

**New York City Department of Transportation
Office of School Safety Engineering**



School Safety Engineering Project

FINAL REPORT: P.S. 156, Waverly School, Brooklyn



**Prepared by
The RBA Group/Urbitran Associates**

NOVEMBER 3, 2006

**School Safety Engineering Project
P.S. 156, The Waverly School, Brooklyn**

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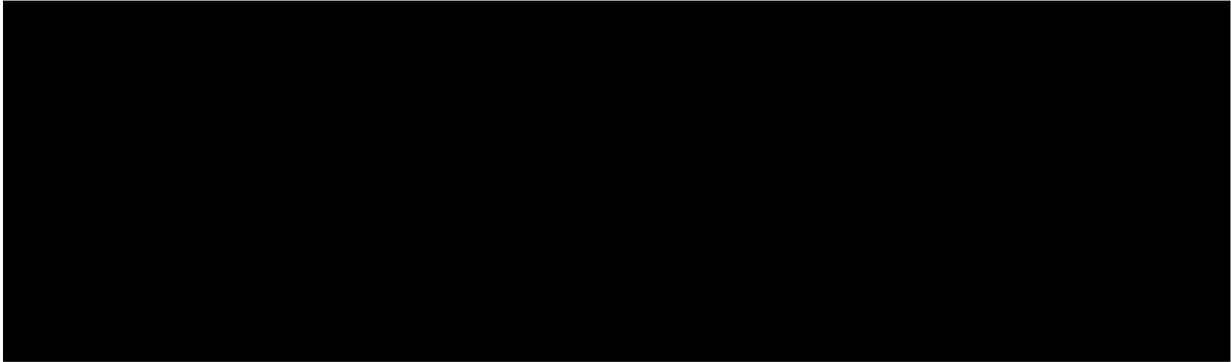
1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The Department of Transportation has developed school safety maps for 1,471 schools throughout the City. Schools currently in the program are primarily elementary and intermediate schools with an enrollment of at least 250 students. The safety plans include the designation of official school crosswalks, identified by prominent warning signs and roadway markings. DOT also designates curbside locations for school bus loading and unloading and other parking controls to improve conditions for students. In addition, nearly 600 speed reducers (humps) have been installed in the immediate vicinity of schools.

Under this consultant study, the School Safety Engineering Project, crash data in the vicinity of all program schools was reviewed. As a result, schools were ranked in terms of pedestrian safety, and 135 “priority” schools were identified Citywide. At each of these priority schools safety improvements are being recommended (e.g., new school crosswalks, new traffic signals and signal timing modifications, new speed reducers). In addition, 32 of these schools will receive further investigation to design physical improvements (e.g., raised center medians, widened sidewalks, “neckdowns” or “bulbouts” at intersections). P.S. 156 (Waverly School) in Brooklyn is one of the 135 priority schools. Quickly

2. BACKGROUND—EXISTING CONDITIONS AND ANALYSIS



2.2 NEIGHBORHOOD DESCRIPTION

The area surrounding P.S. 156 is mostly residential. There are apartment buildings to the north and west, with single and two-family homes to the south and east. New housing has been built in this area in recent years. Most blocks are characterized by single-family row houses or walk-up apartment buildings.

The elevated number 3 train runs along East 98th Street with a stop on Sutter Avenue, five blocks west of the school. This subway stop is located in a commercial area with many stores and restaurants.

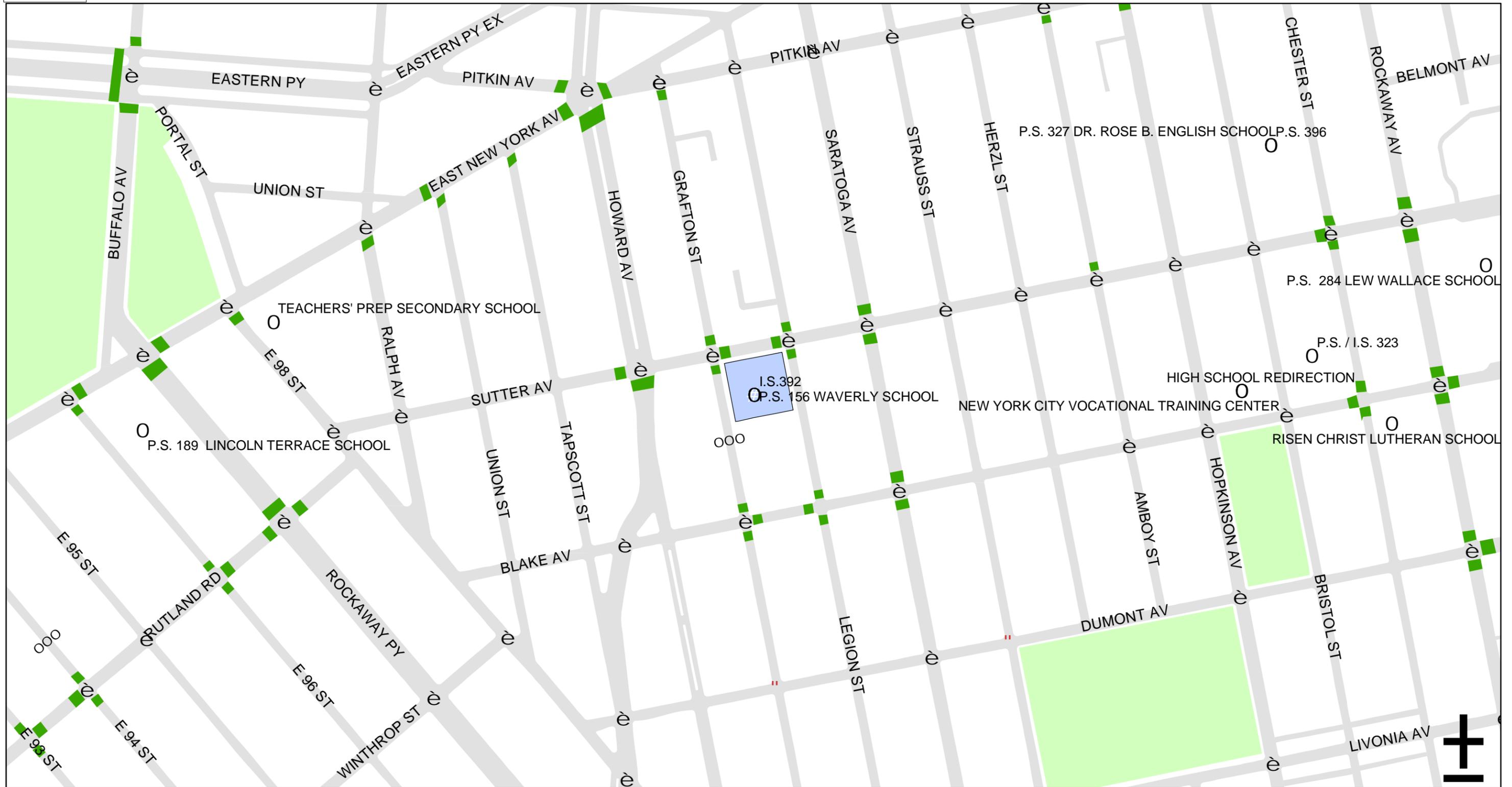


1 inch equals 150 feet

EXHIBIT 1
WAVERLY SCHOOL
P.S. 156, BROOKLYN
AERIAL PHOTOGRAPH



School Traffic Safety Map



The School Traffic Safety Map was established to help provide the maximum degree of safety for children going to and from school - by indicating the location of speed reducers, school crosswalks and some traffic control devices. (While virtually all intersections in NYC benefit from traffic control devices - such as stop signs, traffic signals, yield signs, and all way stop signs - this map shows only traffic signals and all way stop signs.) The school crosswalks that are shown are ladder striped and make the crosswalk more visible to drivers and help make the intersection safer. These crosswalks are where school children are recommended to cross.

Note: Every attempt has been made to provide complete and accurate information that is updated regularly. The City's streets are constantly changing and it is not always possible to present information without error.

LEGEND:

- SCHOOL LOCATION
- SCHOOL CROSSWALK
- TRAFFIC SIGNAL
- ALL - WAY STOP
- SPEED REDUCER

**PS 156 Brooklyn
WAVERLY SCHOOL**

Prepared by the NEW YORK CITY DEPARTMENT OF TRANSPORTATION, Iris Weinsahl, COMMISSIONER.

Map created on 10/12/2006

EXHIBIT 2

COMM. BOARD: 316
PRECINCT: 73

1.5.0

2.3 MEETING WITH SCHOOL REPRESENTATIVES

Representatives from P.S. 156 and I.S. 392, a Community Board District Manager and the consultant team met at the school on the afternoon of May 5, 2004. Representatives from the schools included the school principals and parent coordinators for P.S. 156 and I.S. 392, a custodian, a school safety officer and two parents (see Attendance Sheet in the Appendix).

