

Traffic Impact Assessment
Proposed Magnet School
200 Strawberry Hill Avenue
Stamford, Connecticut

Submitted to:
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1.0 INTRODUCTION

BETA Group has prepared this Traffic Impact and Parking Study to evaluate the potential impacts on the local transportation network associated with the proposed Magnet School, located at the southwest corner of the Strawberry Hill Avenue/Fifth Street intersection in Stamford, CT. The site is bounded by Strawberry Hill Avenue to the east, Fifth Street to the north, and private properties to the west and south. The site is currently occupied by a facility which served as the former Sacred Heart Academy, which has been vacant since 2006. The site location is shown in Figure 1.

The school's plan is to develop a K-2 and K-5 school in the short term, and subsequently may consider adding grades 6, 7, and 8 to the site. The school population will be up to 1,080 students and 175 staff for a K-8 full build-out. The site currently has primary driveway access along Strawberry Hill Avenue and secondary access along Fifth Street. Future access will also connect to Strawberry Hill Avenue and Fifth Street.

Due to the nature of the land use, the site traffic is expected to peak during the weekday morning school arrival period (8:00 – 9:00 a.m.) and the afternoon school dismissal peak period (2:00 – 4:00 p.m.). Data collection efforts and traffic analyses were concentrated to these time periods.

The study area used to examine the traffic impact for the project includes the following intersections:

- Hope Street at Wenzel Terrace
- Hope Street at Rock Spring Road and Strawberry Hill Court
- Strawberry Hill Avenue at Grove and Hoyt Streets
- Strawberry Hill Avenue at Rock Spring Road
- Strawberry Hill Avenue at Fifth Street
- Strawberry Hill Avenue at Colonial Road
- Bedford Street at Hoyt Street
- Bedford Street at Third Street
- Bedford Street at Fifth Street
- Fifth Street at Morgan Street

Accident data for the study area intersections was compiled from the Accident Records Section of the CT Department of Transportation (CTDOT). The data from 2011 through 2013 shows a total of 122 accidents. No fatalities were observed and 84 of the 122 crashes resulted in property damage only. No unexpected or critical crash patterns were recognized however, at Strawberry Hill and Hoyt Street the absolute number of accidents was high.

This study includes:

- Evaluation of existing traffic operations at the study area intersections,
- A description of future traffic operations at the study area intersections without the school (No-Build),
- Estimation of future trips generated by the proposed school for both the K-5 and K-8 service (Table 2); and
- Level of Service evaluation of future no-build traffic operations at the study area intersections and with the school developed for K-5 and K-8 service (Build) (Table 4).

2.0 EXISTING CONDITIONS

This section will present existing conditions related to the site and to traffic volumes and traffic operations at the study area intersections.

2.1 Site Conditions

The project site currently contains three main buildings which served the Sacred Heart Academy, and several smaller auxiliary buildings. The school has been vacant since 2006. The site has driveway access to both Strawberry Hill Road and Fifth Street. The neighborhood is generally residential in nature, while commercial properties are located several blocks to the south.

2.2 Roadway and Intersection Geometry/Traffic Control

Existing geometry and traffic control measures in the immediate vicinity of the project site are described below. Strawberry Hill Avenue is generally a two-lane, two-way, roadway running in the north/south direction and is posted for 25 mph travel. Sidewalks are present along both sides of the roadway. A crosswalk is present at the site driveway connecting to Hackett Circle. Fifth Street is a two-lane, two-way (east/west) and is posted for 25 mph travel. A sidewalk exists along the northern side of Fifth Street.

1. Strawberry Hill Avenue at Fifth Street (signalized)

The intersection of Strawberry Hill Avenue at Fifth Street is a three-legged, signalized intersection located at the northeast corner of the site. Strawberry Hill Avenue approaches from the north with two lanes and from the south with one lane. Fifth Street approaches from the west with one lane. Crosswalks are provided at the western and southern legs of the intersection

1. Strawberry Hill Avenue at Strawberry Hill Court and Rock Spring Road (signalized)

The intersection of Strawberry Hill Avenue at Strawberry Hill Court and Rock Spring Road is a signalized intersection located approximately 400 feet south of the site. Strawberry Hill Avenue approaches from the north and south with two lanes. Strawberry Hill Court approaches from the west with one lane. Rock Spring Road approaches from the east with two lanes. Crosswalks are provided at the eastern, western, and southern legs of the intersection.

2.3 Existing Traffic Volumes

Turning Movement Counts (TMC's) were collected from 7 AM to 9 AM and 2 PM to 4 PM at the study intersections within the first week of December 2015. Turning movement data was reviewed, and it was determined that the morning peak hour occurs between 8:00 AM and 9:00 AM, the afternoon school peak hour was between 3:00 PM and 4:00 PM. Traffic volume networks for the morning and afternoon peak hours are presented in Figures 2 and 3, respectively.

2.4 Accident Data

The most recent three years of available accident data within the study area were reviewed. The data was procured from the CTDOT for the years 2011 through 2013 at the study area intersections. A summary of this data is shown in Table 1.

