West 181st Street from Amsterdam Avenue to Riverside Drive, Manhattan

Citywide Congested Corridors Project
Final Report

NEW YORK CITY DOT

Submitted to
New York City Department of Transportation

Submitted by
JHK Engineering, P.C.,
Urbitran Associates, Inc.
A Joint Venture

July 2012

AECOM

Citywide Congested Corridors Project

West 181st Street
(Amsterdam Avenue to Riverside Drive)
Borough of Manhattan
Final Report

Congestion Mitigation and Air Quality Improvement (CMAQ) Program

PIN X501.70

Contract No. D024673

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EXECUTIVE SUMMARY

The Citywide Congested Corridors Project (CCCP) is a study undertaken by the New York City Department of Transportation (NYCDOT) of selected roadways across the five boroughs which experience congestion, with the goals of improving mobility and safety for all street users, air quality and the quality of life. The study is consistent with the City's goal of building "Complete Streets" that accommodate all street users including pedestrians, bicyclists, transit users and motorists. It is funded by the federal Congestion Mitigation and Air Quality Improvement (CMAQ) program. West 181st Street in Manhattan is selected as one of the congested corridors. This report presents the evaluation of various improvement alternatives and the selection of a preferred alternative for the West 181st Street corridor, based on analysis of existing and future conditions presented previously.

The study area of the West 181st Street corridor, which extends from Riverside Drive on the west to Amsterdam Avenue on the east, also includes nearby roadways that would be affected, such as the avenues that cross West 181st Street, and West 178th and West 179th Streets.

Problems were identified as a result of data collection and analyses, field observations, and consultation with stakeholders, which includes residents, businesses, transportation providers, community board members, elected officials, local government agencies and assorted interest groups. The following is a summary of the major problems:

- Chronic congestion on West 181st Street, especially between Broadway and Amsterdam Avenue.
- Double parking affecting traffic operations and safety.
- Lack of loading/unloading zones.
- Slow bus speeds.
- Sidewalk congestion, especially near subway stations and bus stops.
- Unsafe crosswalks due to conflicts with turning vehicles.
- Missing links between existing bike lanes and bike routes.

Three improvement alternatives were formulated, analyzed and presented to the stakeholders. The best elements of each alternative were identified and were used to develop a recommended alternative which represents a synergy of the three initial improvement alternatives. Most of the short-term improvements of the recommended alternative have been implemented in 2011; others will be implemented during the spring of 2012. Long term improvements are planned to be implemented in 2014.

The major elements of the recommended alternative are:

- To reduce congestion by separating left-turning vehicles from through vehicles, left-turn bays are created at five approaches on West 181st Street:
    - Eastbound at Broadway.
    - Westbound at Broadway.
    - Westbound at Wadsworth Avenue.
    - Eastbound at Audubon Avenue.
    - Westbound at Audubon Avenue.
- To reduce congestion and safety problems caused by double-parking, loading zone windows (9am-noon) are created at several locations along West 181st Street.

- An eastbound bus lane is created from 3PM to 7PM Monday through Friday from Broadway to Amsterdam Avenue.
- To protect pedestrians in the crosswalks at the busy intersection of West 181st Street and St. Nicholas Avenue, where there is a subway station and bus stops for six bus lines, all turns are prohibited, except eastbound and westbound right turns.
- Curb extensions are planned for long term implementation for six of the eight sidewalks at the corners of West 181st Street and St. Nicholas Avenue.
- Other pedestrian refuge areas that are built or planned for long-term implementation include:
    - Curb extension along West 181st Street at southwest corner of Haven Avenue.
    - Curb extension along Broadway at northwest corner of West 181st Street.
    - Median refuge island on east leg of the intersection of West 181st Street and Amsterdam Avenue.
- Shared lane markings for bicycles, including bike boxes at key intersections, are installed along the following segments:
    - Both directions of West 181st Street from Riverside Drive to Ft. Washington Avenue.
    - Both directions of Riverside Drive from West 181st Street to the pedestrian bridge.
    - Southbound direction of Ft. Washington Avenue from West 183rd Street to West 179th Street.
- Other markings that are installed to define roadway usage or enhance pedestrian safety:
    - Parking lane markings.
    - Stop bars set back 10 feet from crosswalks.
- Signal timing and offset improvements.

The recommended alternative retains the existing two-way operation of West 181st Street, addresses the most pressing issues that were identified through the study process and extensive community outreach, and is projected to improve operations and safety for all street users (i.e., pedestrians, bicyclists, transit riders and motorists) as well as service to local businesses. Air quality is projected to improve with fewer emissions from vehicles. The corridor will be monitored to assess the effectiveness of the improvements beginning in 2013.

1.0 INTRODUCTION

This Final Report (the "Report") documents the evaluation of various improvement alternatives under future conditions and the selection of a preferred alternative for the Citywide Congested Corridors Project – West 181st Street corridor located in Manhattan Community Board 12. The Report is the conclusion of a planning process which included extensive community outreach, analysis of existing and future without improvements conditions, the development of future conditions with improvement alternatives and the selection of a preferred alternative. Figure 1.1-1 demonstrates the study process and project timeline and Figure 1.1-2 illustrates the project study area.

The community outreach effort was a critical component of the study process. The consultant, in conjunction with NYCDOT, held multiple meetings with project advisory committee (PAC) members as well as the community at-large to present the extent of the study area, selection of study intersections, collection of operation and safety data, and analysis of the existing and future without improvements conditions; identify safety and operational deficiencies; and obtain feedback from PAC and the community to fine tune the data analysis. These meetings consisted of various stakeholders including residents, businesses, transportation providers, community board members, elected officials, local government agencies and assorted interest groups. Input from these meetings was incorporated into the development of the various improvement alternatives and the selection of the preferred alternative.

Additionally, technical memoranda were prepared as the study process developed. These memoranda included:

- *Technical Memorandum #1: Data Summary Report,* June 2008
- *Technical Memorandum #2: Existing and Future Conditions (Without Improvements) Analyses,* May 2009
- *Technical Memorandum #3: Future Conditions with Improvements: Alternatives Analysis,* June 2010

Study Process

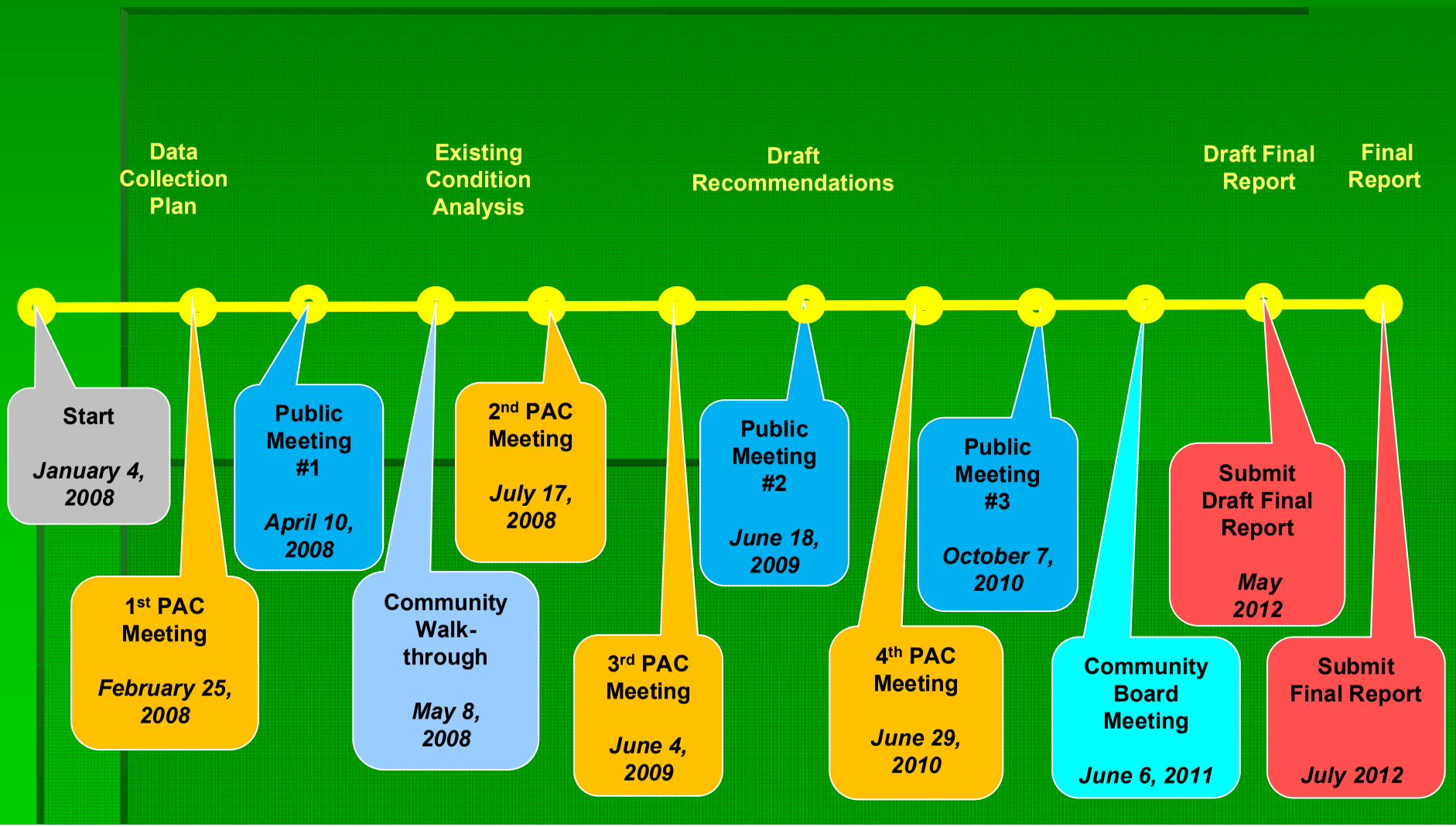


Figure 1.1-1 - Study Process and Project Timeline

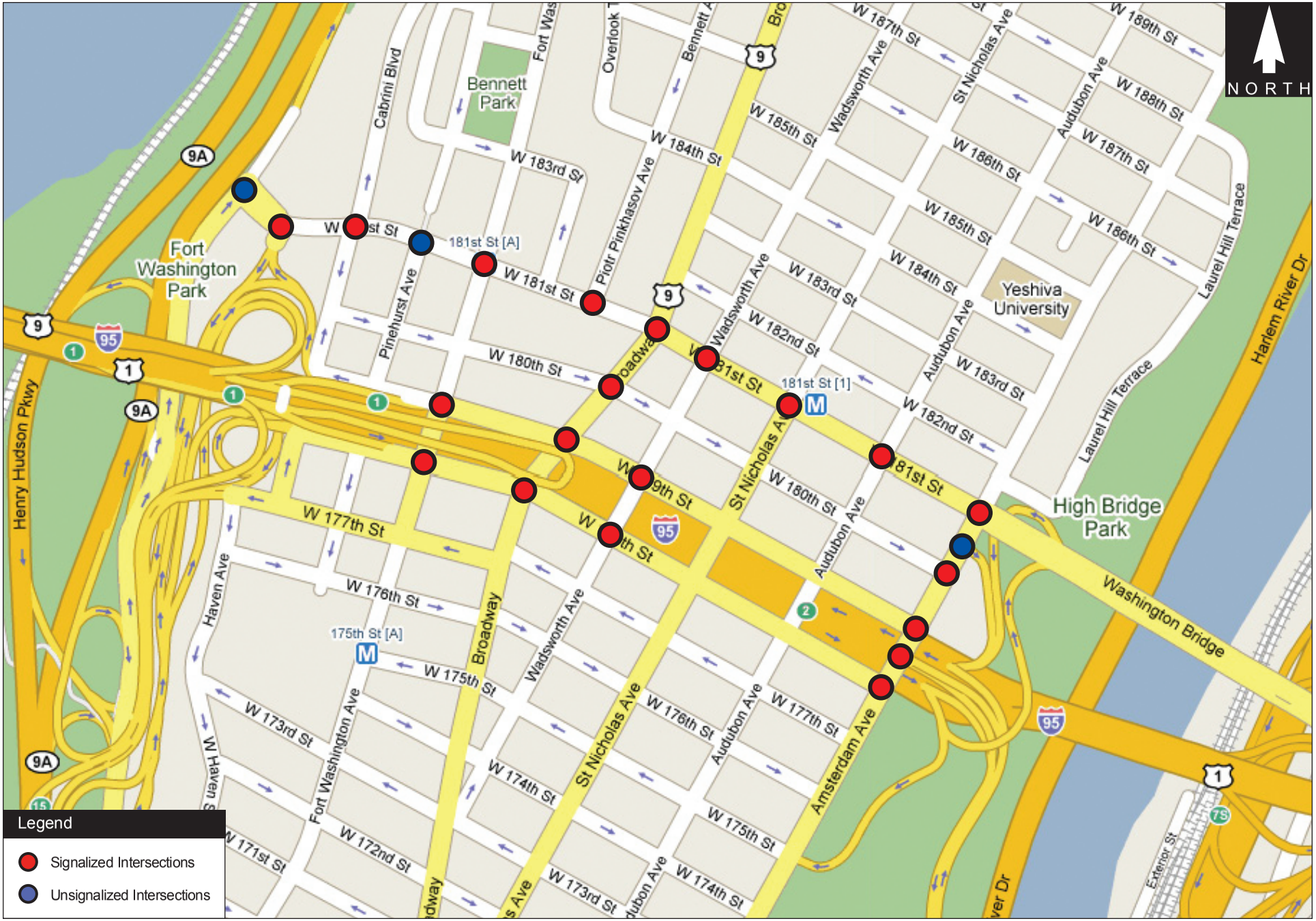


Figure1.1-2 - Study Intersections

Citywide Congested Corridors: West 181st Street Study

2.0 ALTERNATIVES STUDIED

Existing operational and safety needs and deficiencies were identified through data collection and analyses, field observations and community feedback as documented in the *Technical Memorandum #1 (Data Summary Report) and Technical Memorandum #2 (Existing and Future Without Improvement Conditions with Analyses)*. These needs and deficiencies were further discussed and presented to the Project Advisory Committee (PAC) and to the community at public meetings in an attempt to solicit community feedback and input in the development of improvement alternatives for the corridor.

Three future improvement alternatives were developed to address the identified issues in the study area. They were tailored to address the most pressing issues including, but not limited to, recurring traffic congestion in the study area, safety of all street users (i.e., motorists, pedestrians, bicyclists and transit riders), and pedestrian mobility on some of the more congested sidewalks along the West 181st Street corridor, especially at the intersection of West 181st Street and St. Nicholas Avenue, where there is a subway station for the No. 1 train and bus stops for 6 bus lines.

All of the improvement alternatives were developed to fit within the existing curb-to-curb width of West 181st Street, which is approximately 50 feet east of Broadway, and 40 feet west of Broadway. Alternatives 1, 2 and 3 present different sets of improvements for West 181st Street east of Broadway, which are described in Sections 2.1, 2.2 and 2.3, respectively. Section 2.4 presents improvements west of Broadway, which are common to all three alternatives.

2.1 Improvement Alternative 1

Figure 2.1-1 shows a layout of Alternative 1 for typical eastbound and westbound approaches on West 181st Street between Broadway and Amsterdam Avenue. It consists of exclusive left-turn lanes where geometrically feasible, turn restrictions, parking regulation modifications, and signal phasing/timing changes. Two-way traffic flow would be maintained along the entire length of West 181st Street, as today.

The left-turn lanes, aimed at separating left-turning vehicles from "through" vehicles, were proposed to be located on West 181st Street along the eastbound approach to Amsterdam Avenue, the eastbound and westbound approaches at Audubon and Wadsworth Avenues, and the eastbound approach at Broadway. The proposed left-turn lanes would be 10 feet wide, with varying storage lengths based on left-turn volumes and projected queuing. The remaining 20 feet on either side of the roadway would be occupied by an 11-foot travel lane and a 9-foot lane to be used, where not specified otherwise, for parking, loading/unloading and bus stops.

All turns at the intersection of West 181st Street and St. Nicholas Avenue were proposed to be prohibited from 7 AM to 7 PM, seven days a week. This would eliminate existing conflicts between turning vehicles and large numbers of pedestrians at this very busy intersection and thereby improve traffic flow and pedestrian safety.

2.2 Improvement Alternative 2

Figure 2.2-1 shows a layout of Alternative 2 for typical eastbound and westbound approaches on West 181st Street between Broadway and Amsterdam Avenue. It involves a one-way westbound operation for general traffic, with left-turn lanes and parking. The southern part of the roadway would contain a two-way bus transit-way. The northern-most 18 feet of the roadway would accommodate one 10-foot wide westbound travel lane for general traffic and an 8-foot curb lane to be used, where not otherwise specified, for parking and

