

 **Volume 1 – Traffic Impact Analysis**

**Greenville Avenue at Walnut Hill Lane
Mixed-Use Development**
Dallas, Texas

Updated Submission: July 24, 2019

Original Submission: October 18, 2018

Kimley-Horn and Associates, Inc.
Dallas, Texas

Project #064526201
Registered Firm F-928

Kimley»»Horn

Traffic Impact Analysis

**Greenville Avenue at Walnut Hill Lane
Mixed-Use Development
Dallas, Texas**

Prepared by:

Kimley-Horn and Associates, Inc.
13455 Noel Road, Two Galleria Tower, Suite 700
Dallas, Texas 75240
Registered Firm F-928

Contact:

Scot Johnson, P.E., PTOE
Jake Halter, EIT
972-770-1300

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EXECUTIVE SUMMARY

The Project is located east of Greenville Avenue between Walnut Hill Lane and Pineland Drive in Dallas, Texas. The development as proposed changes the zoning from PD 85 to MU-2. Using aggressive development assumptions which result in an FAR of 2.25, the site was modeled to include 250 multifamily units; a 125-key hotel; 470,000 SF office (which is comprised of 155,000 SF Medical-Dental Office and 315,000 Generic Office); 50,000 SF retail; and 25,000 SF restaurant. This study is intended to identify traffic generation characteristics, identify potential traffic related impacts on the local street system, and to develop mitigation measures required for identified impacts.

The following existing intersections were selected to be part of this study:

- Greenville Avenue at Walnut Hill Lane;
- Greenville Avenue at Jackson Lane;
- Greenville Avenue at Pineland Drive;
- Greenville Avenue at Phoenix Drive;
- Pineland Drive at Belco Drive;
- Pineland Drive at Holly Hill Drive; and
- Pineland Drive at Fair Oaks Avenue.

The analysis also included the following proposed driveways, all of which exist today:

- Drive 0, which is a full-access driveway to Greenville Avenue north of Jackson Street;
- Drive 1, which is a right-in/right-out (RIRO) driveway to Greenville Avenue north of Jackson Street;
- Drive 2, which is a RIRO driveway to Greenville Avenue south of Jackson Street;
- Drive 3, which is a RIRO driveway to Greenville Avenue south of Drive 2 and north of Pineland Drive; and
- Drive 4, which is a full-access driveway to Pineland Drive west of Belco Drive.

Traffic operations were analyzed at the study intersections for existing volumes, 2021 and 2026 background traffic volumes, and 2021 and 2026 background plus site-generated traffic volumes. The future years correspond to the expected buildout year of the site and a key future study year. Conditions were analyzed for the weekday AM and PM peak hours.

The Project is expected to generate approximately 850 new weekday AM peak hour one-way vehicle trips and 1,148 new weekday PM peak hour one-way vehicle trips at buildout. The distribution of the site-generated traffic volumes onto the street system was based on the surrounding roadway network, existing traffic patterns, and the project's proposed access locations.

The mixed-use development also includes a rezoning of the multifamily neighborhoods known as The Venue at Greenville and The Venue at Greenville Phase 2 from PD 85 to MU-2. The rezoning will not increase the amount of existing multifamily units or add any other uses to the

areas. There will be no additional traffic generated for either site, and the existing traffic is already included within the background traffic.

Based on the analysis presented in this report, the proposed mixed-use MU-2 rezoning can be successfully incorporated into the surrounding roadway network. The proposed site driveways provide the appropriate level of access for the development. The site-generated traffic does not significantly affect the existing vehicle traffic operations. No improvements to the external roadway network are recommended for the site.

Since Jackson Lane is used to serve the Texas Health Presbyterian Hospital of Dallas in a critical manner, no site traffic will be routed to the intersection except through traffic along Greenville Avenue. The current intersection median opening and geometry will not be changed during the development process.

I. INTRODUCTION

A. Purpose

Kimley-Horn was retained to conduct a Traffic Impact Analysis (TIA) of future traffic conditions associated with the rezoning of the Greenville Avenue at Walnut Hill Lane mixed-use site located east of Greenville Avenue between Walnut Hill Lane and Pineland Drive in Dallas, Texas. A site vicinity map is provided as **Exhibit 1**. **Exhibit 2** shows the proposed conceptual site plan. This study is intended to identify traffic generation characteristics, identify potential traffic related impacts on the local street system, and to develop mitigation measures required for identified impacts.

B. Methodology

Traffic operations were analyzed at the study intersections for AM and PM peak hours for the following scenarios:

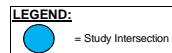
- 2018 existing traffic
- 2021 background traffic
- 2021 background plus site traffic
- 2026 background traffic
- 2026 background plus site traffic

The capacity analyses were conducted using the *Synchro*[™] software package and its associated *Intersection* reports for signalized intersections and *Highway Capacity Manual* reports for unsignalized intersections.



EXHIBIT 1

Vicinity Map
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



North
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 Not To Scale

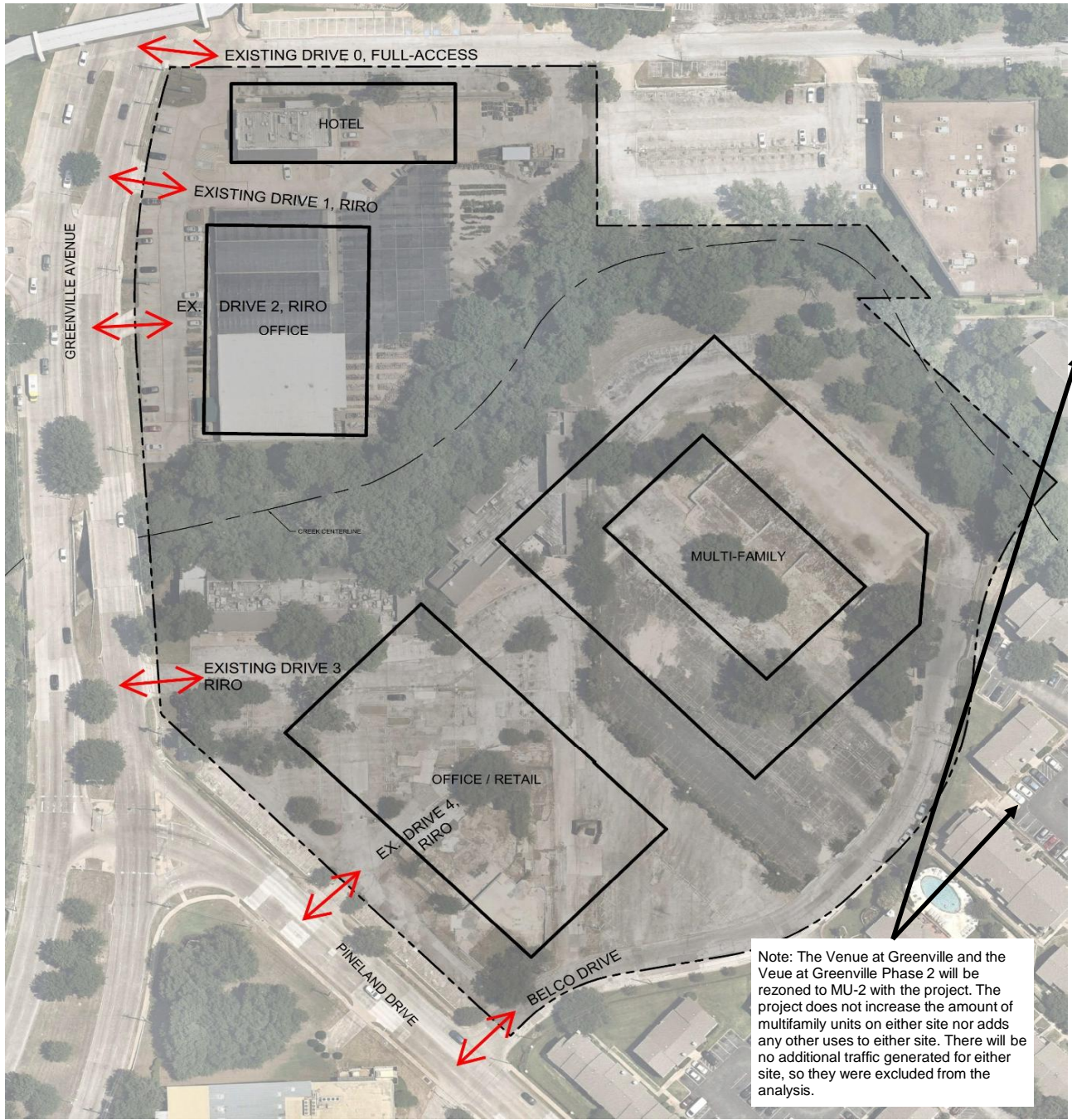


EXHIBIT 2

Conceptual Site Plan
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas

Kimley»»Horn

North
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Not To Scale

II. EXISTING AND FUTURE AREA CONDITIONS

A. Roadway Characteristics

The following signalized intersections were evaluated as part of this study.

- Greenville Avenue at Walnut Hill Lane;
- Greenville Avenue at Pineland Drive;
- Greenville Avenue at Phoenix Drive; and
- Pineland Drive at Fair Oaks Avenue.