**Table 1
Accident Data Summary**

Intersection	Accident Result				Collision Type														
	Property Damage Only	Personal Injury	Fatality	Total	Angle	Rear-end	Turn, Intersecting Path	Moving Object	Fixed Object	Turn, Same Direction	Turn, Opposite Direction	Turn, Intersecting Paths	Sideswipe, Same Direction	Parking	Pedestrian	Backing	Unknown/ Miscellaneous Non-collision	Total	
Hope Street at Wenzel Terrace	2	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
Hope Street at Rock Spring Road	13	4	0	17	0	7	0	0	1	1	2	2	3	0	0	1	0	0	17
Strawberry Hill Avenue at Grove and Hoyt Streets	17	7	0	24	0	11	0	0	1	0	6	1	1	1	1	1	1	1	24
Strawberry Hill Avenue at Rock Spring Road	13	5	0	18	0	7	0	0	0	0	3	1	6	0	1	0	0	0	18
Strawberry Hill Avenue at Fifth Street	9	3	0	12	0	4	0	0	3	0	0	5	0	0	0	0	0	0	12
Strawberry Hill Avenue at Colonial Road	7	4	0	11	0	6	0	0	1	0	0	3	1	0	0	0	0	0	11
Bedford Street at Hoyt Street	10	4	0	14	2	4	0	0	1	1	1	0	3	0	0	1	1	1	14
Bedford Street at Third Street	8	7	0	15	2	8	0	0	0	0	0	2	2	0	0	0	1	1	15
Bedford Street at Fifth Street	5	4	0	9	3	2	0	1	1	2	0	0	0	0	0	0	0	0	9
TOTAL	84	38	0	122	7	50	1	1	8	4	12	14	16	1	2	3	3	122	

As shown in Table 1, the most prevalent crash type is the rear-end collision, which is typical of signalized intersections. The supermajority of crashes resulted in property damage only. Also, the locations with higher crash frequency are also the intersections with higher traffic volumes. Specifically, the Strawberry Hill Avenue/Grove Street/Hoyt Street intersection experienced 24 crashes during the three year analyses period. This location is a five-legged intersection that carries more than 4,000 vehicles during the morning and afternoon peak hours combined. A crash rate is a calculation that relates accident frequency and traffic volumes. Intersections with higher volume have a greater likelihood of accidents. The calculated crash rate for this location is below 1.00. By engineering standards, a crash rate of 1.00 is the threshold to consider further investigation into intersection safety conditions. Therefore, the data indicates that there are no crash patterns or crash peaks at specific locations.

3.0 FUTURE CONDITIONS

The following section will present the analysis of future conditions at the project intersections.

3.1 Traffic Projections

The design year for the development is the proposed opening year of 2017. To accurately estimate the traffic conditions in the design year a projection analysis was done using provided by the City. City of Stamford staff has indicated that the annual growth patterns in the area of the project site increase by approximately 1% per year. City staff also noted that no off-site proposed area developments will be constructed. Therefore, no proposed development site traffic will be present within the study area by 2017. Therefore, the existing traffic volumes were increased by 1% annually, and were also rounded to the nearest “five” to develop the future No Build traffic volumes. These represent future traffic volumes without the presence of the proposed magnet school. The 2017 No Build peak hour traffic volumes are featured in Figures 4 and 5, respectively.

3.2 Proposed Development

The Magnet School site is located along the western side of Strawberry Hill Avenue in Stamford, Connecticut. The current site contains three primary buildings occupied by the Sacred Heart Academy, which has been vacant since 2006. Several smaller auxiliary buildings also exist on the site.

The school is planning to open with grades Kindergarten through second grade (K-2), later expand to include fifth grade (K-5), and ultimately expand to include eighth grade (K-8). The K-2 school will have 240 students and 40 staff. The K-5 school will have 720 students and 115 staff members. The K-8 school will have 1,080 students with 175 staff members. If all students are dismissed simultaneously, and parent pick-up vehicles were stored on-site awaiting a singular dismissal, the site would likely not accommodate the 500+ vehicles at the same time. For this reason, BETA recommends the arrival and dismissal periods accommodate various age groups to avoid the need to store this volume of vehicles on site. Therefore, the analyses assume that the school arrival and dismissal times are staggered. This study focusses on the K-5 and K-8 formats for impact assessment purposes, as traffic volume conditions will have negligible increases K-2 & will have no noticeable changes compared to existing conditions. .

Vehicular site access will continue along both Strawberry Hill Avenue and Fifth Street. Site access will be modified from its current location. Based on information from City staff, busses will access the site via Strawberry Hill Avenue and will exit the site via Fifth Street. Passenger vehicles will access and exit the site via both Strawberry Hill Avenue and Fifth Street.

The geometry along Strawberry Hill Avenue and Fifth Avenue lends itself to unobstructed sight lines; however, without a site plan to indicate actual proposed driveway locations, a sight distance assessment could not be performed.

3.3 Estimated Trip Generation

Traffic generated by the site was provided by City staff. For the purposes of this assessment, BETA assumed that two thirds of staff traffic will occur within the peak hour during which student drop-off/pick-up occurs. This assessment also assumes that the arrival and dismissal

operations will be staggered for various age groups to avoid all parent pick-up/drop-off vehicles arriving and departing together. A summary of the site trips are summarized in Table 2.

