



# **Traffic Impact Analysis**

## **Violet Crown TIA**

## **Travis County, Texas**

Prepared for:

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2/4/2022

# Violet Crown TIA



FEBRUARY 4, 2022

Prepared By:

**Kimley»»Horn**

## EXECUTIVE SUMMARY

The proposed Violet Crown development is a site west of SH 71 and north of Southwest Parkway in the City of Austin Extra Territorial Jurisdiction (ETJ), Travis County, Texas. The site is anticipated to contain 476 multi-family dwelling units, a 96-position golf driving range, 120,000 square-feet of general office space, 69,200 square-feet of retail space, and 5,200 square-feet of drinking establishment. The project is assumed to be completed in the year 2024. This study determines traffic generation characteristics, analyzes potential traffic related impacts on the adjacent road network, and identifies mitigation measures.

The site will have access to the surrounding roadway network via three driveways on SH 71. The southernmost driveway, referred to as Driveway 1, is an emergency access only driveway and is not open to inbound or outbound traffic. The middle driveway, referred to as Driveway 2, is a full-access driveway with SH 71. The northernmost driveway, referred to as Driveway 3, is a right-in only driveway. Intersections to be analyzed were determined after discussions with review agency staff and are listed below.

1. SH 71 & Southwest Parkway
2. SH 71 & Arroyo Canyon Drive
3. SH 71 & Preserve Way
4. SH 71 & Old Bee Caves Road / Thomas Springs Road
5. Southwest Parkway & Barton Creek Boulevard / Travis Cook Road
6. SH 71 & Site Driveway 1
7. SH 71 & Site Driveway 2
8. SH 71 & Site Driveway 3

Turning movement counts were obtained at the above existing intersections during weekday AM and PM peak demand periods on Wednesday, December 8, 2021. Traffic operations were analyzed at the study intersections for Existing conditions, 2024 No Build, and 2024 Site Build-Out. Background traffic was projected to 2024 by applying a 2.50% annual growth factor that was determined by using historical traffic counts in the area. More detailed discussion of the turning movement counts methodology can be found in the Existing Traffic Volumes section.

Site traffic is distributed into and out of the site driveways and onto the street system based on the area street system characteristics, existing traffic patterns, and the location of driveway access to/from the site.

For the proposed land uses, projected site traffic is calculated using the Institute of Transportation Engineers (ITE) *Trip Generation Manual* 10<sup>th</sup> Edition. The development is anticipated to generate approximately 420 new trips during the AM peak-hour and 508 new trips during PM peak-hour. Analysis of the 2024 Build-Out scenario showed some study intersections operate below acceptable LOS D or lower than the No Build LOS. To restore operating conditions to acceptable LOS, the following mitigations are recommended:

- SH 71 & Southwest Parkway
  - a. Retime signal.
- SH 71 & Old Bee Caves Road / Thomas Springs Road
  - a. Retime signal.
- Southwest Parkway & Barton Creek Boulevard / Travis Cook Road
  - a. Retime signal.
  - b. Extend westbound left turn lane by 290 feet (500' turn bay and 50' taper).
- SH 71 & Site Driveway 2
  - a. Install traffic signal.
  - b. Restripe northbound approach to create northbound left turn lane (440' turn bay and 50' taper).
  - c. Install southbound right turn lane (420' turn bay and 50' taper).
- SH 71 – Based on sub-standard roadway cross section
  - a. Addition of one lane per direction between Southwest Parkway and Arroyo Canyon Drive – Approximately 3,500 feet (**Appendix L**).

**For the above mitigations, the developer pro-rata cost share is expected to be approximately \$192,901 and construct the required improvements at Driveway 2 & SH 71.**

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# INTRODUCTION AND BACKGROUND

## PURPOSE

Kimley-Horn and Associates, Inc. was retained to conduct a Traffic Impact Analysis (TIA) of future traffic conditions associated with the Violet Crown development. The proposed Violet Crown development is a site west of SH 71 and north of Southwest Parkway in the City of Austin Extra Territorial Jurisdiction (ETJ), Travis County, Texas. A site vicinity map is provided in *Figure 1*.

This study addresses potential traffic impacts of the proposed development on the surrounding roadway network and intersections. This traffic impact study was prepared based on criteria set forth by the review agency. The specific objectives of this study are to determine the future operational levels-of-service (LOS) at the various study intersections and to identify capacity related improvements.

## GENERAL STUDY INFORMATION

This development will consist of 476 multi-family dwelling units, a 96-position golf driving range, 120,000 square-feet of general office space, 69,200 square-feet of retail space, and 5,200 square-feet of drinking establishment. A TIA determination worksheet was completed and signed by review agency staff and is provided in *Appendix A*; additionally, the scope of analysis for this study was prepared in consultation with the review agency staff and is provided in *Appendix B*. The following scenarios were analyzed:

- 2021 Existing Conditions
- 2024 No Build
- 2024 Site Build-Out

The following intersections were studied in the scenarios listed above for both AM and PM peak hour periods:

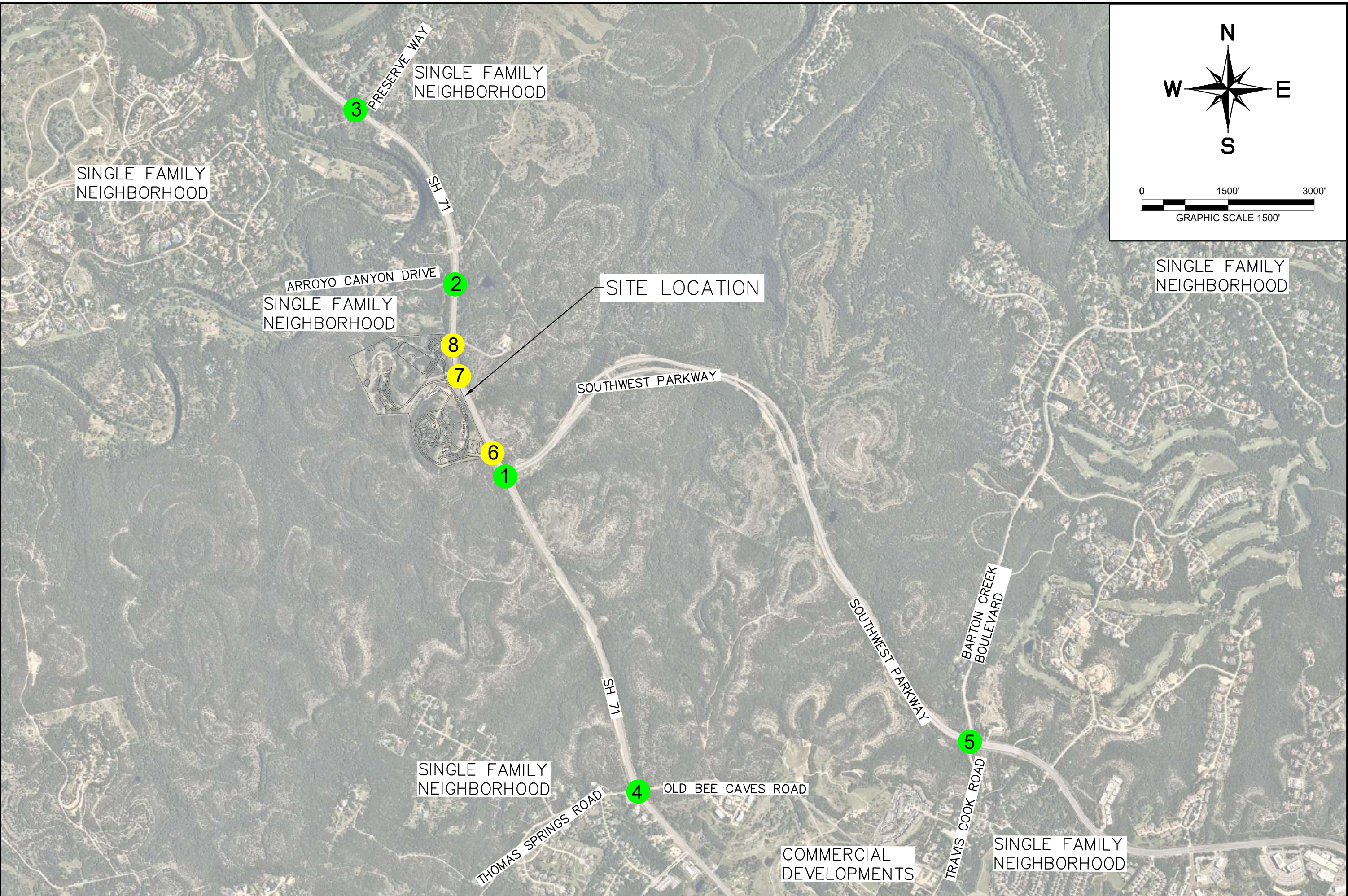
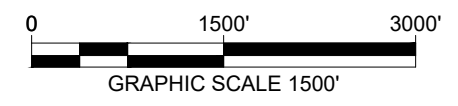
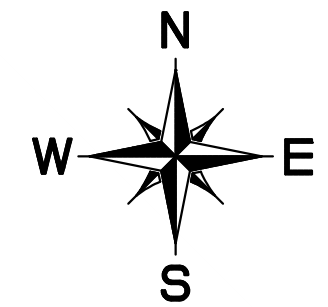
1. SH 71 & Southwest Parkway
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6. SH 71 & Site Driveway 1
7. SH 71 & Site Driveway 2
8. SH 71 & Site Driveway 3

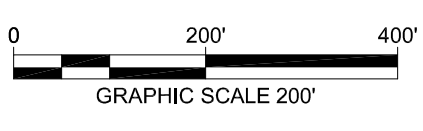
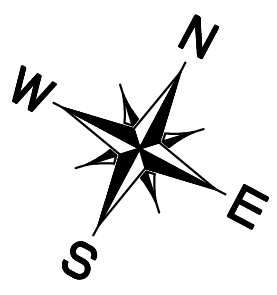
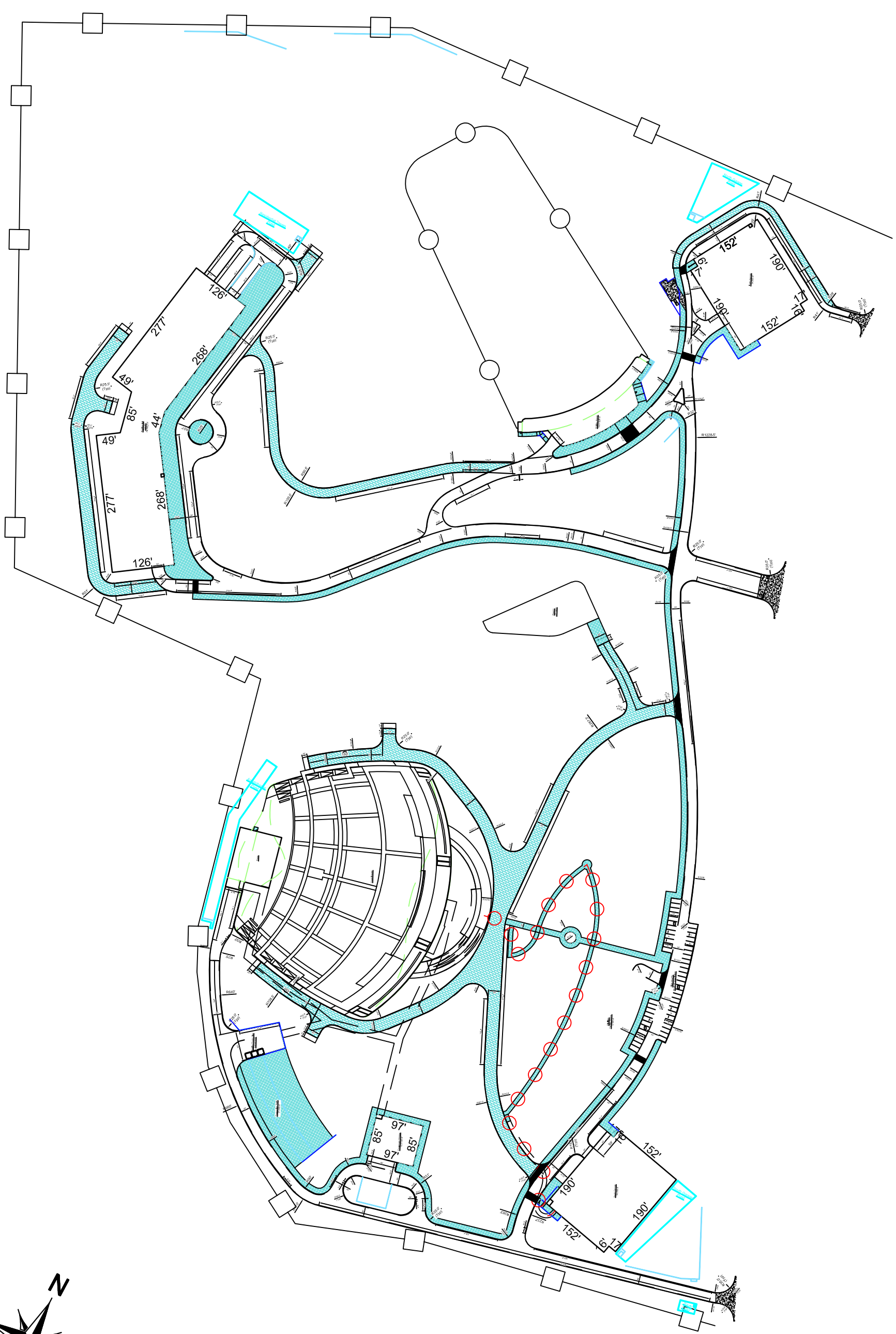
**Figure 1** shows the study intersections and proposed driveways. Access to the project site was discussed with the review agency. The southernmost driveway, referred to as Driveway 1, is an emergency access only driveway and is not open to inbound or outbound traffic. The middle driveway, referred to as Driveway 2, is a full-access driveway with SH 71. The northernmost driveway, referred to as Driveway 3, is a right-in only driveway. **Figure 2** shows the proposed site plan and driveway dimensions. **Figures 3A-E** show the existing roadway dimensions at all study intersections.