The following unsignalized intersections were evaluated as part of this study:

- Greenville Avenue at Drive 0;
- Greenville Avenue at Jackson Lane;
- Pineland Drive at Belco Drive; and
- Pineland Drive at Holly Hill Drive.

The major study area roadways are described in **Appendix A**.

Exhibit 3 illustrates the existing intersection geometry used for the traffic analysis.

B. Existing Study Area

The property lies within the General Retail and Office areas of PD 85.

The Venue at Greenville and the Venue at Greenville Phase 2 are also zoned as PD 85.

C. Proposed Site Improvements

The maximized development within MU-2 is assumed to include 250 multifamily units; a 125-key hotel; 470,000 SF office (which is comprised of 155,000 SF Medical-Dental Office and 315,000 Generic Office); 50,000 SF retail; and 25,000 SF restaurant.

The Venue at Greenville and the Venue at Greenville Phase 2 are also proposed to be rezoned as MU-2, but this will not add any additional multifamily units or other uses to the site. There will be no additional traffic generated for either site, and the existing traffic is already included within the background traffic.

For this TIA, the site is assumed to have access via a total of five existing driveways in addition to other access points on Belco Drive. The driveways to be modeled in this analysis are as follows:

Drive 0 – is an existing full-access driveway to Greenville Avenue located just north of Jackson Lane at the existing median opening. The Project site has an access easement to use Drive 0. One lane is constructed for the inbound movement, and one lane is constructed for the outbound movement.

Drive 1 – is an existing right-in/right-out (RIRO) driveway to Greenville Avenue located just north of Jackson Lane. One lane is constructed for the inbound movement, and one lane is constructed for the outbound movement.

Drive 2 – is an existing RIRO driveway to Greenville Avenue located just south of Jackson Lane. Currently, Drive 2 is only designed for inbound access. It is recommended, in addition to the existing lane constructed for the inbound movement, that one lane be constructed for the outbound movement.

Drive 3 – is an existing RIRO driveway to Greenville Avenue located 100' north of Pineland Drive. One lane is constructed for the inbound movement, and one lane is constructed for the outbound movement.

Drive 4 – is an existing full-access driveway to Pineland Drive located 150' east of Greenville Avenue. One lane is constructed for the inbound movement, and one lane is constructed for the outbound movement.

D. Existing Traffic Volumes

24-hour machine counts were collected near the site while school was in session on Greenville Avenue and Pineland Drive. **Exhibit 4** shows the existing weekday AM and PM peak hour traffic volumes. The raw count sheets, as well as a comparison between the 24-hour volumes collected and previous 24-hour counts, are provided in **Volume 2** of this report.

The 24-hour count showed the daily volume on the roadway link as follows:

- Greenville Avenue: 35,509 vehicles per day (vpd)
- Pineland Drive: 9,164 vpd

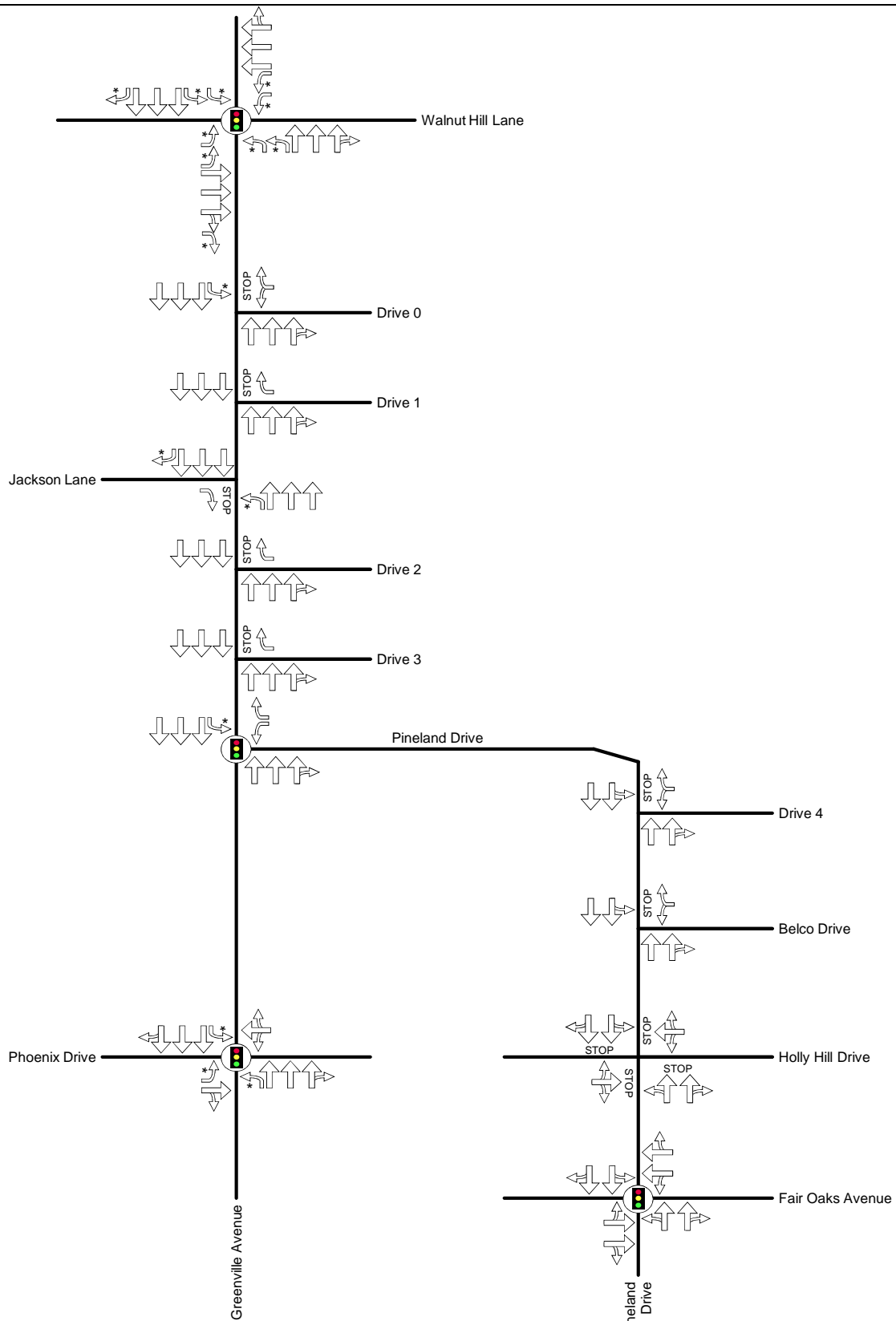


EXHIBIT 3

Lane Assignment and Intersection Control
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:	
	= Signalized Intersection
	= Stop-Controlled Approach
	= Travel Lane
*	= Turn Bay
	= Driveway Lanes or Off-Site Improvements
	= Two-Way Left Turn Lane

