July 6, 2022

Mr. Ahmed Choudhry
Bestway Co.
P.O. Box 126
Norwich, CT 06360
Bestway411@yahoo.com

RE: Traffic Study
Proposed Convenience Store
2040 Route 32 (Norwich - New London Turnpike)
Montville, Connecticut
SLR #141.21045.00001

Dear Mr. Choudhry:

At your request, we have prepared this traffic study with respect to your 4,200 square-foot (GSF) convenience store with seven vehicle fueling pumps (VFP), to be located at 2040 Route 32 (Norwich-New London Turnpike) in Montville, Connecticut.

Vehicular access to the development will be provided via two new driveways along Route 32: an ingress-only driveway and an egress-only driveway. The ingress will allow left- and right-turns in, and the egress will allow right-turns out only. The site location and area roadways are shown in **Figure 1**.

The study involved field reconnaissance and inventory of current roadway and traffic conditions; collection of traffic volume data, queuing data, crash data, and other pertinent information; a determination of future roadway traffic before the proposed development is opened (background traffic); an estimation of site traffic volumes generated by the proposed development; review of the sight line visibility at Route 32 from the proposed site access; and analysis of the signalized intersection of Route 32 at Occum Lane as well as the proposed development site driveways on Route 32.

Study Area Roadway and Site Environs

Norwich-New London Turnpike (Route 32) is a minor arterial that runs north to south as Route 32 in Monson, Massachusetts to I-95/US Route 1 in New London, Connecticut. The roadway provides regional access between Norwich and New London, as well as local access to the Site. In the vicinity of the Site, the road is approximately 75 feet wide, providing two travel lanes and two turn lanes in the southbound direction and two travel lanes in the northbound direction. A sidewalk is provided in front of the site. Southeast Area Transit District (SEAT) bus service route 1 travels north/south on Route 32 in the study area and has two non-sheltered stop locations near the site.

The posted speed limit on Route 32 within the study area is 35 miles per hour (mph). As measured by the Connecticut Department of Transportation (CTDOT) in April 2020, the 85th percentile speed for this

segment of Route 32 in front of the site is 41.4 mph in the northbound direction and 38.7 mph in the southbound direction.

Route 32 at Occum Lane is a signalized intersection within the study area. The east approach of Occum Lane is a slow residential street and the west approach connects to the Montville Commons shopping center adjacent to the site. The surrounding area is a mixture of commercial and residential uses. Opposite the site midblock along Route 32 is the Mohegan Fire Company station. The long southbound left-turn lane at the Occum Lane intersection provides left-in access to the fire station.

Area Traffic Volumes

Review was made of available traffic data from CTDOT. The state maintains a traffic monitoring location north of the site on Route 32 between Podurgiel Lane and Route 2A overpass. The available State data from April 2020 at this location indicates two-way annualized average daily traffic (AADT) of 10,700 vehicles. It shows peak-hour traffic occurred in the afternoon when 1,075 vehicles were counted on a Tuesday, April 28, 2020. As these volumes are affected by the Covid-19 pandemic, for reference, the data from February 2017 indicates two-way annualized average daily traffic (AADT) of 16,800 with peak-hour traffic occurring in the afternoon when 1,400 vehicles were counted on Tuesday, February 7, 2017.

To supplement the data obtained from CTDOT, manual turning movement counts were performed at the intersection of Route 32 at Occum Lane on Saturday, June 18, 2022, from 11:00 a.m. to 1:00 p.m. and on Tuesday, June 21, 2022, from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. CTDOT's Bureau of Policy and Planning advised no adjustments to the counts were necessary to account for COVID-19 traffic impacts. **Figure 2** and **Figure 3** show the overall peak-hour traffic volumes for the weekday morning (8:00 a.m. to 9:00 a.m.) and afternoon (4:00 p.m. to 5:00 p.m.), respectively. **Figure 4** shows the overall peak-hour traffic volumes during the Saturday peak hour (12:00 p.m. to 1:00 p.m.).

Crashes

Information on crash data for Route 32 between Occum Lane and Hyatt Place Drive was obtained from the University of Connecticut's Connecticut Crash Data Repository for the period of June 1, 2019, to June 1, 2022. The data collected for this period is shown in **Table 1**, summarized by location, collision type, and crash severity.

There was a total of thirteen crashes reported on Route 32 between the Occum Lane intersection and the Hyatt Place Drive intersection; twelve were property damage only, and one was possible injury. Of these crashes, six were collisions at an angle, five were rear-end-type collisions, one was a head-on collision, and the other crash was a sideswipe, same direction. Overall, there were no strong crash trends reported along Route 32 in the vicinity of the site.

TABLE 1
Crash Summary

LOCATION	TYPE OF COLLISION					CRASH SEVERITY		
	ANGLE	HEAD ON	REAR END	SIDESWIPE, SAME DIRECTION	TOTAL	POSSIBLE INJURY	PROPERTY DAMAGE ONLY	TOTAL
Route 32 at Hyatt Place Drive	1		1		**2**		2	**2**
Route 32 between Occum Lane and Hyatt Place Drive	2		2		**4**		4	**4**
Route 32 at Occum Lane	3	1	2	1	**7**	1	6	**7**
Grand Total	**6**	**1**	**5**	**1**	**13**	**1**	**12**	**13**

Source: UConn Connecticut Crash Data Repository from June 1, 2019, to June 1, 2022

Proposed Development and Sightlines

The proposed development will be located at 2040 Route 32 (Norwich-New London Turnpike) in Montville, Connecticut. Planned is a 4,200 GSF convenience store with seven (7) vehicle fueling pumps along with 15 parking spaces. Vehicular access to the development will be provided via two new driveways along Route 32: an ingress-only driveway and an egress-only driveway. The ingress should be placed approximately 105 - 110 feet south of Podurgiel Lane measured from centerline to centerline. The egress will be placed along the southern site frontage and will be stop-sign controlled and right-out only. Additionally, a left-turn lane into the site is proposed by modifying the pavement markings on Route 32, as discussed in a later section.

Visibility was reviewed in the field from the point of view of a motorist looking from the new site egress. Intersection sight distance (ISD) is the desirable distance for a motorist stopped at the site egress to see approaching traffic and be able to turn from the site into the flow of traffic adequately. As discussed previously, speed data was collected by CTDOT for Route 32 in April 2020. The location of speed collection aligns within feet of the proposed access at 2040 Route 32 (Norwich-New London Turnpike). The 85th percentile speed was found to be 38.7 mph in the southbound direction, which would require 430 feet of

ISD for a motorist turning right out of the site. Field observations confirmed there is at least 460 feet of sight distance for this right-turn outbound movement. Left turns out of the site will be prohibited; however, if they were to be permitted, approximately 460 feet of ISD would be required for the 85th percentile speed of 41.4 mph in the northbound direction. Field observations confirmed available sight distance in surplus of the requirement.

Site Traffic and Distribution

The site traffic for the proposed convenience store/gas station was estimated based on review of statistical data published within the *Trip Generation Manual, 11th edition,* by the Institute of Transportation Engineers (ITE), for land use code #945, Convenience Store/Gas Station. The site will include "pass-by trips," which are site trips that are not primary end-destinations but rather are on the way to another destination and are made by patrons already on Route 32. Based on the ITE data, approximately 60 percent of trips are expected to be pass-by trips, which was approved by CTDOT. The remaining 40 percent of site trips is therefore new traffic to Route 32. **Table 2** below summarizes the peak hour traffic that is estimated to be generated by this development.

TABLE 2
Trip Generation

LAND USE	NUMBER OF VEHICLE TRIPS								
	WEEKDAY MORNING PEAK HOUR			WEEKDAY AFTERNOON PEAK HOUR			SATURDAY MIDDAY PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
Convenience Store/Gas Station, 4,200 GFA, 7 Vehicle Fueling Positions	94	95	189	83	84	167	73	70	143
Pass-By Trips	-56	-56	-112	-50	-50	-100	-44	-42	-86
Net New Trips	***38***	***39***	***77***	***33***	***34***	***67***	***29***	***28***	***57***

The geographic distribution of the non-pass-by site-generated traffic was estimated based on review of Census Journey-to-Work data. It is estimated that approximately 75 percent of the new site traffic will access the site via Route 32 from the north, and approximately 25 percent via Route 32 from the south. The pass-by site traffic was based on existing traffic along Route 32. Approximately 60 percent of the pass-by trips will enter the site from the north on Route 32 and continue south upon leaving the site, and 40 percent of the pass-by trips will enter from the south and continue north upon exit. **Figure 5** illustrates the site traffic distribution through the study area. **Figures 6, 7, and 8** represent the site generated trips

distributed throughout the study area during the weekday morning, afternoon, and Saturday midday peak hours, respectively.

Future Traffic

For the purpose of this study, a future horizon year of 2023 was used for analysis. The existing traffic volumes were projected to year 2023 using an annual growth rate of 1.0 percent, which was suggested by CTDOT's Bureau of Policy and Planning. Discussions with CTDOT indicate that there are no approved developments within the study area at this time to include in background traffic volumes. The future background (no-build) volumes for the weekday morning, afternoon, and Saturday peak hour, which do not include site-generated traffic, are shown in **Figures 9, 10, and 11,** respectively.

