AKRF, Inc.
Environmental, Planning, and Engineering Consultants
34 South Broadway
Suite 401
White Plains, NY 10601
tel: 914 949-7336
fax: 914 949-7559
www.akrf.com

Copies 1 Planning Board
..... Town Board
..... Zoning Board
1 Legal Dept.
1 DOTS Director
..... C.A.C.
..... A.R.C.
1 Applicant
1 David Skinner, Esq.
1 Tim Cronin, P.E.
Sent 3/31/17

Technical Memorandum

To: Michael Preziosi, P.E., Chris Kehoe, AICP – Town of Cortlandt

From: Anthony Russo, Alex Auld

Date: March 28, 2017

Re: Montauk Bus Garage Facility – Traffic Impact Study

cc: Marissa Tarallo, P.E.

A. INTRODUCTION AND EXECUTIVE SUMMARY

INTRODUCTION

This memorandum examines traffic, transportation, and pedestrian conditions and provides an assessment of project generated vehicle trips and potential traffic impacts associated with the proposed site plan for the Montauk Bus Garage Facility (Facility). The project site is located at the western terminus of 6th Street in the Hamlet of Verplanck.

The proposed site plan consists of the creation of more formalized parking and circulation areas due to the anticipated increase in the number of vehicles proposed to utilize the Facility in the future.

EXECUTIVE SUMMARY

Traffic conditions were assessed at (1) the project site and (2) key intersections and roadways in the study area.

PROJECT SITE

Existing traffic conditions at the project site were assessed based on field observations and counts. Vehicle and pedestrian circulation on-site appears to be problematic:

- There are no pavement markings to delineate parking stalls for autos and buses.
- There are no sidewalks that connect the employee parking lot to the bus parking lot.
- The surfaces of the parking lots are unpaved and uneven.
- The two project site driveways are narrow making two-way traffic flow difficult.
- There does not appear to be sufficient space on-site to accommodate facility operations. Buses were observed to queue on 6th Street, Highland Avenue, and Broadway. Employees were observed walking to the site from surrounding streets (where some parked).

The proposed site plan improvements appear to provide a remedy to many of the problems identified above and may allow for more efficient on-site operations so vehicles do not need to queue or park off-site.

STUDY AREA INTERSECTIONS AND ROADWAYS

Traffic conditions along the nearby study area intersections and roadways were determined based on data collection, field observations, and capacity analyses. Key points identified for the study area intersections and roadways include the following:

- Capacity analyses revealed that all study area intersections operate at acceptable Levels-of-Service (LOS) in the LOS A to B range and no notable queueing conditions occur at these locations for all conditions analyzed—Existing (with and without the facility in operation) and in the future with the proposed expansion in-place.
- Autos and buses traveling to and from the Facility were observed to park along study area roadways (see "Project Site" section above).
- Based on speed counts conducted, speeding is an issue along the roadways studied (6th Street, 11th Street, and Broadway). This is particularly the case on Broadway where speeds were recorded approximately 5 to 20 mph over the 30 mph speed limit.

In order to address speeding issues (both auto and bus) along the study area roadways, the Town's Traffic Consultant will work with the Town staff in developing traffic calming measures to address reducing traffic speeds in the area. It is recommended that the Applicant contribute towards future traffic calming improvements to be installed on Broadway.

An analysis of the two signalized intersections—Broadway and 6th Street, and Broadway and 8th Street, as unsignalized intersections revealed that they would operate acceptably (LOS A to B range) and appear not to warrant signalization.

B. EXISTING CONDITIONS

STUDY AREA

To assess the traffic impacts associated with the project site, a study area was identified that considered key intersections that might be affected by project site-generated trips. A total of 4 locations were identified for analysis, as shown in **Figure 1**. These intersections are:

1. Broadway and 6th Street (signalized)
2. Broadway and 8th Street (signalized)
3. Broadway and 11th Street (unsignalized)
4. Highland Avenue and 6th Street (unsignalized)

DATA COLLECTION PROGRAM

In order to establish Existing traffic conditions at the four study area intersections, manual turning movement counts (TMC) and vehicle classification counts (VCC) were collected at the study area intersections during the weekday AM (6:30 AM – 9:30 AM), and weekday PM (2:00 PM – 6:00 PM) peak periods in December, 2016 (with local schools in session).

Additional bus classification counts (in order to distinguish between large and small buses) and route observations were conducted at the following locations in February, 2017 (with local schools in session) for the same weekday AM and PM peak periods identified above:

1. Project Site Driveway
2. Broadway and 6th Street
3. 6th Street and Highland Avenue

Automatic Traffic Recorder (ATR) counts for volume and speed data were conducted for one full week in December, 2016 (with local schools in session) at the following locations:

1. 6th Street, between Madeline Avenue and Broadway.
2. Broadway, between 11th Street and 13th Street
3. 11th Street, between Highland Avenue and Broadway.

Additional speed data was collected in February 2017 along Broadway between 13th Street and 16th Street.

Field inventories of roadway geometry and signal timings/phasings were also conducted to provide the appropriate inputs to the operational analyses.

All data collection sheets are provided in **Appendix A**.

ROADWAY CHARACTERISTICS

The following section provides brief descriptions of the major roadways within the study area. The pavement condition definitions provided for each roadway are based on definitions provided in the Pavement Data Report published by NYSDOT and are as follows:

- Good – Surface distress beginning to show
- Fair – Surface distress is clearly visible

BROADWAY

Broadway, a roadway which generally traverses in a north-south direction, is classified by NYSDOT as a minor arterial roadway north its intersection with Seventh Street and as a local roadway south of its intersection with Seventh Street. Broadway is under the jurisdiction of the Town of Cortlandt.

Broadway generally provides one moving lane in each direction within the study area and varies in pavement width between 36 and 74 feet within the Study Area. On its northern approach at its intersection

Montauk Bus Garage/Facility

Project Site
Automatic Traffic Recorder (ATR) Count Locations
Turning Movement Count (TMC)/Vehicle Classification Count (VCC) Locations

Intersections to be Analyzed

1. *Broadway and 6th Street*
2. *Broadway and 8th Street*
3. *Broadway and 11th Street*
4. *Highland Avenue and 6th Street*

Traffic Study Area Intersections
Figure 1

with 6th Street, Broadway provides 90 degree parking spaces on the west side of the street and parallel parking spaces on the east side of the street. On its southern approach at its intersection with 6th Street, Broadway provides 90 degree parking spaces on both sides of the street. On its northern approach at its intersection with 8th Street, Broadway provides 90 degree parking spaces on both sides of the street. At all other study area intersection locations, Broadway generally provides paved shoulders on both sides of the street. Based on field observations, the pavement along Broadway in the study area is in good condition.

The speed limit along Broadway is 30 mph in the study area.

6TH STREET

6th Street, a roadway which generally traverses in an east-west direction, is classified by NYSDOT as a minor arterial roadway east of its intersection with Broadway and as a local roadway west of its intersection with Broadway. 6th Street is under the jurisdiction of the Town of Cortlandt.

6th Street generally provides one moving lane in each direction within the study area and varies in width between approximately 29 and 67 feet within the Study Area. On its eastern approach at its intersection with Broadway, 6th Street provides parallel parking spaces on the both sides of the street. Paved shoulders are provided along the other segments of 6th Street within the study area. Based on field observations, the pavement along Broadway in the study area is in fair to good condition.

The speed limit along 6th Street ranges between 25 and 30 mph in the study area.

Direct access to the Project Site is provided from a driveway along 6th Street located near its western terminus.

8TH STREET

8th Street is classified by NYSDOT as a local roadway and generally traverses in an east-west direction within the study area. 8th Street is under the jurisdiction of the Town of Cortlandt.

8th Street generally provides one moving lane in each direction and paved shoulders are provided for much of its length within the study area. The pavement width along 8th Street varies between approximately 29 and 41 feet. Based on field observations, the pavement along 8th Street in the study area is in fair to good condition.

The speed limit along 8th Street is 30 mph in the study area.

11TH STREET

11th Street is classified by NYSDOT as a local roadway and generally traverses in an east-west direction within the study area. 11th Street is under the jurisdiction of the Town of Cortlandt.

11th Street generally provides one moving lane in each direction and narrow (less than 6 feet wide) paved shoulders are provided for much of its length within the study area. The pavement width along 8th Street varies between approximately 29 and 33 feet. Based on field observations, the pavement along 8th Street in the study area is generally in good condition.

The speed limit along 8th Street is 30 mph in the study area.

HIGHLAND AVENUE

Highland Avenue is classified by NYSDOT as a local roadway and generally traverses in a north-south direction. Highland Avenue is under the jurisdiction of the Town of Cortlandt.

Highland Avenue generally provides one moving lane in each direction. The pavement width along Highland Avenue varies between approximately 38 and 50 feet and no shoulders are provided along much of its length. Based on field observations, the pavement along Highland Avenue in the study area is in fair to good condition.

Highland Avenue has a posted speed limit of 30 mph in the study area.

MONTAUK BUS FACILITY ACCESS DRIVEWAYS AND PARKING AREAS

The Montauk Bus Facility is accessible via two driveways off of 6th Street (near its western terminus), both of which have restricted gate access.

The western driveway, which serves as the primary driveway to the facility, is paved but unstriped and is approximately 16 feet in width. The western driveway is primarily used by buses, as it provides a direct connection to the facility's bus parking area and garages. On-site, the pavement is either in poor condition or non-existent with no pavement marking to designate traffic circulation patterns or parking stalls.

The eastern driveway is unpaved and is primarily used by employee/bus driver autos as it provides a direct connection to the facility's employee parking area, which is also unpaved. As the employee parking area is unpaved, there are no pavement marking to designate traffic circulation patterns or parking stalls.

EXISTING FACILITY TRAFFIC VOLUMES, TRIP ASSIGNMENTS, AND PATTERNS

Based on field counts, it was observed that approximately 55 buses and 50 autos currently utilize the Facility on a typical weekday (it is important to note that all vehicles do not currently park on-site). In addition to parking on-site, buses were observed parking along 6th Street, Broadway, and Highland Avenue while employees were observed parking on 6th Street and Highland Avenue.