North

 Not To Scale

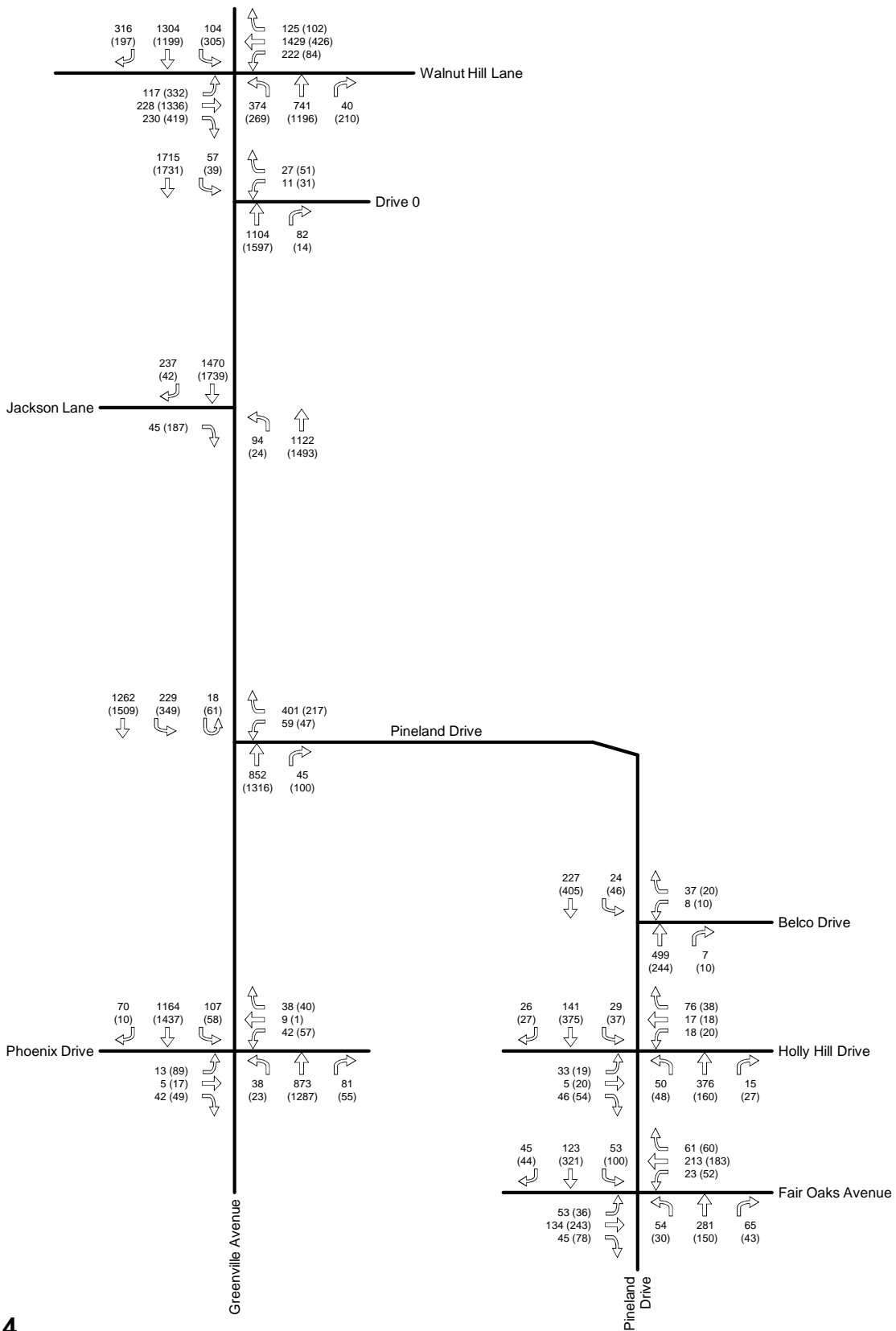


EXHIBIT 4

2018 Existing Traffic Volumes
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X (Y)
 X = Weekday AM Peak Hour Turning Movements
 Y = Weekday PM Peak Hour Turning Movements
 Volumes may not sum from point to point due to rounding and presence of smaller driveways not included in analysis.

North
 ↑
 Not To Scale

III. PROJECT TRAFFIC CHARACTERISTICS

A. Site-Generated Traffic

Site-generated traffic estimates are determined through a process known as trip generation. Rates and equations are applied to the proposed land use to estimate traffic generated by the development during a specific time interval. The acknowledged source for trip generation rates is the 10th edition of *Trip Generation Manual* published by the Institute of Transportation Engineers (ITE). ITE has established trip rates in nationwide studies of similar land uses. The trips indicated are actually one-way trips or *trip ends*, where one vehicle entering and exiting the site is counted as one inbound trip and one outbound trip.

Reductions to the base trip generation estimates are sometimes applied due to internal capture. Internal capture is the tendency for customers or tenants to visit several parts of the mixed-use development in one trip, but be counted twice in the trip generation since the formulae assume the residential, retail, restaurant, hotel, and office developments are isolated. Internal capture reductions are applied based on the procedures in the 2017 3rd edition of the *Trip Generation Handbook*, a companion manual to *Trip Generation Manual* also published by ITE. The internal capture worksheets are included in **Volume 2** of this report. Internal capture reduces the number of trips leaving the site, and results in a projection of internal trips and external trips.

No reductions were taken for pass-by trips or multimodal trips.

Table 1 shows the resulting daily and weekday AM and PM peak hour trip generation for the proposed development, showing new external trips.

Table 1 – Trip Generation

Land Uses	Amount	Units	ITE Code	Daily One-Way Trips	AM Peak Hour One-Way Trips			PM Peak Hour One-Way Trips		
					IN	OUT	TOTAL	IN	OUT	TOTAL
Multifamily Housing (Mid-Rise)	250	Units	221	1,361	22	62	84	65	42	107
Hotel	125	Rooms	310	984	34	23	57	35	33	68
General Office Building	315,000	SF	710	3,229	278	45	323	54	285	339
Medical-Dental Office Building	155,000	SF	720	5,867	257	73	330	148	379	527
Retail/Shopping Center	50,000	SF	820	1,888	29	18	47	92	99	191
High-Turnover (Sit-Down) Restaurant	25,000	SF	932	2,805	137	112	249	151	93	244
Development Totals										
Raw Trip Generation Total:				16,134	757	333	1,090	545	931	1,476
Internal Capture Total:				4,064	120	120	240	164	164	328
Total Net New External Vehicle Trips:				12,070	637	213	850	381	767	1,148

Trip Generation rates based on ITE's *Trip Generation Manual*, 10th Edition.

Internal Capture procedure from *ITE Trip Generation Handbook*, 3rd Edition (2017).

The development also includes a rezoning of the multifamily neighborhoods known as The Venue at Greenville and The Venue at Greenville Phase 2. The rezoning will not increase the amount of existing multifamily units or add any other uses to the areas, so they were not included in the site-generated traffic volumes for this analysis. There will be no

additional traffic generated for either site, and the existing traffic is already included within the background traffic.

B. Trip Distribution and Assignment

The distribution of the site-generated traffic volumes into and out of the site driveways and onto the street system was based on the area street system characteristics, existing traffic patterns, relative land use density, and the locations of the proposed driveway access to/from the site.

The corresponding inbound and outbound traffic assignment, where the directional distribution is applied using the most probable paths to and from the site, can be found in **Exhibit 5**. **Exhibit 6** shows the resulting site-generated weekday AM and weekday PM peak hour turning movements after multiplying the new external trip generation for each phase by the respective traffic assignment percentages.

C. Development of 2021 Background Traffic

In order to obtain 2021 background traffic, the existing traffic counts and historic counts near the site were compared to find expected growth trends within the study area. Based on the recent growth in the area, an annual growth rate of 1% was assumed for the background traffic through 2021. To calculate the 2021 background traffic, the existing 2018 traffic counts were grown by 1% annually for three years. The resulting 2021 background weekday AM and PM peak hour traffic volumes are shown in **Exhibit 7**.

D. Development of 2021 Total Traffic

Site traffic volumes were added to the background volumes to represent the estimated total (background plus site-generated) traffic conditions for the 2021 study year after completion of the proposed development. **Exhibit 8** shows the resulting 2021 weekday AM and PM peak hour total traffic volumes.

E. Development of 2026 Background and Total Traffic

The background and total traffic volumes in the 2026 study year were calculated in a similar manner to the 2021 traffic volumes by adding five years of 1% growth over the 2021 background volumes **Exhibit 9** shows the resulting 2026 weekday AM and PM peak hour background traffic volumes, and **Exhibit 10** shows the resulting 2026 weekday AM and PM peak hour total traffic volumes after the addition of the site-generated traffic.

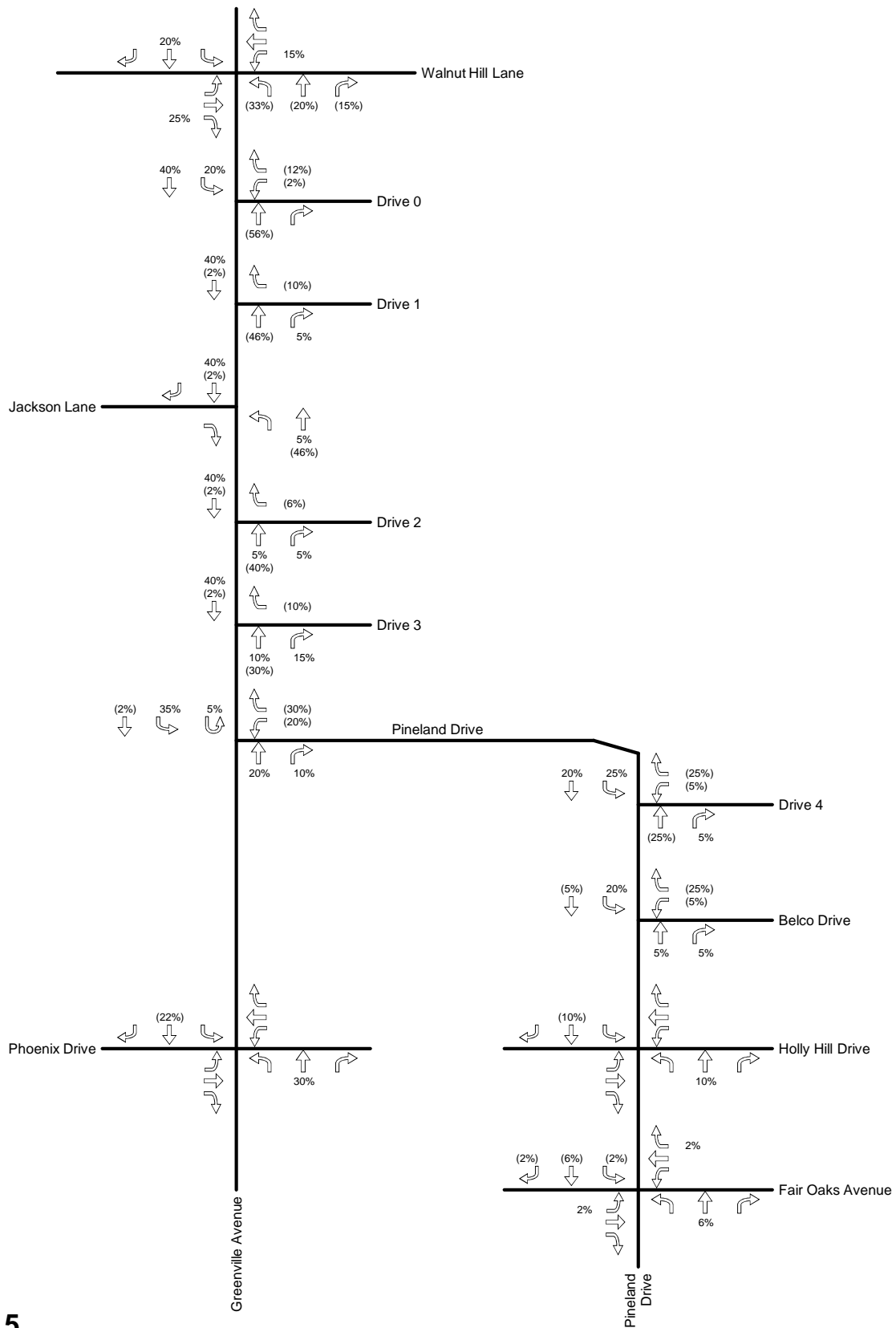


EXHIBIT 5

Trip Distribution and Traffic Assignment
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X% (Y%)
 X% = Percentage of Inbound Site-Generated Traffic
 (Y%) = Percentage of Outbound Site-Generated Traffic