According to representatives of the school, the identifiable problems that student pedestrians encounter on a regular basis include the following:

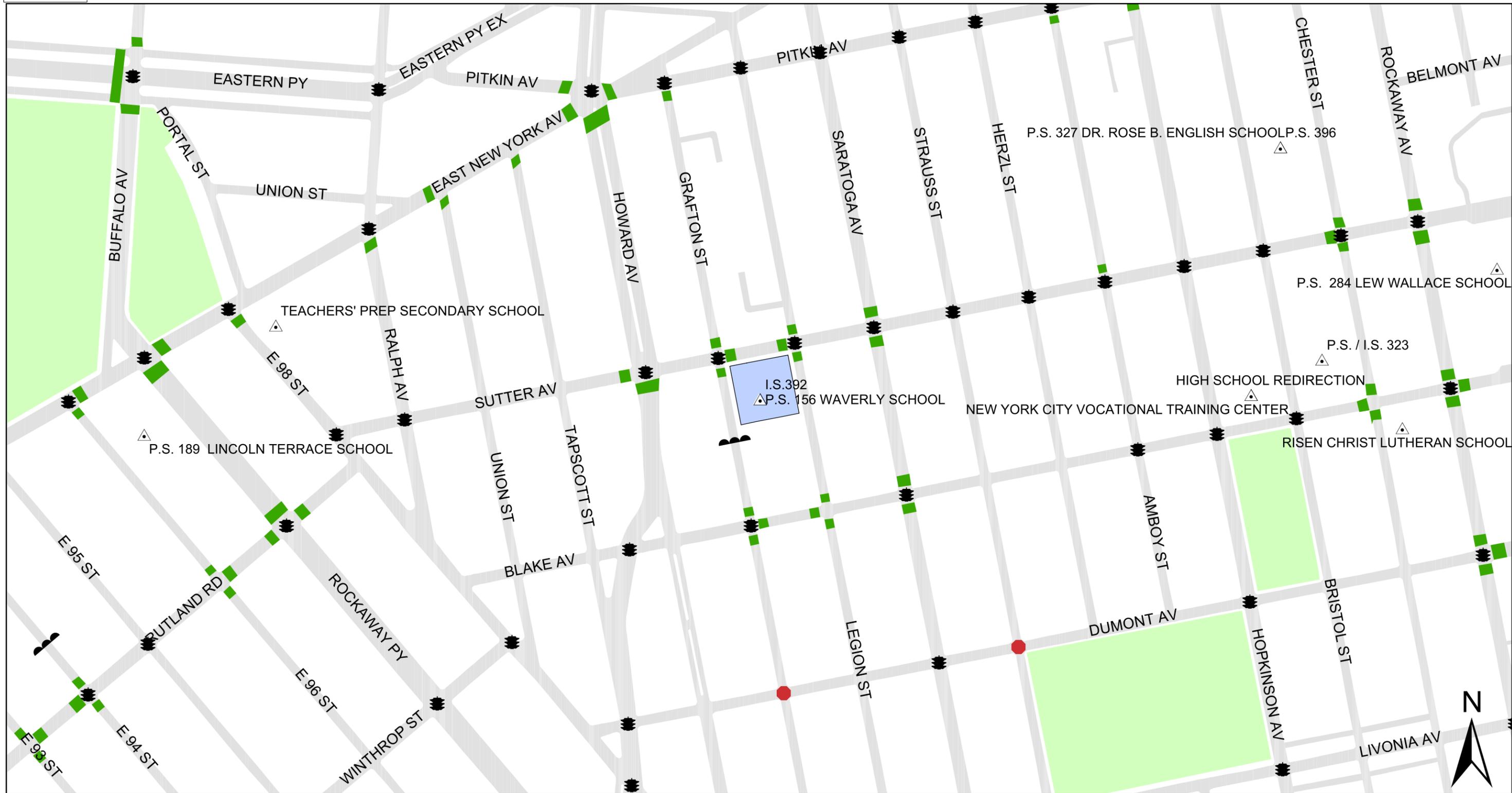
- Wide pedestrian crossing across Howard Avenue at the intersection of Howard Avenue and Sutter Avenue (see Figure 1)
- Vehicles speeding on Grafton Street
- Vehicles speeding on Blake Avenue
- Unsignalized intersection at Blake Avenue and Legion Street with excessive speeds in both directions on Blake Avenue.



Figure 1: The intersection of Howard Avenue and Sutter Avenue (looking east)



School Traffic Safety Map



The School Traffic Safety Map was established to help provide the maximum degree of safety for children going to and from school - by indicating the location of speed reducers, school crosswalks and some traffic control devices. (While virtually all intersections in NYC benefit from traffic control devices - such as stop signs, traffic signals, yield signs, and all way stop signs - this map shows only traffic signals and all way stop signs.) The school crosswalks that are shown are ladder striped and make the crosswalk more visible to drivers and help make the intersection safer. These crosswalks are where school children are recommended to cross.

Note: Every attempt has been made to provide complete and accurate information that is updated regularly. The City's streets are constantly changing and it is not always possible to present information without error.

LEGEND:

- SCHOOL LOCATION
- SCHOOL CROSSWALK
- TRAFFIC SIGNAL
- ALL - WAY STOP
- SPEED REDUCER

**PS 156 Brooklyn
Waverly School**

Prepared by the NEW YORK CITY DEPARTMENT OF TRANSPORTATION, Iris Weinsahl, COMMISSIONER.

EXHIBIT 3

Map created on 11/16/2006

COMM. BOARD: 316
PRECINCT: 73

2.6 PRIMARY MODES OF TRANSPORT TO AND FROM SCHOOL

According to P.S. 156 school officials, approximately 73% of students walk to school, 2% arrive by private vehicles, 10% by school bus and the remaining 15% by public transportation.

According to I.S. 392 officials, approximately 40% of students walk to school, 10% arrive by private vehicles, 5% by school bus and the remaining 45% by public transportation.

See Tables 1 and 2 for the school’s estimate of the modes of travel.

TABLE 1: MODES OF TRAVEL (P.S. 156) (AS ESTIMATED BY SCHOOL OFFICIALS)	
DESCRIPTION	PERCENTAGE
Walk	73%
Driven by car, livery cab or mini-bus	2%
School bus	10%
MTA bus or subway	15%
TOTAL	100%

TABLE 2: MODES OF TRAVEL (I.S. 392) (AS ESTIMATED BY SCHOOL OFFICIALS)	
DESCRIPTION	PERCENTAGE
Walk	40%
Driven by car, livery cab or mini-bus	10%
School bus	5%
MTA bus or subway	45%
TOTAL	100%

2.7 OTHER PEDESTRIAN TRAFFIC GENERATORS

As indicated previously, the school is located in a residential neighborhood. No major pedestrian traffic generators were identified in the vicinity of the school.

2.8 CROSSING GUARD LOCATIONS

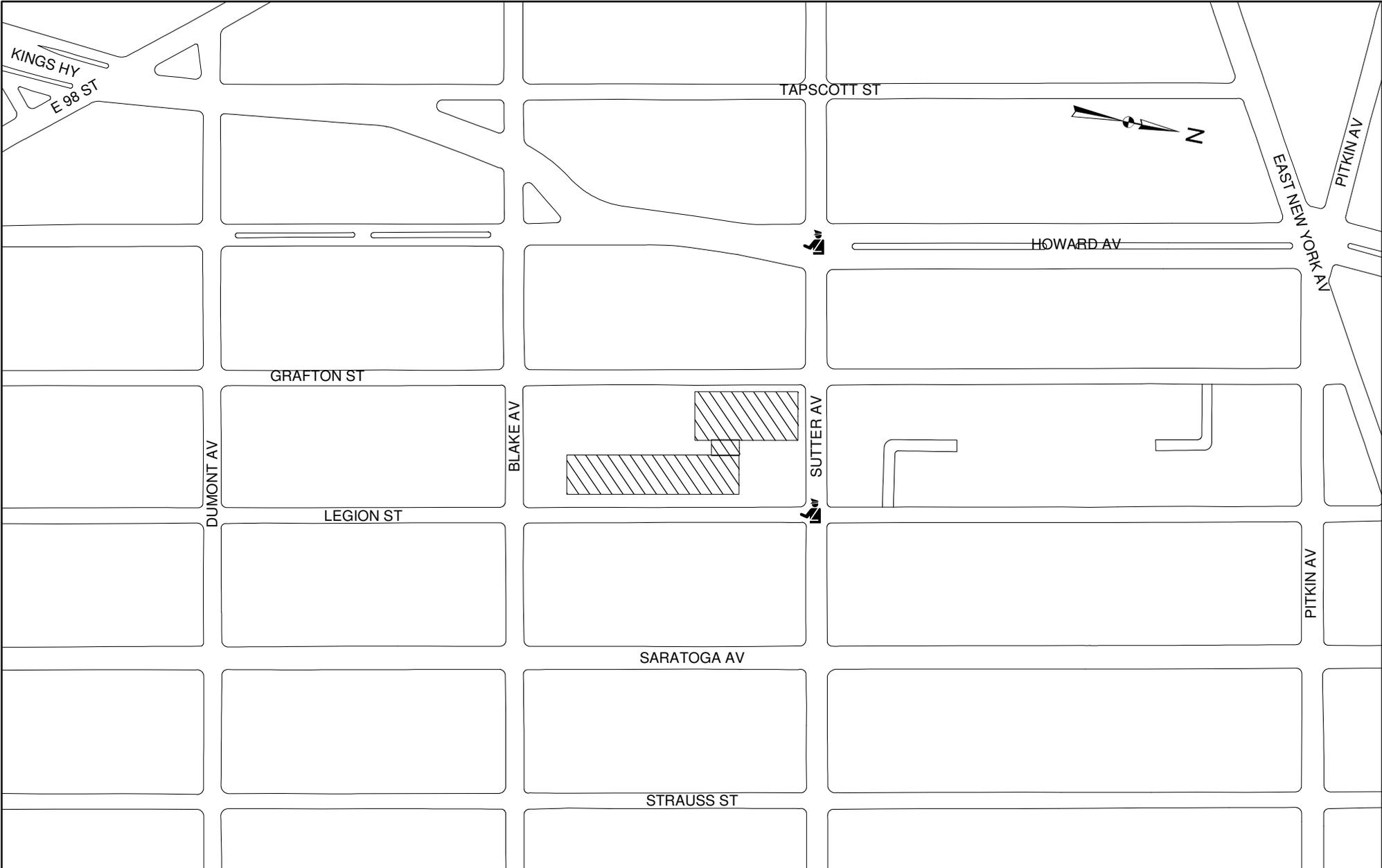
According to field observations, there are two crossing guards assigned to this school. They are stationed at the following intersections:

- Sutter Avenue at Legion Street (see Figure 2)
- Sutter Avenue at Howard Avenue

See Exhibit 4 for a map of crossing guard locations.