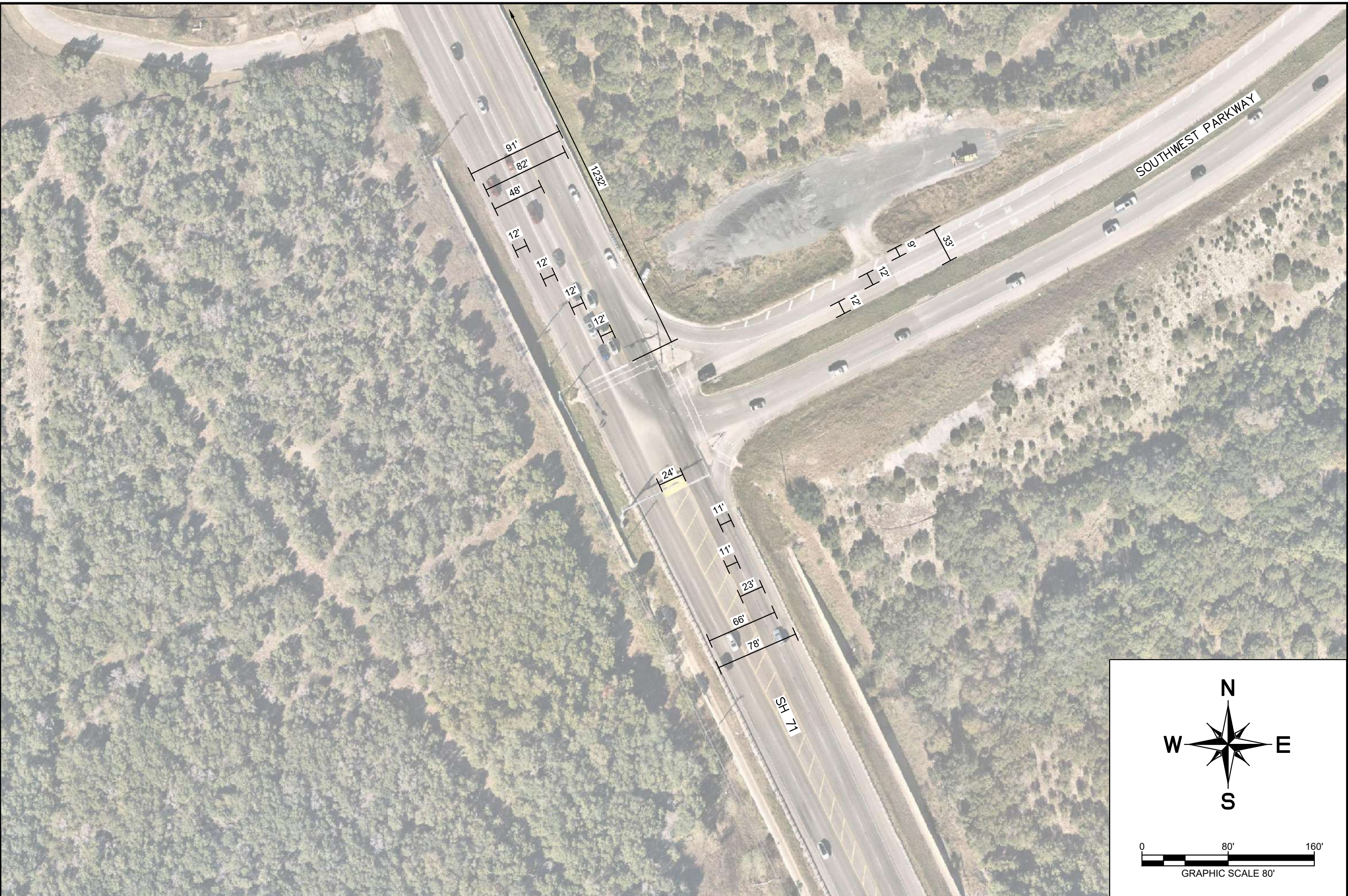
Land uses for the development are summarized in **Table 1**.

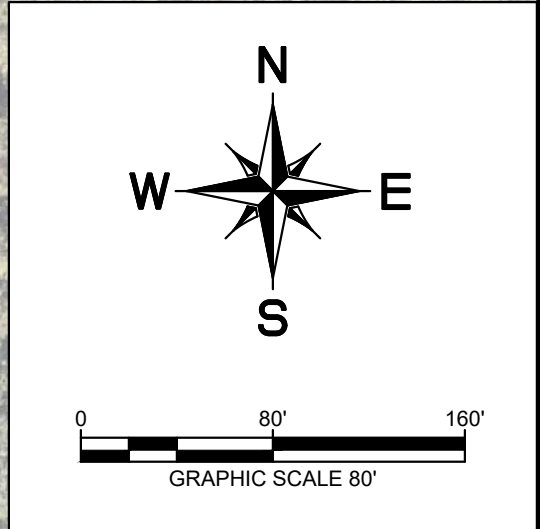
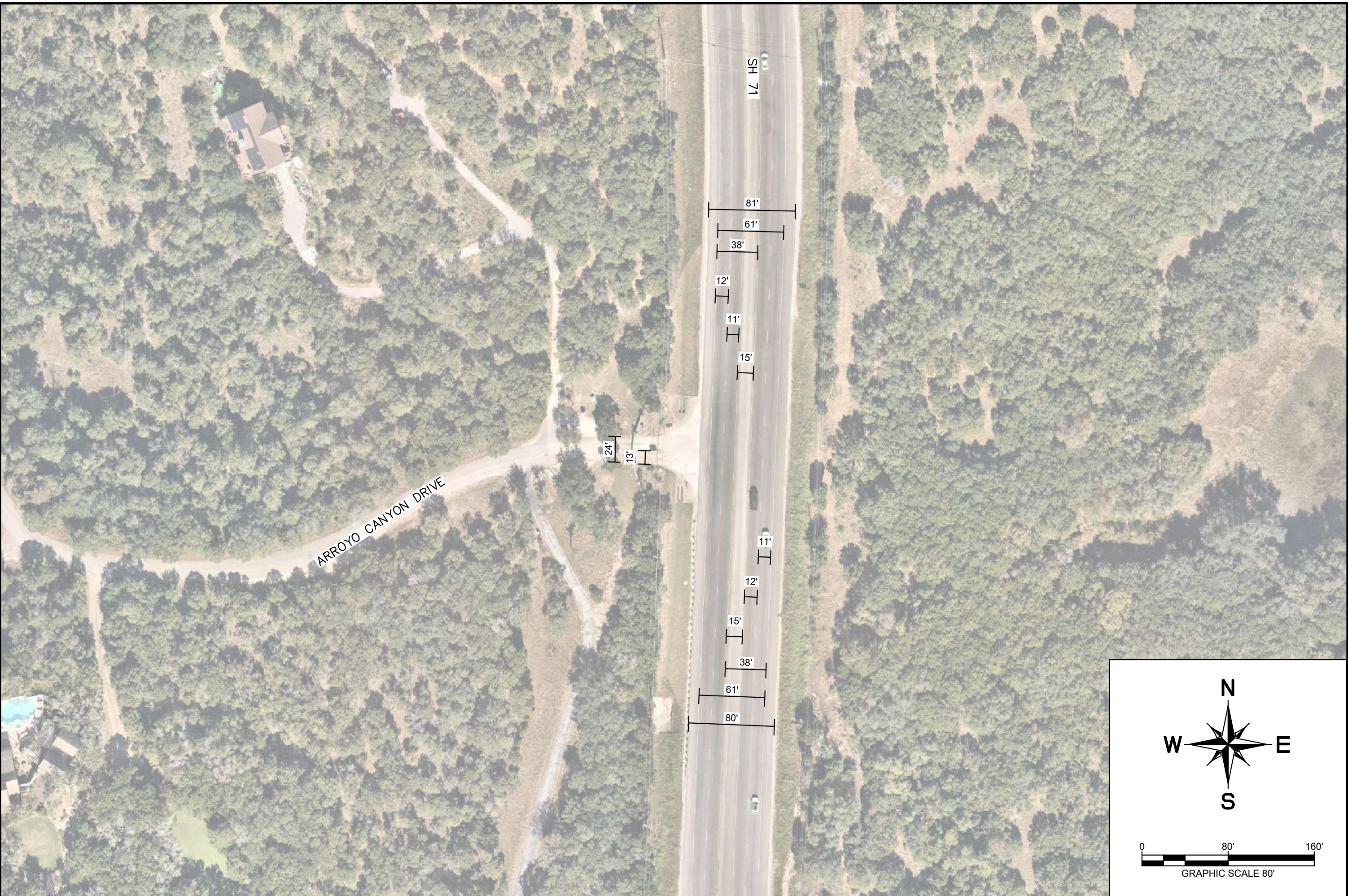
**Table 1 – Proposed Land-Uses**

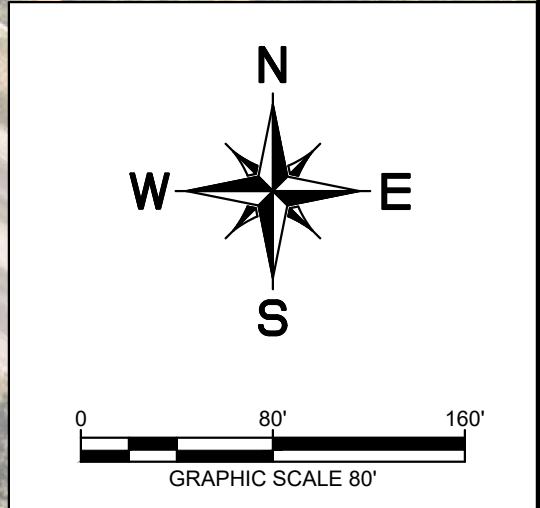
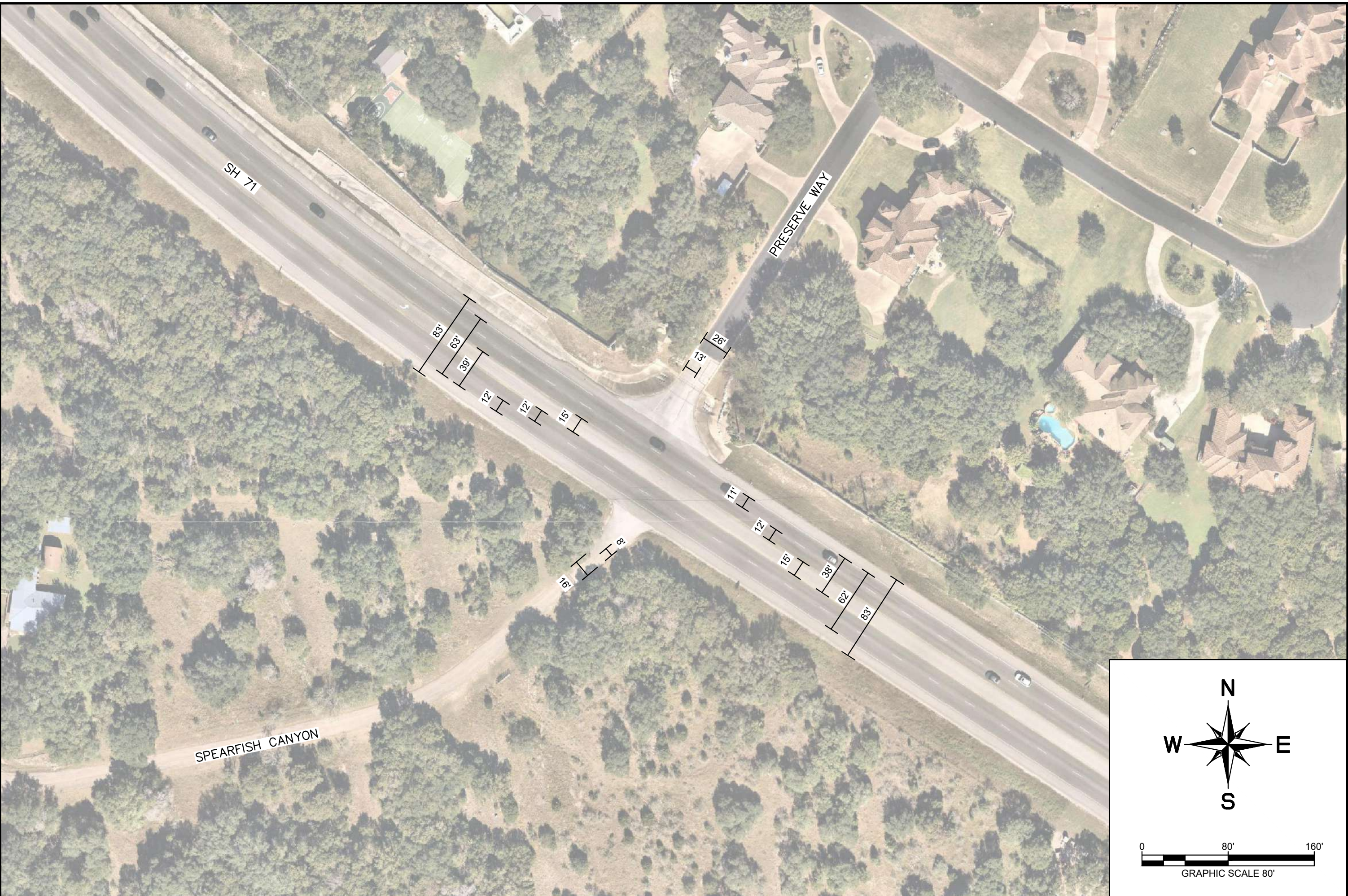
Land Uses	Size	ITE Code
Multifamily Housing (Low-Rise)	476 DU	220
Golf Driving Range	96 Driving Positions	432
General Office Building	120 KSF	710
Shopping Center	69.2 KSF	820
Drinking Place	5.2 KSF	925