North
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 Not To Scale

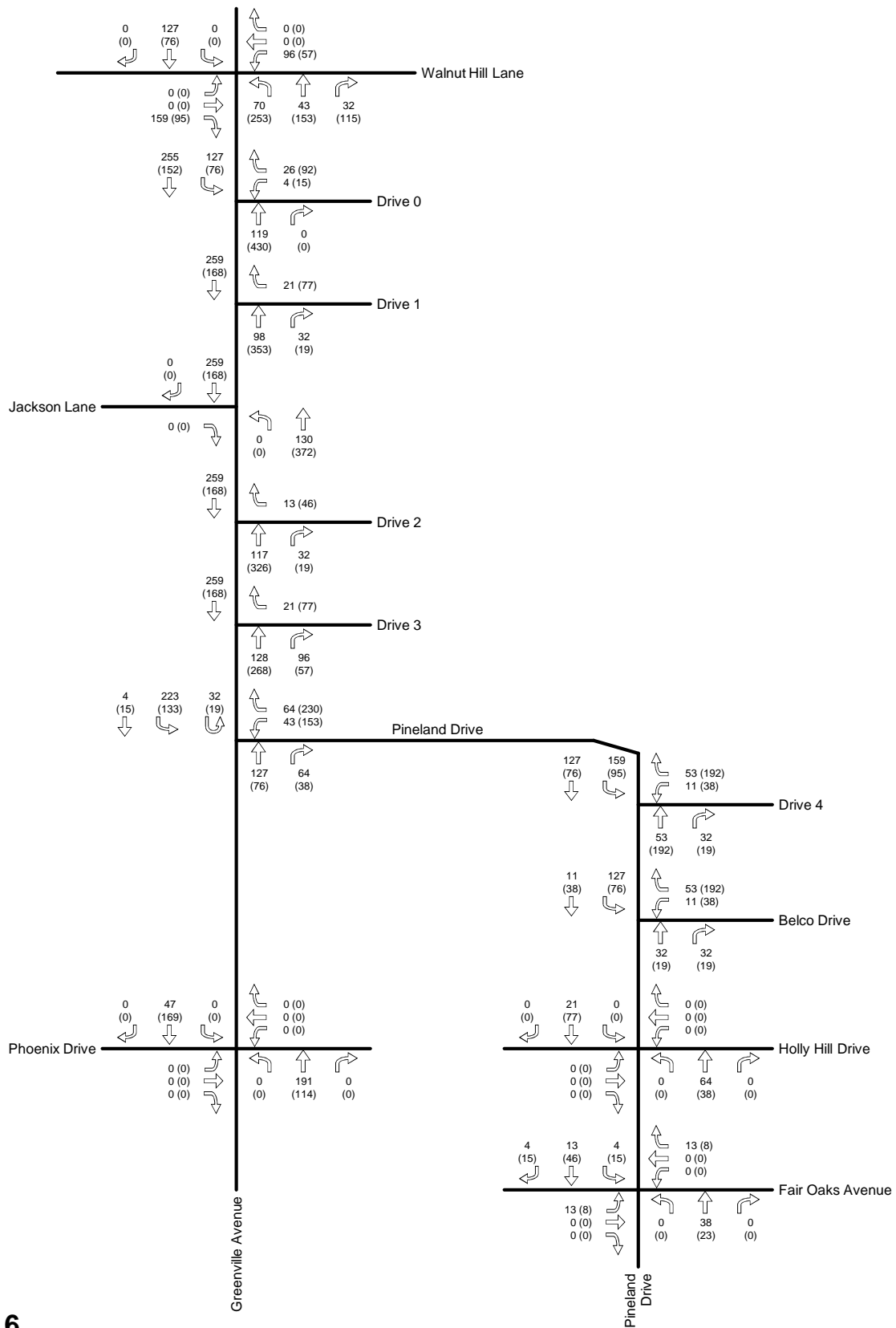


EXHIBIT 6

Site-Generated Traffic Volumes
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X (Y)
 X = Weekday AM Peak Hour Turning Movements
 Y = Weekday PM Peak Hour Turning Movements
 Volumes may not sum from point to point due to rounding and presence of smaller driveways not included in analysis.

North
 ↑
 Not To Scale

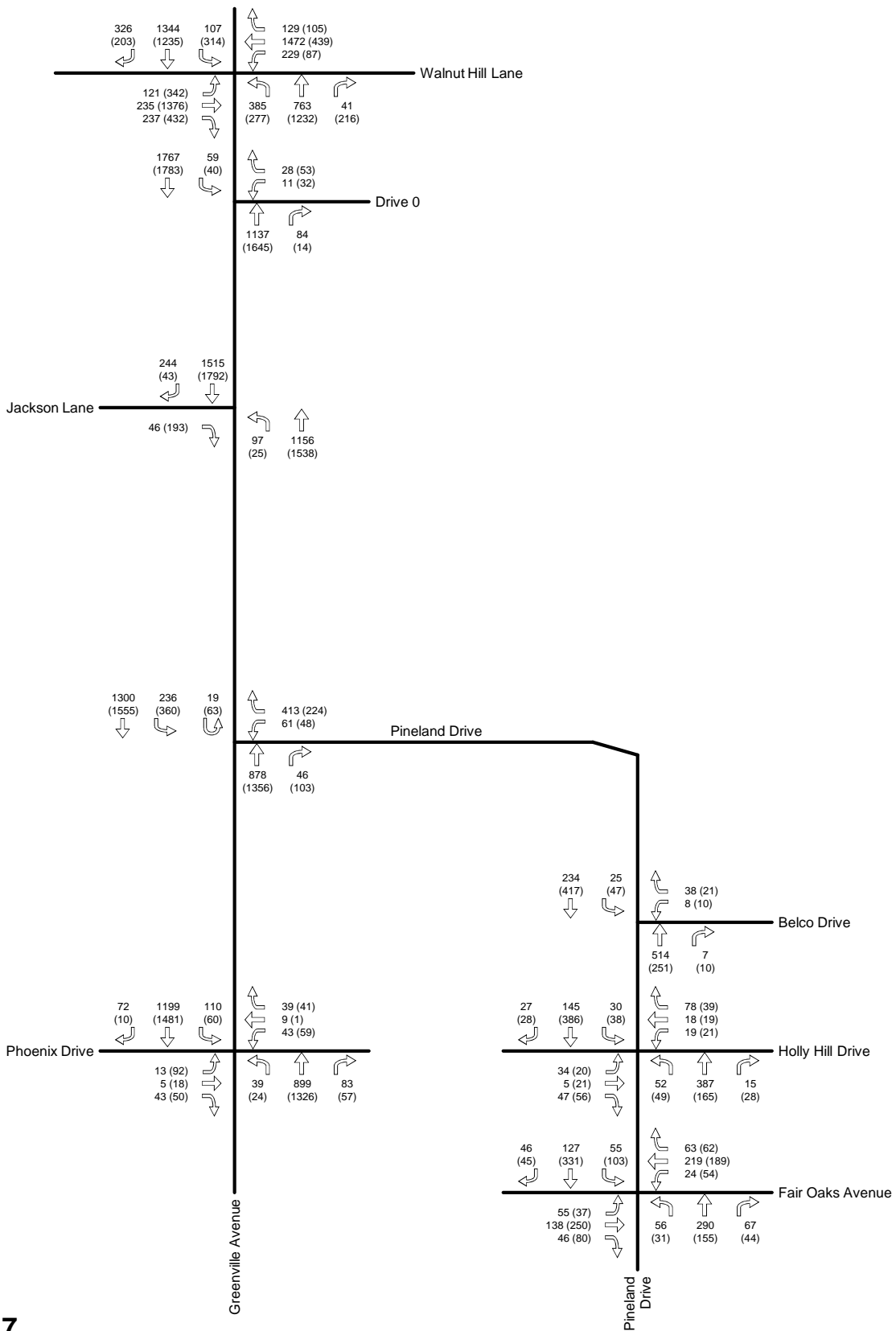


EXHIBIT 7

2021 Background Traffic Volumes
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X (Y)
 X = Weekday AM Peak Hour Turning Movements
 Y = Weekday PM Peak Hour Turning Movements
 Volumes may not sum from point to point due to rounding
 and presence of smaller driveways not included in analysis.