Figure 2: A crossing guard at the intersection of Sutter Avenue and Legion Street during student dismissal



1 inch equals 250 feet



Crossing Guards Assigned to P.S. 156

EXHIBIT 4

**P.S. 156, BROOKLYN
WAVERLY SCHOOL**

CROSSING GUARDS

3. TRAFFIC OPERATIONS

3.1 SCHOOL BUS OPERATIONS

School officials have indicated that four school buses and two mini buses transport P.S. 156 and I.S. 392 students to and from school. The four buses mostly double park along Sutter Avenue during the arrival/dismissal times (Figure 3).



Figure 3: Double-parked school buses on Sutter Avenue in front of P.S. 156

The two mini buses use the main entrance on Legion Street for morning arrival (see Figure 4).

In the afternoon, one mini bus picks up students at the back of the school on Blake Avenue, and one mini bus picks up students on Legion Street near the main entrance.



Figure 4: School buses on Legion Street in front of P.S. 156

3.2 PARENT DROP-OFF OPERATIONS

According to the survey provided by the school representatives approximately 2% of P.S. 156 students, and 10% of I.S. 392 students are driven to and from school by parents or guardians. During the school commuting times, vehicles are typically double-parked along Legion Street and Sutter Avenue (see Figure 5).



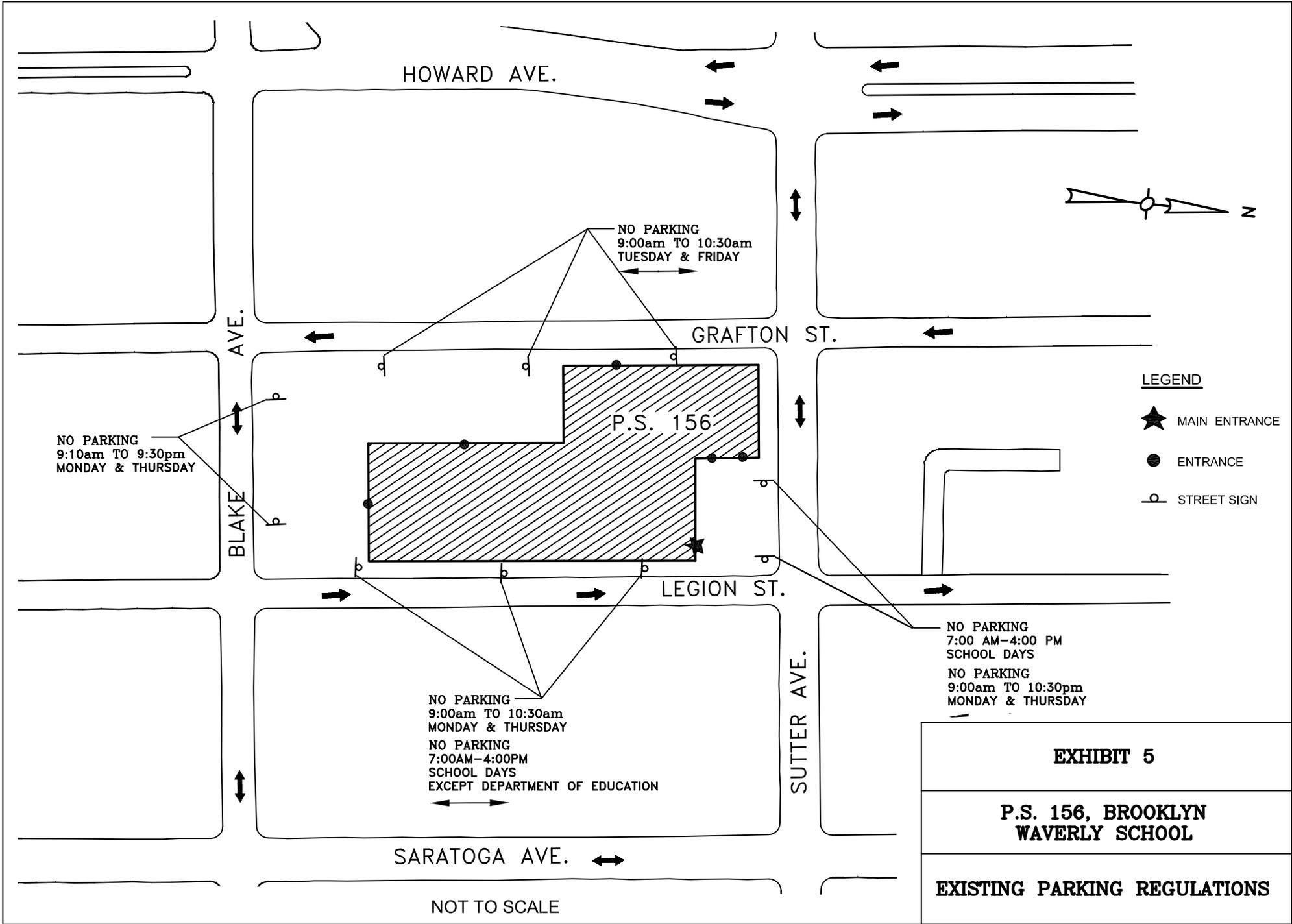
Figure 5: Vehicles double-park on Legion Street during afternoon dismissal time

3.3 PARKING REGULATIONS

“NO PARKING, 7:00 AM – 4:00 PM, SCHOOL DAYS” parking regulation is posted on Sutter Avenue between Legion Street and Grafton Street. A “NO PARKING 7AM – 4 PM, SCHOOL DAYS, EXCEPT BOARD OF EDUCATION” parking regulation is posted on Legion Street in front of the school. Alternate side parking regulations are in effect from 9:00 am to 10:30 am on Mondays and Thursdays. Exhibit 5 shows the parking regulations on the roadways surrounding the school.

3.4 EXISTING SCHOOL SIGNS AND MARKINGS

The Traffic Safety Plan, Exhibit 2, shows existing signals and crosswalk pavement markings. It is noted that a citywide signage program is currently underway to upgrade school signage to current Federal Manual of Uniform Traffic Control Devices (MUTCD) standards of fluorescent yellow-green signs accompanied by downward pointing arrows. Signs scheduled to be installed under this program are shown as “existing” on Exhibit 8.



3.5 ACCIDENT SUMMARY

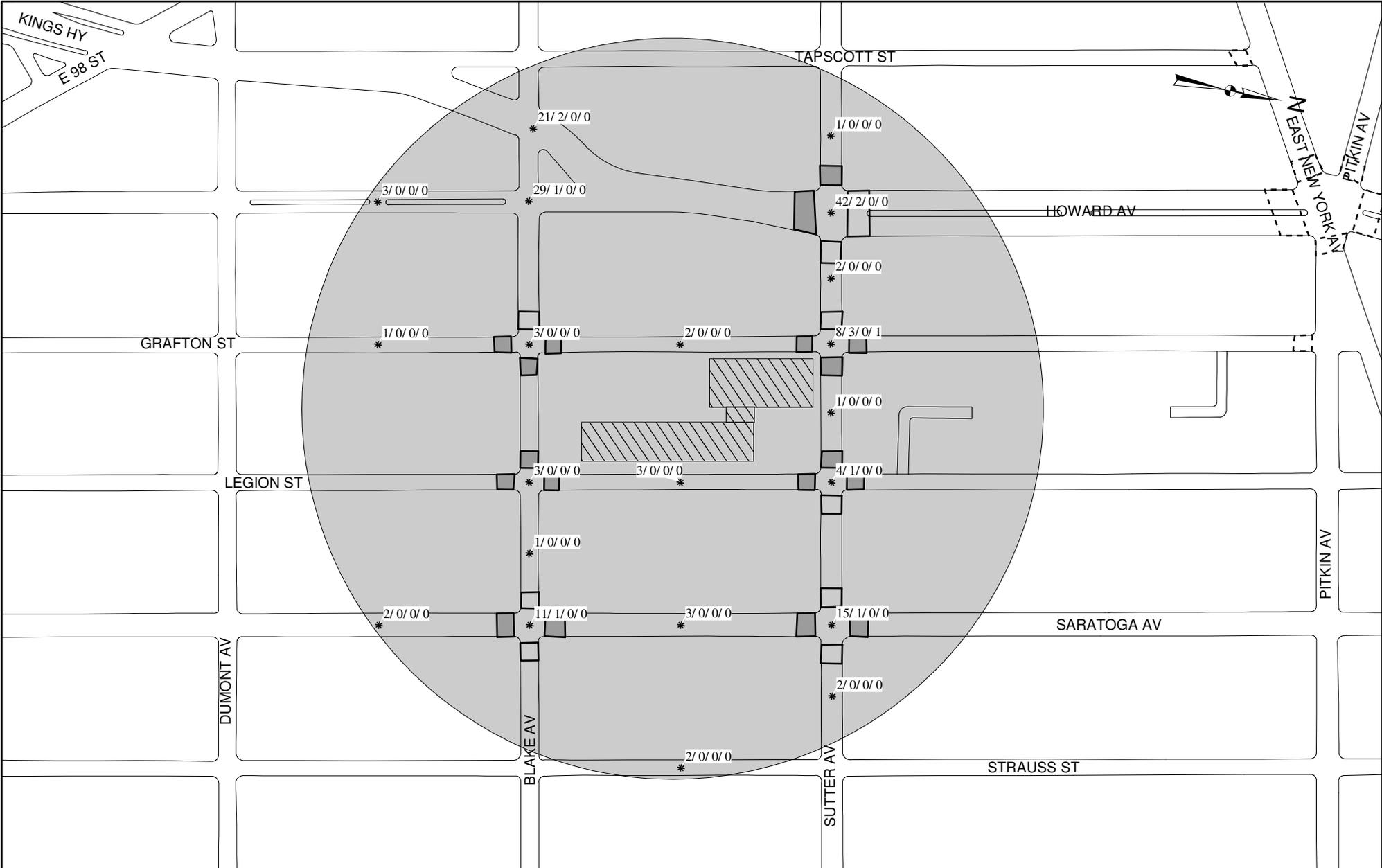
Exhibit 6 and Table 3 show a summary of accidents, as obtained from the New York State Department of Motor Vehicles (DMV), in the vicinity of P.S. 156 for the three-year period from January 1, 1998 through December 31, 2000. The DMV data provides some detail relating to the circumstances and cause of the accident. Table 3 is a summary of more recent accident data obtained from the NYC Police Department (NYPD). Though current through 2004, the NYPD data does not provide the same level of detail as the DMV data.