The estimated site traffic volumes generated by the proposed development were added to the 2023 background traffic volumes to derive the future combined (build) traffic volumes. The combined traffic volumes reflect future roadway traffic volumes with the proposed development in place and are used in analysis to determine if the roadway's capacity is adequate for the new site traffic. **Figures 12, 13 and 14** depicts the 2023 combined traffic volumes for the weekday morning, afternoon, and Saturday peak hours along the adjacent roads.

Modification of Route 32 for Left Turn Ingress

Presently, along the site frontage on Route 32 between Podurgiel Lane and Occum Lane, in the southbound direction, there is a right-turn lane, two through lanes, and a left-turn lane that serves the southbound direction for most of the road segment. In the northbound direction, there are two through lanes and a short left-turn lane onto Podurgiel Lane.

To accommodate a left-turn lane into the site ingress, the pavement markings along Route 32 would need to be modified. The most practical option would be to elongate the existing northbound left-turn lane onto Podurgiel Lane and shorten the southbound left-turn pocket onto Hyatt Place Drive by approximately 60 feet. This would allow site patrons to use the modified northbound left-turn lane to enter the site with the ingress placed approximately 105 - 110 feet south of Podurgiel Lane measured from centerline to centerline.

Vehicular queueing data was collected to assure modification of the turn lane would continue to accommodate existing queues. The data was collected during each of the three weekday and Saturday peak hours for the Route 32 southbound left-turn lane into Hyatt Place Drive and the key southbound queues at the signal along the site frontage that would affect the ability for a motorist to turn left into the site. Queues were counted every signal cycle length, from which average and maximum queue lengths were determined.

Queues at the Route 32 southbound left-turn lane into Hyatt Place Drive were found to be three cars (75 feet) maximum, but more typically one to two car-lengths long. With the left-turn lane modification, adequate storage for three cars is proposed.

At the signal, the through lane queues were found to be controlling. The data showed the following queue lengths for each southbound lane:

- Right-turn lane: 1 to 2 cars (25 to 50 feet) maximum.
- Through lanes (the longer of each of the two through lanes): 6 cars (150 feet) average, and 10 cars (250 feet) maximum.
- Left-turn lane: 5 cars (125 feet) maximum.

Review of the queueing data determined there would be sufficient queue clearance and queue storage capacity to modify the existing lane markings along Route 32 as described, giving the northbound left-turn lane into the site adequate queue storage for two to three cars. Under this plan, access to the fire station south of Hyatt Place Drive will not be changed. The station presently has garage driveways along Route 32 and parking lot driveways along Occum Lane. Based on field observations, the building on the northern side of the fire station, which has an ingress-only driveway on the northern side of the building and shares the parking lot driveways with the fire station, does not appear to be in use presently.

Capacity Analysis

The study intersections were evaluated by means of capacity analysis techniques. Levels of Service (LOS) were then determined, which are qualitative measures of the efficiency of operations in terms of delay and inconvenience to motorists. A description of the various LOS designations, A through F, is given in the Appendix. LOS A describes operations with very low average control delay per vehicle while LOS F describes operations with long average delays. The analysis worksheets are also enclosed in the Appendix. Table 3 summarizes the findings of future LOS at the study intersections without (background conditions) and with (combined conditions) the estimated new traffic from the proposed development.

TABLE 3
Capacity Analysis Summary

Intersection / Movement	Levels Of Service					
	Weekday Morning Peak Hour		Weekday Afternoon Peak Hour		Saturday Midday Peak Hour	
	Background Conditions	Combined Conditions	Background Conditions	Combined Conditions	Background Conditions	Combined Conditions
Route 32 at Occum Lane						
Eastbound Left/Through	C	C	D	D	D	D
Eastbound Right	A	A	A	A	A	A
Westbound Left/Through/Right	C	C	D	D	D	D
Northbound Left	B	B	B	B	B	B
Northbound Through/Right	B	B	B	B	B	C
Southbound Left	B	B	B	B	B	B
Southbound Through	B	B	B	B	B	B
Southbound Right	A	A	A	A	A	A
OVERALL	**B**	**B**	**C**	**C**	**C**	**C**
Route 32 at Site Driveway						
Northbound Left	-	A	-	A	-	A
Eastbound Right	-	B	-	B	-	B

With the development in place, all traffic movements at the study intersections are expected to operate at LOS D or better and all but one will not degrade in LOS. The northbound through movement during the Saturday midday peak hour degrades from LOS B to LOS C; however, LOS C still reflects desirable operations. The new site traffic is expected to have a negligible impact on the intersections and roads involved in our study.

Maximum queueing at the proposed left-turn lane into the site was estimated to be one car length, for which the proposed lane modification will be sufficient.

Summary of Findings and Recommendations

A study was conducted to assess the traffic impact of the proposed 4,200 GSF convenience store with seven vehicle fueling pumps to be located at 2040 Route 32 (Norwich-New London Turnpike) in Montville, Connecticut. Below summarizes the key findings:

Figures

- Figure 1 – Site Location Map
- Figure 2 – Existing Weekday AM Peak Hour Traffic Volumes
- Figure 3 – Existing Weekday PM Peak Hour Traffic Volumes
- Figure 4 – Existing Saturday Midday Peak Hour Traffic Volumes
- Figure 5 – Site Traffic Distribution for New and Pass-by Trips
- Figure 6 – Site-Generated Weekday AM Peak Hour Traffic Volumes
- Figure 7 – Site-Generated Weekday PM Peak Hour Traffic Volumes
- Figure 8 – Site-Generated Weekday Saturday Midday Peak Hour Traffic Volumes
- Figure 9 – Background Weekday AM Peak Hour Traffic Volumes
- Figure 10 – Background Weekday PM Peak Hour Traffic Volumes
- Figure 11 – Background Saturday Midday Peak Hour Traffic Volumes
- Figure 12 – Combined Weekday AM Peak Hour Traffic Volumes
- Figure 13 – Combined Weekday PM Peak Hour Traffic Volumes
- Figure 14 – Combined Saturday Midday Peak Hour Traffic Volumes

Appendix

- Peak Hour Traffic Counts
- LOS Designation Descriptions
- Synchro Analysis Worksheets

- A left-turn lane into the site is proposed on Route 32 by lengthening the existing left-turn lane onto Podurgiel Lane. A queueing analysis was conducted to ensure adequate storage would be available for these site trips and the southbound left turns onto Hyatt Place Drive.
- The driveway ingress should be placed approximately 105 - 110 feet south of Podurgiel Lane measured from centerline to centerline to accommodate the Route 32 left-turn lane.
- Sightlines were measured to be sufficient for CTDOT ISD criteria.
- No notable impacts to levels of service at the study intersections are expected to be caused by the development.
- Based on our analysis, it is our opinion that the surrounding roadway system will be able to accommodate new traffic that would be generated the new development.

We hope this study is useful to you and the Town of Montville in assessing the traffic aspects of this proposed development. If you have any questions or need any further information, please do not hesitate to contact us.