Based on field observations and vehicle classification counts, typical existing travel patterns for buses traveling to and from the project site have been identified and are presented in **Figure 2**. Most bus trips were noted to utilize 6th Street and Broadway as the principal routes to and from the Facility with a small percentage utilizing Highland Avenue and 11th Street as routes to and from the Facility.

CAPACITY ANALYSIS

See Section C, "Traffic Capacity Analysis"

SAFETY

ACCIDENT DATA

Table 1 summarizes the most recent three year's traffic accident data for each of the study area intersections compiled from the NYSDOT records for the period of September 1, 2013 through August 31, 2016 (see **Appendix A** for NYSDOT accident data records). **Table 2** summarizes recent three year's traffic accident data for each of the study area non-intersection locations (i.e., road segments between study area intersections) compiled from the same NYSDOT records.

INTERSECTION ACCIDENTS

As shown in **Table 1**, one accident occurred at each of the following of intersections over the 3-year period studied (September, 2013 through August, 2016):

- Broadway & 6th Street
- Broadway & 8th Street
- Broadway & 14th Street (outside of the immediate study area)
- Broadway & 16th Street (outside of the immediate study area).

Of the four recorded intersection accidents, two involved collisions with pedestrians; one at the intersection of Broadway and 6th Street and the other at the intersection of Broadway and 16th Street. Driver inattention and failure to yield right of way were the factors cited for these two accidents. The other two recorded accidents involved a rear end collision (Broadway and 8th Street) and a collision with an animal (Broadway and 14th Street).

Due to the low number of intersection accidents in the study area, no trends could be identified for the intersection accident experience in the study area.

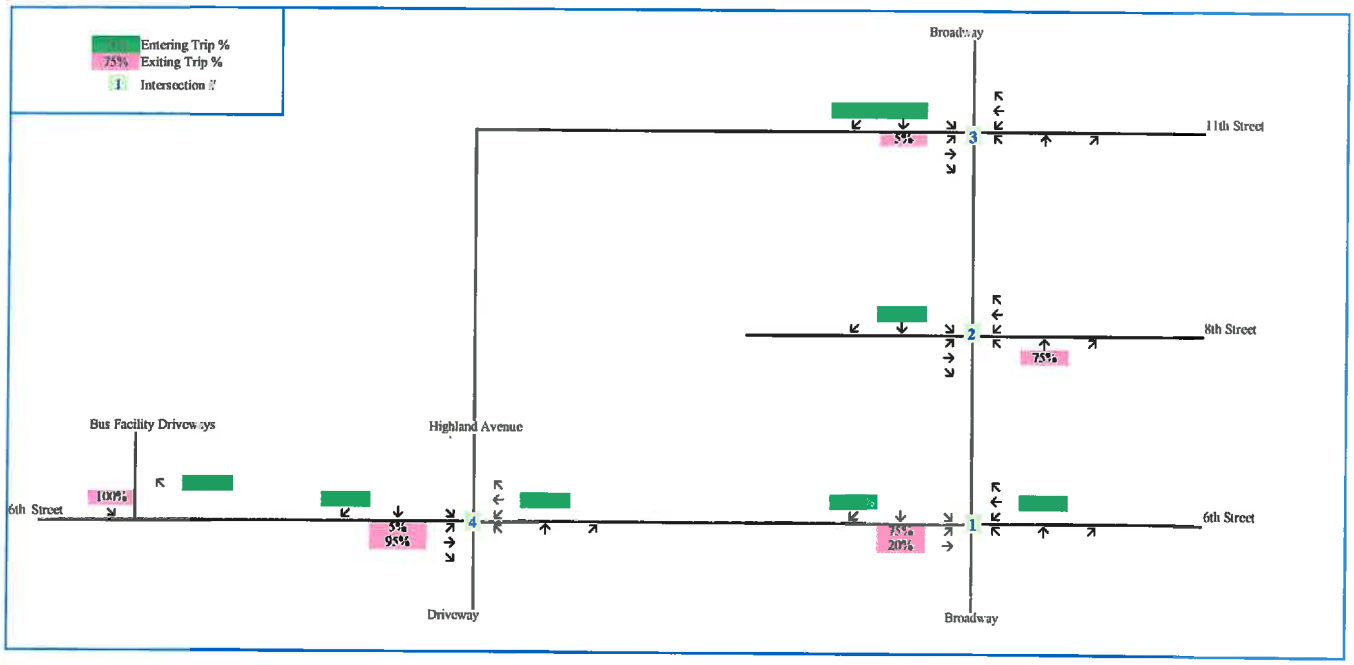

Figure 2
Existing Bus Travel Patterns

Table 1

Accident Summary - Study Area Intersection Locations

Intersection	Number of Accidents		Accident Trend																
	Avg/Yr	Period 9/1/13-8/31/16	Fatalities	Personal Injury	Non Reported	Reported	Overtaking	Rear End	Right Angle	Left Turn (with other car)	Left Turn (against other car)	Right Turn (with other car)	Right Turn (against other car)	Side-swipe	Ped/Bike	Head On	Animal	Other	Unknown
1. Broadway & 6th Street	0.3	1				1									1				
2. Broadway & 8th Street	0.3	1				1		1											
3. Broadway & 11th Street	0.0	0																	
4. Highland Avenue and 6th Street	0.0	0																	
*5. Broadway & 14th Street**	0.3	1				1											1		
*6. Broadway & 16th Street**	0.3	1		1		1									1				

Notes:
*Intersection located outside of immediate study area.
Source: NYSDOT, December 2016

Table 2

Accident Summary - Study Area Non-Intersection Locations

Road Segment	Number of Accidents		Accident Trend																
	Avg/Yr	Period 9/1/13-8/31/16	Fatalities	Personal Injury	Non Reported	Reported	Overtaking	Rear End	Right Angle	Left Turn (with other car)	Left Turn (against other car)	Right Turn (with other car)	Right Turn (against other car)	Side-swipe	Ped/Bike	Head On	Animal	Other	Unknown
Broadway b/w 6th Street & 8th Street	0.3	1			1			1											
Broadway b/w 8th Street & 11th Street	0.7	2			2			1	1**										
6th Street b/w Highland Avenue & Broadway	0.0	0																	
Highland Avenue/11th Street b/w 6th Street & Broadway	0.0	0																	
*9th Street b/w Highland Avenue & Broadway**	0.3	1				1		1											

Notes:
*Road segment not part of immediate study area.
** Occurred at the (non-study area) intersection of Broadway and 10th Street
Source: NYSDOT, December 2016

There were no fatalities reported at any of the study area intersections in the records provided by NYSDOT during the 3-year time period studied.

NON-INTERSECTION ACCIDENTS

As shown in **Table 2**, the segment of Broadway between 8th Street and 11th Street had the highest number of accidents (2) over the 3-year time period examined. Along this segment one rear end collision and one right angle collision occurred. The segments of Broadway between 6th Street and 8th Street, and 9th Street between Highland Avenue and Broadway, each experienced one rear end collision over the 3-year period studied.

The most common accident factors at the study area road segment locations was vehicles following too closely ("tailgating") and backing unsafely.

No fatalities were reported along any of the road segments studied.

SPEED DATA

Automatic Traffic Recorder (ATR) counts for speed data were conducted for one full week at the following locations:

- 6th Street, between Madeline Avenue and Broadway.
- Broadway, between 11th Street and 13th Street
- 11th Street, between Highland Avenue and Broadway.

Additional (stationary speed observations) speed counts were conducted along Broadway between 13th Street and 16th Street

The results of the ATR speed counts are presented below in **Table 3**. Speed limits for the specified locations are also presented in **Table 3**.

Table 3

Speed Data Summary

Location	Direction	Speed (mph)			Speed Limit (mph)	Exceeds Speed Limit?		
		85th %	95th %	Average		85th %	95th %	Average
6th Street (between Madeline Avenue & Broadway)	Eastbound	34	38	28	30	Yes	Yes	No
	Westbound	35	40	29		Yes	Yes	No
11th Street (between Highland Avenue & Broadway)	Eastbound	33	35	26	30	Yes	Yes	No
	Westbound	32	35	26		Yes	Yes	No
Broadway (between 11th Street & 13th Street)	Northbound	39	43	33	30	Yes	Yes	Yes
	Southbound	37	41	30		Yes	Yes	No
Broadway (between 13th Street & 16th Street)	Northbound and Southbound	45 to 50 (measured range)			30	Yes		

As presented in **Table 3**, the recorded speeds exceed the speed limits at each of the locations examined.

The stationary speed observations conducted on Broadway showed that the speeds along that segment of Broadway were generally higher in the southbound directions and that both autos and buses were noted speeding along that segment of Broadway.

PEDESTRIAN ENVIRONMENT

Pedestrian (walkers, joggers) and bicycle volumes were generally observed to be low in the study area. However, as the field observations were conducted in the winter months, it is anticipated that pedestrian and bicycle volumes would be higher during the spring, summer, and fall months. A network of sidewalks

and crosswalks are provided along Broadway (between 5th and 8th Streets), along with 6th and 7th Streets (east of Broadway only). Pedestrian facilities are generally not provided along the remaining study area roadways, including 6th Street in the vicinity of the project site.

No pedestrian facilities are provided on-site at the Facility.

C. TRAFFIC CAPACITY ANALYSIS

In order to assess current and future traffic conditions, the following conditions were analyzed for the study area intersections:

- 2016 Existing Conditions
- 2017 No Build Conditions
- 2017 Build Conditions (increased bus and employee auto activity associated with the proposed project)

EXISTING CONDITIONS

PEAK HOURS AND TRAFFIC VOLUMES

Based on a review of all the traffic count data, the peak periods for the study area traffic network were determined to be as follows:

- Weekday AM Peak Period – 6:30 AM to 9:30 AM
- Weekday PM Peak Period – 2:00 PM to 6:00 PM

As the volumes for the various study area intersections peak at different times within each peak period, the individual intersection peak hour volumes were integrated into a single network for each peak period (AM and PM) examined in order to provide for a conservative analysis.