This report targets intersections closest to the school where the highest concentrations of student pedestrians occur. Intersections that are farther from the school which did not have detailed data available at the time of this study will be addressed with DOT's School Safety Engineering Program's ongoing work. DMV accident data is discussed in Section 3.6, Traffic Operations and Issues.

INTERSECTION	TOTAL ACCIDENTS	PEDESTRIAN ACCIDENTS	PEDESTRIAN FATALITIES	SCHOOL-RELATED ACCIDENTS*
Sutter Avenue and Saratoga Ave	15	1	0	0
Sutter Avenue and Legion Street	4	1	0	0
Sutter Avenue and Grafton Street	8	3	0	1
Sutter Avenue and Howard Ave	42	2	0	0
Blake Avenue and Saratoga Ave	11	1	0	0
Blake Avenue and Legion Street	3	0	0	0
Blake Avenue and Grafton Street	3	0	0	0
Blake Avenue and Howard Ave	29	1	0	0
TOTAL	115	9	0	1

INTERSECTION	TOTAL ACCIDENTS	PEDESTRIAN ACCIDENTS	PEDESTRIAN FATALITIES	SCHOOL-RELATED ACCIDENTS*
Sutter Avenue and Saratoga Ave	19	2	0	1
Sutter Avenue and Legion Street	20	1	0	0
Sutter Avenue and Grafton Street	10	1	0	1
Sutter Avenue and Howard Ave	60	6	0	1
Blake Avenue and Saratoga Ave	14	2	0	0
Blake Avenue and Legion Street	5	0	0	0
Blake Avenue and Grafton Street	8	1	0	0
Blake Avenue and Howard Ave	48	5	0	1
TOTAL	184	18	0	4

*School-Related Accidents are defined as accidents involving school-age pedestrians (age 4-14), occurring weekdays during the school year.



ACCIDENT LOCATION *

SCHOOL CROSSWALK ASSIGNED TO P.S. 156

SCHOOL CROSSWALK ASSIGNED TO ANOTHER SCHOOL

CROSSWALK

X/X/X/X

*



1 inch equals 250 feet

TOTAL ACCIDENTS	PED ACCIDENTS	PED FATAL	SCHOOL_PED ACCIDENTS
X	X	X	X

EXHIBIT 6

P.S. 156, BROOKLYN

WAVERLY SCHOOL

ACCIDENT SUMMARY

THREE YEAR PERIOD

(1998-2000)

3.6 TRAFFIC OPERATIONS AND ISSUES

The following sections outline traffic accidents and operations issues at intersections in the vicinity of P.S. 156.

3.6.1 Sutter Avenue and Saratoga Avenue

Sutter Avenue is a 40-foot wide, two-way (east-west) roadway with one travel lane in each direction and parking on both sides. Saratoga Avenue is a 45-foot wide, two-way roadway (north-south) with one travel lane in each direction and parking on both sides. This is a signalized intersection. There are school crosswalks on the north and south legs of the intersection.

A total of 15 accidents occurred at this intersection during the 1998-2000 study period. One accident involved a pedestrian. According to the accident data the pedestrian was crossing with the signal, but the driver failed to yield while making a left turn onto Saratoga Avenue. This was not a school-related accident.

3.6.2 Sutter Avenue and Legion Street

Legion Street is a 30-foot wide, one-way (northbound) roadway with one travel lane and parking on both sides of the street. This intersection is signalized and was identified by school officials as the primary crossing for P.S. 156 students. There are school crosswalks on the north, south and west legs of the intersection (see Figure 6).

A total of four accidents occurred at this intersection during the 1998-2000 study period. One accident involved a pedestrian. This was not a school-related accident; no further data was available regarding this incident.



Figure 6: The intersection of Sutter Avenue and Legion Street (looking southwest)

3.6.3 Sutter Avenue and Grafton Street

Grafton Street is a 30-foot wide, one-way (southbound) roadway with one travel lane and parking on both sides. The intersection of Sutter Avenue and Grafton Street is signalized (see Figure 7). There are school crosswalks on the north, south and east legs of the intersection.

There were eight accidents at this intersection during the 1998-2000 study period. Three accidents involved pedestrians, of which one was school related. According to the accident data, an 11-year old student was crossing against the signal and was struck by a southbound vehicle. The two other pedestrians were struck while crossing with the signal.



Figure 7: The intersection of Grafton Street and Sutter Avenue (looking north)

3.6.4 Sutter Avenue and Howard Avenue

Howard Avenue is an 85-foot wide, two-way busy high volume arterial with three travel lanes in each direction and parking on both sides. North of Sutter Avenue a 12-foot wide raised median separates the northbound from the southbound traffic. The raised median terminates approximately 25 feet north of the pedestrian crosswalk (see Figure 8). There is no raised median south of Sutter Avenue. There are school crosswalks on the west and south leg of the intersection.

School representatives noted that due to Howard Avenue's width, children do not have sufficient time to cross Howard Avenue in one signal cycle. However, during a field visit the consultant verified the actual pedestrian walk phase to be 35 seconds and the required pedestrian phase is 32 seconds for a walking speed of three feet per second and three second reaction time (see Table 5).

There were 42 accidents at this intersection during the 1998-2000 study period. Two accidents involved pedestrians. None were school related. Both accidents were attributed to driver's lack of attention, and vehicles traveling at an unsafe speed.

To determine the level of vehicular and pedestrian conflicts at this intersection traffic counts were performed on Tuesday, June 28, 2005. Traffic count results and can be found in Exhibit 7A.



Figure 8: Looking south on Howard Avenue at Sutter Avenue

3.6.5 Blake Avenue and Saratoga Avenue

Blake Avenue is a 35-foot wide street east of Grafton Street and 40-foot wide west of Grafton Street. It is a two-way roadway with one travel lane in each direction and parking on both sides. This is a signalized intersection. There are school crosswalks on the north and south legs of the intersection

There were 11 accidents at this intersection during the 1998-2000 study period. One accident involved a pedestrian. The pedestrian was crossing with the signal when struck by a southbound vehicle, which failed to yield.

3.6.6 Blake Avenue and Legion Street

This is a stop-controlled intersection with a stop sign on Legion Street. There are school crosswalks on the north, south and west legs of the intersection (see Figure 9). The school crosswalk on the west leg is uncontrolled.

There were three accidents at this intersection during the 1998-2000 study period. None of these accidents involved pedestrians.

Many children exit the small schoolyard at the rear of the building directly adjacent to this intersection. As per field observations, most children proceed directly south on Legion Street using the existing uncontrolled school crosswalk across Blake Avenue. Several students also travel east on Blake Avenue when exiting the school, using the existing crosswalk on the north side of Legion Street. They then continue across the east leg of the intersection across Blake Avenue, where there is no crosswalk.

In addition, school officials identified this intersection as one of their major safety concerns.

Traffic counts were conducted at this intersection on Thursday January 5, 2006 between 2:30 pm and 3:30 pm (see Exhibit 7B). There were 295 (143+152) vehicles per hour

traveling on Blake Avenue during the study hour. During the same period a total of 128 (109+19) pedestrians (mostly school students) crossed Blake Avenue. Based on MUTCD Section 4C.05 Signal Warrant 4 (Pedestrian Volume) the need for a traffic control signal at an intersection shall be considered if an engineering study finds that the pedestrian volume crossing the major street at an intersection during an average day is 190 or more during any one hour. Therefore, the existing conditions do not meet warrants for the installation of a traffic signal.



Figure 9: Looking east on Blake Avenue at Legion Street

3.6.7 Blake Avenue and Grafton Street

This is a signalized intersection, with school crosswalks on the north, south and east legs of the intersection.



Figure 10: Looking west on Blake Avenue at Grafton Street

There were three accidents at this intersection during the 1998-2000 study period. None of them involved pedestrians.

A spot speed study was conducted on Blake Avenue between Grafton Street and Legion Street, on June 30, 2005. The objective of the survey was to determine if there is a speeding problem on Blake Street as reported by school officials.

Spot speed study results shown in Table 5 and in the Appendix, show that the 85th percentile speeds on Blake Avenue is 35 mph, which exceeds the legal speed limit of 30 mph. Due to the block length, a speed reducer is not feasible on Grafton Avenue; however see Section 4 for alternative recommendations.