Sincerely,

SLR International Corporation

David G. Sullivan, PE
US Manager of Traffic & Transportation Planning

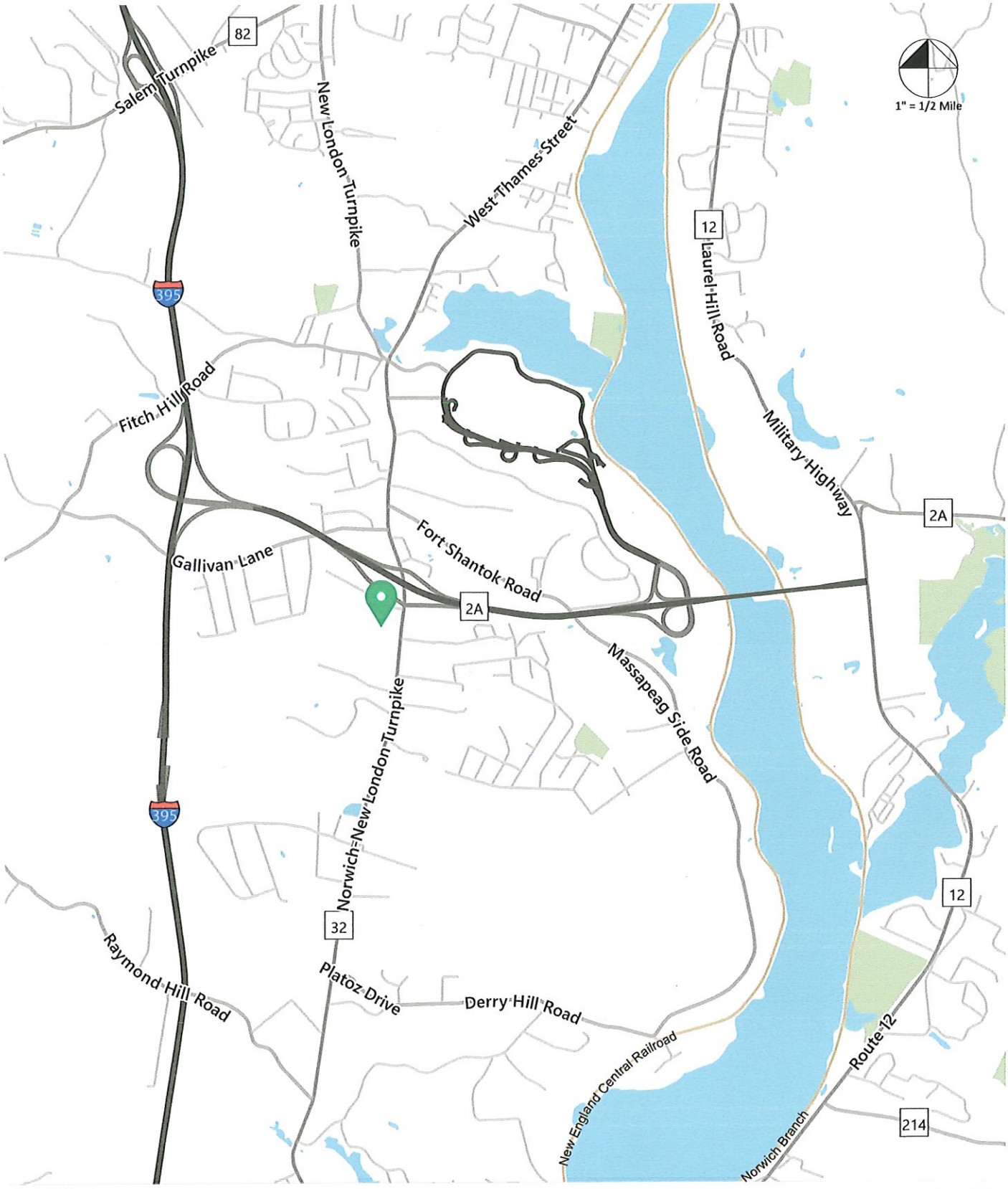

Figure 1
Site Location Map

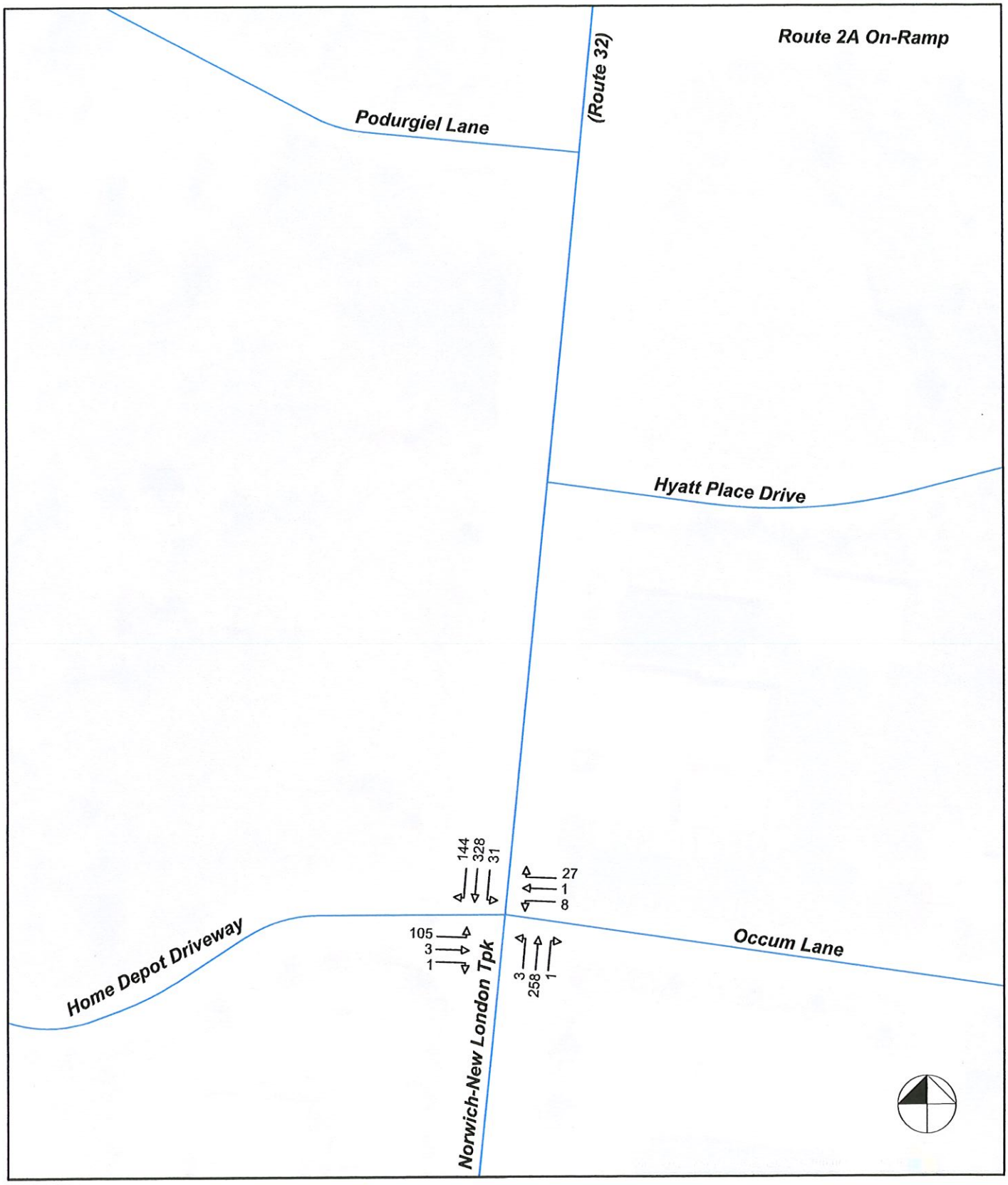

Figure 2
Existing Weekday AM Peak Hour Vehicular Traffic Volumes (2022)

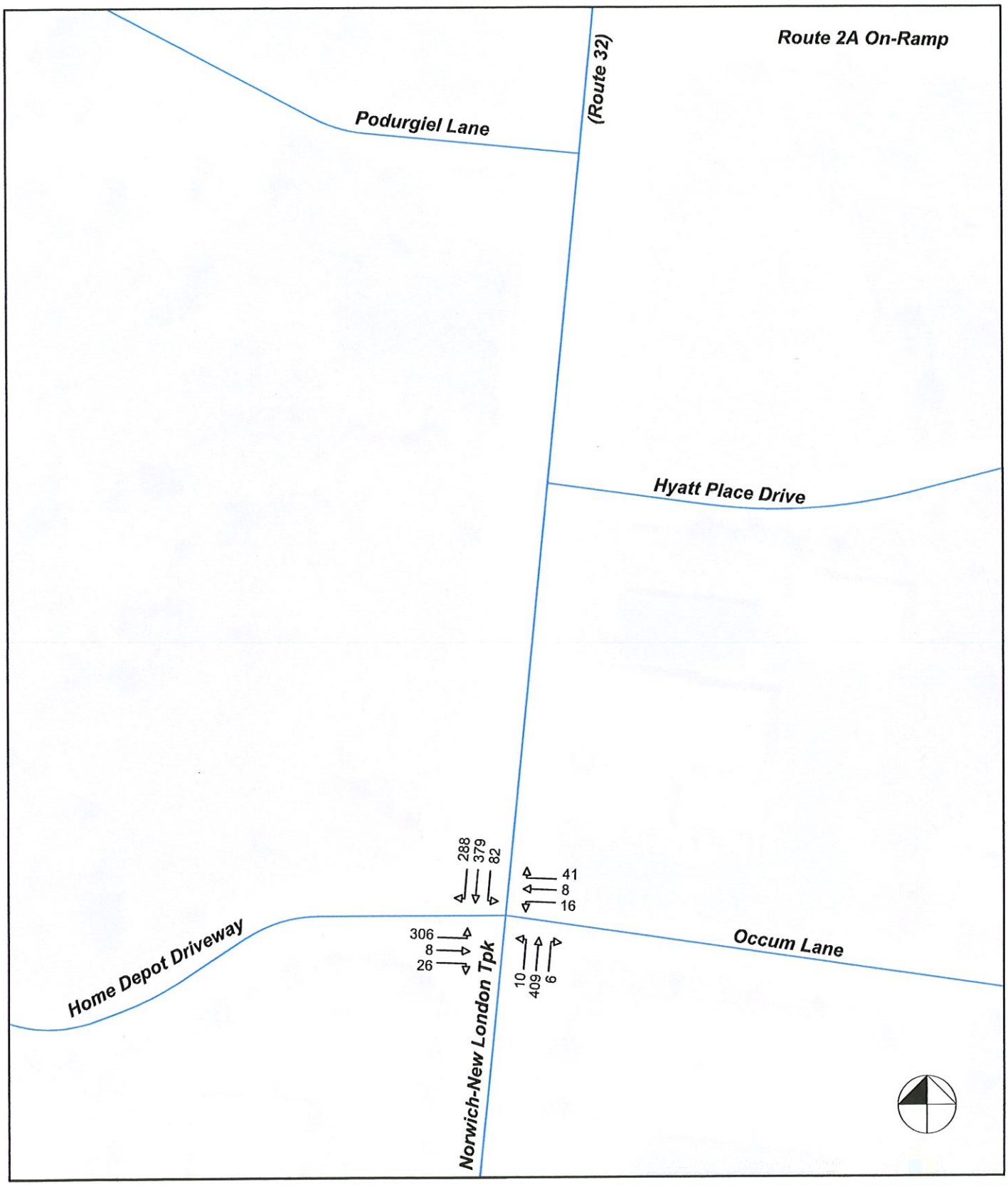

Figure 3
Existing Weekday PM Peak Hour Vehicular Traffic Volumes (2022)