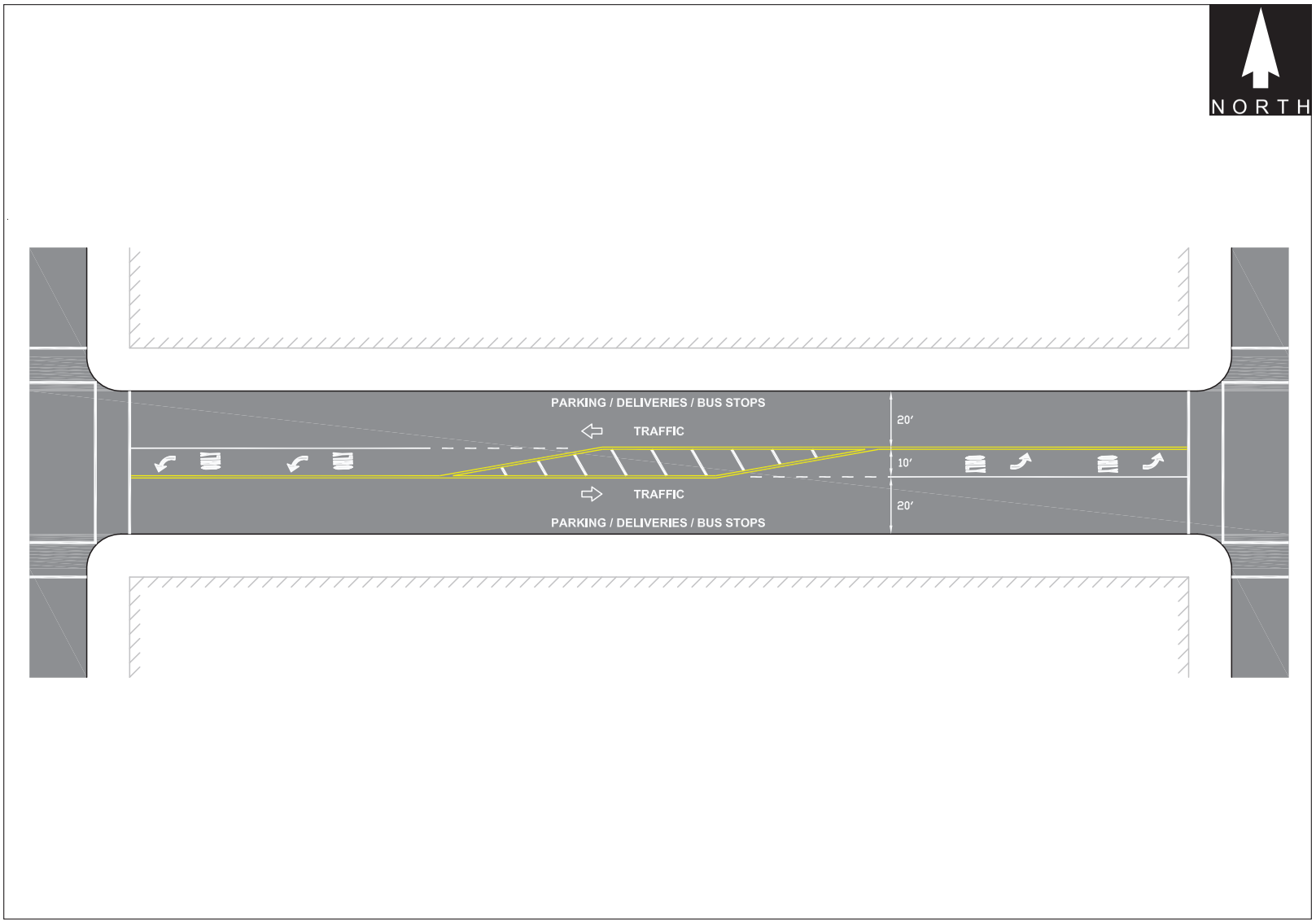


Figure 2.1-1 - Alternative 1 - Typical Treatments

West 181st Street From Broadway To Amsterdam Avenue

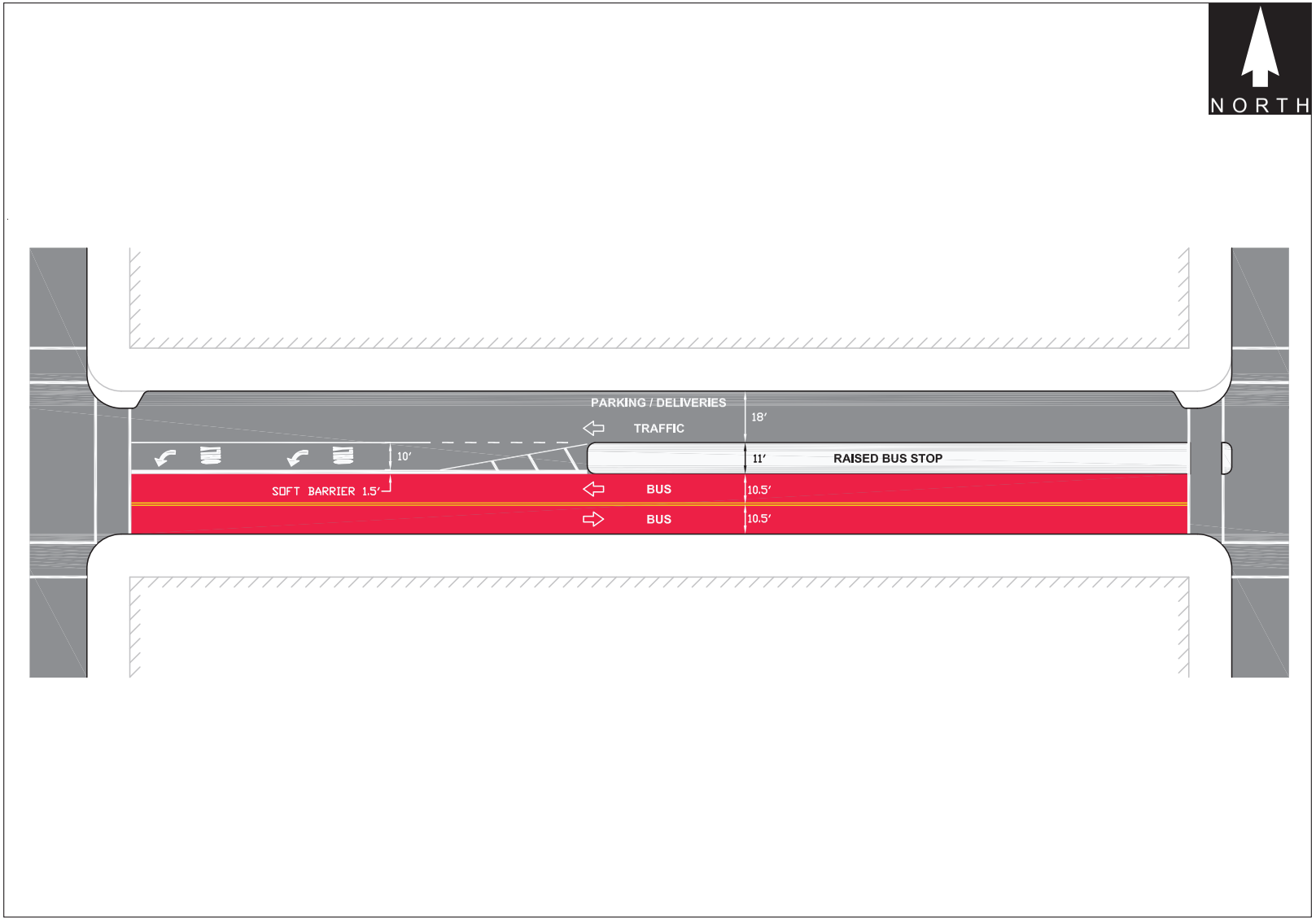


Figure 2.2-1 - Alternative 2 - Typical Treatments

West 181st Street From Wadsworth Avenue To Amsterdam Avenue

loading/unloading. The left-turn lanes are proposed to be located along West 181st Street at the westbound approaches to Audubon and Wadsworth Avenues and will be 10 feet wide. As in Alternative 1, all turns would be prohibited at West 181st Street and St. Nicholas Avenue from 7 AM to 7 PM, seven days a week.

The two-way bus transit-way would have one 10.5-foot lane in each direction. The westbound travel lane and the bus transit-way would be separated partially by an 11-foot raised boarding island in the center of the roadway to serve as westbound bus stops. All westbound buses would turn left at Wadsworth Avenue following their mapped routes. Since westbound buses would operate from a dedicated lane and would have separate traffic signal phasing, there is no need for any overflow buses to turn left at Broadway, as is the current practice. The bus transit-way between Broadway and Wadsworth Avenue would be one-way eastbound since all westbound buses turn left at Wadsworth Avenue. At the sections containing the left-turn lanes, a 1.5 foot stripe or quick-curb (soft barrier) would serve as a buffer between the westbound left-turn lane and the bus transit-way.

2.3 Improvement Alternative 3

Figure 2.3-1 shows a layout of Alternative 3 for typical eastbound and westbound approaches on West 181st Street between Broadway and Amsterdam Avenue. This alternative involves a one-way westbound operation with an off-set bus lane, a general-purpose traffic lane, a bike lane with a 3-foot striped buffer, and parking/deliveries on both sides of the street.

No exclusive left-turn lanes were proposed for this alternative; therefore turns would be made from the single travel lane on a "permissive" basis. As in Alternatives 1 and 2, all turns would be prohibited at West 181st Street and St. Nicholas Avenue from 7AM to 7PM, seven days a week. All westbound buses would operate from a dedicated lane, and at Wadsworth Avenue would have separate phasing to allow them to turn left.

The westbound general travel lane would be 11 feet wide, the bus lane would be 12 feet wide and there would be an 8-foot curb lane (north of the bus lane) to be used, where not otherwise specified, for parking, loading/unloading and bus stops. South of the general travel lane would be a 5-foot bike lane with a 3-foot buffer between the bike lane and the 8-foot curbside parking and loading/unloading lane. Additionally, the sidewalk(s) would be widened by a total of three feet, either extending into the roadway 1.5 feet on both sides or 3.0 feet on one side. These measures were designed to improve safety, traffic flow and bus operations as well as to provide increased opportunities for non-motorized modes. Eastbound buses would use West 178th Street, turn left onto northbound Amsterdam Avenue, then right onto the Washington Bridge where they would follow their current route. It is projected that eastbound car and truck traffic would also be diverted to this route.

2.4 Improvements Common to Improvement Alternatives 1, 2 & 3

In addition to the "packages of improvements" described above for the three alternatives, there are several improvements which are common to all of the above improvement alternatives and would be considered "stand-alone" improvements. These measures were designed to improve traffic flow and safety at the western end of the West 181st Street corridor between Broadway and Riverside Drive. These improvements include signal timing modifications, implementation of exclusive left-turn lanes and associated left-turn signals and phases, signal coordination, vehicular and bike route restriping and parking restrictions, by location.

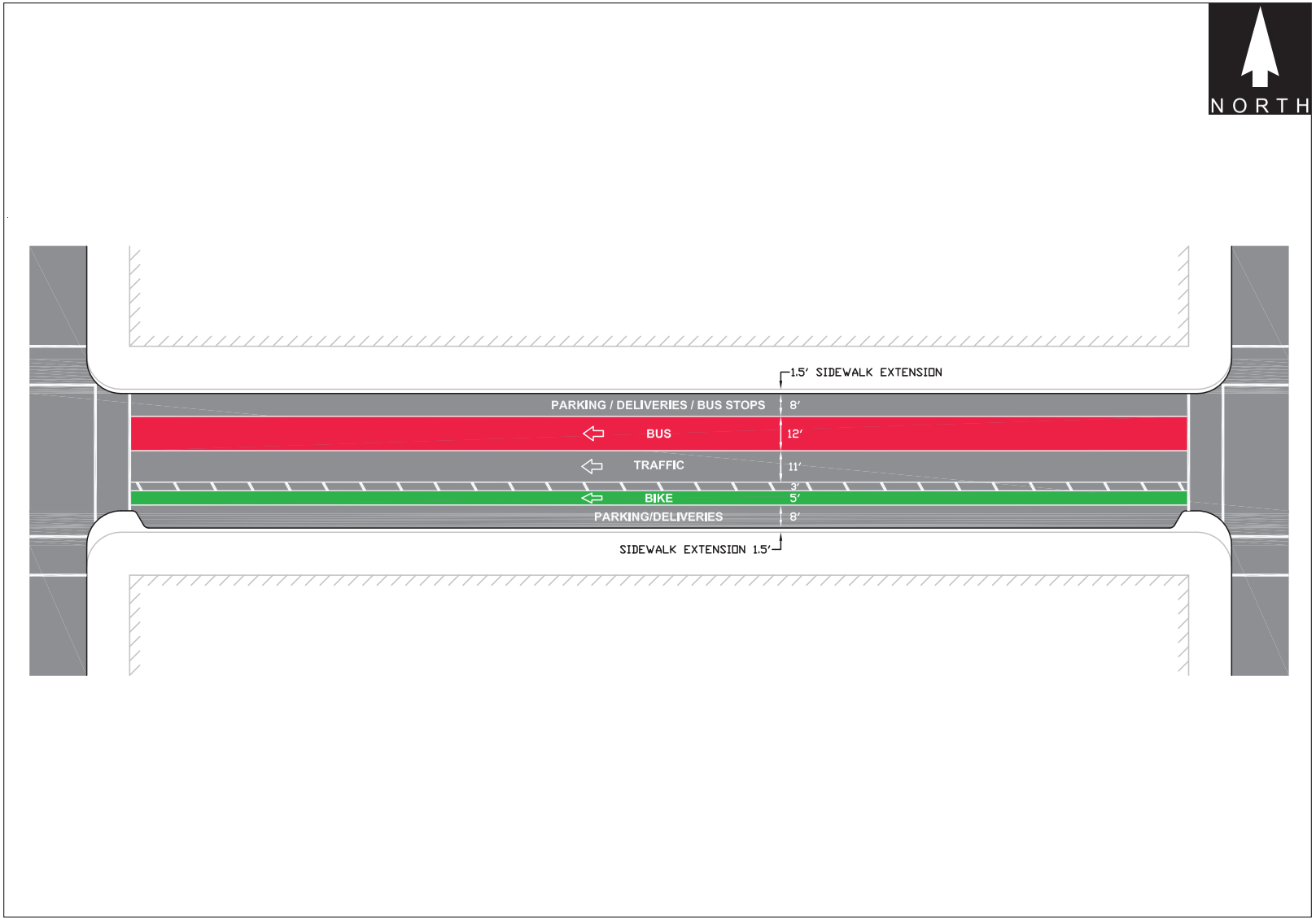


Figure 2.3-1 - Alternative 3 - Typical Treatments

West 181st Street From Broadway To Amsterdam Avenue

3.0 DEVELOPMENT OF THE RECOMMENDED ALTERNATIVE

The three improvement alternatives were presented to the PAC, Community Board 12 representatives and elected officials for comment and feedback. Each alternative's unique strengths, limitations, and the issues it addressed were discussed. From the feedback obtained, it was clear that Alternatives 2 and 3, despite some unique beneficial features, had severe shortcomings, specifically related to potential traffic diversions onto adjacent roadways in the neighborhood. Alternative 1, with more modest improvements and the least amount of potential traffic diversions seemed more acceptable, but did not address several pressing issues, including improvements to bus service along the corridor.

The best elements of each alternative were identified and were used to develop a recommended alternative which represents a synergy of the three initial improvement alternatives. The recommended alternative, which is most similar to Alternative 1, was presented to the Community Board 12 Transportation Committee and elected officials at the final input meeting convened for this project.

The recommended improvements, located primarily along West 181st Street, Ft. Washington Avenue and St. Nicholas Avenue, consist of exclusive left-turn lanes, a right-turn lane, a bus lane, shared lane markings for bicycles, parking-lane markings, turn restrictions, signal timing changes, modifications to curbside parking regulations and curb extensions. Most of the short-term improvements have been implemented during the fall of 2011. Two-way traffic flow is maintained along the entire length of West 181st Street. The eastbound curb lane of West 181st Street between Broadway and Amsterdam Avenue operates as a bus-only lane during the 3PM to 7PM weekday peak period. During other times, the eastbound curb lane accommodates metered parking, with truck loading and unloading windows from 9AM to 12 Noon at selected locations. The north side of the roadway (westbound) has no bus lane and provides metered parking, also with truck loading and unloading windows from 9AM to 12 Noon at selected locations. Figure 3.0-1 shows a layout of the recommended alternative for typical eastbound and westbound approaches on West 181st Street between Broadway and Amsterdam Avenue, with some exceptions where turns are prohibited or not geometrically feasible.

The left-turn lanes, aimed at separating left-turning vehicles from "through" vehicles, are located along West 181st Street at the eastbound and westbound approaches at Audubon Avenue and Broadway, and the westbound approach at Wadsworth Avenue. The proposed left-turn lanes are nine or ten feet wide, with varying storage lengths based on left-turn volumes and projected queuing. The southern side of the roadway is occupied by an 11-foot travel lane and an 11-foot part-time curbside bus lane. The northern side of the roadway has one 11-foot travel lane and an 8-foot lane to be used, where not specified otherwise, for parking, loading/unloading and bus stops.

Special consideration for pedestrian safety was given to the busy intersection of West 181st Street and St. Nicholas Avenue because of the large volume of pedestrians generated by the 181st Street station to the No. 1 train and bus stops for six bus lines. All turns at this intersection are prohibited at all times except for the eastbound and westbound right turns from West 181st Street. This improvement measure eliminates/reduces conflicts between turning vehicles and pedestrians and thereby improves traffic flow and pedestrian safety.

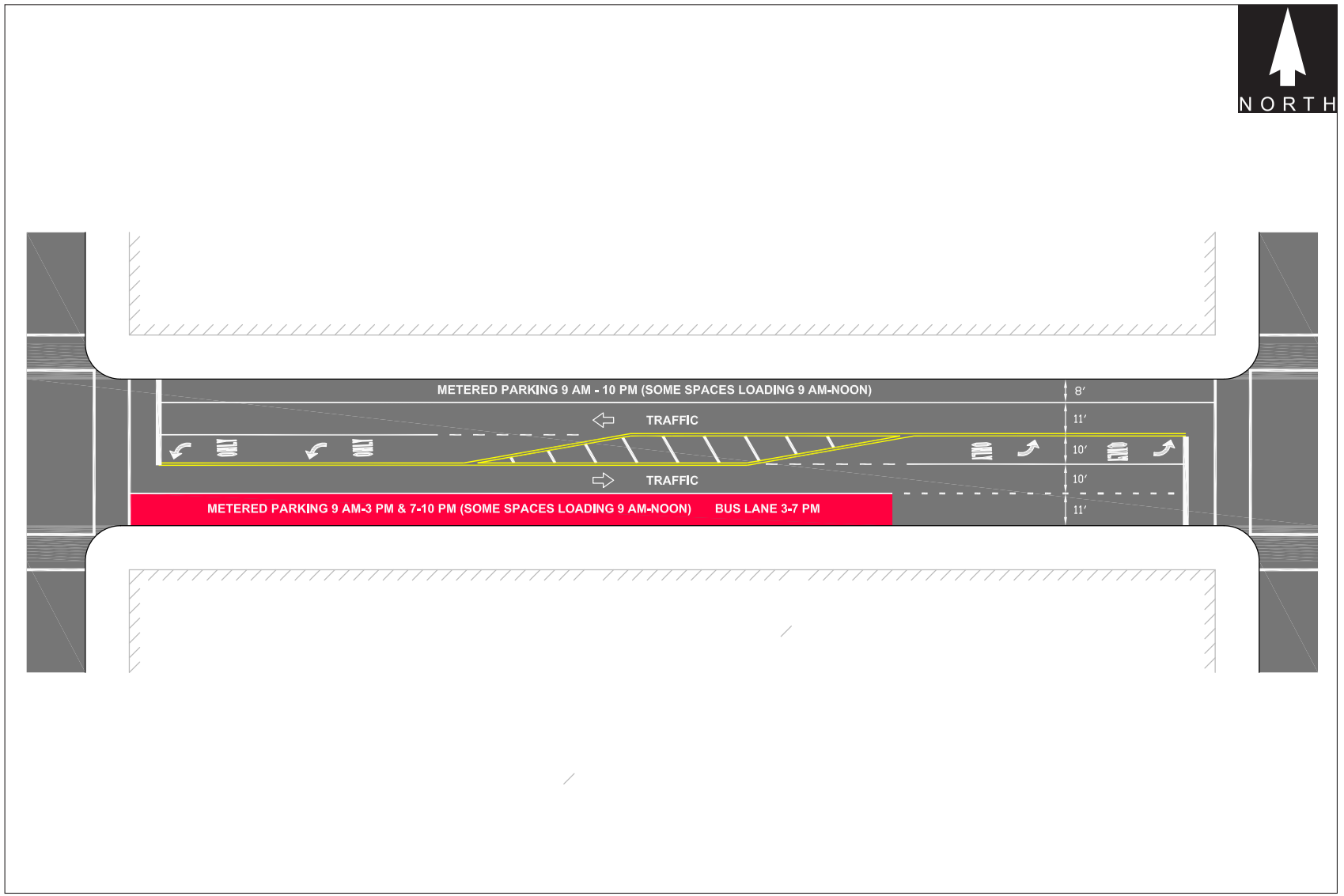


Figure 3.0-1 - Recommended Alternative - Typical Treatments

West 181st Street From Broadway To Amsterdam Avenue

3.1 Short-Term Improvement Measures

The following are the short-term improvement measures, which have been implemented during the fall of 2011 unless specified otherwise.

Riverside Drive from West 181st Street to Pedestrian Bridge over Henry Hudson Parkway

See Figure 3.1-1. Previously, this section of roadway operated as one-way northbound. There is a parking garage on the east side of Riverside Drive, about 250 feet north of West 181st Street. Across the street is the entrance to a pedestrian bridge over the Henry Hudson Parkway, which provides access to Fort Washington Park and the Hudson River Greenway. Parking is removed from west side of Riverside Drive to provide two-way operation between West 181st Street and the pedestrian bridge and parking garage. Shared bike route markings are provided on both sides of Riverside Drive. A parking lane marking is provided for the east side of the roadway. Curb ramps will be installed on both sides of Riverside Drive at the existing pedestrian bridge.

West 181st Street from Riverside Drive to Haven Avenue

See Figure 3.1-1. Parking lane markings are provided on both sides of the divided eastbound and westbound roadways. Shared bike route markings are provided in both directions. Diagonal striping is provided for buffer areas.

West 181st Street at Haven Avenue

See Figure 3.1-1. The southwest corner of the intersection is extended northward to reconfigure and shorten the crossing distance along the west crosswalk. A bike box and new stop bar is provided for the eastbound approach to Haven Avenue. On the northbound approach, left-only and right-only pavement markings are provided. During the PM peak period, the off-set is changed from 88 to 77 seconds.

West 181st Street between Haven Avenue and Cabrini Boulevard

See Figure 3.1-1. Parking lane markings and shared bike route markings are provided on both sides of the roadway.

West 181st Street at Cabrini Boulevard

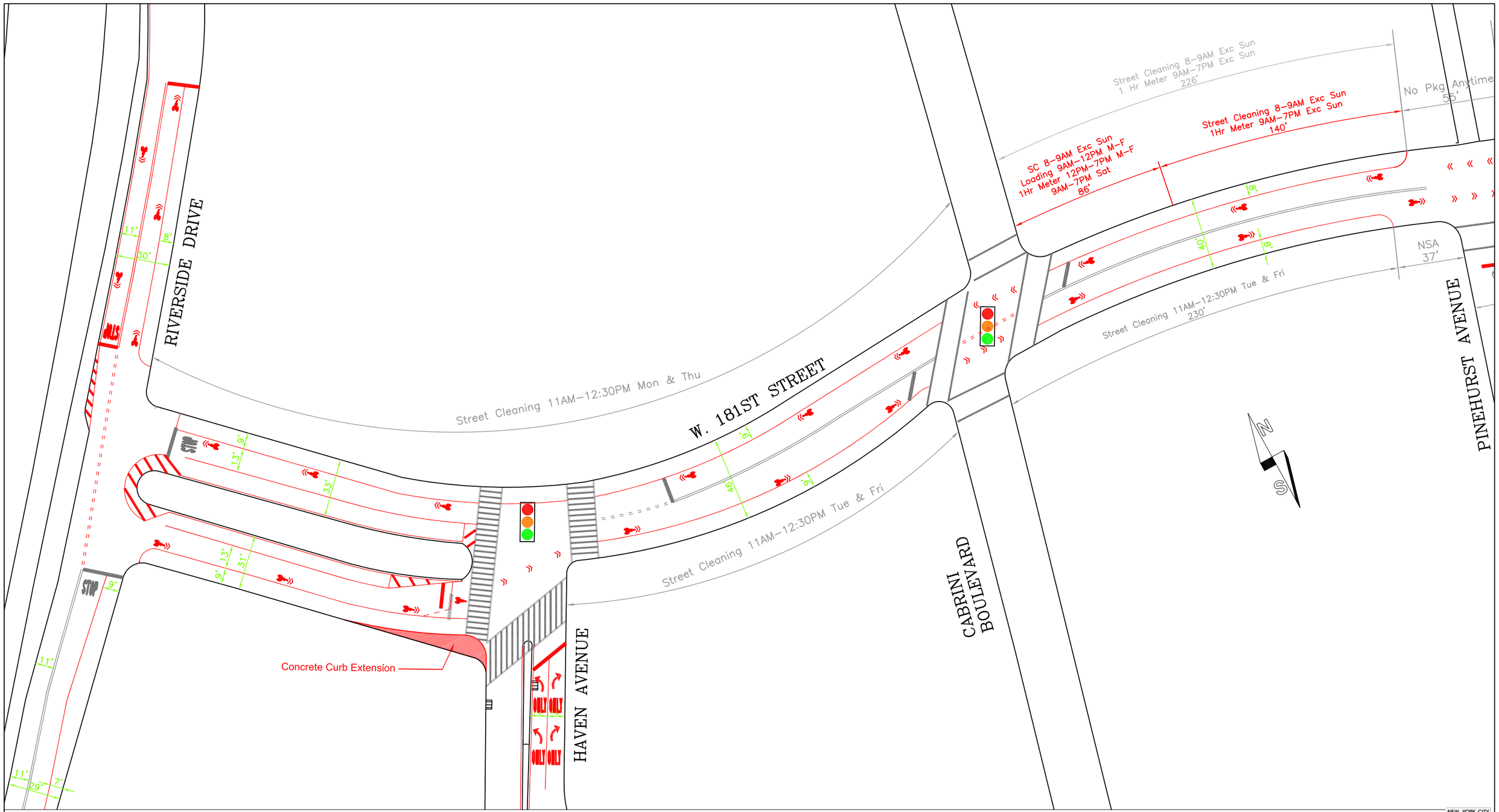
See Figure 3.1-1. Peg-a-track markings and shared bike route markings are provided for east-west movement through the intersection. At all times, the off-set is changed from 9 to 13 seconds.

