Traffic Impact Study

Residential Development

(West of CR10)

Fallis Line, Millbrook, ON

Township of Cavan Monaghan,

County of Peterborough

ASURZA ENGINEERS

January 31, 2022

Project № 2124-19

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Project Nº 2124-19

January 31, 2022

Mr. Saverio Montemarano,
Bromont Group
457 Jevlan Dr.
Woodbridge, ON
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Dear Mr. Montemarano,

Reference: Residential Development (West of CR10)
Traffic Impact Study Report
Township of Cavan Monaghan, County of Peterborough
Project Nº 2124-19

Asurza Engineers Ltd. is pleased to submit the enclosed Traffic Report for the proposed Residential Development in Millbrook. The study and report were prepared on behalf of the proponent as part of the documentation required by the Township of Cavan Monaghan.

Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Martin Asurza, M.Eng, P.Eng
Senior Transportation/Traffic Engineer

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Project Team Member List

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Project Technical Staff:	Hassan A. Bajwa, B.Eng, EIT
	Celine S. Asurza, Civil B.Eng. Student

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Executive Summary

Asurza Engineers Ltd. was retained to undertake a traffic impact study in order to review, assess, and determine any traffic impact the proposed development may generate on the adjacent road and intersections.

The subject site, a vacant land, is located on the west side of County Rd (CR10), south of Fallis Line in the Township of Cavan Monaghan, County of Peterborough.

The site is proposed for development to include a residential development; the residential development includes a mixture of single detached, townhouses and apartment units. It is expected the proposed residential development to be 50% developed/occupied by the year 2025, and fully developed/occupied by the year 2030.

In order to evaluate existing conditions, traffic operations were evaluated at intersections within the study area. The traffic operations for the existing condition (2021) shows that turning movements at intersections are operating well, with level of service “A”, “B” or “C”.

In order to establish base conditions for comparison and evaluation of future scenarios, it is necessary to review results of traffic operations over time. The estimated normal growth traffic volumes are based under the premise that existing geometric conditions is maintained and that traffic growth is expected over the next years.

As part of the background volumes; the study includes those major proposed developments that are approved or in process for approval, as it is the case for Tower Hill North, and also those that are in construction. The

traffic volumes of these developments were obtained from the "Millbrook Development Phase 2 – Traffic Impact Study for the Tower Hill Developments Ltd." Prepared by JD Engineering. Additionally, the proposed Residential and Commercial developments on Fallis Line, east of CR10 were also included as part of the background volumes.

With the normal growth over time and the additional traffic generated by those approved or in construction developments, the intersections become more saturated with some movements that reach their capacity. The most impacted is the CR10/Fallis Line intersection with some movements at level of service "F". The CR10/Larmer Line shows also some impacts over time, with the increase of thru volumes on CR10, the side road traffic (Larmer Line) finds difficult to find proper gaps to merge into CR10; the level of service "E" and "F" are noted by the horizon year 2025.

Estimation of trips generated by the proposed development were derived from the Trip Generation Manual, 10th Edition, published by the Institute of Transportation Engineers (ITE). According to the ITE Trip Generation Rates, the proposed developments will generate approximately 260 new trips for the year 2025 and approximately 520 new trips for the year 2030.

As part of the background traffic volumes, the intersections are reaching their capacity (unsignalized intersections) and some improvements are required already. For purposes of evaluating total volumes (including the new trips generated by the proposed development) the intersections were assessed with traffic signals and auxiliary lanes. With these improvements, the CR10/Larmer Line and CR10/Fallis Line intersections will be able to handle the additional traffic generated by the proposed developments.

Therefore, from the traffic point of view and with the inclusion of the recommended improvements, the proposed developments can take place without significant impacts to traffic operations.

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1 Introduction

1.1 Overview

Asurza Engineers Ltd. was retained by The Applicant or Developer, to undertake a traffic impact study for the proposed Developments located next to Fallis Line, approximately 850 m west of CR10, in the Township of Cavan Monaghan, County of Peterborough. The report was prepared for the Township's review and approval in order to permit the proposed development.

1.2 Objectives

The purpose of this study is to determine any traffic impact the proposed developments may generate on the adjacent roadway, as well as to identify the required improvements to maintain acceptable operational levels on the roadway within the study area.

The general scope of this study includes the following key elements:

- Establish a baseline traffic conditions for the study area.
- Estimate the traffic growth for future planning horizons.
- Estimate the additional traffic the proposed development will generate.
- Estimate the total future traffic and identify impacts within the study area.
- Identify any operational and/or geometric issues within the study area.
- Provide recommendations to address any deficiencies, if identified.

To achieve these objectives, the traffic study makes use of accepted methodologies and procedures including informational reports, publications from recognized institutions and agencies, recommended best practice manuals and municipal guidelines when available. These documents will be noted within the report in the associated topic of discussion.

2 Existing Conditions

2.1 Study Area

The Township of Cavan Monaghan, with a population of 8,829 residents, according to the 2016 Census, is located approximately 20 kilometres southwest of the city of Peterborough.

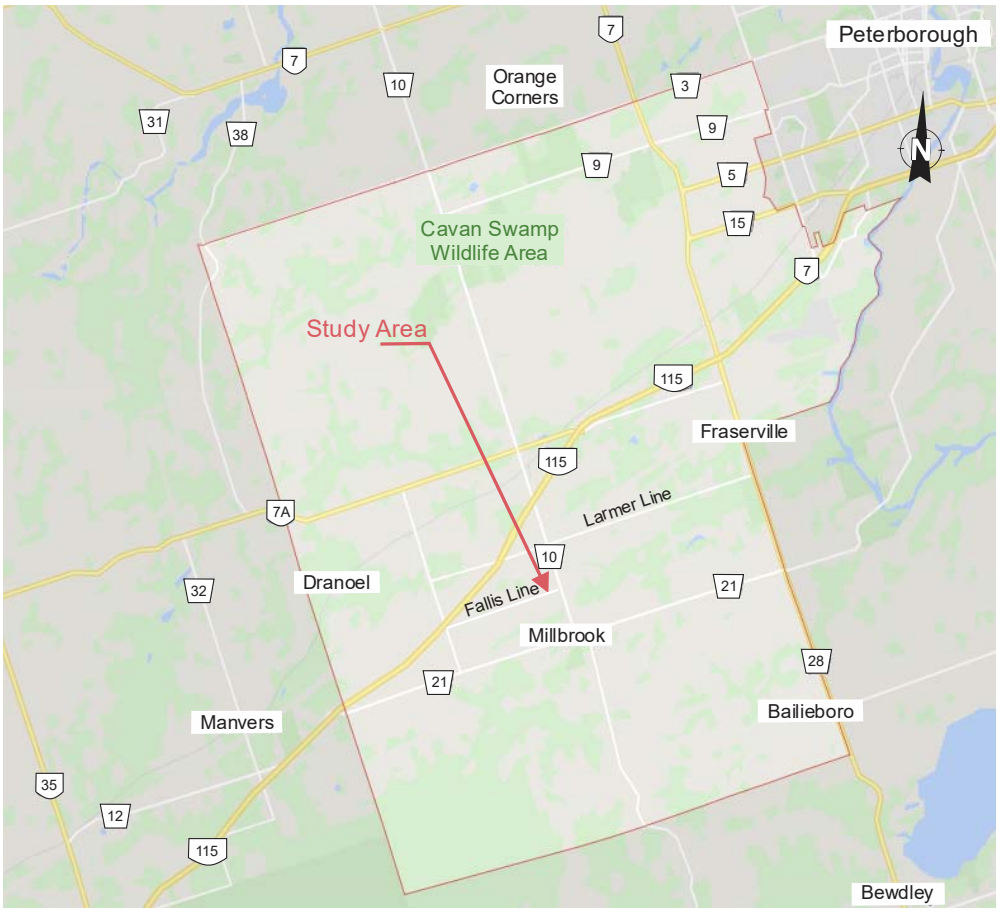

Exhibit 1: *Study Area.*

The proposed development is located on Fallis Line, west of County Road 10 (CR10). The traffic study includes the operational analysis of the following intersections:

- CR10/Larmer Line. unsignalized intersection
- CR10/Fallis Line. unsignalized intersection
- Fallis Line/Tapley Quarter Line unsignalized intersection
- CR10/CR21. unsignalized intersection

2.2 The Site

The subject site for the residential development, is a vacant land located on the west of County Road 10 (CR10), see Exhibit 2.

Exhibit 2: *The Site.*

These sites are intended for development to include a mix of residential uses with a total of 669 units, as noted below:

- 35’ Single Detached – 201 units
- 45’ Single Detached – 113 units
- 52’ Single Detached – 57 units
- 24’ Street Townhouse – 148 unites
- Medium Density (5-Storey Building) – 150 units

It is expected the residential development is 50% developed/occupied by the year 2025 and fully developed/occupied by the year 2030.

2.3 Roadway Network

County Road (CR10) within the study area is a two-lane (one lane per direction) north/south arterial road. In general, CR10 shows a rural cross-section with granular shoulders and ditches for surface water drainage; as the road approached the Downtown, CR10 becomes and urban roadway with curb & gutter, sidewalks and catchbasin for surface water collection. CR10 (locally named as Tupper St) connects with King St (CR21) to make a 4-leg 4-way stop intersection. This intersection surrounding shows a commercial area environment with the intersection being the core center of Millbrook. CR10 posted speed is 80 km/h north of the site; within the site is reduced to 60 km/h and within the urban area, the posted speed is 50 Km/h.

Larmer Line is a two-lane (one lane per direction) east/west rural road. It connects with CR10 to make a 4-leg intersection with stop signs at both approaches of Larmer Line. There is no posted speed on Larmer Line; however, according to the Ontario Traffic Act, any road is restricted to 50 km/h unless posted otherwise.

Fallis Line is a two-lane (one lane per direction) east/west rural road. It also connects with CR10 to form a 4-leg intersection; the east leg of Fallis Line is more like an unpaved pathway which currently serves like a driveway for the adjacent property. Fallis Line has a posted speed limit of 60 km/h.

Tapley Quarter Line is a two-lane (one lane per direction) north/south rural road, Fallis Line connects with Tapley Quarter Line to form a “T” type

intersection. No posted speed was identified in proximity within the area; therefore, the legislative speed limit of 50 km/h is adopted.

County Road 21 (CR21), also locally know as King Street, is a two-lane (one lane per direction) east/west urban arterial road. The road has a mix of a residential and commercial environment within the intersection area. A speed of 50 Km/h is posted within this area.

2.4 Traffic Data

Due to the provincial actions to control Covid-19, regular traffic has been impacted; therefore, the use of field traffic counts has been limited or included as supplementary information when required. For purposes of this study, traffic data was obtained from the turning movement count reports included in the "Millbrook Development Phase 2 – Traffic Impact Study for the Tower Hill Developments Ltd." Prepared by JD Engineering; these counts were done in the year 2017 (Pre-Covid) for the CR10/Larmer Line and CR10/Fallis Line intersections.

The County of Peterborough provided turning movement counts for the CR10/CR21/Distillery St intersection, counts were performed in 2018.

Field traffic counts for the Fallis Line/Tapley Quarter Line intersection was performed in 2021 and included as part of the study.

2.5 Existing Traffic Volumes

The existing lane configuration and traffic control at intersections are shown in Exhibit 3. Existing traffic turning volumes for the morning, afternoon and Saturday peak hours at the performed intersections are shown in Exhibit 4, 5 and 6, respectively.