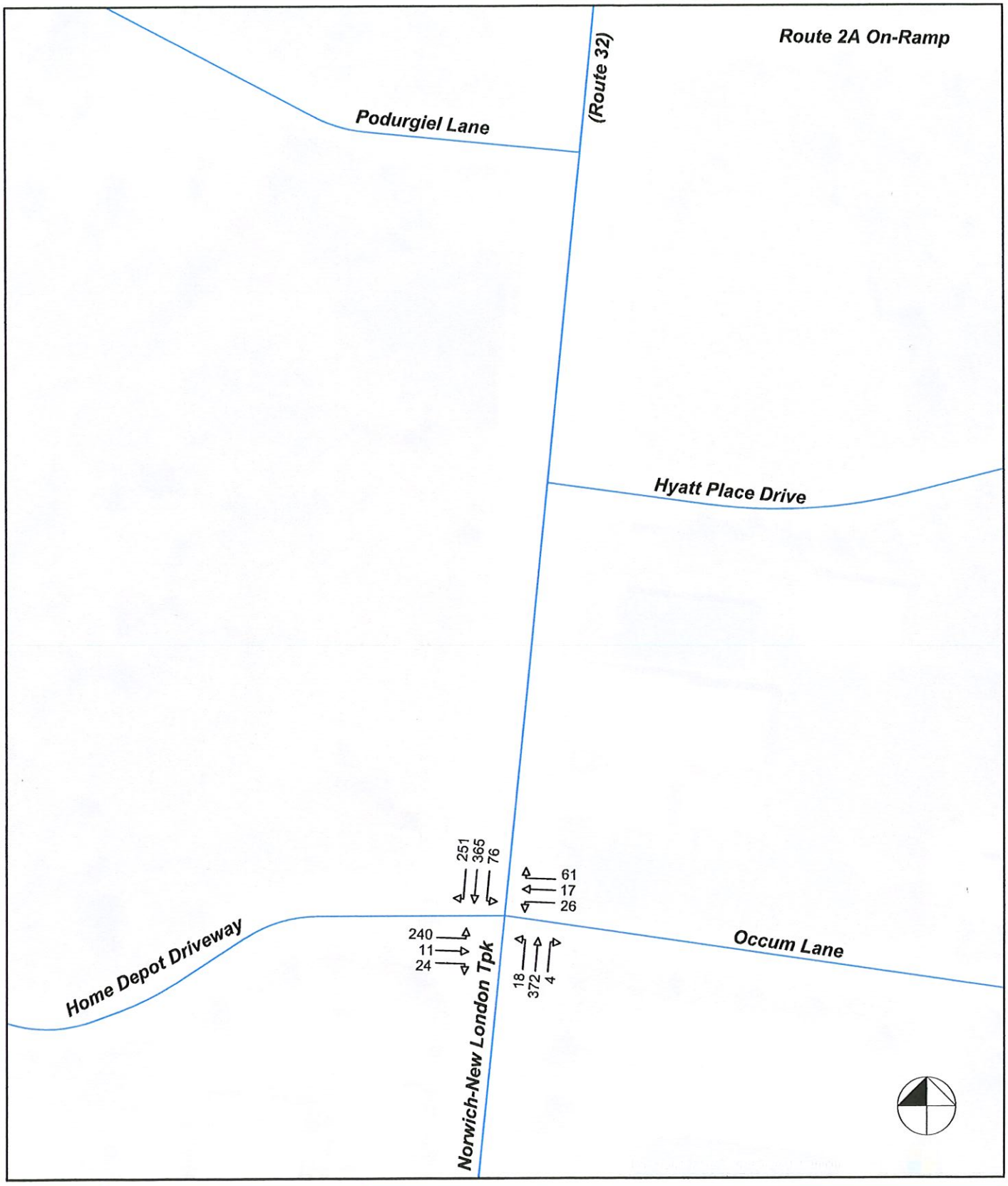

Figure 4
Existing Saturday Midday Peak Hour Vehicular Traffic Volumes (2022)