TABLE 5: SPOT SPEED STUDY ON BLAKE AVENUE		
Location	MEDIAN SPEED (MPH)	85TH PERCENTILE SPEED (MPH)
Blake Avenue between Grafton Street and Legion Street	29	35

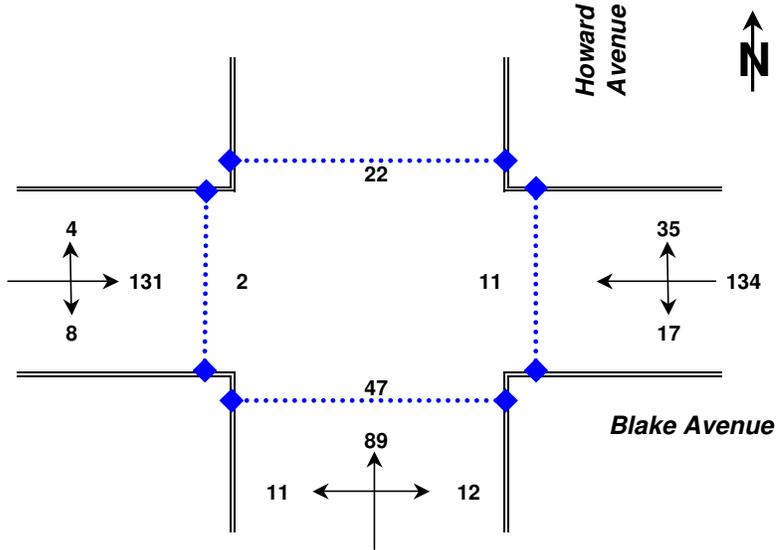
3.6.8 Blake Avenue and Howard Avenue

School officials identified this intersection as a school crossing. South of Blake Avenue, Howard Avenue is a two-way local street with a parking lane on each side. Between Blake Avenue and Kings Highway, Howard Avenue is one way northbound with parking on the east side. Howard Avenue is stop controlled in the northbound direction at the intersection with Blake Avenue. Blake Avenue is a two-way street with one travel lane in each direction and parking on both sides.

There are no crosswalks at this intersection. Accident data from the 1998-2000 study period indicates that 29 accidents occurred at this location, one of which involved a pedestrian.

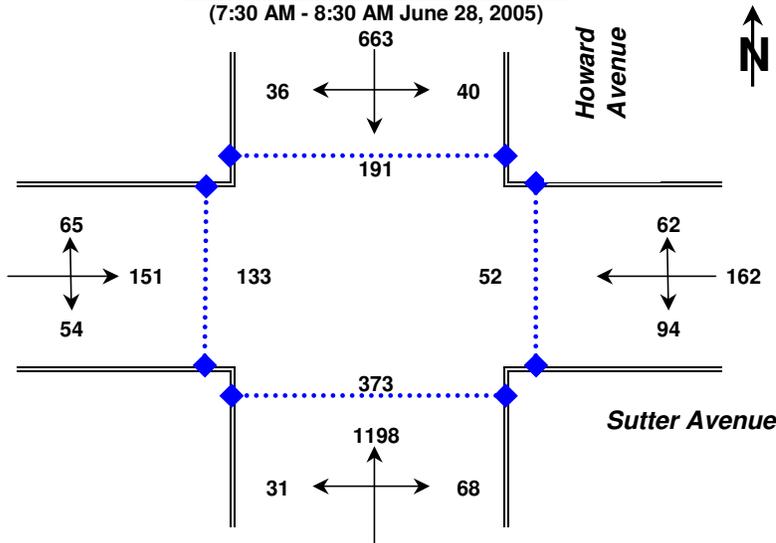
To determine the number of pedestrians crossing at this intersection traffic counts were performed on Thursday, May 26, 2005 between 7:30 am and 8:30 am. Traffic count results are shown in Exhibit 7A. Traffic counts show that 47 pedestrians crossed the south leg of the intersection during the study hour. Many of them were student pedestrians. The northbound traffic on Howard Avenue is stop controlled.

One Hour Traffic Count Volumes
(7:30 AM - 8:30 AM May 26, 2005)



Intersection of Howard Avenue and Blake Avenue

One Hour Traffic Count Volumes
(7:30 AM - 8:30 AM June 28, 2005)



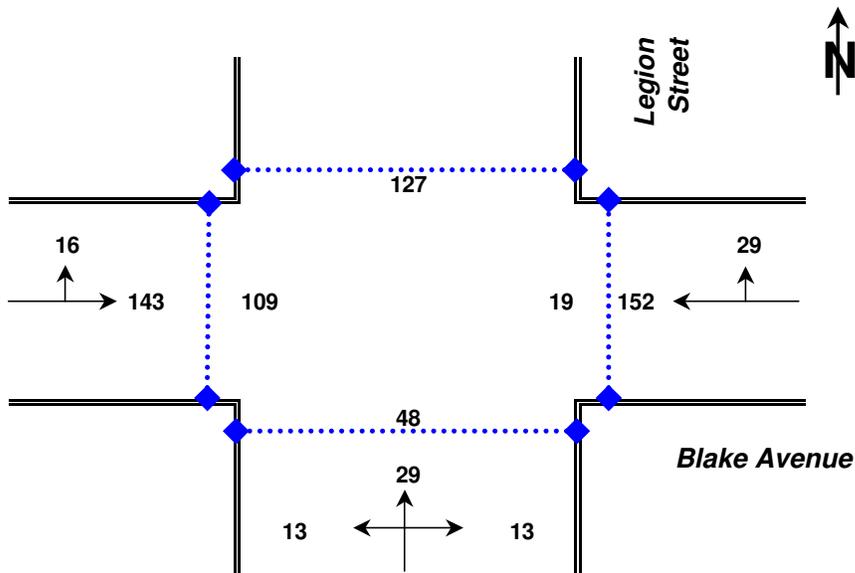
Intersection of Howard Avenue and Sutter Avenue

-  Number of Pedestrians
-  Pedestrian Crossing
-  Vehicle Movement
-  Number of Vehicles

EXHIBIT 7A
P.S. 156, BROOKLYN WAVERLY SCHOOL
TURNING MOVEMENT COUNTS

One Hour Traffic Count Volumes

(2:30 PM - 3:30 PM January 5, 2006)



Intersection of Legion Street and Blake Avenue

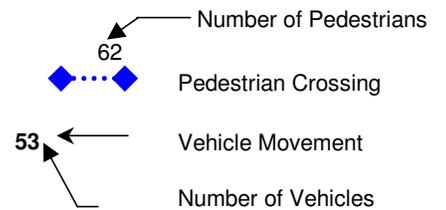


EXHIBIT 7B
P.S. 156, BROOKLYN WAVERLY SCHOOL
TURNING MOVEMENTS COUNTS

3.7 SIGNAL TIMING: PEDESTRIAN PHASE

Pedestrian crossing time was field verified at all signalized intersections in the vicinity of P.S. 156 and found to be adequate for a child pedestrian walking rate of three feet per second plus three seconds reaction time in all directions and approaches.

TABLE 6: PEDESTRIAN CROSSING TIME AT SIGNALIZED INTERSECTIONS				
Intersection Name	Crosswalk Length (Feet)	Ped. Phase Actual (Seconds)	Ped. Phase Req'd (Seconds)	Timing Adjustment? (Yes/No)
Grafton Avenue and Sutter Avenue				
crossing Grafton Avenue	30	73	13	NO
crossing Sutter Avenue	40	47	17	NO
Legion Street and Sutter Avenue				
crossing Legion Street	30	70	13	NO
crossing Sutter Avenue	40	50	17	NO
Grafton Street and Blake Avenue				
crossing Grafton Street	30	35	13	NO
crossing Blake Avenue	40	25	17	NO
Saratoga Avenue and Sutter Avenue				
crossing Saratoga Avenue	42	72	17	NO
crossing Sutter Avenue	40	48	17	NO
Howard Avenue and Sutter Avenue				
crossing Howard Avenue	87	35	32	NO
crossing Sutter Avenue	40	85	17	NO
Saratoga Avenue and Blake Avenue				
crossing Saratoga Avenue	42	25	17	NO
crossing Blake Avenue	40	35	17	NO

Note – A rate of 3 ft/sec plus 3 seconds reaction time was utilized as the child pedestrian walking rate

3.8 PHYSICAL CONDITIONS (ROADWAYS AND SIDEWALKS)

In general, roadways and sidewalks are in fair to good condition in the vicinity of the school.

At the intersection of Sutter Avenue and Grafton Street, the roadway pavement is extremely uneven in the eastbound travel lane, particularly within the crosswalk on the east leg of Sutter Avenue.

4. PROPOSED MEASURES TO IMPROVE STUDENT PEDESTRIAN SAFETY

Proposed countermeasures are divided into short-term and long-term measures. Short-term measures are those that potentially can be performed in-house; long-term measures are proposed capital improvements.

4.1 SHORT-TERM MEASURES

- Administer student pedestrian safety education program

It is recommended that the NYCDOT Safety Education Program work with the school to educate students on pedestrian safety, including crossing the street with the WALK phase, and the meaning of WALK - FLASHING DON'T WALK - DON'T WALK pedestrian signal sequence. It is also recommended that the students be educated not to cross at mid-block locations.

- “No Standing School Days 7am-4pm” parking regulations

During arrival and dismissal, cars parked on Legion Street, Sutter Avenue, and Blake Avenue force buses to double-park, thus creating congestion. Therefore, to provide school buses with an area to load and unload students it is recommended that “NO STANDING, SCHOOL DAYS, 7:00 AM – 4:00 PM” parking regulations be installed at the following locations:

- South side of Sutter Avenue in front of the school’s main entrance for a length of 60 feet
- West side of Legion Street near the school’s main entrance, for a length of 30 feet (see Exhibit 8 for detail).

- Submit Request to Police Department for Crossing Guards

It is recommended that crossing guards be requested for the following intersections:

- Sutter Avenue and Grafton Street
- Blake Avenue and Legion Street

- Install new school crosswalks

New school crosswalks should be installed at the following location:

- Blake Avenue at Howard Avenue – south leg

The intersection of Blake Avenue and Howard Avenue currently has no marked crosswalks. Students traveling from the southwest of this intersection utilize the south leg across Howard Avenue. Therefore, it is recommended that a new school crosswalk be installed at this leg of the intersection (see Exhibit 8).

- Place stop bars ten feet in advance of school crosswalks

The MUTCD and New York City DOT standard for placement of a stop bar is four feet in advance of a marked crosswalk. At signalized (or stop controlled)

crosswalks, the vehicle stop line can be placed farther back from the crosswalk in order to maximize visibility of pedestrians and to minimize the potential for pedestrian/vehicle conflicts. Therefore, it is recommended that stop bars be placed ten feet in advance of all school crosswalks.