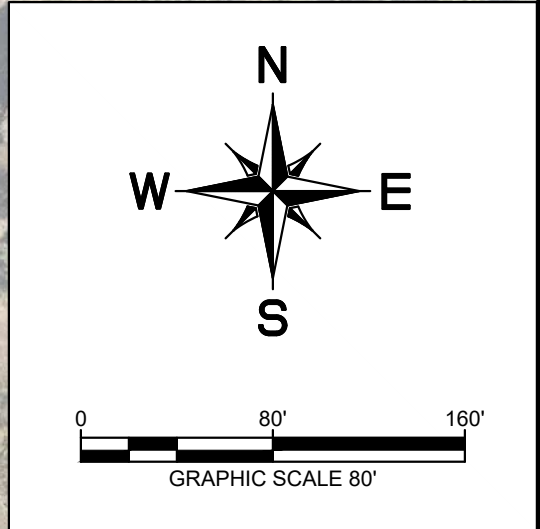
















## EXISTING OPERATING CONDITIONS

### SURROUNDING TRANSPORTATION SYSTEM

The major study area roadways are described below.

**SH 71** – is currently a five (5) lane undivided roadway, with two lanes in each direction of travel and a two way left turn lane. It is classified by Travis County as a Highway and classified by TxDOT as a Principal Arterial. It runs generally in the north-south direction. There is a posted speed limit of 55 miles per hour (mph) in the project vicinity. There are no bicycle or pedestrian facilities in the project vicinity; however, the Travis County 2045 Master Plan has plans for SH 71 north of Southwest Parkway to partner with TxDOT for potential bicycle facilities.

**Southwest Parkway** – is currently a four (4) lane divided roadway, with two lanes in each direction of travel, classified by Travis County as a Rural Arterial. It runs generally in the east-west direction near all site study intersections. There is a posted speed limit of 55 mph in the project vicinity. There are no bicycle or pedestrian facilities in the project vicinity; however, the Travis County 2045 Master Plan has unfunded plans for Southwest Parkway east of SH 71 to partner with TxDOT for potential bicycle facilities.

**Arroyo Canyon Drive** – is currently a two (2) lane undivided roadway, with one lane in each direction of travel, unclassified by Travis County. Arroyo Canyon Drive is gated at SH 71. It runs generally in the east-west direction. There is no posted speed limit in the project vicinity, so a speed limit of 30 mph was assumed. There are no bicycle or pedestrian facilities in the project vicinity.

**Preserve Way** – is currently a two (2) lane undivided roadway, with one lane in each direction of travel, unclassified by Travis County. Preserve Way is gated at SH 71 on both legs. It runs generally in the east-west direction. There is no posted speed limit in the project vicinity, so a speed limit of 30 mph was assumed. There are no bicycle or pedestrian facilities in the project vicinity.

**Old Bee Caves Road** – is currently a two (2) lane undivided roadway, with one lane in each direction of travel. Old Bee Caves Road is not classified by Travis County, but it is classified as a Level 3 roadway by the City of Austin. It runs generally in the east-west direction. Old Bee Caves Road becomes Thomas Springs Road west of SH 71. There is a posted speed limit of 40 mph in the project vicinity. There are no bicycle or pedestrian facilities in the project vicinity; however, the Travis County 2045 Master Plan has unfunded plans for Old Bee Caves Road between Travis Cook Road and SH 71 to have 6-foot bicycle lanes and 5-foot sidewalks on both sides.

**Thomas Springs Road** – is currently a two (2) lane undivided roadway, with one lane in each direction of travel, classified by Travis County as a Rural Arterial. It runs generally in the east-west direction. Thomas Springs Road becomes Old Bee Caves Road east of SH 71. There is a posted speed limit of 35 mph in the project vicinity. There are no bicycle or pedestrian facilities in the project vicinity; however, the Travis County 2045 Master Plan has unfunded plans for Thomas Springs Road between SH 71 and Circle Drive to have 6-foot shoulder widening on both sides to better serve bicycles.

**Barton Creek Boulevard** – is currently a three (3) lane undivided roadway, with one lane in each direction of travel and a center two way left turn lane, classified by Travis County as a Rural Arterial. It runs generally in the north-south direction. Barton Creek Boulevard becomes Travis Cook Road south of Southwest Parkway. There is a posted speed limit of 35 mph in the project vicinity. There are no bicycle or pedestrian facilities in the project vicinity; however, the Travis County 2045 Master Plan has

unfunded plans for Barton Creek Boulevard between Bee Caves Road and Southwest Parkway to have 6-foot bicycle lanes or 4-6 foot wide outer shoulders on both sides.

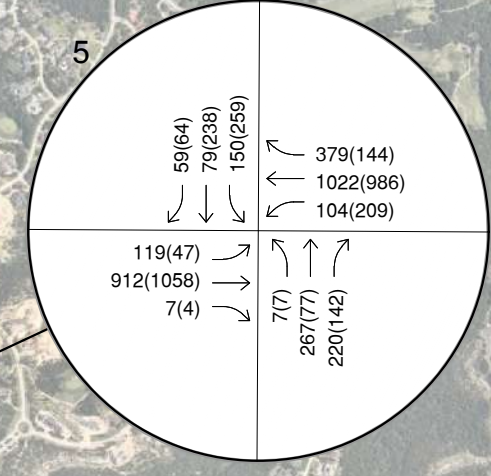
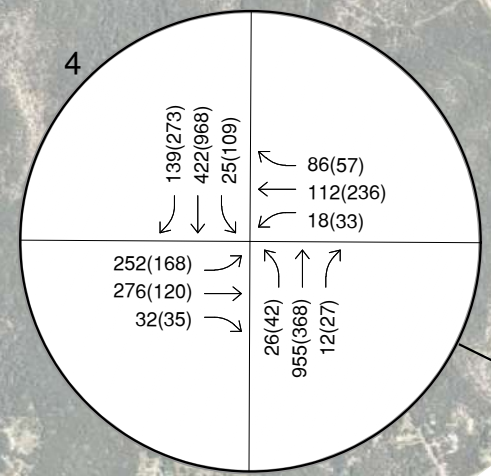
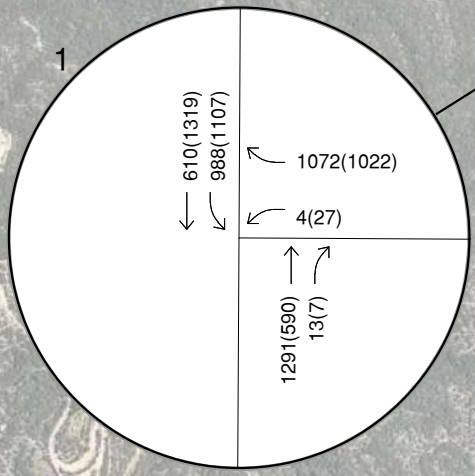
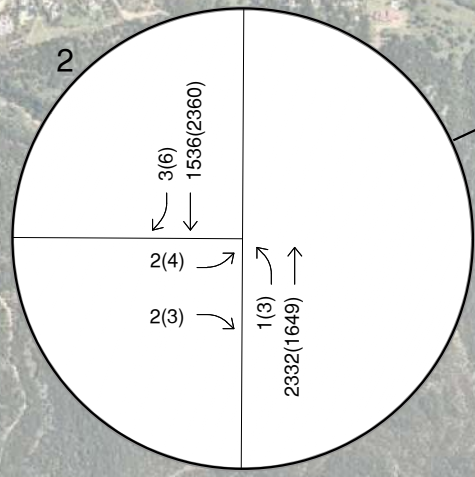
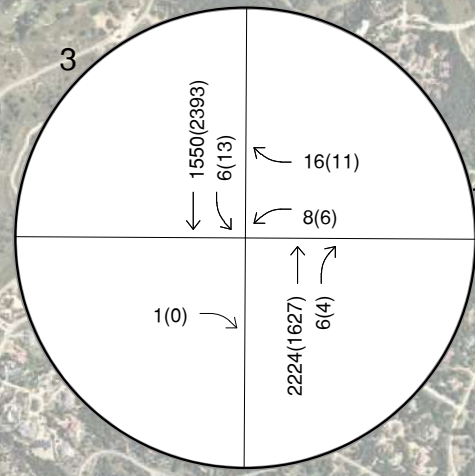
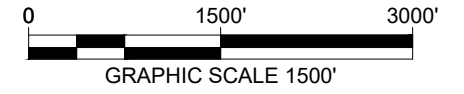
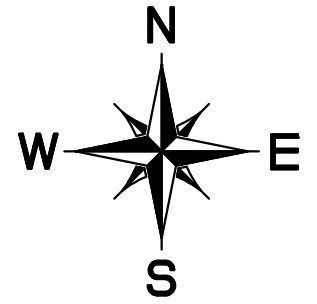
**Travis Cook Road** – is currently a two (2) lane undivided roadway, with one lane in each direction of travel. Travis Cook Road is not classified by Travis County. It runs generally in the north-south direction. Travis Cook Road becomes Barton Creek Boulevard north of Southwest Parkway. There is a posted speed limit of 30 mph in the project vicinity. There are no bicycle or pedestrian facilities in the project vicinity; however, the Travis County 2045 Master Plan has unfunded plans for Old Bee Caves Road between Travis Cook Road and SH 71 to have 6-foot bicycle lanes and 5-foot sidewalks on both sides.

## EXISTING TRAFFIC VOLUMES

Weekday AM and PM peak period turning movement counts were collected at the following study intersections on Wednesday December 8<sup>th</sup>, 2021:

1. SH 71 & Southwest Parkway
  - AM Peak Hour: 7:30 AM – 8:30 AM
  - PM Peak Hour: 5:00 PM – 6:00 PM
2. SH 71 & Arroyo Canyon Drive
  - AM Peak Hour: 7:30 AM – 8:30 AM
  - PM Peak Hour: 4:45 PM – 5:45 PM
3. SH 71 & Preserve Way
  - AM Peak Hour: 7:30 AM – 8:30 AM
  - PM Peak Hour: 4:45 PM – 5:45 PM
4. SH 71 & Old Bee Caves Road / Thomas Springs Road
  - AM Peak Hour: 7:30 AM – 8:30 AM
  - PM Peak Hour: 5:00 PM – 6:00 PM
5. Southwest Parkway & Barton Creek Boulevard / Travis Cook Road
  - AM Peak Hour: 7:30 AM – 8:30 AM
  - PM Peak Hour: 5:00 PM – 6:00 PM

**Figure 4** shows the existing traffic volumes. The raw count sheets are provided in **Appendix C**.



- EXISTING INTERSECTIONS
- TURNING MOVEMENT
- XX(XX) AM (PM) TURNING MOVEMENT VOLUMES

## NO BUILD (FORECASTED) OPERATING CONDITIONS

To obtain 2024 background traffic projections, historic counts near the site were compared to find expected growth trends within the study area. Based on data from TxDOT’s Traffic Count Database System (TCDS), traffic volumes were assumed to increase at a growth rate of 2.50% per year. **Table 2** shows the location of historic counts from TCDS used to calculate the assumed growth rate. The TCDS counts are included in **Appendix C**. The equation used for determining the average annual growth is provided below.

$$Growth\ Rate = \frac{Total\ Trips_{Current\ Year}}{Total\ Trips_{Previous\ Year}}^{\frac{1}{Current\ Year - Previous\ Year} - 1}$$

**Table 2 – Growth Rate Calculation**

Year	Southwest Pkwy 227HP385	Annual Growth Rate	SH 71 227H143	Annual Growth Rate	SH 71 227H145	Annual Growth Rate
2019	25,250	6.45%	31,982	-0.25%	51,545	2.03%
2016	20,932	-----	32,221	-----	48,530	-----
Average		6.45%		-0.25%		2.03%
Overall Average	2.39%					
Assumed Growth Rate	2.50%					

## BACKGROUND PROJECTS

In addition to background growth accounted for by the assumed growth rate, background development projects identified in the scope were reviewed, and relevant background traffic was added to the network's existing traffic counts. Trips generated by unconstructed background projects were distributed as discussed in the previous Background Projects section.