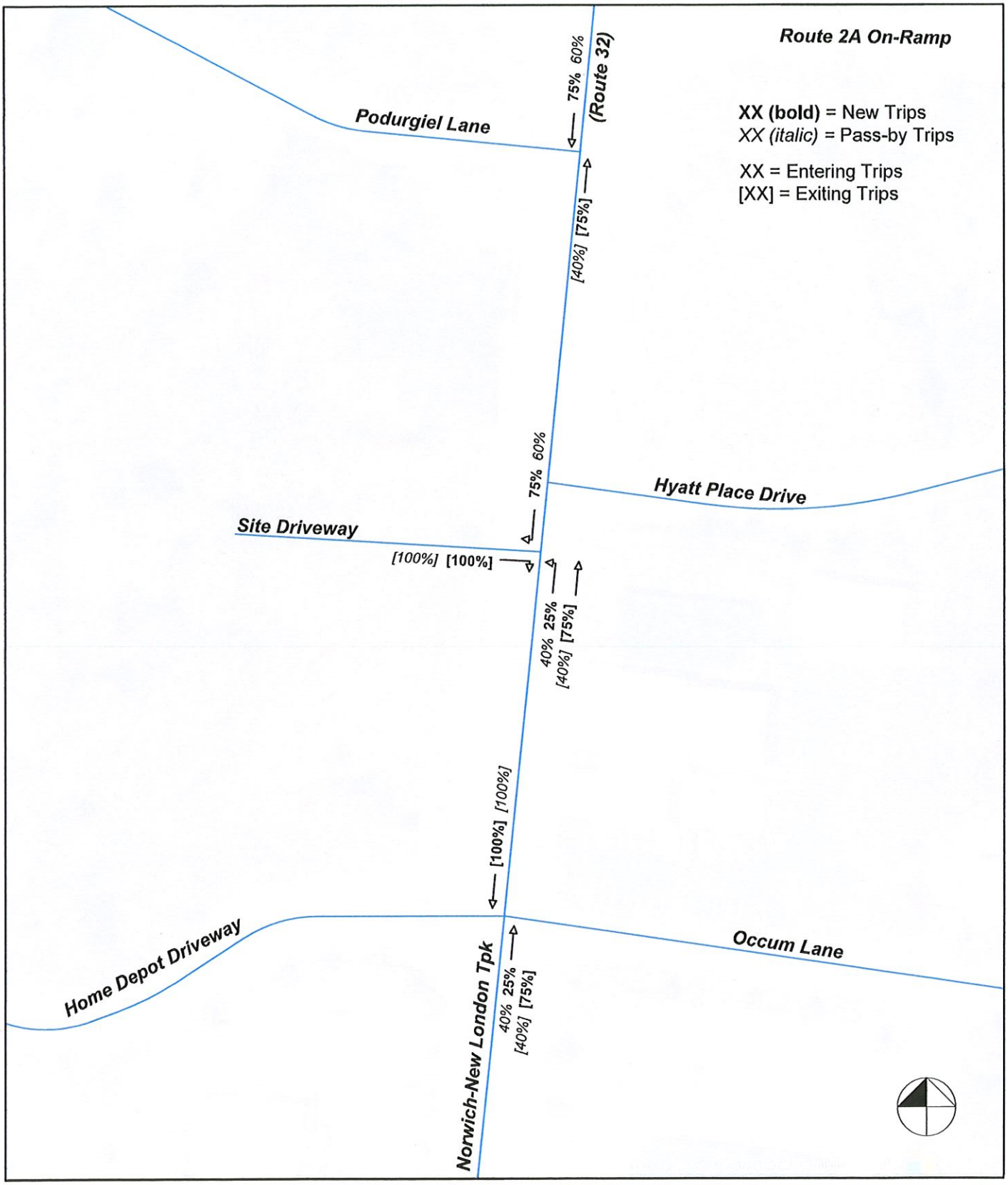

Figure 5
Site Traffic Distribution for New and Pass-by Trips

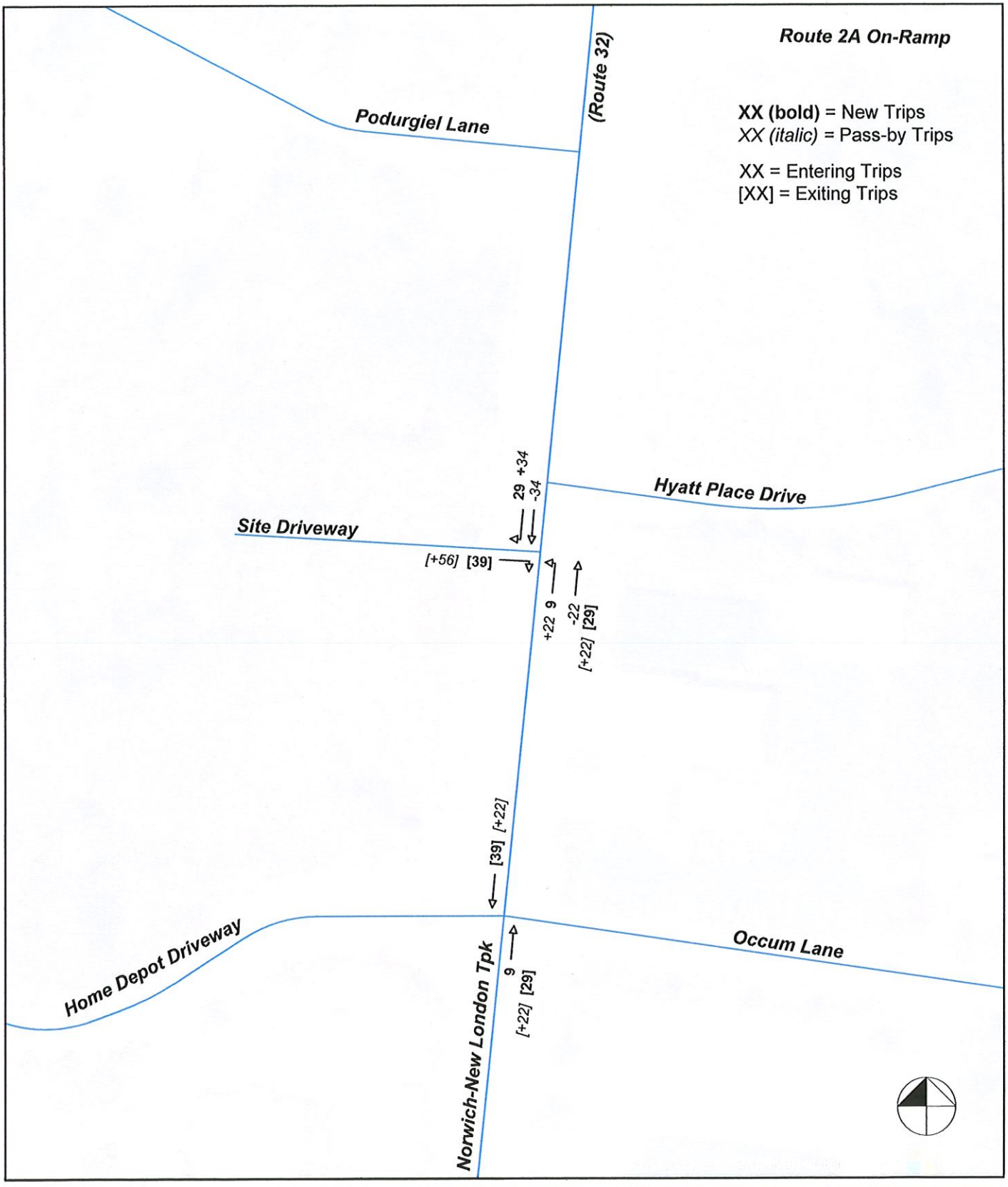

Figure 6
Site-Generated Weekday AM Peak Hour Traffic Volumes

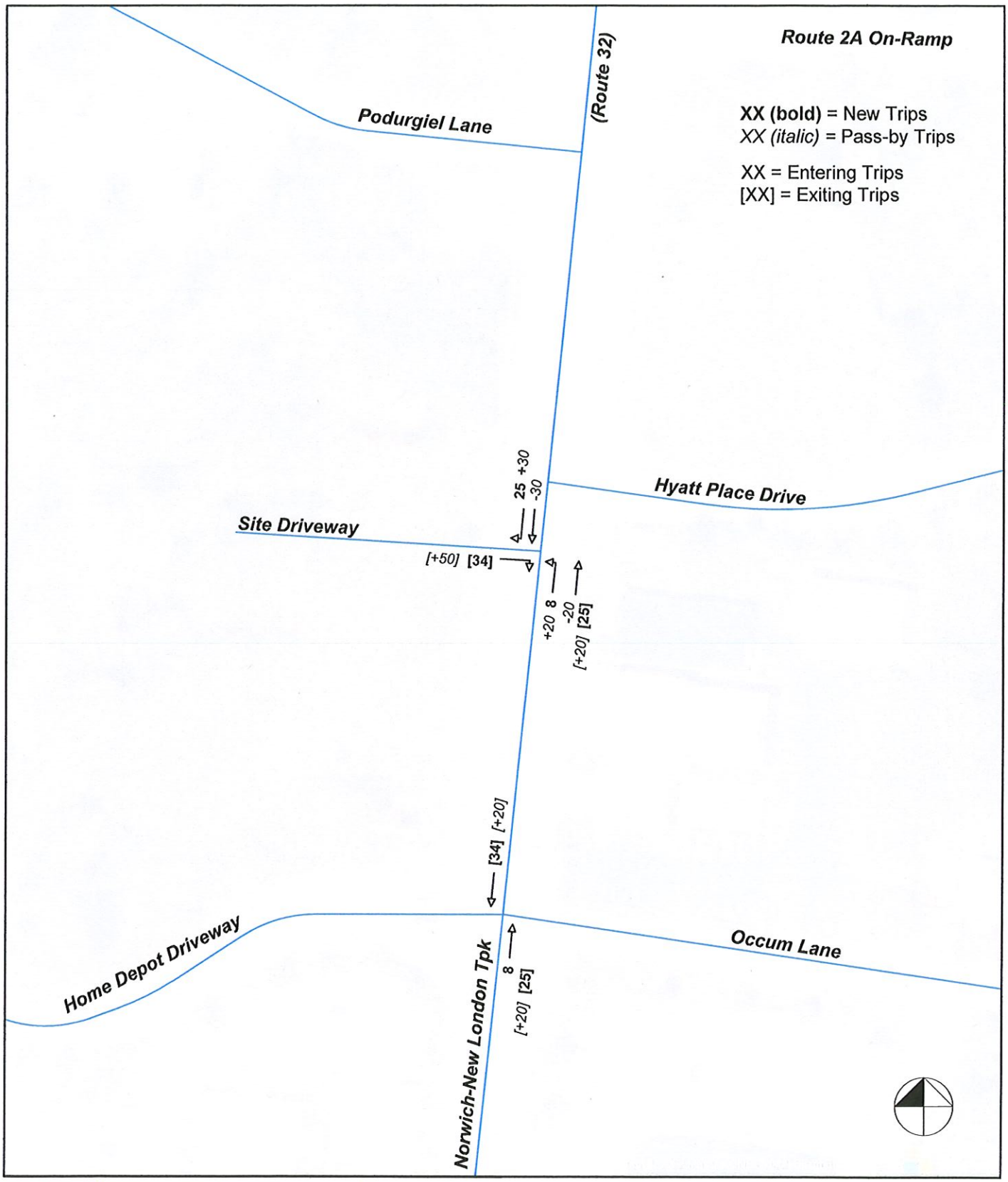

Figure 7
Site-Generated Weekday PM Peak Hour Traffic Volumes