- Install speed reducer (hump) on Grafton Street

A spot speed study was conducted on Grafton Street between Sutter Avenue and Blake Avenue, on June 30, 2005. The objective of the survey was to determine if there is a speeding problem on Grafton Street as reported by school officials.

Spot speed study results shown in Table 7 and in the Appendix, show that the 85th percentile speeds on Grafton Street is 35 mph, which exceeds the legal speed limit of 30 mph.

To reduce speeding in the vicinity of the school, installation of a speed reducer is recommended on Grafton Street. The exact location of the speed reducer will be determined by NYCDOT.

TABLE 7: SPOT SPEED STUDY ON GRAFTON STREET		
Location	MEDIAN SPEED (MPH)	85TH PERCENTILE SPEED (MPH)
Grafton Street between Sutter Street and Blake Avenue	29	35

At time of report release, it should be noted that NYCDOT had installed this recommended speed reducer.

4.2 LONG -TERM MEASURES

- Install a raised refuge island on the south leg of the intersection of Howard Avenue and Sutter Avenue

Consideration should be given to the installation of a raised refuge island instead of the striped median on the south side of this intersection. This raised refuge island will provide protection for pedestrians crossing Howard Avenue. The refuge island should have an ADA compliant at-grade cut-through.

- Extend the raised concrete median on the north leg of the intersection of Howard Avenue and Sutter Avenue

Consideration should be given to extending the raised concrete median through the existing pedestrian crosswalk to provide refuge for pedestrians. The median should have an ADA compliant at-grade cut-through.

- Extend raised concrete median and triangular island at the intersection of Howard Avenue and Blake Avenue

Consideration should be given to extending the raised concrete median through the proposed school crosswalk to provide refuge for pedestrians. The median should have an ADA compliant at-grade cut-through. Additionally, consideration should be given to extending the triangular island into the striped gore area at this intersection.

▪ Consider curb extensions at the following intersections:

Consideration should be given to installing a curb extension at the following locations, provided that the Final Design confirms that construction of the recommended curb extension would be feasible and would not interfere with traffic operations. Final details pertaining to the number, location and geometry of curb extensions will be developed during the Final Design/Contract Document preparation.

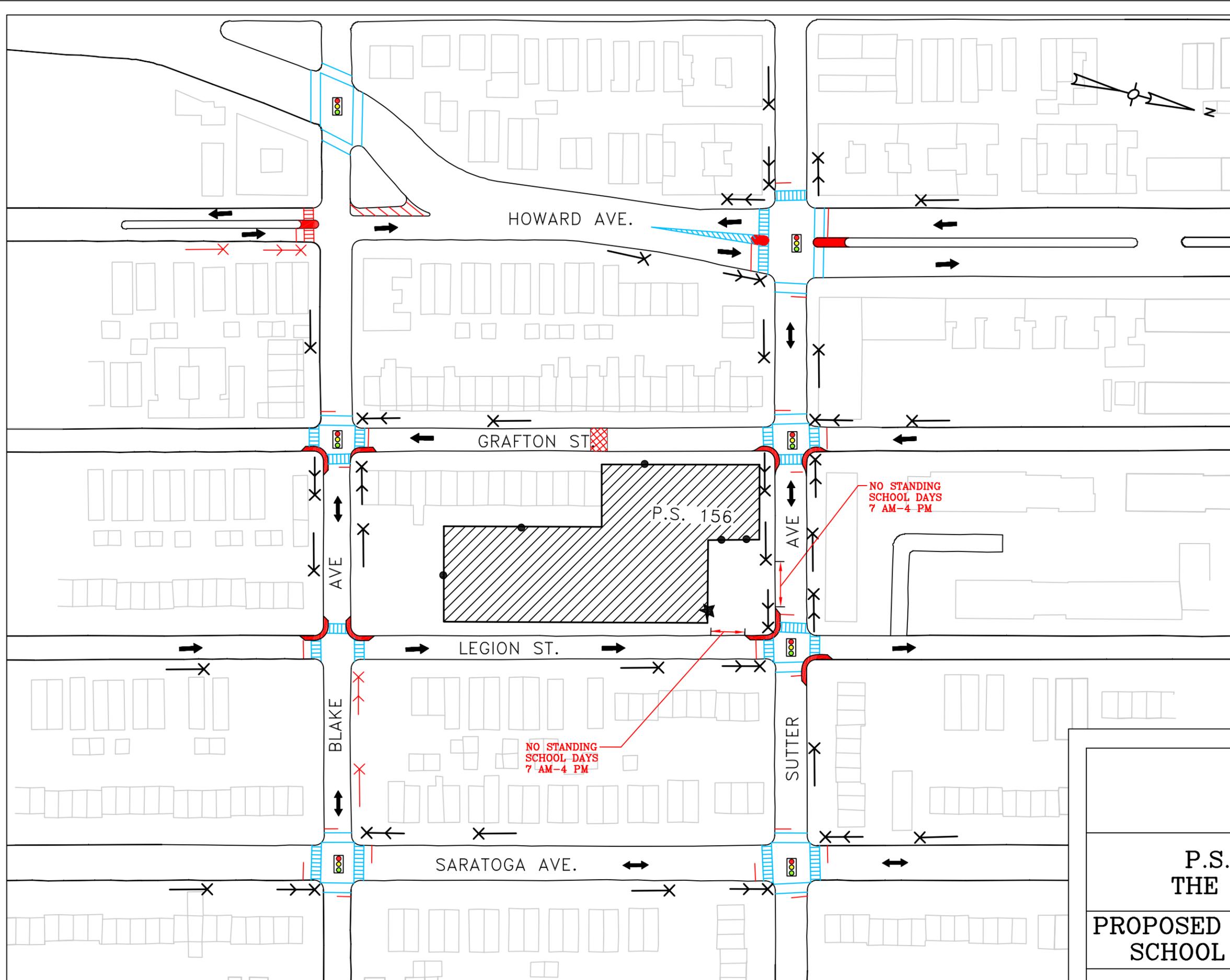
- Grafton Street and Sutter Avenue
- Legion Street and Blake Avenue
- Grafton Street and Blake Avenue
- Legion Street and Sutter Avenue

Curb extensions should be considered at the corners as shown in Exhibit 8.

The purpose of the curb extensions is to shorten the crossing distance for pedestrians, and to reduce speeds of vehicles approaching and turning at these heavily utilized school crosswalks (or intersections). These curb extensions would not eliminate or reduce the width of any moving lanes.

▪ Consider repaving the intersection at Sutter Avenue/Grafton Street

Resurface the intersection of Sutter Avenue and Grafton Street to correct uneven pavement. Engineered resurfacing of this intersection is recommended.



- LEGEND**
- ★ MAIN ENTRANCE
 - OTHER ENTRANCES
 - X EXISTING ADVANCE WARNING SIGN WITH ARROW
 - X EXISTING ADVANCE WARNING SIGN
 - ↔ EXISTING TRAVEL DIRECTION
 - 🚦 SIGNALIZED INTERSECTION
 - ▬▬▬▬ EXISTING SCHOOL CROSSWALK
 - ▬▬▬▬ EXISTING STANDARD (NON-SCHOOL) CROSSWALK
 - X PROPOSED ADVANCE WARNING SIGN WITH ARROW
 - X PROPOSED ADVANCE WARNING SIGN
 - PROPOSED STOP LINE
 - ▬▬▬▬ PROPOSED SCHOOL CROSSWALK
 - PROPOSED TRAFFIC SIGN
 - ⤴⤵ PROPOSED CURB EXTENSION (NECKDOWN)
 - ↔ PROPOSED PARKING REGULATIONS
 - ▨ PROPOSED SPEED REDUCER (HUMP)

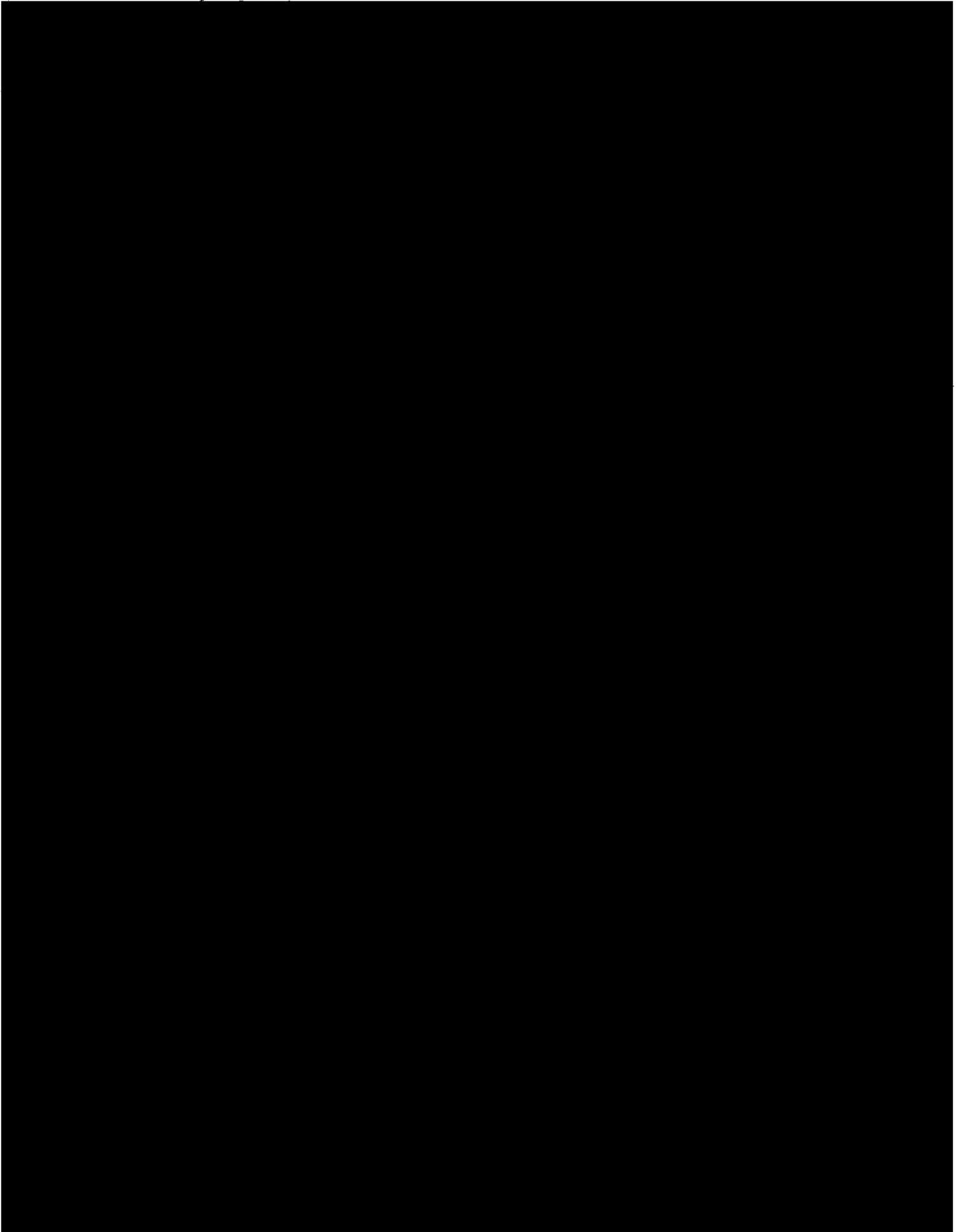
SCALE: 1"=120'