The proposed site is currently vacant. Two (2) developments were identified to be included in the analysis. Details of the approved developments are listed in **Table 3**. The nearby background project locations in relation to the proposed site and their resulting trips are shown in **Figures 5A-C**. Site trip exhibits from approved background TIAs are included in **Appendix K**.

Where there were common study intersections, site trips from approved background TIAs are shown on the future roadway network exactly as they are in the background TIA. When study intersections are not in common, site trips from background TIAs are distributed onto the future roadway network using engineering judgement and the proposed distribution discussed in subsequent sections of this report with the background TIA site trip volumes at the nearest adjacent intersection.

**Table 3 – Background Projects**

Project Name	Case Number	Land Use(s)	Size	% Build-Out (2021)	% Build-Out (2024)
Amarra MF	Travis County: 20-27921 City of Austin: SPC-2020-0168C	Multifamily Housing (Low-Rise)	182 du	0%	100%
Leif Johnson Ford	TxDOT	Automobile Sales – New Car	100 KSF	0%	100%

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## AMARRA MULTIFAMILY

Amarra Multifamily is a multi-family development that is to be constructed in one phase. The build-out year in the report is 2021, but based on aerial imagery from October 2021, it is assumed that the development was delayed until 2022. The Amarra Multifamily TIA includes a figure for build-out (assumed 2022) site trips. Pages from the Amarra Multifamily TIA can be found in **Appendix K**.

Using common study intersections, site trips from the AM and PM Site Traffic Distribution figures in the background TIA were shown on the future roadway network exactly as they are in the background TIA at the following intersection:

- Southwest Parkway & Barton Creek Boulevard / Travis Cook Road

Volumes at the following study intersections were balanced from the background TIA onto the future roadway network. This was completed using the closest adjacent background study intersection and the overall site trip distribution used in the background TIA.

- SH 71 & Southwest Parkway
  - Volumes were balanced from Southwest Parkway & Barton Creek Boulevard / Travis Cook Road.
    - All trips entering Southwest Parkway & Barton Creek Boulevard / Travis Cook Road from the east were assumed to be present as southbound left trips at SH 71 & Southwest Parkway. All trips exiting Southwest Parkway & Barton Creek Boulevard / Travis Cook Road toward the east were assumed to be present as westbound right trips at SH 71 & Southwest Parkway.
- SH 71 & Arroyo Canyon Drive
  - Volumes were balanced from Southwest Parkway & Barton Creek Boulevard / Travis Cook Road.
    - All trips entering Southwest Parkway & Barton Creek Boulevard / Travis Cook Road from the east were assumed to be present as southbound through trips at SH 71 & Arroyo Canyon Drive. All trips exiting Southwest Parkway & Barton Creek Boulevard / Travis Cook Road toward the east were assumed to be present as northbound through trips at SH 71 & Arroyo Canyon Drive.
- SH 71 & Preserve Way
  - Volumes were balanced from Southwest Parkway & Barton Creek Boulevard / Travis Cook Road.
    - All trips entering Southwest Parkway & Barton Creek Boulevard / Travis Cook Road from the east were assumed to be present as southbound through trips at SH 71 & Preserve Way. All trips exiting Southwest Parkway & Barton Creek Boulevard / Travis Cook Road toward the east were assumed to be present as northbound through trips at SH 71 & Preserve Way.
- SH 71 & Old Bee Caves Road / Thomas Springs Road
  - Volumes were balanced from Southwest Parkway & Barton Creek Boulevard / Travis Cook Road.
    - Twenty percent of trips exiting Southwest Parkway & Barton Creek Boulevard / Travis Cook Road toward the south were assumed to be present as westbound left trips at SH 71 & Preserve Way.

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## LEIF JOHNSON FORD

Leif Johnson Ford TIA is an automobile sales development that is to be constructed in one phase. The build-out year is 2022. The Leif Johnson Ford TIA includes a figure for 2022 site trips. Pages from the Leif Johnson Ford TIA can be found in *Appendix K*.

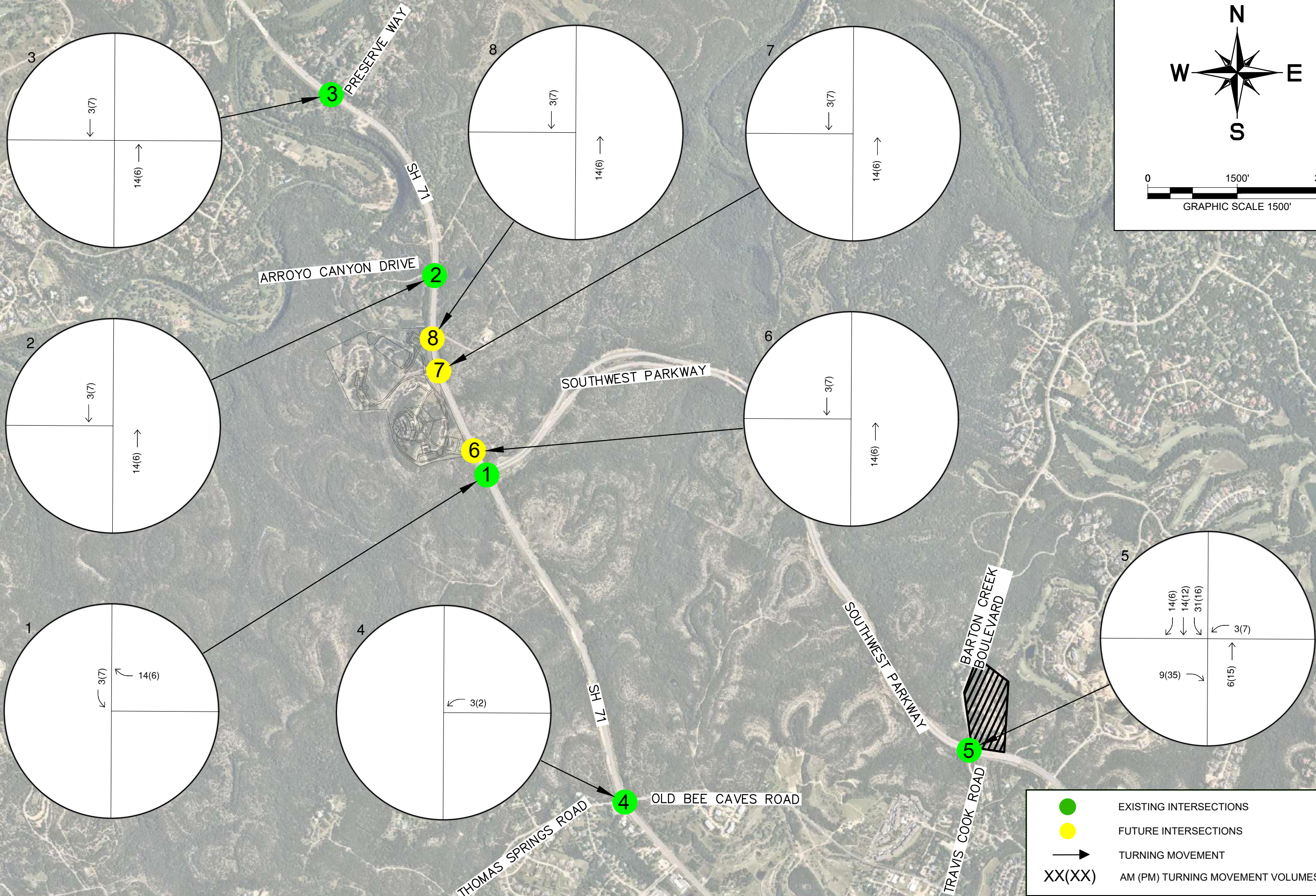
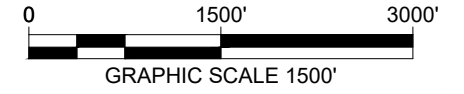
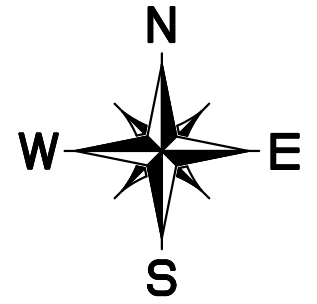
Using common study intersections, site trips from the 2022 AM and PM Peak Hour Site Traffic Conditions figures in the background TIA were shown on the future roadway network exactly as they are in the background TIA at the following intersection(s):

- SH 71 & Old Bee Caves Road / Thomas Springs Road

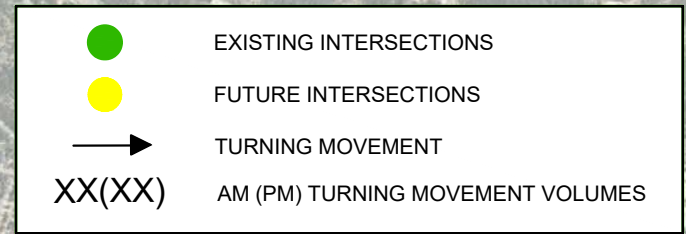
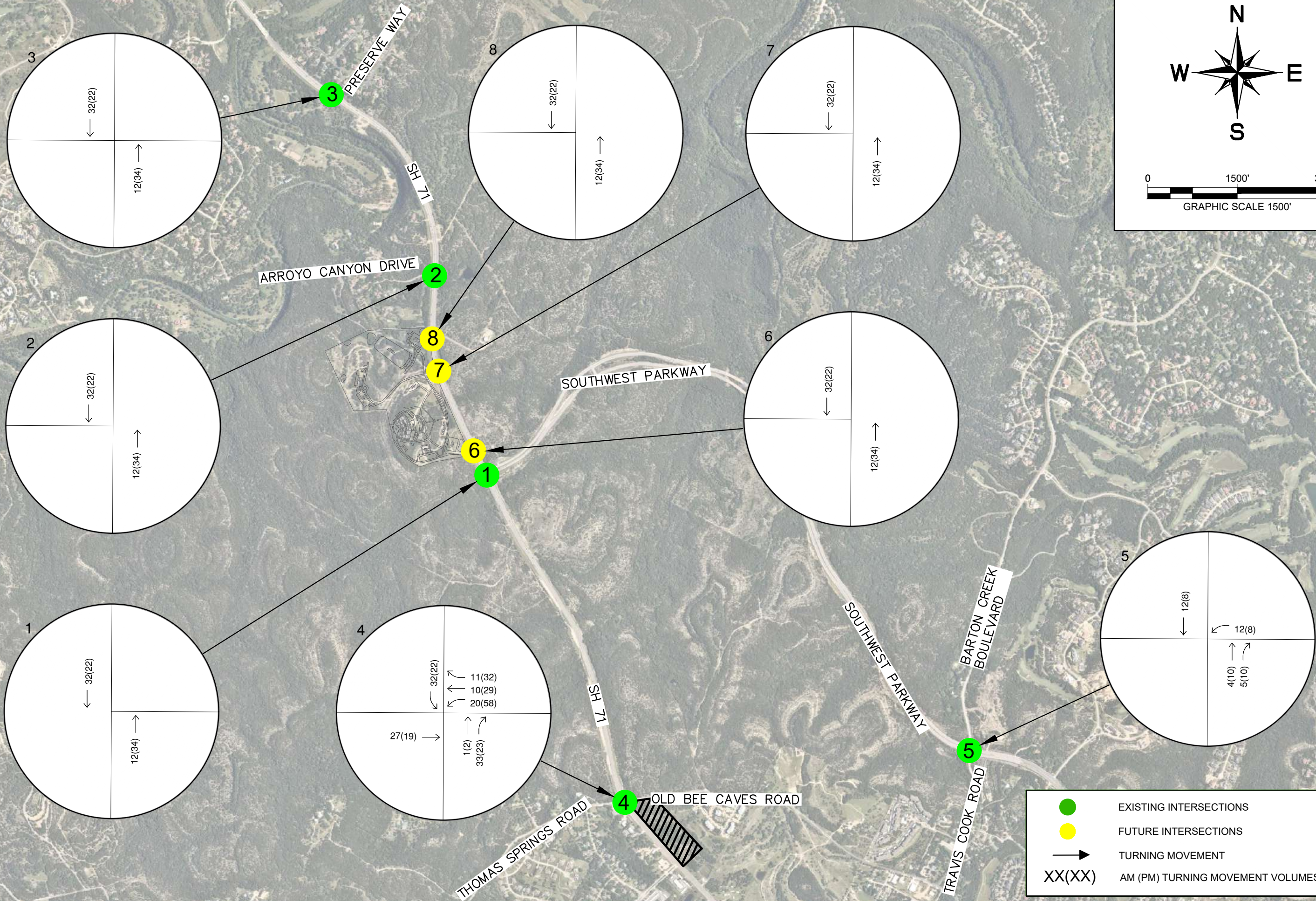
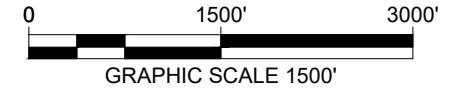
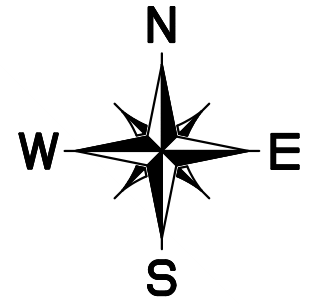
Volumes at the following study intersections were balanced from the background TIA onto the future roadway network. This was completed using the closest adjacent background study intersection and the overall site trip distribution used in the background TIA.