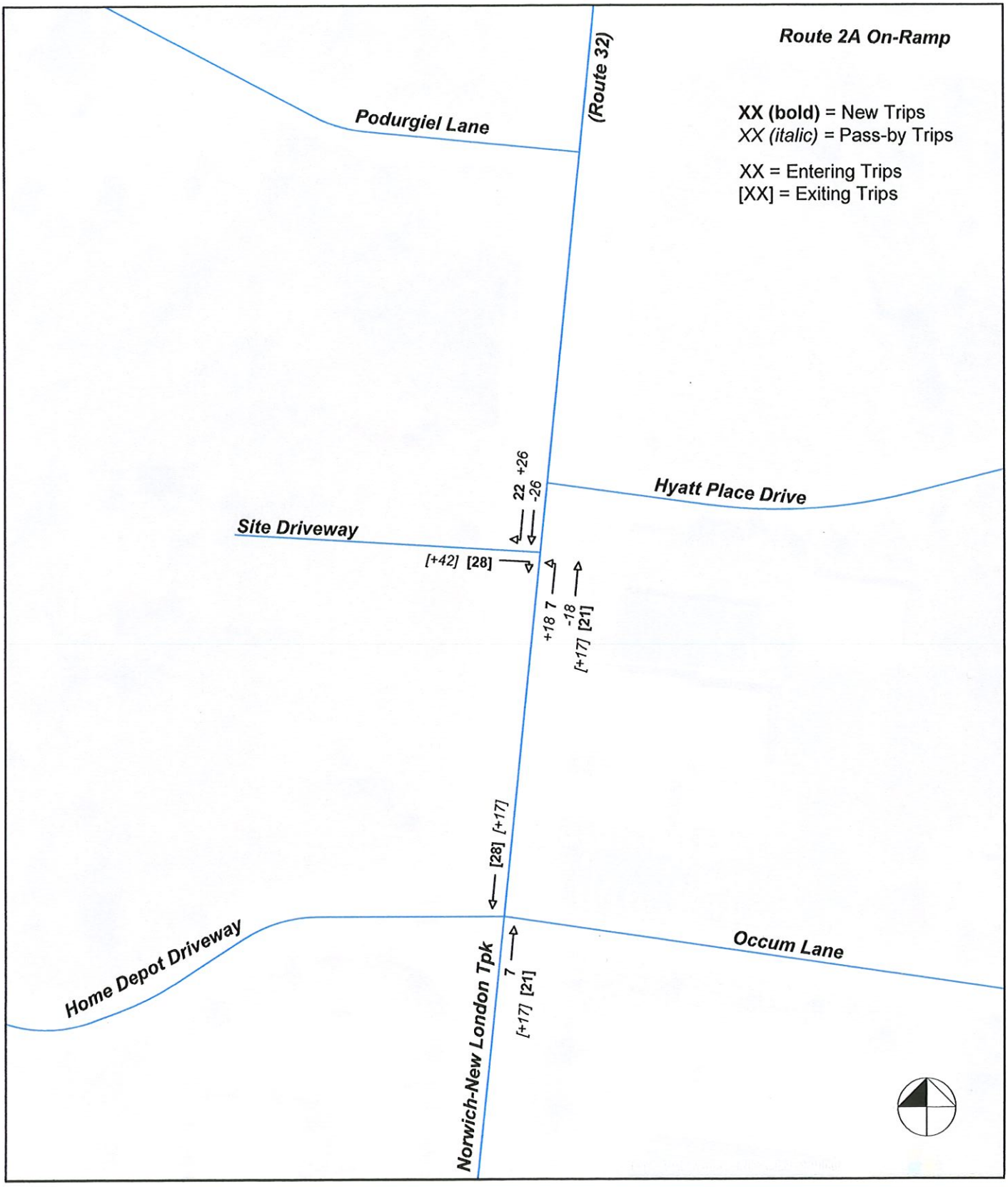

Figure 8
Site-Generated Saturday Midday Peak Hour Traffic Volumes

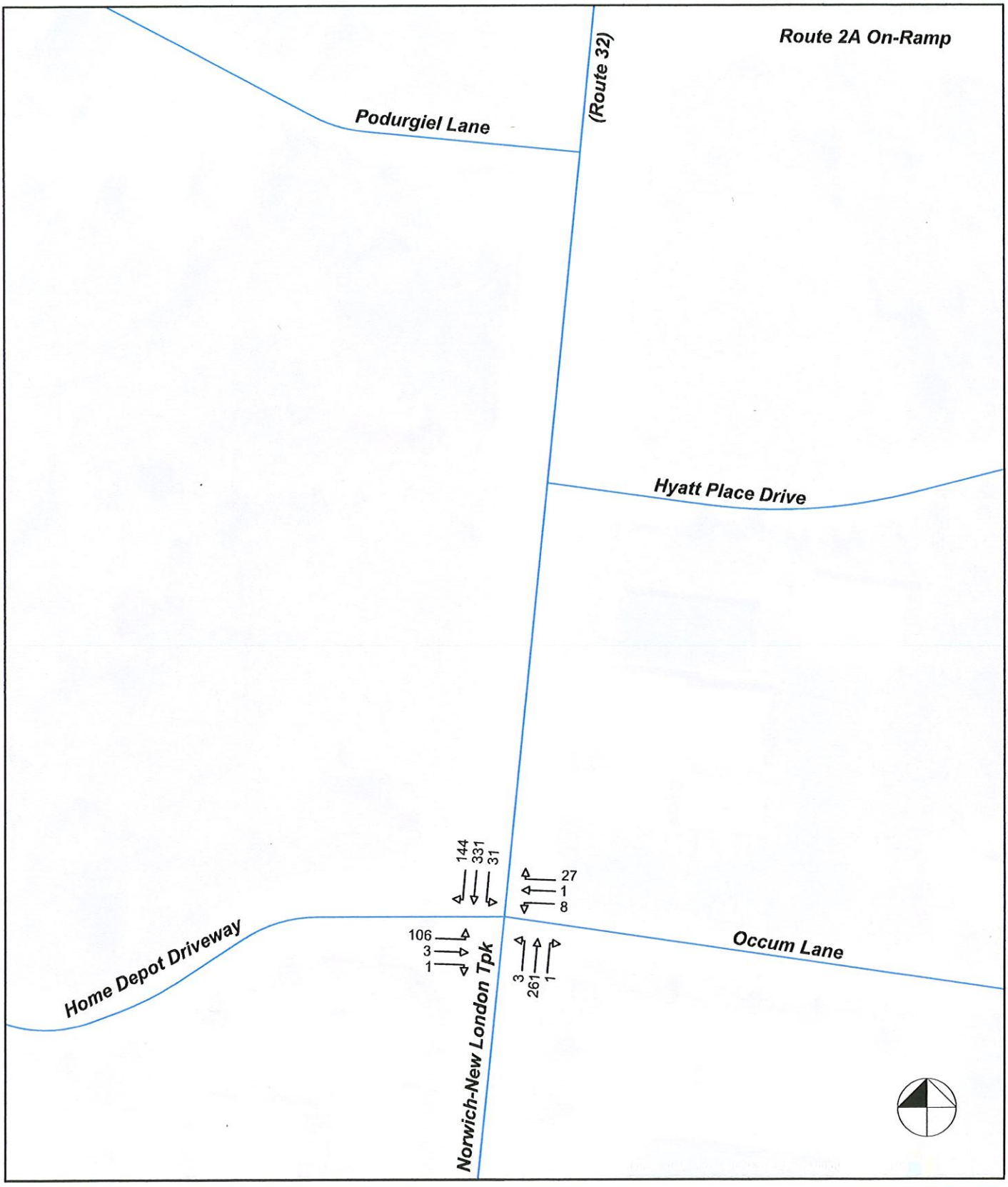

Figure 9
Future Background Weekday AM Peak Hour Traffic Volumes (2023)

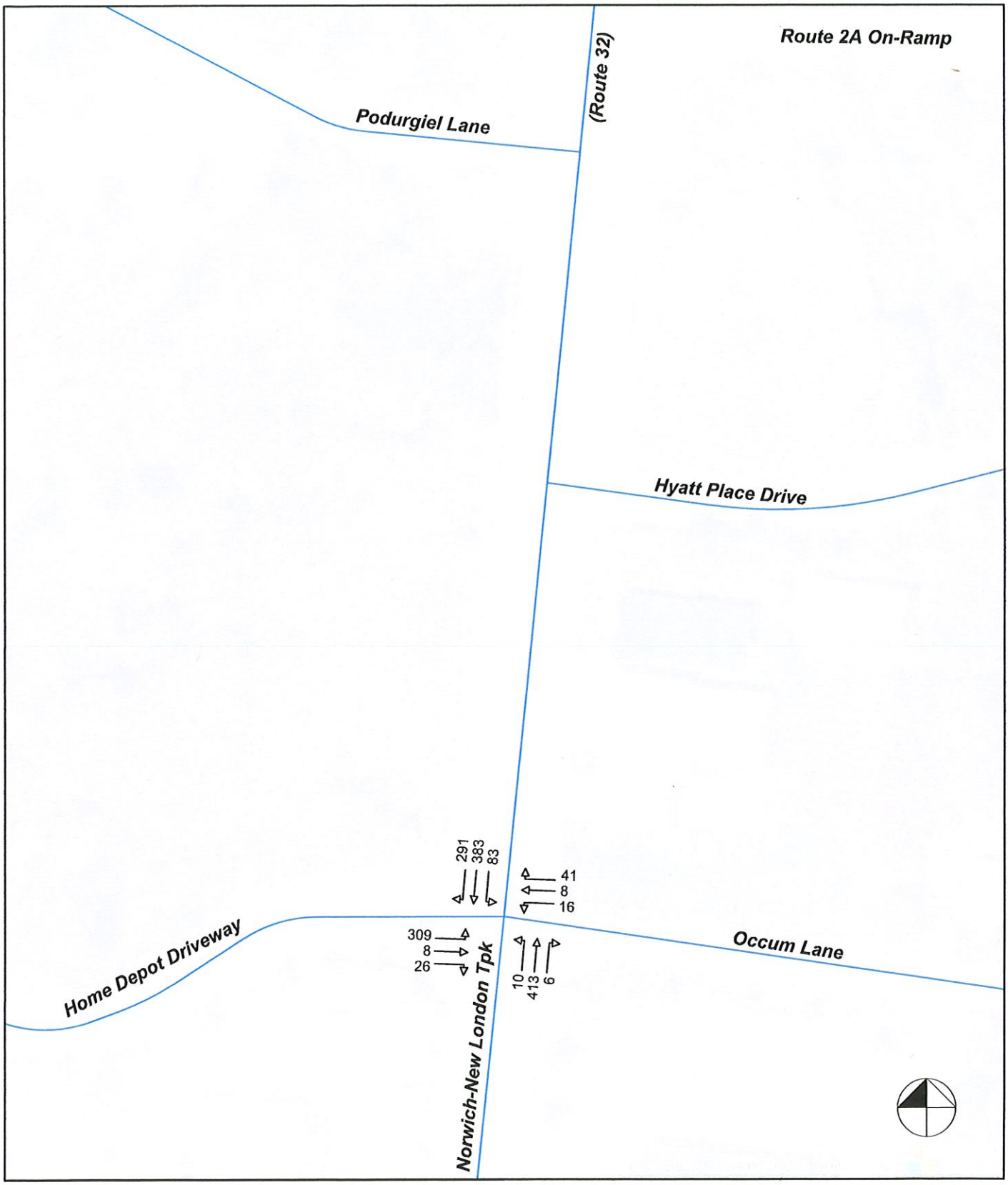

Figure 10
Future Background Weekday PM Peak Hour Traffic Volumes (2023)