Figures 3 and **4** show the roadway volumes at the study area intersections for 2016 Existing conditions for the peak periods analyzed.

CAPACITY ANALYSIS METHODOLOGY

Signalized Intersections

The operation of signalized intersections in the Study Area was analyzed using the Synchro 8 traffic software applying the methodologies presented in the 2010 *Highway Capacity Manual (HCM2010)*. This procedure evaluates signalized intersections for average control delay per vehicle and level of service (LOS).

LOS can be characterized for the entire intersection, each intersection approach, and each lane group. Control delay alone is used to characterize LOS for the entire intersection or an approach. Control delay and volume-to-capacity (v/c) ratio are used to characterize LOS for a lane group. Delay quantifies the increase in travel time due to traffic signal control. It is also a surrogate measure of driver discomfort and fuel consumption. The volume-to-capacity ratio quantifies the degree to which a phase's capacity is utilized by a lane group.

LOS A describes operation with a control delay of 10 seconds per vehicle or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If it is due to favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

LOS B describes operation with control delay between 10 and 20 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

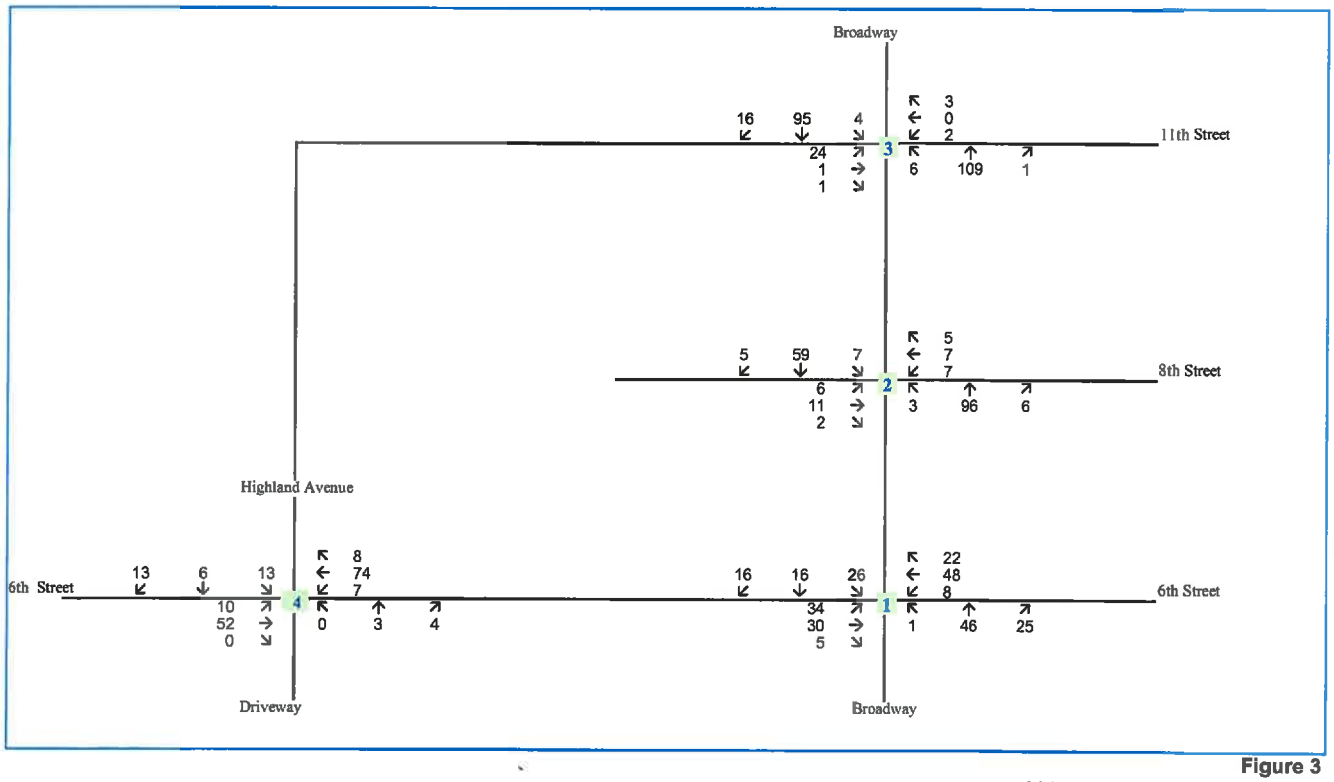

Figure 3
2016 Existing Traffic Volumes
Weekday AM Peak Period

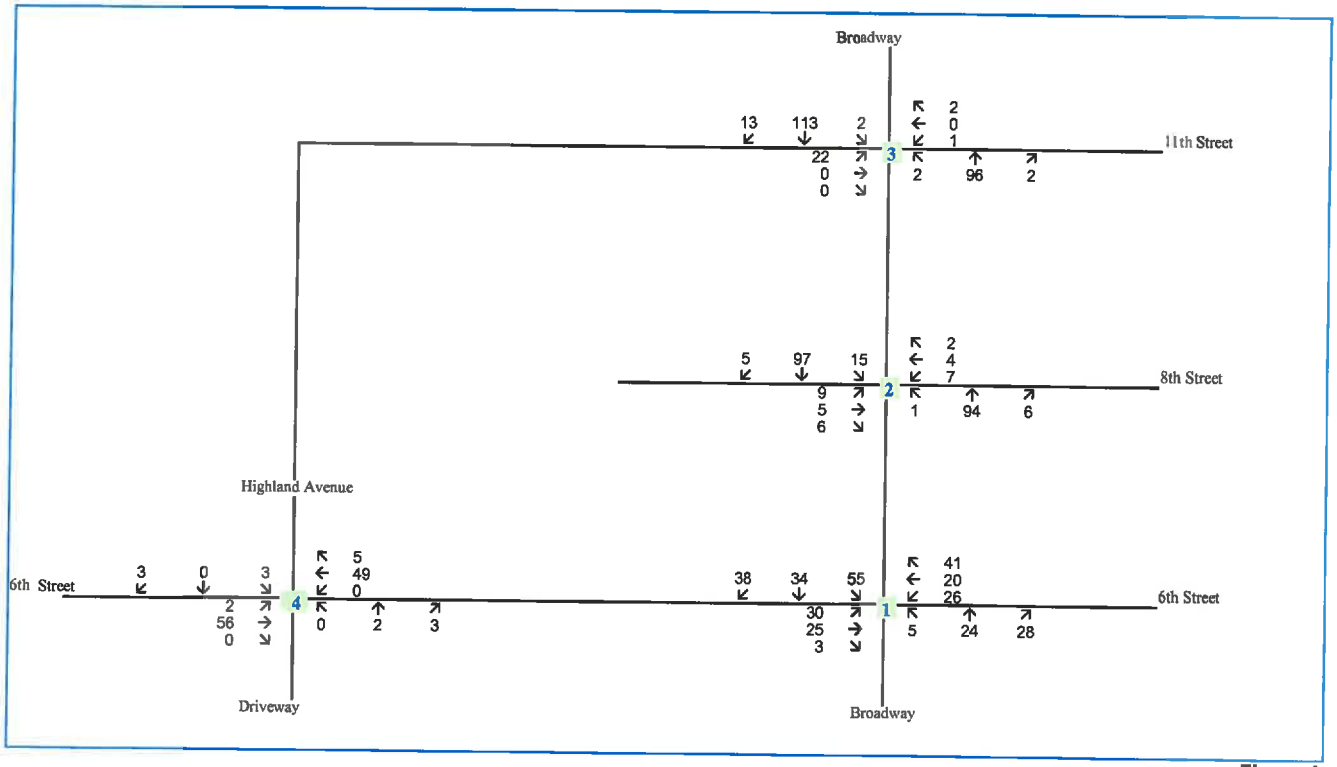

Figure 4
2016 Existing Traffic Volumes
Weekday PM Peak Period

LOS C describes operation with control delay between 20 and 35 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is favorable or the cycle length is moderate. Individual cycle failures (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

LOS D describes operation with control delay between 35 and 55 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

LOS E describes operation with control delay between 55 and 80 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

LOS F describes operation with control delay exceeding 80 seconds per vehicle or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

A lane group can incur a delay less than 80 seconds per vehicle when the volume-to-capacity ratio exceeds 1.0. This condition typically occurs when the cycle length is short, the signal progression is favorable, or both. As a result, both the delay and volume-to-capacity ratio are considered when lane group LOS is established. A ratio of 1.0 or more indicates that cycle capacity is fully utilized and represents failure from a capacity perspective (just as delay in excess of 80 seconds per vehicle represents failure from a delay perspective).

The control delay criteria for the range of service levels for signalized intersections are shown in **Table 4.**

Table 4
LOS Criteria for Signalized Intersections

Control Delay Per Vehicle	Level-of-Service (LOS)[1]	
	v/c ratio ≤ 1.0	v/c ratio > 1.0
≤ 10.0 seconds	A	F
>10.0 and ≤ 20.0 seconds	B	F
>20.0 and ≤ 35.0 seconds	C	F
>35.0 and ≤ 55.0 seconds	D	F
>55.0 and ≤ 80.0 seconds	E	F
>80.0 seconds	F	F

Source: Transportation Research Board. *2010 Highway Capacity Manual.*
Note: (1) For approach-based and intersectionwide assessments, LOS is defined solely by control delay.

Unsignalized Intersections

LOS for a two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections is determined by the computed or measured control delay. For motor vehicles, LOS is determined for each minor-street movement (or shared movement) as well as major-street left turns at TWSC intersections and for all movements at AWSC intersections. LOS is not defined for the intersection as a whole for TWSC and AWSC intersections.