Existing Lane Configuration at Intersections

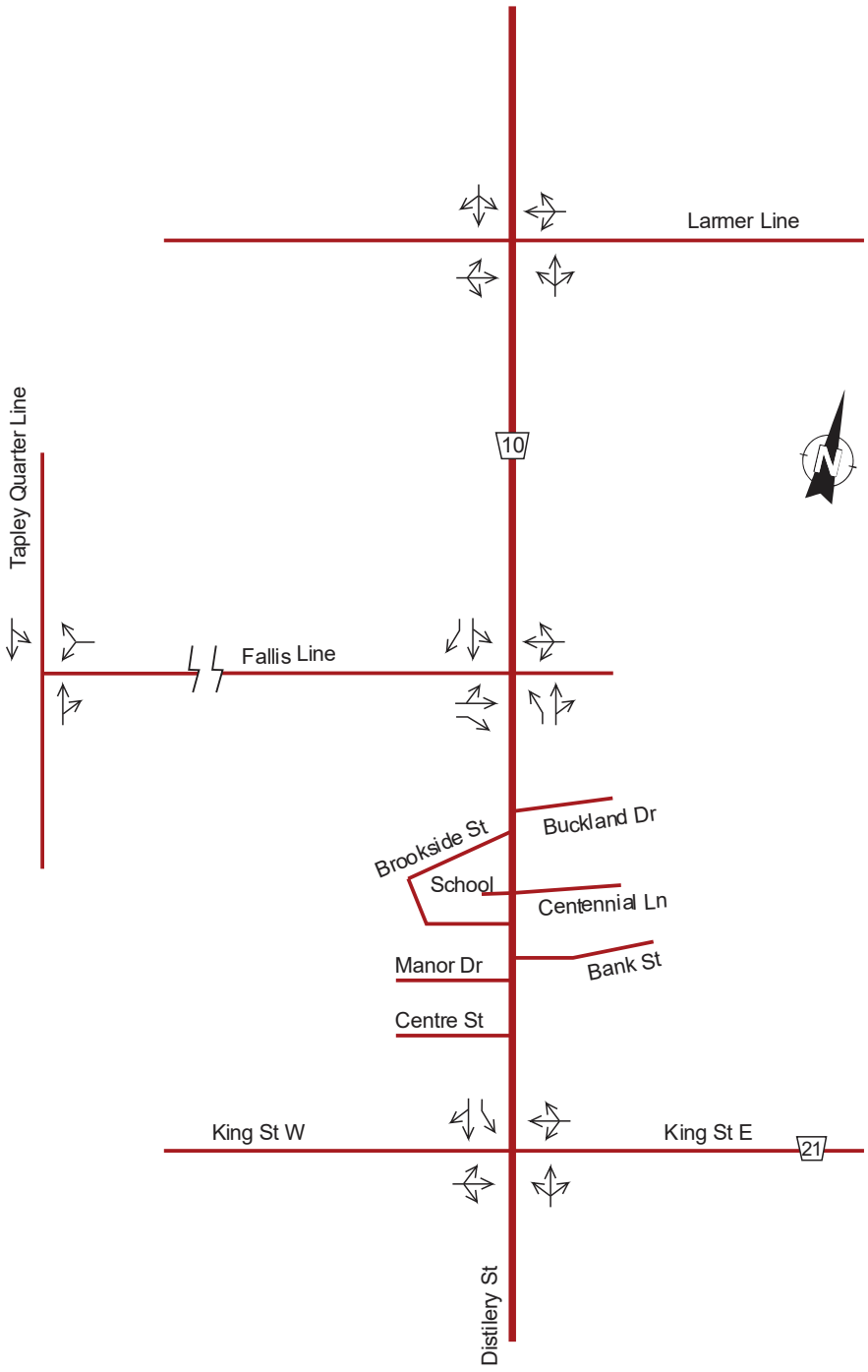

Exhibit 3: *Existing Lane Configuration at Intersections.*

AM Peak Hour - Existing Volumes 2021

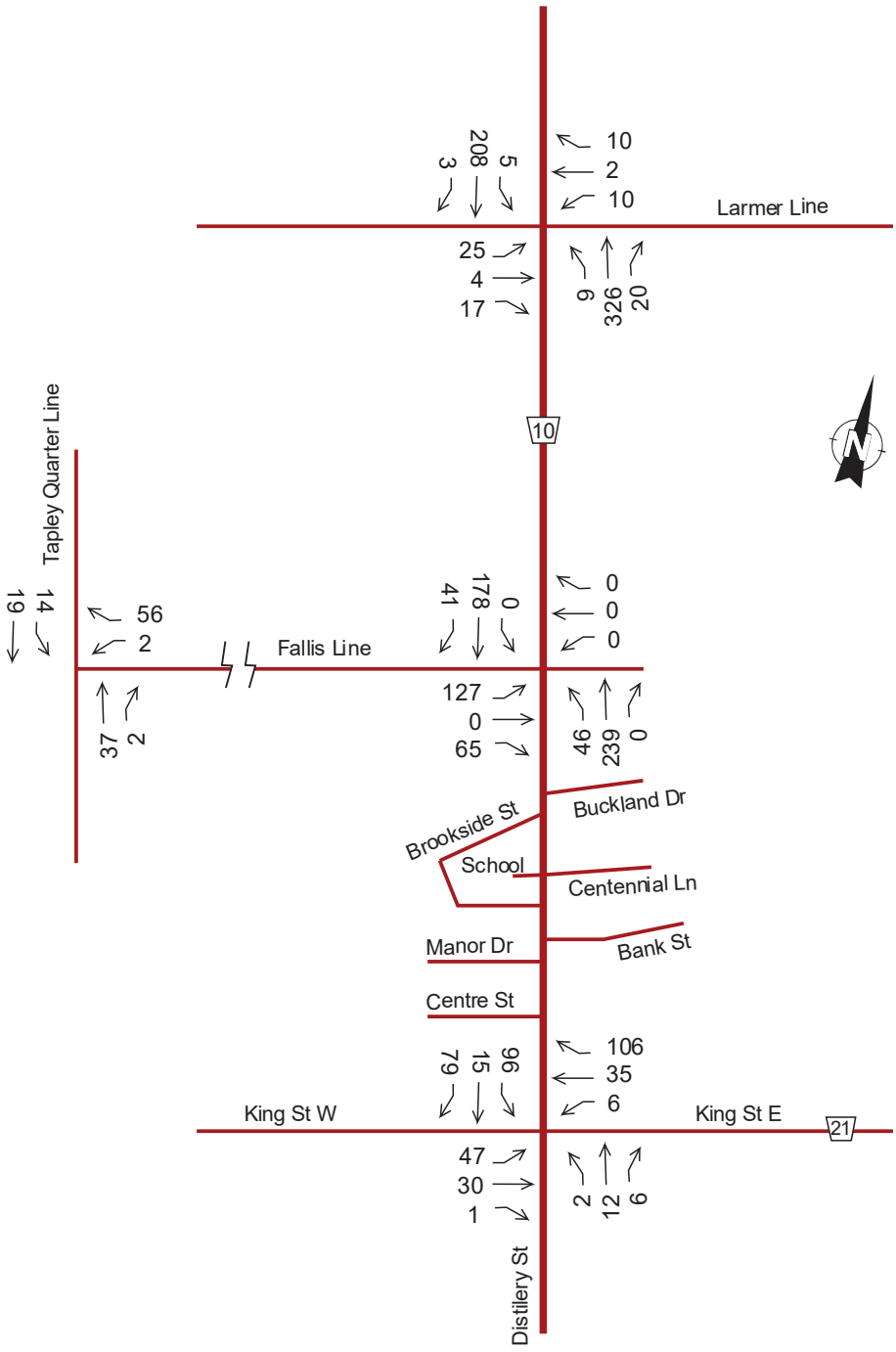

Exhibit 4: *Existing AM Peak Hour Traffic Volumes (2021).*

PM Peak Hour - Existing Volumes 2021

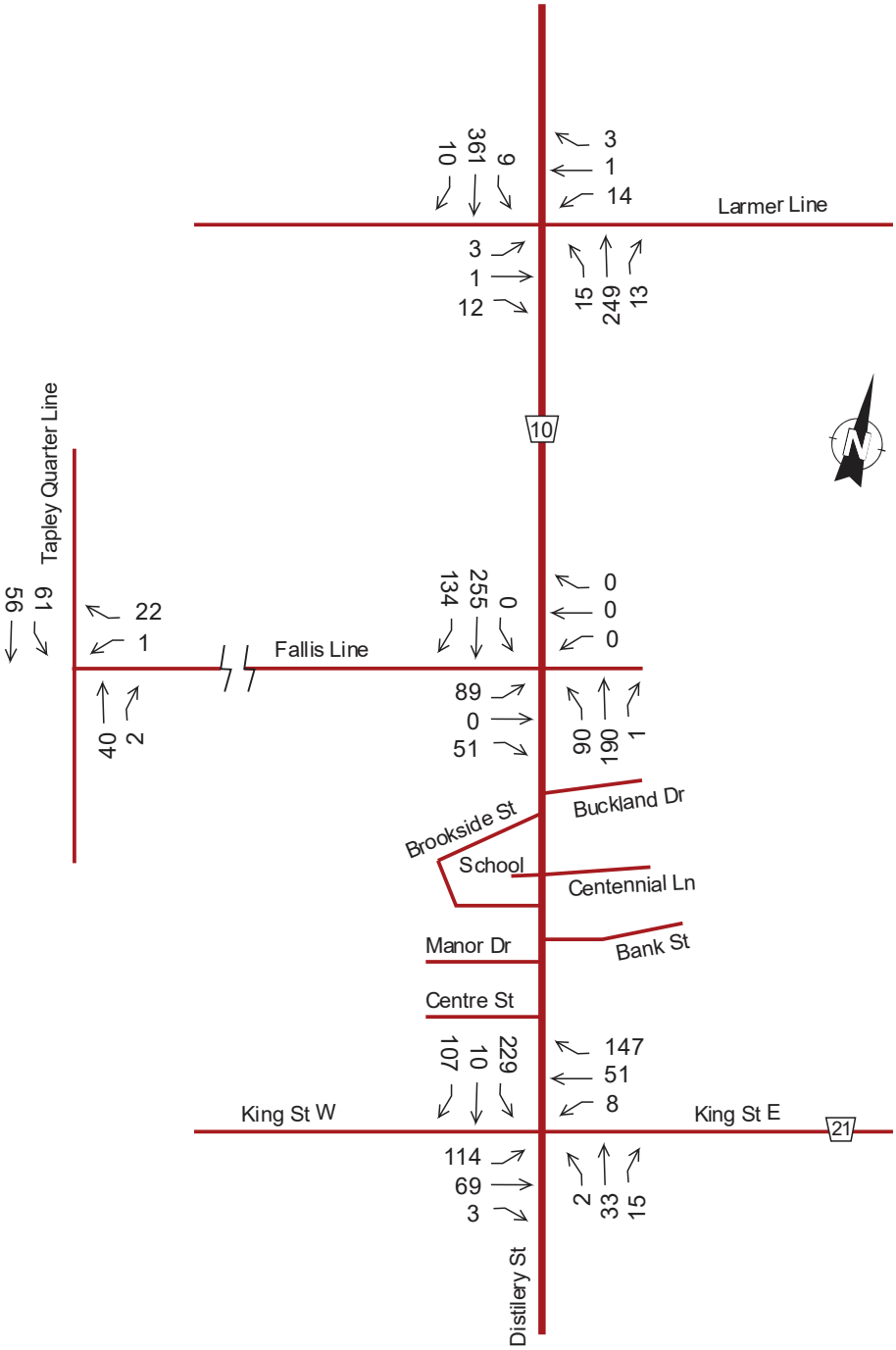

Exhibit 5: *Existing PM Peak Hour Traffic Volumes (2021).*

SAT Peak Hour - Existing Volumes 2021

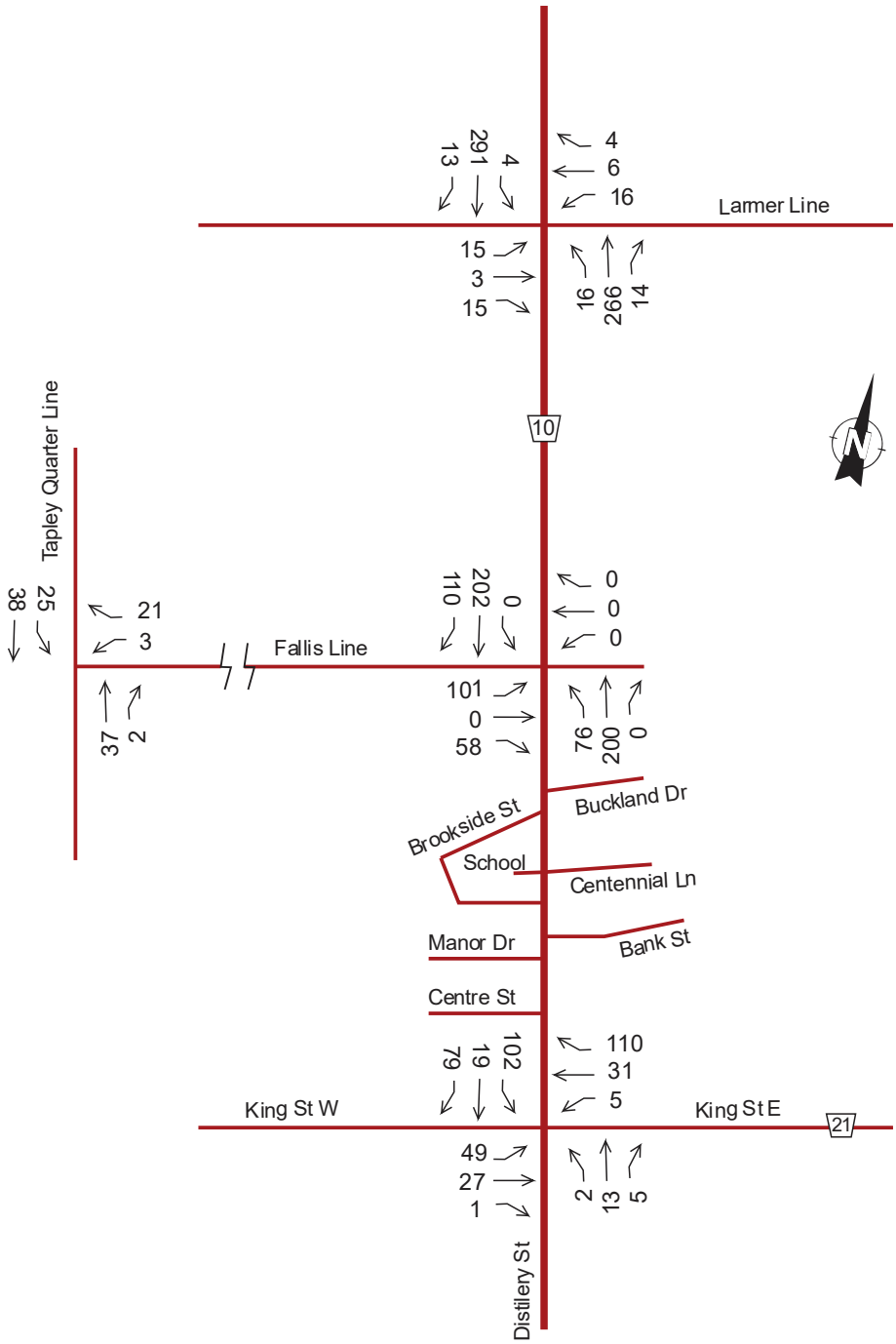

Exhibit 6: *Existing SAT Peak Hour Traffic Volumes (2021).*

The Tower Hills South residential development is still in construction but very close to its final stage. By the year 2020, the number of units already built/occupied reached approximately 75% of the total; for purposes of this study, it is expected that during the 2021 (existing year) the 100% is built and occupied; therefore, the above noted exhibits include the total traffic generated by the Tower Hills South as part of the existing traffic volumes. The same for the Millbrook Community Centre, the trips generated by this facility were included as part of the existing volumes. The traffic volumes of these developments were obtained from the "Millbrook Development Phase 2 – Traffic Impact Study for the Tower Hill Developments Ltd." Prepared by JD Engineering; the same is included in the appendix of this report.

2.6 Existing Traffic Operations

Intersection level of service (LOS) is a recognized method of qualifying the efficiency of traffic flow at intersections. The assigned LOS is determined on the delay caused by the control system experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a particular movement, compared to the estimated capacity for that movement.

For stop-controlled intersection, the method assesses the available and critical gaps in the traffic stream, which make it possible for the side road traffic to enter the main street flow. High delays are indicative of insufficient gaps in the approaching traffic flow to allow vehicles from the side street to execute their turning movements.

LOS	Signalized Intersection Control Delay (sec/veh)	Stop Controlled Intersection Control Delay (sec/veh)
A	0 - 10	0 - 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

Table 1: *Level of Service Definition.*

Table 1 shows the level of service criteria for signalized and stop-controlled intersections. The level of service ranges from the letter 'A' to 'F' where 'A' represents the ideal traffic condition and 'F' represents the extreme congested traffic condition.

		Existing 2021											
		AM Peak Hour				PM Peak Hour				SAT Peak Hour			
		V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS
CR10 / Larmer Line	EB-LTR	0.11	13.6	2.7	B	0.03	12.1	0.8	B	0.08	13.4	1.9	B
	WB-LTR	0.05	13.1	1.2	B	0.06	15.7	1.3	C	0.07	15.1	1.8	C
	NB-LTR	0.01	0.3	0.2	A	0.01	0.6	0.3	A	0.01	0.6	0.3	A
	SB-LTR	0.00	0.2	0.1	A	0.01	0.3	0.2	A	0.00	0.1	0.1	A
CR10 / Fallis Line	EB-TL	0.32	14.7	10.5	B	0.28	16.2	8.8	C	0.28	14.9	8.7	B
	EB-R	0.32	14.7	10.5	B	0.28	16.2	8.8	C	0.28	14.9	8.7	B
	WB-LTR	0.00	0.0	0.0	A	0.00	0.0	0.0	A	0.00	0.0	0.0	A
	NB-L	0.04	7.8	0.9	A	0.09	8.5	2.1	A	0.07	8.2	1.7	A
	NB-TR	0.15	0.0	0.0	A	0.12	0.0	0.0	A	0.13	0.0	0.0	A
	SB-TL	0.00	0.0	0.0	A	0.00	0.0	0.0	A	0.00	0.0	0.0	A
	SB-R	0.03	0.0	0.0	A	0.09	0.0	0.0	A	0.07	0.0	0.0	A
Fallis Line / Tapley Q. Line	WB-LR	0.06	8.8	1.5	A	0.03	8.7	0.6	A	0.03	8.7	0.6	A
	NB-TR	0.02	0.0	0.0	A	0.03	0.0	0.0	A	0.02	0.0	0.0	A
	SB-LTR	0.01	3.2	0.2	A	0.04	4.0	1.0	A	0.02	3.0	0.4	A
CR10 / Kiing St / Distillery Rd	EB-LTR	0.11	8.4	14.9	A	0.31	11.0	21.8	B	0.11	8.4	11.9	A
	WB-LTR	0.19	8.2	20.2	A	0.31	10.3	16.7	B	0.18	8.1	17.2	A
	NB-LTR	0.03	7.8	14.5	A	0.09	9.2	14.1	A	0.03	7.9	11.6	A
	SB-L	0.16	8.5	16.9	A	0.43	12.8	26.8	B	0.17	8.6	18.0	A
	SB-TR	0.13	7.0	14.9	A	0.18	8.0	17.9	A	0.13	7.1	23.0	A

Table 2: *Existing 2021 Intersection Capacity – AM, PM, SAT Peak Hour.*

The Synchro software, based on the Highway Capacity Manual 2000 methodologies (HCM 2000), was used to estimate the existing operations at the intersections. Results are summarized in ***Table 2.***

The intersection analysis considered the following:

- The average delay in seconds for each movement.
- The volume to capacity (v/c) ratio for each movement.
- The level of service for each movement.

During typical peak hours, results show that all movements at intersections are operating well with Level of Service (LOS) “A”, “B” or “C” for peak hours.

3 Background Traffic Volumes

3.1 Background Traffic Volumes

In order to establish base conditions for comparison and evaluation of future scenarios, it is necessary to review results of traffic operations over time. The estimated normal growth traffic volumes are based under the premise that existing geometric conditions is maintained and that traffic growth is expected over the next years.

As part of the background volumes; the study includes those major proposed developments that are approved or in construction; the background volumes also include the proposed development "Commercial and Residential" east of CR10 on Fallis Line; the sketch of these developments is shown in Exhibit 7. The traffic volumes of these developments were obtained from the "Millbrook Development Phase 2 – Traffic Impact Study for the Tower Hill Developments Ltd." Prepared by JD Engineering; these trips are included in the appendix.

Annual growth rate was estimated at 2.0% per year; this rate was used to project existing traffic volumes over the next years.

For estimation of the horizons years traffic volumes, the growth rate was applied to the existing volumes. The growth rate is yearly compounded.

The following Exhibits 8, 9 and 10 show the projected traffic volumes for the morning, afternoon and Saturday peak hours for the horizon years 2025 and 2030, respectively.