EXHIBIT 8

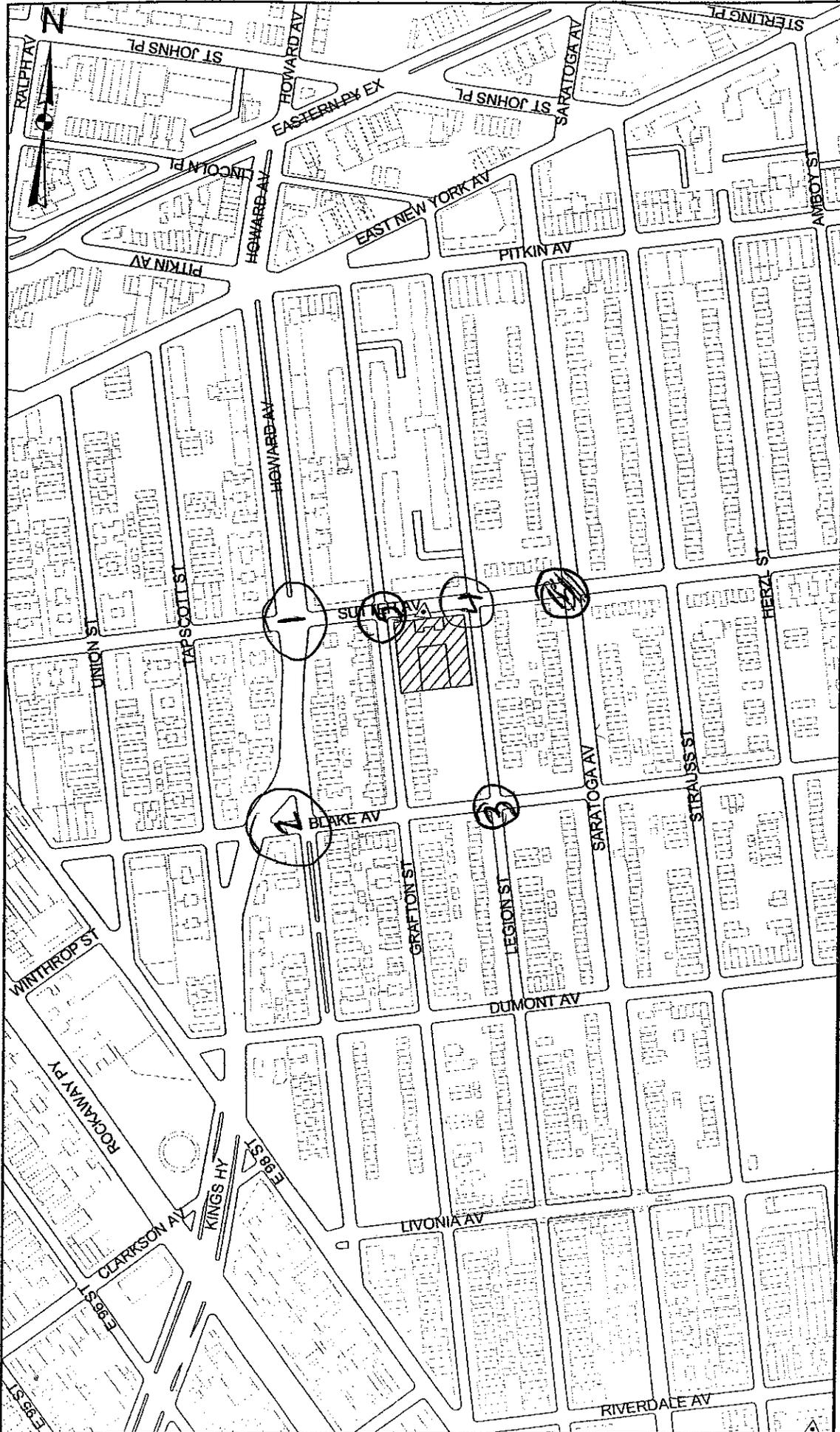
**P.S. 156, BROOKLYN
THE WAVERLY SCHOOL**

**PROPOSED MEASURES TO IMPROVE
SCHOOL PEDESTRIAN SAFETY**

APPENDIX



**TRAFFIC SAFETY PLAN
OFFICIAL ROUTES TO SCHOOL**



The TRAFFIC SAFETY PLAN shown on this map was established to provide the maximum degree of safety for children going to and from school. It is required that all children follow the prescribed routes and use the designated crosswalks.

LEGEND:

- TRAFFIC FLOW
- ROUTE TO SCHOOL
- ADV. WARNING SIGN
- SCHOOL LOCATION
- MAIN SCHOOL ENTRANCE
- OTHER SCHOOL ENTRANCES
- SCHOOL X-WALK
- PED. X-WALK
- STOP LINE
- X-WALKS ASSOCIATED WITH OTHER SCHOOLS
- SPEED HUMP
- TRAFFIC SIGNAL
- ALL-WAY STOP
- 2-WAY STOP

I.S. 392

Prepared by the NEW YORK CITY DEPARTMENT OF TRANSPORTATION, its Weithshall, COMMISSIONER, in cooperation with SCHOOL, and POLICE OFFICIALS.

ORIG. DATE: 5/12/1961
 GIS CONVRT: 04/2002
 REVISIONS: 1/14/2002

COMM. BOARD: 16
 BOROUGH: BROOKLYN
 PRECINCT: 73

DRAWING NO. CC-2881

SPOT SPEED STUDY

Date: **June 30, 2005** Time: **11:35 AM to 12:35 PM**
 Location: **Blake Avenue Between Grafton Street and Legion Street**
 Surveyor: **Eyad Yousef**

School: **P.S. 156**
 Direction:
 Comments:

Speed S (mph)	No. of Vehicles in Group n	% of Vehicles in Group	% Cumulative Vehicles	nS	nS ²
8	0	0.0%	0.0%	0	0
9	0	0.0%	0.0%	0	0
10	0	0.0%	0.0%	0	0
11	0	0.0%	0.0%	0	0
12	0	0.0%	0.0%	0	0
13	0	0.0%	0.0%	0	0
14	0	0.0%	0.0%	0	0
15	0	0.0%	0.0%	0	0
16	0	0.0%	0.0%	0	0
17	0	0.0%	0.0%	0	0
18	0	0.0%	0.0%	0	0
19	0	0.0%	0.0%	0	0
20	4	5.0%	5.0%	80	1600
21	3	3.8%	8.8%	63	1323
22	3	3.8%	12.5%	66	1452
23	3	3.8%	16.3%	69	1587
24	1	1.3%	17.5%	24	576
25	2	2.5%	20.0%	50	1250
26	4	5.0%	25.0%	104	2704
27	4	5.0%	30.0%	108	2916
28	4	5.0%	35.0%	112	3136
29	4	5.0%	40.0%	116	3364
30	8	10.0%	50.0%	240	7200
31	8	10.0%	60.0%	248	7688
32	7	8.8%	68.8%	224	7168
33	7	8.8%	77.5%	231	7623
34	4	5.0%	82.5%	136	4624
35	4	5.0%	87.5%	140	4900
36	3	3.8%	91.3%	108	3888
37	2	2.5%	93.8%	74	2738
38	1	1.3%	95.0%	38	1444
39	2	2.5%	97.5%	78	3042
40	1	1.3%	98.8%	40	1600
41	1	1.3%	100.0%	41	1681
42	0	0.0%	100.0%	0	0
43	0	0.0%	100.0%	0	0
44	0	0.0%	100.0%	0	0
45	0	0.0%	100.0%	0	0
46	0	0.0%	100.0%	0	0
47	0	0.0%	100.0%	0	0
48	0	0.0%	100.0%	0	0
49	0	0.0%	100.0%	0	0
50	0	0.0%	100.0%	0	0
51	0	0.0%	100.0%	0	0
52	0	0.0%	100.0%	0	0
53	0	0.0%	100.0%	0	0
54	0	0.0%	100.0%	0	0
55	0	0.0%	100.0%	0	0
56	0	0.0%	100.0%	0	0
	80	100.0%		2390	73504