**Table 2
Site-Generated Traffic Summary**

Vehicle Type	School Size	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Staff Vehicles	K-5	78	3	81	3	78	81
	K-8	118	3	121	3	118	121
Passenger Vehicles	K-5	170	170	340	230	230	460
	K-8	250	250	500	350	350	700
Busses	K-5	17	17	34	17	17	34
	K-8	17	17	34	17	17	34
TOTAL	K-5	265	190	455	250	325	575
	K-8	385	270	655	370	485	855

Based on the values shown in Table 2, the proposed K-5 school will generate approximately 455 weekday morning peak hour trips and 575 weekday afternoon peak hour trips. The K-8 school will generate approximately 655 weekday morning peak hour trips and 855 weekday afternoon peak hour trips.

3.4 Estimated Trip Distribution

BETA has been advised the school is expected to accept students from all Stamford neighborhoods and regional communities in Connecticut. Based on this and the location of the school within the surrounding roadway network, the traffic distribution was based on an evenly balanced distribution to all directions throughout the study area. The peak hour site trip figures for K-5 and K-8 morning and afternoon peak hours are presented in Figures 6 through 9.

3.5 On-Site Parking

Based on data provided by City staff for the K-8 school, the site will expect demands of 175 staff, 17 busses, and 350 parent pick-up vehicles during the afternoon dismissal period. Adequate on-site parking should be provided to accommodate these demands. BETA recommends the busses and parent pick-up vehicles be kept separate. On-site storage for the pick-up vehicles do not require typical parking spaces, but should be provided with a stacking area while awaiting student dismissal. BETA can provide additional approach methodologies for streamlining the dismissal operations.

3.6 Combined Traffic Volumes

The peak hour site traffic has been added to the future No Build traffic to develop the future Build traffic volumes. These are presented in Figures 10 through 13.

4.0 TRAFFIC OPERATIONS

The following section provides a description of the methodology used to evaluate traffic conditions and the results of the Level of Service analysis. Our traffic analysis is based on all student pick up and all staff parking being accommodated within the property.

4.1 Analysis Methodology

Intersection operations at the project intersections were evaluated using the SYNCHRO software package (Version 8). Traffic operations are defined by Level of Service (LOS), which is a qualitative measure that associates LOS with vehicle delays. The criteria for unsignalized intersections are different than for signalized intersections because drivers expect different performance levels from each type of intersection. The relationship between LOS and delay is summarized in Table 3.

Table 3 - Level of Service Criteria

LOS	Unsignalized Intersection Criteria	Signalized Intersection Criteria
	Average Total Delay (Seconds per Vehicle)	Average Total Delay (Seconds per Vehicle)
A	< 10.0	< 10.0
B	10.1 to 15.0	10.1 to 20.0
C	15.1 to 25.0	20.1 to 35.0
D	25.1 to 35.0	35.1 to 55.0
E	35.1 to 50.0	55.1 to 80.0
F	> 50.0	> 80.0

Source: Highway Capacity Manual, Transportation Research Board; Washington, DC; 2009

4.2 Traffic Operational Analysis Results

The following section presents the results of the Level of Service analysis for the future background conditions during the weekday morning and afternoon peak hours. Analysis results are presented below in Table 4.

**Table 4
Level of Service Summary^a**

Intersection	AM Peak Hour			PM Peak Hour		
	No Build	Build (K-5)	Build (K-8)	No Build	Build (K-5)	Build (K-8)
Hope Street at Wenzel Terrace	A	A	A	A	A	A
Hope Street at Rock Spring Road	B	B	B	B	B	B
Strawberry Hill Avenue at Grove and Hoyt Streets	E	F	F	D	D	E
Strawberry Hill Avenue at Rock Spring Road	F	F	F	F	F	F
Strawberry Hill Avenue at Fifth Street	A	B	B	B	B	C
Strawberry Hill Avenue at Colonial Road	B	B	B	B	B	B
Bedford Street at Hoyt Street	C	C	C	B	B	B
Bedford Street at Third Street	B	B	B	C	C	C
Bedford Street at Fifth Street	B	B	B	B	B	B
Fifth Street at Morgan Street ^b	B	B	C	B	B	C

^a Summary of overall intersection level of service and volume/capacity ratio

^b Unsignalized intersection results for Stop controlled approach

As shown in Table 4, the introduction of site traffic generated by either the K-5 school, or the K-8 school will not significantly degrade levels of service at the study area intersections. Two locations already operate at LOS E or F without the school. The additional school traffic will create minor additional delay. With modifications to signal timing, operations can be improved. The addition of turn lanes at problem locations would further improve operations. The overall level of service results are illustrated in Figures 14 through 19 for each study intersection. The level of service at the intersection of Fifth Street at Morgan Street represents the operation for the Morgan Street approach.

5.0 RECOMMENDATIONS

All roadway and/or intersection improvements at Strawberry Hill Avenue @ Fifth Street will be accommodated within the city right-of-way and school property. To better accommodate access/egress at the site driveways, local traffic demands, and pedestrians, BETA recommends the following improvements:

- Widen Fifth Street to provide an eastbound left-turn lane and a right-turn lane, and a westbound travel lane (14' wide) at the intersection with Strawberry Hill Avenue. This section should extend from Strawberry Hill Avenue and the nearest site driveway (approximately 300');
- Widen Strawberry Hill Avenue to provide a northbound left-turn lane and through lane, and a southbound travel lane (14' wide) between the intersection at Fifth Street and the southernmost site driveway of the property (approximately 600');
- Construct a sidewalk along the southern side of Fifth Street. This will be accommodated by relocating the existing stone wall in this area. Impacts to trees should be minimized, but the trees that must be removed will be replaced on-for-one where necessary.