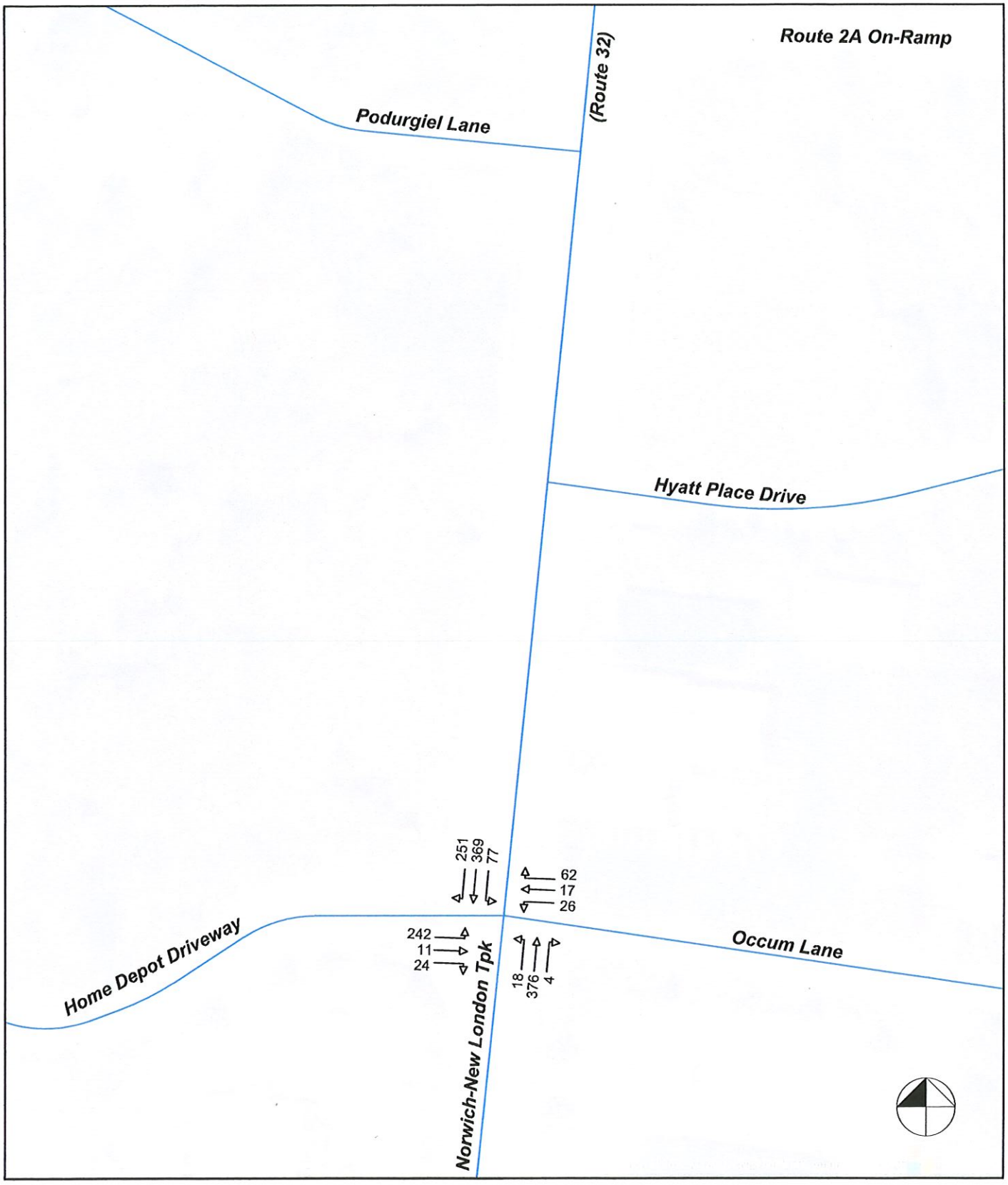

Figure 11
Future Background Saturday Midday Peak Hour Traffic Volumes (2023)

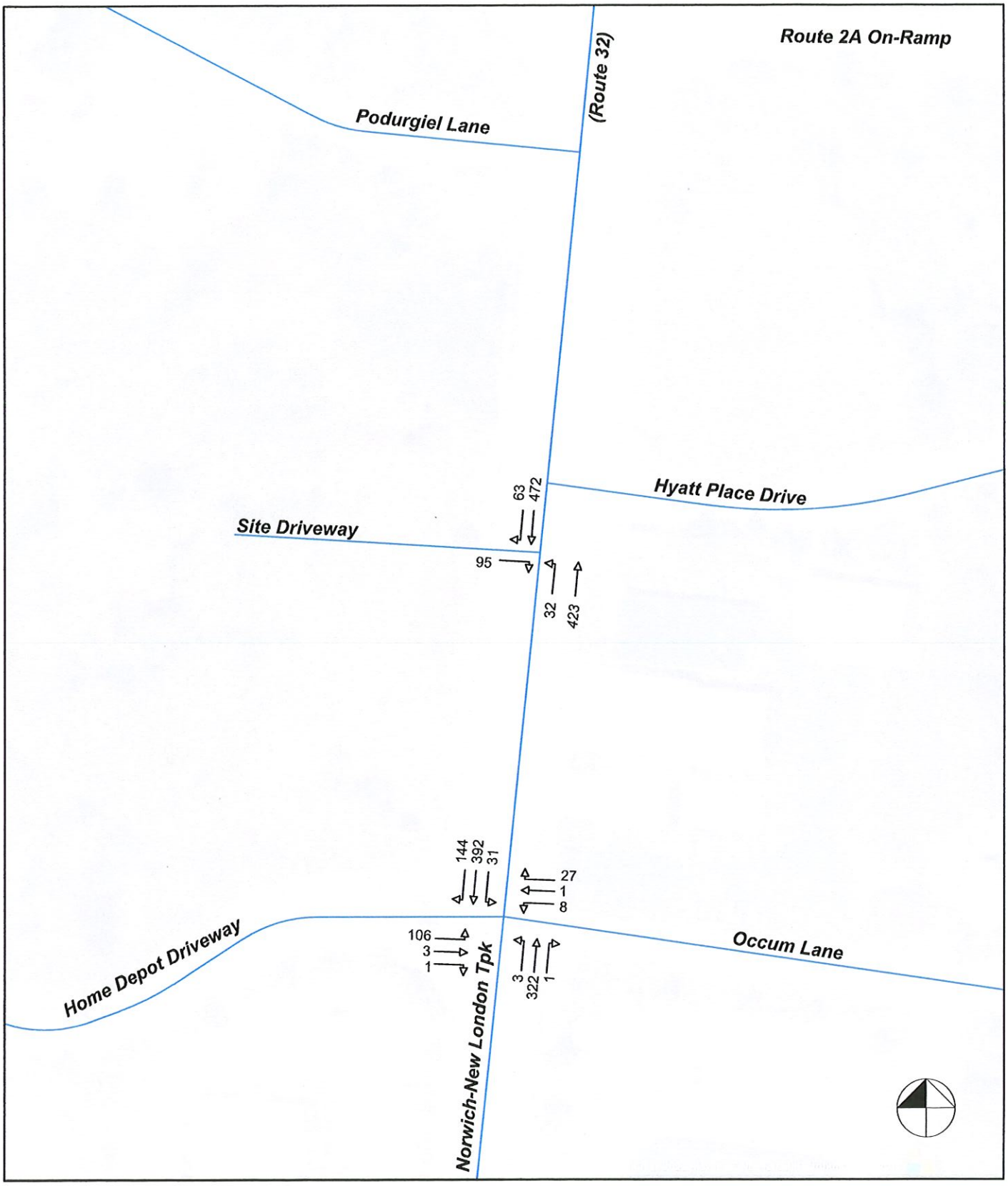

Figure 12
Future Combined Weekday AM Peak Hour Traffic Volumes (2023)