Sketch of Developments Within the Area

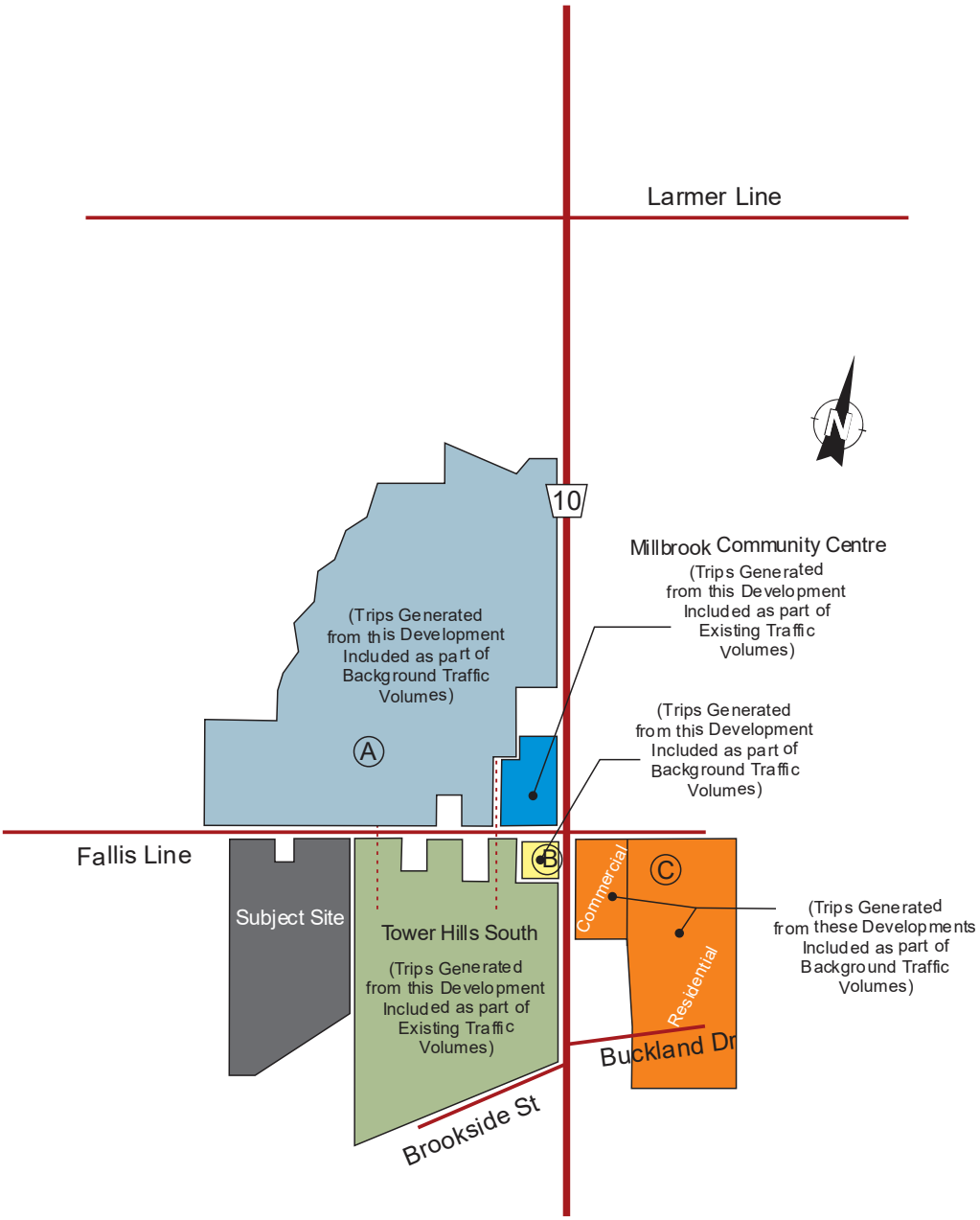

Exhibit 7: *Sketch of Developments Within the Area.*

AM Peak Hour - Background Volumes 2025

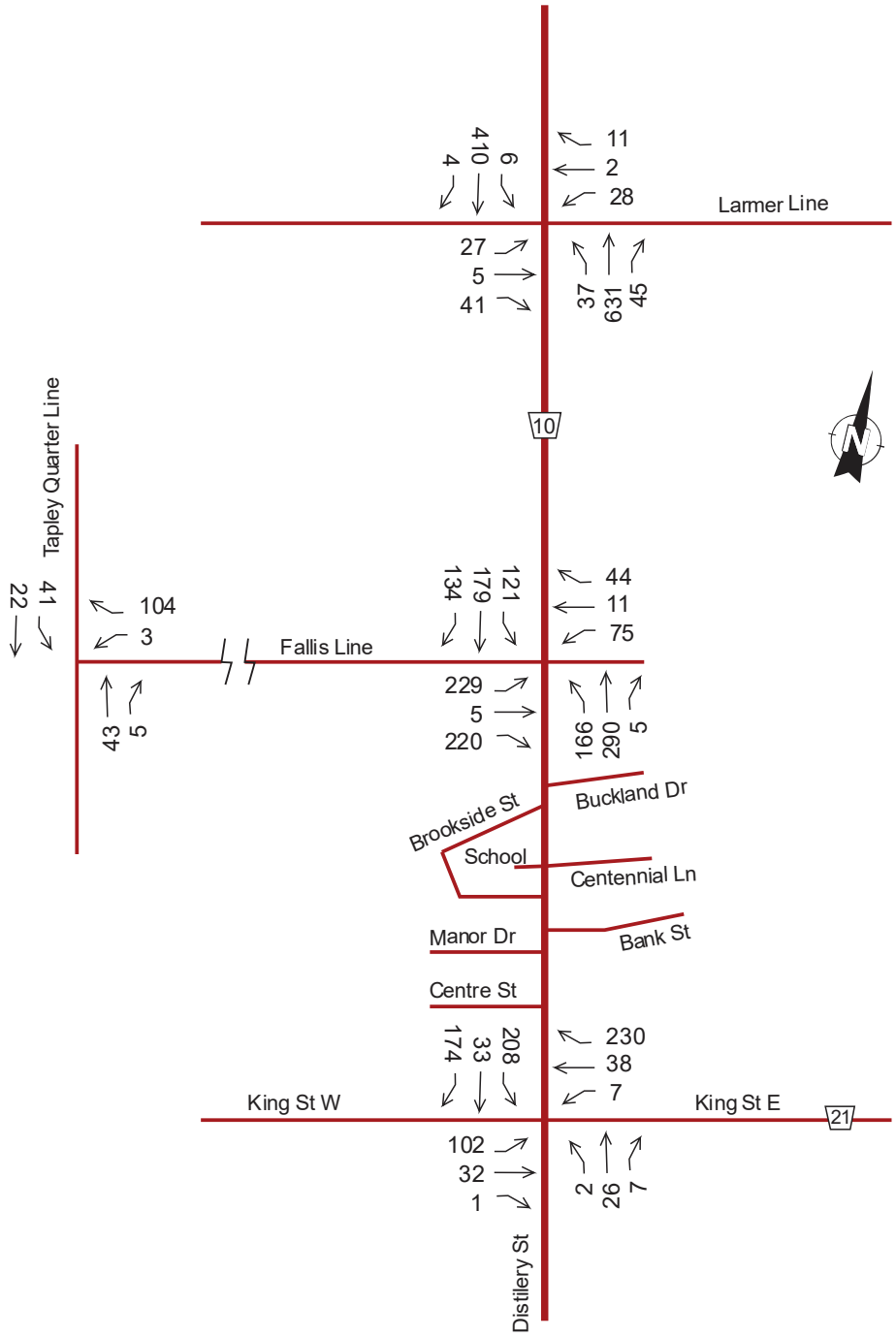

Exhibit 8: *Background AM Peak Hour Traffic Volumes (2025).*

PM Peak Hour - Background Volumes 2025

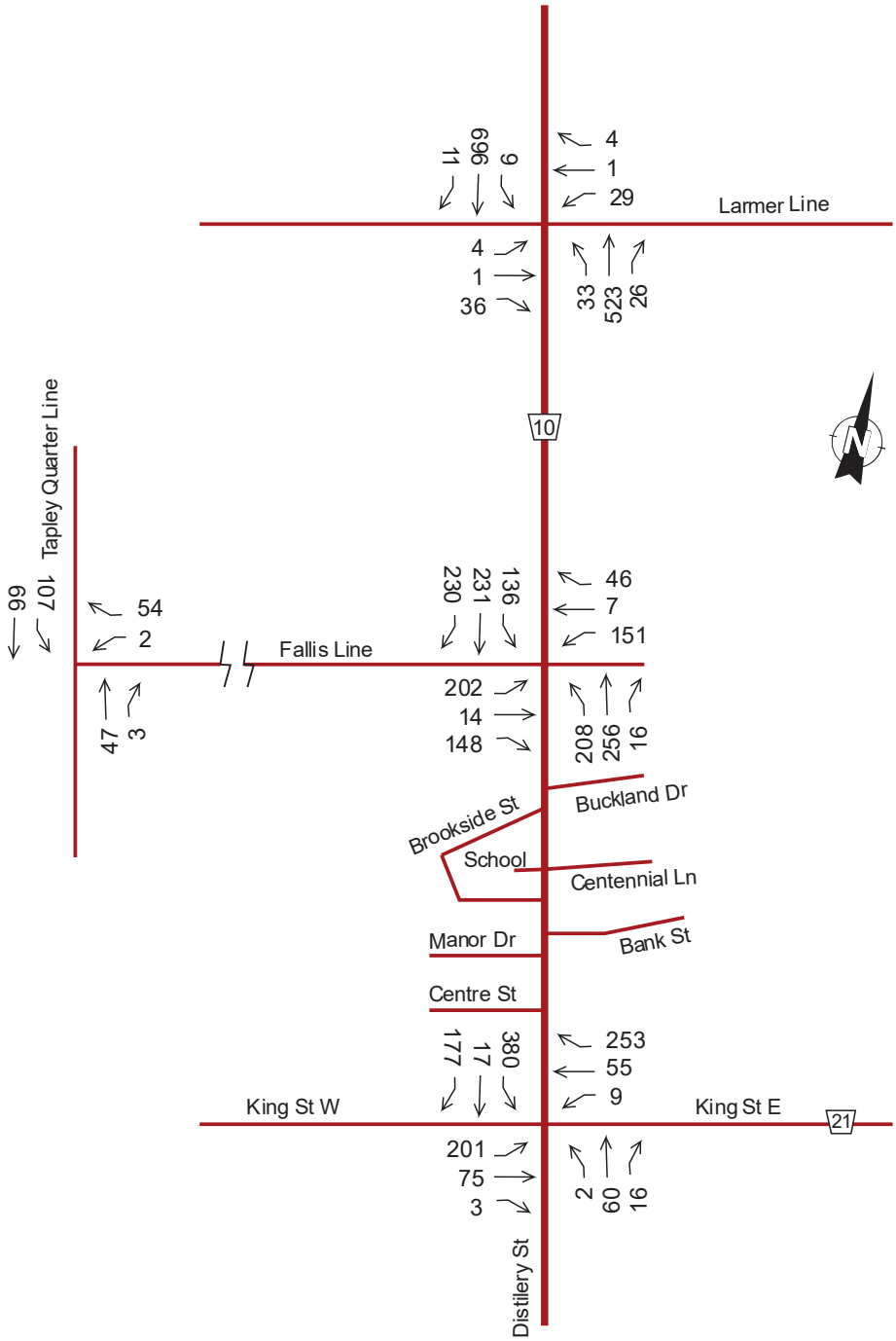

Exhibit 9: *Background PM Peak Hour Traffic Volumes (2025).*

SAT Peak Hour - Background Volumes 2025

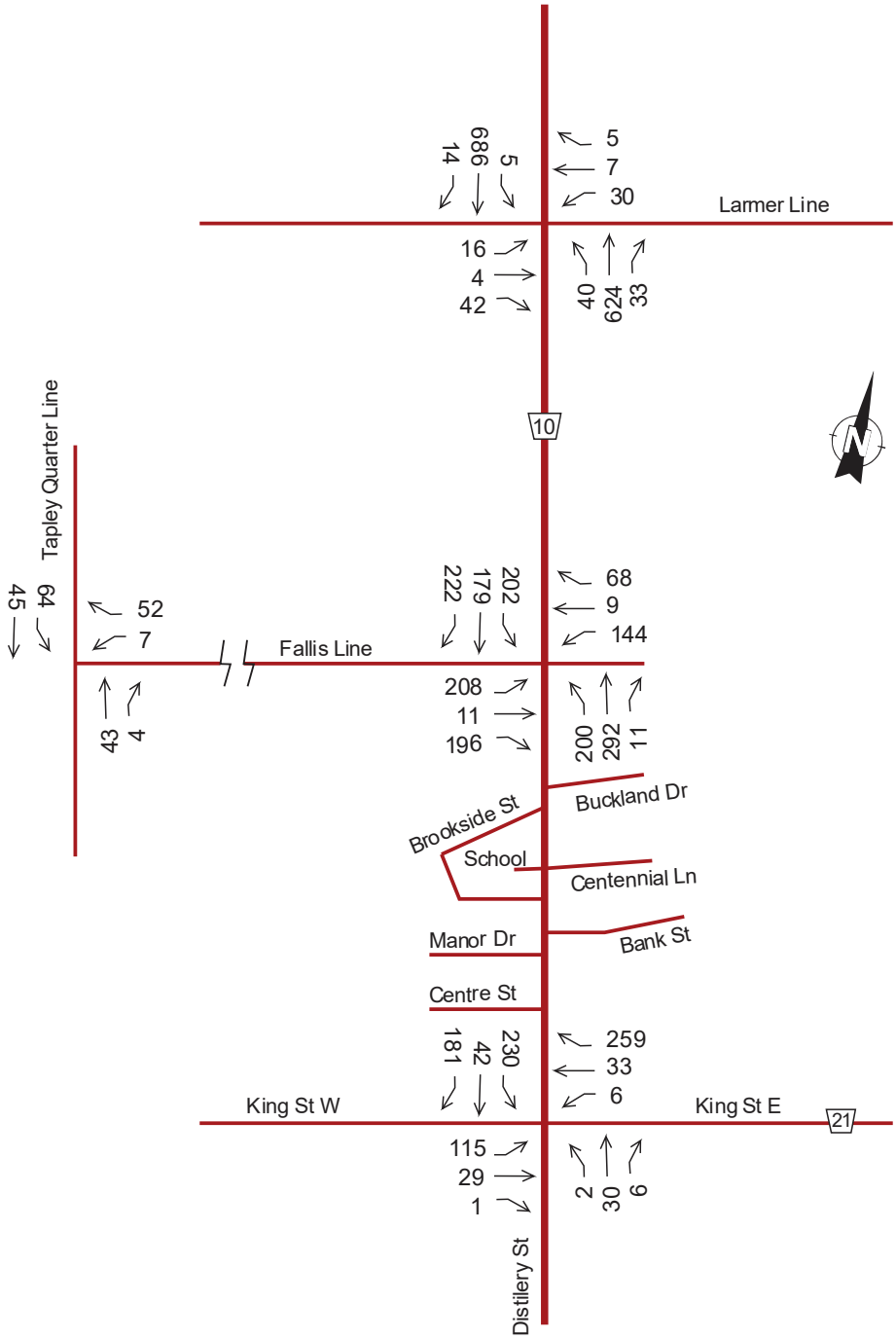

Exhibit 10: *Background SAT Peak Hour Traffic Volumes (2025).*

AM Peak Hour - Background Volumes 2030

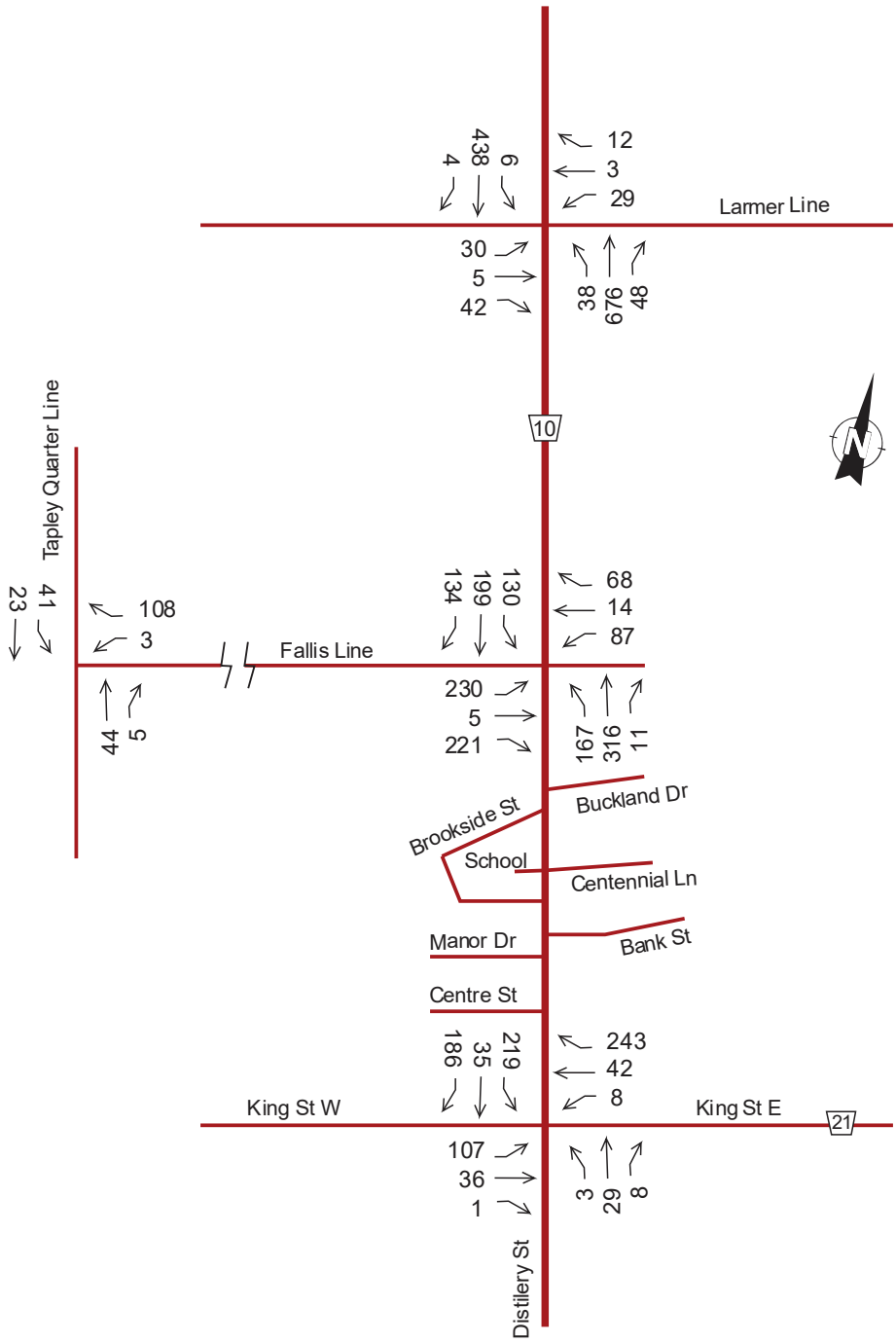

Exhibit 11: *Background AM Peak Hour Traffic Volumes (2030).*

PM Peak Hour - Background Volumes 2030

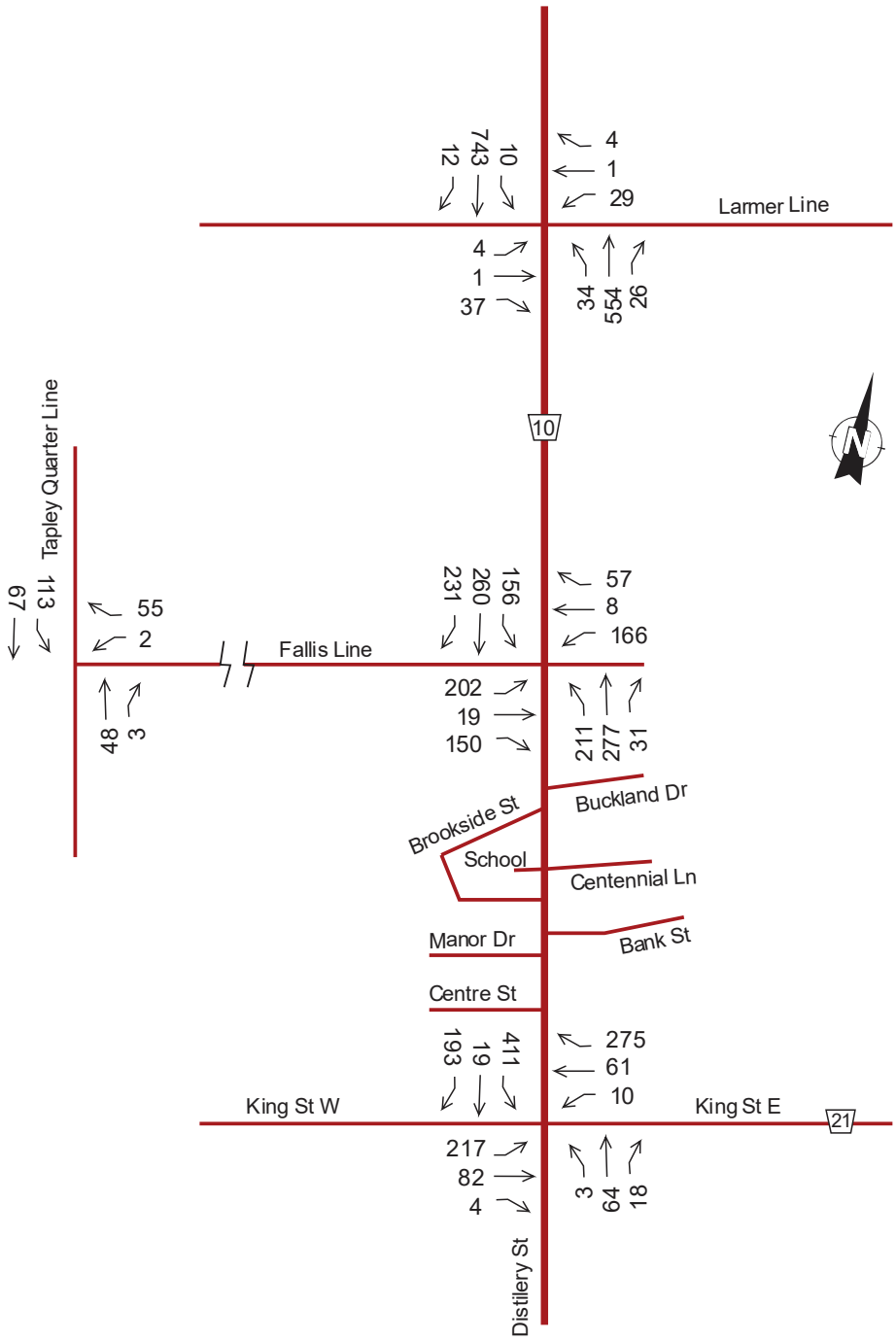

Exhibit 12: *Background PM Peak Hour Traffic Volumes (2030).*

SAT Peak Hour - Background Volumes 2030

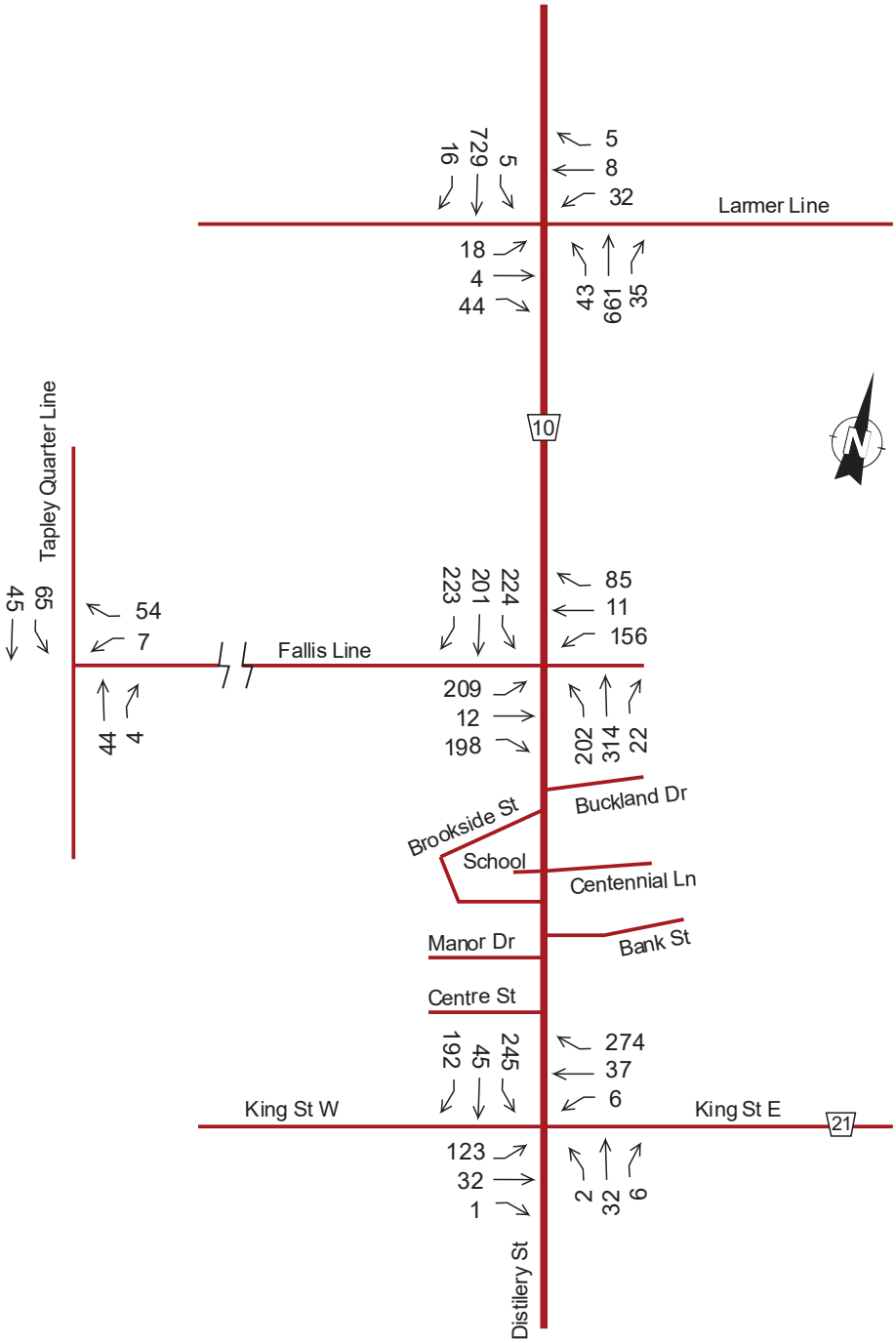

Exhibit 13: *Background SAT Peak Hour Traffic Volumes (2030).*

The traffic operation results for the base and horizon years are shown in the following table:

		Background 2025											
		AM Peak Hour				PM Peak Hour				SAT Peak Hour			
		V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS
CR10 / Larmer Line	EB-LTR	0.33	26.9	10.4	D	0.13	16.9	3.3	C	0.37	35.3	11.9	E
	WB-LTR	0.29	38.3	8.7	E	0.23	34.1	6.5	D	0.54	90.2	18.1	F
	NB-LTR	0.04	0.9	0.9	A	0.04	1.4	1.0	A	0.05	1.3	1.2	A
	SB-LTR	0.01	0.2	0.2	A	0.01	0.2	0.2	A	0.01	0.2	0.1	A
CR10 / Fallis Line	EB-TL	2.41	687.9	309.2	F	2.83	894.1	274.5	F	3.96			F
	EB-R	2.41	687.9	309.2	F	2.83	894.1	274.5	F	3.96			F
	WB-LTR	1.13	187.4	63.6	F	2.60	828.5	159.6	F	3.38			F
	NB-L	0.15	8.5	3.9	A	0.21	9.3	6.1	A	0.19	9.0	5.4	A
	NB-TR	0.19	0.0	0.0	A	0.17	0.0	0.0	A	0.19	0.0	0.0	A
	SB-TL	0.11	3.9	2.7	A	0.12	3.8	3.0	A	0.18	5.3	4.9	A
	SB-R	0.09	0.0	0.0	A	0.15	0.0	0.0	A	0.14	0.0	0.0	A
Fallis Line / Tapley Q. Line	WB-LR	0.12	9.1	3.0	A	0.06	8.9	1.5	A	0.07	9.0	1.6	A
	NB-TR	0.03	0.0	0.0	A	0.03	0.0	0.0	A	0.03	0.0	0.0	A
	SB-LTR	0.03	5.0	0.7	A	0.08	4.9	1.9	A	0.05	4.5	1.1	A
CR10 / Kiing St / Distillery Rd	EB-LTR	0.24	10.6	19.6	B	0.58	18.9	25.9	C	0.26	11.0	16.4	B
	WB-LTR	0.41	11.3	24.1	B	0.60	18.0	24.9	C	0.45	12.1	23.6	B
	NB-LTR	0.06	9.2	15.0	A	0.18	12.1	14.4	B	0.07	9.5	13.3	A
	SB-L	0.40	12.2	20.3	B	0.84	37.3	24.7	E	0.45	13.3	20.8	B
	SB-TR	0.33	9.5	22.7	A	0.36	11.5	20.0	B	0.36	10.1	22.4	B

Table 3: *Background 2025 Intersection Capacity – AM, PM, SAT Peak Hour.*

		Background 2030											
		AM Peak Hour				PM Peak Hour				SAT Peak Hour			
		V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS
CR10 / Larmer Line	EB-LTR	0.40	33.1	13.6	D	0.16	20.5	4.4	C	0.46	46.1	16.1	E
	WB-LTR	0.36	46.2	11.2	E	0.43	75.5	13.4	F	0.70	131.7	23.9	F
	NB-LTR	0.04	1.0	0.9	A	0.05	1.2	1.1	A	0.06	1.5	1.4	A
	SB-LTR	0.01	0.2	0.2	A	0.01	0.3	0.3	A	0.01	0.2	0.1	A
CR10 / Fallis Line	EB-TL	3.05			F	3.69			F	5.36			F
	EB-R	3.05			F	3.69			F	5.36			F
	WB-LTR	1.55	348.8	101.1	F	3.84			F	4.70			F
	NB-L	0.15	8.5	4.1	A	0.22	9.5	6.4	A	0.20	9.1	5.6	A
	NB-TR	0.21	0.0	0.0	A	0.20	0.0	0.0	A	0.21	0.0	0.0	A
	SB-TL	0.12	4.0	3.0	A	0.14	4.0	3.7	A	0.20	5.6	5.8	A
	SB-R	0.09	0.0	0.0	A	0.15	0.0	0.0	A	0.14	0.0	0.0	A
Fallis Line / Tapley Q. Line	WB-LR	0.12	9.1	3.1	A	0.06	8.9	1.5	A	0.07	9.0	1.7	A
	NB-TR	0.03	0.0	0.0	A	0.03	0.0	0.0	A	0.03	0.0	0.0	A
	SB-LTR	0.03	4.9	0.7	A	0.08	5.0	2.0	A	0.05	4.5	1.1	A
CR10 / Kiing St / Distillery Rd	EB-LTR	0.26	11.0	19.9	B	0.66	23.4	26.6	C	0.29	11.5	17.0	B
	WB-LTR	0.45	12.1	29.3	B	0.69	22.9	30.1	C	0.49	13.1	24.7	B
	NB-LTR	0.07	9.5	15.5	A	0.21	13.1	16.3	B	0.08	9.8	14.1	A
	SB-L	0.42	12.9	22.0	B	0.96	58.0	29.9	F	0.48	14.3	20.3	B