6.0 CONCLUSIONS

Using standard traffic engineering practices, this Traffic Impact Assessment has:

- Evaluated future “no build” traffic operations at the signalized and unsignalized intersections within study area,
- Provided a description of future operations for the proposed K-5 and K-8 Magnet Schools,
- Provided an estimate of future trip generation and assignment, and
- Evaluated future traffic operations at the study area intersections for the “build” conditions, and
- Addressed the parking demand and student dismissal operations for this project.

This study analyses shows that:

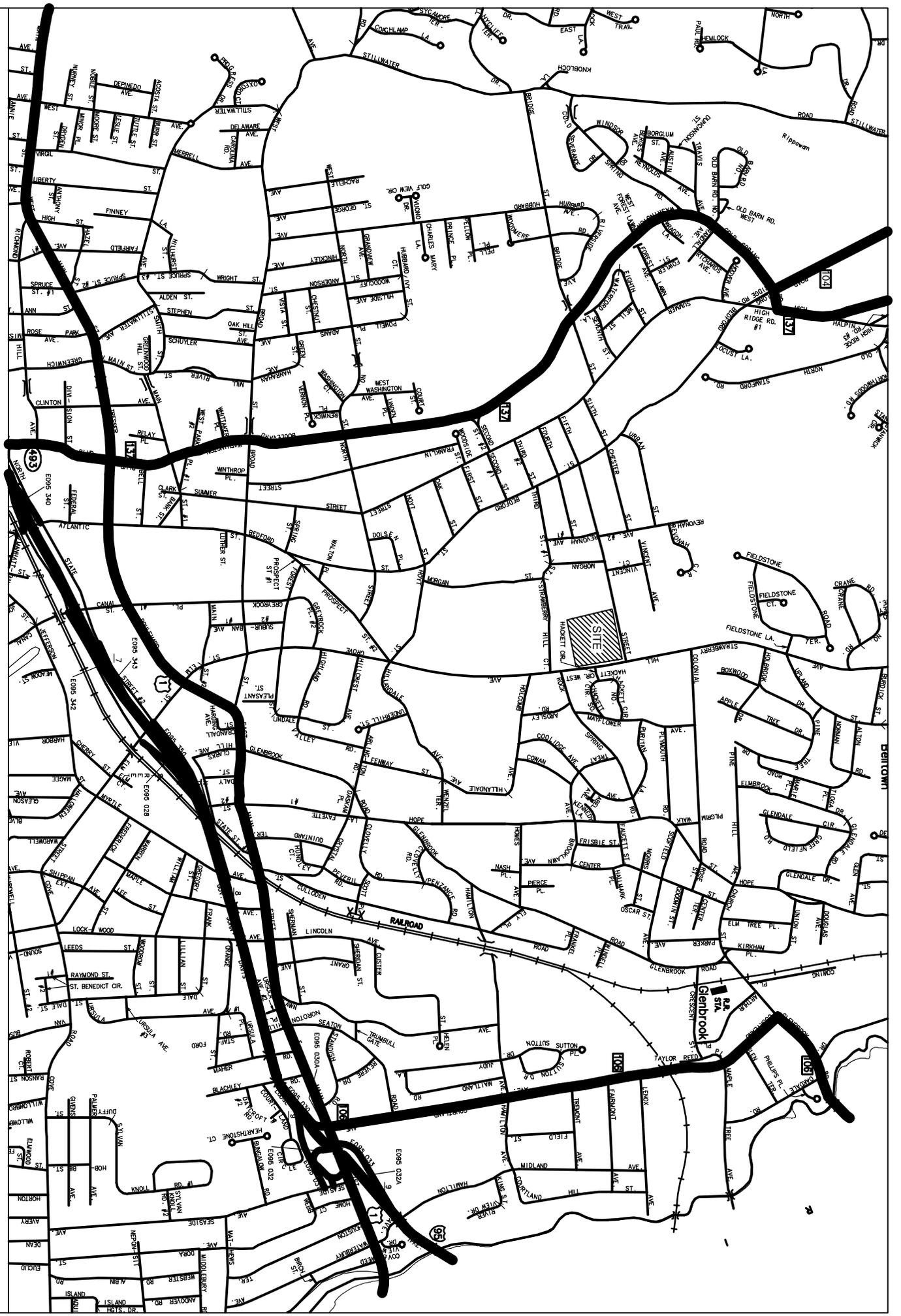
- Accident records do not indicate a pattern of crash types or severity within the study area to develop corrective measures;
- Based on an analysis of trip generation, the proposed K-5 Magnet School is expected to generate approximately 455 trips during the morning peak hour and 575 trips during the afternoon peak hour. The K-8 Magnet School will generate approximately 655 trips during the morning peak hour and 855 trips during the afternoon peak hour;
- Site access will be permitted via Strawberry Hill road and Fifth Street, as it does today;
- All vehicles picking up students shall be maintained within the site during the afternoon dismissal period or managed if off-site parent parking location is identified;
- Traffic operations at study area intersections will experience a relatively minor increase in delay; however, levels of services will not be significantly impacted. With minor changes to traffic signal timings, safety & operational improvements can be realized
- The K-8 school will experience approximately 175 staff members, 17 busses, and 350 parent pick-up vehicles on site during the afternoon dismissal period. The site will not likely accommodate the demand of 500+ vehicles parked on site during the dismissal period without staggered dismissal. Pick-up by parents should be separated by age group to avoid excessive on-site parking, lingering, and unnecessary conflicts. Also, dismissal operations should maintain separation between busses and other vehicles.