West 181st Street from Cabrini Boulevard to Pinehurst Avenue

See Figure 3.1-1. Parking lane markings and shared bike route markings are provided on both sides of the roadway. Along the north side, just east of Cabrini Boulevard for a length of 86 feet, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 7PM on weekdays and 9AM to 7PM on Saturday.

West 181st Street at Pinehurst Avenue

See Figure 3.1-2. Peg-a-track markings are provided for east-west movement through the intersection. A new stop bar is provided for the northbound approach.



LEGEND

- New Marking
- Previous Marking to Remain
- Previous Marking Removed
- NSA New Parking Regulation
- NSA Previous Parking Regulation to Remain
- NSA Previous Parking Regulation Changed

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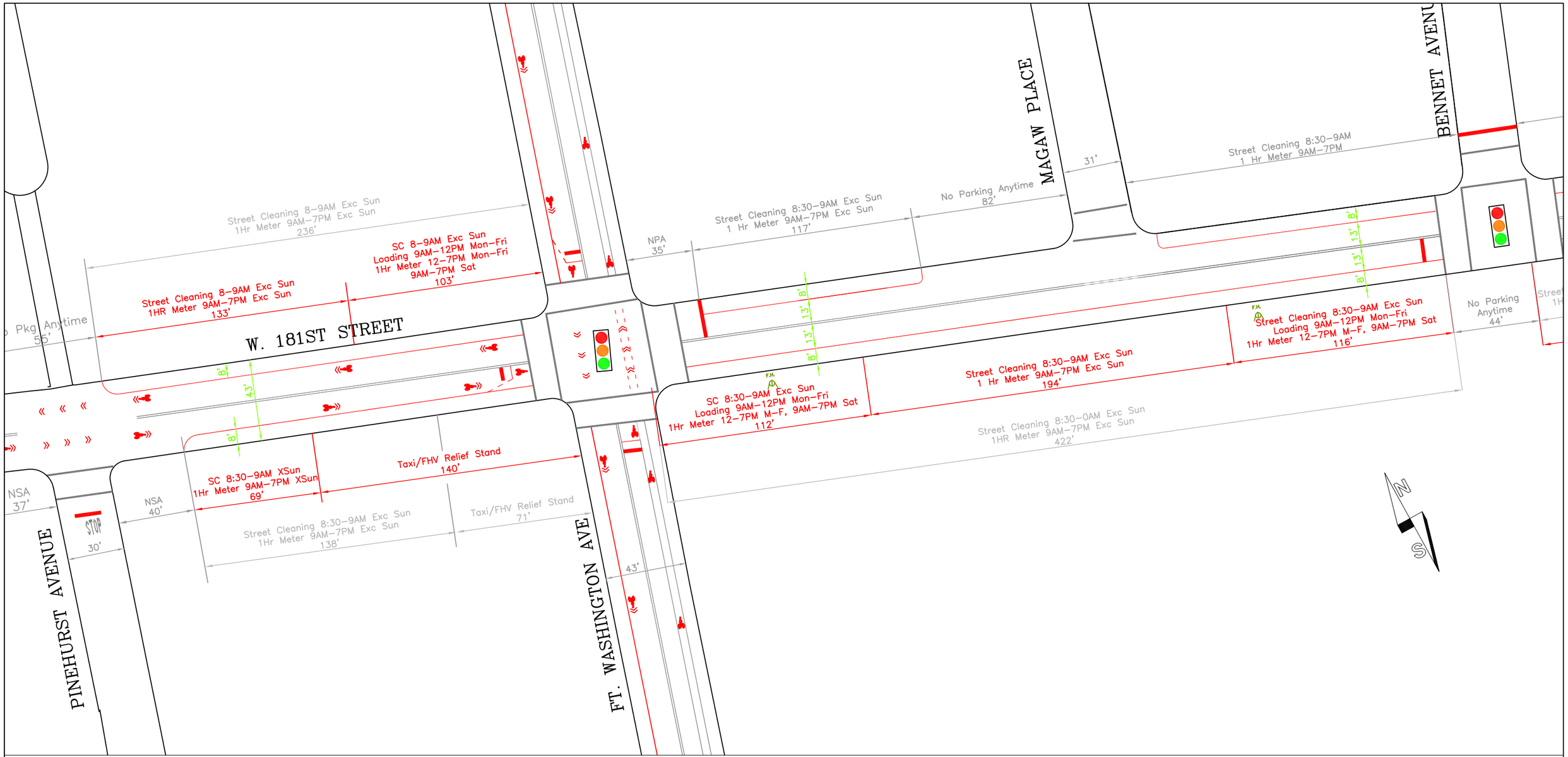
Figure 3.1-1

Short-Term Improvements
W. 181st Street
Between Riverside Drive and Pinehurst Avenue

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'



LEGEND

- New Marking
- Previous Marking to Remain
- Previous Marking Removed
- NSA New Parking Regulation
- NSA Previous Parking Regulation to Remain
- NSA Previous Parking Regulation Changed

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Figure 3.1-2

Short-Term Improvements
W. 181st Street
Between Pinehurst Avenue and Bennet Avenue

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'

West 181st Street from Pinehurst Avenue to Ft. Washington Avenue

See Figure 3.1-2. Parking lane markings and shared bike route markings are provided on both sides of the roadway. Approximately three parking spaces on the south side are eliminated to extend the existing taxi/FHV relief stand westward to the mid-block to provide additional space for taxis and livery cabs to stand. Along the north side of West 181st Street, just west of Ft. Washington Avenue for a length of 103 feet, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 7PM on weekdays and 9AM to 7PM on Saturday.

West 181st Street at Ft. Washington Avenue

See Figure 3.1-2. Bike boxes are provided for eastbound, northbound and southbound approaches. Shared bike route markings are provided for north-south movement through the intersection. Two seconds of green time is reallocated to the east-west phase at all times.

West 181st Street from Ft. Washington Avenue to Bennett Avenue

See Figure 3.1-2. Parking lane markings are provided on both sides of the roadway. Along the south side, just east of Ft. Washington Avenue for a length of 112 feet, and just west of Bennet Place for a length of 116 feet, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 7PM on weekdays and 9AM to 7PM on Saturday.

Fort Washington Avenue from West 179th to West 183rd Streets

See Figure 3.1-2. Parking lane markings and shared bike route markings will be provided along southbound Ft. Washington Avenue from West 183rd to West 179th Streets to connect to existing bike lanes.

West 179th Street at Ft. Washington Avenue

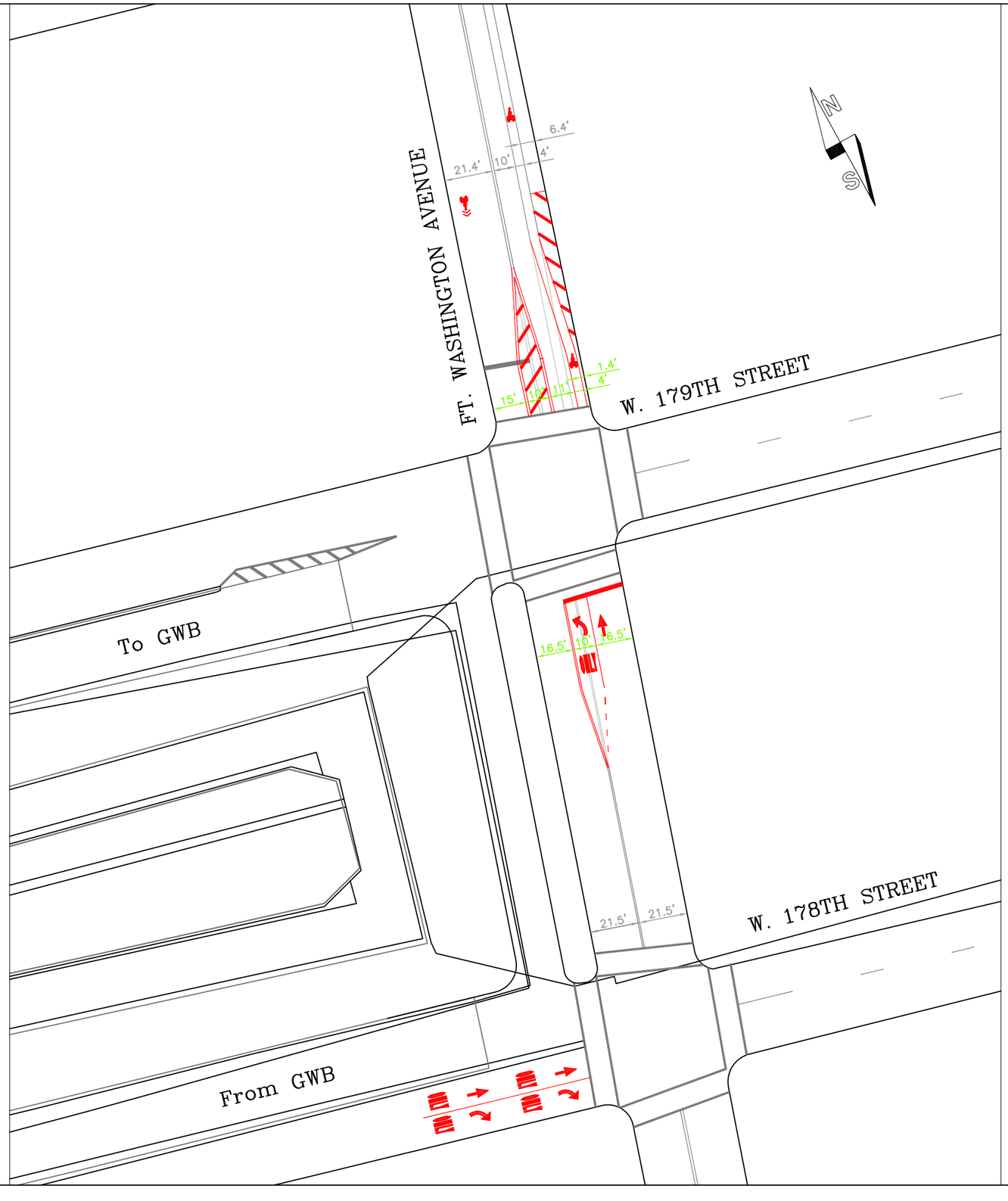
See Figure 3.1-3. To improve safety and increase the capacity of the single-lane northbound approach on Ft. Washington Avenue, the approach is restriped as an exclusive left-turn lane and a through-only lane to separate left turning traffic and allow through traffic to proceed unobstructed. This improvement measure also required shifting the double yellow center line on Ft. Washington Avenue to the west in order to accommodate the northbound left-turn lane. It also required restriping and tapering the northbound departure leg so that northbound movements are aligned on both sides of the intersection. The existing northbound and southbound bus stops are relocated from the north leg of the intersection to the south leg. The existing taxi stand on the east side of the south leg is eliminated.

West 178th Street at Ft. Washington Avenue

See Figure 3.1-3. The eastbound West 178th Street approach is restriped as a through lane and an exclusive right-turn lane to accommodate the heavy right-turn volumes and to reduce conflict with eastbound through traffic from the George Washington Bridge (GWB) upper-level off-ramp.

West 181st Street at Bennet Avenue

See Figure 3.1-4. Stop bars at all approaches are provided 10 feet from the crosswalk. The off-set is changed from 38 to 48 seconds at all times to provide progression with the adjacent intersection at Broadway.



LEGEND

- New Marking
- Previous Marking to Remain
- Previous Marking Removed

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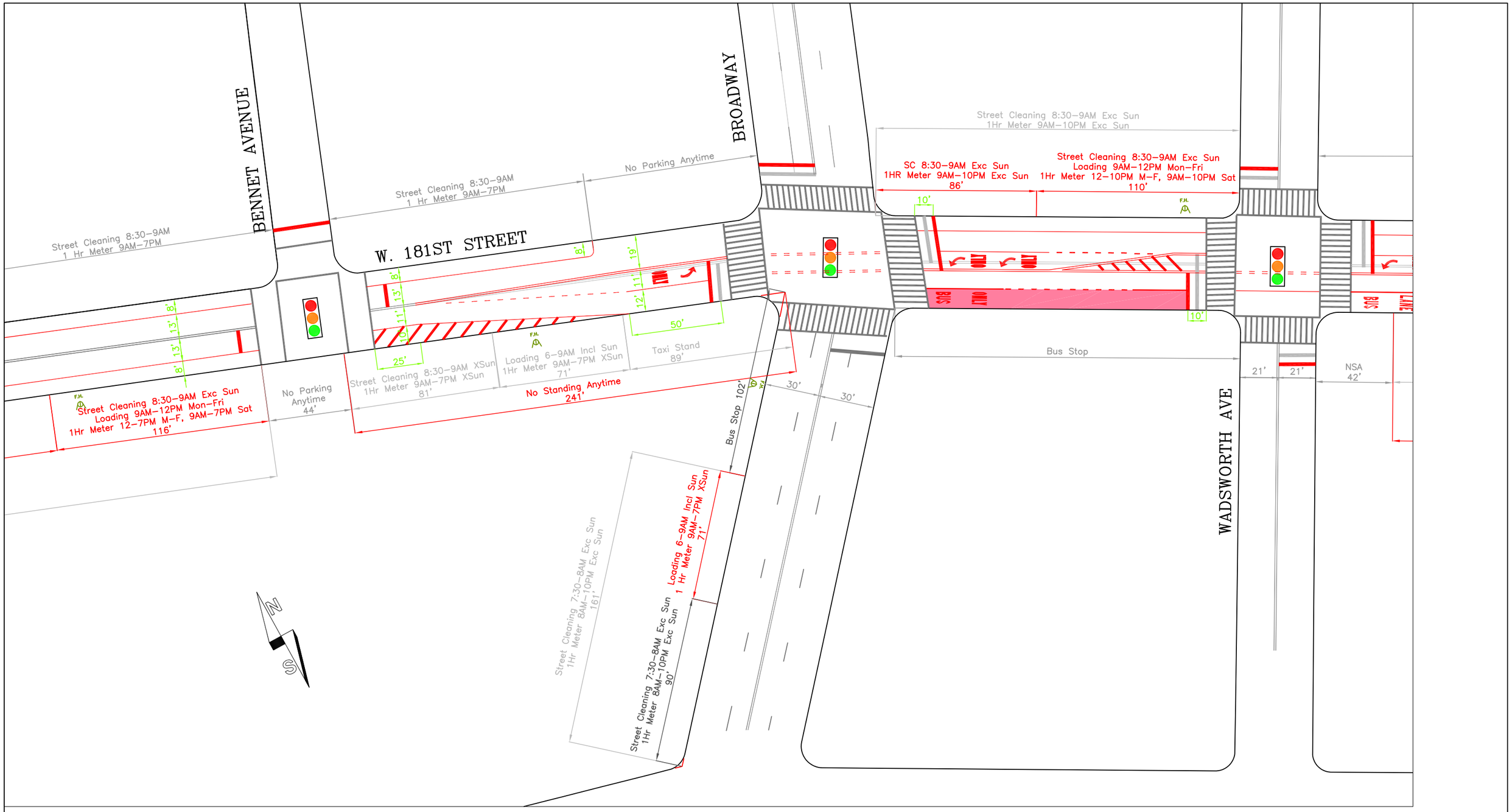
Figure 3.1-3

Short-Term Improvements
Ft. Washington Avenue
Between West 178th Street and West 179th Street

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'



LEGEND

- New Marking
- Previous Marking to Remain
- Previous Marking Removed
- NSA New Parking Regulation
- NSA Previous Parking Regulation to Remain
- NSA Previous Parking Regulation Changed

AECOM

NEW YORK CITY DOT

Figure 3.1-4

Short-Term Improvements
W. 181st Street
Between Bennet Avenue and Wadsworth Avenue

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'

West 181st Street from Bennett Avenue to Broadway

See Figure 3.1-4. A parking lane marking is provided for the north side of the roadway. Parking along the south side is eliminated to create a "No Standing Anytime" zone. The previous taxi/FHV relief stand is relocated to the block between Pinehurst and Ft. Washington Avenues. The previous 6AM to 9AM loading zone along the south side of West 181st Street is relocated to the west side of Broadway between West 181st and West 180th Streets.

West 181st Street at Broadway

See Figure 3.1-4. The eastbound approach of West 181st Street to Broadway is restriped to provide a left-turn bay and a curbside through/right-turn lane. At the westbound approach, left-turns were previously prohibited. The "No Left Turn" signs have been taken down, and the westbound approach is restriped to allow for a left-turn bay and a shared through/right-turn lane. Peg-a-track markings are provided to guide east-west traffic through this misaligned intersection. Stop bars at all approaches are provided 10 feet from the crosswalk.

Broadway between West 180th and West 181st Streets

See Figure 3.1-4. On the west side of the roadway, in the middle of the block, just south of the existing bus stop for a length of 71 feet, a truck loading window is created from 6AM to 9AM (Including Sunday), while maintaining the existing one-hour meter parking from 9AM to 7PM, except Sunday.

West 181st Street from Broadway to Wadsworth Avenue

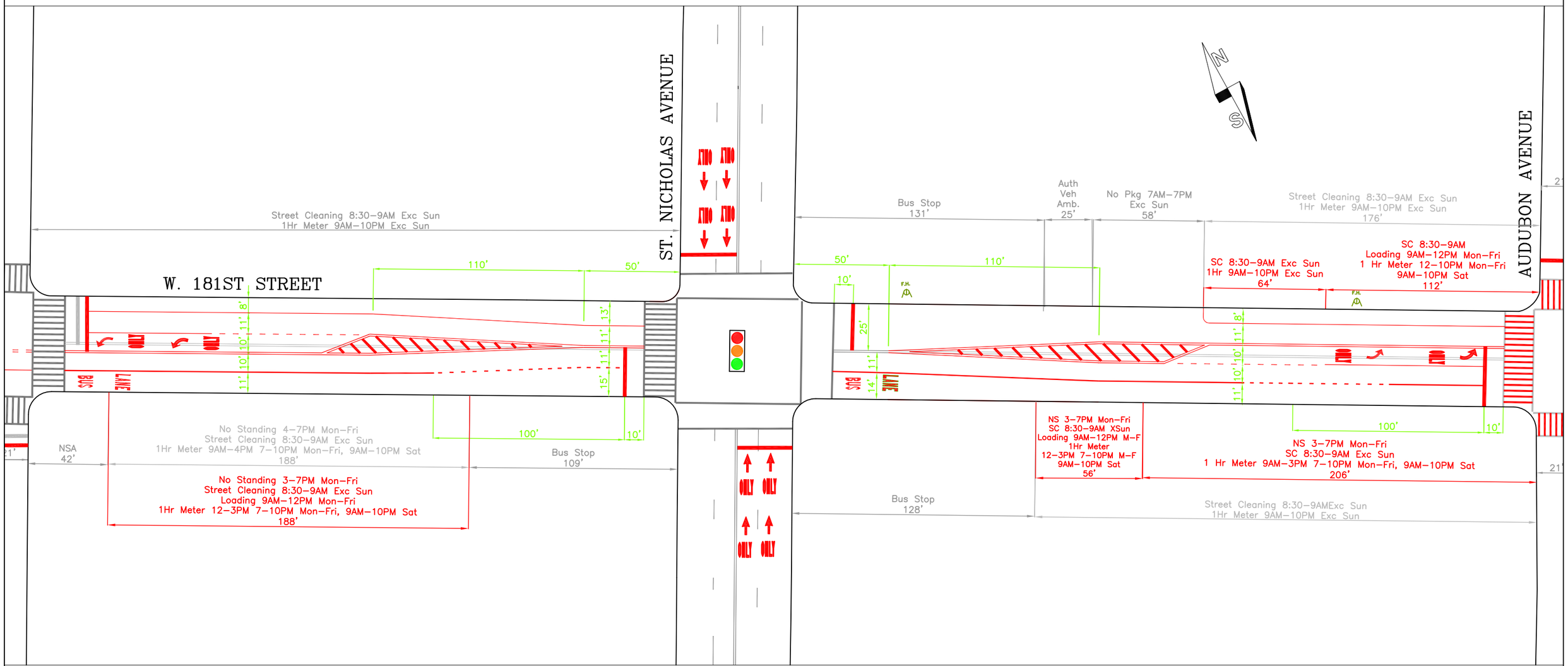
See Figure 3.1-4. A parking lane marking is provided on the north side of the roadway. Along the north side, just west of Wadsworth Avenue for a length of 110 feet, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 10PM on weekdays and 9AM to 10PM on Saturday. The south curb lane will be restriped and signed during the spring of 2012 to provide a painted eastbound bus-only lane. A westbound left-turn only lane is provided by shifting the double yellow lane southward.