	SB-TR	0.35	10.0	21.2	B	0.42	13.0	20.9	B	0.39	10.7	20.1	B

Table 4: *Horizon Year 2030 Intersection Capacity – AM, PM, SAT Peak Hour.*

4 Proposed Development Traffic Forecasting

4.1 Traffic Impact Study Methodology

The traffic impact analysis was completed in accordance with the Transportation Impact Analysis for Site Developments methodologies published by the Institute of Transportation Engineers (ITE) and with The Traffic Impact Assessment Guidelines published by the County of Peterborough.

4.2 Site Trip Generation

Estimation of trips generated by the proposed development were derived from the latest Trip Generation Manual, 10th Edition, published by the Institute of Transportation Engineers (ITE). The land uses which most closely describe the proposed residential development are the following:

- Single-Family Detached Housing – Land Use 210
- Multifamily Housing (Low Rise) – Land Use 220
- Multifamily Housing (Mid Rise) – Land Use 221

According to the ITE Trip Generation Manual, Single-Family Detached Housing have the highest trip generation rate per dwelling unit of all residential uses because they are largest units in size and have more residents and more vehicles per unit than other residential uses.

Multifamily Housing (Low Rise) includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units a that have one or two levels (floors); the Multifamily Housing (Mid Rise) also includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units but that have between three and ten levels (floors).

The trips rates and the corresponding number of trips for each land use are noted in the following table:

TRIP GENERATION RATES BY LAND USE											
ITE	ITE	Unit of	AM Peak Hr. of Adj. Street			PM Peak Hr. of Adj. Street			SAT Peak Hr. of Adj. Street		
Code	Land Use	Measure	Rate	In	Out	Rate	In	Out	Rate	In	Out
210	Single-Family Detached Housing	Dwelling Units	0.74	25%	75%	0.99	63%	37%	0.93	54%	46%
220	Multifamily Housing (Low Rise)	Dwelling Units	0.46	23%	77%	0.56	63%	37%	0.70	50%	50%
221	Multifamily Housing (Mid Rise)	Dwelling Units	0.36	26%	74%	0.44	61%	39%	0.44	49%	51%

ESTIMATED NUMBER OF TRIPS BY LAND USE - RESIDENTIAL (YEAR 2025)											
ITE	ITE	Total	AM Peak Hr. of Adj. Street			PM Peak Hr. of Adj. Street			SAT Peak Hr. of Adj. Street		
Code	Land Use	Units	Trips	In	Out	Trips	In	Out	Trips	In	Out
210	Single-Family Detached Housing	186	137	34	103	184	116	68	173	93	79
220	Multifamily Housing (Low Rise)	74	34	8	26	41	26	15	52	26	26
221	Multifamily Housing (Mid Rise)	75	27	7	20	33	20	13	33	16	17
TOTAL TRIPS RESIDENTIAL			198	49	149	258	162	96	257	135	122

ESTIMATED NUMBER OF TRIPS BY LAND USE - RESIDENTIAL (YEAR 2030)											
ITE	ITE	Total	AM Peak Hr. of Adj. Street			PM Peak Hr. of Adj. Street			SAT Peak Hr. of Adj. Street		
Code	Land Use	Units	Trips	In	Out	Trips	In	Out	Trips	In	Out
210	Single-Family Detached Housing	371	275	69	206	367	231	136	345	186	159
220	Multifamily Housing (Low Rise)	148	68	16	52	83	52	31	104	52	52
221	Multifamily Housing (Mid Rise)	150	54	14	40	66	40	26	66	32	34
TOTAL TRIPS RESIDENTIAL			397	98	298	516	324	192	515	270	244

Table 5: *Trips Rates and Trips Generation per Land Use.*

According to the site plan, the number of units for the residential development are the following:

- Single-Family Detached Housing – 371 units
- Multifamily Housing (Low Rise) – 148 units
- Multifamily Housing (Mid Rise) – 150 units

For purposes of this study, it is assumed that the subject proposed residential development is 50% built by the year 2025 and fully built/occupied by the year 2030.