The LOS criteria for both TWSC and AWSC unsignalized intersections are summarized in **Table 5.**

Table 5
LOS Criteria for Unsignalized Intersections

Control Delay Per Vehicle	Level-of-Service (LOS)[(1)]	
	v/c ratio ≤ 1.0	v/c ratio > 1.0
≤ 10.0 seconds	A	F
>10.0 and ≤ 15.0 seconds	B	F
>15.0 and ≤ 25.0 seconds	C	F
>25.0 and ≤ 35.0 seconds	D	F
>35.0 and ≤ 50.0 seconds	E	F
>50.0 seconds	F	F

Source: Transportation Research Board. *2010 Highway Capacity Manual.*
Note: (1) For TWSC intersections, the LOS criteria apply to each lane on a given approach and to each approach on the minor street (for TWSC intersections). LOS is not calculated for major-street approaches or for the intersection as a whole.

Note that the LOS criteria for unsignalized intersections are somewhat different from the criteria used in signalized intersections. At TWSC intersections, drivers on the stop-controlled approaches are required to select gaps in the major-street flow in order to execute crossing or turning maneuvers. In the presence of a queue, each driver on the controlled approach must also use some time to move into the front-of-queue position and prepare to evaluate gaps in the major-street flow. AWSC intersections require drivers on all approaches to stop before proceeding into the intersection.

EXISTING OPERATING CONDITIONS

Traffic operating conditions at each study area intersection were analyzed using the *HCM2010* methodology (see **Appendix A** for Synchro 8 outputs for all Study Area intersections) to compute delays, v/c ratios, and LOS as described above.

During peak hours, LOS D (or better) operations are generally considered to be acceptable operating conditions for signalized and unsignalized intersections. As shown in **Table 6** all of the study area intersection lane groups/approaches operate at LOS B or better under 2016 Existing Conditions during the peak hours analyzed.

FUTURE WITHOUT THE PROPOSED PROJECT ("NO BUILD") CONDITIONS

TRAFFIC CONDITIONS

The Future without the Proposed Project, or "No Build," traffic condition is an interim scenario that establishes a future baseline condition without the Proposed Project. The No Build year is the same year as the Build year of the Proposed Project (2017). No Build traffic conditions are ascertained based on the following procedure:

- Increase the 2016 Existing Conditions traffic volumes by 1.0 percent per year from 2016 (existing year) to 2017 (build year) for background growth, resulting in an overall growth rate of 1.0 percent. The use of 1.0 percent per year was based on guidance from the Town of Cortlandt.
- Manually add trips from pending developments ("No Build projects") located in the vicinity of the project site.
- Consideration of major roadway improvements in the vicinity of study area.

The Town of Cortlandt Planning Office was contacted for a list of pending developments located in the vicinity (approximately ½ mile) of the project site. No notable projects scheduled for completion in 2017 were identified by the Town which would be anticipated to be significant traffic generators.

Based on information provided by NYSDOT and the Town, no major roadway improvements are planned or proposed in the vicinity of the study area for 2017. The Town is expecting to construct a sidewalk from 5th Street to Riverview on the east side of Broadway which is tentatively scheduled for construction in

Table 6
Montauk Bus Garage Facility
2016 Existing Conditions Level of Service Analysis

No.	Intersection	Approach	Lane Group	AM Peak Period V/C Ratio	AM Peak Period Delay (sec)	AM Peak Period LOS	PM Peak Period V/C Ratio	PM Peak Period Delay (sec)	PM Peak Period LOS
Signalized Intersections									
1	Broadway & 6th Street	EB	LTR	0.19	12.0	B	0.15	11.6	B
		WB	LTR	0.14	11.3	B	0.17	11.6	B
		NB	LTR	0.15	11.4	B	0.11	11.1	B
		SB	LTR	0.18	11.8	B	0.27	12.8	B
		INT			11.6	B		11.9	B
2	Broadway & 8th Street	EB	LTR	0.06	17.4	B	0.05	17.3	B
		WB	LTR	0.07	17.5	B	0.05	17.3	B
		NB	LTR	0.14	6.0	A	0.17	6.2	A
		SB	LTR	0.10	5.8	A	0.16	6.1	A
		INT			8.8	A		7.8	A
Unsignalized Intersections									
3	Broadway & 11th Street	EB	LTR	0.06	11.0	B	0.05	10.7	B
		WB	LTR	0.02	9.7	A	0.01	9.4	A
		NB	L	0.01	7.6	A	0.00	7.5	A
		SB	L	0.00	7.5	A	0.00	7.5	A
		INT			1.8	A		1.6	A
4	6th Street & Highland Avenue	EB	LTR	0.01	7.7	A	0.00	7.8	A
		WB	LTR	0.01	7.5	A	0.00	7.4	A
		NB	L	0.03	9.8	A	0.01	9.2	A
		SB	L	0.12	10.6	B	0.01	9.3	A
		INT			3.9	A		1.5	A

Notes:
EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound; INT = Intersection.
L = Left-Turn; T = Through; R = Right-Turn.
V/C = Volume to Capacity; SPV = Seconds per Vehicle; LOS = Level of Service.

the spring/summer of 2017. However, this sidewalk construction project is not anticipated to have a significant effect on traffic operations in the area.

Based on the information presented above, the grown 2017 traffic volumes serve as the 2017 No Build traffic volumes. Traffic volumes for the 2017 No Build peak hours analyzed are shown in **Figures 5 and 6**.

Table 7 presents a comparison of 2016 Existing and 2017 No Build LOS conditions for the study area intersections for the peak hours. Synchro 8 outputs for the 2017 No Build scenario are provided in **Appendix A**.

Under the 2017 No Build conditions, there would be no notable changes in LOS for any of the study area intersections analyzed.

FUTURE WITH THE PROPOSED PROJECT ("BUILD") CONDITIONS

PROJECT DESCRIPTION

The proposed project consists of the following improvements:

- Paved parking lots for both the bus and employee/bus driver parking areas.
- Modified widened paved entrances from 6th Street to each of the parking lots.
- An internal roadway connection between the two parking lot areas.
- An increase in the number of parking spaces for buses and autos.
- An increase in circulation space.

PROJECT TRIP GENERATION

In order to determine the number of new vehicle trips that would be generated by the proposed project, the difference in the existing number of vehicles that are utilized by the facility and the proposed number of vehicles anticipated to be accommodated as a result of the site improvements was determined. A summary of the project generated trips are shown in **Table 8**.

PROJECT VEHICLE DISTRIBUTION AND ASSIGNMENT

For the purpose of estimating the likely distribution of project-generated trips to and from the project site, a directional distribution of vehicle trips was created based on existing travel patterns in the traffic network and guidance provided on the site plan (Facility-associated vehicles are to be routed through the 6th Street and Broadway intersection, see **Appendix A**). These trip distribution patterns are shown in **Figure 7**. **Figures 8** and **9** show the project generated vehicle (auto and bus) trips for the Weekday AM and Weekday PM peak periods, respectively. All vehicles traveling to and from the facility would use the new modified driveways located on 6th Street to access the site.

TRAFFIC CONDITIONS

The project-generated traffic volumes described above were added to the No Build traffic volumes to estimate the Build traffic volumes. **Figures 10** and **11** show the 2017 Build traffic volumes for the Weekday AM and Weekday PM peak hours, respectively.

Table 9 presents a comparison of the 2017 No Build and 2017 Build conditions for the study area intersections. Synchro 8 outputs for the 2017 Build scenario are provided in **Appendix A**.

For the purpose of this analysis, impacts are identified as: (1) any change in LOS D or better to LOS E or F; (2) any change from LOS E to LOS F; or (3) any increase of 10% or greater in delay from LOS F.

Under the 2017 Build conditions, none of the study area intersection movements/lane groups would experience impacts based on the criteria above.