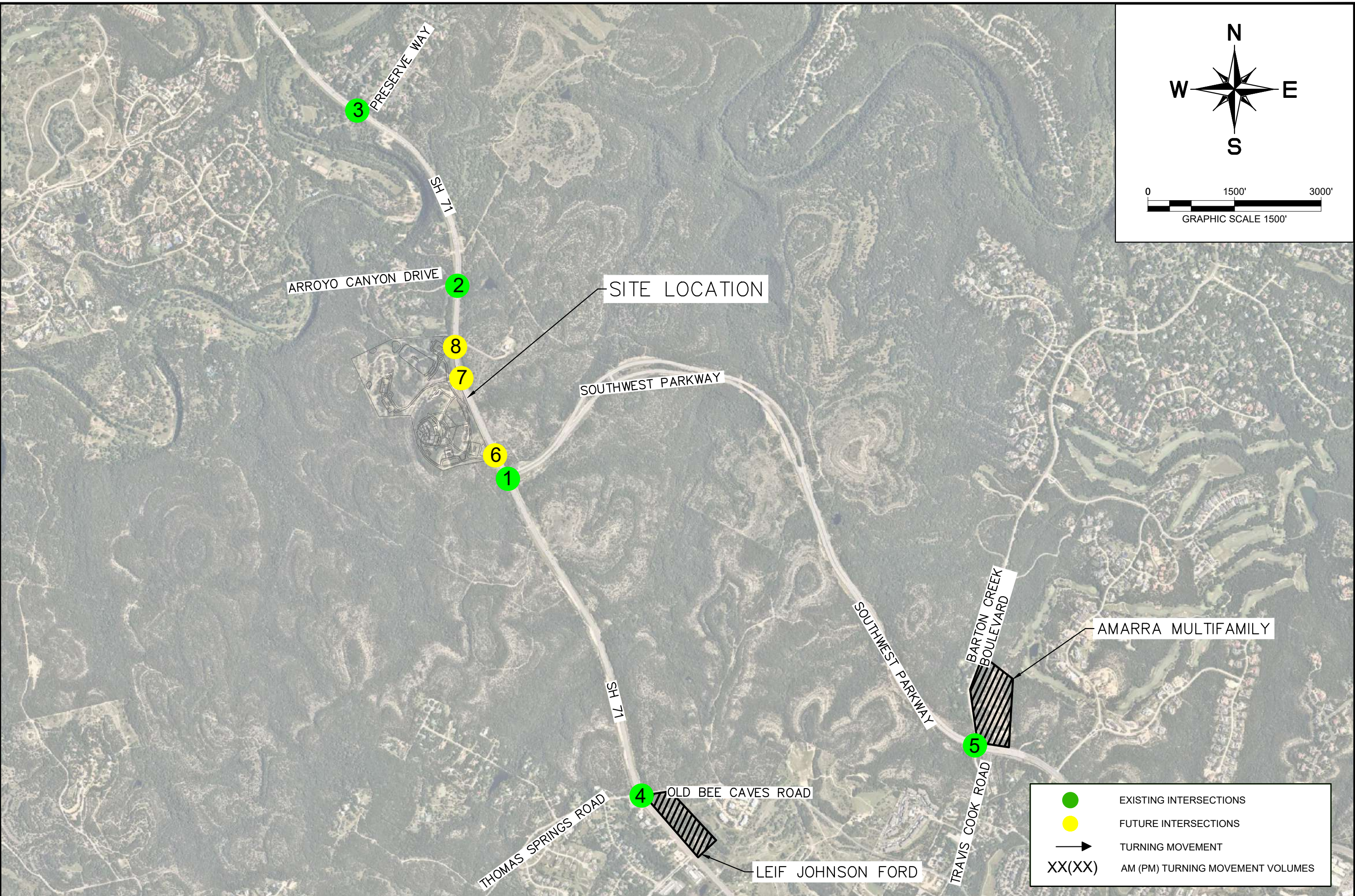
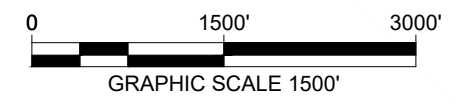
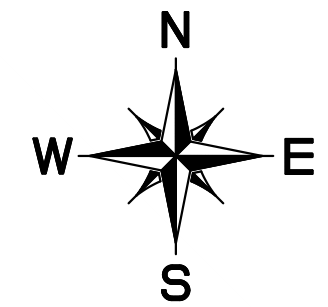
- SH 71 & Southwest Parkway
  - Volumes were balanced from SH 71 & Old Bee Caves Road / Thomas Springs Road.
    - All trips entering SH 71 & Old Bee Caves Road / Thomas Springs Road from the north were assumed to be present as southbound thru trips at SH 71 & Southwest Parkway. All trips exiting Old Bee Caves Road / Thomas Springs Road toward the north were assumed to be present as northbound thru trips at SH 71 & Southwest Parkway.
- SH 71 & Arroyo Canyon Drive
  - Volumes were balanced from SH 71 & Old Bee Caves Road / Thomas Springs Road.
    - All trips entering SH 71 & Old Bee Caves Road / Thomas Springs Road from the north were assumed to be present as southbound through trips at SH 71 & Arroyo Canyon Drive. All trips exiting Old Bee Caves Road / Thomas Springs Road toward the north were assumed to be present as northbound through trips at SH 71 & Arroyo Canyon Drive.
- SH 71 & Preserve Way
  - Volumes were balanced from SH 71 & Old Bee Caves Road / Thomas Springs Road.
    - All trips entering SH 71 & Old Bee Caves Road / Thomas Springs Road from the north were assumed to be present as southbound through trips at SH 71 & Preserve Way. All trips exiting Old Bee Caves Road / Thomas Springs Road toward the north were assumed to be present as northbound thru trips at SH 71 & Preserve Way.
- Southwest Parkway & Barton Creek Boulevard / Travis Cook Road
  - Volumes were balanced from SH 71 & Old Bee Caves Road / Thomas Springs Road.
    - Conservatively, fifty percent of trips entering SH 71 & Old Bee Caves Road / Thomas Springs Road from the east were assumed to be present as southbound thru trips at Southwest Parkway & Barton Creek Boulevard / Travis Cook Road, and the other fifty percent were assumed to be present as westbound left trips. Fifty percent of trips exiting Old Bee Caves Road / Thomas Springs Road toward the east were assumed to be present as northbound thru trips at Southwest Parkway & Barton Creek Boulevard / Travis Cook Road, and the other fifty percent were assumed to be present as northbound right trips.





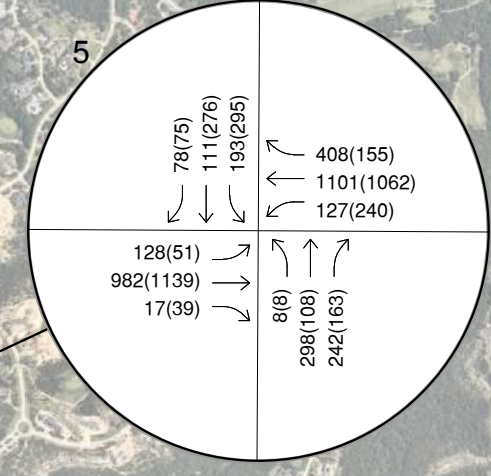
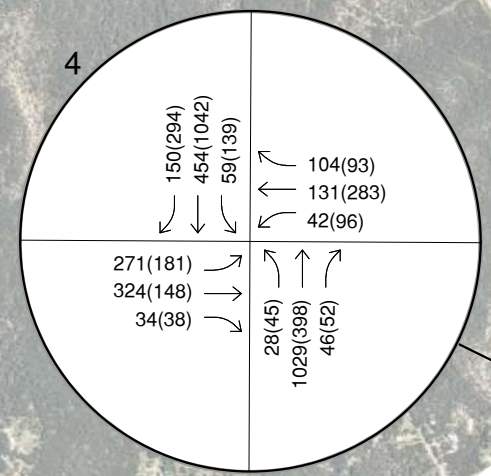
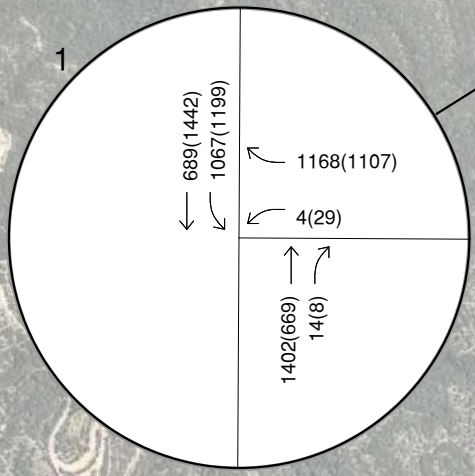
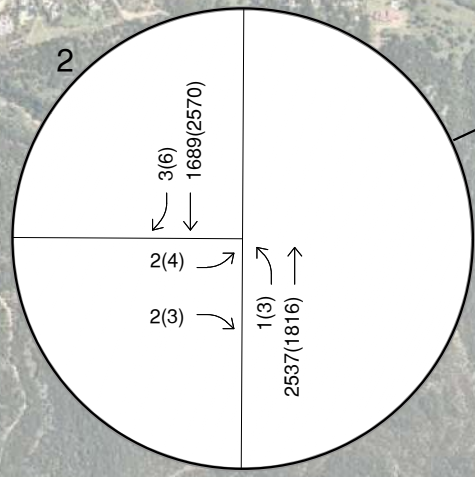
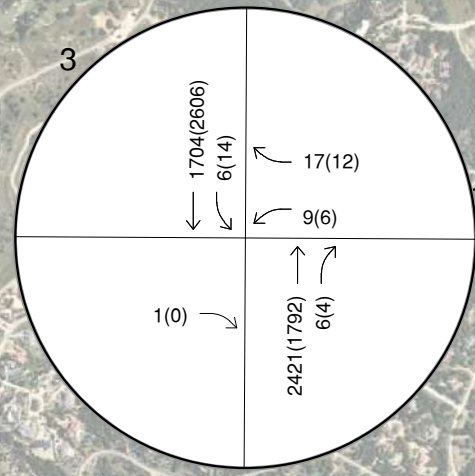
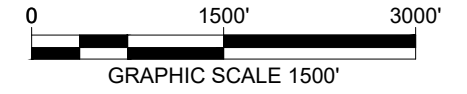
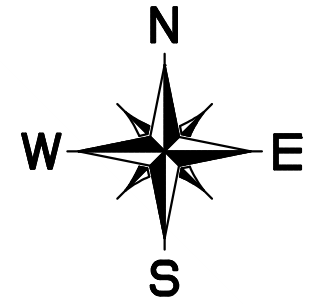
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	TURNING MOVEMENT
XX(X)	AM (PM) TURNING MOVEMENT VOLUMES





## NO BUILD (FORECASTED) VOLUMES

The resulting 2024 No Build weekday AM and PM peak hour traffic volumes, including background traffic projections and traffic associated with background projects, are shown in *Figure 6*.



- EXISTING INTERSECTIONS
- TURNING MOVEMENT
- XX(XX) AM (PM) TURNING MOVEMENT VOLUMES

# TRIP GENERATION AND DISTRIBUTION

## TRIP GENERATION

Site-generated traffic estimates are determined through a process known as trip generation. 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 one-way trips or trip ends, where one vehicle entering and exiting the site is counted as two trips (one inbound trip and one outbound trip).

Internal capture is the tendency for customers or residents to visit several parts of a mixed-use development in one trip but be counted twice in the trip generation since the formula assumes the land uses are isolated. Some internal capture was assumed for this development as shown in **Table 4**. The methodology for determining internal capture followed the NCHRP 684 Internal Trip Capture report. This report is a commonly used tool to calculate internal capture between different land uses. For this project, there were internal capture reductions for all land uses, as listed below:

- Multifamily Housing (Low-Rise)
- Golf Driving Range
- General Office Building
- Shopping Center
- Drinking Place

Pass-by trips are existing vehicles on the adjacent roadways that choose to visit the new site, and then return to their original path. Pass-by trips do not reduce the driveway volumes projected for the site but are deducted from the through traffic volume and routed as right-in / right-out or left-in / left-out movements at driveways on the area roadways. The methodology for determining pass-by followed the ITE 10<sup>th</sup> Edition *Trip Generation Manual*. This report is the acknowledged source to calculate pass-by trips for different land uses. For this project, there were pass-by reductions for the shopping center land use as shown in **Table 4** and **Figures 9A-B**.

