

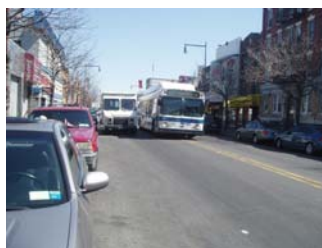
The Citywide Congested Corridor Project

Church Avenue from McDonald Avenue to Utica Avenue

Borough of Brooklyn

Final Report

February, 2013



Michael R. Bloomberg
Mayor



Janette Sadik-Khan
Commissioner



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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 (pedestrians, bicyclists, transit users and motorists), air quality and the quality of life. Church Avenue in Brooklyn has been selected as one of the congested corridors. This report presents the recommended improvement measures for the Church Avenue corridor, based on the analysis of existing and future conditions presented in previous technical memoranda.

The study area of the Church Avenue corridor extends from McDonald Avenue on the west to Utica Avenue on the east, and also includes intersections north and south of Church Avenue on major roadways.

Operational and safety deficiencies 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 Church Avenue.
- Double parking affecting traffic operations and safety.
- Lack of loading/unloading zones.
- Sidewalk congestion, especially at major intersections.
- Unsafe crosswalks due to conflicts with turning vehicles.
- Missing link between existing bike paths.

Improvement options were formulated, analyzed and presented to the stakeholders. One of the bold options that was considered includes converting Church Avenue to one-way westbound, and restriping Linden Boulevard to provide for more eastbound capacity. This option was ultimately removed from consideration due to community concerns that the re-routed traffic would disrupt operations to Church Avenue, Caton Avenue and Linden Boulevard. Another bold idea that was considered is peak direction parking regulations along Church Avenue – banning parking on the north curb during the AM peak period, and on the south curb during the PM peak period – to create an additional travel lane. However, the results of the analysis revealed that this would bring about only a small operational improvement, and the loss of parking would inconvenience shoppers and hurt merchants. Also, the difficulty and added cost of enforcement resulted in this option not being recommended. The improvements that were ultimately selected were further refined through the analysis and community outreach process. Most of the recommended short-term improvements have been implemented in 2010 and 2011; others will be implemented in 2012 or 2013. A capital project has been initiated for long-term improvements.

The major elements of the recommended improvements are:

- Signal phasing, timing and offset improvements.
- To reduce congestion and safety problems caused by double-parking, some curbside parking spaces along Church Avenue have been designated for loading or unloading during key delivery hours.
- To reduce crossing distance, curb extensions have been built at the intersections of Church Avenue & Beverley Road, and Church Avenue & Coney Island Avenue. They

are planned for long term implementation at Church Avenue & McDonald Avenue, and Church Avenue & Bedford Avenue.

- To provide pedestrian refuge, raised median islands have been built at the intersections of Church Avenue & Ocean Parkway, Coney Island Avenue & Albemarle Road, and Church Avenue & Ocean Avenue.
- Shared lane markings for bicycles have been provided at the intersection of Church Avenue and Ocean Parkway to guide cyclists between the Ocean Parkway bike paths on the west mall south of Church Avenue, and the east mall north of Church Avenue.
- To reduce congestion and improve safety by protecting pedestrians from turning vehicles, left turns have been banned at the southbound approach of Church Avenue & Ocean Avenue, and the southbound and westbound approaches at Albemarle Road & Coney Island Avenue.
- To reduce congestion by separating turning vehicles from through vehicles, the following turn bays have been created:
 - Left-turn bay for westbound approach at Church Avenue & McDonald Avenue.
 - Left-turn bay for northbound approach at Church Avenue & Ocean Avenue.
 - Right-turn bay for eastbound, northbound and southbound approaches at Church Avenue & Flatbush Avenue.
 - Left-turn bay for northbound and southbound approaches at Church Avenue & Flatbush Avenue.
- Other markings that have been installed to define roadway usage or enhance pedestrian safety:
 - Parking lane markings (solid white line).
 - Bus stop markings (dashed white line).
 - Stop bars set back 10 feet from crosswalks.
 - Peg-a-track markings.

The recommended improvements address the most pressing issues that were identified through the study process and extensive community outreach, and are projected to improve operations and safety for all street users (i.e., pedestrians, bicyclists, transit riders and motorists).

Westbound travel speeds along Church Avenue are projected to improve by 12.8%, 5.3%, 2.7% and 10.9%, during weekday AM, midday, PM, and Saturday peak hours, respectively, during the year 2017 with improvements. Eastbound travel speeds are projected to improve by 3.5%, 9.2%, 3.2% and 12.0%. For all intersection approaches on the corridor, including the roadways that cross Church Avenue, the number of marginally unacceptable (LOS mid-D to E) or unacceptable (LOS F) approaches is projected to be reduced from 19 to 12 during the weekday AM peak hour, from 3 to 2 during the weekday midday peak hour, from 22 to 15 during the weekday PM peak hour, and from 17 to 3 during the Saturday midday peak hour. Air quality is projected to improve with fewer emissions from vehicles. Emission rate improvements are projected to be about 3.1%, 5.4%, 21.3% and 12.0 % for the four peak hours, when compared to the project's future without improvement conditions.

The corridor will be monitored to assess the effectiveness of the improvements beginning in 2013.



INTRODUCTION

1. INTRODUCTION

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.

Through an evaluation process, NYCDOT has identified Church Avenue in Brooklyn as one of the congested corridors to be studied under the CCCP. The study area is the 2.7 mile long segment of Church Avenue from McDonald Avenue on the west to Utica Avenue on the east, and also includes intersections north and south of Church Avenue on major roadways. It traverses the communities of Kensington, Ditmas Park, Flatbush and East Flatbush in Community Boards 12, 14 and 17. Figure 1 shows the Study Area Map.

The study area consists of diverse neighborhoods with heavy concentrations of retail, commercial and residential land uses. The study segment of Church Avenue typically consists of one travel lane and a curbside parking lane in each direction (Figure 2). In recent years, heavy traffic and pedestrian activities on Church Avenue have created operational and safety deficiencies that require development and implementation of a congestion mitigation program.

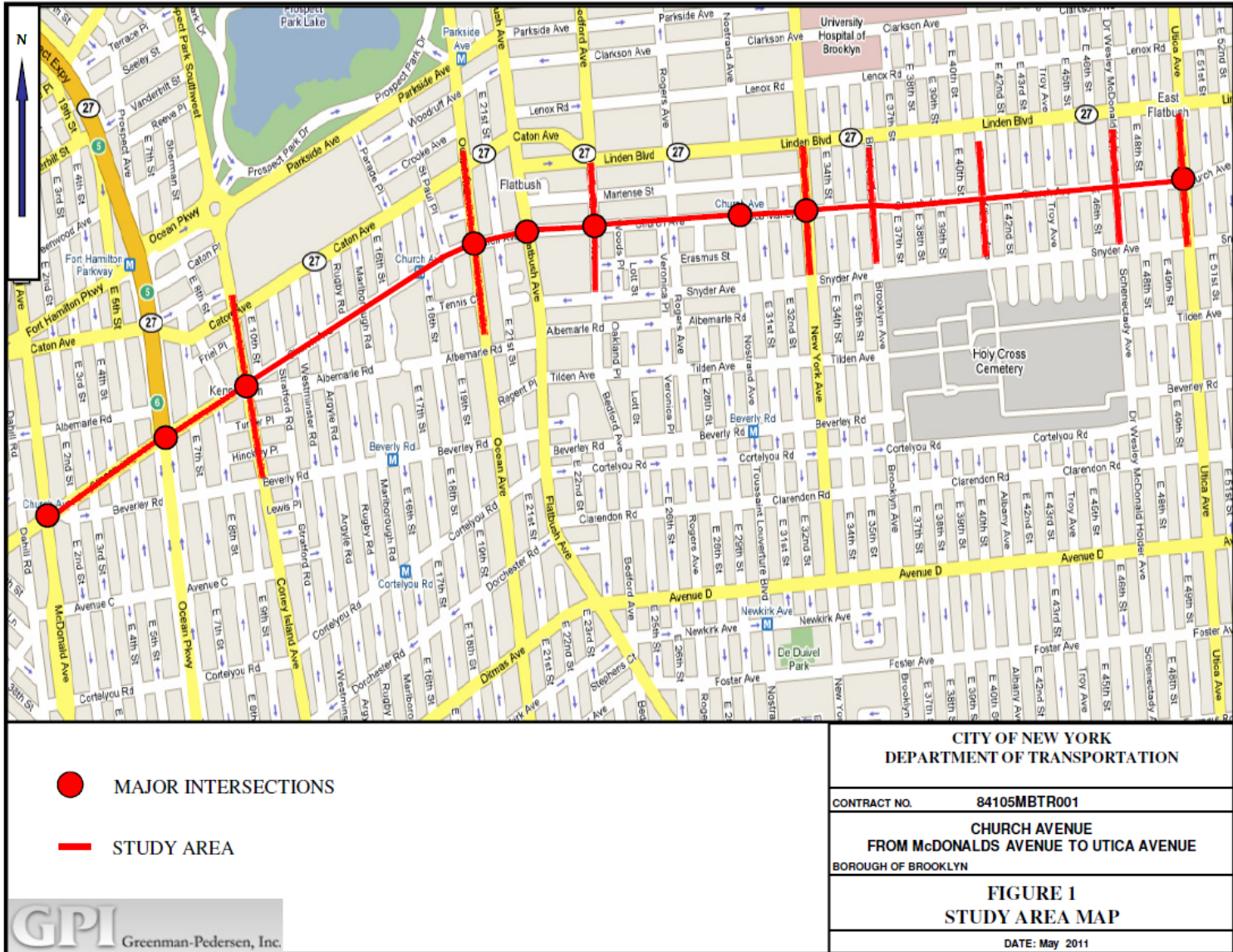
This Final Report documents the evaluation of recommended improvements for the Church Avenue corridor. The Report is the conclusion of a planning process which included extensive community outreach, analysis of existing and future without improvements conditions, the development improvement measures, and the analysis of future with improvements conditions.

The community outreach effort was a critical component of the study process. NYCDOT and its consultant 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 operational and safety data, and analysis of the existing and future without improvements conditions; identify safety and operational deficiencies; and obtain feedback from to fine tune the data analysis. These meetings consisted of various stakeholders including residents, businesses, transportation providers, and community board members, elected officials, local government agencies and various interest groups. Input from these meetings was incorporated into the development of the various improvement options and the selection of the recommended improvements.

Additionally, following technical memoranda were issued as the study process developed:

- *Technical Memorandum No. 1: Data Compilation, April 2008*
- *Technical Memorandum No. 2: Existing And Future Without Improvements Conditions, June 24, 2009*

INTRODUCTION



The Citywide Congested Corridor Project: Church Avenue From McDonald Avenue to Utica Avenue, Brooklyn, NY

1 INTRODUCTION



Figure 2: Church Avenue Looking West Near Flatbush Avenue

2

EXISTING CONDITION

2. EXISTING AND FUTURE WITHOUT IMPROVEMENTS CONDITIONS

A combination of heavy traffic volumes, pedestrian activities and geometric constraints makes this corridor challenging to provide safe and efficient operations for all street users. Detailed information regarding the comprehensive assessment and analysis of existing traffic operating conditions along Church Avenue was presented in TM No. 2: *Existing And Future Without Improvements Conditions*, dated June 24, 2009. Key findings are presented in this section.

2.1 TRAFFIC OPERATIONS

Church Avenue generally operates under congested traffic conditions during the weekday AM, midday, PM, and Saturday midday peak periods. Existing and projected future without improvement travel speeds for the eastbound and westbound directions are presented in Figures 3 and 4, respectively. The existing travel speeds are averages from actual travel time trials conducted in 2007. The future without improvement travel speeds were projected for the year 2017 using Synchro traffic modeling software, using growth rates given in the *City Environmental Quality Review (CEQR) Technical Manual*. No major projects that would affect traffic in the study area were identified by the Department of City Planning.

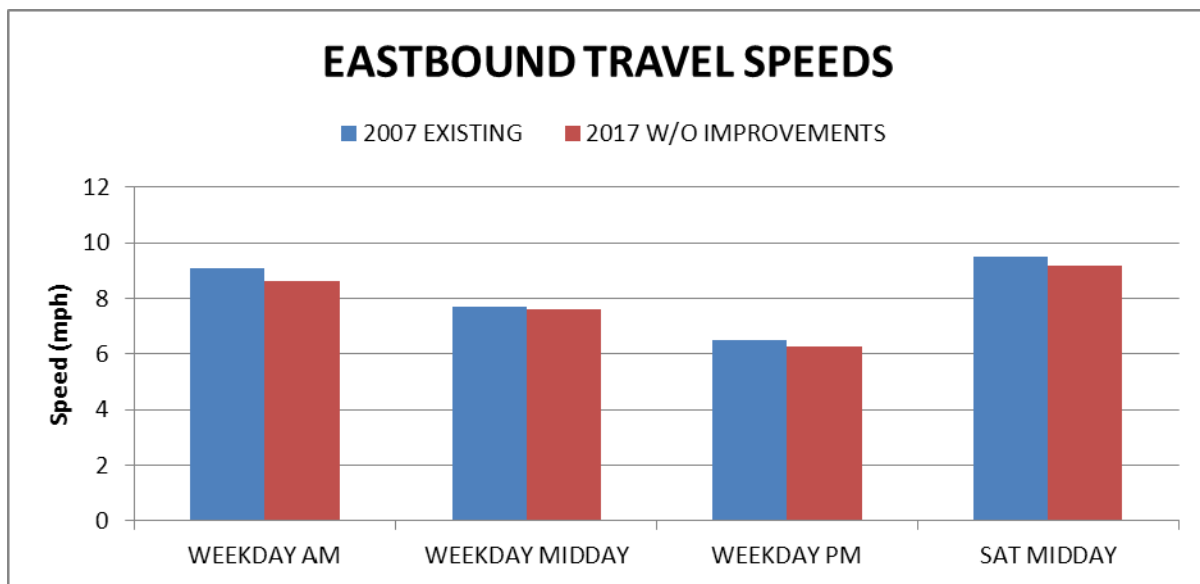


Figure 3: Eastbound Peak Period Travel Speeds for Church Avenue from McDonald Avenue to Utica Avenue

2

EXISTING CONDITION

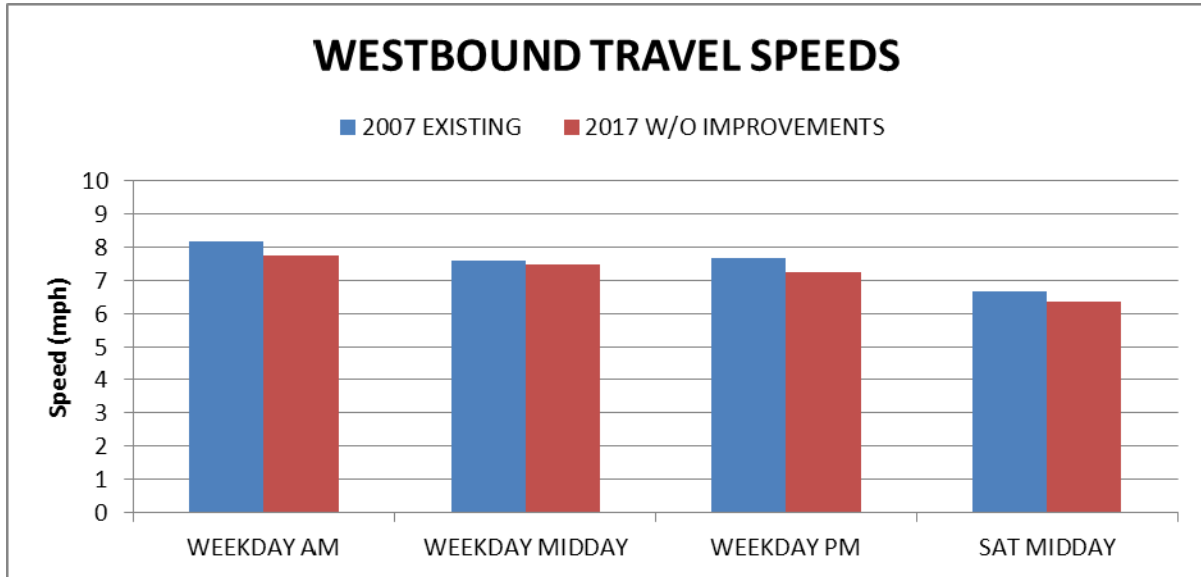


Figure 4: Westbound Peak Period Travel Speeds for Church Avenue from McDonald Avenue to Utica Avenue

Existing travel speeds during the four peak periods of study varied between 6.5 and 9.1 mph. Congested conditions are projected to worsen in the future without any improvements. Figure 5 illustrates congestion in the eastbound direction during the weekday PM peak period, where 2017 future without improvements travel speed is projected to average 6.3 mph. For the westbound direction, the Saturday peak period 2017 future without improvements travel speed is projected to average 6.4 mph.



