, and the limited amount of blasting would not result in any significant adverse vibration impacts.

PUBLIC HEALTH

See Chapter 22, "Public Health."

RODENT CONTROL

Construction contracts would include provisions for a rodent (mouse and rat) control program. Before the start of construction, the contractor would survey and bait the appropriate areas and provide for proper site sanitation. During the construction phase, as necessary, the contractor would carry out a maintenance program. Coordination would be maintained with appropriate public agencies. Only EPA- and DEC-registered rodenticides would be permitted, and the contractor would be required to perform rodent control programs in a manner that avoids hazards to persons, domestic animals, and non-target wildlife. ✷