This study indicates that with appropriate dismissal operations (phased student dismissal), and the above-mentioned recommendations, the area roadways and intersections can accommodate the proposed Magnet School redevelopment in Stamford, Connecticut with relatively minor increases to vehicle delay which are within the acceptable levels of traffic operation.

BETA

Magnet School
Stamford, Connecticut

Figure 1
Site Location





Magnet School
Stamford, Connecticut

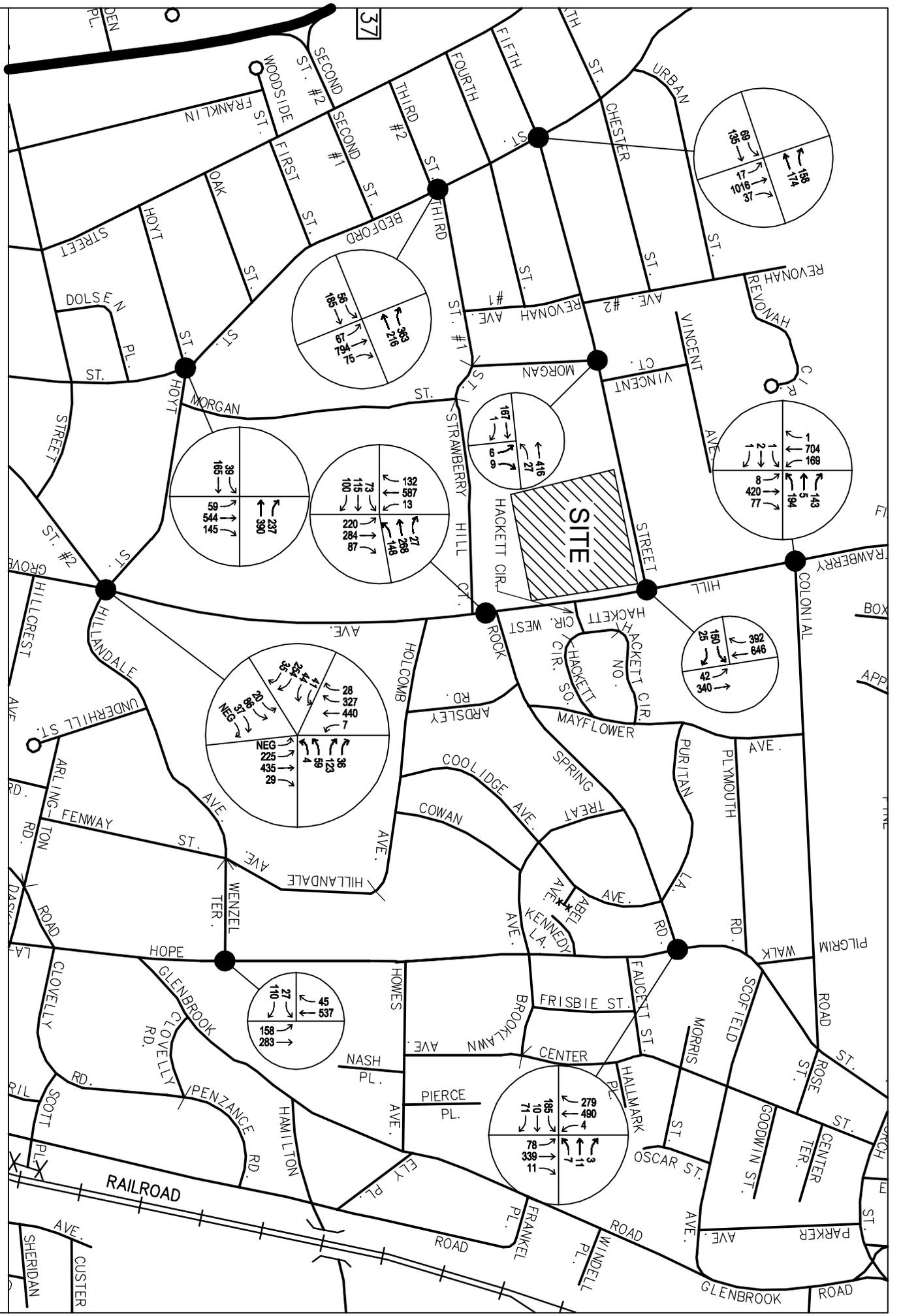
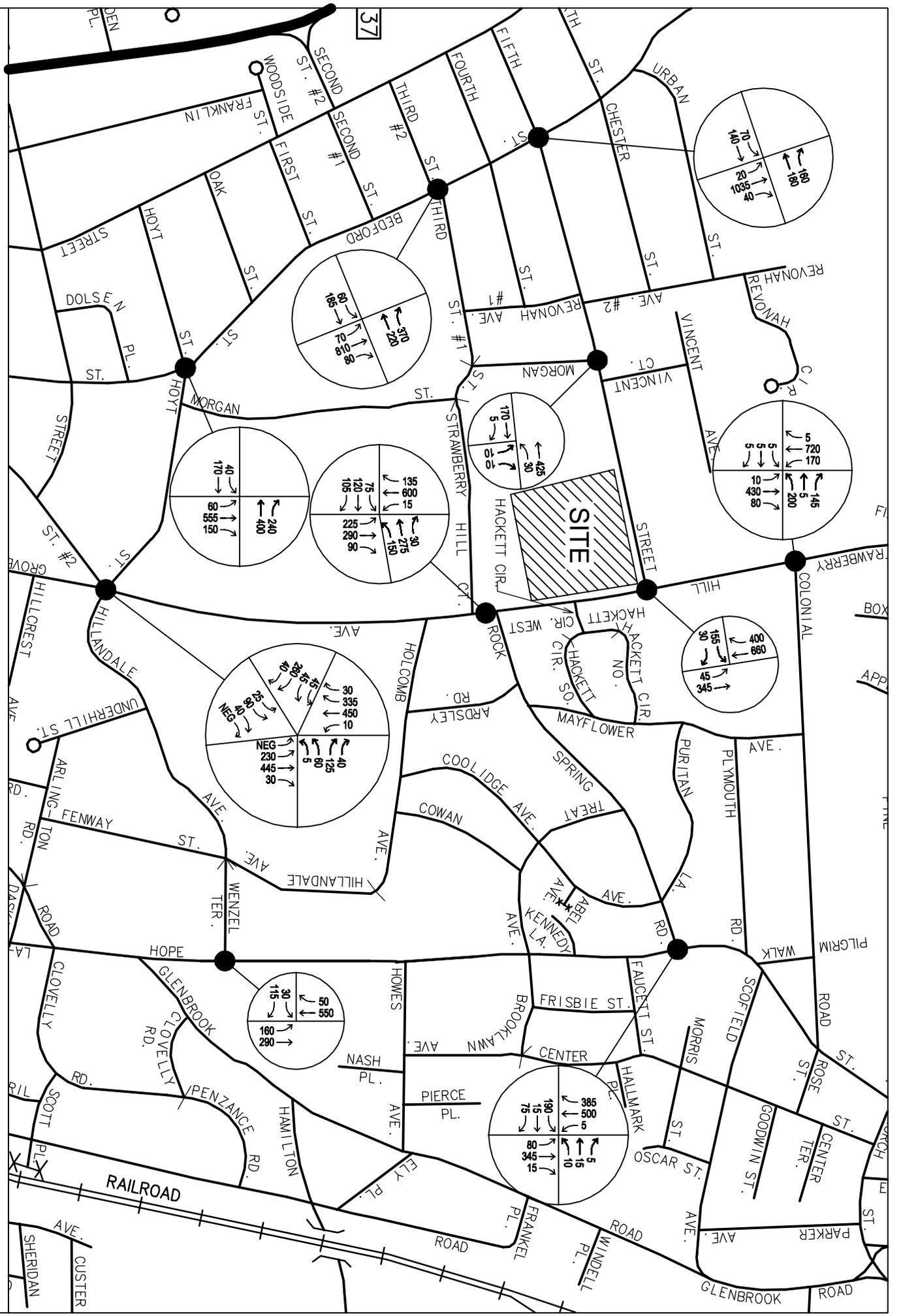