North
 ↑
 Not To Scale

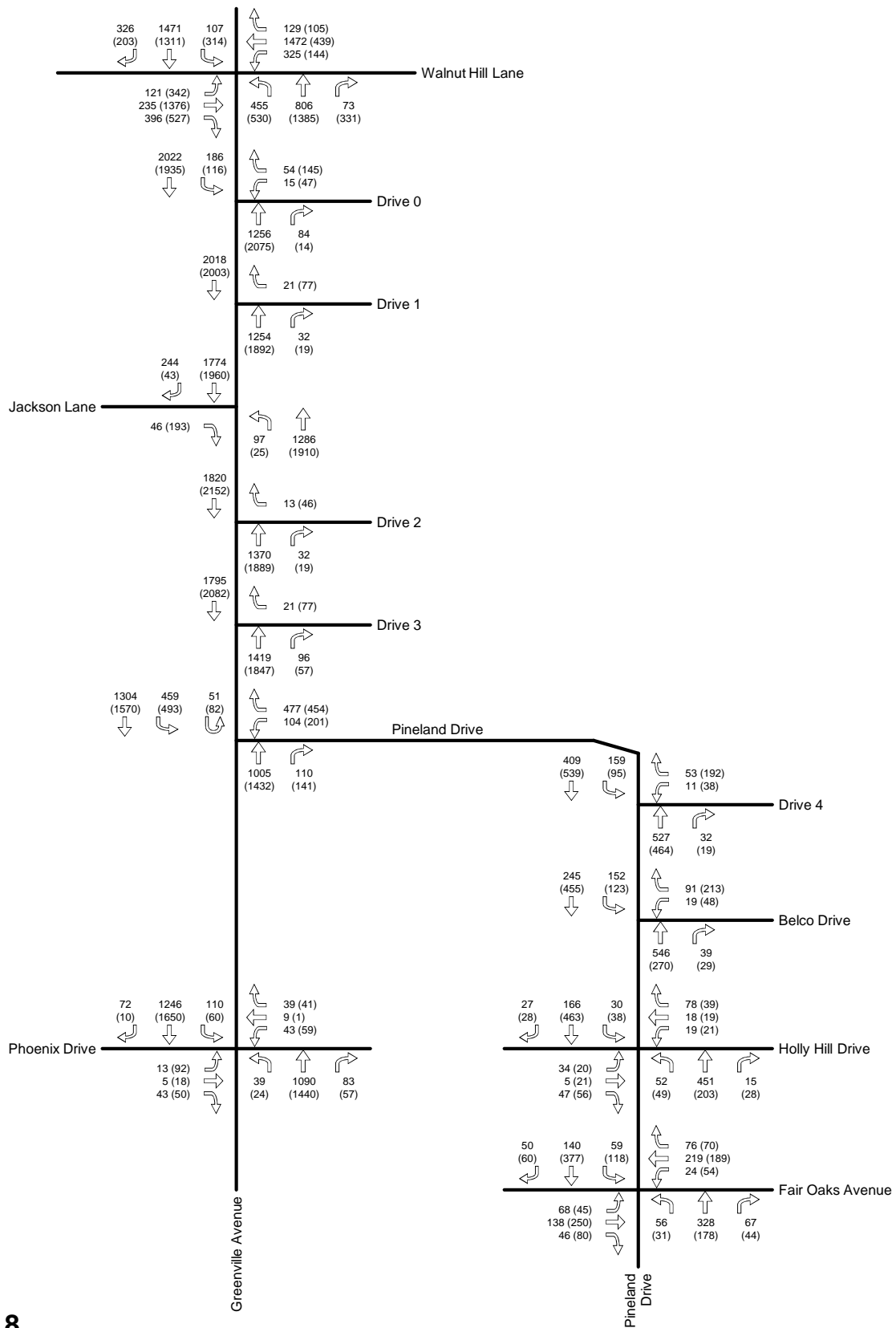


EXHIBIT 8

2021 Background Plus Site-Generated Traffic Volumes
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X (Y)
 X = Weekday AM Peak Hour Turning Movements
 Y = Weekday PM Peak Hour Turning Movements
 Volumes may not sum from point to point due to rounding
 and presence of smaller driveways not included in analysis.

North
 ↑
 Not To Scale

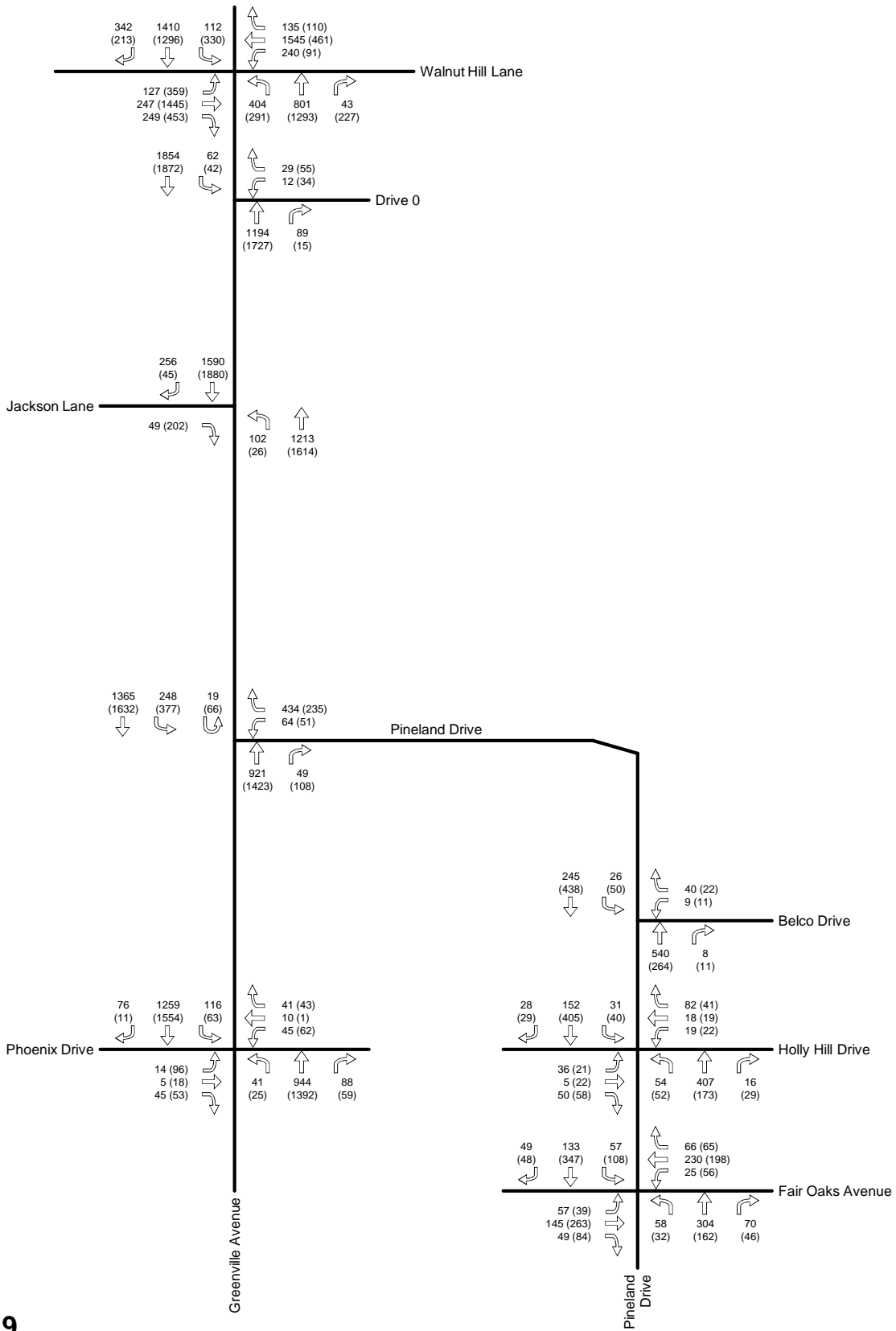


EXHIBIT 9

2026 Background Traffic Volumes
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X (Y)
 X = Weekday AM Peak Hour Turning Movements
 Y = Weekday PM Peak Hour Turning Movements
 Volumes may not sum from point to point due to rounding and presence of smaller driveways not included in analysis.