Figure 5: Church Avenue at Ocean Avenue, Looking East

2

EXISTING CONDITION

2.2 PARKING

There are approximately 640 legal curbside parking spaces on Church Avenue between McDonald and Utica Avenues, not including side streets (Figure 6). While there is excess capacity during the weekday AM peak hour, the vast majority of parking spaces are occupied during the other three peak hours, especially the weekday midday and Saturday midday peak hours. Illegally parked vehicles during these peak hours further exacerbate roadway safety and operations. The lack of loading zones makes it difficult for trucks to make deliveries. Figure 7 illustrates double-parked trucks causing through vehicles to cross the double yellow line. High parking utilization also results in increased congestion due to the circulation of traffic on Church Avenue as motorists attempt to find vacant parking spaces near their desired destination point.

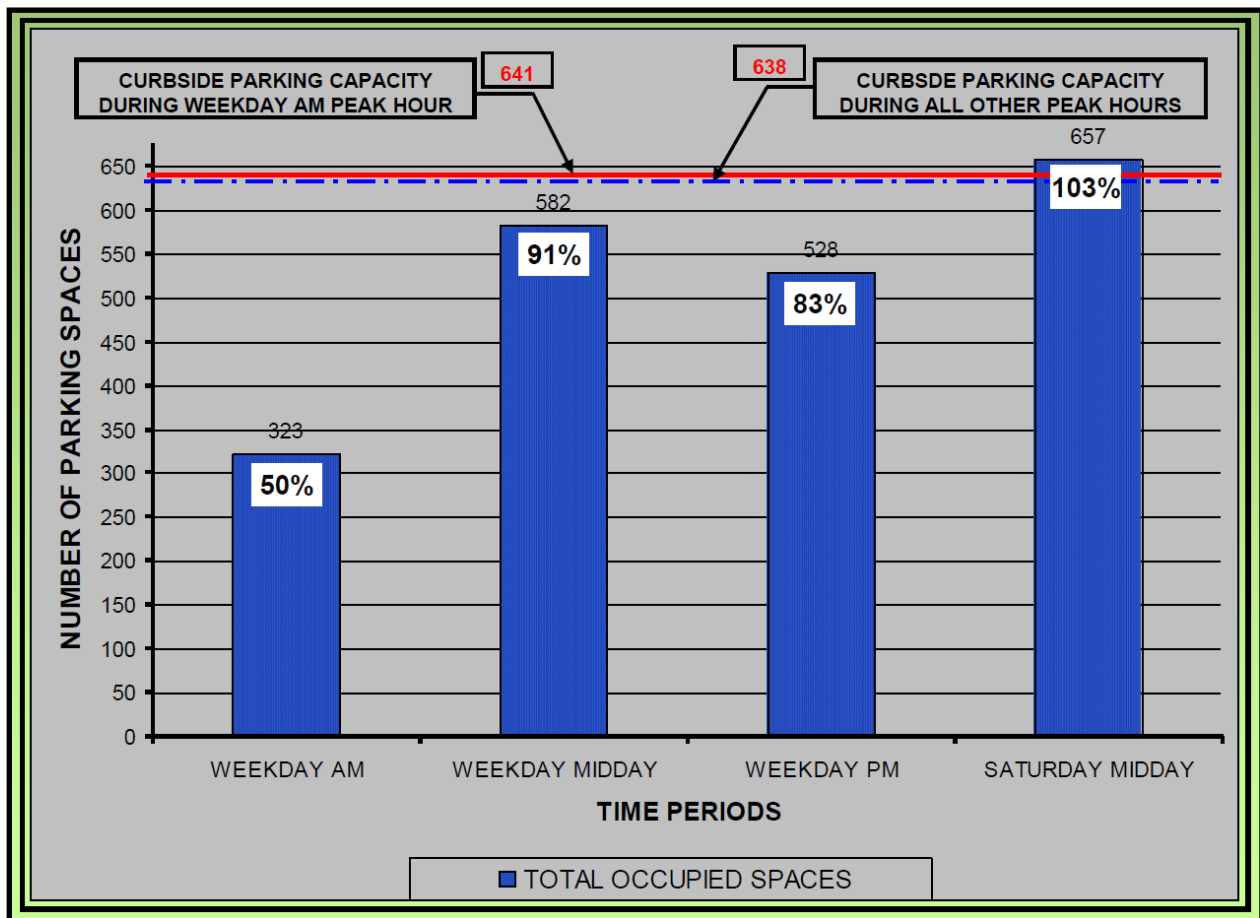


Figure 6: Church Avenue Peak Hour Curbside Parking Utilization



Figure 7: Typical Illegal Double Parking Activity along Church Avenue

2.3 SAFETY

Crash inventory conducted within the study area during a three-year period has indicated a total of 296 reportable crashes (Figure 8). Among these crashes, 182 were vehicle-to-vehicle crashes, 102 involved pedestrians and 12 involved bicycles. The most number of intersection crashes occurred at the intersection of Church Avenue and Flatbush Avenue. At this intersection there were a total of 30 crashes within the three years. The top contributing factors of these crashes, based on police reports, were failure to yield right of way, driver inattention and pedestrian error/confusion.

2

EXISTING CONDITION

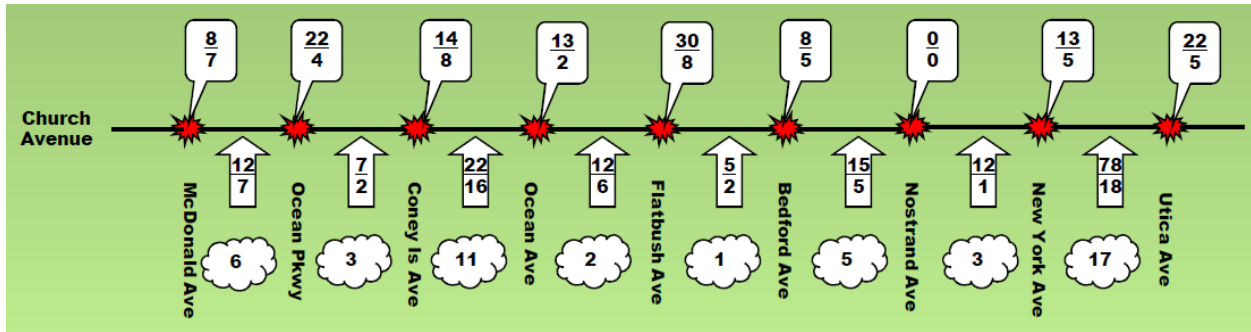
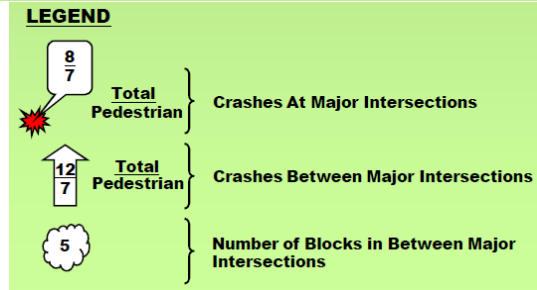


Figure 8: Traffic Crashes on Church Avenue between McDonald Avenue and Utica Avenue



2.4 PEDESTRIANS

Pedestrian level of service analysis was conducted at the nine major intersections shown in Figure 1. Sidewalk corner analysis has indicated poor pedestrian operations at the following four intersections along Church Avenue: Flatbush Avenue, Nostrand Avenue, New York Avenue and Utica Avenue. In addition, large numbers of pedestrians are observed to jaywalk across Church Avenue between East 17th and East 18th Streets.

The intense retail activity and bus stops for multiple routes at Flatbush Avenue (Figure 9) generates the largest pedestrian volume in the study area. At Nostrand Avenue (Figure 10) and East 18th Street, subway stations generate large numbers of pedestrians. At Nostrand Avenue, New York Avenue and Utica Avenue, the effective sidewalk widths are narrowed due to surrounding store encroachments, subway staircases and fencing, which has resulted in reduced sidewalk capacity.

2

EXISTING CONDITION



Figure 9: Pedestrian Activity at Church Avenue and Flatbush Avenue, Northeast Corner



Figure 10: Pedestrian Activity at Church Avenue and Nostrand Avenue, Southwest Corner

2.5 MASS TRANSIT

The B35 bus operates along Church Avenue throughout the entire length of the study area. In addition, six bus lines traverse Church Avenue: B67, B68, B41, B44, B46 & B49. Due to the delays in the traffic stream on Church Avenue, the B35 bus is often not able to keep up with the schedule. Also, buses have been observed to “bunch,” with multiple buses arriving at a single bus stop simultaneously (Figure 11). This creates unnecessary backup and queues, especially when hanging out of a far-side bus stop, blocking the adjacent crosswalk, and sometimes spilling back to the adjacent intersection.

There are three major subway-bus transfer points located along Church Avenue: McDonald Avenue for the F and G lines, East 18th Street for the B and Q lines, and Nostrand Avenue for the Nos. 2 and 5 lines.

2.6 AIR QUALITY

Motorized traffic activity is demonstrated to be one of the significant sources contributing to air contamination. The pollutants emitted by motor vehicles include carbon monoxide (CO), volatile organic compounds (VOC), and oxides of nitrogen (NOX), among others. All of these are detrimental to human health.



Figure 11: Church Avenue at McDonald Avenue, Looking West. Buses Arriving Simultaneously, Competing for Bus Stop Space

2

EXISTING CONDITION

Traffic congestion increases the emission rates of these contaminants in the air mix. Traffic analysis conducted for Church Avenue has shown that the congested traffic conditions during the weekday AM, weekday Midday, weekday PM and Saturday midday peak hour contribute to the high air quality emission rates of CO, VOC and NOX (Table 1). During these three peak hours, the CO emission rates range between 34.7 to 70.43 kilograms per hour, the VOC emission rates range between 8.04 to 16.32 kilograms per hour, and NOX emission rates range between 6.75 to 13.7 kilograms per hour. In the 2017 future without improvements condition, the CO emission rates for the weekday AM, weekday Midday, weekday PM and Saturday midday peak hours are projected to degrade to the range of about 36.78 to 76.83 kilograms per hour, VOC emission rates are projected to degrade to the range of about 8.52 to 17.81 kilograms per hour, and NOX to the range of about 7.16 to 14.95 kilograms per hour. Thus, any recommendations proposed for this project in reducing traffic congestion are expected to improve air quality of the study area. Please note that future projected emission rates do not account for improved emission standards or alternative fuels for new vehicles.

TABLE 1

CHURCH AVENUE PEAK HOUR – NETWORK AIR QUALITY SUMMARY - EXISTING CONDITION (2007)

PEAK HOUR	CONTAMINANTS	EXISTING CONDITION 2007 SYNCHRO EMISSION RATES (Kilograms Per Hour)	FUTURE WITHOUT IMPROVEMENTS 2017 SYNCHRO EMISSION RATES (Kilograms Per Hour)	EMISSION RATES COMPARISON % BETWEEN 2007 EXISTING VERSUS 2017 FUTURE WITHOUT IMPROVEMENTS
WEEKDAY AM PEAK HOUR	NOX	11.19	12.08	-8.0%
	VOC	13.33	14.38	-7.9%
	CO	57.53	62.07	-7.9%
WEEKDAY MIDDAY PEAK HOUR	NOX	6.75	7.16	-6.1%
	VOC	8.04	8.52	-6.0%
	CO	34.70	36.78	-6.0%
WEEKDAY PM PEAK HOUR	NOX	13.70	14.95	-9.1%
	VOC	16.32	17.81	-9.1%
	CO	70.43	76.83	-9.1%
SATURDAY MIDDAY PEAK HOUR	NOX	9.72	10.67	-9.8%
	VOC	11.58	12.71	-9.8%
	CO	49.95	54.84	-9.8%

Note: Negative (-) percentages represent degradation in air quality when compared to existing conditions.

3 IMPROVEMENTS

3. IMPROVEMENTS

In a geometrically constrained roadway network such as Church Avenue, with heavily built-up surroundings and limited right-of-way, the most significant traffic operational benefits could be achieved by optimizing the traffic network, taking advantage of locations where geometrical “spot improvements” could be implemented, and by applying traffic operational management strategies. Without the luxury of adding additional travel lanes or turn lanes in the constrained area, attention was focused on implementing efficient traffic control strategies and effective use of the available roadway in order to sustain growth and improve traffic and pedestrian operations and safety.

As such, alternatives that were included in the screening and assessment process were confined to utilizing the available curb-to-curb widths of Church Avenue. The improvements fall into four broad categories:

- Traffic Signal Timing and Offsets
- Pavement Markings
- Parking
- Intersection Specific Improvements

Sections 3.1 through 3.4 describe these improvements in detail. Section 3.5 briefly describes improvements that were considered but not recommended.

3.1 TRAFFIC SIGNAL TIMING AND OFFSET

During the traffic assessment, community walk-throughs and various field visits, it was identified that the existing traffic signal timing and offsets along Church Avenue did not provide for smooth traffic flow. Much of this is due to the fact that there are many major roadways that cross Church Avenue which are radial in direction to and from the central business districts of Downtown Brooklyn and Manhattan. These roadways also require good progression, and the challenge was to improve traffic capacity and progression on Church Avenue while maintaining, or even improving, flow on the cross roadways. In addition, considerations must be given for safe pedestrian crossing. In some instances, Leading Pedestrian Intervals (LPIs) and pedestrian crossing times superseded concerns for traffic flow. For example, at Flatbush Avenue and Church Avenue, the two LPI phases were each increased from six to seven seconds, reducing the time allocated to traffic movements by two seconds per cycle. Synchro software was used to improve the network as a whole. Table 2 presents the recommended signal phasing, timing and offset improvements, due to be implemented in 2012.

3

IMPROVEMENTS

**TABLE 2
SIGNAL PHASING, TIMING AND OFFSET CHANGES
OFFSET REFERENCED TO START OF GREEN ON MAJOR STREET
MAJOR STREET LISTED FIRST**

LOCATION	PEAK HR	PHASING	TIMING	OFFSET
Church Av & McDonald Av	All Times	--	Church +3 to 63, McDonald -3 to 57	--
Coney Island Av & Church Av	AM	Leading dual NB/SB left instead of leading SB-L	--	--
	Midday	Leading dual NB/SB left instead of leading SB-L	--	+43 to 48
	PM	Leading dual NB/SB left instead of leading SB-L	--	+12 to 60
	Sat	Leading dual NB/SB left instead of leading SB-L	--	+33 to 38
Coney Island Av & Albemarle Rd	AM	From Stop to signal control.	Cycle 120, NB CIA 70, Albemarle 50	79
	Midday	From Stop to signal control.	Cycle 120, NB CIA 52, Albemarle 38	37
	PM	From Stop to signal control.	Cycle 120, NB CIA 80, Albemarle 40	46
	Sat	From Stop to signal control.	Cycle 120, NB CIA 52, Albemarle 38	27
Church Av & Ocean Av	AM	--	Church +1 to 61, Ocean -1 to 59	--
	Midday	--	Church +4 to 49, Ocean -4 to 41	--
	Sat	--	Church +4 to 64, Ocean -4 to 56	--
Church Av & E 21 St	AM	--	Church -1 to 89, E 21 +1 to 31	--
Flatbush Av & Church Av	AM	--	Flatbush -1 to 65, Church -1 to 41, Both LPIs +1 to 7	--
	Midday	--	Flatbush -1 to 41, Church -1 to 35, Both LPIs +1 to 7	--
	PM	--	Flatbush -3 to 63, Church +1 to 43, Both LPIs +1 to 7	--
	Sat	--	Flatbush -5 to 61, Church +3 to 45, Both LPIs +1 to 7	--
Bedford Av & Church Av	AM	--	--	-3 to 52
	Midday	--	--	-5 to 76
	PM	--	--	+53 to 114
	Sat	--	--	+60 to 60
Bedford Av & Martense St	Sat	--	--	-31 to 60
Rogers Av & Church AV	AM	--	Cycle from 100 to 120, Rogers 57, Church 63	43
	Midday	--	Cycle from 100 to 90, Rogers 45, Church 45	0
	PM	--	Cycle from 100 to 120, Rogers 60, Church 60	15
	Sat	--	Cycle from 100 to 90, Rogers 40, Church 50	5
Nostrand Av & Church Av	AM	--	Nostrand -9 to 51, Church +9 to 69	+29 to 56
	Midday	--	Nostrand -3 to 42, Church +3 to 48	+29 to 52
	PM	--	--	+29 to 52
	Sat	--	Nostrand -3 to 42, Church +3 to 48	+29 to 52

3

IMPROVEMENTS

TABLE 2 (CONT'D)
SIGNAL PHASING, TIMING AND OFFSET CHANGES
OFFSET REFERENCED TO START OF GREEN ON MAJOR STREET
MAJOR STREET LISTED FIRST