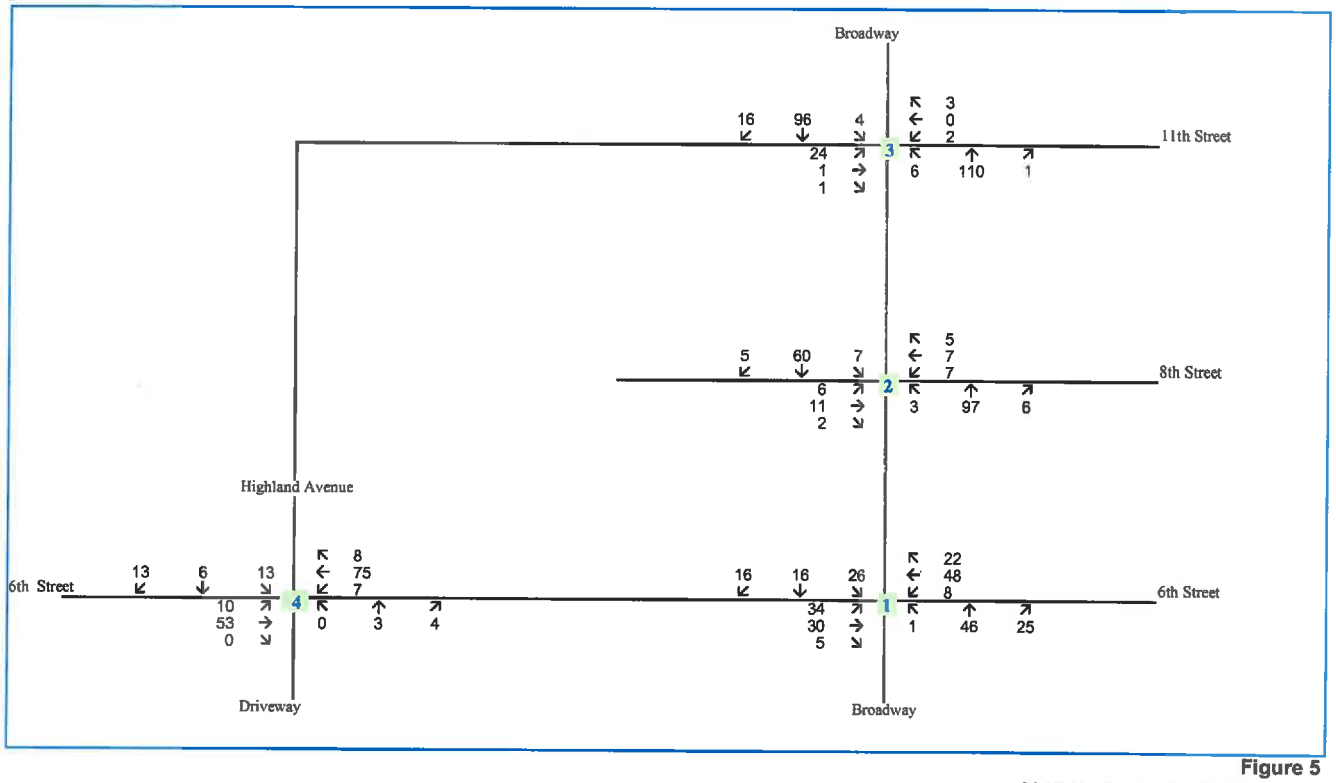

Figure 5
2017 No Build Traffic Volumes
Weekday AM Peak Period

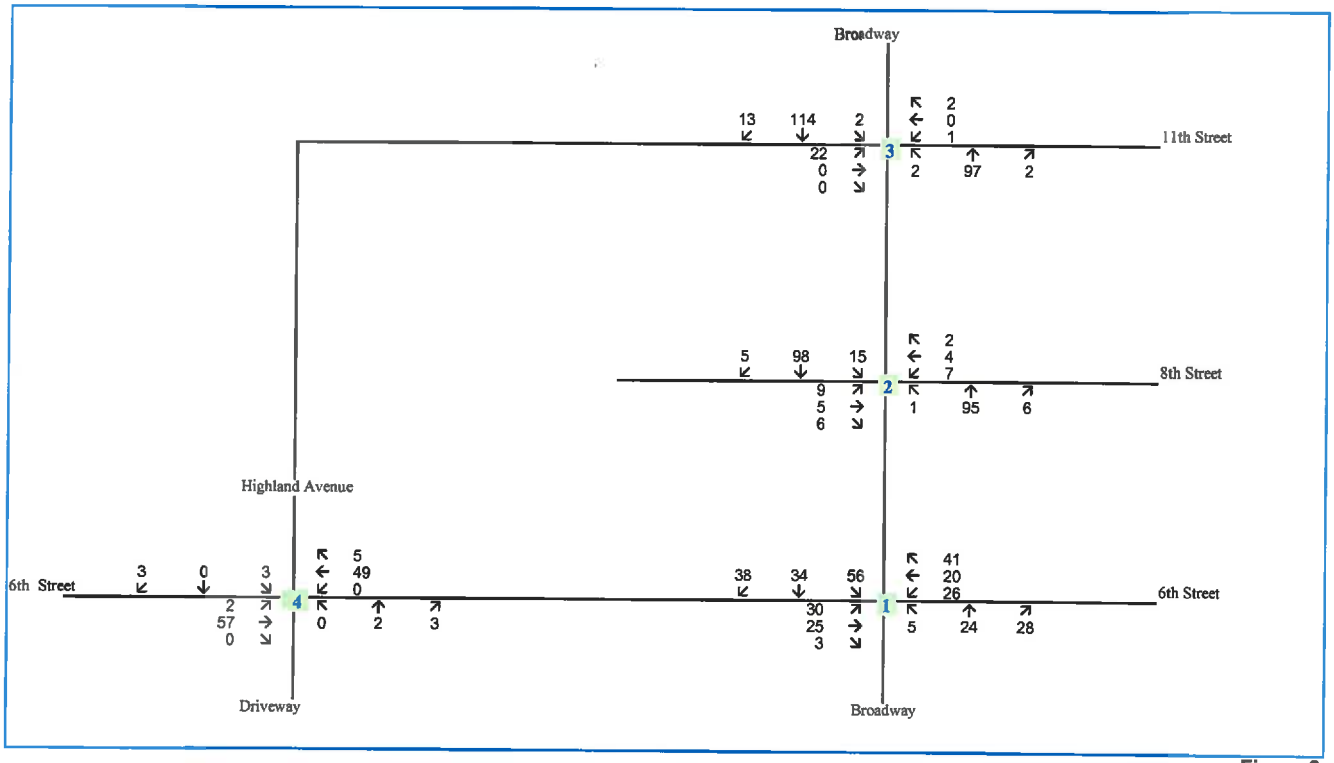

Figure 6
2017 No Build Traffic Volumes
Weekday PM Peak Hour (3:45 - 4:45 PM)

Table 7
Montauk Bus Garage Facility
2016 Existing Conditions and 2017 No Build Level of Service Analysis

No.	Intersection	Approach	Lane Group	AM Peak Period						PM Peak Period					
				2016 Existing			2017 No Build			2016 Existing			2017 No Build		
				V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS
Signalized Intersections															
1	Broadway & 6th Street	EB	LTR	0.19	12	B	0.19	12.0	B	0.15	11.6	B	0.15	11.6	B
		WB	LTR	0.14	11.3	B	0.14	11.3	B	0.17	11.6	B	0.17	11.6	B
		NB	LTR	0.15	11.4	B	0.15	11.4	B	0.11	11.1	B	0.11	11.1	B
		SB	LTR	0.18	11.8	B	0.18	11.8	B	0.27	12.8	B	0.27	12.8	B
		INT			11.6	B		11.6	B		11.9	B		12.0	B
2	Broadway & 8th Street	EB	LTR	0.06	17.4	B	0.06	17.4	B	0.05	17.3	B	0.05	17.3	B
		WB	LTR	0.07	17.5	B	0.07	17.5	B	0.05	17.3	B	0.05	17.3	B
		NB	LTR	0.14	6	A	0.14	6.0	A	0.17	6.2	A	0.17	6.3	A
		SB	LTR	0.10	5.8	A	0.10	5.8	A	0.16	6.1	A	0.16	6.1	A
		INT			8.8	A		8.8	A		7.8	A		7.8	A
Unsignalized Intersections															
3	Broadway & 11th Street	EB	LTR	0.06	11	B	0.06	11.0	B	0.05	10.7	B	0.05	10.7	B
		WB	LTR	0.02	9.7	A	0.02	9.7	A	0.01	9.4	A	0.01	9.4	A
		NB	L	0.01	7.6	A	0.01	7.6	A	0.00	7.5	A	0.00	7.5	A
		SB	L	0.00	7.5	A	0.00	7.5	A	0.00	7.5	A	0.00	7.5	A
		INT			1.8	A		1.8	A		1.6	A		1.5	A
4	6th Street & Highland Avenue	EB	LTR	0.01	7.7	A	0.01	7.7	A	0.00	7.8	A	0.00	7.8	A
		WB	LTR	0.01	7.5	A	0.01	7.5	A	0.00	7.4	A	0.00	7.4	A
		NB	L	0.03	9.8	A	0.03	9.8	A	0.01	9.2	A	0.01	9.2	A
		SB	L	0.12	10.6	B	0.12	10.6	B	0.01	9.3	A	0.01	9.3	A
		INT			3.9	A		3.8	A		1.5	A		1.5	A

Notes:
EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound; INT = Intersection.
L = Left-Turn; T = Through; R = Right-Turn.
V/C = Volume to Capacity; SPV = Seconds per Vehicle; LOS = Level of Service.

Table 8
Trip Generation

	Number of Facility Vehicles			AM Peak Period					PM Peak Period				
				Peak Period Increment	In		Out		Peak Period Increment	In		Out	
	Existing	Proposed	Increase		%	#	%	#		%	#	%	#
Bus	55	92	37	20	15%	3	85%	17	15	80%	12	20%	3
Auto	50	94	44	20	100%	20	0%	0	12	7%	1	93%	11
TOTAL	105	186	81	**40**		**23**		**17**	**27**		**13**		**14**