Figure 2
Existing AM Peak Hour
Turning Movement Volumes



Magnet School
Stamford, Connecticut

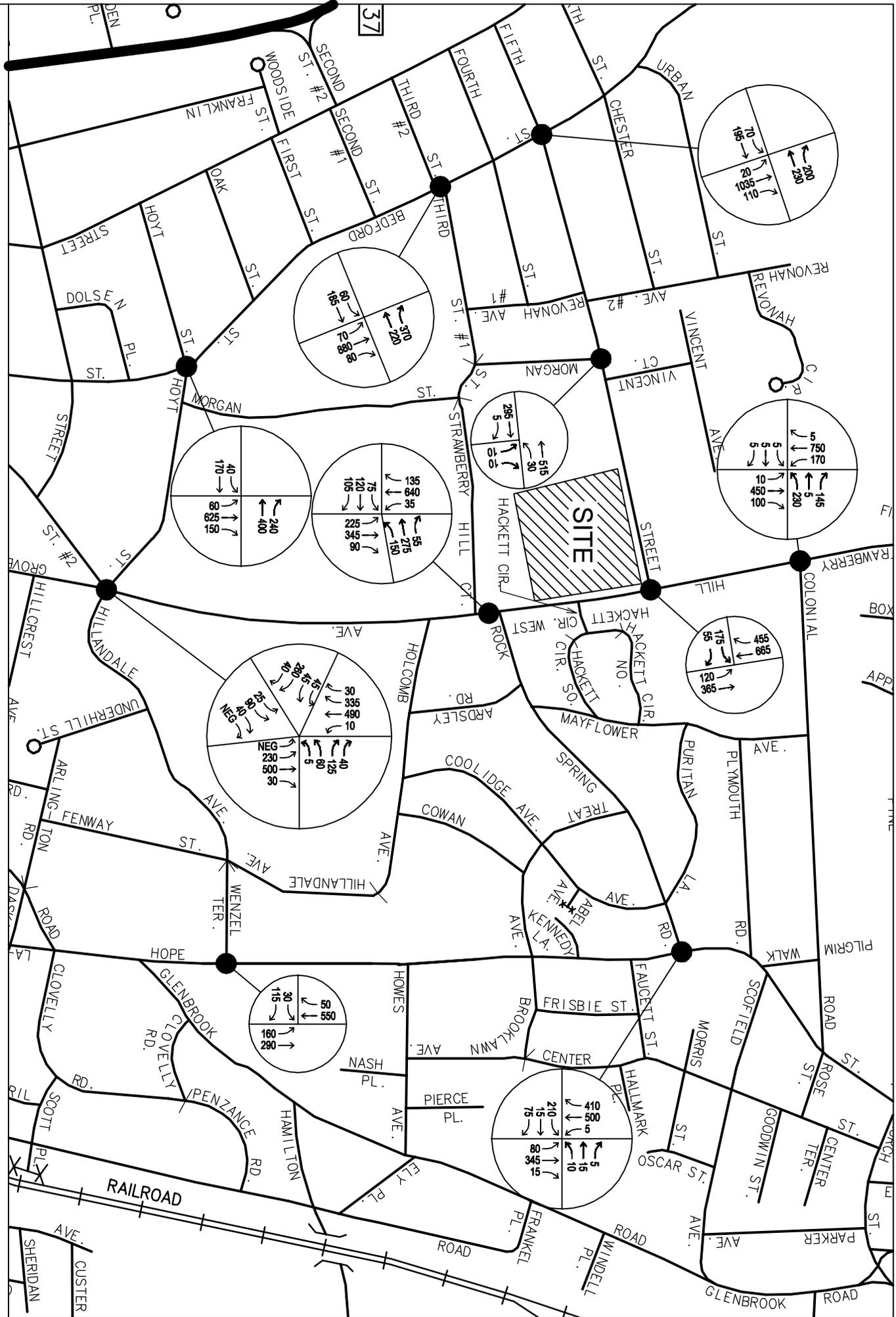
Figure 4
No Build AM Peak Hour
Turning Movement Volumes





Magnet School
Stamford, Connecticut

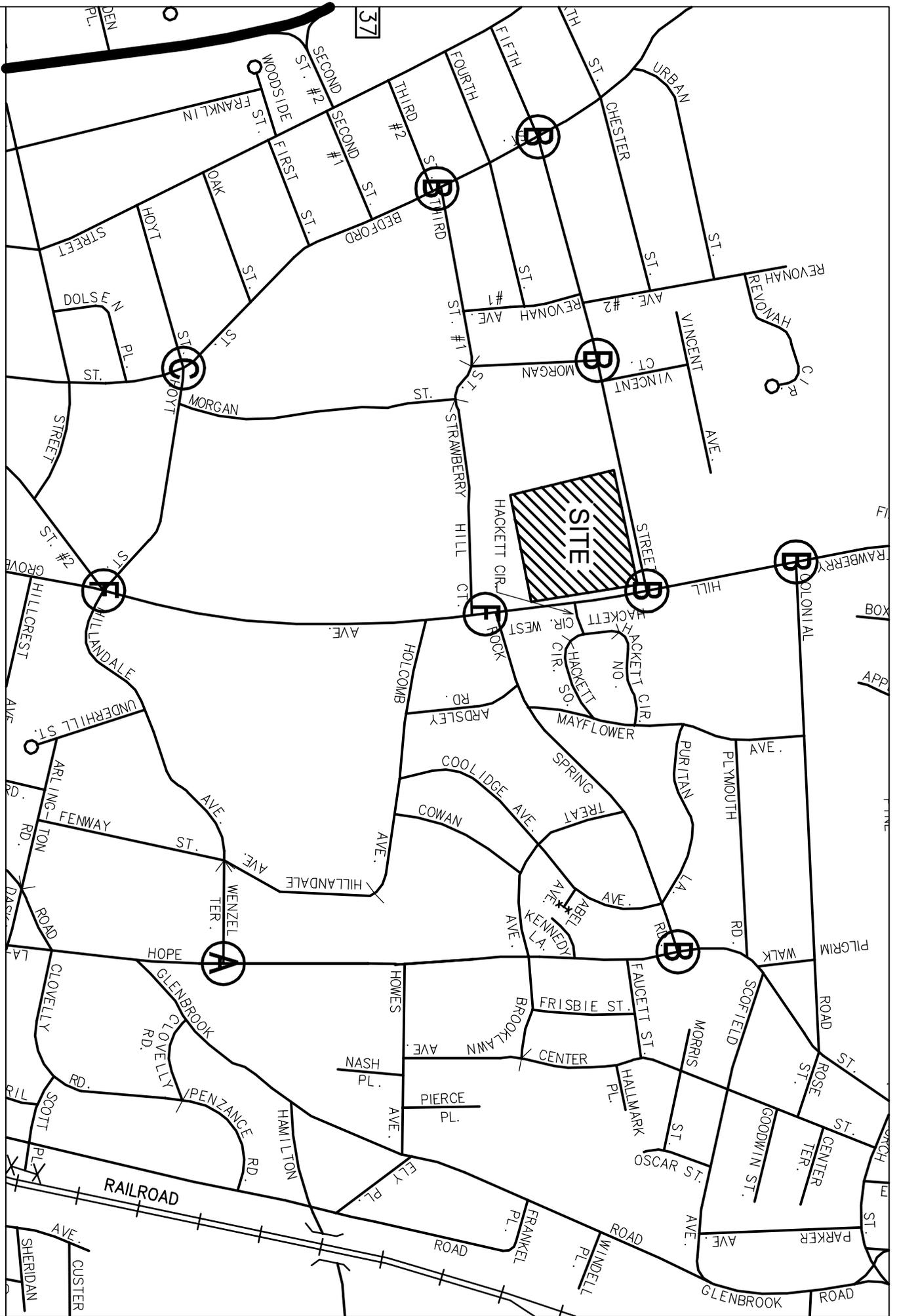
Figure 10
Build K-5 School AM Peak Hour
Turning Movement Volumes