LOCATION	PEAK HR	PHASING	TIMING	OFFSET
Church Av & New York Av	AM	--	Church -4 to 66, New York +4 to 54	+19 to 0
	PM	--	Church -4 to 66, New York +4 to 54	--
New York Av & Martense St	AM	--	--	+6 to 6
	PM	--	--	+31 to 31
Church Av & E 34 St	Midday	--	--	+45 to 55
	Sat	--	--	+45 to 55
Church Av & E 35 st	Midday	--	--	+45 to 55
	Sat	--	--	+45 to 55
Church Av & Brooklyn Av	Midday	--	--	+45 to 55
	Sat	--	--	+45 to 55
Church Av & E 37 St	Midday	--	--	+45 to 55
	Sat	--	--	+45 to 55
Church Av & E 38 St	Midday	--	--	+45 to 55
	Sat	--	--	+45 to 55
Church Av & E 39 St	Midday	--	--	+45 to 55
	Sat	--	--	+45 to 55
Church Av & E 40 St	Midday	--	Church +9 to 54, E 40 -9 to 36	+45 to 55
	Sat	--	Church +9, E 40 -9	+45 to 55
Church Av & Albany Av	Midday	--	Church +9 to 54, E 40 -9 to 36	+45 to 55
	Sat	--	Church +9, E 40 -9	+45 to 55
Church & E 45 St	Am	--	Cycle 90 to 120, Church 84, E 45 36	0
	Midday	--	Church -9 to 54, E 45 +9 to 36	+7.3 to 55
	PM	--	Cycle 90 to 120, Church 84, E 45 36	85
	Sat	--	Cycle 90, Church 54, E 45 36	+7.3 to 55
Church & Schenectedy Av	Midday	--	Cycle 90, Church 54, Schenectedy 36	+44 to 55
Church Av & 48 St	Midday	--	Cycle 90, Church 54, E 48 36	+44 to 55
Church Av & E 49 St	Midday	--	Cycle 90, Church 54, E 48 36,	+44 to 55
Utica Av & Church Av	AM	--	Utica -1 to 57, LPI +1 to 7	--
	Midday	--	Utica -1 to 42, LPI +1 to 7	--
	PM	--	Utica -1 to 57, LPI +1 to 7	--
	Sat	--	Utica -1 to 42, LPI +1 to 7	--

3 IMPROVEMENTS

3.2 PAVEMENT MARKING

A pavement marking plan has been prepared and implemented in order to define roadway usage and enhance pedestrian safety along Church Avenue (Figure 12). The following corridor wide improvements are contained in the plan:

- *Parking Lane Markings:* Introduction of four inch wide solid white parking lane markings visually define the available moving lane on Church Avenue by differentiating it from the parking lane. By providing positive guidance to traffic flow, it also discourages double-parking and calms traffic flow.
- *Bus Stop Markings:* Curbside bus stop lanes have been demarked utilizing a 4 inch wide dashed white line to provide positive guidance to the bus drivers and motorists about the appropriate use and limit of bus stop lanes.
- *Right-Turn Bays:* Approximately two to three car parking spaces have been removed at a few intersection approaches along Church Avenue to provide right-turn bays.
- *Peg-a-Trac Markings:* Dashed line Peg-a-Trac markings have been provided at key intersections to guide drivers through intersections.
- *Stop Bars:* Stop bars have been set back ten feet from crosswalks. At many locations they were previously set back at five feet or were not provided at all.

The striping plan also illustrates the some of the site specific improvements described in Section 3.4

3 IMPROVEMENTS

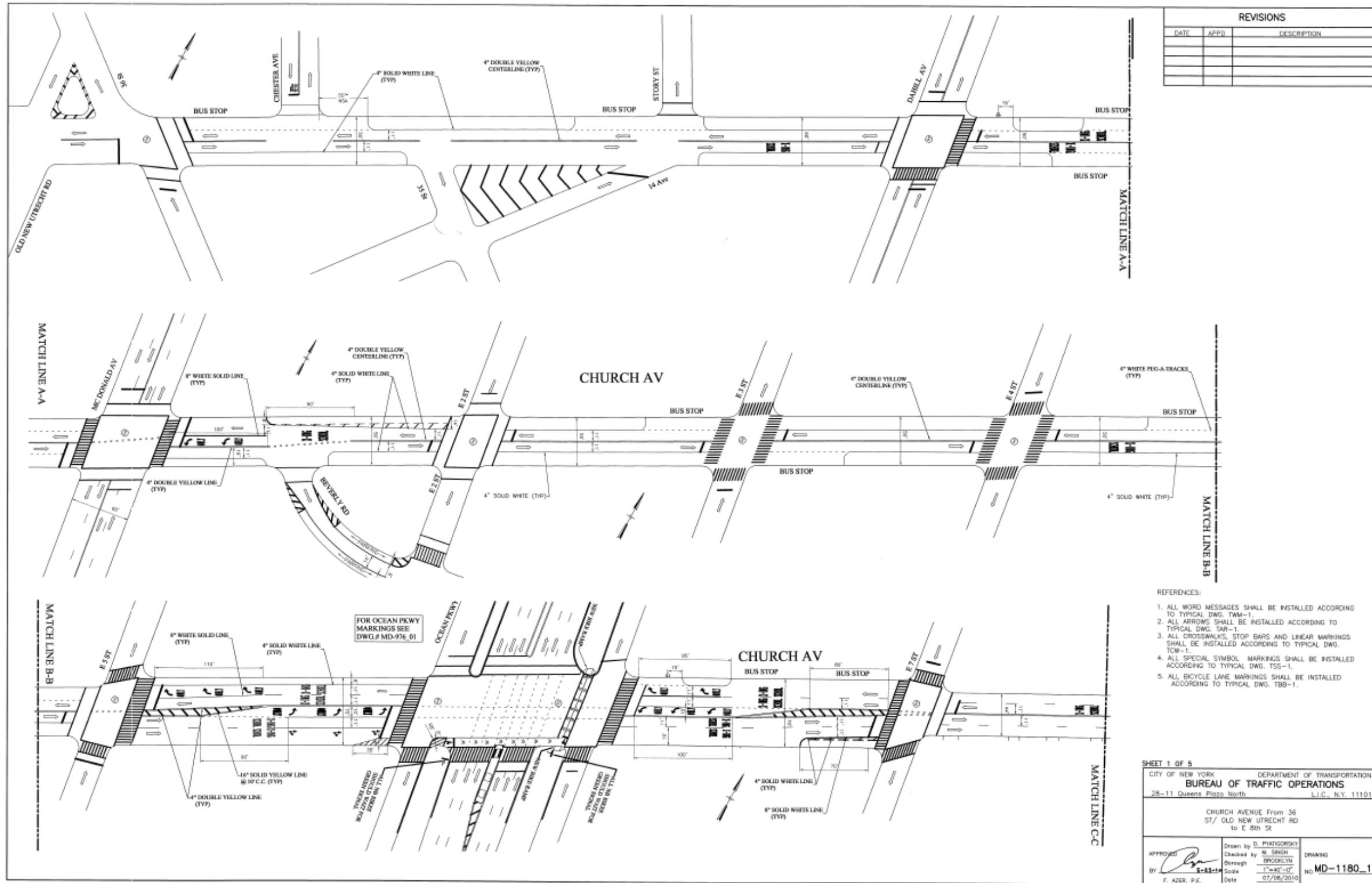


Figure 12: Striping Plan - Page 1 of 5 (Cont'd)

3 IMPROVEMENTS

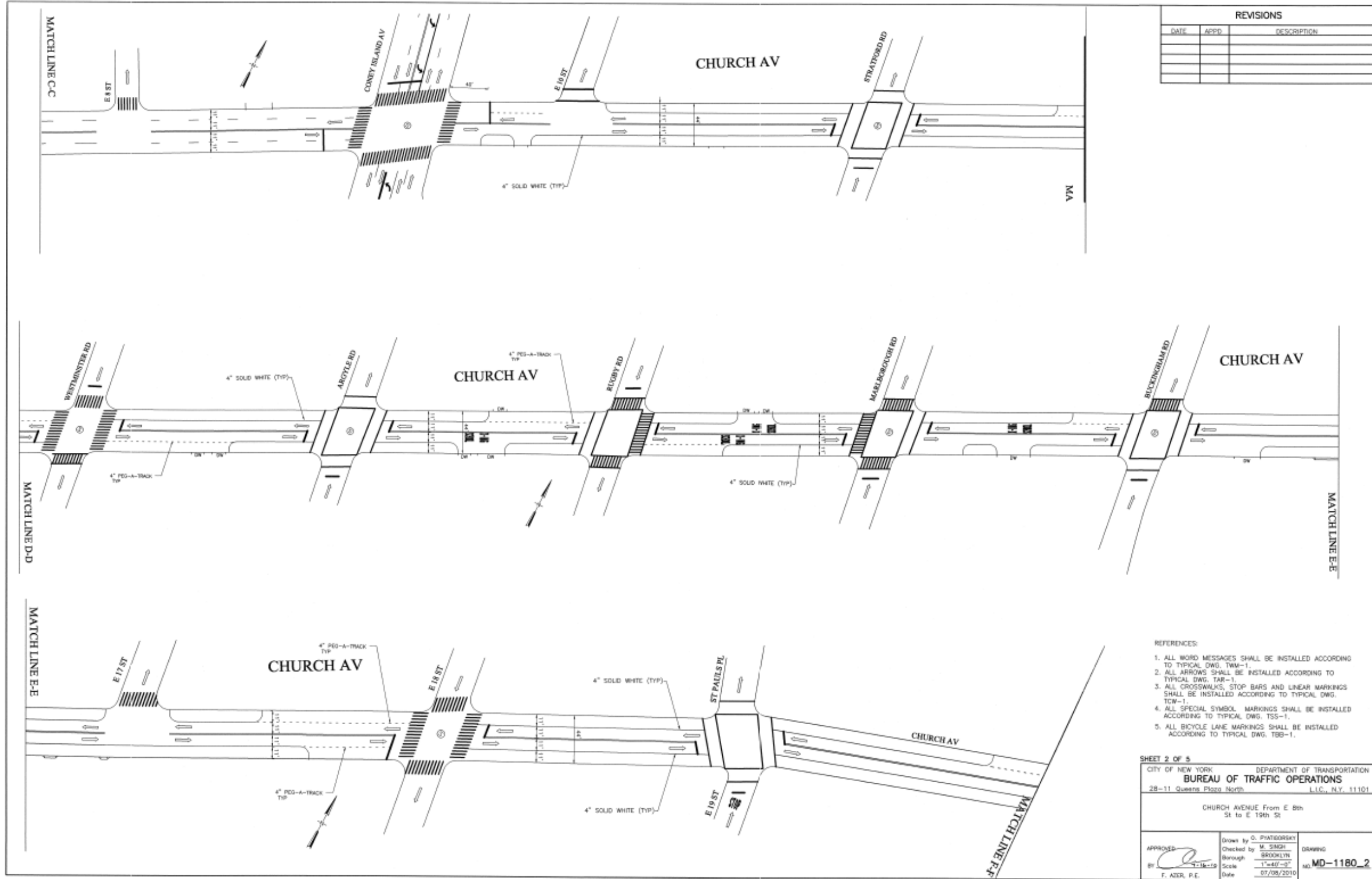
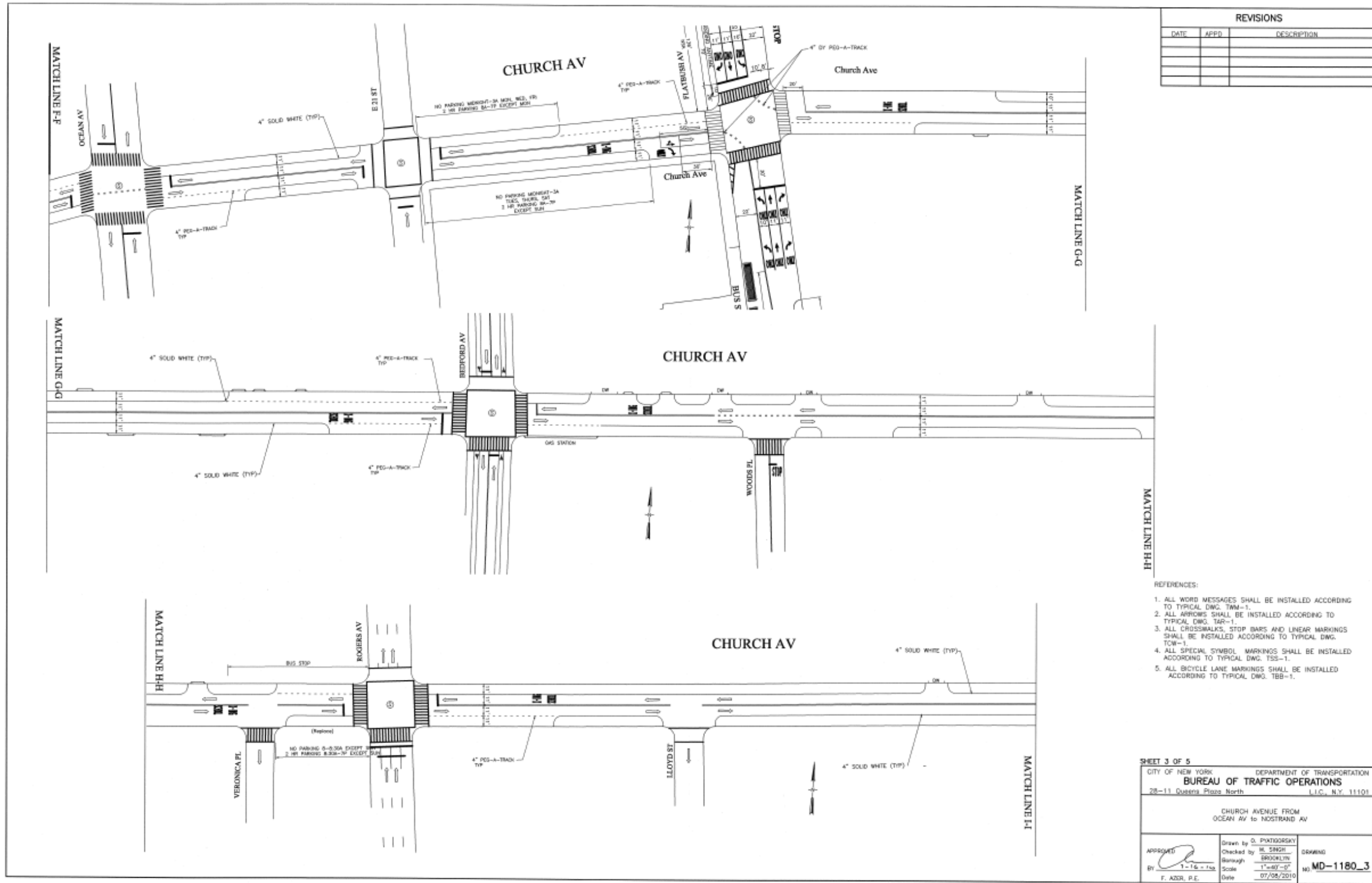


Figure 12: Striping Plan - Page 2 of 5 (Cont'd)

3 IMPROVEMENTS



REVISIONS		
DATE	APPD	DESCRIPTION

- 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.