West 181st Street at Wadsworth Avenue

See Figure 3.1-4. The eastbound approach is striped to provide one general purpose lane and a painted curbside bus lane. Peg-a-track markings are provided to guide eastbound traffic across the intersection. The westbound approach is restriped to provide for a left-turn bay and a shared through/right-turn lane. Stop bars at all approaches are provided 10 feet from the crosswalk.

West 181st Street from Wadsworth Avenue to St. Nicholas Avenue

See Figure 3.1-5. A parking lane marking is provided on the north side of the roadway. The south curb lane will be restriped and signed during the spring of 2012 to provide an eastbound bus lane during the 3PM to 7PM weekday peak period. Along the south side in the middle of the block where metered parking currently exists, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 3PM and 7PM to 10PM on weekdays and 9AM to 10PM on Saturday. A left-turn only bay is provided at the westbound approach to Wadsworth Avenue. However, at the eastbound approach to St. Nicholas Avenue, there is no left-turn bay; the median narrows to a double yellow line. The bus and parking lane markings taper towards the center of the roadway.



LEGEND

- New Marking
- Previous Marking to Remain
- Previous Marking Removed
- NSA New Parking Regulation
- NSA Previous Parking Regulation to Remain
- NSA Previous Parking Regulation Changed

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NEW YORK CITY DOT

Figure 3.1-5

Short-Term Improvements
W. 181st Street
Between Wadsworth Avenue and Audubon Avenue

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'

West 181st Street at St. Nicholas Avenue

See Figure 3.1-5. All turns are prohibited, except eastbound and westbound right-turns. Stop bars at all approaches are provided 10 feet from the crosswalk. Since there are no left-turn bays at the eastbound and westbound approaches, the lane markings taper towards the center of the roadway, creating extra wide curbside bus/parking lanes. As a long-term improvement, these spaces will be used for future concrete curb extensions (see Section 3.2).

West 181st Street from St. Nicholas Avenue to Audubon Avenue

See Figure 3.1-5. A parking lane marking is provided on the north side of the roadway on the eastern half of the block. Along the north side, starting 112 feet west of Audubon Avenue and continuing westward for a length of 64 feet, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 10PM on weekdays and 9AM to 10PM on Saturday. The south curb lane will be restriped and signed during the spring of 2012 to provide an eastbound bus lane during the 3PM to 7PM weekday peak period. Along the south side in the middle of the block, just east of the bus stop for a length of 56 feet, a truck loading window is created from 9AM to noon on weekdays, while maintaining the existing one-hour meter parking from noon to 3PM and 7PM to 10PM on weekdays, and 9AM to 10PM on Saturday. A left-turn only bay is provided at the eastbound approach to Audubon Avenue. However, at the westbound approach to St. Nicholas Avenue, there is no left-turn bay; the median narrows to a double yellow line. The bus and parking lane markings taper towards the center of the roadway.

West 181st Street at Audubon Avenue

See Figure 3.1-6. The eastbound and westbound approaches are restriped to provide left-turn bays and through/right lanes. Stop bars at all approaches are provided 10 feet from the crosswalk. Four seconds of green time is reallocated to the north-south phase at all times.

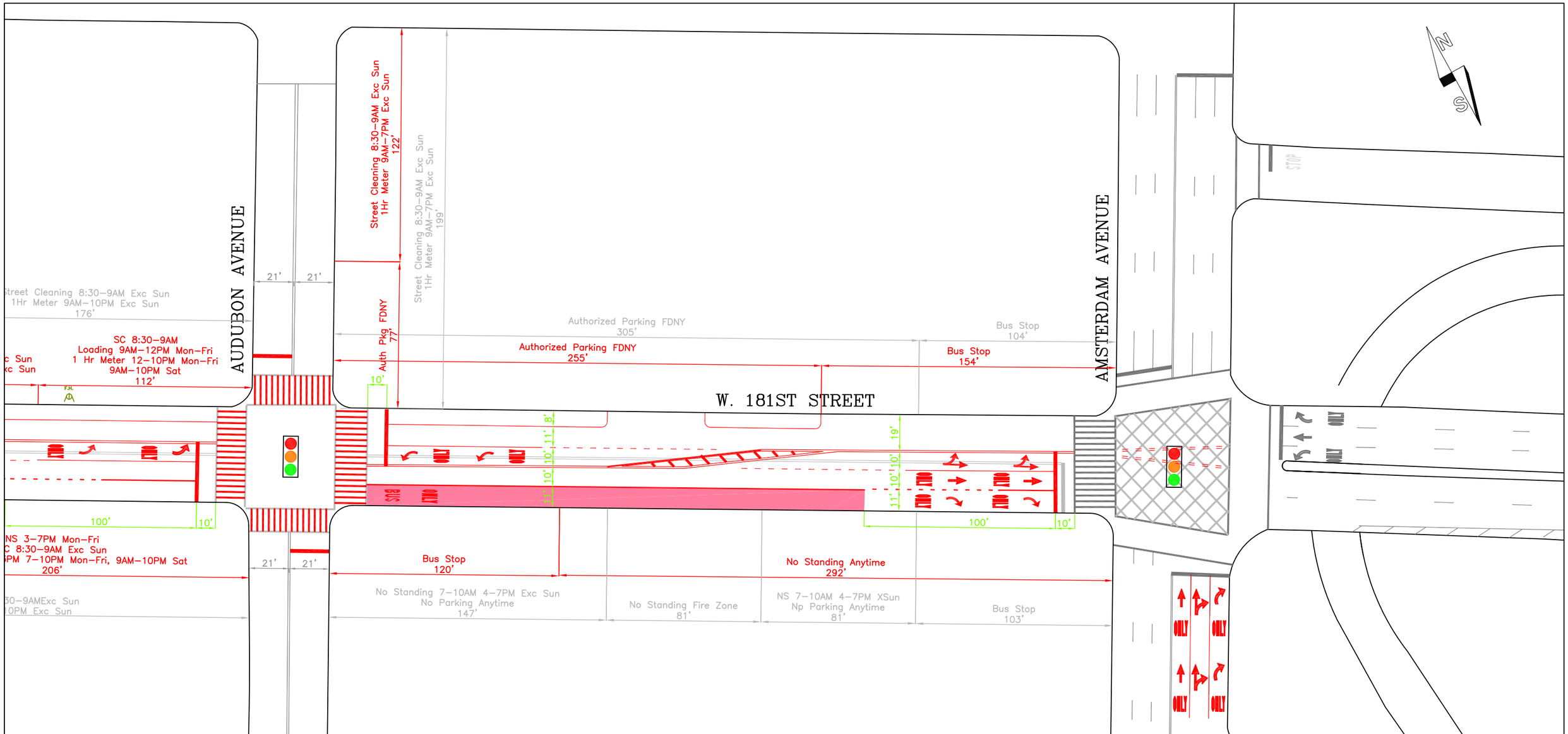
West 181st Street from Audubon Avenue to Amsterdam Avenue

See Figure 3.1-6. The south curb lane will be restriped and signed during the spring of 2012 to provide a painted eastbound bus-only lane. The bus stop is relocated to the western end of the block, just east of Audubon Avenue. Along the north curb, parking lane markings are provided, and the westbound bus stop is extended further west by about 50 feet into previous authorized parking for FDNY. The displaced FDNY parking is relocated to the east side of Audubon Avenue, just north of West 181st Street.

West 181st Street at Amsterdam Avenue

See Figure 3.1-6. Vehicles are prohibited from turning left from northbound Amsterdam Avenue onto westbound 181st Street to address the issue of northbound left-turns occurring from a shared through/left-turn lane and conflicting with pedestrians in the west crosswalk. This improvement measure reduces vehicle-vehicle and vehicle-pedestrian conflicts, and allows for the restriping of the three northbound approach lanes to provide a through lane, a shared through/right-turn lane, and an exclusive right-turn lane.

The eastbound approach is restriped as a shared left-turn/through lane, a through-only lane and an exclusive right-turn lane. Peg-a-track markings are provided to guide east-west traffic across the intersection.



LEGEND

- New Marking
- Previous Marking to Remain
- Previous Marking Removed
- NSA New Parking Regulation
- NSA Previous Parking Regulation to Remain
- NSA Previous Parking Regulation Changed

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Figure 3.1-6

Short-Term Improvements
W. 181st Street
Between Audubon Avenue and Amsterdam Avenue

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'

3.2 Long-Term Improvement Measures

The following are the long-term capital improvement measures.

Riverside Drive from West 181st Street to Pedestrian Bridge over Henry Hudson Parkway

The obsolete pedestrian bridge over the Henry Hudson Parkway, which provides access to Fort Washington Park and the Hudson River Greenway, will be replaced on a new alignment closer to West 181st Street, with an ADA compliant bridge to accommodate all park users (i.e., pedestrians and bicyclists).

West 181st Street at Broadway

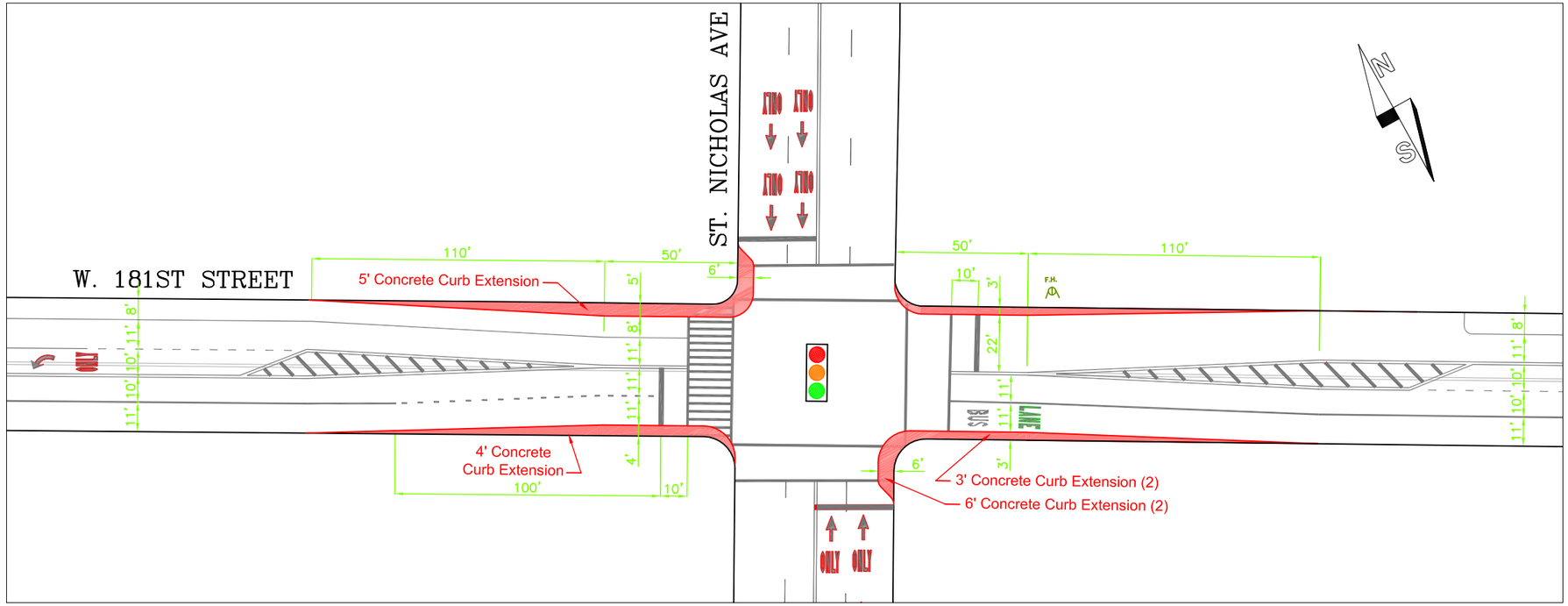
See Figure 3.2-1. The sidewalk along Broadway at the northwest corner will be extended by six feet with a concrete curb extension to improve pedestrian safety, especially for senior citizens, by reducing the crossing distance.

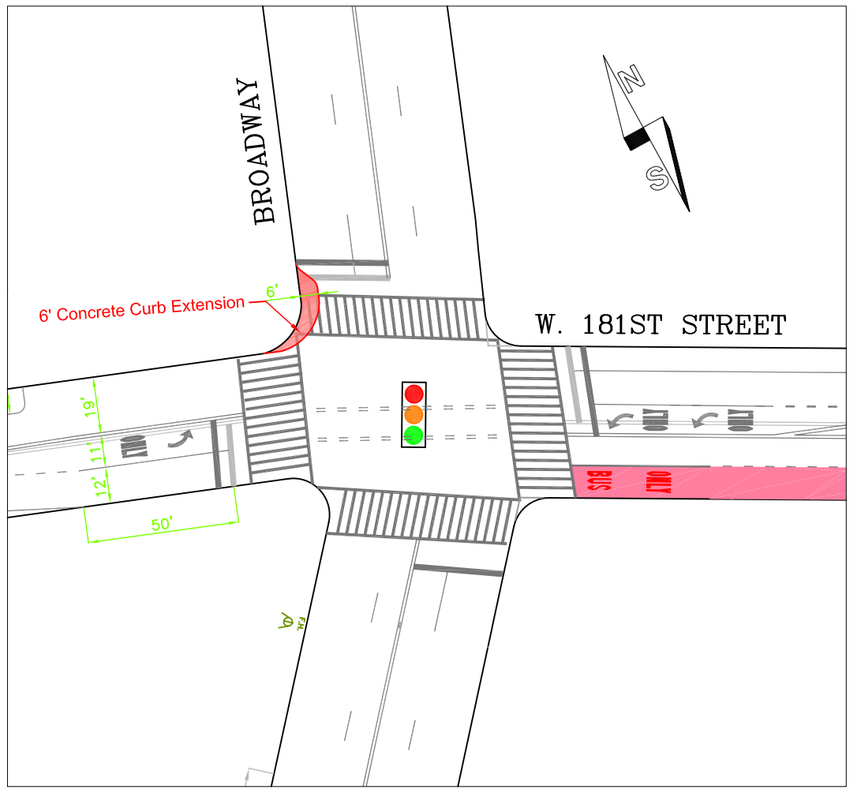
West 181st Street at St. Nicholas Avenue

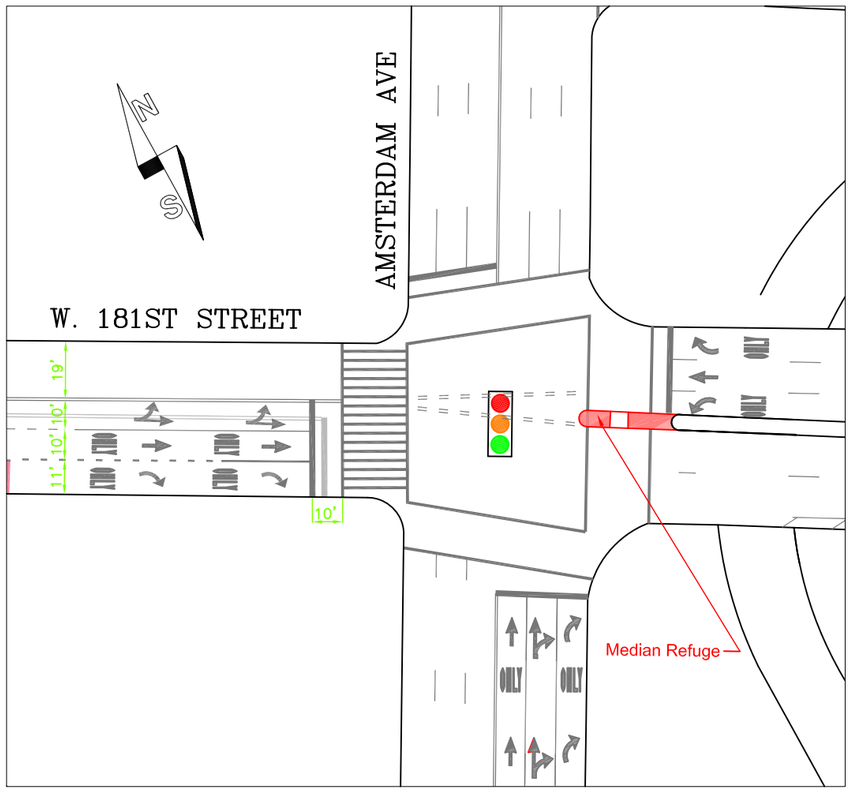
See Figure 3.2-1. Since there are no left-turn bays at the eastbound and westbound approaches, the lane markings taper towards the center of the roadway, creating extra wide curbside bus/parking lanes, as mentioned in Section 3.1. As a long-term improvement, these spaces will be used for future concrete curb extensions. The width of the curb extensions along West 181st Street are five feet at the northwest corner, four feet at the southwest corner, and three feet at the northeast and southeast corners. In addition, six feet curb extensions along St. Nicholas Avenue will be provided at the northwest and southeast corners.

West 181st Street at Amsterdam Avenue

See Figure 3.2-1. On the east leg of the intersection, the bridge median will be extended to provide a pedestrian refuge with cut-through for the eastern crosswalk.







LEGEND

- Proposed Curb or Median Extensions
- New Marking or Previous Marking to Remain
- Previous Marking Removed

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Figure 3.2-1

Long-Term Improvements
W. 181st Street and St. Nicholas Ave
W. 181st Street and Broadway
W. 181st Street and Amsterdam Ave

Citywide Congested Corridors: W. 181st Street
Borough of Manhattan

Scale: 1" = 50'

4.0 ANALYSIS OF THE RECOMMENDED IMPROVEMENT ALTERNATIVE

The three improvement alternatives and the recommended alternative were analyzed using Synchro software. Refer to *Technical Memorandum 3 – Future Conditions with Improvements: Alternatives Analysis* - for detailed analysis of Alternatives 1, 2 and 3.

Under the recommended alternative, West 181st Street continues to accommodate general traffic and buses in both directions with the addition of a PM peak period eastbound bus lane. The prohibited turns at West 181st Street and St. Nicholas Avenue were evenly reassigned to Wadsworth and Audubon Avenues. The westbound left-turn volume from West 181st Street onto Broadway, previously prohibited, was reassigned from Ft. Washington Avenue and Wadsworth Avenue.

For analysis purposes, the future horizon year for this study has been established as 2017. Included in this section are quantitative assessments of 2017 conditions that are likely to occur in the study area with the recommended improvement alternative.

4.1 Traffic

Under the recommended alternative traffic operates similar to Alternative 1 except for adjustments in left-turns, transit operations, signal timing/phasing and curbside management. A new left-turn at the westbound approach to West 181st Street and Broadway, previously prohibited, has been added, whereas the proposed eastbound left-turn bay at Wadsworth Street has been removed due to insufficient storage length. Also, all turns except eastbound and westbound right-turns are prohibited at West 181st Street and St. Nicholas Avenue. Improved curbside management, which provides limited curbside loading zones, is projected to reduce double-parking.

Detailed level of service analysis was performed for the recommended alternative using Synchro software. The results are presented in Tables 4.1-1 to 4.1-4 which compare level of service and other measures of effectiveness between the Recommended Alternative and the Future without Improvements condition for the weekday AM, midday, PM and Saturday midday peak hours, respectively.

Table 4.1-5 compares all analyzed scenarios in a condensed fashion, showing the number of lane groups projected to operate at each level of service. In general, the recommended alternative is projected to have more intersection approaches operating at LOS A through mid-LOS D during every peak hour than the Future Without Improvements (No-Build) condition. Similarly, the Recommended Alternative has the least number of approaches projected to operate at LOS F during every peak hour, with the AM and midday peak hours having no approach to operate at LOS F. Figures 4.1-1 through 4.1-4 present the lane group level-of-service comparison in bar chart format for the weekday AM, midday, PM and Saturday midday peak hours, respectively.