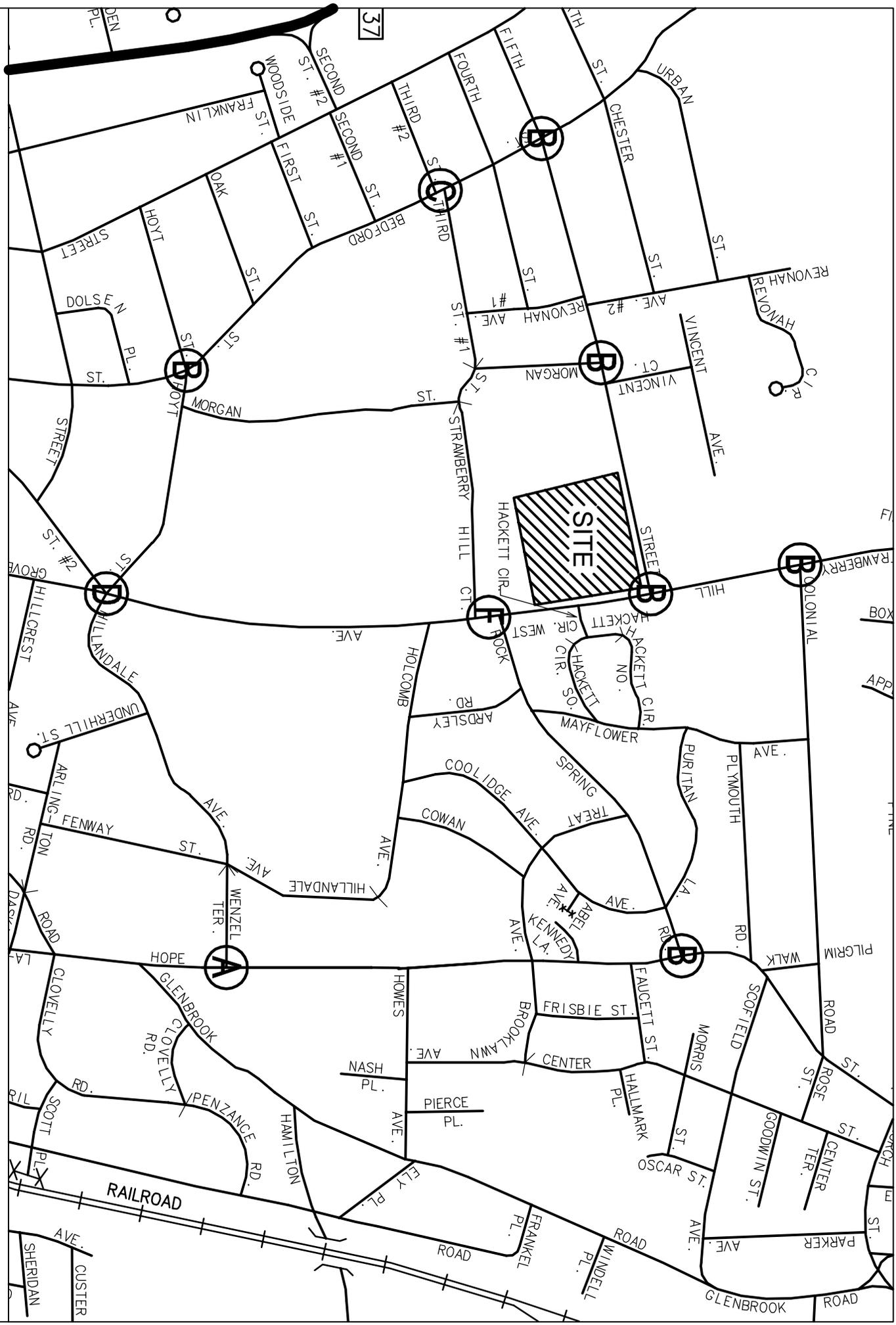




Magnet School
Stamford, Connecticut

Figure 16
Build K-5 School AM Peak Hour
Level of Service





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Figure 17
Build K-5 School PM Peak Hour
Level of Service



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Figure 18
Build K-8 School AM Peak Hour
Level of Service