SHEET 3 OF 5
 CITY OF NEW YORK DEPARTMENT OF TRANSPORTATION
BUREAU OF TRAFFIC OPERATIONS
 28-11 Queens Plaza North L.I.C., N.Y. 11101

CHURCH AVENUE FROM
 OCEAN AV TO NOSTRAND AV

APPROVED BY F. AZER, P.E.	Drawn by D. PAKHOMOVSKY Checked by M. SENGH Borough BROOKLYN Scale 1"=87'-0" Date 07/08/2010	DRAWING NO. MD-1180_3
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Figure 12: Striping Plan - Page 3 of 5 (Cont'd)

3 IMPROVEMENTS

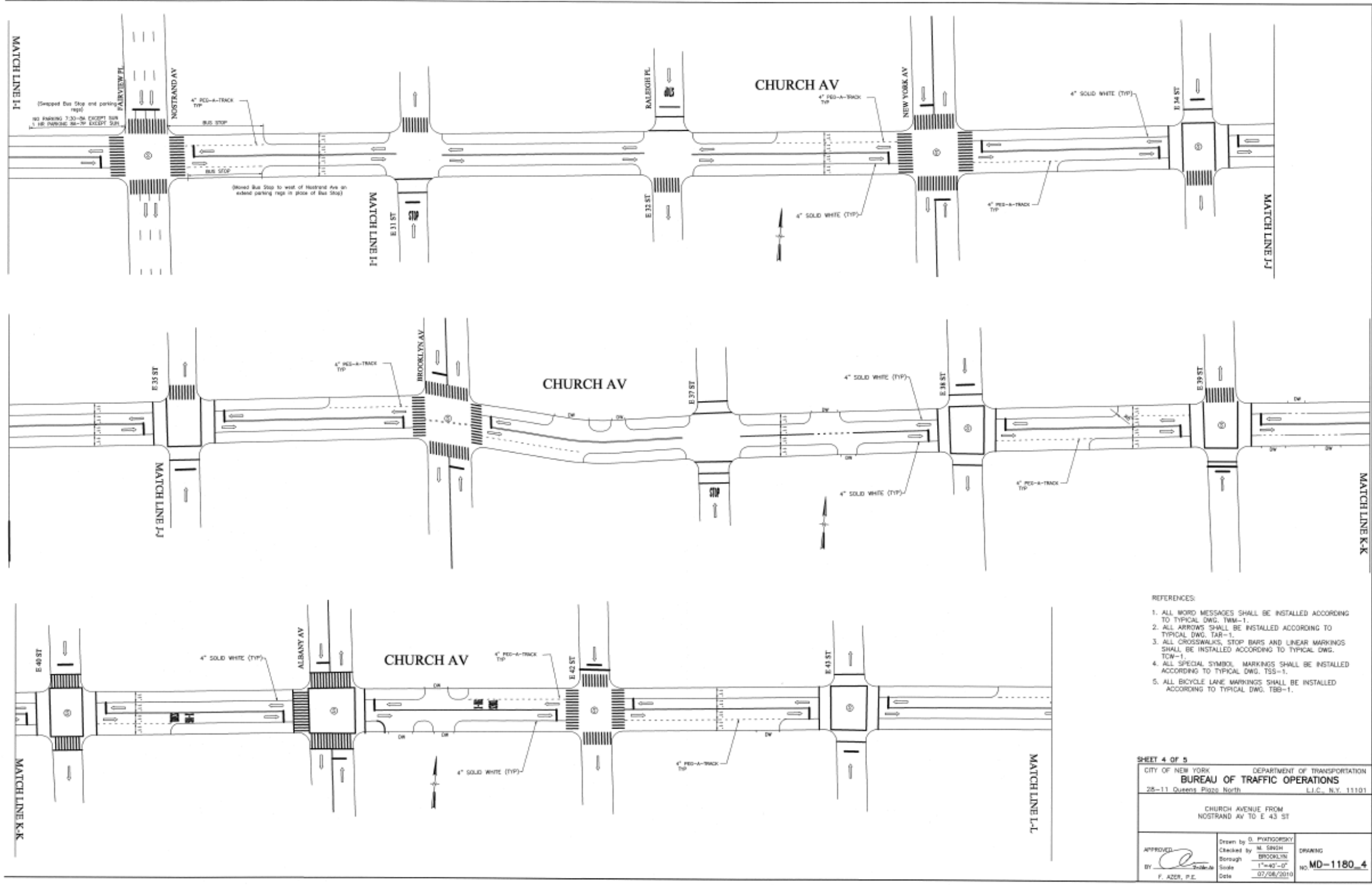


Figure 12: Striping Plan - Page 4 of 5 (Cont'd)

3 IMPROVEMENTS

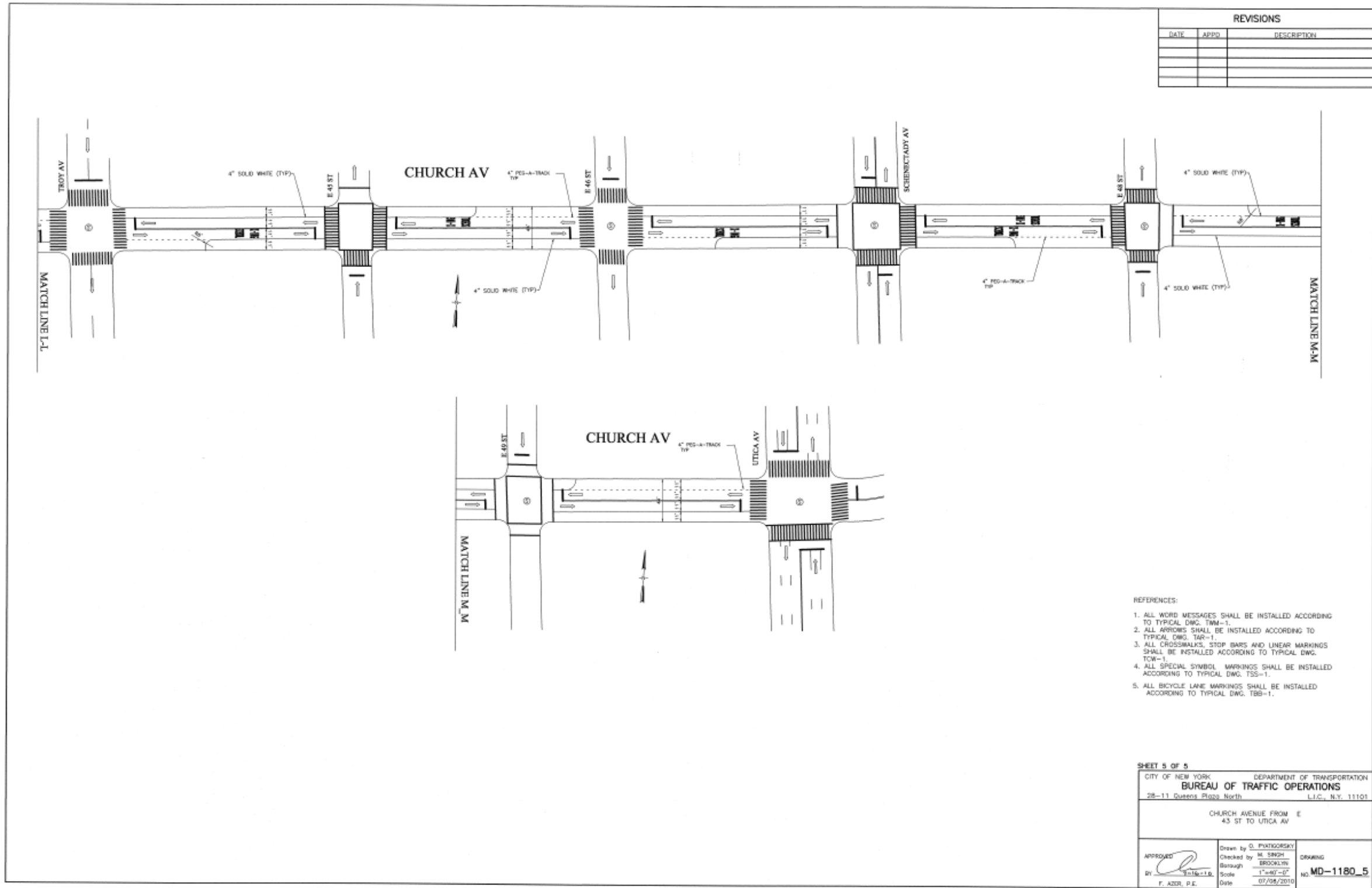


Figure 12: Striping Plan - Page 5 of 5

3

IMPROVEMENTS

3.3 PARKING

The most significant improvement in utilizing curbside parking space is the introduction of truck delivery windows, implemented during 2011.

As mentioned earlier in the report, curbside double parking of trucks during delivery operations was found to be a major concern. This is mainly due to the lack of off-street loading docks and on-street loading spaces along Church Avenue. This practice occurs most notably between East 16th Street and East 21st Street. Within these blocks a supplemental parking analysis was conducted after Community Board 14 and the Church Avenue Business Improvement District (BID) asked NYCDOT for assistance in providing truck delivery operations. The parking surveys indicated that at least one travel lane was blocked by one or more delivery vehicles about 25% of the time on a typical weekday from 6AM to 6PM. A temporal distribution of this travel lane blockage is presented in Figure 13. This survey also revealed that about 65% of all truck delivery operations occur before 12PM, as shown in Figure 14. This is consistent with observations for the entire Church Avenue study area. Commercial delivery trends obtained from the Fall 2008 Church Avenue BID Commercial Delivery and Parking Capacity Study indicates truck delivery operations within the area vary between 150 and 700 per day. Thus, a delivery window program was developed that would balance the delivery needs with customer demand for metered parking spaces.

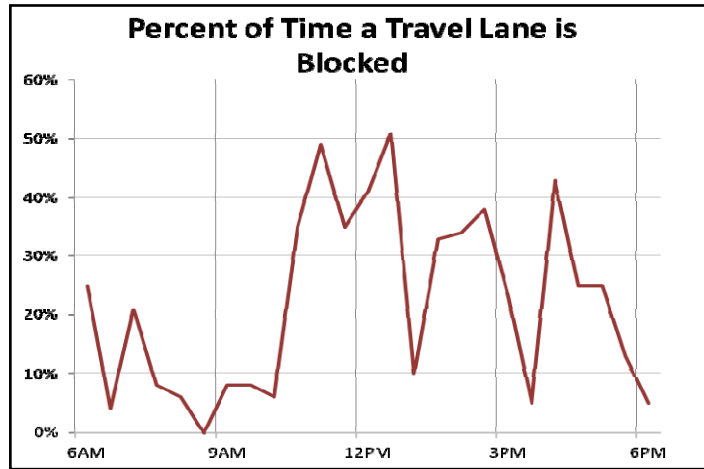


Figure 13: Weekday Lane Blockage on Church Avenue between East 16th Street and East 21st Street

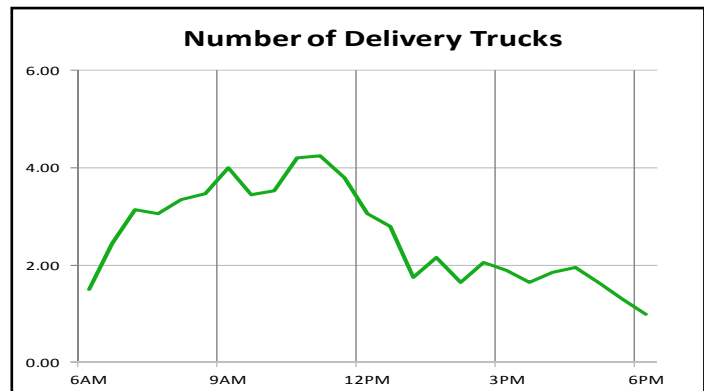


Figure 14: Weekday Number of delivery Trucks on Church Avenue between East 16th Street and East 21st Street

The delivery window dedicates a number of curbside parking spaces to truck loading and unloading use for a specific time period on weekdays. With the support of the local community, the following delivery windows were implemented between East 16th Street and East 21st Street along Church Avenue:

- Delivery Zone Window from 7AM to 12PM Monday thru Friday – thirty-one parking spaces.

3 IMPROVEMENTS

- Delivery Zone Window from 7AM to 3PM Monday thru Friday – thirty-one parking spaces.

Normal one-hour metered parking resumes after the loading and unloading windows indicated above. The locations of these metered parking spaces dedicated to Delivery Zone Windows for truck loading and unloading are presented in Figure 15.

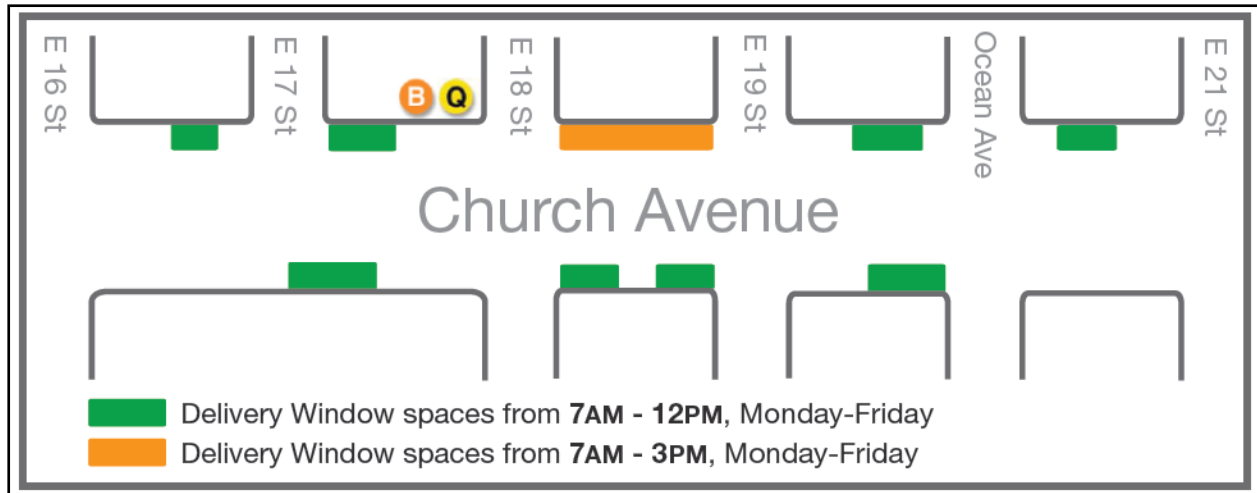


Figure 15: Delivery Windows on Church Avenue

Other parking related recommendations include the replacement of the 355 traditional single-space parking meters with muni-meters. The muni-meter is a proven effective technology to fit more vehicles within the same curbside parking space. Under the traditional one space per meter system, the space allotted (usually 18 to 20 feet) accommodates larger vehicles; thus space is wasted when smaller cars park. Some studies report as much as 15% extra capacity when converting to muni-meters. In addition, parking can be paid by credit card or pre-paid parking card, eliminating the incidence of having to “run for change.”

Finally, parking capacity will be increased by creating 17 one-hour metered spaces on Church Avenue between East 21st Street and Flatbush Avenue on the north curb and part of the south curb that was previously No Parking 8AM-6PM. This is shown in detail in the Intersection Specific Improvements section.

3.4 INTERSECTION SPECIFIC IMPROVEMENTS

Table 3 summarizes the intersection specific recommendations. Many of these recommendations are aimed at improving mobility and safety for pedestrians, bicyclists and transit users, as well as improving conditions for motorists. The pages that follow give detailed descriptions of the improvements.

3

IMPROVEMENTS

**TABLE 3
SUMMARY OF INTERSECTION SPECIFIC IMPROVEMENTS**

INTERSECTION	Revise Signal Phasing, Timing and/or Offset	Restripe Crosswalk(s)	Restripe Stop Bar(s)	Provide Parking and/or Bus Stop Lane	Provide Peg-a-Trac Markings	Provide Left-Turn Bay	Provide Right-Turn Bay	Facilitate right-turns by removing parking	Provide Bike Path Markings	Ban Left Turns	Reconfigure Traffic Lanes	Install Pedestrian Refuge Island	Install Curb Extensions	Install or Replace Pedestrian Ramps	Provide Additional On-Street Parking	Install/Relocate Bus Shelter
Church Ave & McDonald Ave	2	1	1	1		1							3	3	1	
Church Ave & Beverley Rd		1		1									1			
Church Ave & Ocean Pkwy		1	1	1	1				1			1, 3				
Church Ave & Coney Island Ave	1	1	1	1												
Albemarle Rd & Coney Island Ave	1	1	1	1	1					1		1	3	3		
Church Ave & Ocean Ave	2	1	1	1	1	1				1		1				
Church Ave & East 21st St																
Church Ave & Flatbush Ave	1, 2	1	1	1	1	1	1				1				3	
Church Ave & Bedford Ave	2	1	1	1									3	3		3
Church Ave & Nostrand Ave	2	1	1	1												3
Church Ave & New York Ave	2	1	1	1				1								3
Church Ave & Utica Ave	1	1	1	1												3

Notes:

- 1: Improvement has been implemented in 2010 or 2011
- 2: Improvement will be implemented in 2012
- 3: Improvement will be implemented in 2013

3

IMPROVEMENTS

3.4.1 Church Avenue & McDonald Avenue/Beverly Road

Improvements for this location are presented in Figure 16.