Pass-by traffic was assumed to be distributed similarly to existing traffic. Ten percent of pass-by trips enter southbound right at the northernmost Driveway 3, reducing southbound thru traffic at this intersection by 10%; 40% of pass-by trips enter southbound right at the middle Driveway 2, reducing southbound thru traffic at this intersection by 40%; and 50% of pass-by trips exit eastbound right at the middle Driveway 2. The remaining 50% of pass-by trips enter northbound left at the middle Driveway 2, reducing northbound thru traffic at this intersection by 50%, and exit eastbound left at the same driveway.

**Table 4** summarizes the resulting Daily and Weekday AM and PM peak hour trip generation for 2024. Details of site trip generation are provided in **Appendix E**.

**Table 4 – 2024 Site Trip Generation**

Land Uses	Quantity	ITE Code	Daily Trips	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Multifamily Housing (Low-Rise)	476 DU	220	3,558	210	48	162	237	149	88
Golf Driving Range	96 Positions	432	1,312	38	23	15	120	54	66
General Office Building	120 KSF	710	1,268	139	120	19	135	22	113
Shopping Center	69.2 KSF	820	4,682	65	40	25	414	199	215
Drinking Place	5.2 KSF	925	592	0	0	0	59	39	20
<b>Subtotal</b>			11,412	452	231	221	965	463	502
Internal Capture Trip Adjustment			-	32	16	16	316	158	158
Pass-By Trip Adjustment			-	-	-	-	141	68	73
<b>TOTAL TRIPS</b>			<b>11,412</b>	<b>420</b>	<b>215</b>	<b>205</b>	<b>508</b>	<b>237</b>	<b>271</b>

Notes:

1. Land uses and quantities are subject to change with the final design and implementation of the project, though the overall vehicle trip generation will be limited to overall trip generation approved in the Violet Crown TIA.
2. Multifamily Housing (Low-Rise)
  - Daily:  $T = 7.56(X) - 40.86$
  - AM:  $\text{Ln}(T) = 0.95\text{Ln}(X) - 0.51$ ; 23% IN, 77% OUT
  - PM:  $\text{Ln}(T) = 0.89\text{Ln}(X) - 0.02$ ; 63% IN, 37% OUT
3. Golf Driving Range
  - Daily:  $T = 13.65(X) + 2.71$
  - AM:  $T = 0.4(X)$ ; 61% IN, 39% OUT
  - PM:  $T = 1.25(X)$ ; 45% IN, 55% OUT
4. General Office Building
  - Daily:  $\text{Ln}(T) = 0.97\text{Ln}(X) + 2.50$
  - AM:  $T = 0.94(X) + 26.49$ ; 86% IN, 14% OUT
  - PM:  $\text{Ln}(T) = 0.95\text{Ln}(X) + 0.36$ ; 16% IN, 84% OUT
5. Shopping Center
  - Daily:  $\text{Ln}(T) = 0.68\text{Ln}(X) + 5.57$
  - AM:  $T = 0.50(X) + 151.78$ ; 62% IN, 38% OUT
  - PM:  $\text{Ln}(T) = 0.74\text{Ln}(X) + 2.89$ ; 48% IN, 52% OUT
6. Drinking Place
  - Daily: *No equation or rate given; assumed  $K = 0.1$  with PM volumes*
  - AM:  $T = 0$ ; 0% IN, 0% OUT
  - PM:  $T = 11.36(X)$ ; 66% IN, 34% OUT

## TRIP DISTRIBUTION AND ASSIGNMENT

The trip distribution for this site is based on existing traffic data, using cordon line calculations. The cordon line methodology consists of delineating an imaginary line around the study area and calculating the number of vehicles entering and exiting the study area through that line. This calculation provides a picture of how many vehicles approach or leave the study area from each direction and roadway connection. The percentage of vehicles approaching or departing the study area on each roadway connection forms the basis for the overall distribution of traffic in the study area. The percentages determined from the cordon line calculations should also reflect expected traffic patterns.

**Table 5** displays the directional distribution percentages calculated using the Cordon count methodology for the proposed development.

**Table 5 – Cordon County Distribution**

Direction	Cordon Counts		Distribution		Average
	AM	PM	AM	PM	
To/From N on SH 71	3961	4038	35%	36%	<b>35%</b>
To/From S on SH 71	1465	1473	13%	13%	<b>13%</b>
To/From E on Southwest Parkway	2787	2798	25%	25%	<b>25%</b>
To/From W on Arroyo Canyon Dr	8	16	0%	0%	<b>0%</b>
To/From W on Spearfish Canyon	1	0	0%	0%	<b>0%</b>
To/From E on Preserve Way	36	34	0%	0%	<b>0%</b>
To/From W on Thomas Springs Rd	837	874	7%	8%	<b>8%</b>
To/From E on Old Bee Caves Rd	529	582	5%	5%	<b>5%</b>
To/From N on Barton Creek Blvd	1053	829	9%	7%	<b>8%</b>
To/From S on Travis Cook Rd	684	677	6%	6%	<b>6%</b>

Using engineering judgment, the cordon count was analyzed to determine if it would reflect the expected trip destination and sources. Percentages in red represent distribution values that were determined to be an inaccurate representation of the site trip distributions.

The cordon counts projected that site traffic would come from many sources, including to/from east on Old Bee Caves Road, to/from north on Barton Creek Boulevard, and to/from South on Travis Cook Road. However, these roads carry relatively low volumes of traffic and connect to relatively few housing developments, with no major producers or attractors along their routes. For Old Bee Caves Road, it is not expected that a significant portion of traffic would use the road rather than the parallel east/west alternatives of SH 71 and Southwest Parkway. For Travis Cook Road, there are few producers and attractors along the road. For Barton Creek Boulevard, there are few attractors or cut throughs to major roads, so it is not expected that a significant amount of site traffic would utilize the route over Southwest Parkway. Additionally, a significant amount of cordon-counted traffic is double-counted in the current configuration, especially at the intersections of SH 71 & Thomas Springs Road / Old Bee Caves Road and Southwest Parkway & Barton Creek Boulevard / Travis Cook Road. Due to these discrepancies, directional distribution percentages were calculated based on the specific site location to validate the cordon count data.



**Table 6** displays directional distribution percentages calculated using the site dependent directional distribution for the proposed development outer study intersections. For example, for trips coming to/from the south along SH 71, existing volumes for the NBT and SBT at the most southern study intersection (SH 71 & Thomas Springs Road / Old Bee Caves Road) were used.

**Table 6 – Adjusted Count Distribution**

Direction	Cordon Counts		Distribution		Average
	AM	PM	AM	PM	
To/From N on SH 71	3774	4020	48%	49%	<b>49%</b>
To/From S on SH 71	1377	1336	18%	16%	<b>17%</b>
To/From E on Southwest Parkway	1934	2044	25%	25%	<b>25%</b>
To/From W on Arroyo Canyon Dr	3	6	0%	0%	<b>0%</b>
To/From W on Spearfish Canyon	1	0	0%	0%	<b>0%</b>
To/From E on Preserve Way	14	10	0%	0%	<b>0%</b>
To/From W on Thomas Springs Rd	391	441	5%	5%	<b>5%</b>
To/From E on Old Bee Caves Rd	111	166	1%	2%	<b>2%</b>
To/From N on Barton Creek Blvd	178	111	2%	1%	<b>2%</b>
To/From S on Travis Cook Rd	14	11	0%	0%	<b>0%</b>

To finalize the distribution, engineering judgement was used to modify the averages to more closely reflect current conditions. Just like the percentages calculated using the cordon counts, the red numbers did not closely represent existing conditions. Engineering judgment and was used to finalize the distribution.

The percentage of traffic using Old Bee Caves Road and Barton Creek Boulevard was rounded down to 0% on each road using the same judgement mentioned previously; there are not enough producers or attractors on either road to expect a significant amount of traffic to use them. The traffic percentages from these roads were added to traffic to/from south SH 71, adjusting it to a total of 20%, as it is the direct southern connection between the site and US 290.

**Table 7** displays the general directional distribution percentages assumed for the proposed development after using cordon counts, directional calculation and engineering judgment.

**Table 7 - Site Trip Distribution**

Direction	Percent to Development
To/From N on SH 71	<b>50%</b>
To/From S on SH 71	<b>20%</b>
To/From E on Southwest Parkway	<b>25%</b>
To/From W on Thomas Springs Rd	<b>5%</b>

After considering the overall distribution of the site traffic, assumptions can be made for a development about how vehicles will choose the most appropriate exit point. Some factors that are included in distributing site traffic between the proposed driveways include the following:

- The accessibility of the driveway to the primary travel directions,
- The preference of drivers to use the first available driveway when entering and exiting the site
- The preference of drivers to make right-turns versus left-turns, and
- The choice of a route to provide the most opportunity to make preferred maneuvers.

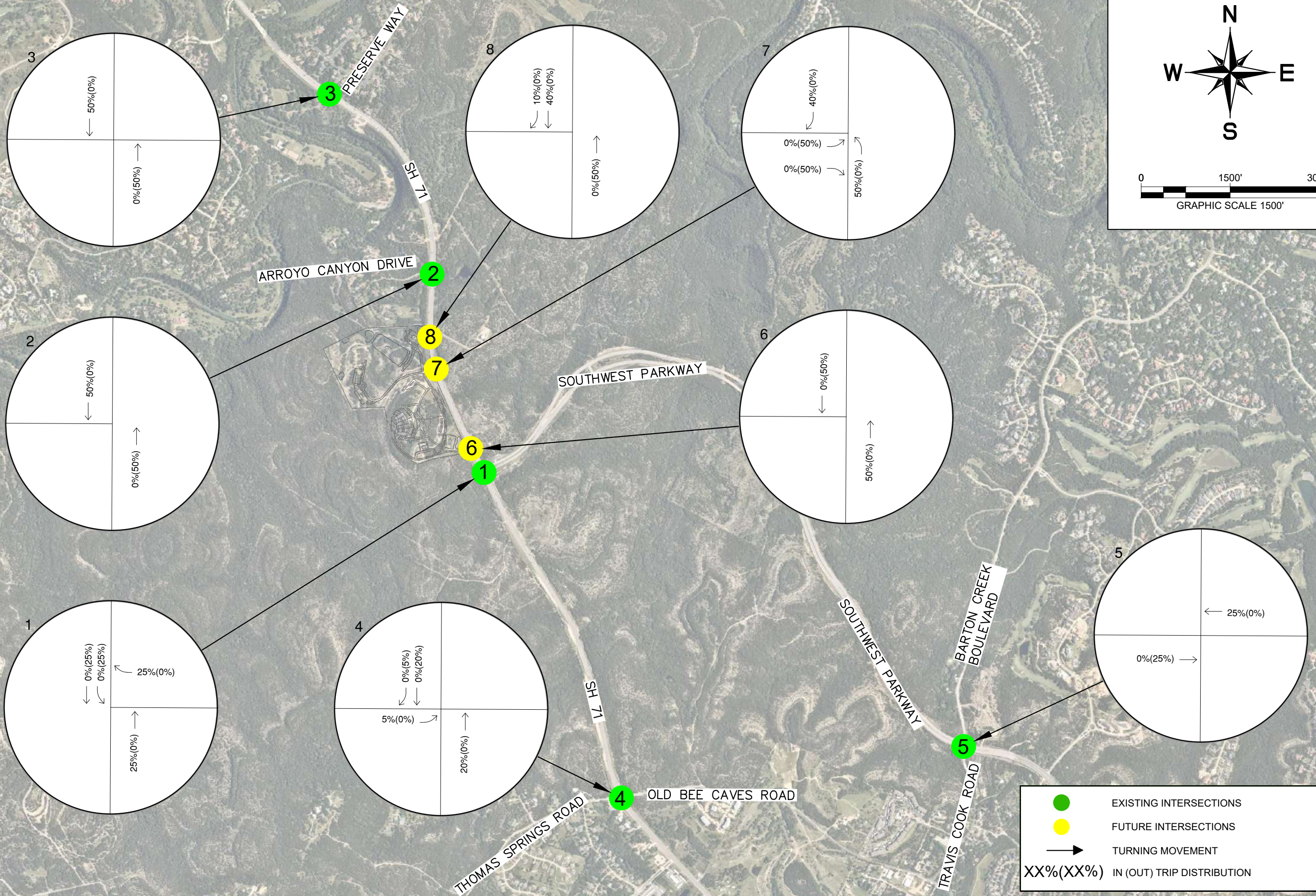
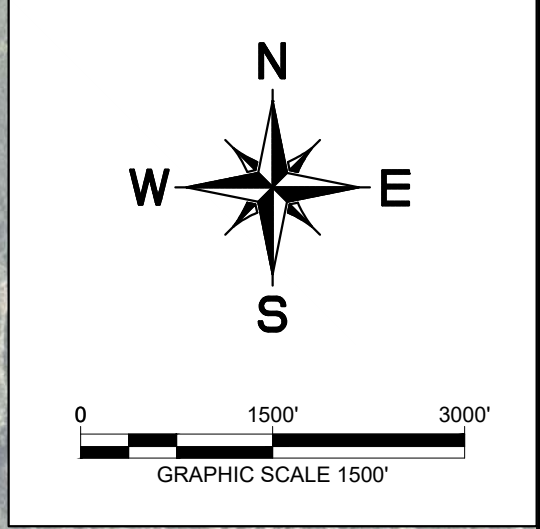
The southernmost driveway, Driveway 1, is an emergency access only driveway which is not generally open for use. Site trips are at 0% for both inbound and outbound movements at Driveway 1. Due to the full access nature of the middle driveway, Driveway 2, 90% of inbound site traffic and 100% of outbound site traffic is assumed to access the site via Driveway 2. The northernmost driveway, Driveway 3, is an entrance driveway only. It is assumed that 10% of inbound traffic utilizes Driveway 3 due to its proximity to the golf driving ranges and a parking garage.