According to the ITE trip generation rates, it is estimated that the proposed residential development will generate a total of 198 trips during the morning peak hour, 258 trips during the afternoon peak hour and 257 trips during a typical Saturday peak hour for the year 2025.

By the year 2030 (full build-out), the proposed residential development will generate a total of 397 trips during the morning peak hour, 516 trips during the afternoon peak hour and 515 trips during a typical Saturday peak hour.

4.3 Trip Distribution/Assignment

The number of vehicles entering and leaving the site are distributed proportional to the existing directional traffic patterns. Directional traffic patterns were estimated from the traffic data report obtained from the County and from turning movement count reports included in the "Millbrook Development Phase 2 – Traffic Impact Study for the Tower Hill Developments Ltd." Prepared by JD Engineering.

The new trips generated by the proposed development are shown in the following figures:

AM Site Generated Trips With Diverted Trips - 2025 (Residential Site West of CR10)

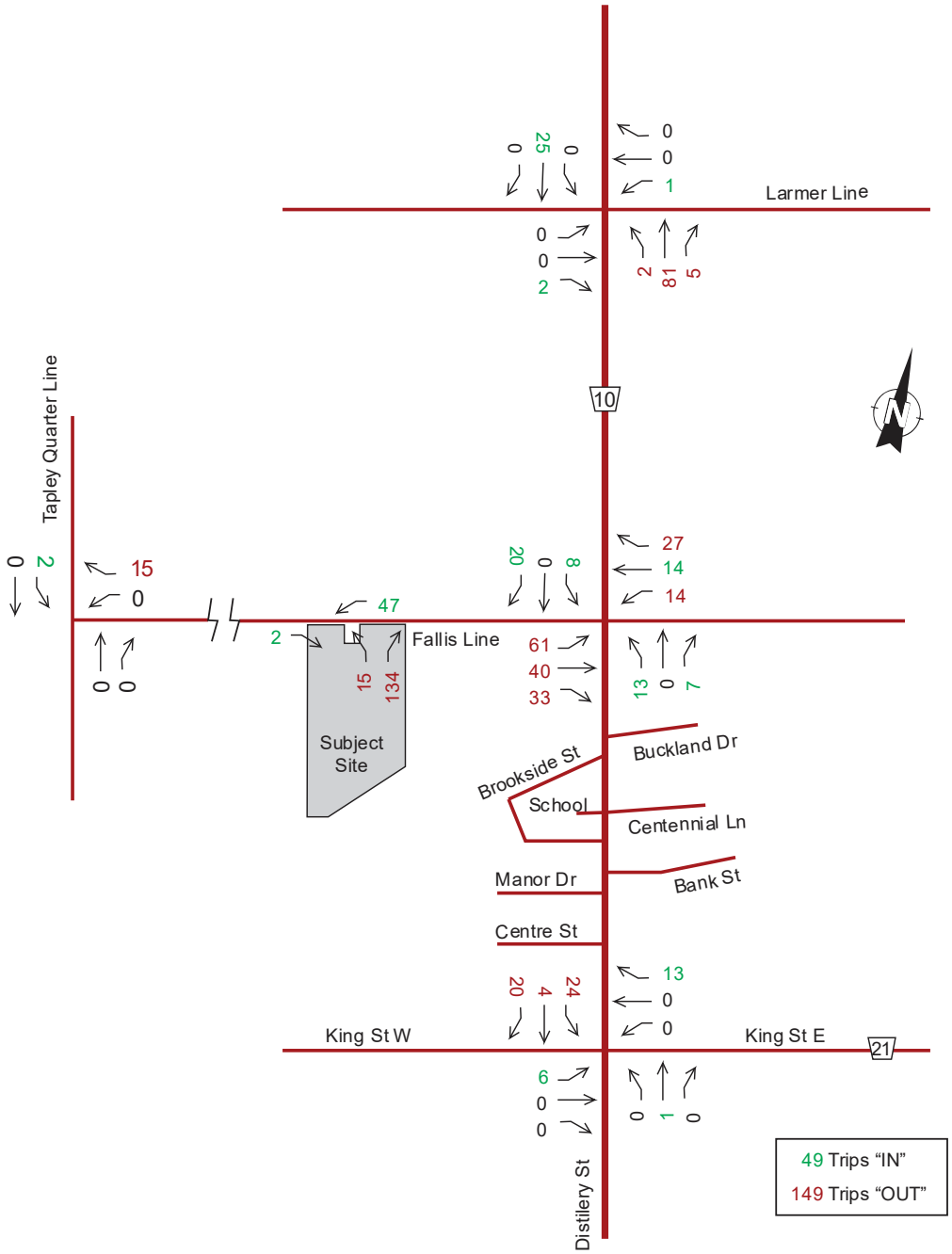

Exhibit 14: *AM Peak Hour Development Trips - 2025.*

PM Site Generated Trips With Diverted Trips - 2025 (Residential Site West of CR10)

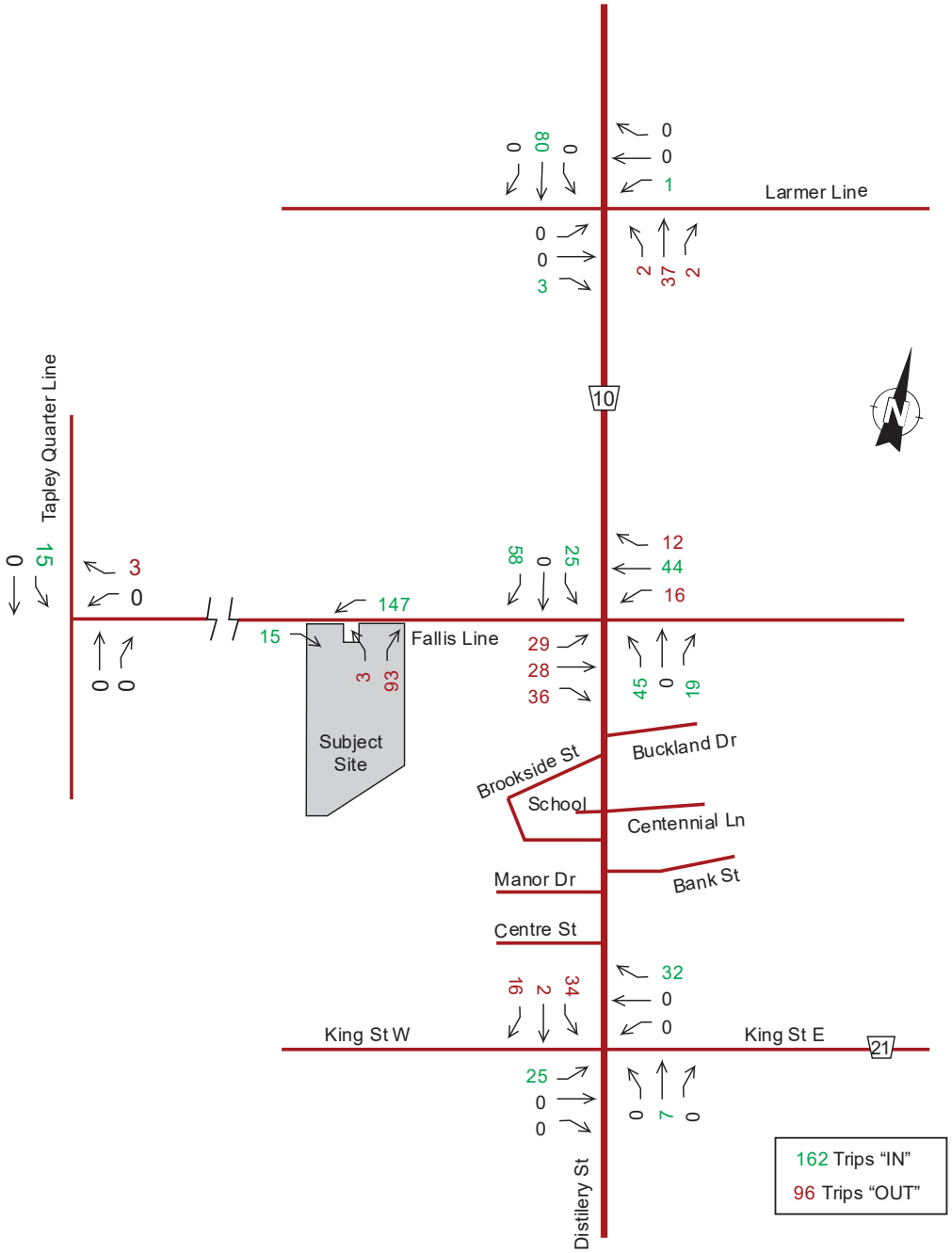

Exhibit 15: *PM Peak Hour Development Trips - 2025.*

SAT Site Generated Trips With Diverted Trips - 2025 (Residential Site West of CR10)

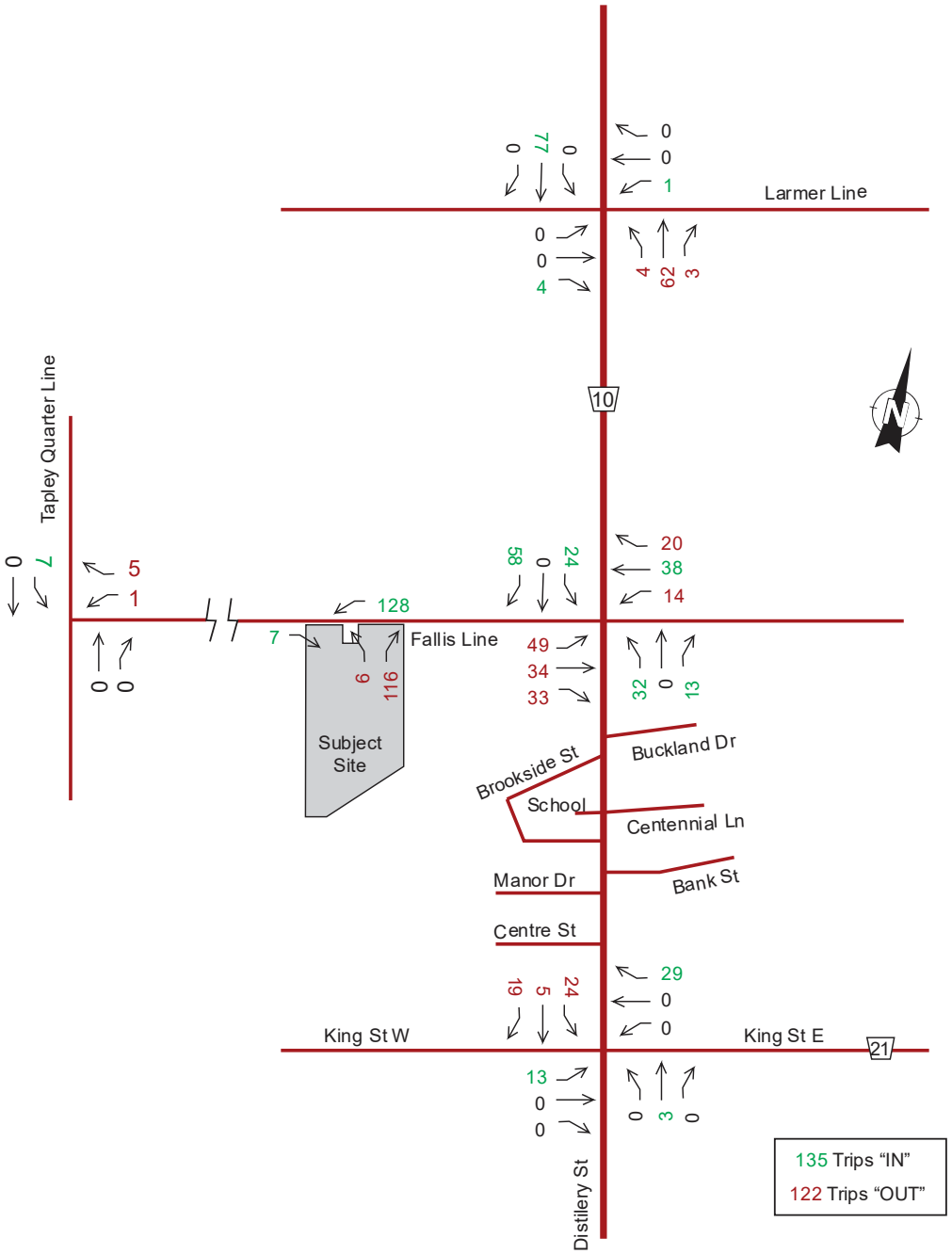

Exhibit 16: *SAT Peak Hour Development Trips - 2025.*

AM Site Generated Trips With Diverted Trips - 2030 (Residential Site West of CR10)

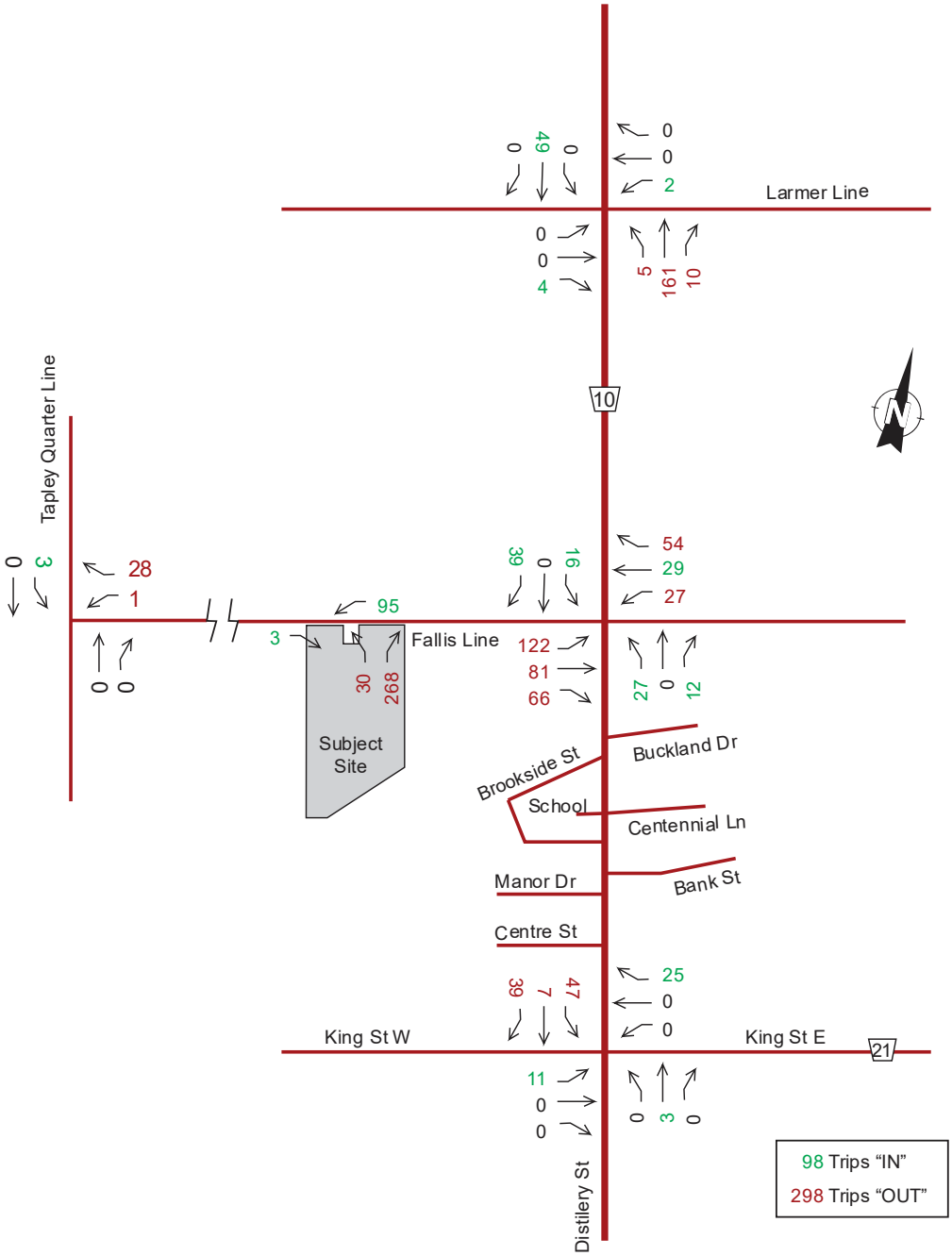

Exhibit 17: *AM Peak Hour Development Trips - 2030.*

PM Site Generated Trips With Diverted Trips - 2030 (Residential Site West of CR10)