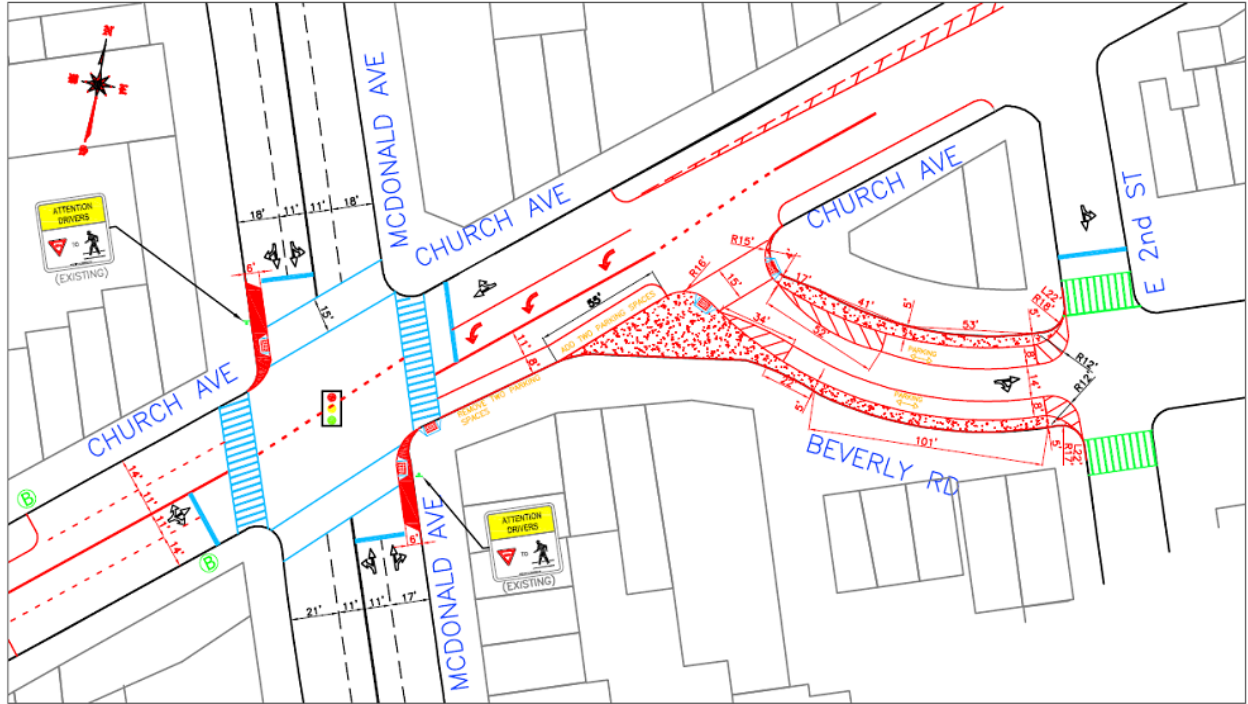
Problems:

- Poor traffic operations during the weekday AM and PM peak hours at the McDonald Avenue and Church Avenue intersection. During the weekday AM peak, the eastbound left-turn lane group is congested. During the weekday PM peak, the entire westbound approach is congested.
- A total of 10 crashes occurred during a three-year study period at these intersections, of which 9 involved pedestrians. Seven pedestrian crashes occurred at McDonald Avenue intersection while 2 pedestrian crashes occurred at Beverly Road intersection. Drivers' inattention and pedestrian confusion were cited as main causes of these crashes.
- Dangerous, long crosswalk across Beverley Road at McDonald Avenue, as drivers making the eastbound right-turn often fail to slow down because of the large radius at this uncontrolled crossing.

Improvements:

- Green time will be reallocated as shown in Table 2.
- Crosswalks have been restriped.
- Stop bars have been provided 10 feet from crosswalks.
- Parking lanes have been striped along Beverley Road from McDonald Avenue to East 2nd Street.
- Parking and bus stop lanes have been striped along Church Avenue.
- A left-turn bay has been installed at the westbound approach.
- Curb extensions have been installed:
 - On both sides of Beverley Road from McDonald Avenue to East 2nd Street.
 - At the southwest corner of Beverley Road and Church Avenue.
- Two extra parking spaces have been provided along Church Avenue at the curb extension on the southwest corner of Beverley Road.
- Curb extensions and pedestrian ramps will be installed on the east side of the south crosswalk, and the west side of the north crosswalk at McDonald Avenue and Church Avenue.

3 IMPROVEMENTS



Legend:

	Existing School Crosswalk		Proposed High Visibility Crosswalk		Proposed Striping		Proposed Pedestrian Refuge Island (Raised Median)
	Proposed Pedestrian Ramp		Proposed Stopbar as per Recommended Standard		Relocate Bus Stop		Proposed Traffic Sign
	Restripe School Crosswalk		Remove Existing Parking (Daylighting)		Existing Bus Stop Location		Existing Signalized Intersection
	Restripe High Visibility Crosswalk		Resurface Pavement		Existing Bus Stop and Shelter		Proposed Metered Parking
	Restripe Standard Pedestrian Crosswalk		Pavement Marking Symbol		New Bus Stop Shelter		Proposed Curb Extension (Neckdown)
			Direction of Travel		Proposed Quick Curb		Proposed Recommendations already implemented

Figure 16: Church Avenue and McDonald Avenue/Beverly Road Improvements

3

IMPROVEMENTS

3.4.2 Church Avenue & Ocean Parkway

Improvements for this location are presented in Figure 17.

Problems:

- Poor traffic operations, especially during the weekday AM peak hour. During this time, the eastbound left-turn lane group, the westbound through and right lane group, and the entire northbound approach is congested.
- A total of 22 crashes occurred during a three-year study period at this intersection, of which 4 involved pedestrians. One of the main reasons cited for pedestrian crashes was driver failure to yield right of way.
- Ocean Parkway is a wide, forbidding crossing for pedestrians.
- There is no guidance for bicyclists to travel from/to the Ocean Parkway bike path on the west mall south of Church Avenue to/from the bike path on the east side north of Church Avenue.
- Lane markings are confusing.

Improvements:

- Crosswalks have been restriped.
- *Stop bars have been provided 10 feet from crosswalks.*
- Parking and bus stop lanes have been striped.
- Peg-A-Track striping has been installed for positive guidance across a wide intersection box in both directions.
- Bicycle markings have been striped for bicyclists to travel from/to the Ocean Parkway bike path on the west mall south of Church Avenue to/from the bike path on the east side north of Church Avenue.
- A pedestrian refuge island has been provided for the south crosswalk to provide pedestrian refuge.
- A pedestrian refuge island is being planned for the north crosswalk to provide pedestrian refuge.

3 IMPROVEMENTS

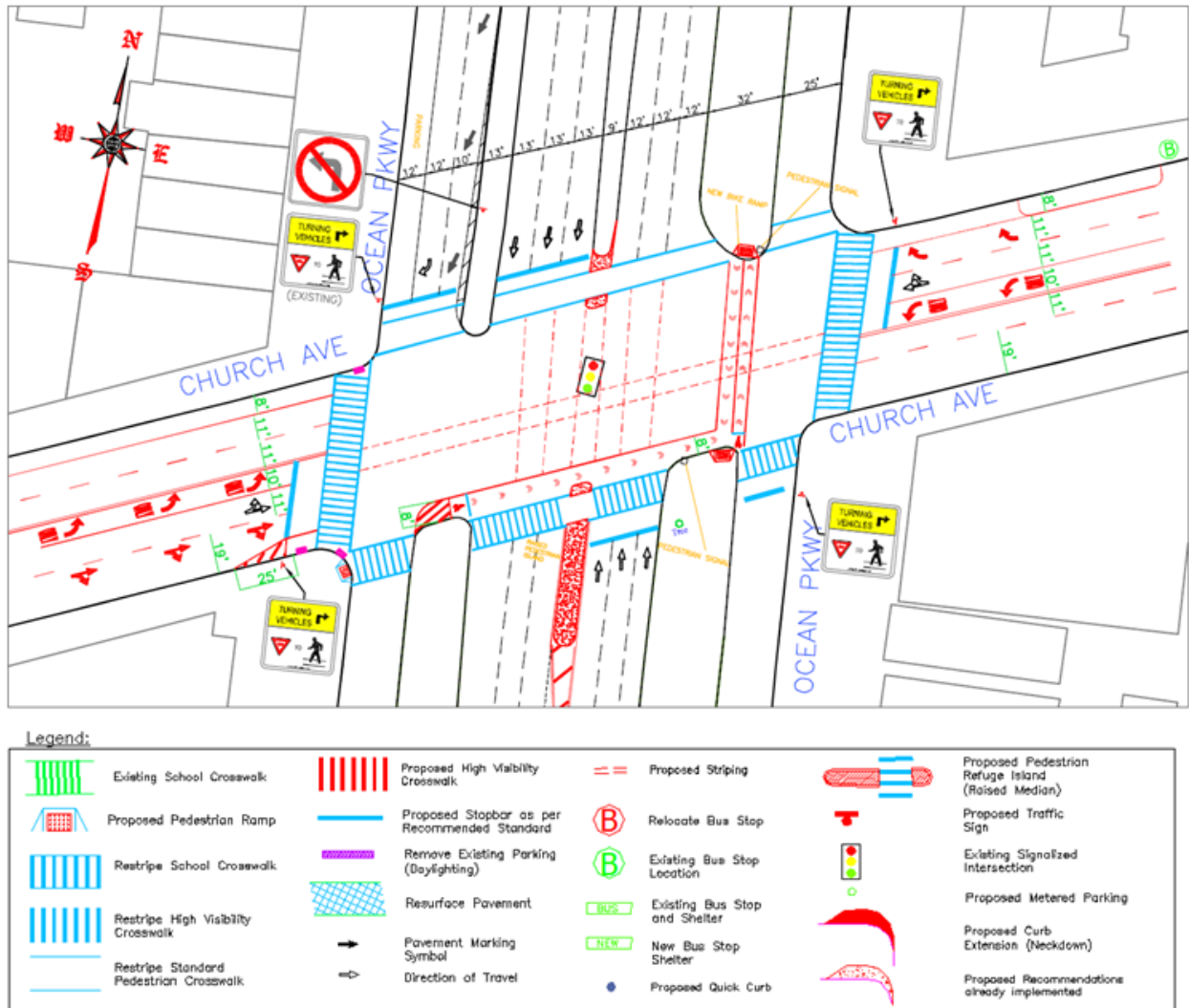


Figure 17: Church Avenue and Ocean Parkway Improvements

3

IMPROVEMENTS

3.4.3 Church Avenue, Coney Island Avenue and Albemarle Road

Improvements for this location are presented in Figure 18.

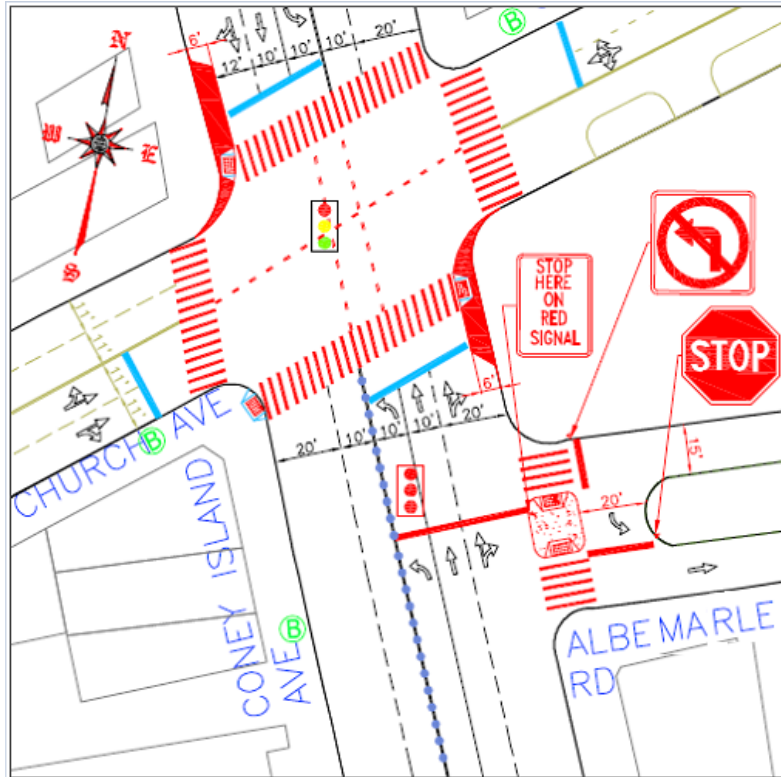
Problems:

- Poor traffic operations during the weekday AM, midday and PM peak hours at the Church Avenue and Coney Island Avenue intersection. The northbound left-turn lane group is especially congested.
- A total of 14 crashes occurred during a three-year study period at the Coney Island Avenue intersection, of which 8 involved pedestrians. One of the main reasons cited for pedestrian crashes was driver failure to yield right of way. The average crash rate at this intersection is higher than the statewide average.
- Albemarle Road and Church Avenue are two very closely spaced intersections on Coney Island Avenue. Frequently, when the northbound approach of Coney Island Avenue and Church Avenue intersection is stopped, the ensuing queue begins in front of Albemarle Road instead of before Albemarle Road where the stop bar is located. As a result, access to and egress from Albemarle on to Coney Island Avenue is frequently blocked by these queued vehicles.
- Motorists traveling southbound on Coney Island Avenue are also noted to make illegal left turns onto Albemarle Road by crossing the Coney Island Avenue yellow line against high opposing traffic. This further adds to queuing and unsafe traffic conditions between these intersections.
- Drivers perform dangerous left turns in and out of the carwash located on the west side of Coney Island Avenue directly across from Albemarle Road.

Improvements:

- Phasing for Coney Island Avenue approaching Church Avenue has been changed from leading southbound left-turn phase to leading dual northbound/southbound left-turn phase.
- Coney Island Avenue at Albemarle Road has been changed from STOP to signal control. The signal is coordinated with Church Avenue.
- High visibility crosswalks have been provided at all four crosswalks at Church Avenue and Coney Island Avenue, and along the east side of Coney Island Avenue at Albemarle Road.
- Stop bars have been provided 10 feet from crosswalks. The northbound stop bar is moved up to align with the north edge of the Albemarle Road refuge island.
- Parking and bus stop lanes have been striped along Church Avenue.
- Peg-A-Track striping has been installed for positive guidance in both directions at Church Avenue and Coney Island Avenue.
- Provision has been made for westbound U-turn on Albemarle Road just before approaching Coney Island Avenue.
- Quick Kurb delineators have been installed along the double yellow line of Coney Island Avenue to prevent left-turns in or out of Albemarle Road or the car wash.
- A pedestrian refuge island has been provided along the east side of Coney Island Avenue crossing Albemarle Road.
- Curb extensions and pedestrian ramps will be installed on the east side of the south crosswalk, and the west side of the north crosswalk at Coney Island Avenue Avenue and Church Avenue.

3 IMPROVEMENTS



Legend:

	Existing School Crosswalk		Proposed High Visibility Crosswalk		Proposed Striping		Proposed Pedestrian Refuge Island (Raised Median)
	Proposed Pedestrian Ramp		Proposed Stopbar as per Recommended Standard		Relocate Bus Stop		Proposed Traffic Sign
	Restripe School Crosswalk		Remove Existing Parking (Daylighting)		Existing Bus Stop Location		Existing Signalized Intersection
	Restripe High Visibility Crosswalk		Resurface Pavement		Existing Bus Stop and Shelter		Proposed Metered Parking
	Restripe Standard Pedestrian Crosswalk		Pavement Marking Symbol		New Bus Stop Shelter		Proposed Curb Extension (Neckdown)
			Direction of Travel		Proposed Quick Curb		Proposed Recommendations already implemented

Figure 18: Church Avenue, Coney Island Avenue and Albemarle Road Improvements

3

IMPROVEMENTS

3.4.4 Church Avenue & Ocean Avenue

Improvements for this location are presented in Figure 19.