Mean Speed = 29.9 mph Median Speed = 29.9 mph
 Standard Deviation = 5.2 mph 15th Percentile Speed = 24.5 mph
 Margin of Error (95% Confidence) = ± 1.1 mph 85th Percentile Speed = 35.2 mph

SPOT SPEED STUDY

Date: June 30, 2005

Time: 11:35 AM to 12:35 PM

School: P.S. 156

Location: Blake Avenue Between Grafton Street and Legion Street

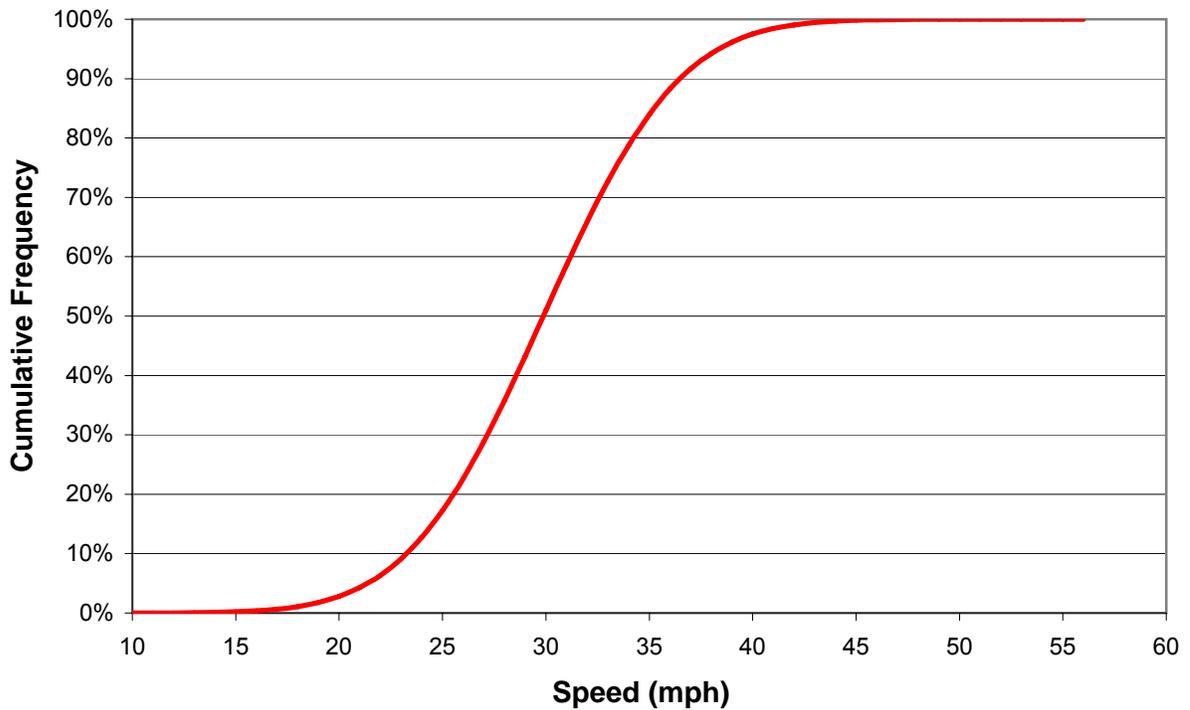
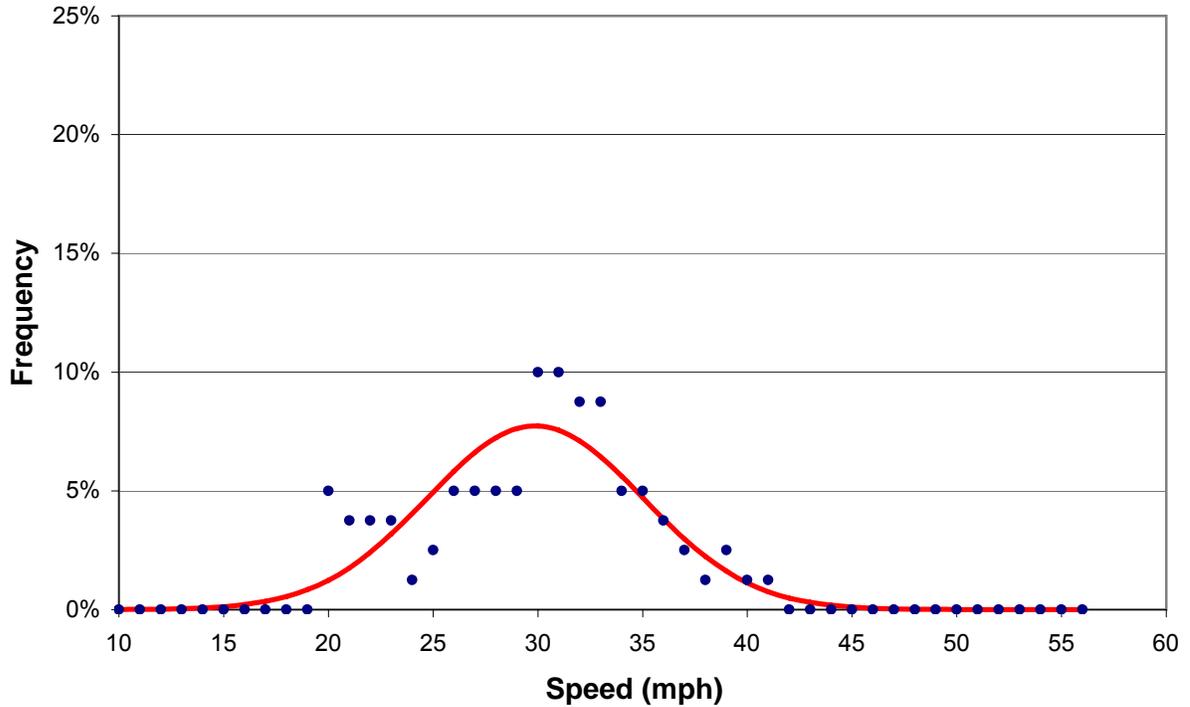
Direction:

Surveyor: Eyad Yousef

Comments:

Mean Speed = 29.9 mph
Standard Deviation = 5.2 mph
Margin of Error (95% Confidence) = ± 1.1 mph

Median Speed = 29.9 mph
15th Percentile Speed = 24.5 mph
85th Percentile Speed = 35.2 mph



SPOT SPEED STUDY

Date: **June 30, 2005** Time: **10:35 AM to 11:35 AM**
 Location: **Grafton Street Between Sutter Ave. and Blake Ave.**
 Surveyor: **Eyad Yousef**

School:
 Direction:
 Comments:

Speed S (mph)	No. of Vehicles in Group n	% of Vehicles in Group	% Cumulative Vehicles	nS	nS ²
8	0	0.0%	0.0%	0	0
9	0	0.0%	0.0%	0	0
10	0	0.0%	0.0%	0	0
11	0	0.0%	0.0%	0	0
12	0	0.0%	0.0%	0	0
13	0	0.0%	0.0%	0	0
14	0	0.0%	0.0%	0	0
15	0	0.0%	0.0%	0	0
16	0	0.0%	0.0%	0	0
17	0	0.0%	0.0%	0	0
18	0	0.0%	0.0%	0	0
19	0	0.0%	0.0%	0	0
20	0	0.0%	0.0%	0	0
21	1	6.3%	6.3%	21	441
22	1	6.3%	12.5%	22	484
23	0	0.0%	12.5%	0	0
24	0	0.0%	12.5%	0	0
25	1	6.3%	18.8%	25	625
26	2	12.5%	31.3%	52	1352
27	2	12.5%	43.8%	54	1458
28	1	6.3%	50.0%	28	784
29	0	0.0%	50.0%	0	0
30	1	6.3%	56.3%	30	900
31	2	12.5%	68.8%	62	1922
32	1	6.3%	75.0%	32	1024
33	0	0.0%	75.0%	0	0
34	0	0.0%	75.0%	0	0
35	1	6.3%	81.3%	35	1225
36	1	6.3%	87.5%	36	1296
37	1	6.3%	93.8%	37	1369
38	0	0.0%	93.8%	0	0
39	1	6.3%	100.0%	39	1521
40	0	0.0%	100.0%	0	0
41	0	0.0%	100.0%	0	0
42	0	0.0%	100.0%	0	0
43	0	0.0%	100.0%	0	0
44	0	0.0%	100.0%	0	0
45	0	0.0%	100.0%	0	0
46	0	0.0%	100.0%	0	0
47	0	0.0%	100.0%	0	0
48	0	0.0%	100.0%	0	0
49	0	0.0%	100.0%	0	0
50	0	0.0%	100.0%	0	0
51	0	0.0%	100.0%	0	0
52	0	0.0%	100.0%	0	0
53	0	0.0%	100.0%	0	0
54	0	0.0%	100.0%	0	0
55	0	0.0%	100.0%	0	0
56	0	0.0%	100.0%	0	0
	16	100.0%		473	14401

Mean Speed = 29.6 mph Median Speed = 29.6 mph
 Standard Deviation = 5.3 mph 15th Percentile Speed = 24.1 mph
 Margin of Error (95% Confidence) = ± 2.6 mph 85th Percentile Speed = 35.0 mph

SPOT SPEED STUDY

Date: **June 30, 2005**

Time: **10:35 AM to 11:35 AM**

School:

Location: **Grafton Street Between Sutter Ave. and Blake Ave.**

Direction:

Surveyor: **Eyad Yousef**

Comments:

Mean Speed = 29.6 mph
 Standard Deviation = 5.3 mph
 Margin of Error (95% Confidence) = ± 2.6 mph

Median Speed = 29.6 mph
 15th Percentile Speed = 24.1 mph
 85th Percentile Speed = 35.0 mph