4.2 Emissions

An emissions analysis was conducted using the Synchro software. The results are presented in Table 4.2-1. Emissions for Carbon Monoxide (CO), Nitrogen Oxide (NO_X) and Volatile Oxygen Compounds (VOC) are projected for the future without improvements, the future with the three initial improvement alternatives, and the future with the recommended alternative. Analysis was conducted for the West 181st Street corridor from Riverside Drive to Amsterdam Avenue, and also for the broader network which included nearby affected roadways, such as parts of West 178th and West 179th Streets and parts of some of the avenues. For the network, the recommended alternative is projected to produce less of all three emissions than all other

Table 4.1-1
Year 2017 Levels-of-Service
Weekday AM

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
SIGNALIZED INTERSECTIONS								
W. 181st Street at Haven Avenue	EB	TR	0.67	172.6	F	0.67	40.6	D
	WB	LT	0.64	32.0	C	0.64	32.9	C
	NB	L	0.32	27.1	C	0.31	26.8	C
		R	0.46	29.5	C	0.44	29.0	C
	Overall			**80.6**	**F**		**33.8**	**C**
W. 181st Street at Cabrini Boulevard	EB	LTR	0.56	63.4	E	0.61	35.0	D
	WB	LTR	0.52	9.4	A	0.54	9.7	A
	Overall			**37.0**	**D**		**22.7**	**C**
W. 181st Street at Fort Washington Avenue	EB	LTR	0.98	81.8	F	0.92	70.0	E
	WB	LTR	1.12	115.2	F	0.87	49.0	D
	NB	LTR	0.57	11.8	B	0.59	14.1	B
	SB	LTR	0.83	32.7	C	0.92	47.8	D
	Overall			**61.0**	**E**		**46.5**	**D**
W. 181st Street at Bennett Avenue	EB	T	0.42	16.3	B	0.39	17.9	B
	WB	T	0.42	14.1	B	0.33	13.5	B
	SB	LR	0.43	23.2	C	0.39	20.5	C
	Overall			**17.2**	**B**		**17.1**	**B**
W. 181st Street at Broadway	EB	LTR	0.93	70.7	E			
		L				0.35	14.9	B
		TR				0.59	18.5	B
	WB	LTR	0.79	51.6	D			
		L				0.68	44.5	D
		TR				0.55	27.2	C
	NB	LTR	0.53	4.7	A	0.53	4.7	A
	SB	LTR	0.61	16.4	B	0.61	16.3	B
	Overall			**27.4**	**C**		**15.5**	**B**
W. 181st Street at Wadsworth Avenue	EB	LTR	0.59	36.6	D			
		L				0.22	18.0	B
		TR				0.48	22.4	C
	WB	LTR	0.72	22.7	C			
		L				0.80	35.2	D
		TR				0.31	2.2	A
	NB	LTR	0.56	14.9	B	0.87	38.5	D
	SB	LTR	0.37	18.3	B	0.58	24.0	C
	Overall			**24.1**	**C**		**25.5**	**C**
W. 181st Street at St. Nicholas Avenue	EB	LTR	0.83	28.2	C			
		TR				0.94	41.2	D
	WB	LTR	0.91	28.3	C			
		TR				0.76	22.4	C
	NB	LTR	0.57	21.0	C			
		T				0.26	15.8	B
	SB	LTR	0.56	20.7	C			
		T				0.33	16.5	B
	Overall			**24.0**	**C**		**25.1**	**C**
W. 181st Street at Audubon Avenue	EB	LTR	0.72	19.7	B			
		L				0.25	9.8	A
		TR				0.61	9.7	A
	WB	LTR	1.07	80.3	F			
		L				0.58	30.9	C
		TR				0.51	26.3	C
	NB	LTR	0.47	26.7	C	0.74	36.3	D
	SB	LTR	0.60	31.1	C	0.76	38.6	D
	Overall			**42.7**	**D**		**26.5**	**C**
W. 181st Street at Amsterdam Avenue	EB	LTR	1.13	107.9	F			
		LT				0.92	50.9	D
		R				0.21	29.6	C
	WB	L	1.02	95.4	F	0.94	72.8	E
		LTR	1.05	89.4	F	0.99	69.7	E
		R	0.64	19.6	B	0.63	18.5	B
	NB	LTR	0.92	30.3	C			
		R	0.68	15.7	B			
		T				0.48	24.9	C
		R				0.75	16.2	B
	SB	L	0.07	11.6	B	0.06	11.9	B
		T	0.76	26.9	C	0.78	28.8	C
		R	0.42	21.2	C	0.43	22.3	C
	Overall			**53.6**	**D**		**36.9**	**D**

Table 4.1-1
Year 2017 Levels-of-Service
Weekday AM

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
Fort Washington Avenue at W. 179th Street	WB	L	0.57	19.7	B	0.57	19.8	B
		LTR	0.49	17.5	B	0.49	17.6	B
	NB	LT	0.86	44.1	D			
		L				0.47	21.0	C
		T				0.25	14.3	B
	SB	TR	0.77	26.5	C	0.71	24.8	C
	Overall			**32**	**C**		**20.5**	**C**
Fort Washington Avenue at W. 178th Street	EB (Ramp)	LT	0.43	18.4	B	0.43	18.4	B
	EB (Main)	TR	0.65	22.5	C			
		T				0.69	26.1	C
		R				0.55	23.4	C
	NB	TR	0.42	20.3	C	0.42	19.8	B
	SB	LT	0.69	16.2	B	0.65	15.3	B
	Overall			**19.8**	**B**	**0.63**	**20.7**	**C**
Broadway at W. 180th Street	EB	LTR	0.46	30.5	C	0.46	30.5	C
	NB	TR	0.39	7.9	A	0.39	7.9	A
	SB	LT	0.48	5.7	A	0.52	8.2	A
	Overall			**9.7**	**A**		**10.7**	**B**
Broadway at W. 179th Street	WB	LTR	0.67	35.1	D	0.67	35.2	D
	NB	L	0.46	14.8	B	0.48	16.6	B
		T	0.31	7.1	A	0.31	6.7	A
	SB	TR	0.56	11.2	B	0.61	10.7	B
	Overall			**15.6**	**B**		**15.4**	**B**
Broadway at W. 178th Street	EB	LTR	0.76	39	D	0.76	38.6	D
	NB	TR	0.55	23.4	C	0.55	23.4	C
	SB	L	0.38	14.5	B	0.38	13.4	B
		T	0.42	10.5	B	0.47	10.1	B
	Overall			**28.2**	**C**		**27.4**	**C**
Wadsworth Avenue at W. 179th Street	WB	LTR	0.28	16.7	B	0.28	16.7	B
	NB	LT	0.44	19.2	B	0.44	18.1	B
	SB	TR	0.52	16	B	0.51	17.7	B
	Overall			**17.1**	**B**		**17.7**	**B**
Wadsworth Avenue at W. 178th Street	EB	LTR	0.53	9.4	A	0.53	9.4	A
	NB	TR	0.38	19	B	0.38	19.0	B
	SB	LT	0.36	10.9	B	0.36	11.9	B
	Overall			**11.7**	**B**		**11.9**	**B**
Amsterdam Avenue at W. 180th Street	EB	LR	0.8	48.1	D	0.80	48.1	D
	NB	T	0.43	6.7	A	0.42	5.3	A
	SB	T	0.29	8.1	A	0.29	7.3	A
	Overall			**14.2**	**B**		**13.3**	**B**
Amsterdam Avenue at W. 179th Street	NB	LT	0.43	3.3	A	0.43	3.7	A
	SB	TR	0.48	6.1	A	0.48	5.9	A
	Overall			**4.6**	**A**		**4.7**	**A**
Amsterdam Avenue at Harlem River Drive Off-Ramp	WB	LR	1.04	89.6	F	0.79	32.8	C
	NB	TR	0.65	46.4	D	0.71	37.3	D
	SB	LT	0.52	11.9	B	1.41	29.0	C
	Overall			**44.5**	**D**		**33.3**	**C**
Amsterdam Avenue at W. 178th Street	EB	LR	0.56	160.5	F	0.48	71.8	E
	NB	T	0.42	16	B	0.63	29.9	C
	SB	T	0.39	15.1	B	0.46	12.9	B
	Overall			**61.5**	**E**		**36.3**	**D**
UNSIGNALIZED INTERSECTIONS								
W. 181st Street at Riverside Drive	WB	LR	0.23	10.0	B	0.23	10.0	B
	NB	TR	0.12	0.0	A	0.12	0.0	A
	SB	L	0.01	7.7	A	0.01	7.7	A
	Overall			**5.2**	**A**		**5.2**	**A**
W. 181st Street at Pinehurst Avenue	EB	T	0.16	0.0	A	0.16	0.0	A
	WB	T	0.18	0.0	A	0.18	0.0	A
	NB	LR	0.36	26.5	D	0.36	26.5	D
	Overall			**3.7**	**A**		**3.7**	**A**

NB = northbound, SB = southbound, EB = eastbound, WB = westbound
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn
v/c = volume-to-capacity ratio, LOS = Level-of-Service
Intersections which experience significant improvement

Table 4.1-2
Year 2017 Levels-of-Service
Weekday MD

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
SIGNALIZED INTERSECTIONS								
W. 181st Street at Haven Avenue	EB	TR	0.56	44.8	D	0.56	36.4	D
	WB	LT	0.66	33.7	C	0.66	34.5	C
	NB	L	0.32	26.9	C	0.31	26.6	C
		R	0.58	33.2	C	0.56	32.3	C
	Overall			**35.4**	**D**		**33.1**	**C**
W. 181st Street at Cabrini Boulevard	EB	LTR	0.47	50.2	D	0.47	23.6	C
	WB	LTR	0.45	6.1	A	0.45	6.6	A
	Overall			**28.8**	**C**		**15.4**	**B**
W. 181st Street at Fort Washington Avenue	EB	LTR	0.86	59.3	E	0.79	53.7	D
	WB	LTR	1.13	115.8	F	0.83	41.0	D
	NB	LTR	0.51	11.2	B	0.53	13.3	B
	SB	LTR	0.59	18.8	B	0.66	23.2	C
	Overall			**56.8**	**E**		**33.7**	**C**
W. 181st Street at Bennett Avenue	EB	T	0.34	14.0	B	0.32	17.2	B
	WB	T	0.42	14.0	B	0.34	14.0	B
	SB	LR	0.36	22.0	C	0.34	19.4	B
	Overall			**15.8**	**B**		**16.5**	**B**
W. 181st Street at Broadway	EB	LTR	0.84	45.3	D			
		L				0.36	15.5	B
		TR				0.50	16.8	B
	WB	LTR	0.53	19.0	B			
		L				0.48	23.6	C
		TR				0.41	18.3	B
	NB	LTR	0.41	4.0	A	0.41	4.0	A
	SB	LTR	0.45	13.7	B	0.45	13.7	B
	Overall			**17.3**	**B**		**12.0**	**B**
W. 181st Street at Wadsworth Avenue	EB	LTR	0.60	25.0	C			
		L				0.25	16.6	B
		TR				0.48	19.0	B
	WB	LTR	0.71	24.1	C			
		L				0.79	54.9	D
		TR				0.42	4.2	A
	NB	LTR	0.51	16.6	B	0.77	30.9	C
	SB	LTR	0.20	15.8	B	0.41	19.7	B
	Overall			**20.6**	**C**		**21.7**	**C**
W. 181st Street at St. Nicholas Avenue	EB	LTR	0.62	18.4	B			
		TR				0.71	19.5	B
	WB	LTR	0.78	25.4	C			
		TR				0.66	21.3	C
	NB	LTR	0.49	19.6	B			
		T				0.23	15.5	B
	SB	LTR	0.49	19.5	B			
		T				0.25	15.6	B
	Overall			**20.6**	**C**		**18.1**	**B**
W. 181st Street at Audubon Avenue	EB	LTR	0.57	15.7	B			
		L				0.19	8.8	A
		TR				0.50	8.6	A
	WB	LTR	0.70	27.8	C			
		L				0.41	24.9	C
		TR				0.41	22.0	C
	NB	LTR	0.57	29.7	C	0.85	46.1	D
	SB	LTR	0.56	29.9	C	0.77	39.9	D
	Overall			**24.7**	**C**		**28.8**	**C**
W. 181st Street at Amsterdam Avenue	EB	LTR	1.00	73.2	E			
		LT				0.92	55.9	E
		R				0.19	31.2	C
	WB	L	0.89	61.6	E	0.82	50.0	D
		LTR	1.05	87.6	F	0.99	68.4	E
		R	0.75	26.0	C	0.74	24.3	B
	NB	LTR	0.85	34.2	C			
		R	0.63	14.7	B			
		T				0.52	27.0	C
		R				0.68	14.9	B
	SB	L	1.10	102.5	F	0.92	52.0	D
		T	0.68	23.0	C	0.73	26.4	C
		R	0.13	13.6	B	0.14	14.4	B
	Overall			**50.8**	**D**		**37.7**	**D**

Table 4.1-2
Year 2017 Levels-of-Service
Weekday MD

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
Fort Washington Avenue at W. 179th Street	WB	LT	0.46	13.9	B	0.46	13.5	B
		LTR	0.42	13.1	B	0.42	12.7	B
	NB	LT	0.55	18.7	B			
		L				0.28	13.1	B
		T				0.22	12.7	B
	SB	TR	0.57	17.5	B	0.50	17.9	B
	Overall			**16.1**	**B**		**14.5**	**B**
Fort Washington Avenue at W. 178th Street	EB (Ramp)	LT	0.31	17	B	0.31	17.0	B
	EB (Main)	TR	0.29	16.7	B			
		T				0.42	19.3	B
		R				0.14	15.6	B
	NB	TR	0.38	18.9	B	0.38	18.9	B
	SB	LT	0.39	11.2	B	0.34	12.4	B
	Overall			**16.1**	**B**		**17.0**	**B**
Broadway at W. 180th Street	EB	LTR	0.33	27.7	C	0.33	27.7	C
	NB	TR	0.34	8.8	A	0.34	8.8	A
	SB	TL	0.3	5.5	A	0.35	9.0	A
	Overall			**9.9**	**A**		**11.1**	**B**
Broadway at W. 179th Street	WB	LTR	0.7	35.5	D	0.70	35.6	D
	NB	L	0.37	6.5	A	0.40	7.4	A
		T	0.26	4.1	A	0.26	4.1	A
	SB	TR	0.36	10.0	B	0.41	9.0	A
	Overall			**14.8**	**B**		**14.4**	**B**
Broadway at W. 178th Street	EB	LTR	0.48	33.2	C	0.48	32.7	C
	NB	TR	0.51	22.7	C	0.51	22.7	C
	SB	L	0.36	11.5	B	0.36	10.2	B
		T	0.24	7.8	A	0.30	7.3	A
	Overall			**24.4**	**C**		**23.3**	**C**
Wadsworth Avenue at W. 179th Street	WB	LTR	0.34	17.5	B	0.34	17.5	B
	NB	LT	0.41	21.1	C	0.41	21.1	C
	SB	TR	0.53	18.9	B	0.44	16.5	B
	Overall			**18.9**	**B**		**18.1**	**B**
Wadsworth Avenue at W. 178th Street	EB	LTR	0.46	9.8	A	0.46	9.7	A
	NB	TR	0.37	18.9	B	0.37	18.9	B
	SB	LT	0.36	9.6	A	0.28	11.3	B
	Overall			**11.7**	**B**		**12.1**	**B**
Amsterdam Avenue at W. 180th Street	EB	LR	0.74	45.3	D	0.74	45.3	D
	NB	T	0.43	6.5	A	0.41	4.9	A
	SB	T	0.22	6.9	A	0.22	6.1	A
	Overall			**12.9**	**B**		**12.0**	**B**
Amsterdam Avenue at W. 179th Street	NB	LT	0.42	3.2	A	0.42	3.5	A
	SB	TR	0.41	6.2	A	0.41	5.8	A
	Overall			**4.5**	**A**		**4.5**	**A**
Amsterdam Avenue at Harlem River Drive Off-Ramp	WB	LR	0.91	51.4	D	0.70	25.5	C
	NB	TR	0.62	22.7	C	0.74	35.9	D
	SB	LT	1.02	9.1	A	1.67	22.9	C
	Overall			**25.5**	**C**		**29.4**	**C**
Amsterdam Avenue at W. 178th Street	EB	LR	0.41	27.9	C	0.35	19.2	B
	NB	T	0.45	16.6	B	0.69	31.7	C
	SB	T	0.25	15.2	B	0.29	12.8	B
	Overall			**19.5**	**B**		**21.7**	**C**
UNSIGNALIZED INTERSECTIONS								
W. 181st Street at Riverside Drive	WB	LR	0.27	10.7	B	0.27	10.7	B
	NB	TR	0.14	0.0	A	0.14	0.0	A
	SB	L	0.01	7.8	A	0.01	7.8	A
	Overall			**5.3**	**A**		**5.3**	**A**
W. 181st Street at Pinehurst Avenue	EB	T	0.14	0.0	A	0.14	0.0	A
	WB	T	0.19	0.0	A	0.19	0.0	A
	NB	LR	0.23	18.6	C	0.23	18.6	C
	Overall			**2.4**	**A**		**2.4**	**A**

NB = northbound, SB = southbound, EB = eastbound, WB = westbound
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn
v/c = volume-to-capacity ratio, LOS = Level-of-Service
Intersections which experience significant improvement

Table 4.1-3
Year 2017 Levels-of-Service
Weekday PM

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
SIGNALIZED INTERSECTIONS								
W. 181st Street at Haven Avenue	EB	TR	0.60	38.8	D	0.60	35.7	D
	WB	LT	0.65	33.3	C	0.65	31.2	C
	NB	L	0.42	28.8	C	0.41	29.6	C
		R	0.53	31.5	C	0.51	30.8	C
	Overall			**33.4**	**C**		**31.7**	**C**
W. 181st Street at Cabrini Boulevard	EB	LTR	0.47	30.1	C	0.47	12.0	B
	WB	LTR	0.39	6.2	A	0.39	6.7	A
	Overall			**18.2**	**B**		**9.4**	**A**
W. 181st Street at Fort Washington Avenue	EB	LTR	0.61	40.3	D	0.57	37.1	D
	WB	LTR	1.10	107.8	F	0.90	52.6	D
	NB	LTR	0.62	8.1	A	0.65	14.5	B
	SB	LTR	0.63	20.2	C	0.70	25.4	C
	Overall			**47.7**	**D**		**32.8**	**C**
W. 181st Street at Bennett Avenue	EB	T	0.36	13.9	B	0.34	13.7	B
	WB	T	0.42	12.9	B	0.36	13.0	B
	SB	LR	0.35	22.0	C	0.32	19.4	B
	Overall			**15.2**	**B**		**14.7**	**B**
W. 181st Street at Broadway	EB	LTR	0.89	129.1	F			
		L				0.41	19.7	B
		TR				0.49	19.5	B
	WB	LTR	0.59	33.6	C			
		L				0.59	41.5	D
		TR				0.43	28.0	C
	NB	LTR	0.56	5.1	A	0.56	5.1	A
	SB	LTR	0.59	16.2	B	0.59	16.0	B
	Overall			**33.4**	**C**		**15.1**	**B**
W. 181st Street at Wadsworth Avenue	EB	LTR	0.67	62.9	E			
		L				0.50	30.3	C
		TR				0.35	22.1	C
	WB	LTR	0.90	56.0	E			
		L				1.00	69.3	E
		TR				0.37	2.1	A
	NB	LTR	0.80	21.1	C	0.99	51.4	D
	SB	LTR	0.36	18.2	B	0.53	22.4	C
	Overall			**39.5**	**D**		**35.4**	**D**
W. 181st Street at St. Nicholas Avenue	EB	LTR	0.72	20.8	C			
		TR				0.43	10.8	B
		R				0.66	53.4	D
	WB	LTR	0.77	24.3	C			
		TR				0.89	40.2	D
	NB	LTR	0.54	20.6	C			
		T				0.23	15.5	B
	SB	LTR	0.55	20.5	C			
		T				0.32	16.5	B
	Overall			**21.4**	**C**		**22.7**	**C**
W. 181st Street at Audubon Avenue	EB	LTR	0.59	17.2	B			
		L				0.20	7.6	A
		TR				0.30	6.4	A
		R				0.16	8.3	A
	WB	LTR	0.80	32.5	C			
		L				0.49	36.1	D
		TR				0.51	34.6	C
	NB	LTR	0.78	39.5	D	1.00	68.6	E
	SB	LTR	0.69	36.4	D	0.71	30.6	C
	Overall			**30.7**	**C**		**39.4**	**D**
W. 181st Street at Amsterdam Avenue	EB	LTR	0.97	66.4	E			
		LT				0.72	41.4	D
		R				0.17	33.6	C
	WB	L	1.14	124.4	F	1.09	104.8	F
		LTR	1.08	93.7	F	0.94	54.2	D
		R	0.75	24.5	C	0.73	22.3	C
	NB	LTR	1.10	52.7	D			
		R	0.92	40.1	D			
		T				0.42	26.7	C
		R				1.01	49.5	D
	SB	L	1.11	102.8	F	0.79	31.6	C
		T	0.52	17.7	B	0.62	21.3	C
		R	0.09	12.9	B	0.09	13.5	B
	Overall			**62.1**	**E**		**45.3**	**D**