North
 ↑
 Not To Scale

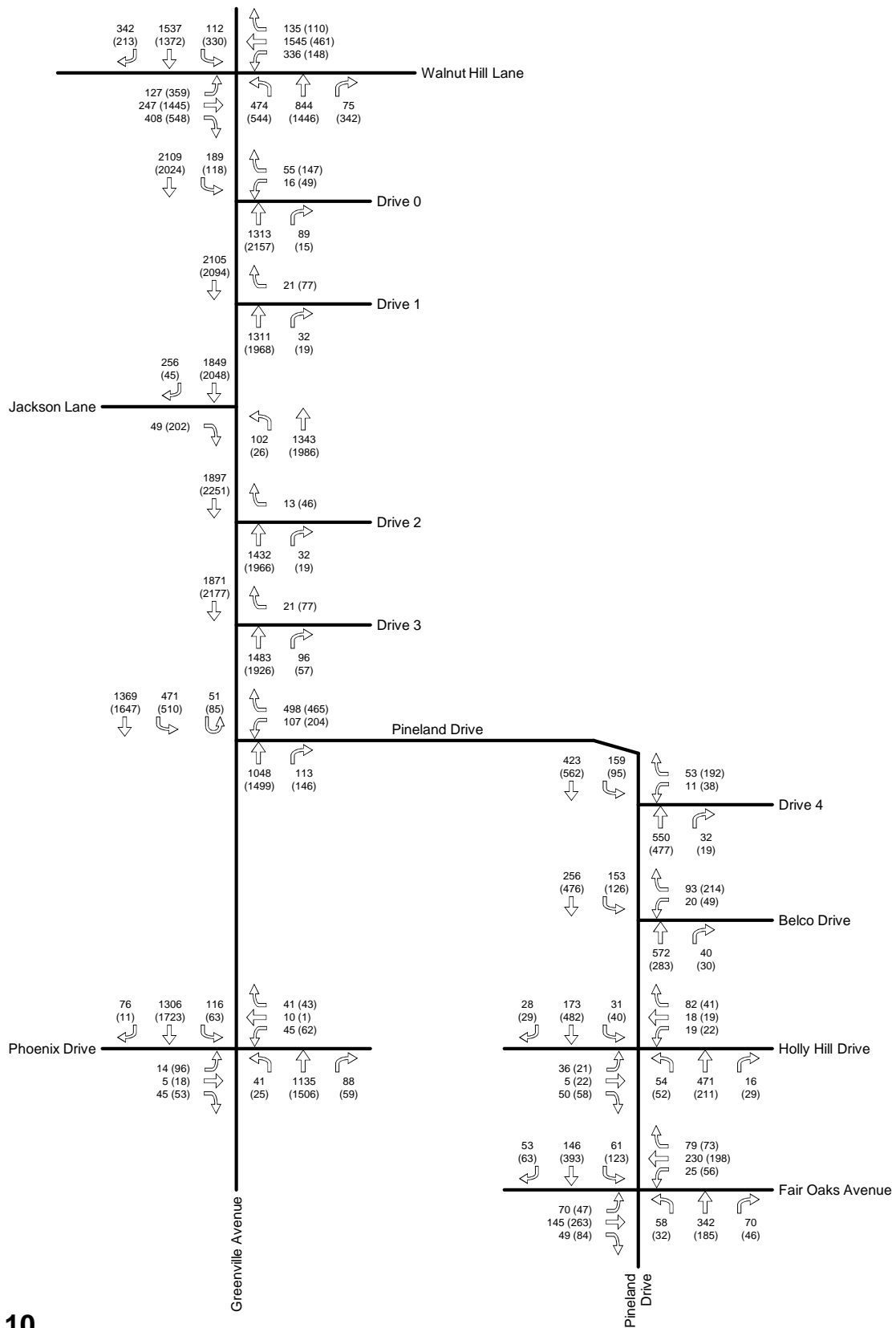


EXHIBIT 10

2026 Background Plus Site-Generated Traffic Volumes
 Greenville Avenue at Walnut Hill Lane Mixed-Use Development - Dallas, Texas



LEGEND:
 X (Y)
 X = Weekday AM Peak Hour Turning Movements
 Y = Weekday PM Peak Hour Turning Movements
 Volumes may not sum from point to point due to rounding
 and presence of smaller driveways not included in analysis.

North
 ↑
 Not To Scale

IV. TRAFFIC OPERATIONS ANALYSIS

Kimley-Horn conducted a traffic operations analysis to determine potential capacity deficiencies in the 2018, 2021 and 2026 study years at the study intersections. The acknowledged source for determining overall capacity is the current edition of the *Highway Capacity Manual*.

A. Analysis Methodology

Capacity analysis results are listed in terms of Level of Service (LOS). Level of service and the corresponding analysis methodology are explained in **Appendix B**.

Signal timings for the signalized intersections are based on Dallas signal timing sheets. Timing adjustments were made in the future scenarios to accommodate changes in traffic volumes due to background growth and site traffic, replicating how City staff will periodically review signal operations in the future.

Calculations for the level of service at the key intersections identified for study are provided in **Volume 2** of this report. The analyses assumed the lane geometry and intersection control shown in **Exhibit 3**.

B. Analysis Results

Table 2 and **Table 3** show the intersection operational results for the weekday AM and PM peak hours, respectively.

Table 2 – Traffic Operational Results – Weekday AM Peak Hour

INTERSECTION	APPROACH	2018 Background Traffic		2021 Background Traffic		2021 Background plus Site Traffic		2026 Background Traffic		2026 Background plus Site Traffic	
		AM Peak Hour		AM Peak Hour		AM Peak Hour		AM Peak Hour		AM Peak Hour	
		DELAY (SEC/VH)	LOS	DELAY (SEC/VH)	LOS	DELAY (SEC/VH)	LOS	DELAY (SEC/VH)	LOS	DELAY (SEC/VH)	LOS
Greenville Avenue @ Walnut Hill Lane	EB	23.4	C	24.7	C	23.0	C	25.4	C	25.2	C
	WB	63.9	E	48.1	D	51.9	D	56.9	E	50.9	D
	NB	32.4	C	33.4	C	30.9	C	34.9	C	40.5	D
	SB	41.1	D	46.5	D	53.1	D	54.4	D	62.0	E
	Overall	45.0	D	41.8	D	43.9	D	47.7	D	48.9	D
Greenville Avenue @ Pineland Drive	WB	40.6	D	48.4	D	41.2	D	64.7	E	26.5	C
	NB	3.3	A	3.3	A	19.5	B	3.4	A	41.5	D
	SB	2.2	A	2.6	A	14.9	B	3.1	A	15.3	B
	Overall	8.7	A	10.2	B	20.7	C	13.1	B	25.5	C
Greenville Avenue @ Phoenix Drive	EB	23.8	C	23.6	C	23.6	C	23.5	C	23.5	C
	WB	45.2	D	45.7	D	45.7	D	46.9	D	46.9	D
	NB	7.3	A	7.4	A	7.9	A	7.7	A	8.2	A
	SB	5.6	A	5.6	A	7.3	A	5.9	A	10.1	B
	Overall	8.2	A	8.2	A	9.2	A	8.5	A	10.8	B
Pineland Drive @ Fair Oaks Avenue	EB	9.7	A	9.8	A	10.1	B	9.9	A	10.3	B
	WB	10.0	B	10.1	B	9.6	A	10.3	B	9.9	A
	NB	11.9	B	12.0	B	12.5	B	12.2	B	12.8	B
	SB	9.6	A	9.6	A	9.8	A	9.7	A	9.9	A
	Overall	10.5	B	10.6	B	10.8	B	10.8	B	11.0	B
Greenville Avenue @ Drive 0	WB*	12.0	B	12.2	B	14.9	B	12.5	B	18.6	C
	SBL	10.3	B	9.9	A	11.7	B	10.5	B	11.5	B
Greenville Avenue @ Drive 1	WB*	-	-	-	-	10.9	B	-	-	11.2	B
Greenville Avenue @ Jackson Lane	NBL	10.7	B	11.0	B	14.7	B	11.3	B	15.3	C
	EB*	11.7	B	12.0	B	13.0	B	12.4	B	13.5	B
Greenville Avenue @ Drive 2	WB*	-	-	-	-	11.1	B	-	-	11.3	B
Greenville Avenue @ Drive 3	WB*	-	-	-	-	11.1	B	-	-	11.1	B
Pineland Drive @ Drive 4	WB*	-	-	-	-	15.3	C	-	-	15.8	C
	WBL	-	-	-	-	9.5	A	-	-	9.7	A
Pineland Drive @ Belco Drive	WB*	11.1	B	11.2	B	15.0	C	11.5	B	15.8	C
	SBL	8.6	A	8.7	A	9.6	A	8.8	A	9.8	A
Pineland Drive @ Holly Hill Drive	NBTL*	11.7	B	12.1	B	13.1	B	12.6	B	13.7	B
	NBTR*	10.6	B	10.9	B	11.7	B	11.2	B	12.1	B
	EB*	9.4	A	9.6	A	9.8	A	9.8	A	10.0	A
	WB*	9.5	A	9.7	A	10.0	A	9.9	A	10.1	B
	SBTL*	9.8	A	9.9	A	10.3	B	10.1	B	10.5	B
	SBTR*	9.3	A	9.4	A	9.7	A	9.6	A	10.0	A
Overall	10.4	B	10.6	B	11.4	B	11.0	B	11.7	B	

* Stop-Controlled Approach
 - No movements in Time Period

Signalized	Unsignalized
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Table 3 – Traffic Operational Results – Weekday PM Peak Hour