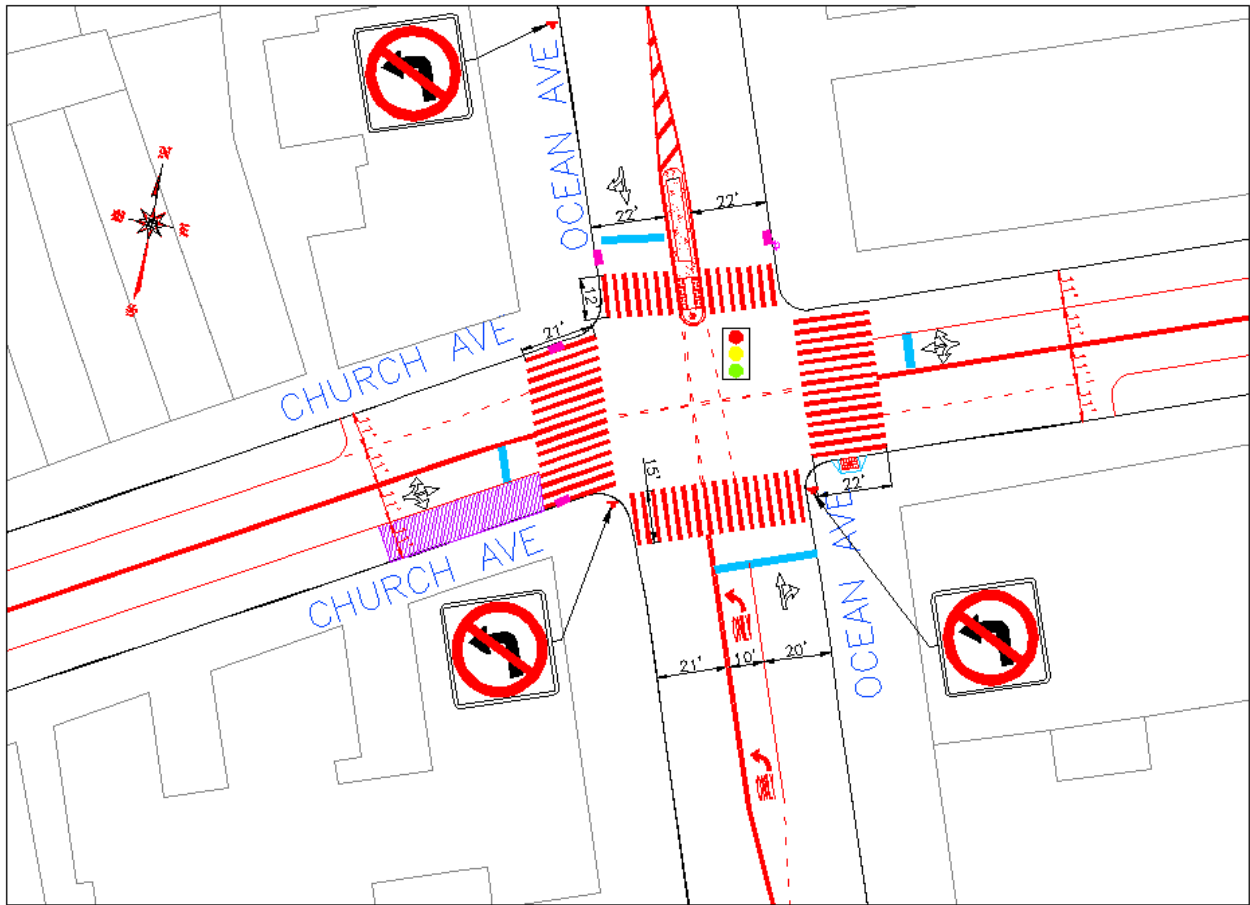
Problems:

- Poor traffic operations during all study periods (weekday AM, midday, PM, and Saturday peak hours). The westbound and northbound approaches experience congestion during the weekday AM peak; northbound and eastbound approaches during the weekday midday and Saturday peaks; eastbound, northbound and southbound approaches during the weekday PM peak.
- Northbound and southbound left turns are permitted with no turn bays, delaying through traffic.
- A total of 13 crashes occurred during a three-year study period at this intersection, of which 2 involved pedestrians. Driver inattention, cars following very closely and improper turning were cited as some of the main causes of these crashes. The average crash rate at this intersection is higher than the statewide average.

Improvements:

- Green time will be reallocated as shown in Table 2.
- High visibility crosswalks have been provided at all four crosswalks.
- Stop bars have been provided 10 feet from crosswalks.
- Parking and bus stop lanes have been striped along Church Avenue.
- Peg-A-Track striping has been installed for positive guidance along Church Avenue.
- Northbound left turn bay has been striped.
- Southbound left-turns have been prohibited at all times.
- A pedestrian refuge island has been installed in the north crosswalk.

3 IMPROVEMENTS



Legend:

	Existing School Crosswalk		Proposed High Visibility Crosswalk		Proposed Striping		Proposed Pedestrian Refuge Island (Raised Median)
	Proposed Pedestrian Ramp		Proposed Stopbar as per Recommended Standard		Relocate Bus Stop		Proposed Traffic Sign
	Restripe School Crosswalk		Remove Existing Parking (Daylighting)		Existing Bus Stop Location		Existing Signalized Intersection
	Restripe High Visibility Crosswalk		Resurface Pavement		Existing Bus Stop and Shelter		Proposed Metered Parking
	Restripe Standard Pedestrian Crosswalk		Pavement Marking Symbol		New Bus Stop Shelter		Proposed Curb Extension (Neckdown)
	Restripe Standard Pedestrian Crosswalk		Direction of Travel		Proposed Quick Curb		Proposed Recommendations already implemented

Figure 19: Church Avenue and Ocean Avenue

3

IMPROVEMENTS

3.4.5 Church Avenue, Flatbush Avenue and East 21st Street

Improvements for this location are presented in Figure 20.

Problems:

- Poor traffic operations during all study periods (weekday AM, midday, PM, and Saturday peak hours).
- A total of 30 crashes occurred during a three-year study period at this intersection, of which 8 involved pedestrians. Failure to yield right of way, drivers inattention, unsafe speed, improper turning, cars following very closely and aggressive driving were cited as some of the causes of these crashes. The average crash rate at this intersection is higher than the statewide average.
- Very high pedestrian volume conflicts with turning vehicles.
- Although this roadway is striped as two lanes in each direction, chronic double parking effectively removes an available lane. Through traffic must frequently change lanes to avoid double parkers in the right lane and left-turners in the left lane.

Improvements:

- LPIs for all four crosswalks have been increased from six to seven seconds.
- Green time will be reallocated as shown in Table 2.
- Crosswalks have been restriped.
- Stop bars have been provided 10 feet from crosswalks.
- Parking and bus stop lanes have been striped.
- Flatbush Avenue in both directions has been narrowed to one lane north and south of Church Avenue to provide an extra wide space for double parkers.
- Peg-A-Track striping has been installed for northbound and southbound left-turns.
- Northbound and southbound left and right turn bays have been striped on Flatbush Avenue.
- An eastbound right-turn bay has been striped on Church Avenue.
- Metered parking will be provided on the north and south sides of Church Avenue between East 21st Street and Flatbush Avenue.

3 IMPROVEMENTS

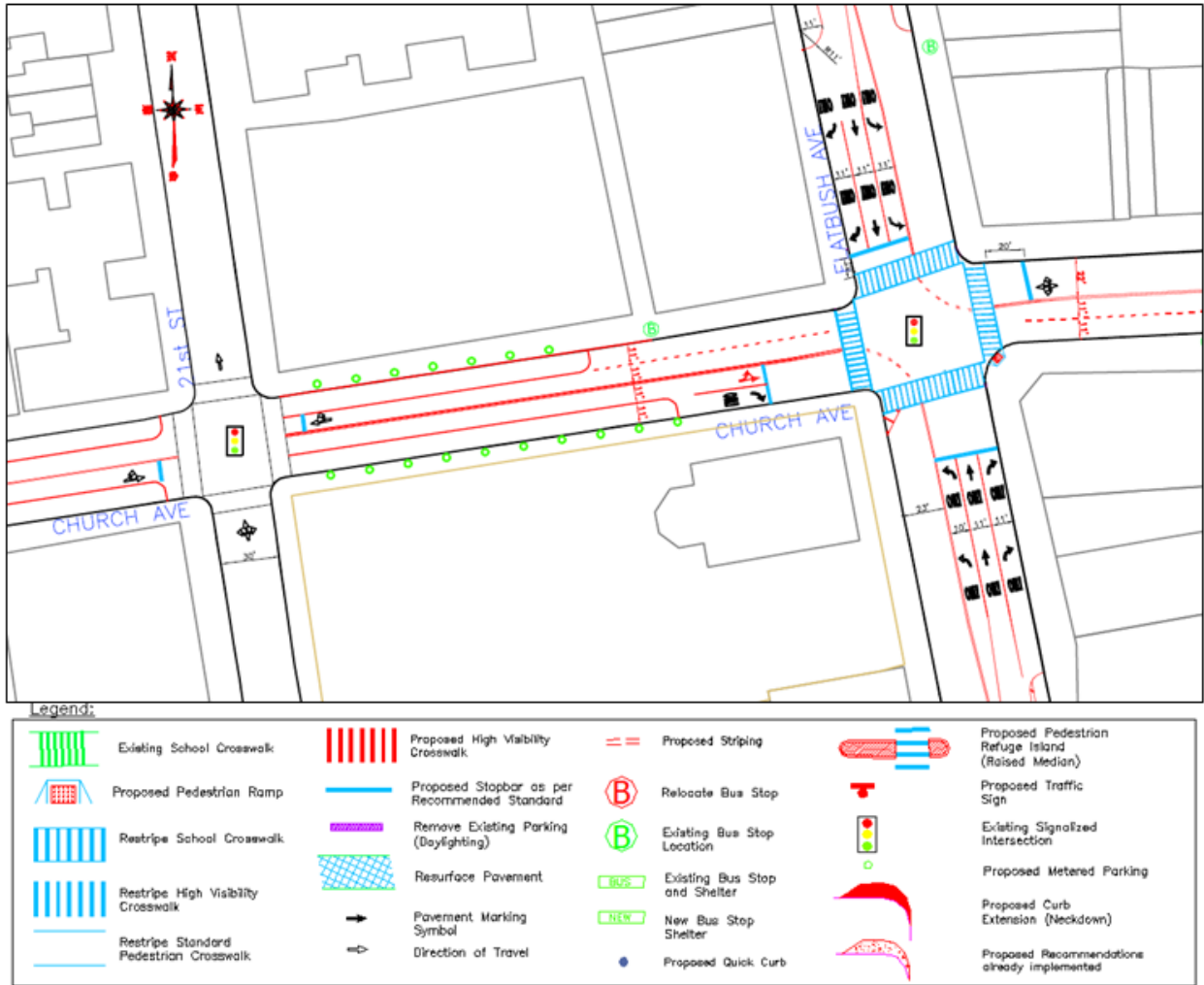


Figure 20: Church Avenue, Flatbush Avenue and East 21st Street Improvements

3

IMPROVEMENTS

3.4.6 Church Avenue & Bedford Avenue

Improvements for this location are presented in Figure 21.

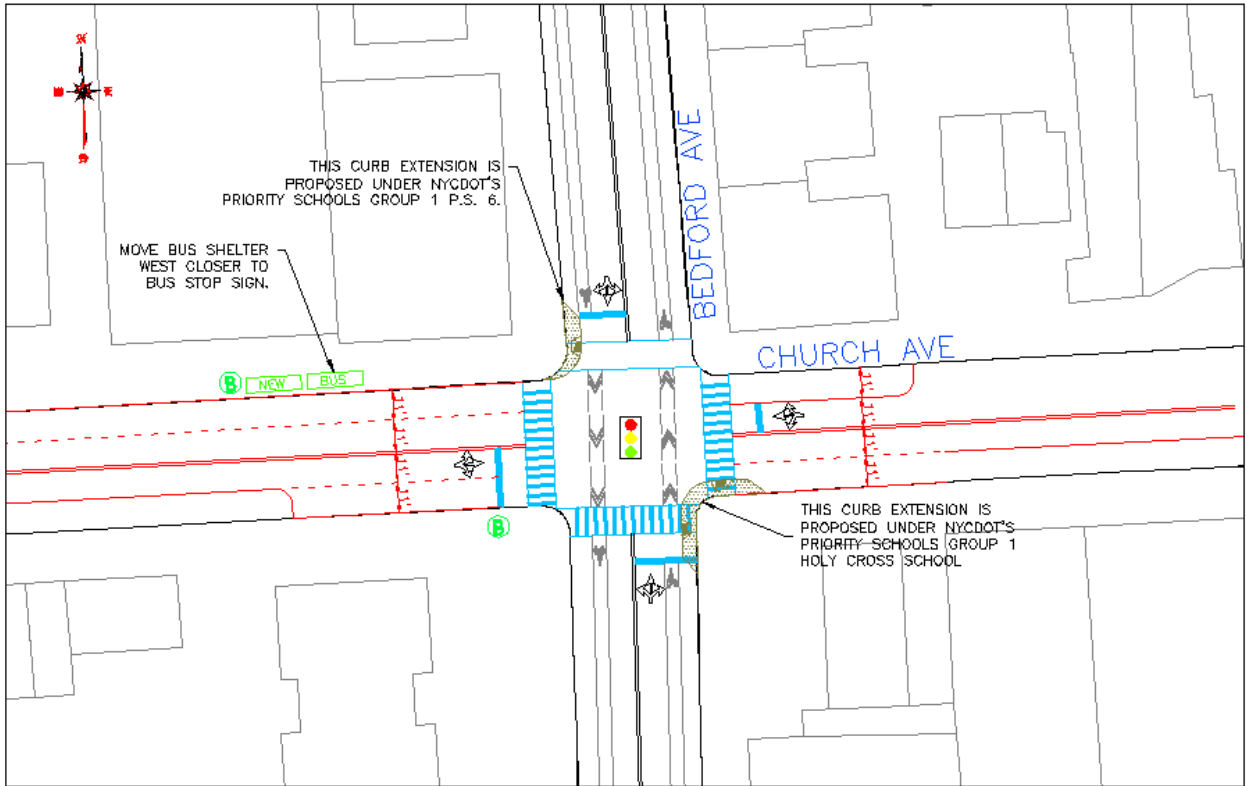
Problems:

- Poor traffic operations during the weekday AM, PM, and Saturday peak hours. All approaches experience congestion during the weekday AM and PM peak hours, while the westbound and northbound approaches experience congestion during the Saturday peak hour.
- A total of 8 Crashes occurred during a three-year study period at this intersection, of which 5 involved pedestrians. One of the main reasons cited for these crashes was driver failure to yield right of way.
- Very high pedestrian volume, partially generated by a nearby school, conflicts with turning vehicles.
- The westbound far-side bus shelter is located very close to the intersection, creating traffic operational and pedestrian safety issues.

Improvements:

- Offsets will be changed as shown in Table 2.
- New crosswalks have been striped.
- Stop bars have been provided 10 feet from crosswalks.
- Parking and bus stop lanes have been striped.
- Curb extensions and pedestrian ramps will be installed on the east side of the south crosswalk, the west side of the north crosswalk, and the south side of the east crosswalk.
- The existing westbound bus shelter will be moved further west.

3 IMPROVEMENTS



Legend:

	Existing School Crosswalk		Proposed High Visibility Crosswalk		Proposed Striping		Proposed Pedestrian Refuge Island (Raised Median)
	Proposed Pedestrian Ramp		Proposed Stopbar as per Recommended Standard		Relocate Bus Stop		Proposed Traffic Sign
	Restripe School Crosswalk		Remove Existing Parking (Daylighting)		Existing Bus Stop Location		Existing Signalized Intersection
	Restripe High Visibility Crosswalk		Resurface Pavement		Existing Bus Stop and Shelter		Proposed Metered Parking
	Restripe Standard Pedestrian Crosswalk		Pavement Marking Symbol		New Bus Stop Shelter		Proposed Curb Extension (Neckdown)
			Direction of Travel		Proposed Quick Curb		Proposed Recommendations already implemented

Figure 21: Church Avenue and Bedford Avenue Improvements

3

IMPROVEMENTS

3.4.7 Church Avenue & Nostrand Avenue

Improvements for this location are presented in Figure 22.

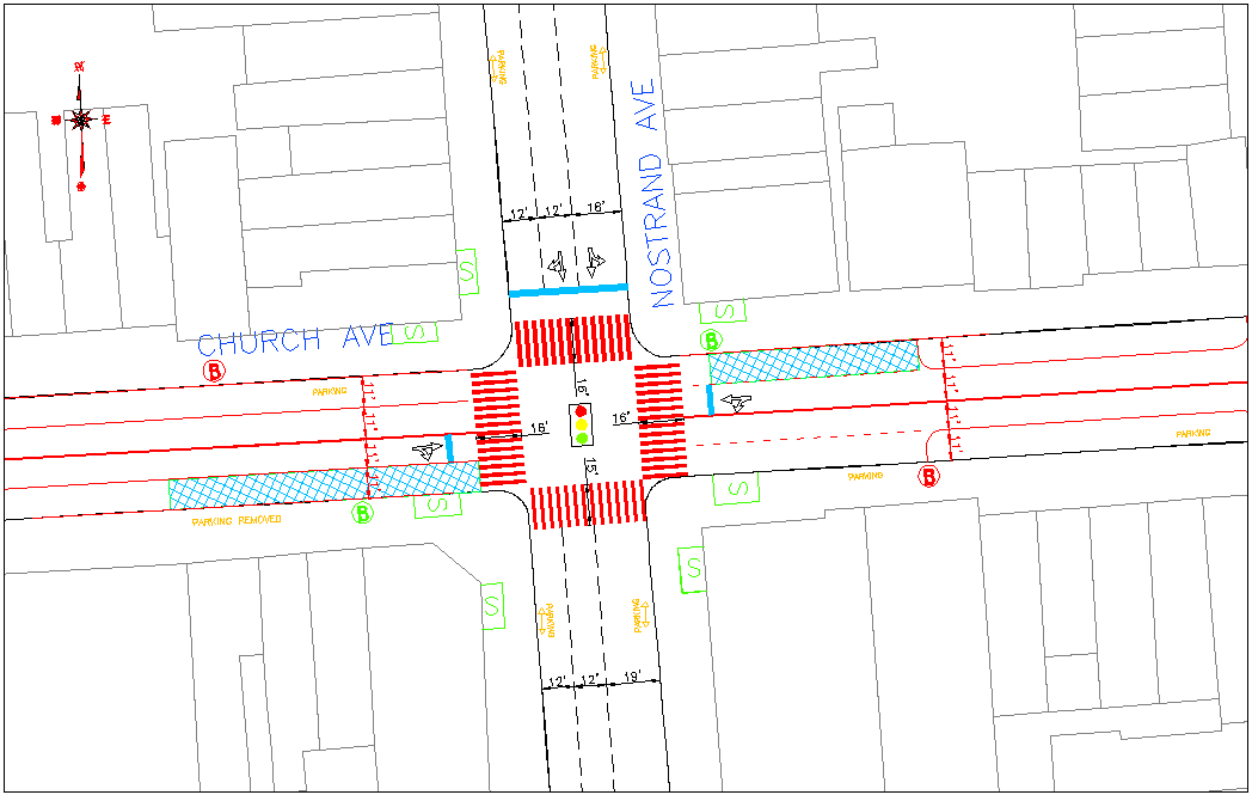
Problems:

- Poor traffic operations during the weekday AM, PM, and Saturday peak hours, especially on the eastbound and westbound approaches.
- Significant bus and subway transfers due to a subway station that serves the Nos. 2 and 5 subway lines, and the bus stops that serve the B35 line along Church Avenue and the B44 lines along Nostrand Avenue. The presences of far-side bus stops on Church Avenue causes unnecessary pedestrian volume in the north and south crosswalks because majority of riders in the AM peak transfer from the westbound B35 to the northbound Nos. 2 and 5 trains, and the reverse during the PM peak.