Table 4.1-3
Year 2017 Levels-of-Service
Weekday PM

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
Fort Washington Avenue at W. 179th Street	WB	LT	0.77	28.2	C	0.77	27.8	C
		LTR	0.67	22.8	C	0.67	22.5	C
	NB	LT	1.14	105.6	F			
		L				0.73	26.2	C
		T				0.27	12.9	B
	SB	TR	0.60	20.6	C	0.56	20.5	C
	Overall			**48.3**	**D**		**22.6**	**C**
Fort Washington Avenue at W. 178th Street	EB (Ramp)	LT	0.40	18.2	B	0.40	18.1	B
	EB (Main)	TR	0.41	18.1	B			
		T				0.62	23.5	C
		R				0.17	15.9	B
	NB	TR	0.72	27.9	C	0.72	28.0	C
	SB	LT	0.79	31.8	C	0.75	30.3	C
	Overall			**22.9**	**C**		**23.8**	**C**
Broadway at W. 180th Street	EB	LTR	0.35	28.2	C	0.35	28.2	C
	NB	TR	0.40	6.3	A	0.40	6.3	A
	SB	LT	0.42	6	A	0.44	8.2	A
	Overall			**8.5**	**A**		**9.4**	**A**
Broadway at W. 179th Street	WB	LTR	0.71	31.7	C	0.71	31.8	C
	NB	L	0.72	21.4	C	0.74	23.8	C
		T	0.32	5.6	A	0.32	5.6	A
	SB	TR	0.46	10.7	B	0.49	10.1	B
	Overall			**15.5**	**B**		**15.6**	**B**
Broadway at W. 178th Street	EB	LTR	0.68	36	D	0.68	34.7	C
	NB	TR	0.63	24.8	C	0.63	24.8	C
	SB	L	0.48	19.1	B	0.48	18.0	B
		T	0.26	9.8	A	0.29	9.3	A
	Overall			**28.1**	**C**		**27.1**	**C**
Wadsworth Avenue at W. 179th Street	WB	LTR	0.40	18.1	B	0.40	18.1	B
	NB	LT	0.67	18.9	B	0.67	18.9	B
	SB	TR	0.38	13	B	0.36	14.5	B
	Overall			**17.3**	**B**		**17.7**	**B**
Wadsworth Avenue at W. 178th Street	EB	LTR	0.59	8.1	A	0.59	8.0	A
	NB	TR	0.56	22.8	C	0.56	22.8	C
	SB	LT	0.32	11.3	B	0.31	12.6	B
	Overall			**12.6**	**B**		**12.8**	**B**
Amsterdam Avenue at W. 180th Street	EB	LR	0.91	70.6	E	0.91	79.3	E
	NB	T	0.57	4.1	A	0.55	4.8	A
	SB	T	0.34	11.3	B	0.34	10.1	B
	Overall			**17.3**	**B**		**18.8**	**B**
Amsterdam Avenue at W. 179th Street	NB	LT	0.48	7.1	A	0.49	5.7	A
	SB	TR	0.51	6.1	A	0.51	5.7	A
	Overall			**6.6**	**A**		**5.7**	**A**
Amsterdam Avenue at Harlem River Drive Off-Ramp	EB	LR	0.51	26.8	C	0.54	29.1	C
	NB	T	0.83	107.1	F	0.72	41.7	D
	SB	T	1.10	13.3	B	1.50	9.7	A
	Overall			**63.1**	**E**		**28.2**	**C**
Amsterdam Avenue at W. 178th Street	EB	LR	0.61	402.3	F	0.73	442.9	F
	NB	T	0.59	18.8	B	0.63	21.6	C
	SB	T	0.32	8.3	A	0.28	4.6	A
	Overall			**141.2**	**F**		**154.4**	**F**
UNSIGNALIZED INTERSECTIONS								
W. 181st Street at Riverside Drive	WB	LR	0.35	11.2	B	0.35	11.2	B
	NB	TR	0.14	0.0	A	0.14	0.0	A
	SB	L	0.01	7.7	A	0.01	7.7	A
	Overall			**6.3**	**A**		**6.3**	**A**
W. 181st Street at Pinehurst Avenue	EB	T	0.11	0.0	A	0.11	0.0	A
	WB	T	0.18	0.0	A	0.18	0.0	A
	NB	LR	0.38	24.8	C	0.38	24.8	C
	Overall			**4.7**	**A**		**4.7**	**A**

NB = northbound, SB = southbound, EB = eastbound, WB = westbound
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn
v/c = volume-to-capacity ratio, LOS = Level-of-Service
Intersections which experience significant improvement

Table 4.1-4
Year 2017 Levels-of-Service
Weekend SAT MD

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
SIGNALIZED INTERSECTIONS								
W. 181st Street at Haven Avenue	EB	TR	0.44	77.9	E	0.44	31.9	C
	WB	LT	0.55	29.5	C	0.55	31.0	C
	NB	L	0.19	24.9	C	0.18	24.7	C
		R	0.66	36.6	D	0.64	35.3	D
	Overall			**44.4**	**D**		**32.0**	**C**
W. 181st Street at Cabrini Boulevard	EB	TR	0.49	60.4	E	0.49	27.5	C
	WB	TR	0.46	8.5	A	0.46	8.6	A
	Overall			**36.3**	**D**		**18.7**	**B**
W. 181st Street at Fort Washington Avenue	EB	LTR	0.88	60.8	E	0.82	54.3	D
	WB	LTR	1.14	125.2	F	0.76	37.5	D
	NB	LTR	0.50	8.0	A	0.52	10.2	B
	SB	LTR	0.71	23.1	C	0.79	30.6	C
	Overall			**55.7**	**E**		**34.1**	**C**
W. 181st Street at Bennett Avenue	EB	T	0.45	15.8	B	0.42	15.7	B
	WB	T	0.50	17.8	B	0.36	21.5	C
	SB	LR	0.28	20.6	C	0.26	18.3	B
	Overall			**17.4**	**B**		**18.4**	**B**
W. 181st Street at Broadway	EB	LTR	0.94	113.1	F			
		L				0.43	16.2	B
		TR				0.54	15.3	B
	WB	LTR	0.70	47.6	D			
		L				0.46	32.1	C
		TR				0.48	30.5	C
	NB	LTR	0.60	6.0	A	0.60	6.0	A
	SB	LTR	0.70	19.2	B	0.70	18.9	B
	Overall			**33.8**	**C**		**15.3**	**B**
W. 181st Street at Wadsworth Avenue	EB	LTR	0.65	55.1	E			
		L				0.41	24.2	C
		TR				0.46	23.7	C
	WB	LTR	0.76	30.6	C			
		L				0.71	19.6	B
		TR				0.37	2.8	A
	NB	LTR	0.85	33.1	C	0.94	43.8	D
	SB	LTR	0.56	23.2	C	0.77	31.9	C
	Overall			**36.2**	**D**		**30.0**	**C**
W. 181st Street at St. Nicholas Avenue	EB	LTR	0.81	26.9	C			
		TR				0.85	28.0	C
	WB	LTR	0.75	19.2	B			
		TR				0.73	20.4	C
	NB	LTR	0.44	18.4	B			
		T				0.25	15.7	B
	SB	LTR	0.67	24.0	C			
		T				0.31	16.4	B
	Overall			**22.4**	**C**		**20.5**	**C**
W. 181st Street at Audubon Avenue	EB	LTR	0.74	20.2	C			
		L				0.19	10.1	B
		TR				0.67	13.1	B
	WB	LTR	0.89	41.1	D			
		L				0.57	39.1	D
		TR				0.47	31.2	C
	NB	LTR	0.60	29.9	C	0.81	40.1	D
	SB	LTR	0.65	32.3	C	0.90	53.0	D
	Overall			**30.0**	**C**		**33.7**	**C**
W. 181st Street at Amsterdam Avenue	EB	LTR	1.05	80.8	F			
		LT				0.89	47.4	D
		R				0.23	29.3	C
	WB	L	1.10	115.0	F	0.92	61.1	E
		LTR	1.07	91.9	F	0.91	49.8	D
		R	0.64	19.0	B	0.56	16.0	B
	NB	LTR	0.99	35.6	D			
		R	0.77	23.1	C			
		T				0.37	22.6	C
		R				0.96	36.2	D
	SB	L	1.13	107.3	F	0.89	42.3	D
		T	0.28	13.8	B	0.28	14.4	B
		R	0.03	11.7	B	0.04	12.3	B
	Overall			**62.1**	**E**		**38.0**	**D**

Table 4.1-4
Year 2017 Levels-of-Service
Weekend SAT MD

Intersection	Approach	Lane Group	Without Improvements			Recommended Alternative		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
Fort Washington Avenue at W. 179th Street	WB	LT	0.64	20.7	C	0.64	21.3	C
		LTR	0.59	19.1	B	0.59	19.7	B
	NB	LT	1.05	83.6	F			
		L				0.57	22.2	C
		T				0.27	13.8	B
	SB	TR	0.7	21.6	C	0.68	23.6	C
	Overall			**35.6**	**D**		**20.7**	**C**
Fort Washington Avenue at W. 178th Street	EB (Ramp)	LT	0.42	18.4	B	0.42	18.4	B
	EB (Main)	TR	0.65	22.4	C			
		T				1.08	83.3	F
		R				0.17	15.9	B
	NB	TR	0.52	22.2	C	0.52	22.2	C
	SB	LT	0.74	23.1	C	0.72	22.1	C
	Overall			**21.4**	**C**		**44.1**	**D**
Broadway at W. 180th Street	EB	LTR	0.44	29.7	C	0.44	29.7	C
	NB	LTR	0.44	5.9	A	0.44	5.9	A
	SB	LTR	0.52	5.7	A	0.61	9.3	A
	Overall			**8.7**	**A**		**10.2**	**B**
Broadway at W. 179th Street	WB	LTR	0.75	36.3	D	0.75	36.6	D
	NB	L	0.61	20.8	C	0.70	30.3	C
		T	0.39	6.7	A	0.39	6.7	A
	SB	TR	0.68	15.7	B	0.82	19.5	B
	Overall			**17.7**	**B**		**19.9**	**B**
Broadway at W. 178th Street	EB	LTR	0.89	44.4	D	0.89	40.4	D
	NB	TR	0.69	26.8	C	0.69	26.8	C
	SB	L	0.75	34.6	C	0.75	30.7	C
		T	0.47	10.8	B	0.61	12.5	B
	Overall			**33.4**	**C**		**30.5**	**C**
Wadsworth Avenue at W. 179th Street	WB	LTR	0.35	17.5	B	0.35	17.5	B
	NB	LT	0.62	21.2	C	0.62	21.1	C
	SB	TR	0.57	17.8	B	0.57	21.8	C
	Overall			**18.8**	**B**		**20.0**	**B**
Wadsworth Avenue at W. 178th Street	EB	LTR	0.83	9.3	A	0.83	9.3	A
	NB	TR	0.45	20.3	C	0.45	20.3	C
	SB	LT	0.41	9.9	A	0.41	9.5	A
	Overall			**11.5**	**B**		**11.4**	**B**
Amsterdam Avenue at W. 180th Street	EB	LR	0.59	36.5	D	0.59	36.5	D
	NB	T	0.41	4.3	A	0.40	5.2	A
	SB	T	0.21	11	B	0.21	9.8	A
	Overall			**11.4**	**B**		**11.5**	**B**
Amsterdam Avenue at W. 179th Street	NB	LT	0.4	2.3	A	0.41	2.1	A
	SB	TR	0.36	7.1	A	0.36	6.6	A
	Overall			**4.1**	**A**		**3.8**	**A**
Amsterdam Avenue at Harlem River Drive Off-Ramp	WB	LR	0.6	29.2	C	0.60	29.2	C
	NB	TR	0.71	49.2	D	0.64	26.5	C
	SB	LT	1.02	7.8	A	1.28	8.4	A
	Overall			**34.7**	**C**		**21.9**	**C**
Amsterdam Avenue at W. 178th Street	EB	LR	0.61	250.4	F	0.68	267.9	F
	NB	T	0.51	17.4	B	0.58	21.7	C
	SB	T	0.21	11.5	B	0.19	7.1	A
	Overall			**105.8**	**F**		**113.1**	**F**
UNSIGNALIZED INTERSECTIONS								
W. 181st Street	WB	LR	0.15	9.6	A	0.15	9.6	A
	NB	TR	0.11	0.0	A	0.11	0.0	A
	SB	L	0.01	7.6	A	0.01	7.6	A
				4.2	**A**		**4.2**	**A**
W. 181st Street at Pinehurst Avenue	EB	T	0.14	0.0	A	0.14	0.0	A
	WB	T	0.20	0.0	A	0.20	0.0	A
	NB	LR	0.23	22.1	C	0.24	22.4	C
	Overall			**2.2**	**A**		**2.3**	**A**

NB = northbound, SB = southbound, EB = eastbound, WB = westbound
L = left-turn, R = right-turn, T = through movement, LTR = left-through-right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn
v/c = volume-to-capacity ratio, LOS = Level-of-Service
Intersections which experience significant improvement

Table 4.1-5: Approach Lane Group Level of Service Comparison					
AM Peak Hour	No. of Lane Groups				
Level of Service	**No Build**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Recommended Alternative**
A, B, C, Mid-D	63	73	74	70	78
Mid-D, E	5	10	11	7	8
F	9	3	3	5	0
MD Peak Hour	No. of Lane Groups				
Level of Service	**No Build**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Recommended Alternative**
A, B, C, Mid-D	65	78	77	75	76
Mid-D, E	7	5	7	5	8
F	3	3	4	2	0
PM Peak Hour	No. of Lane Groups				
Level of Service	**No Build**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Recommended Alternative**
A, B, C, Mid-D	58	72	75	71	73
Mid-D, E	8	5	3	6	9
F	8	9	10	5	2
SAT Peak Hour	No. of Lane Groups				
Level of Service	**No Build**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Recommended Alternative**
A, B, C, Mid-D	62	72	69	65	77
Mid-D, E	5	7	11	10	5
F	8	7	8	6	2