**Figure 7** shows the resulting weekday AM and PM peak hour site trip distribution at all study intersections for the site development. **Figure 8** shows the total site traffic after being calculated using the percentages for each trip assignment group in **Figure 7**. **Figures 9A-B** shows the pass-by adjustment and trips.

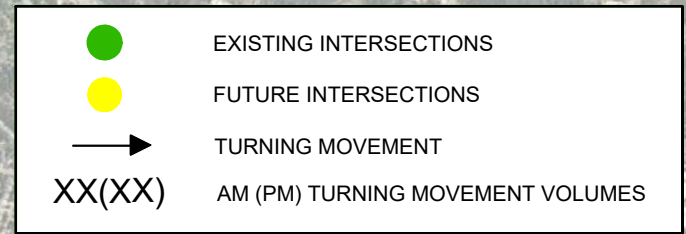
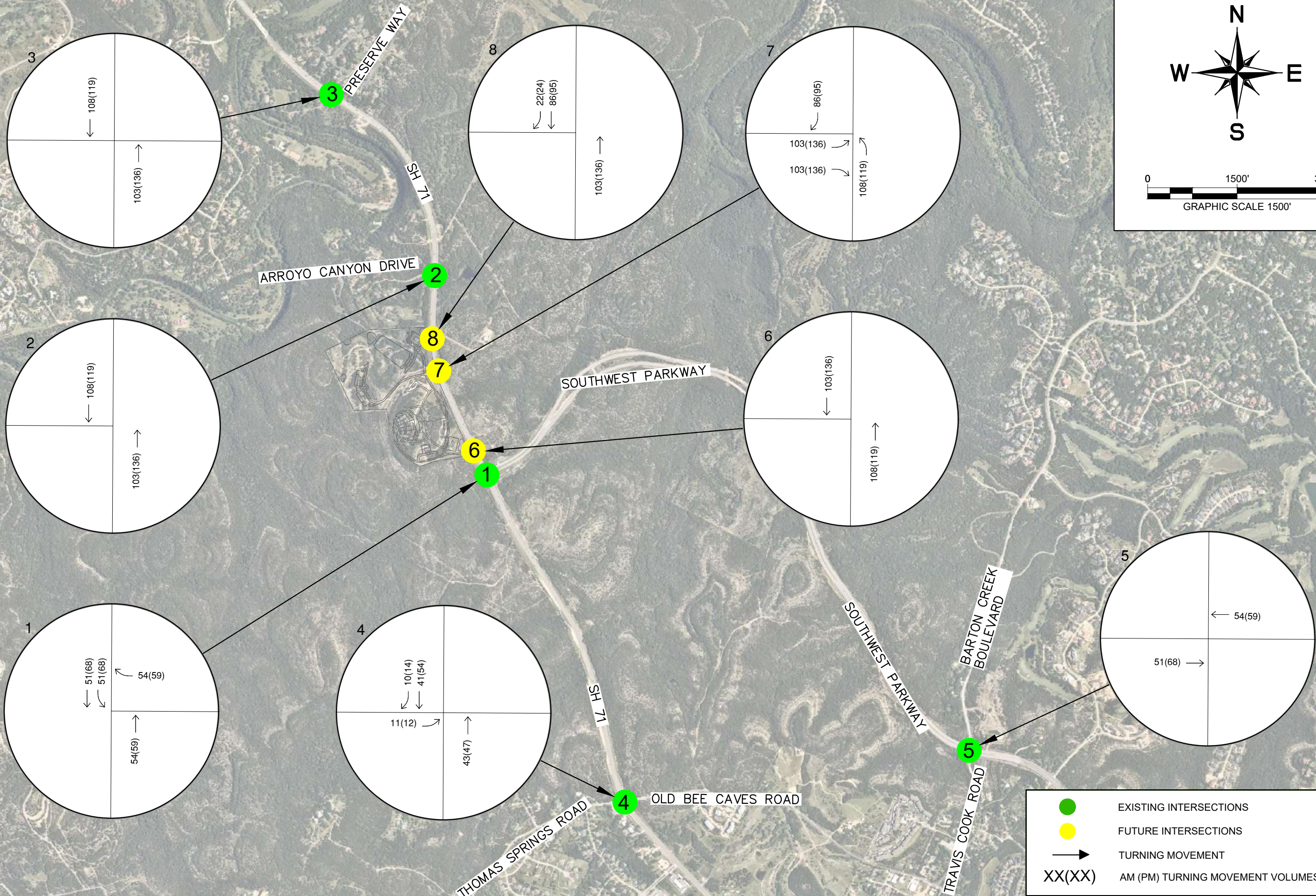
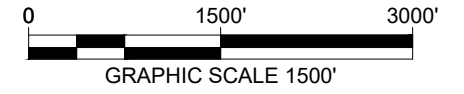
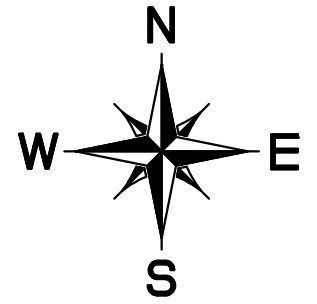
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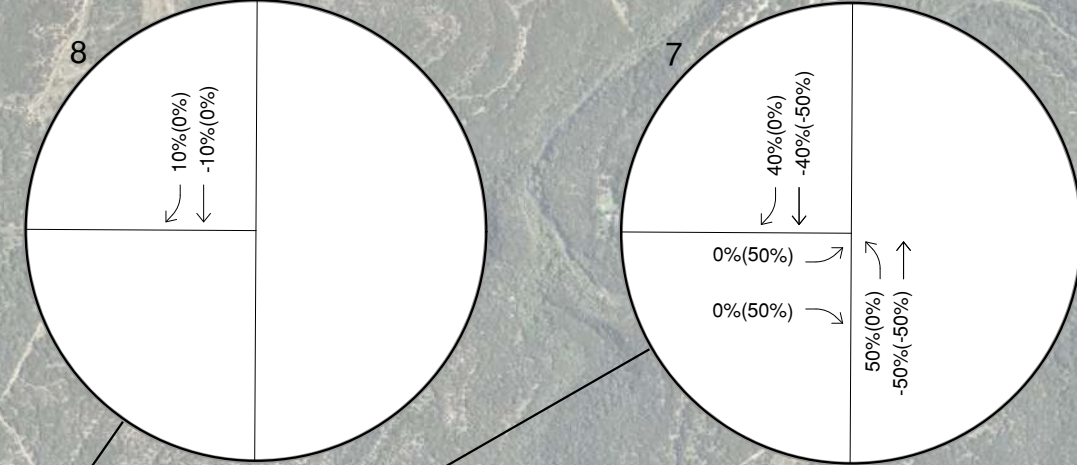
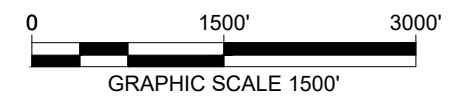
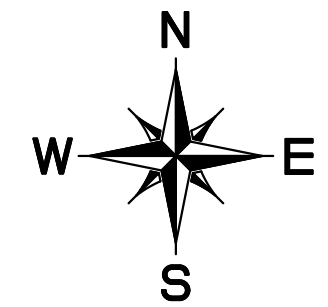
## ASSUMPTIONS

- Cordon line calculations were performed on existing count data for all study intersections.
- Traffic volume calculations can be found in **Appendix F**.
- The traffic generated by the site was assigned to the future roadway network using the appropriate trip distribution percentages for the AM and PM peak hours.
- Site trips are added to the forecasted year 2024 background trips to determine the total 2024 traffic volumes.
- Peak Hour Factors (PHF) and HV% from existing counts were used for every existing intersection.
- *Synchro 11*<sup>TM</sup> default PHF (0.92) and HV% (2%) values were used for proposed intersections.