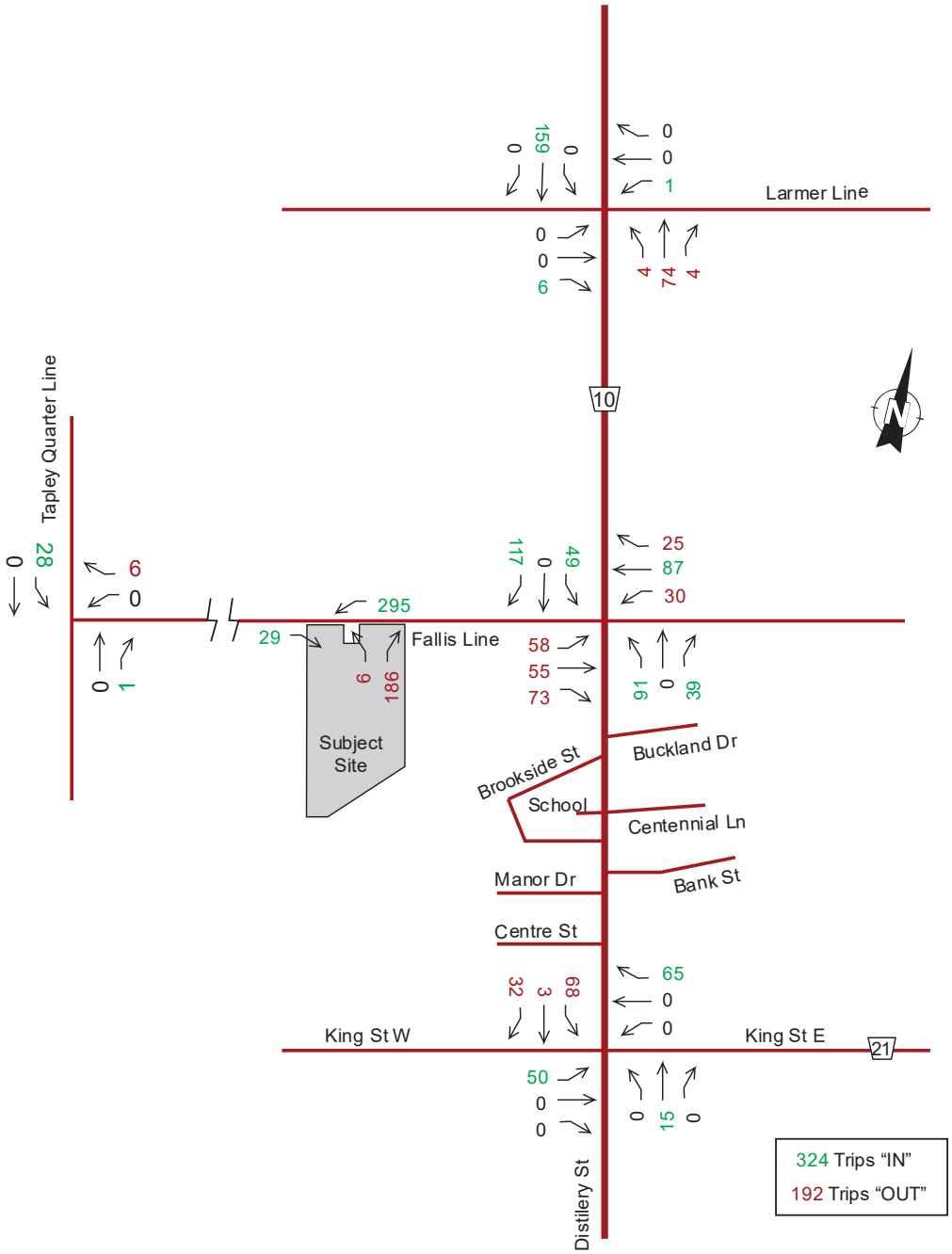

Exhibit 18: *PM Peak Hour Development Trips - 2030.*

SAT Site Generated Trips With Diverted Trips - 2030 (Residential Site West of CR10)

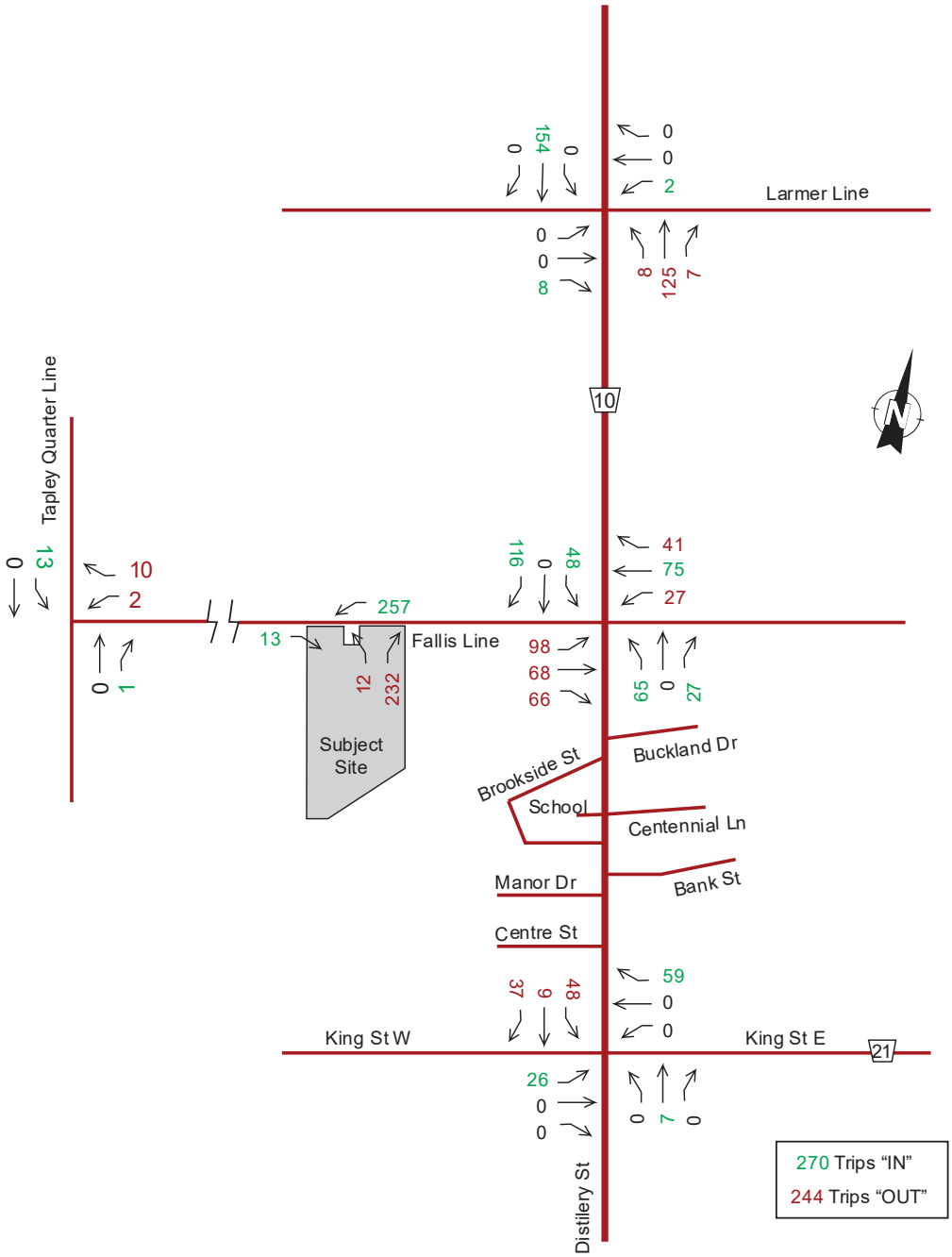

Exhibit 19: *SAT Peak Hour Development Trips - 2030.*

5 Future Traffic Operations

5.1 Future Traffic Volumes

Future total traffic volumes for the horizon years are obtained by adding the background traffic volumes plus the new trips generated by the proposed developments. The background traffic volumes and the total traffic volumes will be the base for comparisons to assess any impact for the future years.

5.2 Scenarios

The analysis will review the intersection operations for the following horizon years:

- Horizon Year 2025 – Morning, Afternoon and Saturday Peak Hour.
- Horizon year 2030 – Morning, Afternoon and Saturday Peak Hour.

5.3 Total Traffic Volumes for Horizon Years

Future total traffic volumes were obtained by adding the background traffic volumes and the new trips generated by the proposed development.

Total traffic volumes for the horizon year 2025 and 2030 for peak hours are shown in the exhibits below.