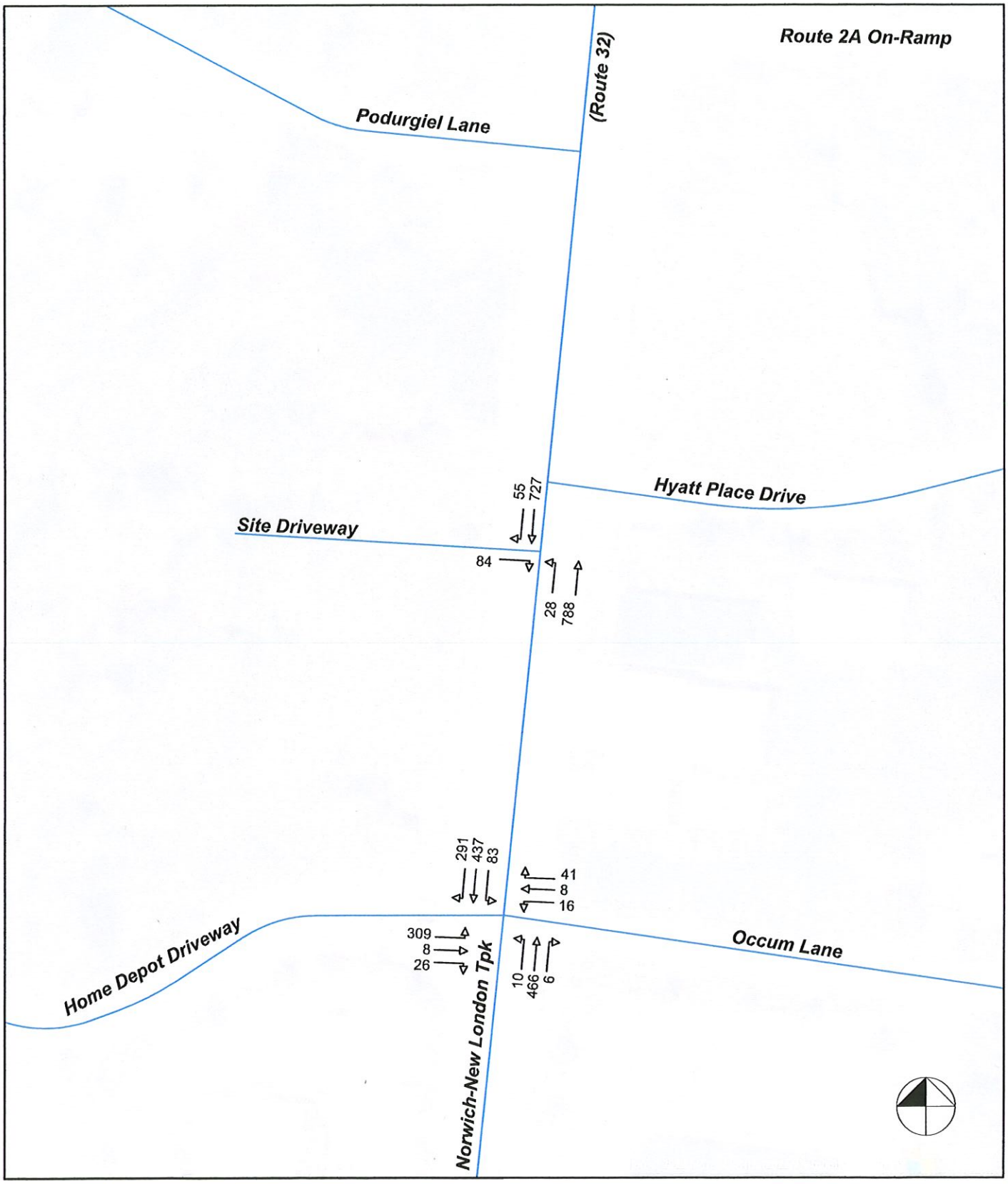

Figure 13
Future Combined Weekday PM Peak Hour Traffic Volumes (2023)

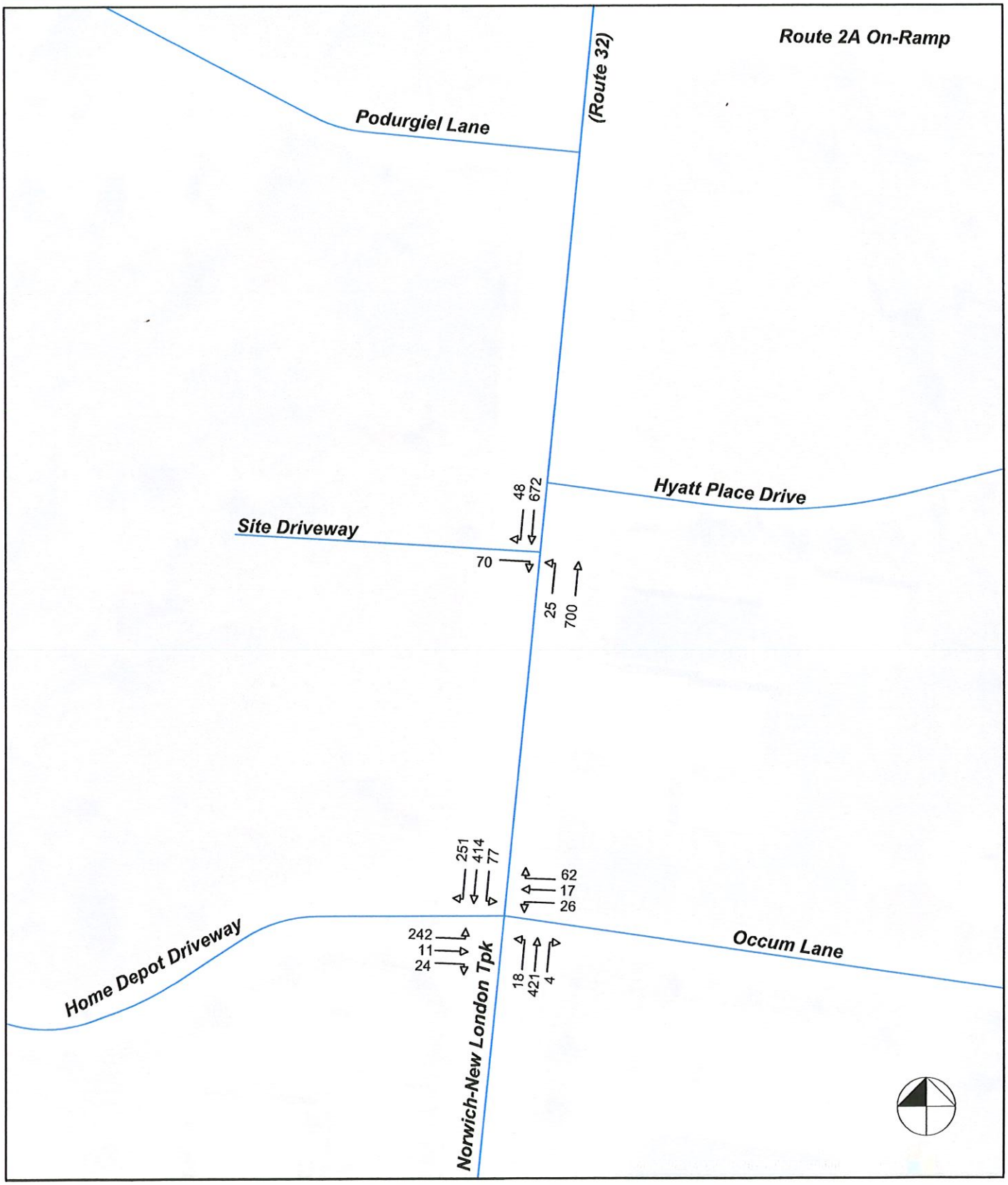

Figure 14
Future Combined Saturday Midday Peak Hour Traffic Volumes (2023)

APPENDIX

LEVEL OF SERVICE

FOR

SIGNALIZED INTERSECTIONS

(MOTORIZED VEHICLE MODE)

Level of service for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions: in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-min analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group. The criteria are given below.

LEVEL-OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS
MOTORIZED VEHICLE MODE

LOS By Volume-to-Capacity Ratio[1]		CONTROL DELAY (s/veh)
v/c ≤ 1.0	v/c > 1.0	
A	F	≤ 10
B	F	> 10 AND ≤ 20
C	F	> 20 AND ≤ 35
D	F	> 35 AND ≤ 55
E	F	> 55 AND ≤ 80
F	F	> 80

[1] For approach-based and intersection-wide assessments, LOS is defined solely by control delay.

Specific descriptions of each LOS for signalized intersections are provided below:

Level of Service A describes operations with a control delay of 10 s/veh and 20 s/veh 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 LOS A is the result of favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

Level of Service B describes operations with control delay between 10 and 20 s/veh 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.

Level of Service C describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression 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 begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

Level of Service D describes operations with control delay between 35 and 55 s/veh 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.

Level of Service E describes operations with control delay between 55 and 80 s/veh 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.

Level of Service F describes operations with control delay exceeding 80 s/veh 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.

Reference: Highway Capacity Manual 6, Transportation Research Board, 2016.

LEVEL OF SERVICE
FOR TWO-WAY
STOP SIGN CONTROLLED INTERSECTIONS

The level of service for a TWSC (two-way stop controlled) intersection is determined by the computed or measured control delay and is defined for each minor movement. Level of service is not defined for the intersection as a whole. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. LOS criteria are given in the Table. LOS criteria are given below:

LEVEL-OF SERVICE CRITERIA FOR AWSC INTERSECTIONS	
LOS[1]	**CONTROL DELAY (s/veh)**
A	**≤ 10**
B	**> 10 AND ≤ 15**
C	**> 15 AND ≤ 25**
D	**> 25 AND ≤ 35**
E	**> 35 AND ≤ 50**
F	**> 50**

Note: LOS criteria apply to each lane on a given approach and to each approach on the minor street.
LOS is not calculated for major-street approaches or for the intersection as a whole.
LOS F is assigned to a movement if the volume-to-capacity ratio exceeds 1.0, regardless of the control delay

Reference: Highway Capacity Manual Version 6.0, Transportation Research Board, 2016.