INTERSECTION	APPROACH	2018 Background Traffic		2021 Background Traffic		2021 Background plus Site Traffic		2026 Background Traffic		2026 Background plus Site Traffic	
		PM Peak Hour		PM Peak Hour		PM Peak Hour		PM Peak Hour		PM Peak Hour	
		DELAY (SEC/VEH)	LOS	DELAY (SEC/VEH)	LOS	DELAY (SEC/VEH)	LOS	DELAY (SEC/VEH)	LOS	DELAY (SEC/VEH)	LOS
Greenville Avenue @ Walnut Hill Lane	EB	48.2	D	46.3	D	65.2	E	57.3	E	60.0	E
	WB	41.0	D	41.3	D	47.0	D	42.2	D	46.0	D
	NB	70.1	E	24.2	C	37.2	D	26.3	C	43.1	D
	SB	39.6	D	40.9	D	52.2	D	41.7	D	64.6	E
	Overall	51.1	D	38.2	D	51.0	D	42.9	D	54.5	D
Greenville Avenue @ Pineland Drive	WB	19.7	B	19.7	B	48.5	D	19.8	B	50.1	D
	NB	33.3	C	35.2	D	46.5	D	38.5	D	49.4	D
	SB	10.0	A	6.7	A	13.3	B	7.1	A	18.5	B
	Overall	19.9	B	18.9	B	30.5	C	20.4	C	34.3	C
Greenville Avenue @ Phoenix Drive	EB	34.5	C	34.9	C	34.4	C	35.2	D	34.6	C
	WB	35.9	D	36.0	D	35.6	D	36.9	D	36.4	D
	NB	8.9	A	9.3	A	10.2	B	9.9	A	11.0	B
	SB	3.3	A	13.5	B	11.3	B	13.8	B	13.0	B
	Overall	8.3	A	13.5	B	12.6	B	13.9	B	13.8	B
Pineland Drive @ Fair Oaks Avenue	EB	9.5	A	9.7	A	10.7	B	10.2	B	11.1	B
	WB	9.2	A	9.4	A	9.9	A	9.8	A	10.3	B
	NB	8.0	A	8.0	A	8.3	A	8.1	A	8.4	A
	SB	11.4	B	11.6	B	12.3	B	11.9	B	12.6	B
	Overall	9.9	A	10.0	A	10.7	B	10.4	B	11.0	B
Greenville Avenue @ Drive 0	WB*	17.8	C	18.6	C	81.4	F	20.1	C	118.9	F
	SBL	10.5	B	10.7	B	13.8	B	11.0	B	14.4	B
Greenville Avenue @ Drive 1	WB*	-	-	-	-	14.1	B	-	-	14.6	B
Greenville Avenue @ Jackson Lane	NBL	36.0	E	38.9	E	53.3	F	44.4	E	62.3	F
	EB*	82.8	F	100.8	F	154.0	F	141.8	F	200.0+	F
Greenville Avenue @ Drive 2	WB*	-	-	-	-	13.4	B	-	-	13.8	B
Greenville Avenue @ Drive 3	WB*	-	-	-	-	13.4	B	-	-	13.7	B
Pineland Drive @ Drive 4	WB*	-	-	-	-	18.7	C	-	-	19.3	C
	WBL	-	-	-	-	8.9	A	-	-	8.9	A
Pineland Drive @ Belco Drive	WB*	9.8	A	9.9	A	13.4	B	9.9	A	13.6	B
	SBL	7.9	A	7.9	A	8.3	A	8.0	A	8.6	A
Pineland Drive @ Holly Hill Drive	NBTL*	10.2	B	10.3	B	10.9	B	10.6	B	11.2	B
	NBTR*	9.3	A	9.4	A	10.0	A	9.6	A	10.2	B
	EB*	9.5	A	9.6	A	10.0	A	9.8	A	10.2	B
	WB*	9.4	A	9.5	A	9.9	A	9.7	A	10.0	A
	SBTL*	11.3	B	11.6	B	12.8	B	12.0	B	13.4	B
	SBTR*	10.6	B	11.0	B	12.1	B	11.3	B	12.6	B
	Overall	10.4	B	10.6	B	11.5	B	10.9	B	11.8	B

* Stop-Controlled Approach

- No movements in Time Period

+ Movement Delay Exceeds 200 seconds

Signalized	Unsignalized
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C. 2018 Existing Traffic Operations

The analysis of the 2018 existing traffic operations shows that the signalized study intersections operate with moderate delay in both peak hours. With the exception of the intersection of Greenville Avenue and Walnut Hill Lane, all of the signalized intersections operate at LOS B or better during both peak hours. The intersection of Greenhill Avenue and Walnut Hill Lane operates at LOS D during both peaks, which is fairly good for the intersection of two City of Dallas Principal Arterials.

Of the unsignalized study intersections, all but two approaches operate at LOS C or better during both peak hours. The northbound left-turning movement from Greenville Avenue to Jackson Lane operates at LOS E during the PM peak hour, and the eastbound Jackson Lane movement of the same intersection operates at LOS F during the PM peak hour.

The intersection of Jackson Lane and Greenville Avenue experiences heavy volumes along Greenville Avenue. High delays at this intersection due solely to the Greenville Avenue southbound volume are to be expected. On a site visit during the PM peak, a couple of factors were noted that make this intersection difficult to properly analyze with the Synchro software. First, there are many sizeable gaps in the southbound Greenville Avenue traffic flow created by the traffic signal at Walnut Hill Lane. It was noted that even though the right-turning vehicles cannot penetrate the southbound traffic flow, there was not a single observed occurrence, once the southbound flow was interrupted upstream, where the eastbound right-turning vehicles were unable to clear the majority of their queue. Most of the time, the whole queue was cleared. While Synchro does have the ability to analyze gaps in the traffic flow, the traffic gaps are not affecting its output, which makes the recorded delays artificially high. Second, though there is a stop-sign for the eastbound approach, people were observed to treat it like a yield-controlled approach, which increases capacity. When changed from stop-controlled to yield-controlled, the delay output for the approach from Synchro remains constant, rendering the delay output higher than reality.

If a user does not want to try and make the eastbound right-turning movement, they may choose to travel along the internal connections of the hospital site and access Greenville Avenue via Phoenix Drive. During the PM site visit, there were no observed ambulances using Jackson Lane.

D. 2021 Background Traffic Operations

The signalized study intersections generally experience more delay with three years of background growth added to the network, but with the retiming of the intersections, there are some delay reductions. All continue to operate at LOS B or better except the intersection of Greenville Avenue and Walnut Hill Lane, which maintains LOS D.

The unsignalized intersections experience additional delays at the study approaches. There are no changes in level of service at any approach after the addition of background traffic growth.

E. 2021 Background Plus Site-Generated Traffic Operations

The addition of the site-generated traffic to the 2021 background traffic results in some additional delay at the existing signalized intersections, and there is one change in level of service. The intersection of Greenville Avenue and Pineland Drive changes from LOS B to a still favorable C during both peak periods. All the signalized intersections operate at LOS D or better, which is appropriate for a semi-urban setting close to a major state highway.

The unsignalized intersections also experience some additional delay after the site-generated traffic is dispersed about the roadway network. The northbound left-turning movement of the intersection of Jackson Lane and Greenville Avenue changes from LOS E to F during the PM peak. The westbound approach of Belco Drive to Pineland Drive changes from LOS B to C during the AM peak.

The westbound approach of Drive 0 to Greenville Avenue changes from LOS C to F during the PM peak. Just like Jackson Lane to the south, the outbound vehicles simply have to wait for a gap in the Greenville Avenue traffic flow before making the turning movements. Only 5% of the total site traffic is routed through the westbound left-turn at Drive 0. If drivers do not wish to wait for gaps in the Greenville Avenue traffic to make the westbound left-turn, they may choose to alter their exit route to a path that does not require southbound Greenville Avenue.

All approaches to the site driveways, except for Drive 0, operate at LOS C or better during both peak hours, providing appropriate access to and from the site.

F. 2026 Background Traffic Operations

The analysis of the 2026 Background Traffic operations shows that, when compared to the 2021 background traffic operations, the signalized study intersections experience one change in level of service with the addition of five more years of background traffic growth. The intersection of Greenville Avenue and Pineland Drive changes from LOS B to C during the PM peak. As in the 2021 background, all the signalized intersections operate at LOS D or better, which is appropriate for the semi-urban nature of the area coupled with its proximity to a major state highway.

The unsignalized intersections experience additional delays at the study approaches, but there are no changes in level of service after the addition of background traffic growth.

G. 2026 Background Plus Site-Generated Traffic Operations

The addition of the site-generated traffic to the 2026 background traffic results in some additional delay at the signalized study intersections, and there is one change in level of service. The intersection of Greenville Avenue with Pineland Drive changes from LOS B to C during the AM peak. Each overall signalized intersection operates at LOS D or better after the addition of site-generated traffic at buildout.

With site traffic, the unsignalized intersections experience additional delays at the study approaches. There are a few changes in level of service. The northbound left-turning approach from Greenville Avenue to Jackson Lane changes from LOS B to C during the AM peak and from LOS E to F during the PM peak. The projected maximum average queue length is less than two vehicles, which is easily contained within the left-turn bay. This movement is subject to the same causes of delay as the eastbound Jackson Lane traffic; northbound left-turners must wait for a gap in the Greenville Avenue traffic, of which there are many, and then they are able to make the turning movement. The westbound approach of Belco Drive to Pineland Drive changes from LOS B to C during the AM peak.