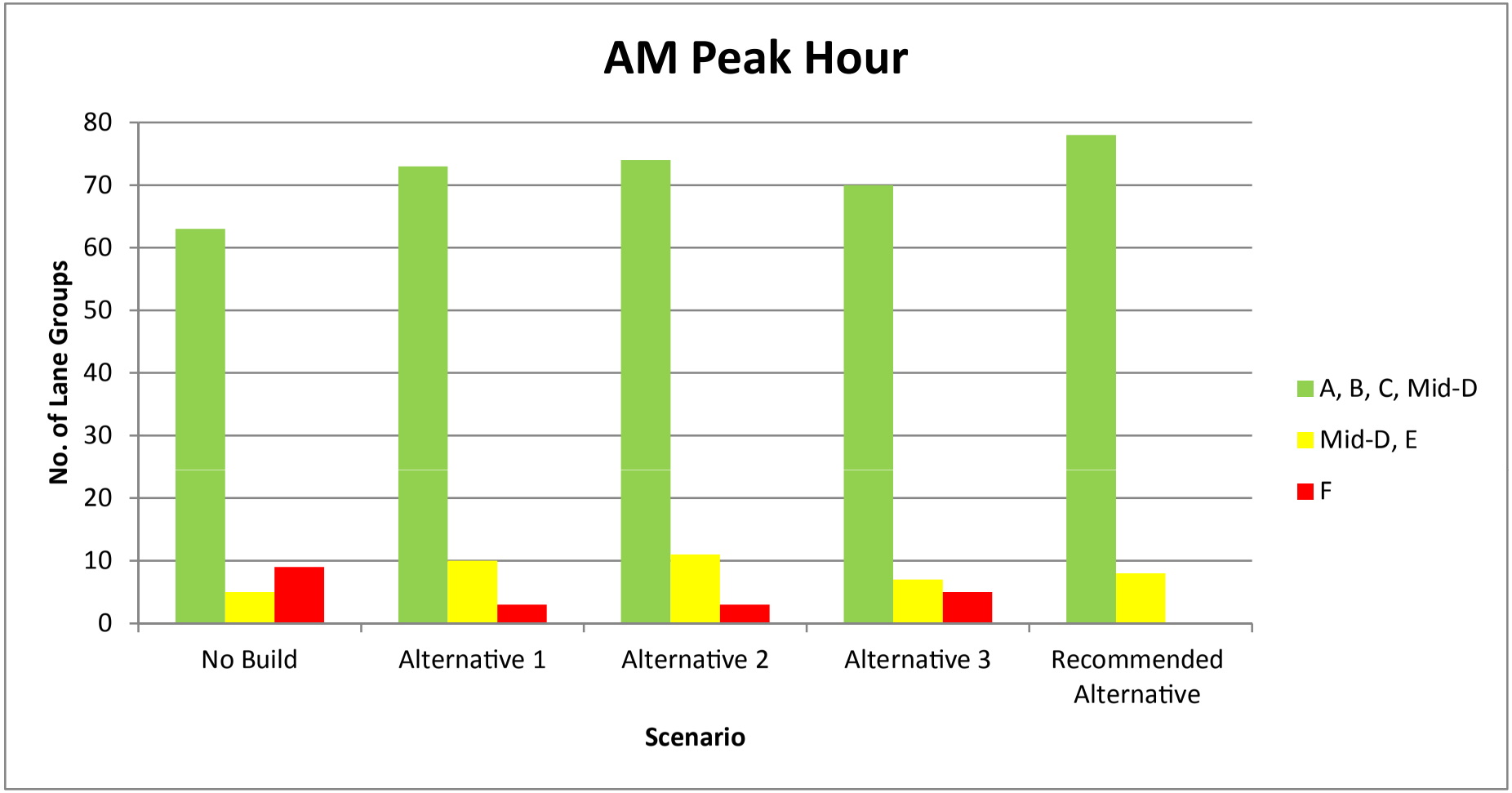


Figure 4.1-1 - Approach Lane Group Level of Service Comparison: AM Peak Hour

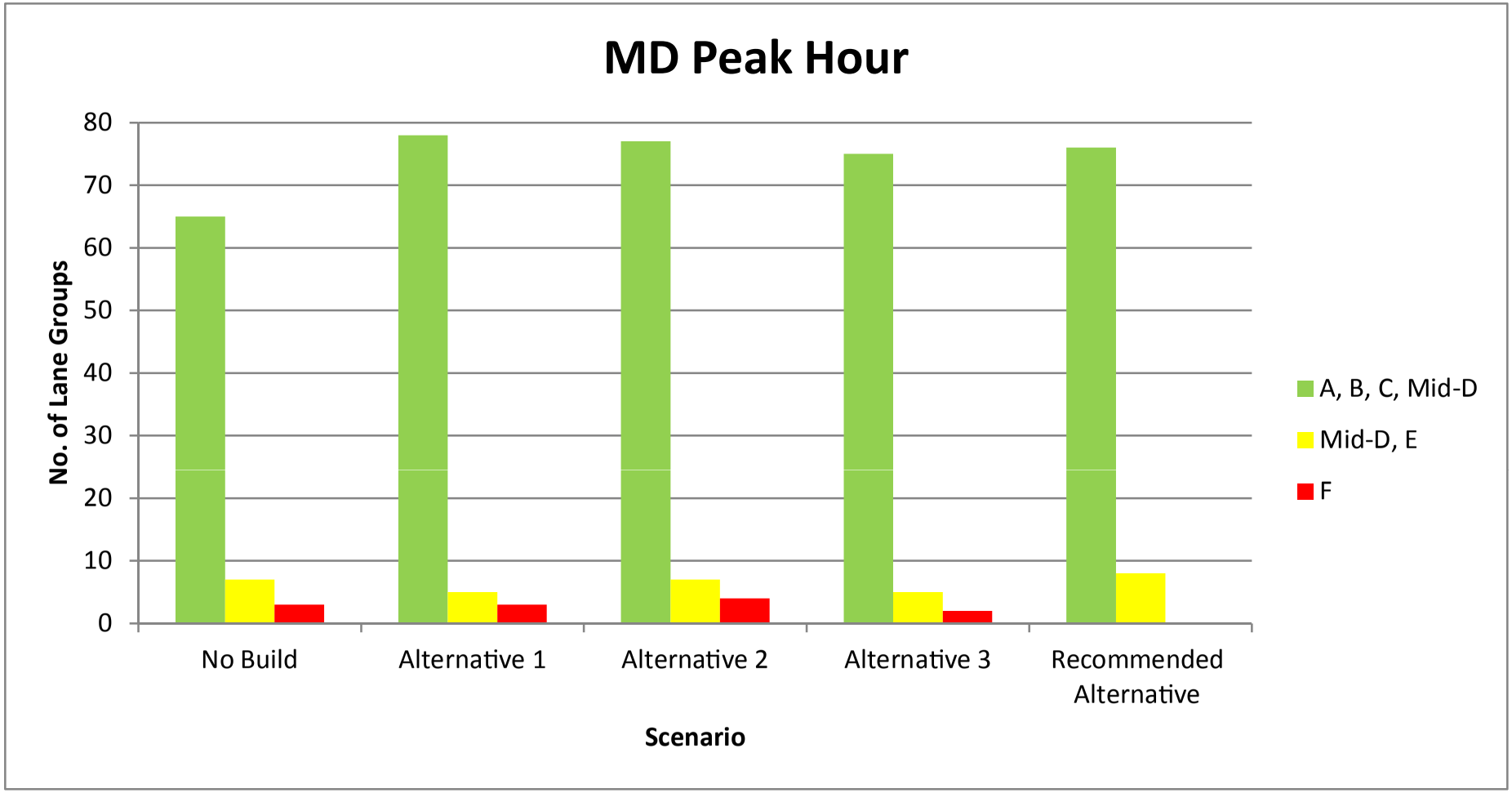


Figure 4.1-2 - Approach Lane Group Level of Service Comparison: MD Peak Hour

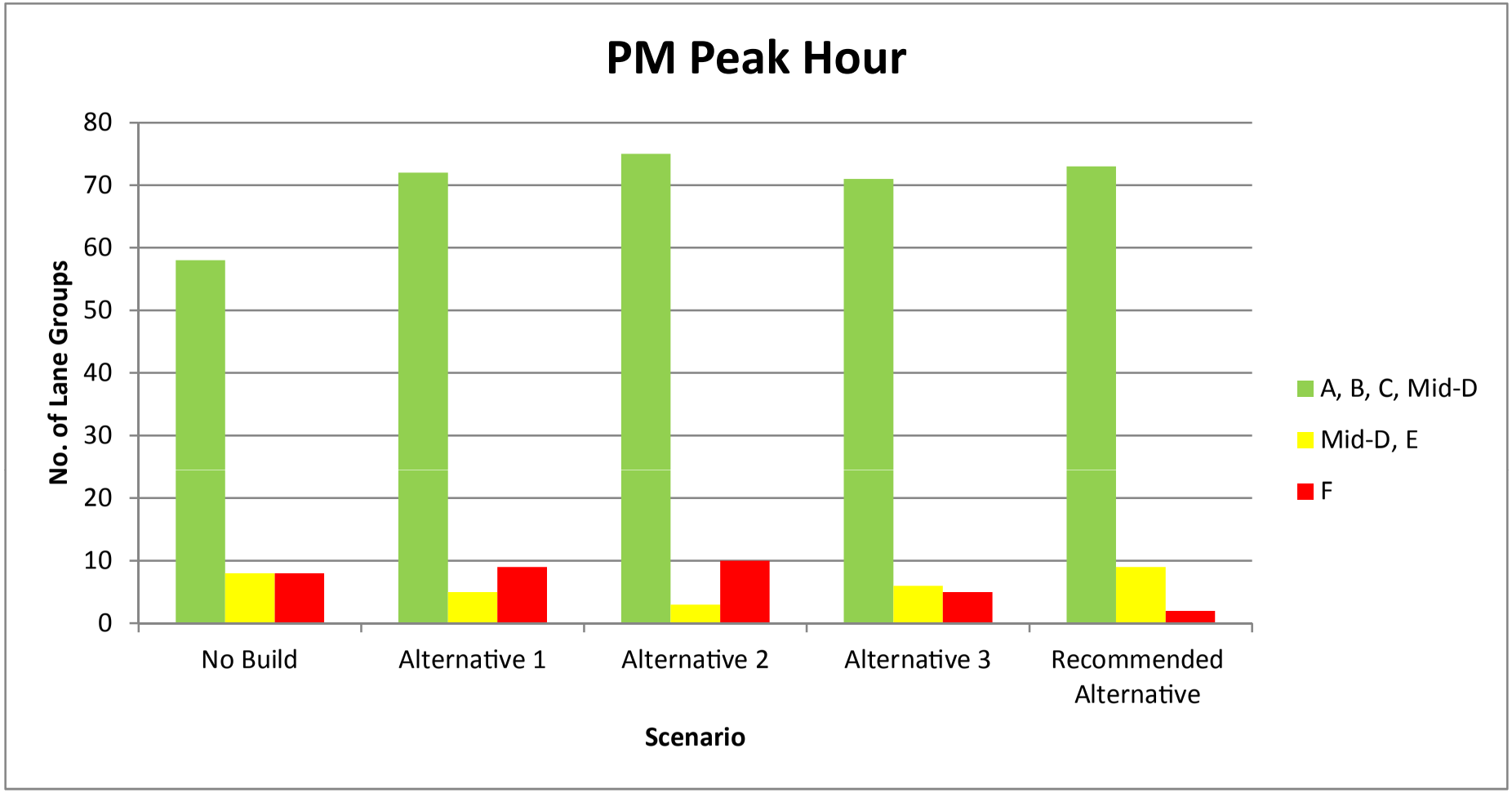


Figure 4.1-3 - Approach Lane Group Level of Service Comparison: PM Peak Hour

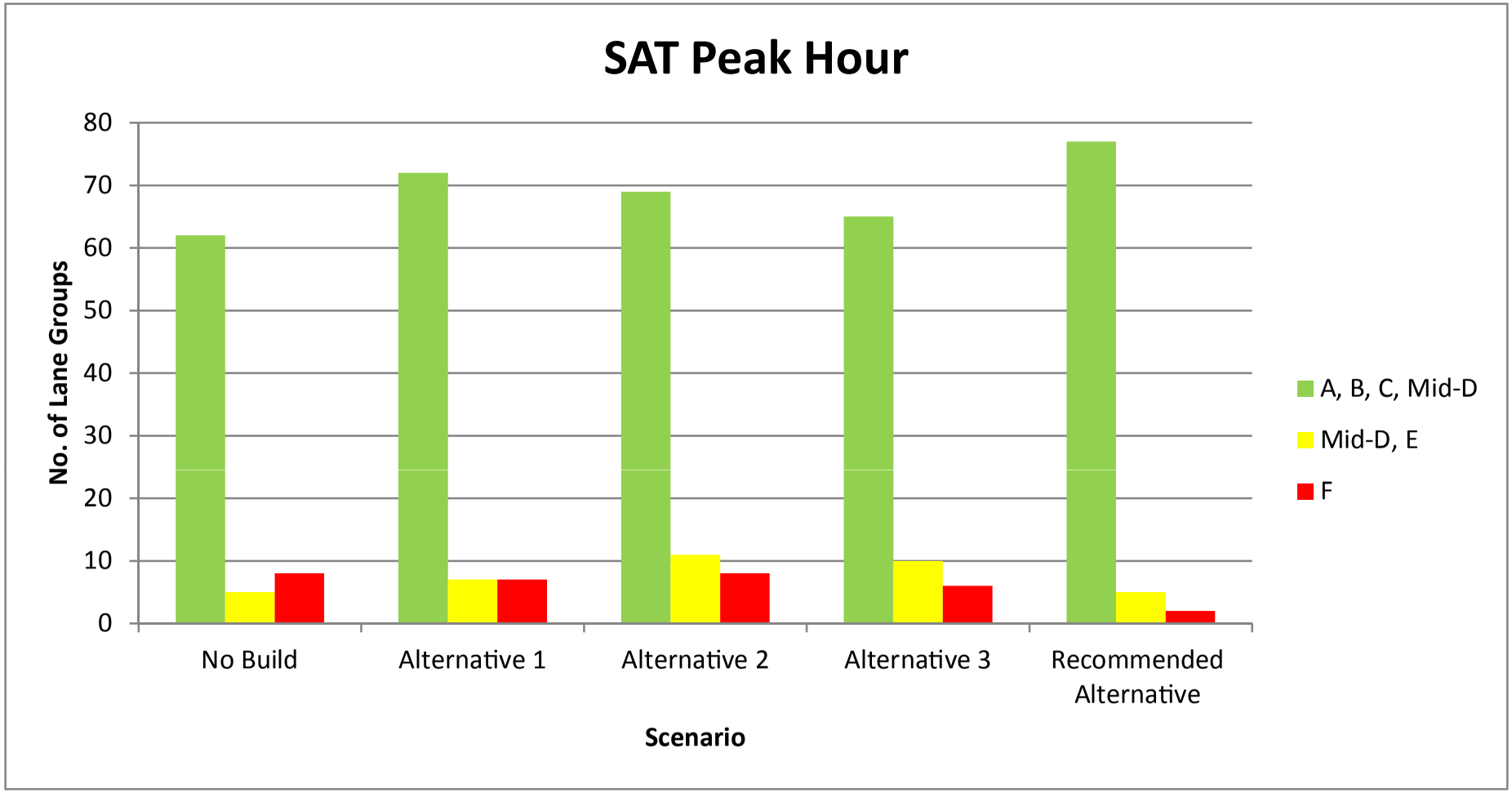


Figure 4.1-4 - Approach Lane Group Level of Service Comparison: SAT Peak Hour

Table 4.2-1: Emissions/Air Quality Analysis - West 181st Street Corridor and Network Totals																
		Scenario														
		Future without Impovements			Future with Improvements: Alternative 1			Future with Improvements: Alternative 2			Future with Improvements: Alternative 3			Future with Improvements: Recommended Alternative		
Intersections	Peak Hour	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)
W. 181 Street Corridor	AM	8.30	1.61	1.92	5.99	1.17	1.39	4.63	0.90	1.07	4.23	0.82	0.98	5.89	1.15	1.36
	Midday	6.12	1.19	1.42	5.68	1.10	1.32	3.80	0.74	0.88	3.95	0.77	0.92	4.98	0.97	1.16
	PM	7.42	1.44	1.72	7.00	1.36	1.62	4.85	0.94	1.13	4.28	0.83	0.99	5.53	1.08	1.28
	Saturday	7.66	1.49	1.77	6.54	1.27	1.52	4.55	0.89	1.05	4.24	0.82	0.98	5.25	1.02	1.22
Network	AM	24.74	4.81	5.73	24.49	4.77	5.68	26.95	5.24	6.25	28.56	5.56	6.62	21.34	4.15	4.95
	Midday	17.97	3.50	4.17	18.86	3.67	4.37	21.02	4.09	4.87	20.28	3.95	4.70	16.78	3.27	3.89
	PM	30.04	5.84	6.96	33.80	6.58	7.83	41.31	8.04	9.57	35.62	6.93	8.26	26.60	5.18	6.16
	Saturday	26.67	5.19	6.18	28.37	5.52	6.58	34.28	6.67	7.94	32.65	6.35	7.57	24.44	4.75	5.66

scenarios for all four peak hours. For example, when comparing the future without improvements to the recommended alternative during the PM peak hour, emissions for CO, NO_X and VOC would be reduced from 30.04 kg, 5.84 kg and 6.96 kg to 26.60 kg, 5.18 kg and 6.16 kg, respectively.

4.3 Pedestrians

The long-term improvements proposed for the recommended alternative include curb extensions which will be located at the southwest corner of West 181st Street and Haven Avenue and on all four corners of West 181st Street and St. Nicholas Avenue. The curb extensions provide additional pedestrian holding area space and would improve corner LOS and reduce crossing distances. The turn prohibitions at West 181st Street and St. Nicholas Avenue and West 181st Street and Amsterdam Avenue eliminate/reduce vehicle-pedestrian conflicts and provide a safer environment for pedestrians.

4.4 Bicycles

In the development of improvement alternatives, every attempt was made to reflect bicyclists' needs. The highest volumes of bicycles in the study area were counted on southbound Ft. Washington Avenue between West 183rd and West 179th Streets, where no bicycle markings are present. Shared bike route marking are planned for this segment. Bike lane markings already exist for the northbound direction. The roadway is not wide enough to accommodate bike lane markings in both directions.

In addition, shared bike route markings are striped on West 181st Street from Riverside Drive to Ft. Washington Avenue, and on Riverside Drive from West 181st Street to the pedestrian bridge. This will provide a seamless connection between the Hudson River Greenway and the Ft. Washington Avenue bike lane/route.

This improvement may result in an increased mode share for bicycles on weekdays as well as on weekends since both work-related and recreational bicycle trips could increase.

4.5 Safety

Safety for all street users (i.e., pedestrians, bicyclists, transit users and motorists) was a key consideration in the process of developing improvement alternatives for the West 181st Street corridor. With almost one-third of all reportable crashes during the 3-year study period being pedestrian crashes, particular attention was paid to improving pedestrian safety. Specifically, measures aimed at reducing the exposure of pedestrians to vehicular traffic (including buses), providing pedestrian amenities and separating vehicles from pedestrians to the extent possible served as guiding principles. The recommended alternative contains several safety-related elements that are expected to improve safety for all street users:

- The elimination of six of eight possible turning movements at the bustling intersection of West 181st Street and St. Nicholas Avenue, the highest volume pedestrian location in the study area reduces vehicular-pedestrian conflicts as well as pedestrian exposure to vehicles.
- Curb extensions are planned for long term implementation for six of the eight sidewalks at the corners of West 181st Street and St. Nicholas Avenue. The width of the extensions ranges from 3 to 6 feet. This will reduce crossing distance, and also provide for more sidewalk space at this busy location.

- Other locations where curb extensions are implemented or planned in order to reduce crossing distances include West 181st Street at the southwest corner of Haven Avenue, and Broadway at the northwest corner of West 181st Street.
- In order to provide pedestrian refuge, a raised median is planned for the east crosswalk at West 181st Street and Amsterdam Avenue.
- In order to protect pedestrians using crosswalks from vehicles, stop bars are located 10 feet from crosswalks. Previously, stop bars were only five feet from crosswalks, and at many approaches did not exist at all.
- The left-turn bays at the intersections of West 181st Street and Broadway (eastbound and westbound), West 181st Street and Wadsworth Avenue (westbound), West 181st Street and Audubon Avenue (eastbound and westbound), and West 179th Street and Ft. Washington Avenue (northbound) separate left-turning vehicles from "through" vehicles, thereby reducing the potential for certain types of vehicular crashes including rear-end collisions, overtaking and sideswipe crashes.

4.6 Curbside Management

The availability of on-street parking is affected by the implementation of the recommended curbside management. There is a slight reduction in the availability of on-street parking spaces as compared to the previous condition. However, most of this reduction occurs weekdays from 9am to noon due to the loading/unloading windows, and 3PM to 7PM due to the bus lane. Much of the corridor was filmed to observe delivery patterns. Also, there was a great deal of outreach to merchants to strike the right balance between metered parking spaces for shoppers and loading/unloading spaces for deliveries. Implementation of truck loading windows along West 181st Street is projected to help reduce double-parking and other illegal parking by commercial vehicles. The provision of the truck loading windows also improves vehicular safety, as vehicles have been observed to cross the double-yellow line to get around double-parked trucks.

4.7 Transit

Improving transit (bus) operations was a major consideration during the development of the recommended alternative. It also had to be balanced with other improvements being recommended for the corridor. The recommended alternative includes a bus lane in the eastbound direction between Broadway and Amsterdam Avenue. The bus lane is in effect weekdays from 3PM to 7PM along two blocks between Wadsworth Avenue and Audubon Avenue, and at all times between Broadway and Wadsworth Avenue, and between Audubon Avenue and Amsterdam Avenue. This dedicated bus lane is expected to increase transit capacity during the PM peak period and would reduce conflicts between buses and other vehicles.

5.0 EVALUATION OF ALTERNATIVES

The three initial alternatives and the recommended alternative were compared and evaluated based on study goals established by NYCDOT and the consultant. Goals were divided into two broad categories: those that support regional transportation goals and those which improve neighborhood quality of life and ambiance. Each alternative was evaluated based on how supportive or unsupportive it was for each goal. Tables 5.0-1 through 5.0-4 present the goal achievement matrix for each of the four alternatives. Figure 5.0-1 presents a graphical comparison of the extent to which the goals are supported by each alternative.

The results of the evaluation indicate that the recommended alternative is somewhat supportive in improving traffic operations and reducing congestion; improving air quality; improving vehicular safety; and enhancing pedestrian safety and walkability. This alternative was also found to be slightly supportive in improving bicycle safety and mobility; and improving transit service and operations as well as encouraging transit mode shift. It was found to work slightly against minimizing traffic displacement onto neighborhood streets, an attribute of all the alternatives analyzed. Due to turn restrictions at the intersections of West 181st Street and St. Nicholas Avenue, and West 181st Street and Amsterdam Avenue, a small amount of traffic is displaced and diverted onto adjacent roadways. It was also found to work slightly against preserving or improving parking supply and availability. The bus lane and loading windows removed a small amount of metered parking during certain hours. The recommended alternative is strongly supported by the community and elected officials as compared to the other alternatives.

Table 5.0-1: Evaluation of Alternatives

ALTERNATIVE 1 - Left-Turn Lanes

	GOALS	WORKS STRONGLY AGAINST	WORKS SOMEWHAT AGAINST	WORKS SLIGHTLY AGAINST	NO EFFECT	SLIGHTLY SUPPORTIVE	SOMEWHAT SUPPORTIVE	STRONGLY SUPPORTIVE	EXPLANATION OF RATING
	Support Regional Transportation Plan Goals								
1.	Improve traffic operations and reduce congestion						X		Additional left-turn lanes improve traffic operation. In all peak hours, the level of service of a small number of intersections will improve. A decline in LOS is only noticed at 2 intersections in the AM peak hour and 5 in the PM peak hour.
2.	Improve air quality				X				All peak hours improve along 181 St. Network-wide: AM and Midday see improvement while PM and SAT experience degradation in air quality.
3.	Improve vehicular safety						X		Turns eliminated at 181 St/St. Nicholas Ave and the NB Left at 181 St/Amsterdam Ave which reduces vehicle-pedestrian conflicts; Left-turn lanes.
4.	Improve pedestrian safety and walkability					X			Pedestrian refuge areas provided 181 St/St. Nicholas Ave and 181 St/Amsterdam Ave. Turn conflicts eliminated at 181 St/St. Nicholas Ave and 181 St/ Amsterdam Ave NB Left which reduces vehicle-pedestrian conflicts.
5.	Improve bicycle safety and mobility					X			Bicycle lane to be striped along SB Ft. Washington Ave between 183 St and 181 St
6.	Improve transit service and operations, and encourage mode shift.					X			Lengthened and reconfigured bus stops. Buses remain on corridor
	Improve Neigbhorhood Quality of Life/Ambience								
7.	Minimize traffic displacement onto neighborhood streets.			X					Traffic diverted to adjacent streets due turn restrictions at 181 St/St. Nicholas Ave and 181 St/Amsterdam Ave
8.	Preserve/improve on-street parking supply/availability			X					Parking displaced. Accomodates loading zones. Provides restricted metered parking
9.	Supported by the community and elected officials.						X		Public meeting participants expressed preference for this alternative among 1-3

Table 5.0-2: Evaluation of Alternatives

ALTERNATIVE 2 - Bus Transit Mall

	GOALS	WORKS STRONGLY AGAINST	WORKS SOMEWHAT AGAINST	WORKS SLIGHTLY AGAINST	NO EFFECT	SLIGHTLY SUPPORTIVE	SOMEWHAT SUPPORTIVE	STRONGLY SUPPORTIVE	EXPLANATION OF RATING
	Support Regional Transportation Plan Goals								
1.	Improve traffic operations and reduce congestion					X			Improves westbound traffic flow on 181 St; Increases traffic on adjacent streets; Provide exclusive left-turn lanes; Reduces vehicle/pedestrian conflicts; In all peak hours, the level of service of a small number of intersections will improve. A decline in LOS will be experienced at a few intersections as well during all peak hours.
2.	Improve air quality		X						All peak hours improve along 181 St. All peak hours show network-wide degradation in air quality with PM and SAT more severe.
3.	Improve vehicular safety							X	Turns eliminated at 181 St/St. Nicholas Ave and the NB Left at 181 St/Amsterdam Ave which reduces vehicle-pedestrian conflicts; WB left-turn lanes on 181 Street; Vehicular conflicts eliminated due to diversion of EB traffic; Buses are seperated from vehiclar traffic and travel in exclusive bus lanes; Buses and vehicular traffic each have exclusive phasing at traffic signals; No parking on the south side of 181 St.
4.	Improve pedestrian safety and walkability					X			Raised median for bus passengers in roadway. Modest curb and sidewalk extensions.
5.	Improve bicycle safety and mobility					X			Bicycle lane to be striped along SB Ft. Washington Ave between 183 St and 181 St
6.	Improve transit service and operations, and encourage mode shift.						X		Two-way bus transit mall; All buses continue to operate on 181st Street; Buses cannot pass each other, so potential for Bus-bunching; Difficulty for buses making NB right-turn at 181 St/Wadsworth Ave
	Improve Neigbhorhood Quality of Life/Ambience								
7.	Minimize traffic displacement onto neighborhood streets.	X							EB vehicular traffic (except buses) diverted; Traffic diverted to adjacent streets due to turn restrictions at 181 St/St. Nicholas Ave and 181 St/Amsterdam Ave;
8.	Preserve/improve on-street parking supply/availability			X					Modified parking regulations; Provides restricted metered parking (north curb); Accommodates loading zones (north curb); Eliminates parking (south curb);
9.	Supported by the community and elected officials.		X						Public meeting participants opposed 1-way traffic and impacts on other streets