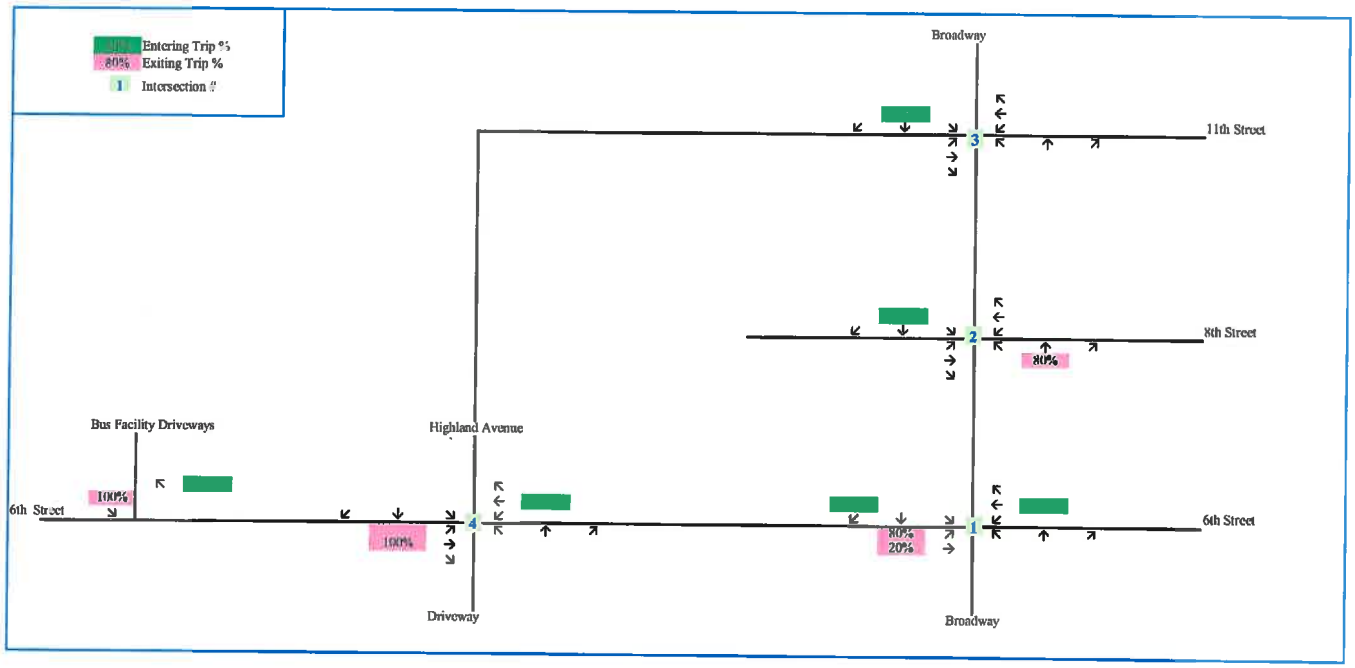

Figure 7
Future Facility Vehicle Travel Patterns

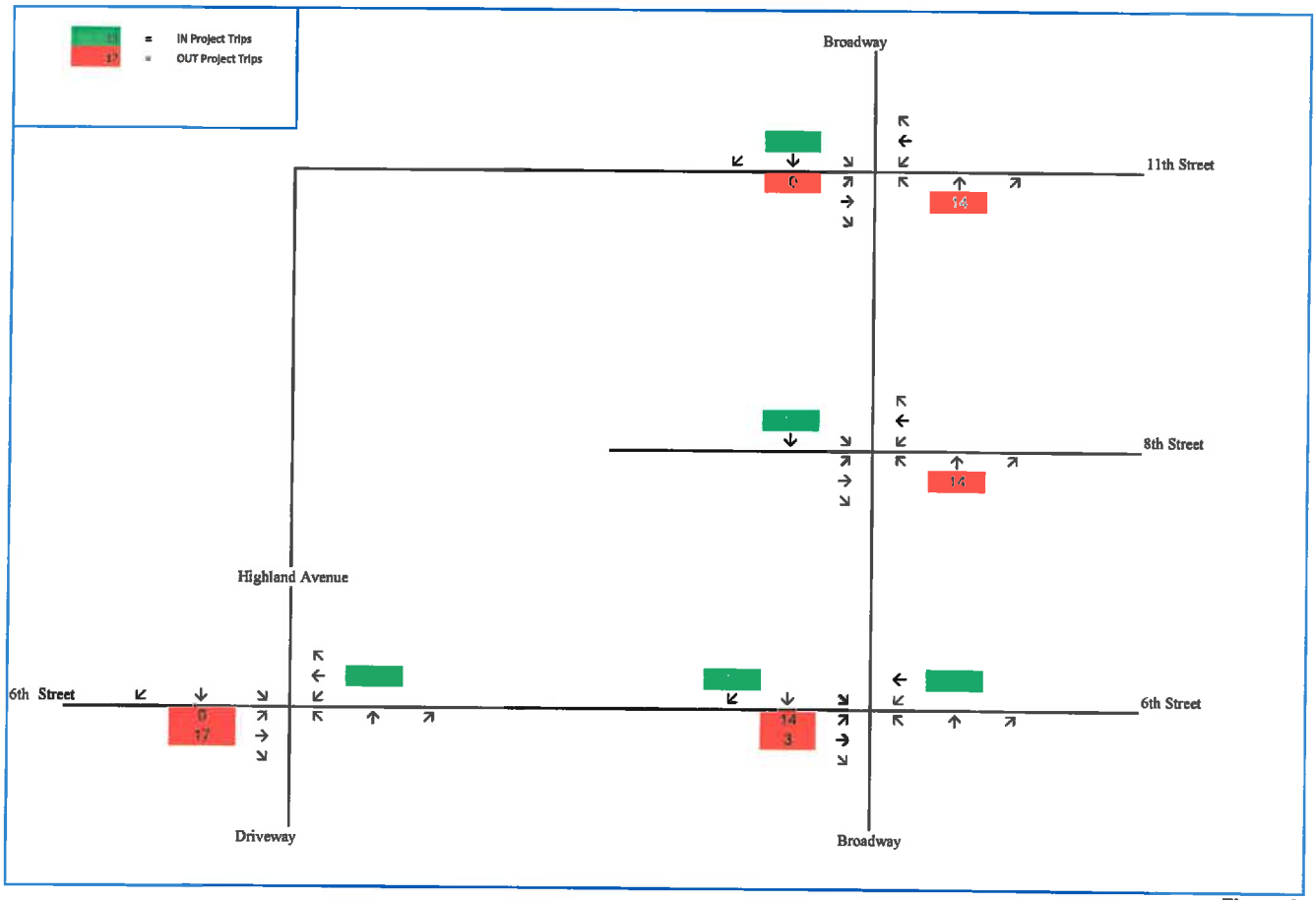

Figure 8
Project Generated Volumes (Auto and Bus)
Weekday AM Peak Period

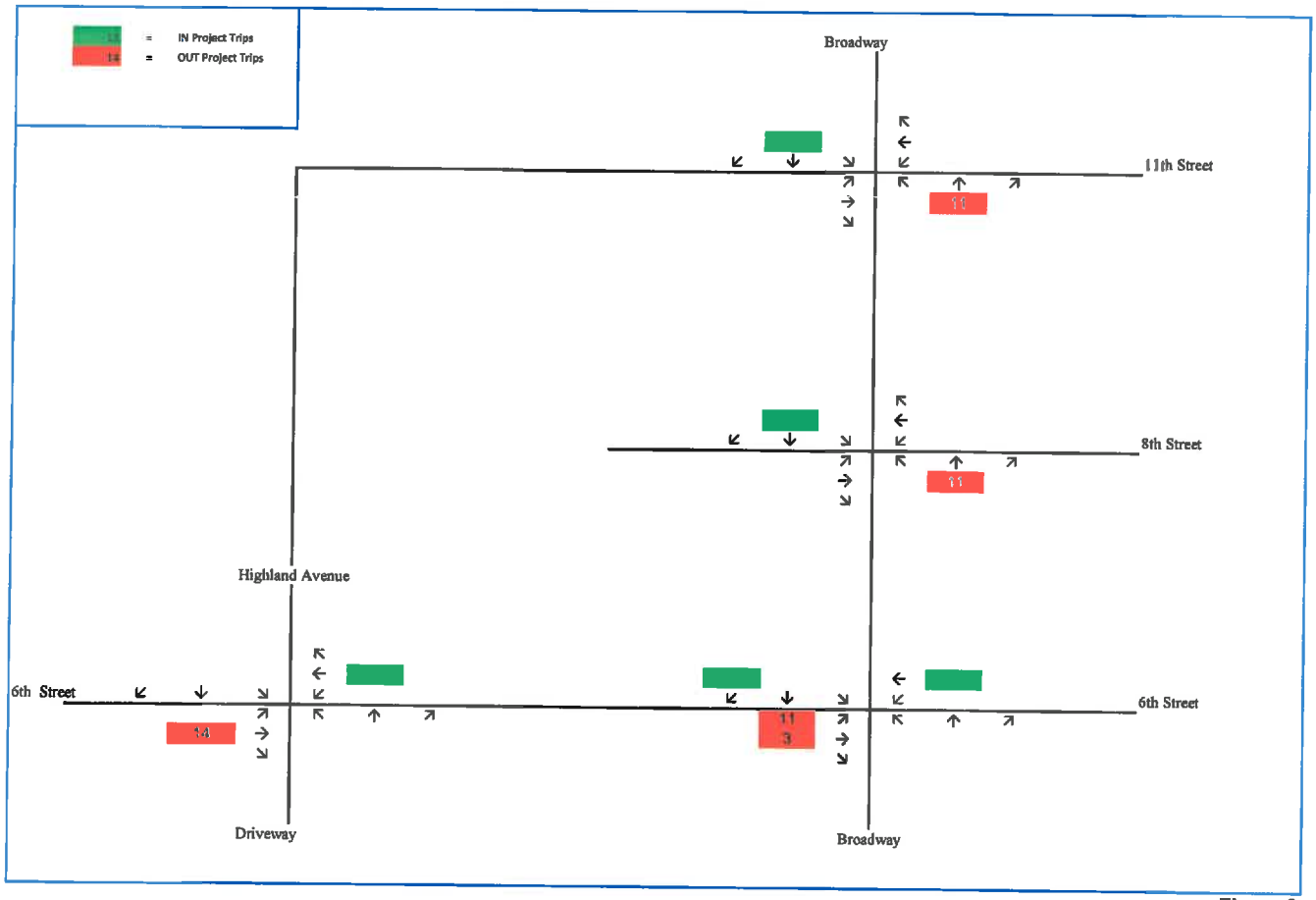

Figure 9
Project Generated Volumes (Auto and Bus)
Weekday PM Peak Period

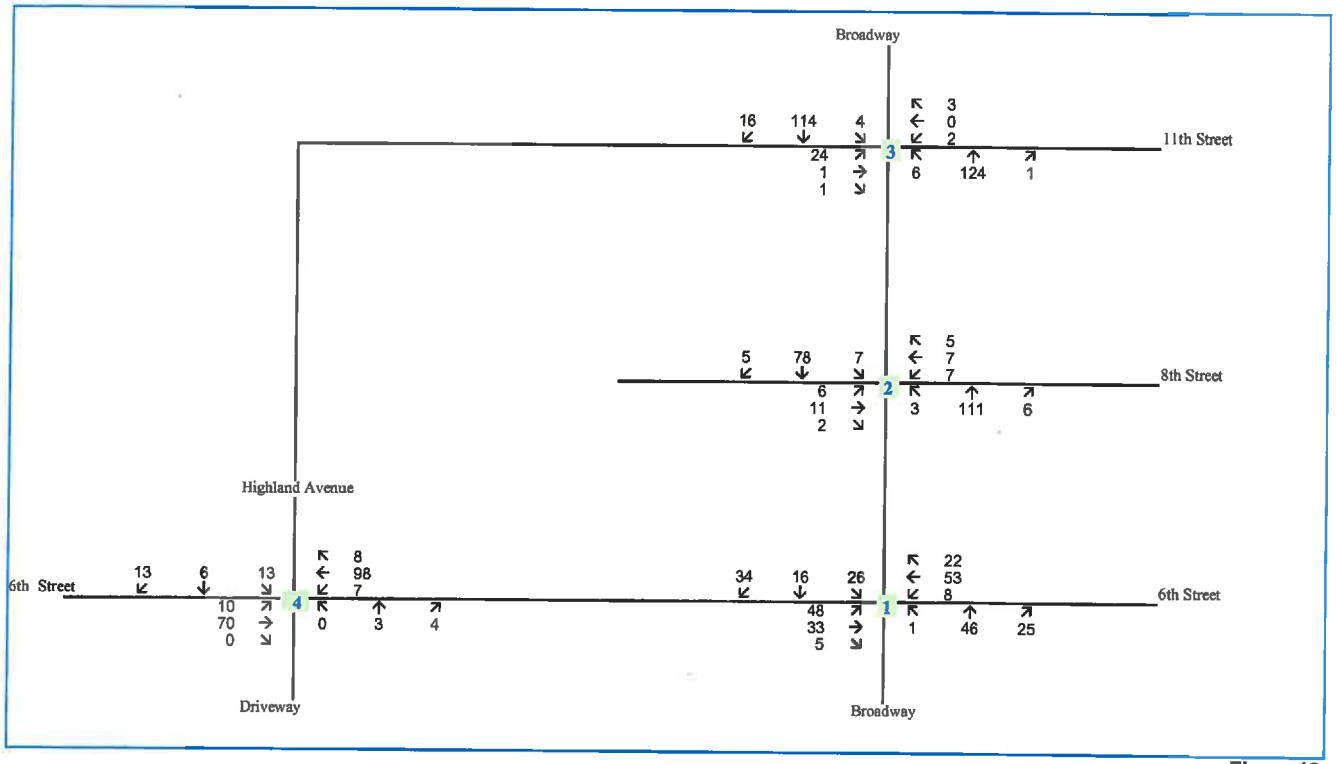

Figure 10
2017 Build Traffic Volumes
Weekday AM Peak Period

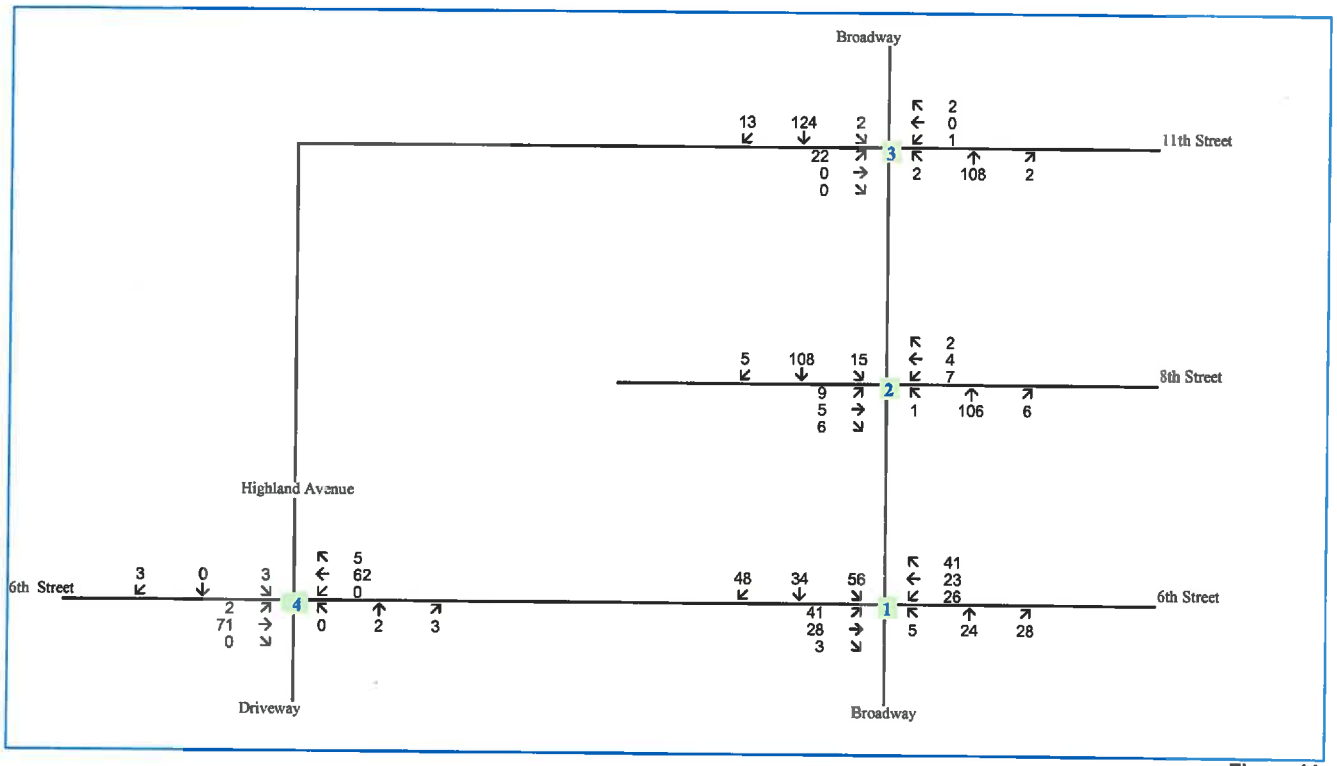

Figure 11
2017 Build Traffic Volumes
Weekday PM Period

Table 9
Montauk Bus Garage Facility
2016 Existing, 2017 No Build, and 2017 Build Conditions Level of Service Analysis

No.	Intersection	Approach	Lane Group	AM Peak Period									PM Peak Period								
				2016 Existing			2017 No Build			2017 Build			2016 Existing			2017 No Build			2017 Build		
				V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS	V/C Ratio	Delay (spv)	LOS
Signalized Intersections																					
1	Broadway & 6th Street	EB	LTR	0.19	12	B	0.19	12.0	B	0.25	12.7	B	0.15	11.6	B	0.15	11.6	B	0.20	12.1	B
		WB	LTR	0.14	11.3	B	0.14	11.3	B	0.15	11.4	B	0.17	11.6	B	0.17	11.6	B	0.18	11.7	B
		NB	LTR	0.15	11.4	B	0.15	11.4	B	0.15	11.4	B	0.11	11.1	B	0.11	11.1	B	0.11	11.1	B
		SB	LTR	0.18	11.8	B	0.18	11.8	B	0.25	12.7	B	0.27	12.8	B	0.27	12.8	B	0.27	12.8	B
		INT			11.6	B		11.6	B		12.1	B		11.9	B		12.0	B		12.1	B
2	Broadway & 8th Street	EB	LTR	0.06	17.4	B	0.06	17.4	B	0.06	17.4	B	0.05	17.3	B	0.05	17.3	B	0.05	17.3	B
		WB	LTR	0.07	17.5	B	0.07	17.5	B	0.07	17.5	B	0.05	17.3	B	0.05	17.3	B	0.05	17.3	B
		NB	LTR	0.14	6.0	A	0.14	6.0	A	0.16	6.2	A	0.17	6.2	A	0.17	6.3	A	0.19	6.4	A
		SB	LTR	0.10	5.8	A	0.10	5.8	A	0.12	5.9	A	0.16	6.1	A	0.16	6.1	A	0.17	6.2	A
		INT			8.8	A		8.8	A		8.5	A		7.8	A		7.8	A		7.8	A