The westbound approach of the intersection of Drive 0 and Greenville Avenue changes from LOS B to C during the AM peak and from LOS C to F during the PM peak. As mentioned in the 2021 background plus site-generated traffic operations discussion, the westbound vehicles essentially must wait for a gap in the Greenville Avenue traffic before they can make their turning movement and may choose to slightly alter their route if they would prefer to make the right-turning movement rather than the left-turning movement.

All approaches to the site driveways, except for the previously mentioned Drive 0, operate favorably at LOS C or better during both peak hours at buildout.

H. Link Volume Analysis

The link capacity analysis examines the operating conditions of roadway links rather than intersections, using the daily volumes passing a fixed point. The operating condition is defined by the ratio of link volume to link capacity, or V/C. The V/C of the different roadway links that would be impacted by the proposed development’s traffic was calculated for the 2018 existing traffic, 2021 background and background plus site traffic, and 2026 background and background plus site traffic scenarios. The daily link capacity for each roadway is taken from the NCTCOG model capacity volumes assuming the urban residential area type. Greenville Avenue, as a divided principal arterial, has a capacity of 850 vehicles per lane per hour (vphpl). Pineland Drive, as an undivided collector street, has a capacity of 475 vehicles per lane per hour (vphpl).

The link analyses, displayed below in **Table 4**, show that Greenville Avenue currently operates at LOS D and continues to do so in both the 2021 and 2026 background scenarios. After site traffic is added in both the 2021 and 2026 scenarios, the roadway changes to LOS E. After the total buildout of the site, Greenville Avenue is approaching its design capacity, which is typical as City Arterials draw near to their design volumes.

Pineland Drive operates at LOS C with current traffic and after the background traffic has been added in both the 2021 and 2026 background scenarios. After site traffic is added in both the 2021 and 2026 scenarios, the roadway changes to LOS D during the 2021 scenario and to LOS E during the 2026 scenario. At site buildout, the roadway link is left with more than 15% of its total capacity unused.

Table 4 – Link Operational Results

Roadway Link		2018 Existing			2021 Background			2021 Site-Generated		2021 Background+Site				
From	To	Volume	V/C Ratio	LOS	Volume	V/C Ratio	LOS	Assignment	Daily Volume	Volume	V/C Ratio	LOS		
Greenville Avenue Pineland Drive Walnut Hill Lane		35,509	0.70	D	36,585	0.72	D	65.0%	7,846	44,431	0.87	E		
Volume Limit 6 Lanes = 51,000					1% growth for 3 years									
Pineland Drive Greenville Avenue Holly Hill Drive		9,164	0.48	C	9,442	0.50	C	45.0%	5,432	14,874	0.78	D		
Volume Limit 4 Lanes = 19,000					1% growth for 3 years									
Roadway Link		2026 Background			2026 Site-Generated		2026 Background+Site							
From	To	Volume	V/C Ratio	LOS	Assignment	Daily Volume	Volume	V/C Ratio	LOS					
Greenville Avenue Pineland Drive Walnut Hill Lane							38,396	0.75	D	65.0%	7,846	46,242	0.91	E
Volume Limit 6 Lanes = 51,000					1% growth for 5 additional years									
Pineland Drive Greenville Avenue Holly Hill Drive							9,909	0.52	C	45.0%	5,432	15,341	0.81	E
Volume Limit 4 Lanes = 19,000					1% growth for 5 additional years									

Volume Limit Based on NCTCOG DFWRTM Hourly Capacity Per Lane

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis presented in this report, the proposed Greenville Avenue at Walnut Hill Lane mixed-use development rezoning, located east of Greenville Avenue between Walnut Hill Lane and Pineland Drive in Dallas, Texas, can be successfully incorporated into the surrounding roadway network. The proposed site driveways provide the appropriate level of access for the rezoning. The site-generated traffic does not significantly affect the existing vehicle traffic operations. No improvements to the external roadway network are recommended for the site.

Since Jackson Lane is used to serve the Texas Health Presbyterian Hospital of Dallas in a critical manner, no site traffic will be routed to the intersection except through traffic along Greenville Avenue. The current intersection median opening and geometry will not be changed during the development process.

APPENDIX A

A. Roadway Characteristics

The following signalized intersections were evaluated as part of this study.

- Greenville Avenue at Walnut Hill Lane;
- Greenville Avenue at Pineland Drive;
- Greenville Avenue at Phoenix Drive; and
- Pineland Drive at Fair Oaks Avenue.

The following unsignalized intersections were evaluated as part of this study:

- Greenville Avenue at the first median opening north of Jackson Lane;
- Greenville Avenue at Jackson Lane;
- Pineland Drive at Belco Drive; and
- Pineland Drive at Holly Hill Drive.

Greenville Avenue – is a six-lane divided road that runs north-south parallel to US-75 throughout the northeastern part of Dallas. In the project vicinity, Greenville Avenue has intersections with Phoenix Drive, Pineland Drive, Jackson Lane, Walnut Hill Lane, other local streets, and various commercial driveways. On the City of Dallas Thoroughfare Plan, Greenville Avenue is classified as a Principal Arterial (M-6-D(A)). The speed limit near the site is posted at 35 mph.

Pineland Drive – is a four-lane undivided road that runs northwest-southeast in the project area. In the project vicinity, Pineland Drive has intersections with Greenhill Avenue, Belco Drive, Holly Hill Drive, Fair Oaks Avenue, other local streets, and various commercial and residential driveways. On the City of Dallas Thoroughfare Plan, Pineland Drive is classified as a Community collector (S-4-U). The speed limit near the site is posted at 30 mph.

Walnut Hill Lane – is a four-lane divided road that runs east-west throughout north Dallas. In the project vicinity, Walnut Hill Lane has intersections with Greenhill Avenue, other local streets, and various commercial driveways. On the City of Dallas Thoroughfare Plan, Walnut Hill Lane is classified as a Principal Arterial (M-6-D(A)). The speed limit near the site is posted at 35 mph.

Holly Hill Drive – is a wide two-lane undivided road that runs northeast-southwest in the project area. In the project vicinity, Holly Hill Drive has intersections with Greenhill Avenue, Phoenix Drive, Pineland Drive, other local streets, and various commercial and residential driveways. On the City of Dallas Thoroughfare Plan, Holly Hill Drive is not classified. The speed limit near the site is posted at 30 mph.

Phoenix Drive – is a two-lane undivided road that runs northwest-southeast in the project area. In the project vicinity, Phoenix Drive has intersections with Greenhill Avenue, Holly Hill Drive, Fair Oaks Avenue, other local streets, and various commercial and residential driveways. On the City of Dallas Thoroughfare Plan, Phoenix Drive is not classified. The speed limit near the site is not posted and assumed to be 30 mph.

Fair Oaks Avenue – is a four-lane undivided road that runs northeast-southwest in the project area. In the project vicinity, Fair Oaks Avenue has intersections with Phoenix Drive, Pineland Drive, and various residential driveways. On the City of Dallas Thoroughfare Plan, Fair Oaks Avenue is classified as a Community collector (S-4-U). The speed limit near the site is posted at 30 mph.

Belco Drive – is a wide two-lane undivided road that runs northeast-southwest in the project area. In the project vicinity, Belco Drive has intersections with Pineland Drive and various residential driveways. Belco Drive also borders the southern edge of the site and will have access to the proposed site. On the City of Dallas Thoroughfare Plan, Belco Drive is not classified. The speed limit near the site is not posted and assumed to be 30 mph.

Jackson Lane – is a two-lane undivided road that services the Texas Health Presbyterian Hospital. Since Jackson Lane is used to serve the hospital in a critical manner, no site traffic will be routed to the intersection except through traffic along Greenville Avenue. The current intersection median opening and geometry will not be changed during the development process. In the project vicinity, Jackson Lane has intersections with Greenville Avenue. On the City of Dallas Thoroughfare Plan, Jackson Lane is not classified. The speed limit near the site is not posted and assumed to be 30 mph.

Exhibit 3 illustrates the existing intersection geometry used for the traffic analysis.

APPENDIX B

A. Analysis Methodology

Capacity analysis results are listed in terms of Level of Service (LOS). LOS is a qualitative term describing operating conditions a driver will experience while traveling on a particular street or highway during a specific time interval. It ranges from A (very little delay) to F (long delays and congestion). **Table 5** shows the definition of level of service for signalized and unsignalized intersections.

Table 5 – Level of Service Definitions

Level of Service	Signalized Intersection Average Total Delay (sec/veh)	Unsignalized Intersection Average Total Delay (sec/veh)
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

Definitions provided from the Highway Capacity Manual, Special Report 209, Transportation Research Board, 2010.

Study area intersections were analyzed based on average total delay analysis for signalized and unsignalized intersections. For the unsignalized analysis, the level of service (LOS) for a two-way stop-controlled intersection is defined for each movement. Unlike signalized intersections which define LOS for each approach and for the intersection as a whole, LOS for two-way stop-controlled intersections is not defined as a whole.

Signal timings for the signalized intersections are based on Dallas signal timing sheets. Timing adjustments were made in the future scenarios to accommodate changes in traffic volumes due to background growth and site traffic, replicating how City staff will periodically review signal operations in the future.

Calculations for the level of service at the key intersections identified for study are provided in the **Volume 2** of this report. The analyses assumed the lane geometry and intersection control shown in **Exhibit 3**.