Table 5.0-3: Evaluation of Alternatives

ALTERNATIVE 3 - One Way Westbound

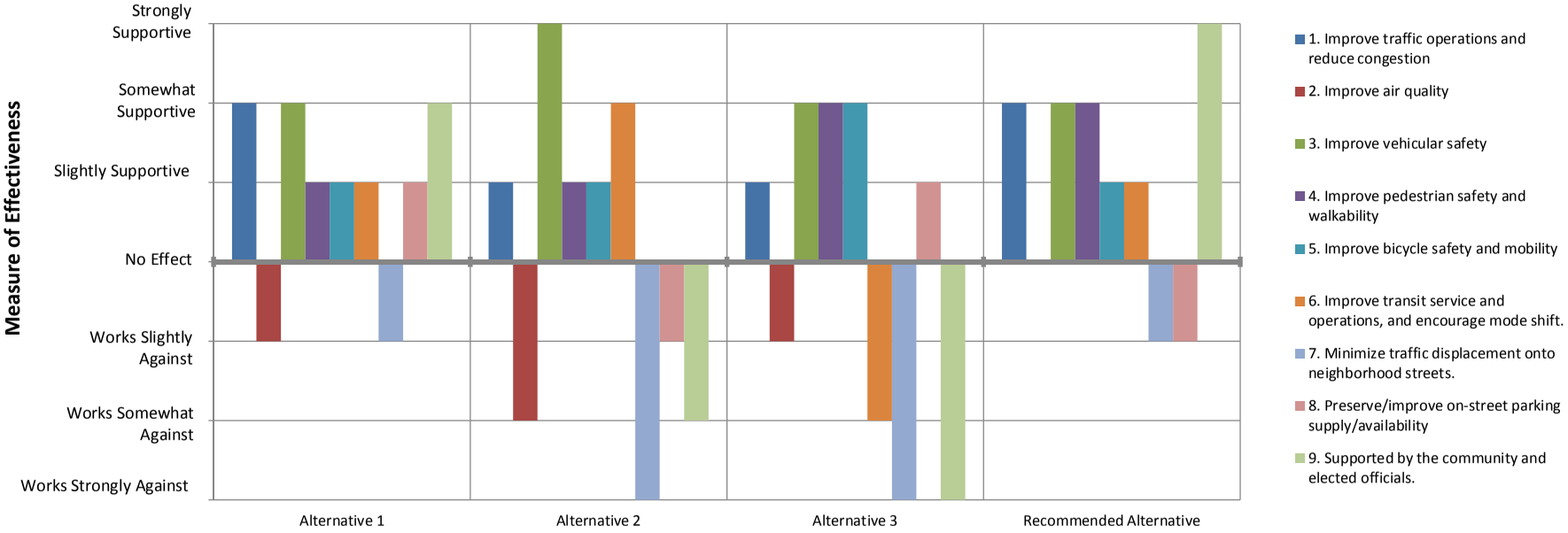
	GOALS	WORKS STRONGLY AGAINST	WORKS SOMEWHAT AGAINST	WORKS SLIGHTLY AGAINST	NO EFFECT	SLIGHTLY SUPPORTIVE	SOMEWHAT SUPPORTIVE	STRONGLY SUPPORTIVE	EXPLANATION OF RATING
	Support Regional Transportation Plan Goals								
1.	Improve traffic operations and reduce congestion					X			One-way WB traffic for all vehicles including buses on 181 St; Improves traffic flow; In all peak hours except weekday midday, the level of service of a small number of intersections will improve. A decline in LOS will be experienced at a few intersections as well during all peak hours.
2.	Improve air quality			X					All peak hours improve along 181 St. Network-wide: All peak hours show degradation in air quality.
3.	Improve vehicular safety						X		Turn prohibitions (St. Nicholas & Amsterdam) Reduces vehicle/pedestrian conflicts; One-way WB bus lane conflict with right-turning vehicles; One-way WB striped bicycle lane Encourages non-auto mode of travel
4.	Improve pedestrian safety and walkability						X		Extensive curb & sidewalk extensions Reduces sidewalk congestion Shortens crosswalk distance
5.	Improve bicycle safety and mobility						X		Bicycle lane to be striped along SB Ft. Washington Ave between 183 St and 181 St; One-way WB striped bicycle lane - transition required between Wadsworth Ave and Broadway Encourages non-auto mode of travel
6.	Improve transit service and operations, and encourage mode shift.		X						All EB buses rerouted to 178th St and operate in mixed traffic; Buses can still pass each other; Extend and relocate bus stops Reduces bus-bunching Reduces congestion at bus stops
	Improve Neigbhorhood Quality of Life/Ambience								
7.	Minimize traffic displacement onto neighborhood streets.	X							All EB 181st St traffic diverted to alternate routes Increases traffic volume on adjacent streets All EB buses rerouted to 178th St
8.	Preserve/improve on-street parking supply/availability					X			Modified parking regulations Provides restricted metered parking (both curbs) Accommodates loading zones (both curbs)
9.	Supported by the community and elected officials.	X							Public meeting participants opposed 1-way traffic and impacts on other streets; Also opposed loss of parking & loading

Table 5.0-4: Evaluation of Alternatives

RECOMMENDED ALTERNATIVE

	GOALS	WORKS STRONGLY AGAINST	WORKS SOMEWHAT AGAINST	WORKS SLIGHTLY AGAINST	NO EFFECT	SLIGHTLY SUPPORTIVE	SOMEWHAT SUPPORTIVE	STRONGLY SUPPORTIVE	EXPLANATION OF RATING
	Support Regional Transportation Plan Goals								
1.	Improve traffic operations and reduce congestion						X		Preserves two way operation; Additional left-turn lanes improve traffic operation. Minimal traffic diversions (only at 181 St/St. Nicholas Ave - all approaches; and at 181 St./Amsterdam Ave - NB left approach); 181 St/Broadway WB left permitted; An improvement in LOS is noticed at four intersections in the AM and MD peak hours and three intersections in the PM and SAT peak hours. A decline in LOS is noticed at two intersections in the AM, PM and SAT peak hours and one intersection in the MD peak hour.
2.	Improve air quality						X		All peak hours improve along 181 Street and Network-wide.
3.	Improve vehicular safety						X		Turns eliminated at 181 St/St. Nicholas Ave and the NB Left at 181 St/Amsterdam Ave which reduces vehicle-pedestrian conflicts; Left-turn lanes.
4.	Improve pedestrian safety and walkability						X		Modest curb & sidewalk extensions; Pedestrian refuge areas at 181 St/St. Nicholas Ave Reduces sidewalk congestion Shortens crosswalk distance
5.	Improve bicycle safety and mobility					X			Bicycle lane to be striped along SB Ft. Washington Ave between 183 St and 181 St
6.	Improve transit service and operations, and encourage mode shift.					X			EB Bus-only lane (3-7 PM); WB bus operation maintained; Buses can still pass each other; Reconfigured bus stops;
	Improve Neigbhorhood Quality of Life/Ambience								
7.	Minimize traffic displacement onto neighborhood streets.			X					Traffic diverted to adjacent streets due turn restrictions at 181 St/St. Nicholas Ave and 181 St/Amsterdam Ave
8.	Preserve/improve on-street parking supply/availability						X		Delineated parking lanes; Trucking loading windows provided; minor parking displacement
9.	Supported by the community and elected officials.							X	Preserves 2-way operation as favored by community, while also providing alternative 1 benefits; Also adds significant transit and pedestrian improvements

Figure 5.0-1: Comparitive Evaluation of Alternatives



6.0 IMPLEMENTATION OF RECOMMENDED IMPROVEMENTS

The implementation of recommended improvements has been divided up between short-term and long-term improvements, as detailed in Section 3.0.

Most of the short-term improvements have been implemented in 2011. These include the following: all striping along West 181st Street between Riverside Drive and Amsterdam Avenue, and along Riverside Drive between West 181st Street and the pedestrian bridge; a concrete curb extension at West 181st Street and Haven Avenue; modification of parking regulations including the creation of truck loading windows along West 181st Street; signal timing modifications; and signs relating to turn prohibition changes. The short-term changes that will be implemented in 2012 include the striping along Ft. Washington Avenue between West 178th and West 183rd Streets; and bus lane markings and signs along West 181st Street from Broadway to Amsterdam Avenue. The official marking plan is shown in Figures 6.0-1 and 6.0-2.

Long-term improvements are slated to be implemented in 2014. These include the installation of tapered curb extensions along West 181st Street at St. Nicholas Avenue, neck-downs on St. Nicholas Avenue at the northwest and southeast corners of West 181st Street, a median extension and pedestrian refuge with cut-through for the eastern crosswalk at West 181st Street and Amsterdam Avenue and a replacement pedestrian/bicycle overpass to the Hudson River Greenway.

REVISIONS		
DATE	APPD	DESCRIPTION

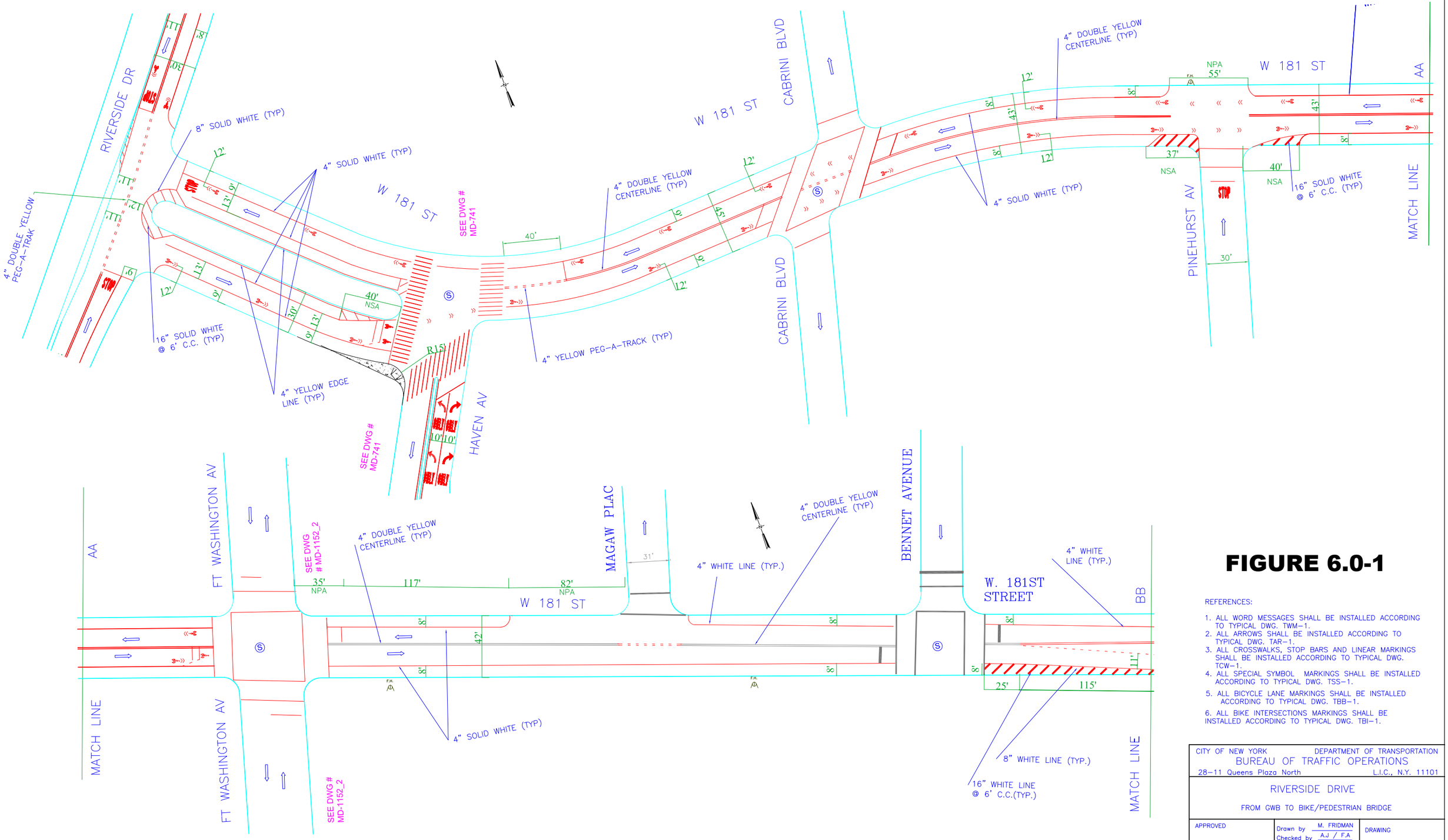


FIGURE 6.0-1

REFERENCES:

1. ALL WORD MESSAGES SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TWM-1.
2. ALL ARROWS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TAR-1.
3. ALL CROSSWALKS, STOP BARS AND LINEAR MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TCW-1.
4. ALL SPECIAL SYMBOL MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TSS-1.
5. ALL BICYCLE LANE MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TBB-1.
6. ALL BIKE INTERSECTIONS MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TBI-1.

CITY OF NEW YORK — DEPARTMENT OF TRANSPORTATION
BUREAU OF TRAFFIC OPERATIONS
28-11 Queens Plaza North — L.I.C., N.Y. 11101

RIVERSIDE DRIVE

FROM GWB TO BIKE/PEDESTRIAN BRIDGE

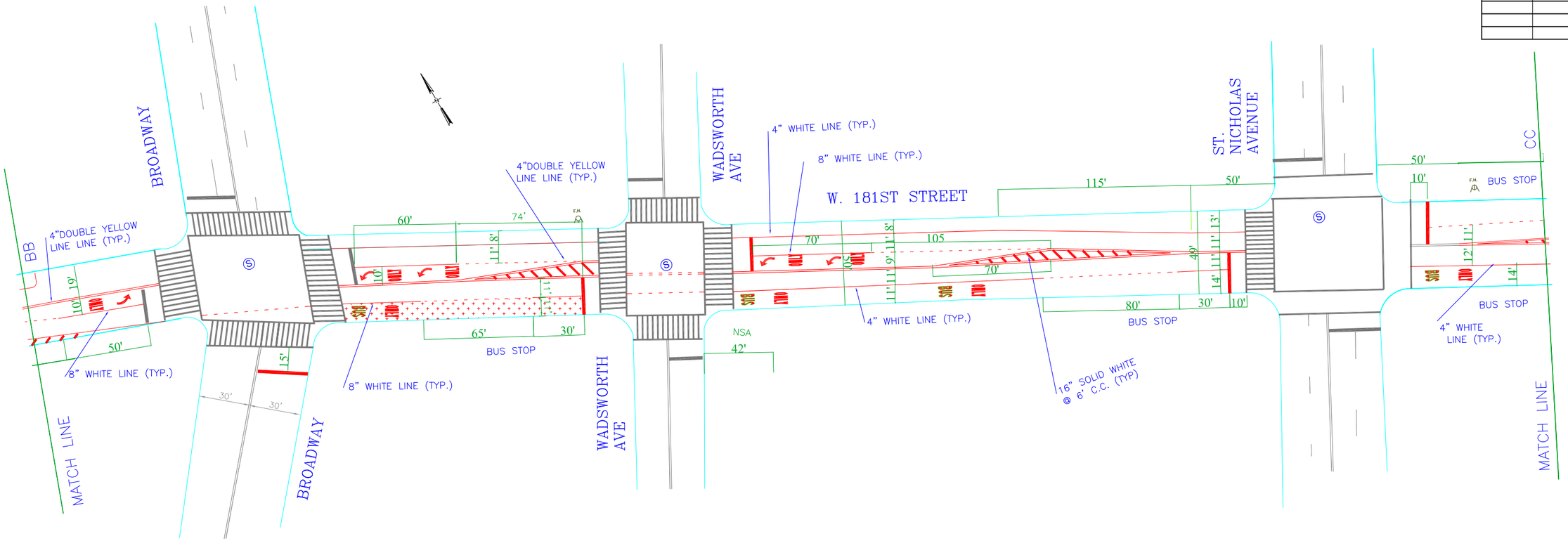
APPROVED

BY _____
F. AZER, P.E.

Drawn by M. FRIDMAN
Checked by A.J / F.A
Borough MANHATTAN
Scale 1"=30'
Date 10/24/2011

DRAWING NO. MD-1274_1

REVISIONS		
DATE	APPD	DESCRIPTION



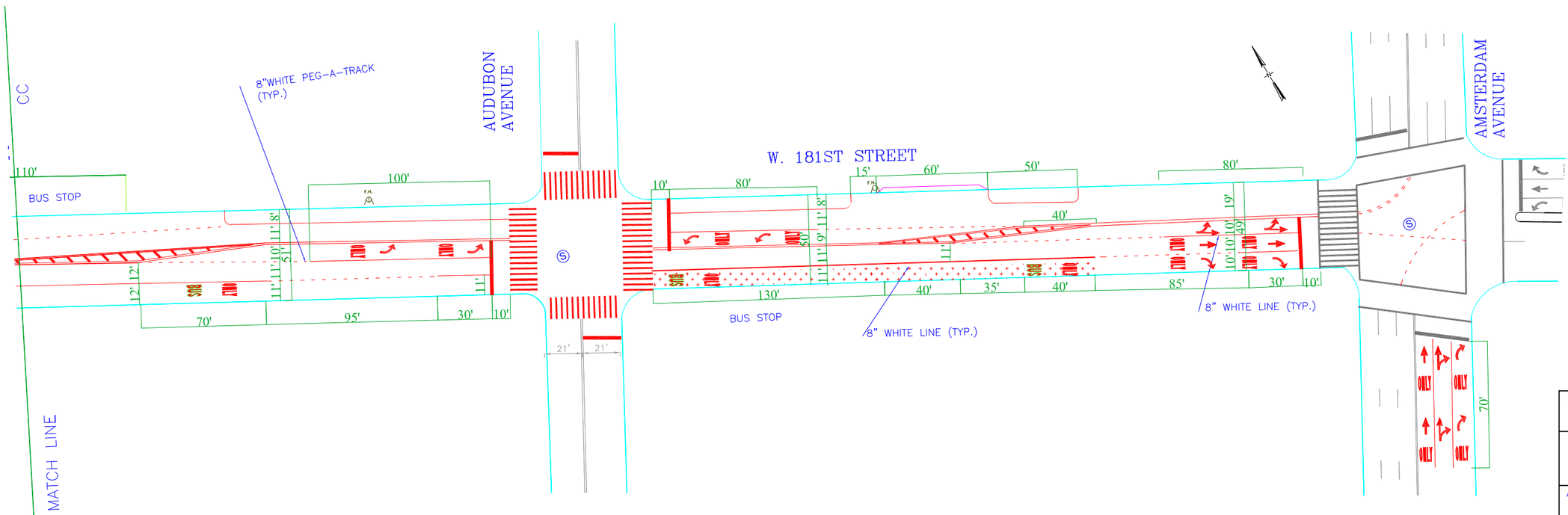


FIGURE 6.0-2

REFERENCES:

1. ALL WORD MESSAGES SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TWM-1.
2. ALL ARROWS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TAR-1.
3. ALL CROSSWALKS, STOP BARS AND LINEAR MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TCW-1.
4. ALL SPECIAL SYMBOL MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TSS-1.
5. ALL BICYCLE LANE MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TBB-1.
6. ALL BIKE INTERSECTIONS MARKINGS SHALL BE INSTALLED ACCORDING TO TYPICAL DWG. TBI-1.

CITY OF NEW YORK — DEPARTMENT OF TRANSPORTATION
BUREAU OF TRAFFIC OPERATIONS
28-11 Queens Plaza North — L.I.C., N.Y. 11101

RIVERSIDE DRIVE

FROM GWB TO BIKE/PEDESTRIAN BRIDGE

APPROVED BY _____ F. AZER, P.E.	Drawn by A.IBRAHIM Checked by A.J/ F.A Borough MANHATTAN Scale 1"=30' Date 10/24/2011	DRAWING NO. MD-1274_2

7.0 SUMMARY AND CONCLUSION

In the development of a recommended alternative, every attempt was made to include as many multimodal elements to the extent possible and practical. Because of the conflicting needs of different road users, not every proposed improvement from the original three alternatives could be included in the recommended alternative; instead, the recommended alternative combined elements of the original three alternatives in addition to community feedback and was therefore tailored to address the most pressing issues that were identified along the West 181st Street corridor.

Under the recommended alternative, which will retain the existing two-way operation of West 181st Street, traffic operations along West 181st Street will be improved with the introduction of exclusive left-turn lanes, and the turn prohibitions at West 181st Street and St. Nicholas Avenue. Buses will continue to operate in mixed traffic as they currently do, except for the PM peak period eastbound bus lane between Broadway and Amsterdam Avenue. Dedicated truck loading windows would help reduce or eliminate double parking and related crashes, as well as improve service to local businesses.

For the recommended improvements to yield optimal benefits, stepped-up enforcement of traffic laws and regulations along the West 181st Street corridor may be required. While traffic enforcement is not under the jurisdiction of NYCDOT, agency coordination and cooperation involving NYCDOT, NYPD, MTA and other key agencies will be critical to ensure that maximum benefits are achieved from implementation of the recommended alternative for the West 181st Street congested corridor. The corridor will be monitored to assess the improvements beginning in 2013.

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