Unsignalized Intersections																					
3	Broadway & 11th Street	EB	LTR	0.06	11.0	B	0.06	11.0	B	0.06	11.5	B	0.05	10.7	B	0.05	10.7	B	0.05	10.9	B
		WB	LTR	0.02	9.7	A	0.02	9.7	A	0.02	9.9	A	0.01	9.4	A	0.01	9.4	A	0.01	9.5	A
		NB	L	0.01	7.6	A	0.01	7.6	A	0.01	7.6	A	0.00	7.5	A	0.00	7.5	A	0.00	7.6	A
		SB	L	0.00	7.5	A	0.00	7.5	A	0.00	7.5	A	0.00	7.5	A	0.00	7.5	A	0.00	7.5	A
		INT			1.8	A		1.8	A		1.6	A		1.6	A		1.5	A		1.4	A
4	6th Street & Highland Avenue	EB	LTR	0.01	7.7	A	0.01	7.7	A	0.01	7.7	A	0.00	7.8	A	0.00	7.8	A	0.00	7.9	A
		WB	LTR	0.01	7.5	A	0.01	7.5	A	0.01	7.5	A	0.00	7.4	A	0.00	7.4	A	0.00	7.4	A
		NB	L	0.03	9.8	A	0.03	9.8	A	0.03	10.2	B	0.01	9.2	A	0.01	9.2	A	0.01	9.4	A
		SB	L	0.12	10.6	B	0.12	10.6	B	0.13	11.1	B	0.01	9.3	A	0.01	9.3	A	0.02	9.5	A
		INT			3.9	A		3.8	A		3.4	A		1.5	A		1.5	A		1.2	A

Notes:
EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound; INT = Intersection.
L = Left-Turn; T = Through; R = Right-Turn.
V/C = Volume to Capacity; SPV = Seconds per Vehicle; LOS = Level of Service.

PAVEMENT CONDITIONS

In order to assess anticipated impacts to the local roadway network pavement, it is recommended that as part of the site plan approval the Town would require a visual inspection of the roadways utilized by buses at least once a year.

QUEUE ANALYSIS

The HCM2010 methodology reports the following vehicle queue statistics as part of its capacity analysis methodology

- 50th Percentile Back of Queue for signalized intersections
- 95th Percentile Queue for unsignalized intersections

A review of the queueing presented in the Synchro outputs shows that the 50th percentile and 95th percentile vehicle queues would remain at 2 to 3 vehicles or less for all conditions studied (Existing through Build) during both peak periods examined.