Improvements:

- Green time will be reallocated and offsets are changed as shown in Table 2.
- High visibility crosswalks have been provided at all four crosswalks.
- Stop bars have been provided 10 feet from crosswalks.
- Parking and bus stop lanes have been striped.
- B35 bus stops will be relocated from far side to near side in both directions.
- Curbside parking will be relocated from near side to far side due to the above mentioned bus stop relocation.

3 IMPROVEMENTS



Legend:

	Existing School Crosswalk		Proposed High Visibility Crosswalk		Proposed Striping		Proposed Pedestrian Refuge Island (Raised Median)
	Proposed Pedestrian Ramp		Proposed Stopbar as per Recommended Standard		Relocate Bus Stop		Proposed Traffic Sign
	Restripe School Crosswalk		Remove Existing Parking (Daylighting)		Existing Bus Stop Location		Existing Signalized Intersection
	Restripe High Visibility Crosswalk		Resurface Pavement		Existing Bus Stop and Shelter		Proposed Metered Parking
	Restripe Standard Pedestrian Crosswalk		Pavement Marking Symbol		New Bus Stop Shelter		Proposed Curb Extension (Neckdown)
			Direction of Travel		Proposed Quick Curb		Proposed Recommendations already implemented

Figure 22: Church Avenue and Nostrand Avenue Improvements

3

IMPROVEMENTS

3.4.8 Church Avenue & New York Avenue

Improvements for this location are presented in Figure 23.

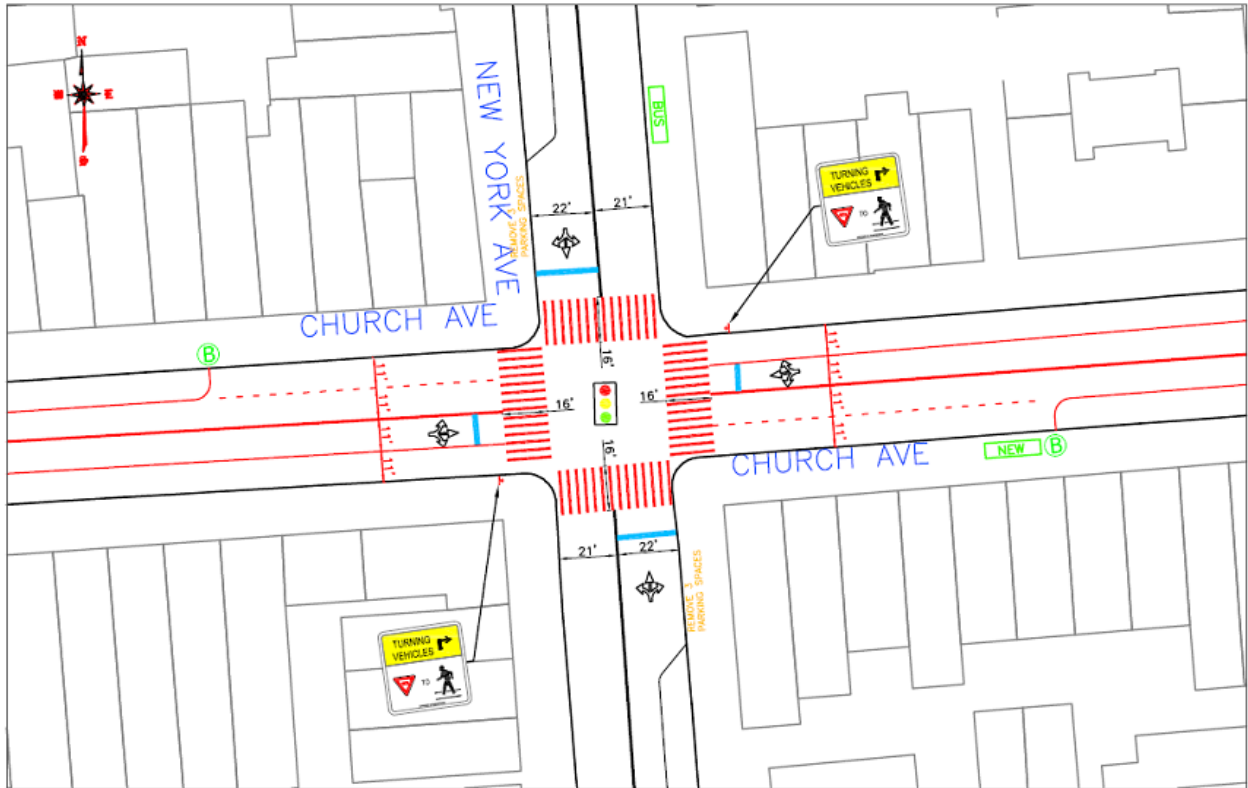
Problems:

- Poor traffic operations during the weekday AM, PM, and Saturday peak hours.
- A total of 13 crashes occurred during a three-year study period at this intersection, of which 5 involved pedestrians. One of the main reasons cited for these crashes was driver failure to yield right of way followed by pedestrian error and confusion. The average crash rate at this intersection is higher than the statewide average.
- Possibility of installing an eastbound far side bus shelter should be explored as a number of bus riders were noted standing for buses at this sidewalk and enough space is available for its installation

Improvements:

- Green time will be reallocated as shown in Table 2.
- High visibility crosswalks have been provided at all four crosswalks.
- Stop bars have been provided 10 feet from crosswalks.
- Parking and bus stop lanes have been striped along Church Avenue.
- Parking has been removed from the northbound and southbound curbside to facilitate right turns.
- A new bus shelter will be installed on the far side of the eastbound approach along Church Avenue.

3 IMPROVEMENTS



Legend:

	Existing School Crosswalk		Proposed High Visibility Crosswalk		Proposed Striping		Proposed Pedestrian Refuge Island (Raised Median)
	Proposed Pedestrian Ramp		Proposed Stopbar as per Recommended Standard		Relocate Bus Stop		Proposed Traffic Sign
	Restripe School Crosswalk		Remove Existing Parking (Daylighting)		Existing Bus Stop Location		Existing Signalized Intersection
	Restripe High Visibility Crosswalk		Resurface Pavement		Existing Bus Stop and Shelter		Proposed Metered Parking
	Restripe Standard Pedestrian Crosswalk		Pavement Marking Symbol		New Bus Stop Shelter		Proposed Curb Extension (Neckdown)
			Direction of Travel		Proposed Quick Curb		Proposed Recommendations already implemented

Figure 23: Church Avenue and New York Avenue Improvements

3

IMPROVEMENTS

3.4.9 Church Avenue & Utica Avenue

Improvements for this location are presented in Figure 24.

Problems:

- Poor traffic operations during the weekday AM, PM, and Saturday peak hours at this intersection.
- A total of 22 crashes occurred during a three-year study period at this intersection, of which 5 involved pedestrians. One of the main reasons cited for these crashes was disregarding of traffic control, failure to yield right of way, and driver's inattention. The average crash rate at this intersection is higher than the statewide average.
- Pedestrian activity is constrained at the southwest corner due to the sidewalk encroachments by the adjacent grocery stores.

Improvements:

- LPIs for all four crosswalks have been increased from six to seven seconds.
- High visibility crosswalks have been provided at all four crosswalks.
- Stop bars have been provided 10 feet from crosswalks.
- Parking and bus stop lanes have been striped along west leg.
- Church Avenue eastbound near side bus stop will be relocated approximately 30 feet east of its current location near the bus shelter.

3 IMPROVEMENTS

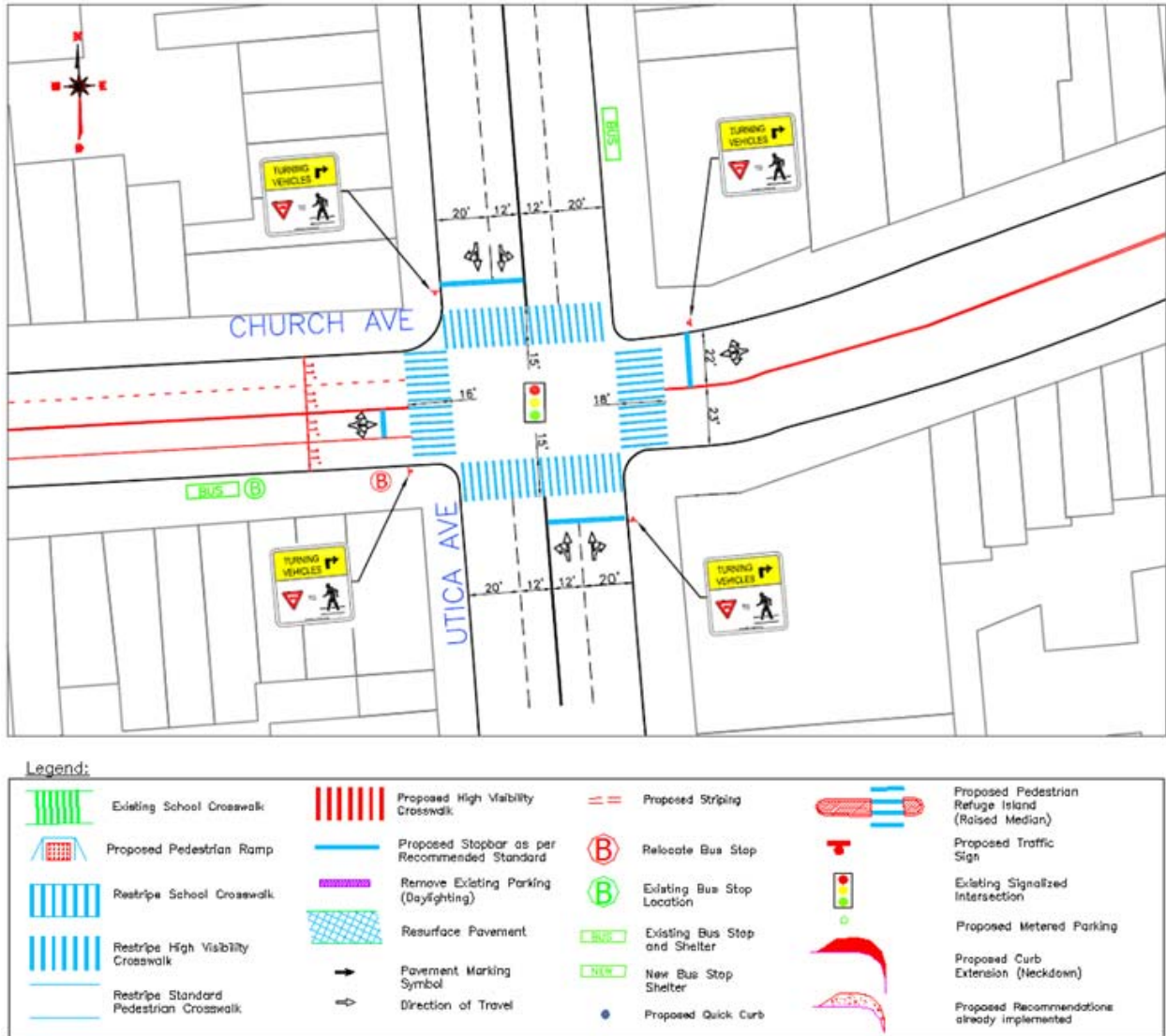


Figure 24: Church Avenue and Utica Avenue Improvements

3

IMPROVEMENTS

3.5 IMPROVEMENT OPTIONS NOT SELECTED

These following three major proposals that were initially considered but not selected for implementation:

- **Converting Church Avenue to One-Way Westbound Operation.** Because a suitable parallel eastbound roadway does not exist to complete a one-way “pair,” the plan entailed changing the lane arrangement on Linden Boulevard to handle the displaced eastbound traffic. This was ultimately rejected due to community concerns about anticipated impacts on parking, access and traffic operations on Linden Boulevard and Caton Avenue.
- **Peak Direction Parking Regulations.** Another bold idea that was considered and studied is banning parking on the north curb of Church Avenue during the AM peak period, and on the south curb during the PM peak period, to provide an additional travel lane in the peak direction. However, the results of the analysis revealed that this would bring about only a small operational improvement, and the loss of parking would inconvenience shoppers and hurt merchants. Also, the difficulty and added cost of enforcement resulted in this option not being recommended.
- **Mid-block Signal Near B and Q Subway Station.** Because the entrance to the B and Q trains is located between East 17th Street and East 18th Street, many pedestrians are observed to jaywalk mid-block. There were several options that were considered to combat this condition. One option was to provide a mid-block signalized crosswalk. However, it was determined that this proposed signal would be too close to existing signals and would pose safety problems. Another solution was to redesign the building that houses the subway entrances so that the doorways are closer to East 18th Street, instead of the middle of the block. However, this would require a large capital expenditure.

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4. EVALUATION

While much of the project is focused on improving mobility and safety for pedestrians, bicyclists and transit users, the purpose of this section is to quantify the improvements to congestion (traffic operations) and air quality.

4.1 TRAFFIC OPERATIONS

Table 4 and Figures 25 and 26 presents the comparative analysis of projected travel speeds on Church Avenue between McDonald and Utica Avenues under the 2017 future without improvements and the 2017 future with improvement scenarios. For the eastbound direction, the improvement is weekday AM, midday, PM and Saturday midday peak hours is projected to be 3.5%, 9.2%, 3.2% and 12.0%, respectively. In the westbound direction, the projected improvement is 12.8%, 5.3%, 2.7% and 10.9%, respectively.