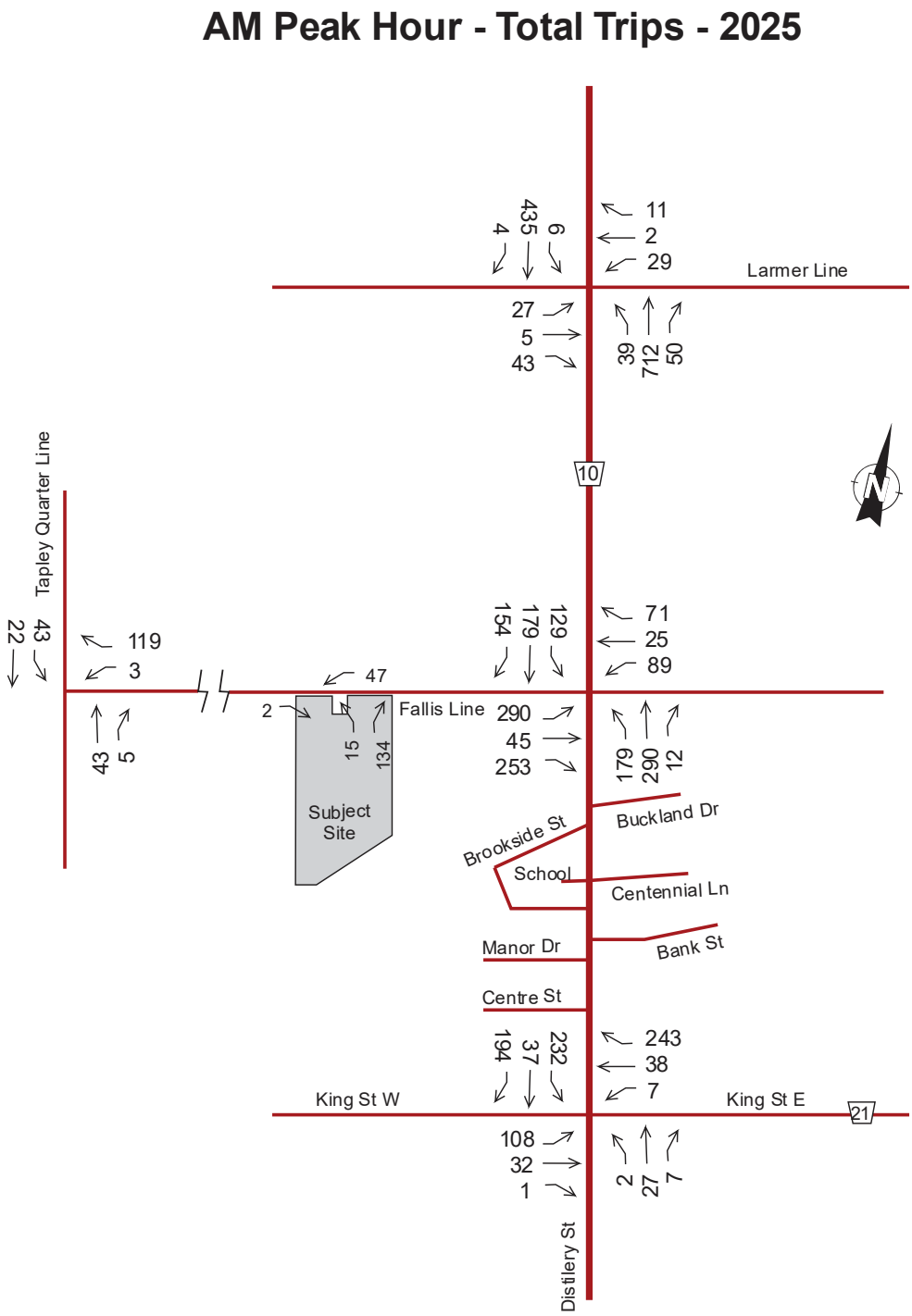

Exhibit 20: *AM Peak Hour Total Trips - 2025.*

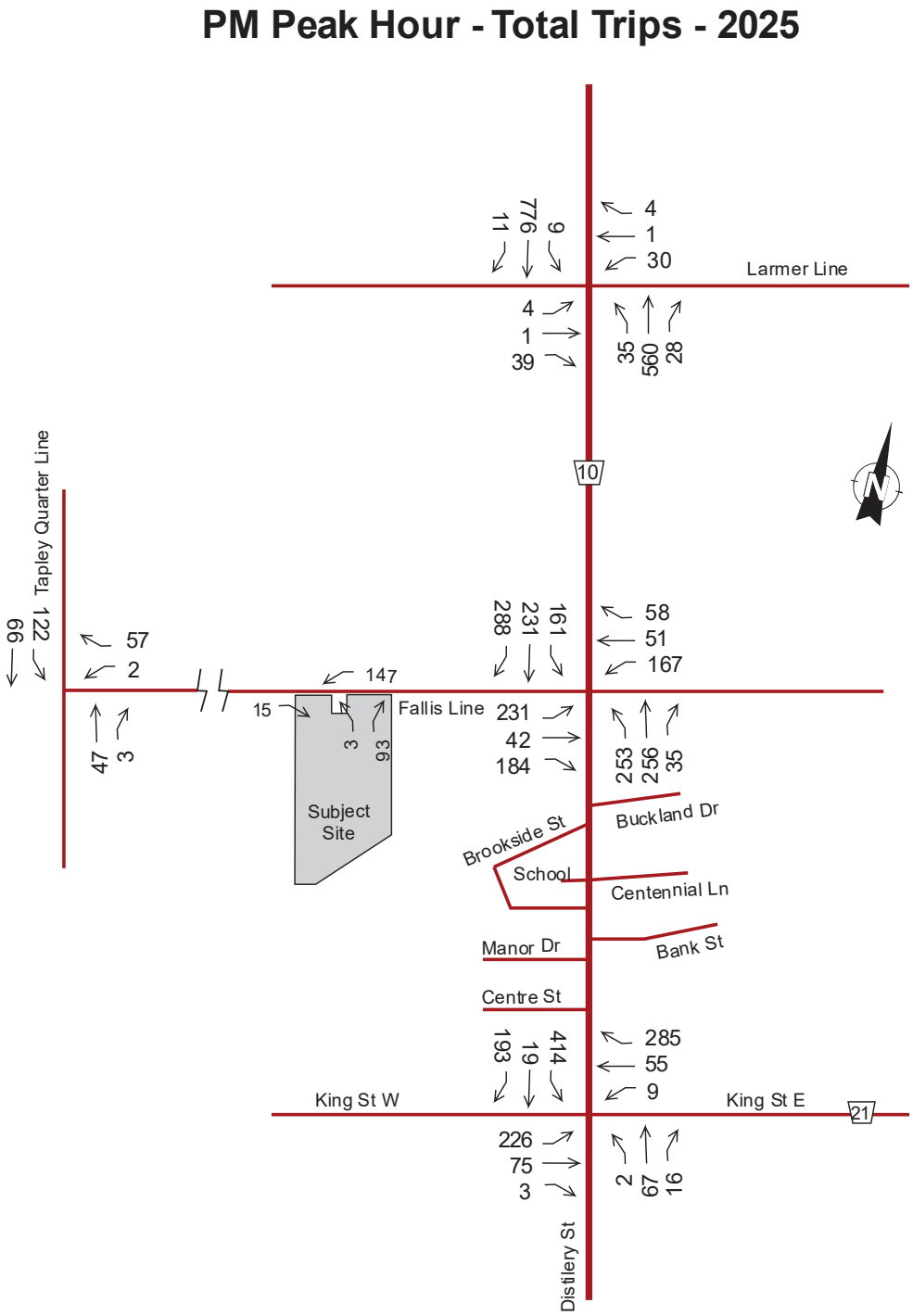

Exhibit 21: *PM Peak Hour Total Trips - 2025.*

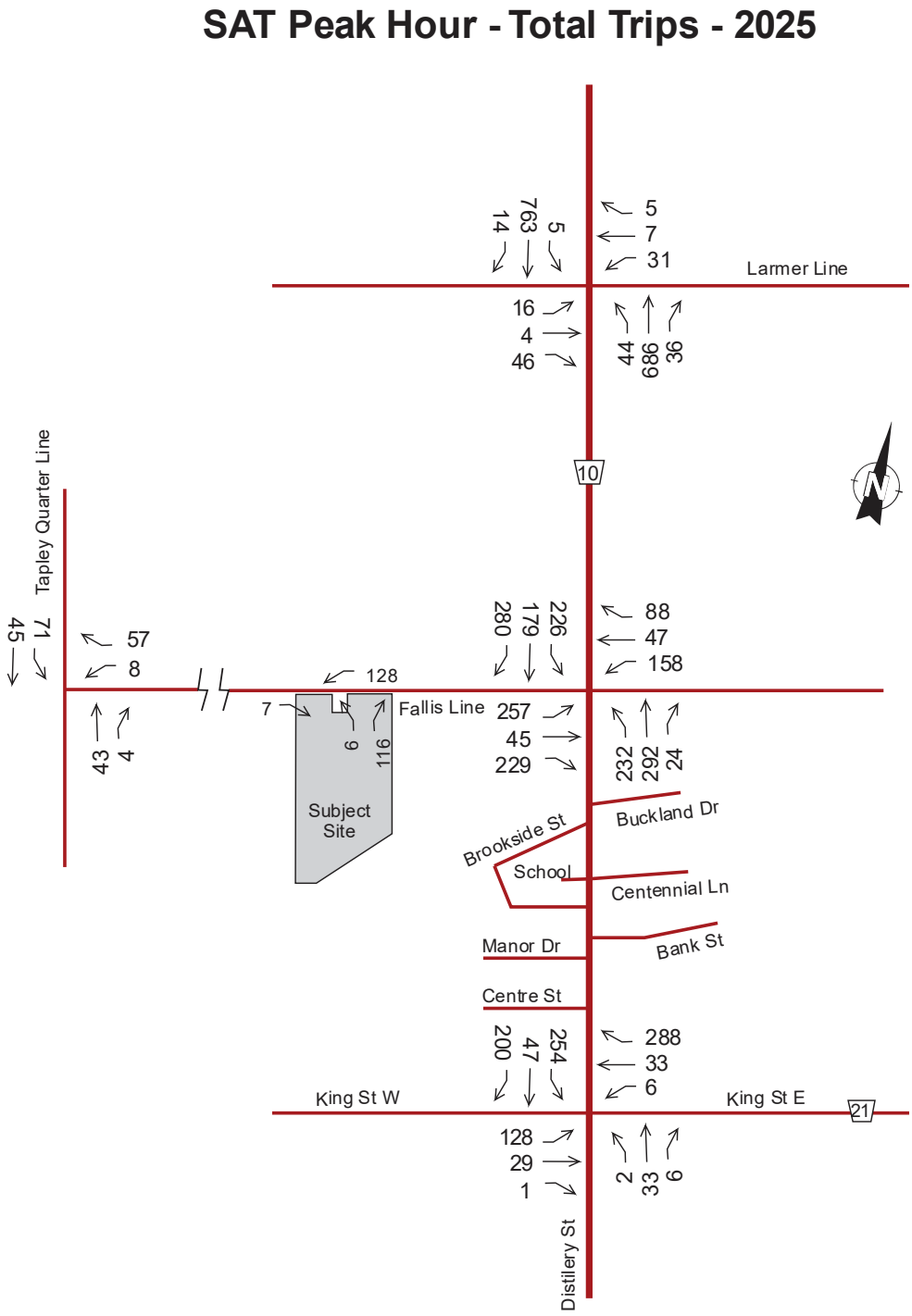

Exhibit 22: *SAT Peak Hour Total Trips - 2025.*

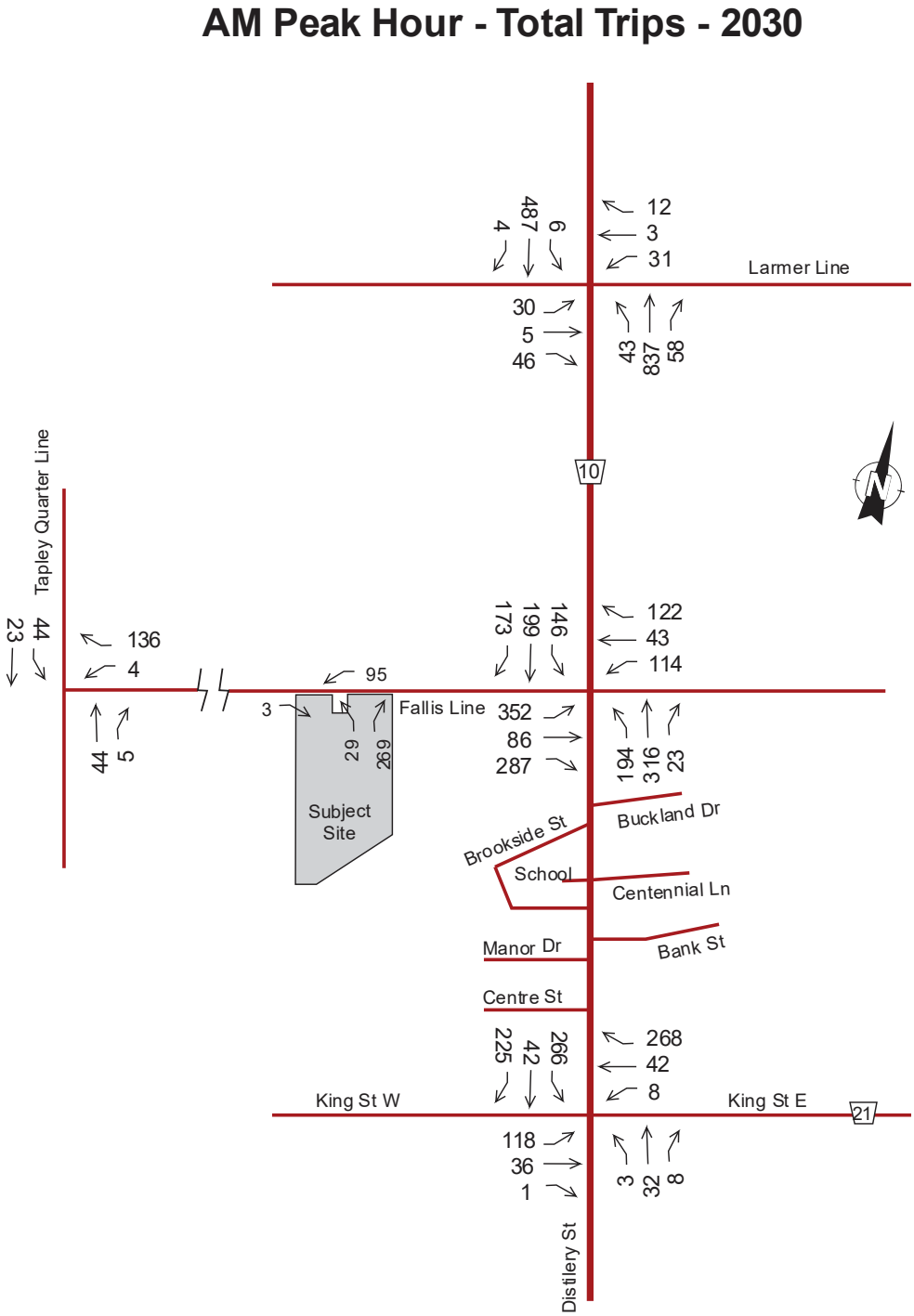

Exhibit 23: *AM Peak Hour Total Trips - 2030.*

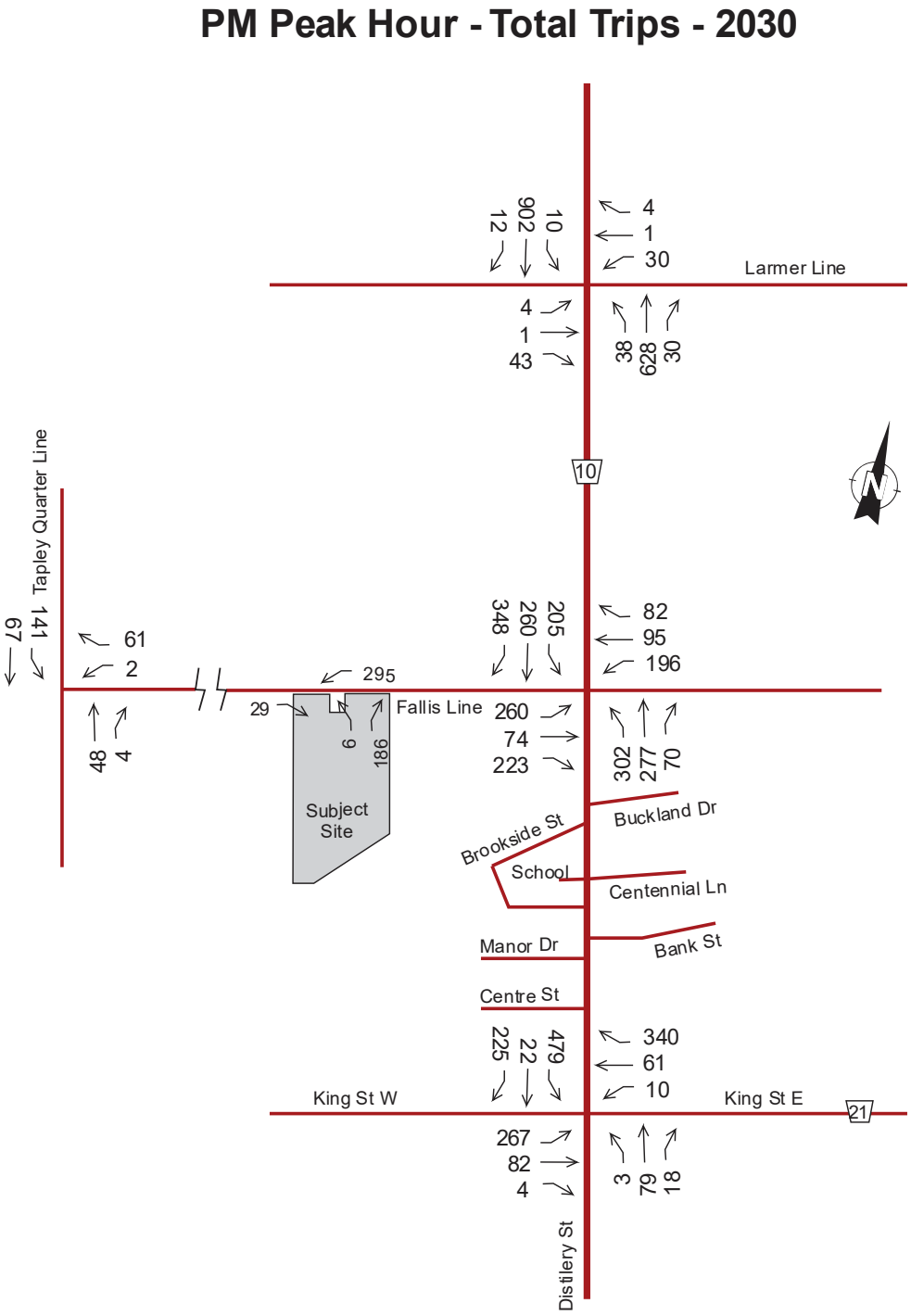

Exhibit 24: *PM Peak Hour Total Trips - 2030.*

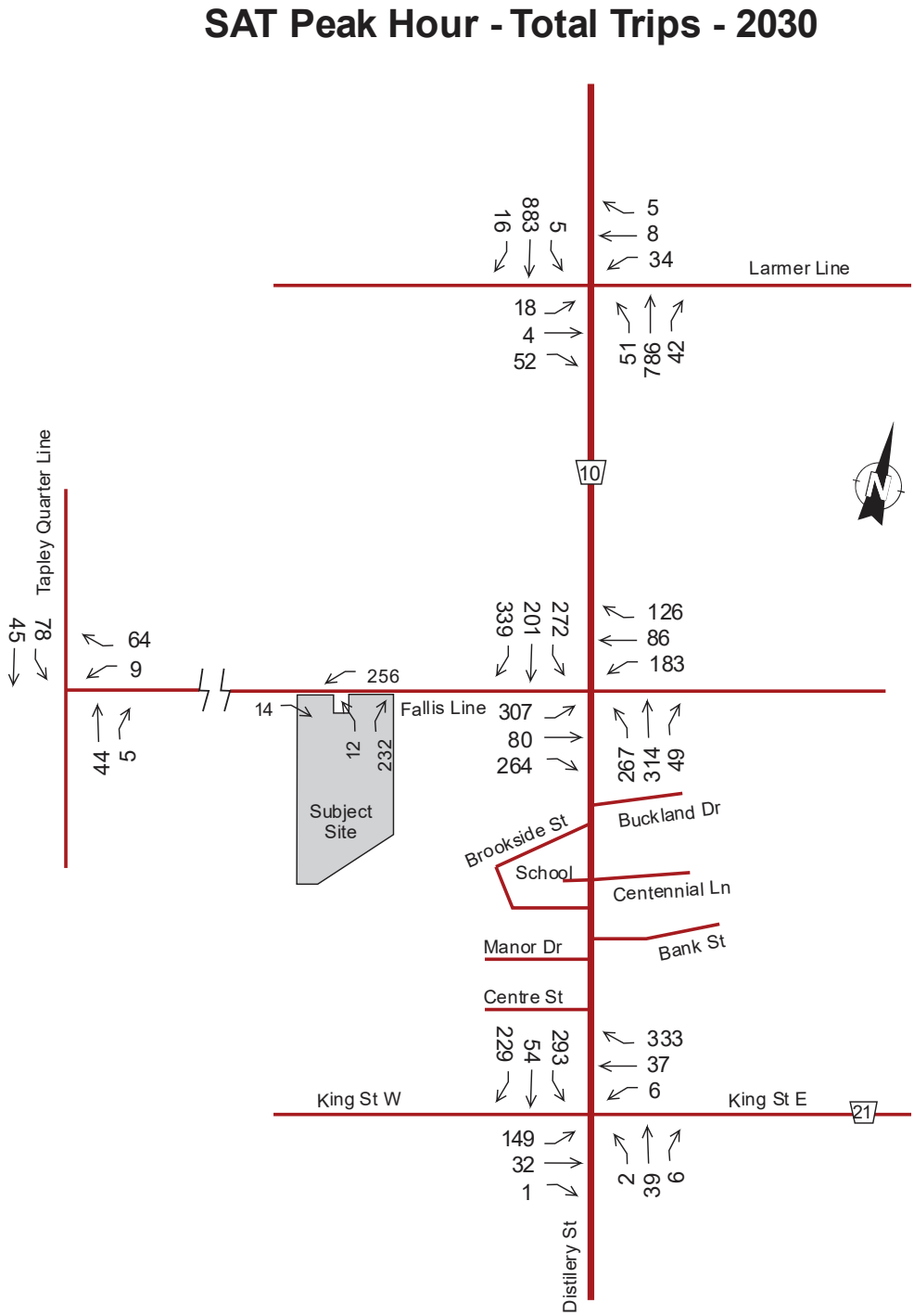

Exhibit 25: *SAT Peak Hour Total Trips - 2030.*

5.4 Future Traffic Operations at Intersections

Review of future traffic operations were done for the intersections under study, results are shown in the following tables:

		Total 2025											
		AM Peak Hour				PM Peak Hour				SAT Peak Hour			
		V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS
CR10 / Larmer Line	EB-LTR	0.43	24.1	16.2	C	0.24	15.8	9.6	B	0.35	19.2	13.5	B
	WB-LTR	0.29	30.3	13.4	C	0.22	33.7	12.7	C	0.30	34.9	14.7	C
	NB-L	0.06	2.5	3.5	A	0.08	2.4	3.1	A	0.10	2.9	3.9	A
	NB-TR	0.56	5.2	72.6	A	0.39	3.0	39.9	A	0.51	4.4	58.5	A
	SB-L	0.01	2.5	1.1	A	0.02	2.1	1.2	A	0.01	2.4	0.8	A
	SB-TR	0.31	3.1	30.1	A	0.52	4.0	65.7	A	0.54	4.8	66.8	A
	Overall	0.56	6.2	-	A	0.52	4.6	-	A	0.54	5.9	-	A
CR10 / Fallis Line	EB-L	0.76	36.1	62.4	D	0.58	27.5	49.1	C	0.67	30.6	54.7	C
	EB-TR	0.66	14.1	31.0	B	0.64	16.6	27.6	B	0.67	15.5	30.3	B
	WB-L	0.31	22.4	20.7	C	0.51	26.6	36.2	C	0.50	25.5	34.1	C
	WB-TR	0.40	17.6	17.1	B	0.46	24.9	23.5	C	0.51	20.5	23.8	C
	NB-L	0.26	8.7	26.4	A	0.41	10.7	36.7	B	0.35	10.4	35.0	B
	NB-T	0.37	17.3	59.6	B	0.33	17.4	51.7	B	0.39	18.8	61.0	B
	NB-R	0.02	10.5	3.9	B	0.05	8.1	6.8	A	0.04	9.8	5.9	A
	SB-L	0.22	8.6	19.4	A	0.27	9.3	23.6	A	0.41	11.1	34.2	B
	SB-T	0.23	15.9	36.8	B	0.31	17.3	46.4	B	0.24	16.9	37.5	B
	SB-R	0.20	3.5	11.3	A	0.36	3.4	14.8	A	0.35	3.5	14.9	A
	Overall	0.76	17.2	-	B	0.64	15.9	-	B	0.67	16.3	-	B
Fallis Line / Tapley Q. Line	WB-LR	0.13	9.2	3.5	A	0.07	8.9	1.6	A	0.07	9.0	1.8	A
	NB-TR	0.03	0.0	0.0	A	0.03	0.0	0.0	A	0.03	0.0	0.0	A
	SB-LTR	0.03	5.1	0.7	A	0.09	5.2	2.2	A	0.05	4.7	1.2	A
CR10 / Kiing St / Distillery Rd	EB-LTR	0.25	11.0	21.8	B	0.67	23.8	29.0	C	0.29	11.7	21.5	B
	WB-LTR	0.44	12.0	28.6	B	0.70	23.3	27.8	C	0.51	13.6	23.8	B
	NB-LTR	0.07	9.4	13.2	A	0.21	13.2	13.3	B	0.08	9.9	13.8	A
	SB-L	0.45	13.3	19.3	B	0.97	60.3	31.3	F	0.51	14.9	20.3	B
	SB-TR	0.37	10.2	19.5	B	0.42	13.0	34.8	B	0.41	11.1	22.5	B

Table 6: *Total Traffic Volumes Operation Results – Horizon Year 2025.*

		Total 2030											
		AM Peak Hour				PM Peak Hour				SAT Peak Hour			
		V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS	V/C	Delay (s)	Q_{95} (m)	LOS
CR10 / Larmer Line	EB-LTR	0.45	24.3	17.3	C	0.26	15.3	9.9	B	0.38	19.0	14.6	B
	WB-LTR	0.31	30.5	14.2	C	0.22	33.5	12.6	C	0.34	35.8	15.6	D
	NB-L	0.07	2.7	4.0	A	0.10	2.7	3.5	A	0.15	3.5	4.9	A
	NB-TR	0.66	7.0	108.1	A	0.44	3.3	47.8	A	0.58	5.4	78.9	A
	SB-L	0.02	2.7	1.1	A	0.02	2.2	1.2	A	0.01	2.4	0.8	A
	SB-TR	0.35	3.4	36.1	A	0.61	5.1	91.7	A	0.63	6.2	94.7	A
	Overall	0.66	7.3	-	A	0.61	5.2	-	A	0.63	7.0	-	A
CR10 / Fallis Line	EB-L	0.91	51.5	85.8	D	0.70	31.0	55.5	C	0.87	46.5	77.6	D
	EB-TR	0.82	35.7	93.6	D	0.80	34.3	63.2	C	0.86	40.2	81.6	D
	WB-L	0.42	23.4	25.4	C	0.62	28.5	41.7	C	0.60	27.6	38.9	C
	WB-TR	0.49	15.3	24.4	B	0.62	35.2	43.4	D	0.68	33.8	47.6	C
	NB-L	0.32	11.1	29.4	B	0.54	15.0	46.4	B	0.45	13.3	40.6	B
	NB-T	0.45	21.1	67.2	C	0.38	20.2	58.0	C	0.44	21.6	66.3	C
	NB-R	0.04	10.8	5.9	B	0.11	8.7	11.1	A	0.08	9.9	9.4	A
	SB-L	0.29	11.0	22.5	B	0.38	12.0	31.1	B	0.55	15.3	41.6	B
	SB-T	0.28	18.8	41.5	B	0.36	20.0	54.2	C	0.28	19.3	41.9	B
	SB-R	0.24	3.7	12.2	A	0.43	3.7	16.3	A	0.42	3.7	16.2	A
	Overall	0.91	25.2	-	C	0.80	20.8	-	C	0.87	24.3	-	C
Fallis Line / Tapley Q. Line	WB-LR	0.15	9.3	4.1	A	0.07	9.0	1.7	A	0.08	9.1	2.1	A
	NB-TR	0.03	0.0	0.0	A	0.03	0.0	0.0	A	0.03	0.0	0.0	A
	SB-LTR	0.03	5.0	0.8	A	0.10	5.4	2.5	A	0.06	4.9	1.3	A
CR10 / Kiing St / Distillery Rd	EB-LTR	0.29	11.9	21.3	B	0.81	35.4	34.7	E	0.36	13.3	18.0	B
	WB-LTR	0.51	13.8	27.8	B	0.85	38.0	41.2	E	0.63	17.4	22.1	C
	NB-LTR	0.08	9.9	18.1	A	0.26	14.9	22.2	B	0.10	10.7	19.4	B
	SB-L	0.53	15.6	19.9	C	1.20	137.2	39.4	F	0.61	19.2	22.7	C
	SB-TR	0.44	11.6	20.4	B	0.53	16.8	92.8	C	0.50	13.4	21.4	B

Table 7: *Total Traffic Volumes Operation Results – Horizon Year 2030.*

It has been shown that traffic operation results with the background volumes have impacted the CR10/Larmer Line and CR10/Fallis Line intersections; some movements at these intersections are at the level of service “E” or “F”. The proposed developments generate additional number of trips to the noted intersections becoming critical if nothing is done.

Due to the above noted condition, traffic signals have been introduced in the analysis of traffic operations for total volumes (background plus site generated traffic volumes) to address the critical conditions at the CR10/Larmer Line and CR10/Fallis Line intersections.

Additional to traffic signals, new auxiliary lanes were included as following:

a. CR10/Larmer Line Intersection – An exclusive northbound and southbound left turn lane.
b. CR10/Fallis Line Intersection – An exclusive southbound left turn lane.
c. CR10/Fallis Line Intersection - A northbound right turn taper.
d. CR10/Fallis Line Intersection - An exclusive eastbound and westbound left turn lane.
e. CR10/Fallis Line Intersection – An eastbound and westbound shared thru/right lane.

With the introduction of traffic signals (already required for background volumes including those major proposed developments in the area) and auxiliary lanes, the intersections show substantial improvement bringing the intersections to acceptable operation conditions as shown in Table 8 and 9 for the horizon year 2025 and 2030, respectively.

6 Conclusions/Recommendations

For purposes of this study, it is estimated that the 50% of the residential development is built/occupied by the year 2025, and fully developed/occupied by the year 2030.

As part of the background volumes, the study includes those major proposed developments within the study area that are approved or in construction. The traffic volumes of these developments were obtained from the "Millbrook Development Phase 2 – Traffic Impact Study for the Tower Hill Developments Ltd." Prepared by JD Engineering. As part of the background volumes, the proposed residential and commercial development on Fallis Line east of CR10 were also included.

Background traffic capacity results for the horizon years 2025 and horizon year 2030 are very similar with acceptable traffic operations. Under the existing geometry, some of the movements reach their capacity; this is the case for the westbound movement at the CR10/Larmer Line which shows level of service "E" for 2025 and becomes "F" for 2030. For the CR10/Fallis Line intersection, the most critical is the eastbound movement which shows level of service "F" for the year 2025 and 2030.

The additional trips generated by the proposed development will degrade even more traffic operations; therefore, the use for traffic signals at CR10/Larmer Line and at CR10/Fallis Line intersections is required to improve operations.

Based on the Book 12 of the Ontario Traffic Manual, traffic signal timing and signal timing offsets have been introduced for both intersections. While the signal timing design for the year 2025 is recommended as an initial setup, the signal timing for the year 2030 is only a reference to demonstrate that signals can handle the intersection; however, the traffic signal timing design for the year 2030 will need to be revisited and evaluated with updated traffic volumes.

There is also some indication that the CR10/King St/Distillery Rd intersection might require traffic signals by the year 2030; however, there are many variables that can change over the long run and preclude to make an accurate forecast; the noted intersection will require some attention after the year 2025 to review the new traffic volumes and to identify if traffic signals are warranted.

Details for auxiliary lanes are as following:

<u>CR10/Fallis Line Intersection</u>

a. Provide an exclusive eastbound left turn lane of 90 m in length and taper length according to Table 9.17.1 of the TAC for 70 km/h design speed.

b. Provide an exclusive westbound left turn lane of 60 m in length and taper length according to Table 9.17.1 of the TAC for 70 km/h design speed.

c. Provide an exclusive southbound left turn lane of 60 m in length and taper length according to Table 9.17.1 of the TAC for 70 km/h design speed.

d. Provide a 60 m northbound right turn taper.

<u>CR10/Larmer Line Intersection</u>

a. Provide an exclusive northbound left turn lane of 25 m and taper length according to Table 9.17.1 of the TAC for 90 km/h design speed.

b. Provide an exclusive southbound left turn lane of 25 m and taper length according to Table 9.17.1 of the TAC for 90 km/h design speed.

Therefore, from the traffic point of view and with the inclusion of the recommended improvements, the proposed developments can take place without significant impacts to traffic operations.

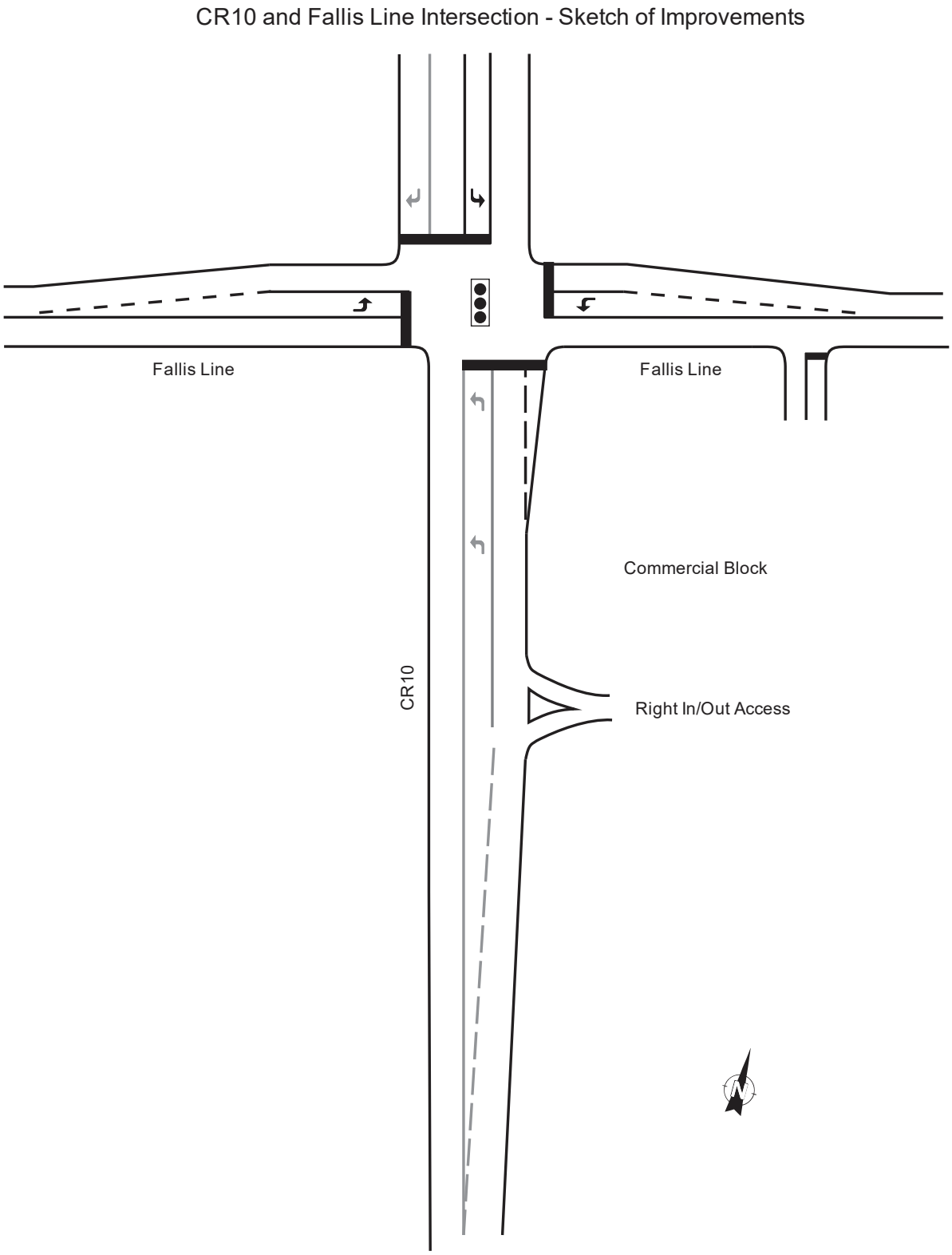

Exhibit 26: *CR10/Fallis Line Intersection – Sketch of Improvements.*

CR10 and Larmer Line Intersection - Sketch of Improvements

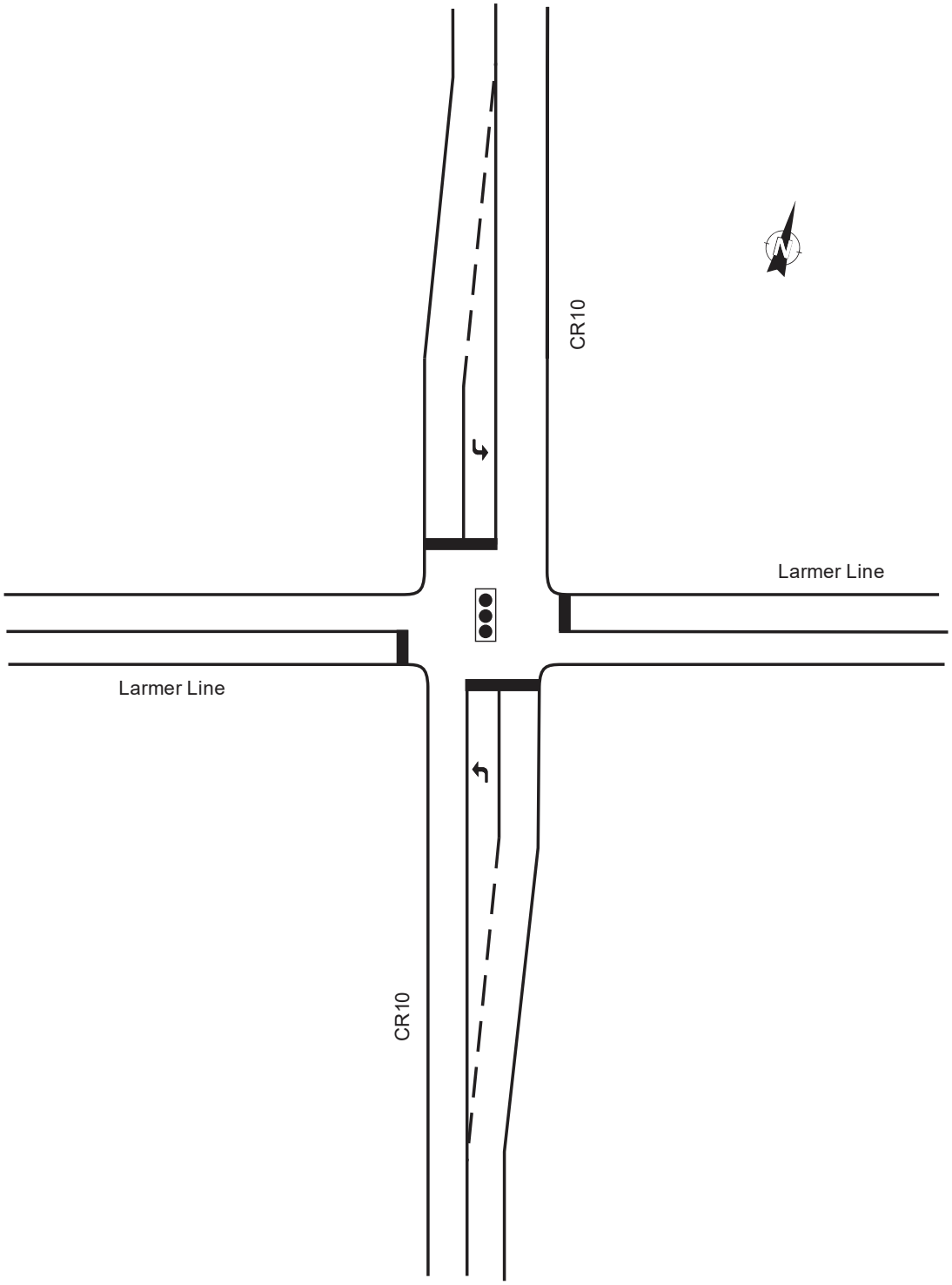

Exhibit 27: *CR10/Larmer Line Intersection – Sketch of Improvements.*