D. ADDITIONAL ANALYSIS

Additional analyses were conducted and include the following:

- Evaluation of Existing Conditions which does not include traffic associated with the bus facility (buses and bus facility employee autos).
- Evaluation of the two signalized study area intersections as unsignalized (stop sign controlled) intersections.

EVALUATION OF EXISTING CONDITIONS (WITHOUT TRAFFIC ASSOCIATED WITH THE BUS FACILITY)

In order to evaluate existing traffic conditions in the study area without traffic associated with the bus facility, TMC counts were conducted during the AM and PM peak periods at the four study area intersections on February 21, 2017. This date was selected as it was a day where (1) minimal busing activity was expected at the bus facility (local schools were not in session that day based on local school district calendars) and (2) it was not a holiday (i.e., counts would capture typical area traffic activity less school related traffic activity).

Capacity analyses revealed that all study area intersections operate at acceptable Levels-of-Service (LOS) in the LOS A to B range and no notable queueing conditions occur at these locations during the peak periods examined.

The traffic volumes, capacity analysis results, and corresponding Synchro worksheets are presented in **Appendix A**.

EVALUATION OF THE TWO SIGNALIZED STUDY AREA INTERSECTIONS AS UNSIGNALIZED (STOP SIGN CONTROLLED) INTERSECTIONS

A scenario was examined to assess traffic operations at the two signalized study area intersections (Broadway & 6th Street and Broadway and 8th Street) operating as unsignalized intersections (i.e., removal of the traffic signals and making the intersections stop-sign controlled) under both Existing and future Build conditions.

The capacity analysis for this scenario revealed that all study area intersection movements would operate at acceptable Levels-of-Service (LOS) in the LOS A to B range and no notable queueing conditions are anticipated to occur at these locations during the peak periods examined under both 2016 Existing and 2017 Build conditions.

A warrant study was conducted to provide an additional assessment of the need for the existing traffic signals at these two intersections. Based on Warrant #3, the Peak Hour Volume Warrant, traffic signals

are currently not warranted at the Broadway & 6th Street and Broadway and 8th Street intersections and would not be warranted under 2016 Existing and 2017 Build conditions. Since the peak hour warrants are not satisfied, typically installation of a traffic signal is not warranted.

The capacity analysis results, corresponding Synchro worksheets, and warrant study are presented in **Appendix A**.

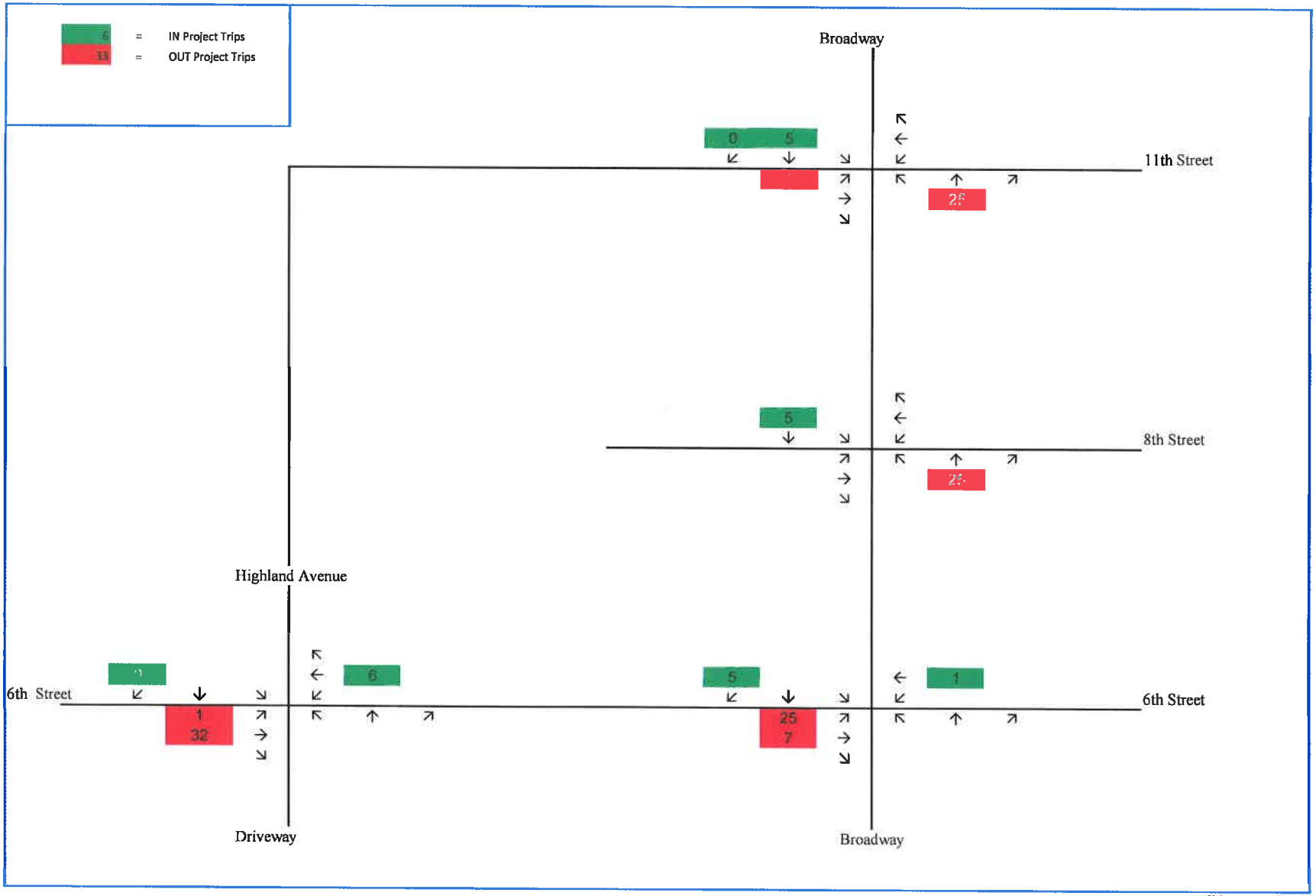

Figure B-1
Existing Bus Trips
Weekday AM Peak Period

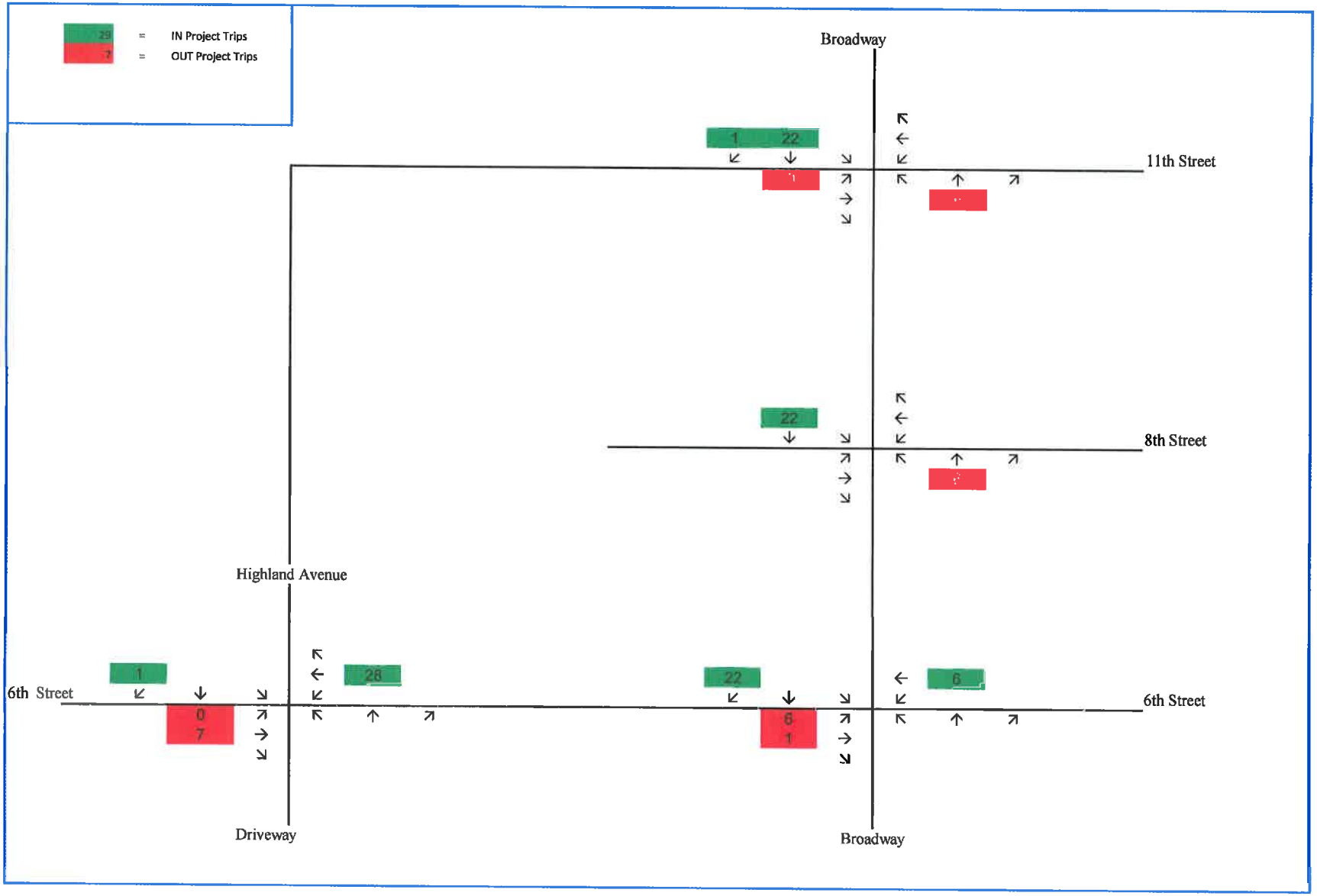

Figure B-2
Existing Bus Trips
Weekday PM Peak Period