**TABLE 4
PROJECTED TRAVEL SPEEDS ON CHURCH AVENUE BETWEEN MCDONALD AND UTICA AVENUES**

	EASTBOUND			WESTBOUND		
	2017 W/O IMPROVEMENTS	2017 WITH IMPROVEMENTS	CHANGE	2017 W/O IMPROVEMENTS	2017 WITH IMPROVEMENTS	CHANGE
	(mph)	(mph)	%	(mph)	(mph)	%
WEEKDAY AM	8.6	8.9	3.5%	7.8	8.8	12.8%
WEEKDAY MIDDAY	7.6	8.3	9.2%	7.5	7.9	5.3%
WEEKDAY PM	6.3	6.5	3.2%	7.3	7.5	2.7%
SAT MIDDAY	9.2	10.3	12.0%	6.4	7.1	10.9%

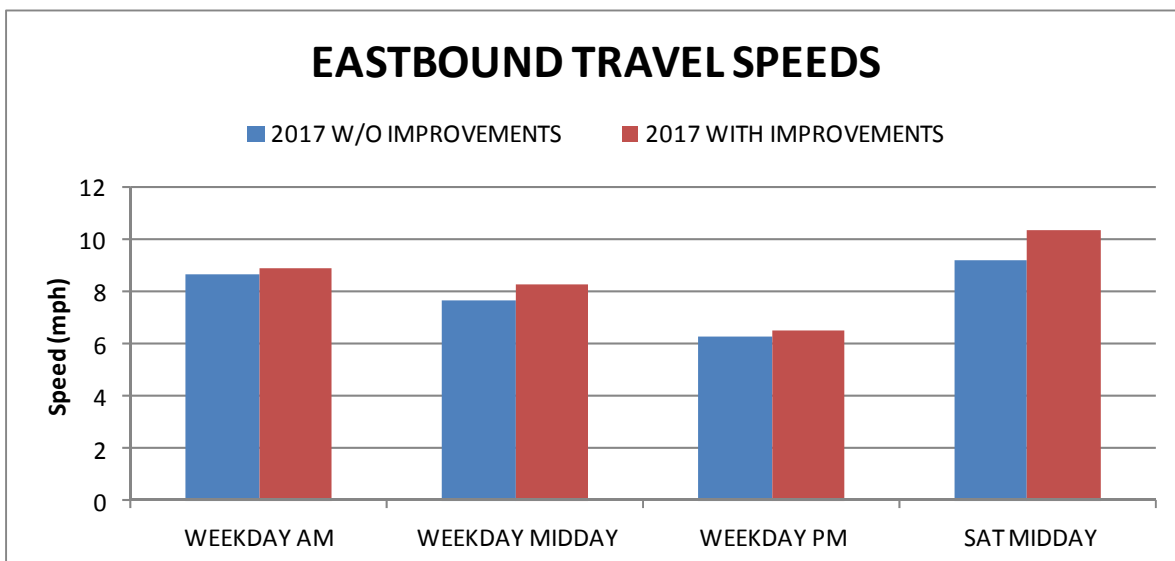


Figure 25: Eastbound Peak Period Travel Speeds for Church Avenue from McDonald Avenue to Utica Avenue

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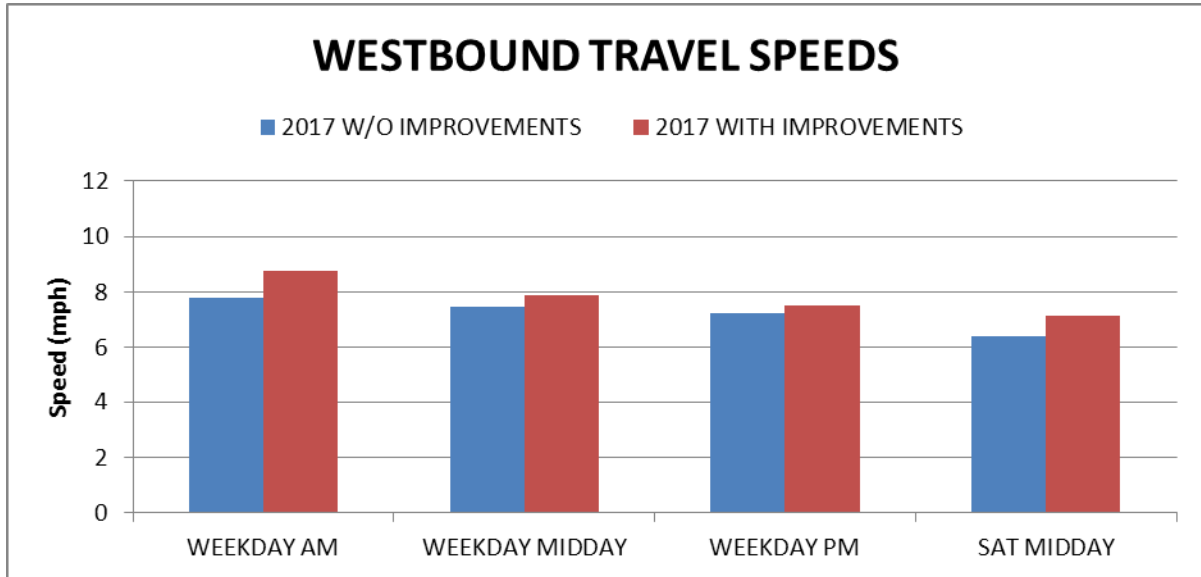


Figure 26: Westbound Peak Period Travel Speeds for Church Avenue from McDonald Avenue to Utica Avenue

As noted earlier, some of the improvements in congestion are realized on the roadways that cross Church Avenue. To give a picture of the overall improvement in the study area, Tables 5 through 8 presents a classification of Level of Service (LOS) for all intersection approaches (eastbound, westbound, northbound and southbound) in the study area, including the roadways that cross Church Avenue, under the 2017 future without improvements and the 2017 future with improvements scenarios. Intersection approaches are classified into three categories: LOS A, B, C up to mid-D (acceptable for urban areas); LOS mid-D to E (marginally unacceptable); and LOS F (unacceptable). Under the future with improvements scenario, the number of marginally unacceptable or unacceptable approaches (LOS mid-D to F) is projected to be reduced from 19 to 12 during the weekday AM peak hour, from 3 to 2 during the weekday midday peak hour, from 22 to 15 during the weekday PM peak hour, and from 17 to 3 during the Saturday midday peak hour. The number of unacceptable lane groups (LOS F) is projected to be reduced from 3 to 2 during the weekday AM peak hour, remain at 0 during the weekday midday peak hour, reduced from 7 to 2 during the weekday PM peak hour, and from 9 to 0 during the Saturday midday peak hour.

There are few intersections within the study area where it was not possible to provide acceptable LOS during some of the peak hours due to the substantial volume of traffic. These intersections include Church Avenue at Flatbush Avenue, Bedford Avenue and Utica Avenue. At these intersections, the Church Avenue and cross street traffic demand is at or near saturation, and it was not possible to bring LOS to acceptable levels, given the geometric constraints. However, following the complete street concept, other intersection improvements are proposed at these intersections which improve mobility and safety for pedestrians, bicyclists and transit users, as noted in Section 3.4.

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**TABLE 5
SIGNALIZED INTERSECTION APPROACHES CLASSIFIED BY LOS
CHURCH AVENUE BETWEEN McDONALD AND UTICA AVENUES
WEEKDAY AM PEAK HOUR**

	2017 WITHOUT IMPROVEMENTS			2017 WITH IMPROVEMENTS		
	ACCEPTABLE LOS A, B, C to Mid-D	MARGINALLY UNACCEPTABLE LOS Mid-D to E	UNACCEPTABLE LOS F	ACCEPTABLE LOS A, B, C to Mid-D	MARGINALLY UNACCEPTABLE LOS Mid-D to E	UNACCEPTABLE LOS F
McDonald Av	3	1		4		
E 2nd St	3			3		
E 3rd St	3			3		
E 4th St	3			3		
E 5th St	3			3		
Ocean Pkwy SSR	3			3		
Ocean Pkwy	3	1		3	1	
Ocean Pkwy NSR	3			3		
E 7th St	3			3		
Coney Island Av	2	2		4		
Stratford Rd	3			3		
Westminster Rd	3			3		
Argyle Rd	3			3		
Rugby Rd	3			3		
Marlborough Rd	3			3		
E 16th St	4			4		
E 18th St	3			3		
Ocean Av	2	1	1	4		
E 21st St	2	1		3		
Flatbush Av	1	2	1		2	2
Bedford Av	1	3		1	3	
Rogers Av	3			3		
Nostrand Av	2		1	3		
New York Av	2	2		4		
E 34th St	3			3		
E 35th St	3			3		
Brooklyn Av	3	1		3	1	
E 38th St	3			3		
E 39th St	3			3		
E 40th St	3			3		
Albany Av	4			4		
E 42nd St	3			3		
E 43rd St	3			3		
Troy Av	3			3		
E 45th St	3			3		
E 46th St	3			3		
Schenectady Av	3	1		3	1	
E 48th St	3			3		
E 49th St	3			3		
Utica Av	3	1		2	2	
TOTALS	113	16	3	120	10	2

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TABLE 6
SIGNALIZED INTERSECTION APPROACHES CLASSIFIED BY LOS
CHURCH AVENUE BETWEEN McDONALD AND UTICA AVENUES
WEEKDAY MIDDAY PEAK HOUR

	2017 WITHOUT IMPROVEMENTS			2017 WITH IMPROVEMENTS		
	ACCEPTABLE LOS A, B, C to Mid-D	MARGINALLY UNACCEPTABLE LOS Mid-D to E	UNACCEPTABLE LOS F	ACCEPTABLE LOS A, B, C to Mid-D	MARGINALLY UNACCEPTABLE LOS Mid-D to E	UNACCEPTABLE LOS F
McDonald Av	4			4		
E 2nd St	3			3		
E 3rd St	3			3		
E 4th St	3			3		
E 5th St	3			3		
Ocean Pkwy SSR	3			3		
Ocean Pkwy	4			4		
Ocean Pkwy NSR	3			3		
E 7th St	3			3		
Coney Island Av	4			4		
Stratford Rd	3			3		
Westminster Rd	3			3		
Argyle Rd	3			3		
Rugby Rd	3			3		
Marlborough Rd	3			3		
E 16th St	4			4		
E 18th St	3			3		
Ocean Av*	3	1		4		
E 21st St	3			3		
Flatbush Av	2	2		2	2	
Bedford Av	4			4		
Rogers Av	3			3		
Nostrand Av	3			3		
New York Av	4			4		
E 34th St	3			3		
E 35th St	3			3		
Brooklyn Av	4			4		
E 38th St	3			3		
E 39th St	3			3		
E 40th St	3			3		
Albany Av	4			4		
E 42nd St	3			3		
E 43rd St	3			3		
Troy Av	3			3		
E 45th St	3			3		
E 46th St	3			3		
Schenectady Av	4			4		
E 48th St	3			3		
E 49th St	3			3		
Utica Av	4			4		
TOTALS	129	3	0	130	2	0

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TABLE 7
SIGNALIZED INTERSECTION APPROACHES CLASSIFIED BY LOS
CHURCH AVENUE BETWEEN McDONALD AND UTICA AVENUES
WEEKDAY PM PEAK HOUR

	2017 WITHOUT IMPROVEMENTS			2017 WITH IMPROVEMENTS		
	ACCEPTABLE LOS A, B, C to Mid-D	MARGINALLY UNACCEPTABLE LOS Mid-D to E	UNACCEPTABLE LOS F	ACCEPTABLE LOS A, B, C to Mid-D	MARGINALLY UNACCEPTABLE LOS Mid-D to E	UNACCEPTABLE LOS F
McDonald Av	3	1		4		
E 2nd St	3			3		
E 3rd St	3			3		
E 4th St	3			3		
E 5th St	3			3		
Ocean Pkwy SSR	3			3		
Ocean Pkwy	4			4		
Ocean Pkwy NSR	3			3		
E 7th St	3			3		
Coney Island Av	2	2		4		
Stratford Rd	3			3		
Westminster Rd	3			3		
Argyle Rd	3			3		
Rugby Rd	3			3		
Marlborough Rd	3			3		
E 16th St	4			4		
E 18th St	3			3		
Ocean Av	2	2		3	1	
E 21st St	3			3		
Flatbush Av		2	2	2	1	1
Bedford Av		1	3		4	
Rogers Av	3			3		
Nostrand Av	2	1		3		
New York Av	2	1	1	3	1	
E 34th St	3			3		
E 35th St	3			3		
Brooklyn Av	3	1		3	1	
E 38th St	3			3		
E 39th St	3			3		
E 40th St	3			3		
Albany Av	3		1	2	2	
E 42nd St	3			3		
E 43rd St	3			3		
Troy Av	3			3		
E 45th St	3			3		
E 46th St	3			3		
Schenectady Av	3	1		3	1	
E 48th St	3			3		
E 49th St	3			3		
Utica Av	1	3		1	2	1
TOTALS	110	15	7	117	13	2

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TABLE 8
SIGNALIZED INTERSECTION APPROACHES CLASSIFIED BY LOS
CHURCH AVENUE BETWEEN McDONALD AND UTICA AVENUES
WEEKDAY SATURDAY PEAK HOUR

	2017 WITHOUT IMPROVEMENTS			2017 WITH IMPROVEMENTS		
	ACCEPTABLE	MARGINALLY UNACCEPTABLE	UNACCEPTABLE	ACCEPTABLE	MARGINALLY UNACCEPTABLE	UNACCEPTABLE
	LOS A, B, C to Mid-D	LOS Mid-D to E	LOS F	LOS A, B, C to Mid-D	LOS Mid-D to E	LOS F
McDonald Av	4			4		
E 2nd St	3			3		
E 3rd St	3			3		
E 4th St	3			3		
E 5th St	3			3		
Ocean Pkwy SSR	3			3		
Ocean Pkwy	4			4		
Ocean Pkwy NSR	3			3		
E 7th St	3			3		
Coney Island Av	4			4		
Stratford Rd	3			3		
Westminster Rd	3			3		
Argyle Rd	3			3		
Rugby Rd	3			3		
Marlborough Rd	3			3		
E 16th St	4			4		
E 18th St	3			3		
Ocean Av	2	2		4		
E 21st St	3			3		
Flatbush Av	1	1	2	3	1	
Bedford Av	1	1	2	3	1	
Rogers Av	3			3		
Nostrand Av	1	2		3		
New York Av		1	3	4		
E 34th St	3			3		
E 35th St	3			3		
Brooklyn Av	4			4		
E 38th St	3			3		
E 39th St	3			3		
E 40th St	3			3		
Albany Av	3		1	4		
E 42nd St	2	1		3		
E 43rd St	3			3		
Troy Av	3			3		
E 45th St	3			3		
E 46th St	3			3		
Schenectady Av	4			4		
E 48th St	3			3		
E 49th St	3			3		
Utica Av	3	1		3	1	
TOTALS	115	9	8	129	3	0

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EVALUATION

4.2 AIR QUALITY

Table 9 presents the comparative analysis of projected emissions in the study area under the 2017 future without improvements and 2017 future with improvements scenarios. The proposed recommendations are projected to improve air quality within the Church Avenue study area. The overall air quality emission rates will decrease between 3.1% and 21.3% when compared to the corresponding future without improvement conditions. The maximum percentage reduction is anticipated to be in the weekday PM peak hour where the reduction in emission rates will be:

- NOX – 11.76 Kilograms Per Hour
- VOC – 14.01 Kilograms Per Hour &
- CO – 60.47 Kilograms Per Hour

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EVALUATION

**TABLE 9
CHURCH AVENUE STUDY AREA - PEAK HOUR AIR QUALITY COMPARISON BETWEEN
FUTURE WITHOUT IMPROVEMENT AND FUTURE WITH IMPROVEMENT 2017**

PEAK HOUR	CONTAMINANTS	FUTURE WITHOUT IMPROVEMENTS 2017 SYNCHRO EMISSION RATES (Kilograms Per Hour)	FUTURE WITH IMPROVEMENTS 2017 SYNCHRO EMISSION RATES (Kilograms Per Hour)	EMISSION RATES COMPARISON % BETWEEN 2017 WITH IMPROVEMENTS VERSUS WITHOUT IMPROVEMENTS
WEEKDAY AM PEAK HOUR	NOX	12.08	11.70	3.1%
	VOC	14.38	13.93	3.1%
	CO	62.07	60.11	3.2%
WEEKDAY MIDDAY PEAK HOUR	NOX	7.16	6.77	5.4%
	VOC	8.52	8.06	5.4%
	CO	36.78	34.78	5.4%
WEEKDAY PM PEAK HOUR	NOX	14.95	11.76	21.3%
	VOC	17.81	14.01	21.3%
	CO	76.83	60.47	21.3%
SATURDAY MIDDAY PEAK HOUR	NOX	10.67	9.39	12.0%
	VOC	12.71	11.18	12.0%
	CO	54.84	48.25	12.0%

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IMPLEMENTATION

5. IMPLEMENTATION

The implementation of improvements has been divided up between short-term and long-term improvements.

Most of the short-term improvements have been implemented in 2010 or 2011. These include the following: markings, including crosswalks, stop bars, parking stripes, bus-stop stripes, turn bays, Peg-a-Trac, etc.; parking changes and delivery windows; curb extensions at Church Avenue and Beverly Road; and pedestrian refuge islands at Church Avenue and Ocean Parkway (south crosswalk), Albemarle Road and Coney Island Avenue (east crosswalk), and Church Avenue and Ocean Avenue (north crosswalk).

Some of the signal timing changes have already been implemented. The LPIs have been increased from six to seven seconds at Church Avenue and Flatbush Avenue, and Church Avenue and Utica Avenue. The phasing changes at Church Avenue and Coney Island Avenue, and Albemarle Road and Coney Island Avenue have also been implemented. This intersection is being monitored for possible future refinements. All other signal timing and offset changes are planned for 2012.

Short term improvements scheduled for implementation in 2013 include: providing metered parking on Church Avenue between East 21st Street and Flatbush Avenue; and all bus stop and bus shelter relocations.

A capital project has been initiated, which will include the following long-term improvements: curb extensions at Church Avenue and McDonald Avenue, Church Avenue and Coney Island Avenue, and Church Avenue and Bedford Avenue. It will also include sidewalk reconstruction, planting strips and other aesthetic treatments. Implementation is scheduled for approximately 2014.

The feasibility of providing a pedestrian refuge island in the north crosswalk of Church Avenue and Ocean Parkway (at the Prospect Expressway terminus) is still being studied at this time.



CONCLUSION

6. CONCLUSION

In the development of improvements, every attempt was made to include as many multimodal elements as is practically possible because of the conflicting needs of street users. Much of the improvements are geared towards traffic flow, parking, deliveries, air quality and safety. Following the Complete Street concept, emphasis is also placed upon bicyclists, pedestrians (residents, workers, students and shoppers), and transit users.

Improvement measures have been developed, evaluated and proposed for implementation within the confines of existing curb-to-curb width of Church Avenue. Community feedback was instrumental in identifying problems and refining solutions. It is anticipated that the improvements will benefit all users along Church Avenue corridor.

For the recommended improvements to yield optimal benefits, stepped-up enforcement of traffic laws and regulations 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.

The corridor will be monitored beginning in 2013.