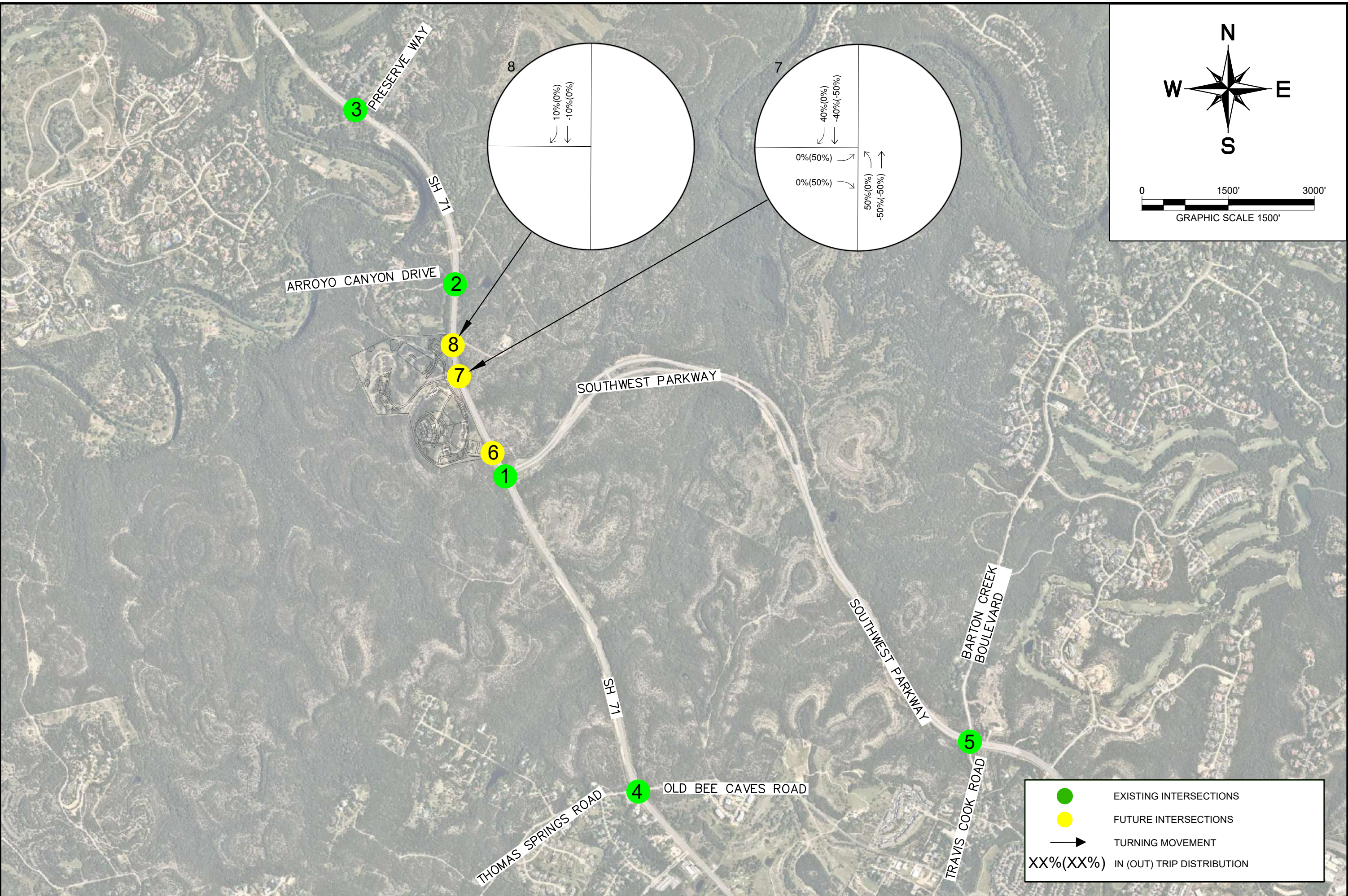


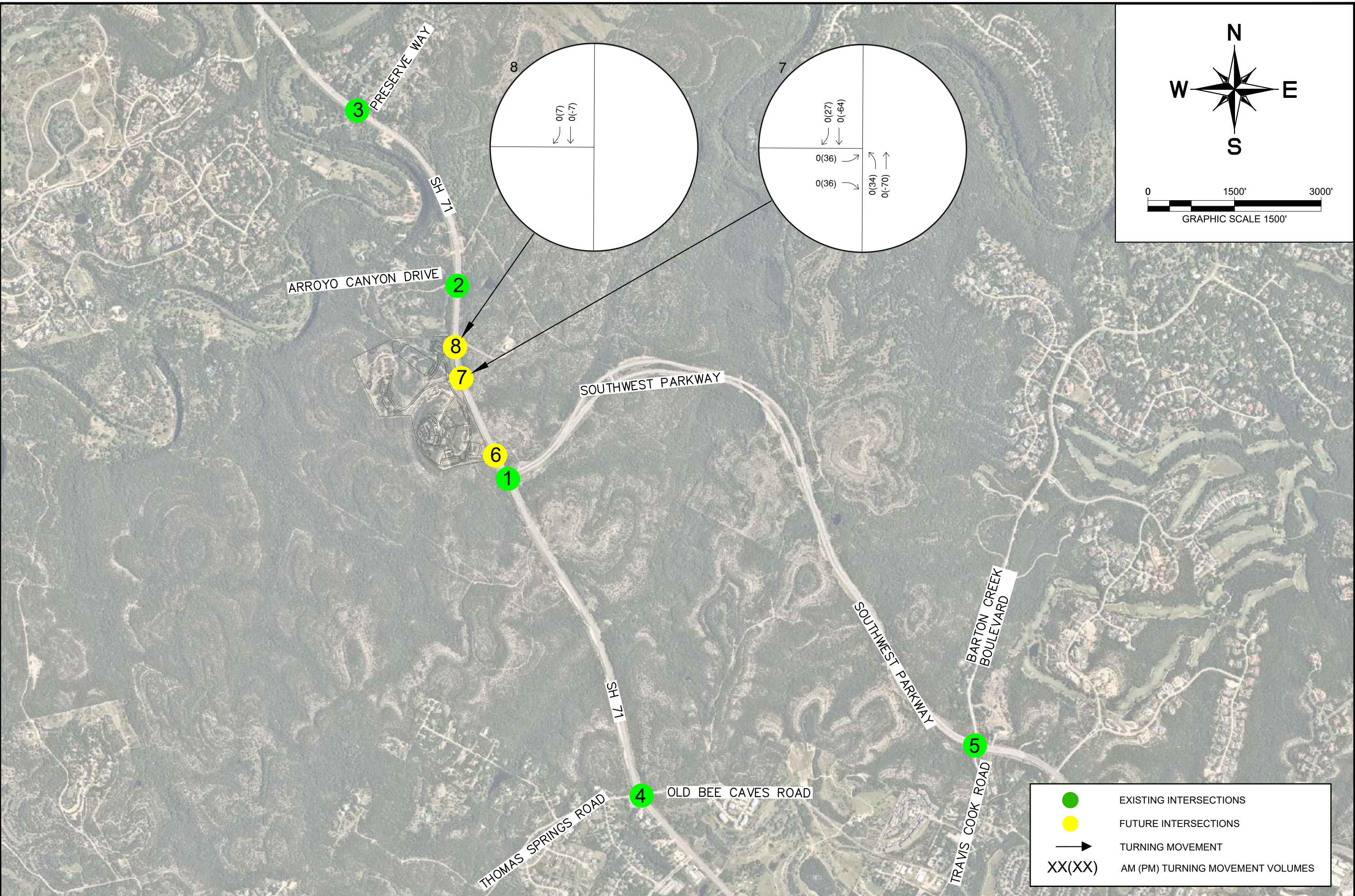
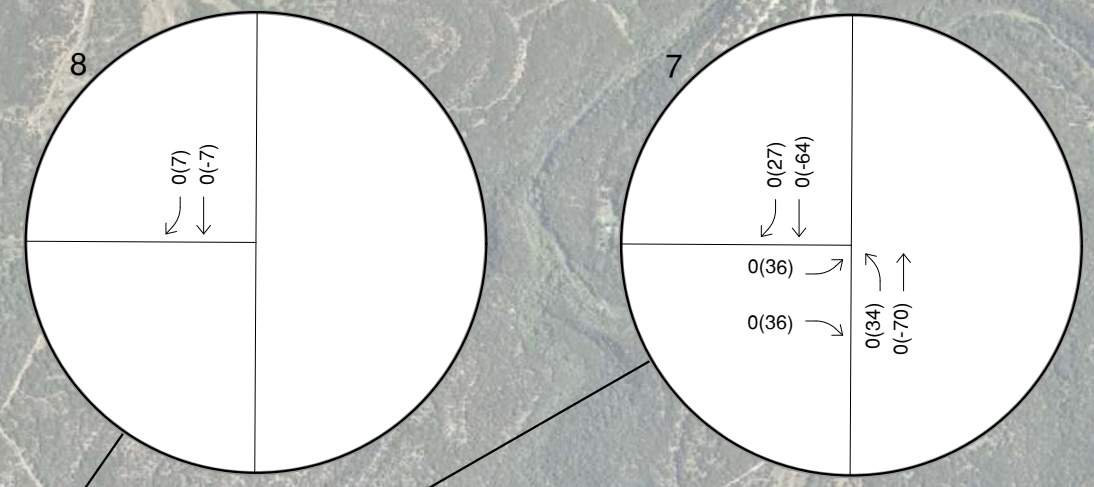
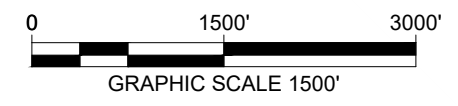
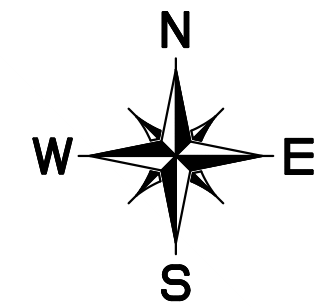
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- FUTURE INTERSECTIONS
- TURNING MOVEMENT
- XX%(XX%)** IN (OUT) TRIP DISTRIBUTION





- EXISTING INTERSECTIONS
- FUTURE INTERSECTIONS
- TURNING MOVEMENT
- XX%(XX%) IN (OUT) TRIP DISTRIBUTION



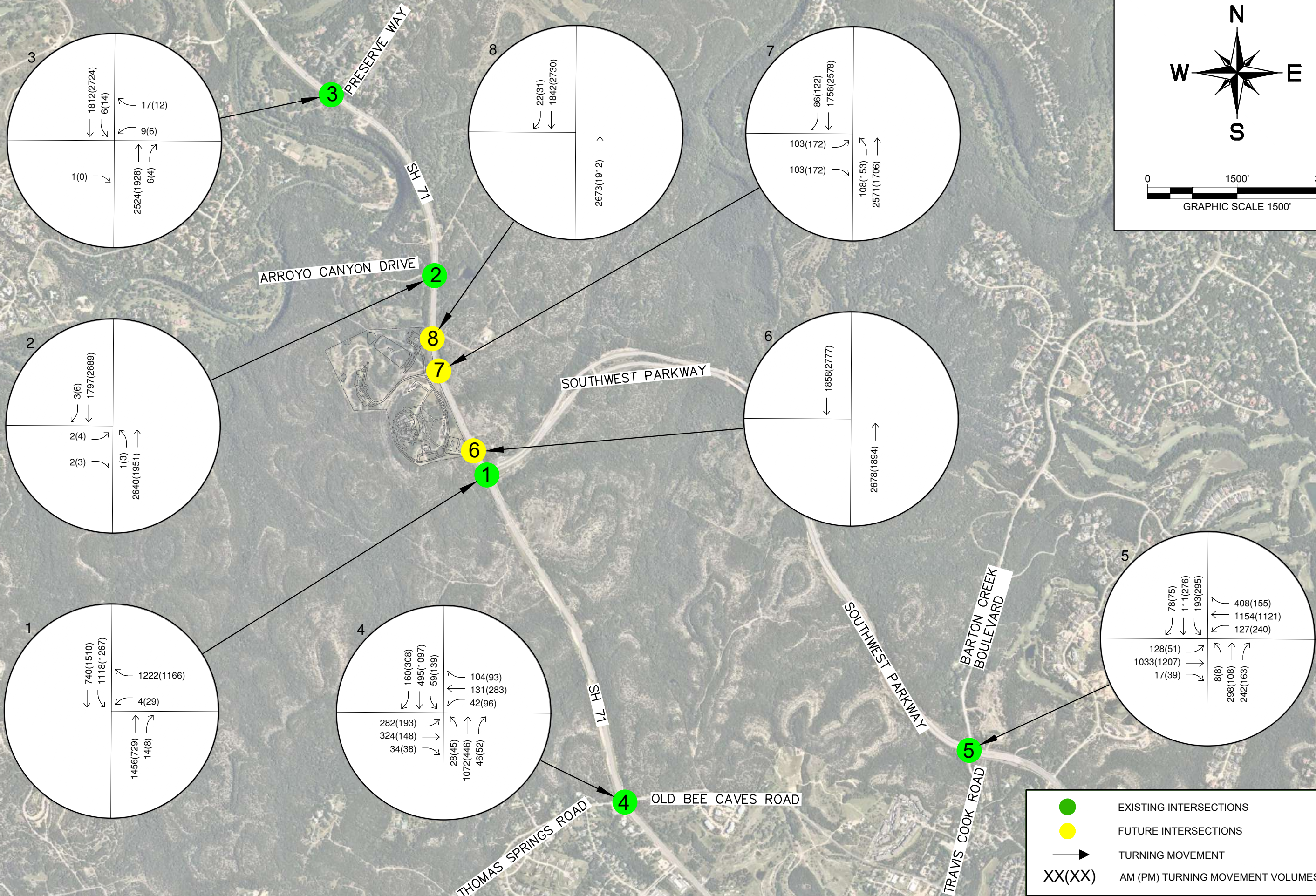
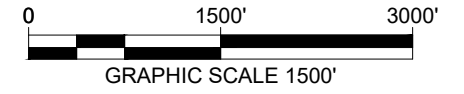
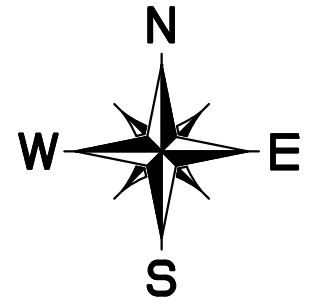


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	TURNING MOVEMENT
XX(XX)	AM (PM) TURNING MOVEMENT VOLUMES

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## BUILD (SITE + FORECASTED) OPERATING CONDITIONS

Site traffic was added to the No Build volumes to represent estimated total buildout (growth plus site-generated) traffic conditions in 2024 after the completion of the proposed development. The resulting 2024 total weekday AM and PM peak hour traffic volumes are shown in *Figure 10*.



- EXISTING INTERSECTIONS
- FUTURE INTERSECTIONS
- TURNING MOVEMENT
- XX(XX)** AM (PM) TURNING MOVEMENT VOLUMES



## BUILD WITH MITIGATIONS OPERATING CONDITIONS

A mitigation plan must be developed for every development phase considered in a Traffic Impact Analysis. Mitigation plans are designed to show the recommended improvements to bring intersection operations back to Level of Service (LOS) D or to at least the operating conditions of the No Build scenario.

To accommodate traffic from the proposed development, the following mitigations are proposed:

- SH 71 & Southwest Parkway
  - a. Retime signal.
- SH 71 & Old Bee Caves Road / Thomas Springs Road
  - a. Retime signal.
- Southwest Parkway & Barton Creek Boulevard / Travis Cook Road
  - a. Retime signal.
  - b. Extend westbound left turn lane by 290 feet (500' turn bay and 50' taper).
- SH 71 & Site Driveway 2
  - a. Install traffic signal.
  - b. Restripe northbound approach to create northbound left turn lane (440' turn bay and 50' taper).
  - c. Install southbound right turn lane (420' turn bay and 50' taper).
- SH 71 – Based on sub-standard roadway cross section
  - a. Addition of one lane per direction between Southwest Parkway and Arroyo Canyon Drive – Approximately 3,500 feet.

The above intersection mitigations bring most movements to an acceptable LOS or reduce delay below No Build conditions where feasible. It should be noted that the intersection of SH 71 & Southwest Parkway is projected to perform with failing LOS and delays greater than the no build analysis scenario for the WBL movement in the AM scenario. However, the AM peak WBL volume is only 4 vehicles. The V/C ratio for this movement is 0.55, and there are no signal timing improvements which can be made to reduce all movements to an acceptable LOS or reduce delay below No Build conditions. It does not make sense to utilize geometric improvements to reduce delay for four vehicles during one peak hour.

It should also be noted that the intersections of SH 71 & Arroyo Canyon Drive and SH 71 & Preserve Way are also projected to perform with failing LOS and delays greater than the no build analysis scenario. However, volumes at these two intersections are well below the threshold to satisfy any signal warrants. At SH 71 & Arroyo Canyon Drive, side street traffic is fewer than 10 vehicles in each peak hour. At SH 71 & Preserve Way, side street traffic is fewer than 30 vehicles in each peak hour. No other geometric improvements were found to improve each movements' LOS to an acceptable level.

In addition to the intersection mitigations, it is recommended that SH 71 (between Southwest Parkway and Arroyo Canyon Drive) be widened to a six-lane section. Road widening diagrams are included in **Appendix L**.

Proposed Roadway Mitigations Figures can be found in **Figures 11A-D**. An overall mitigation plan can be found in **Figure 12**.



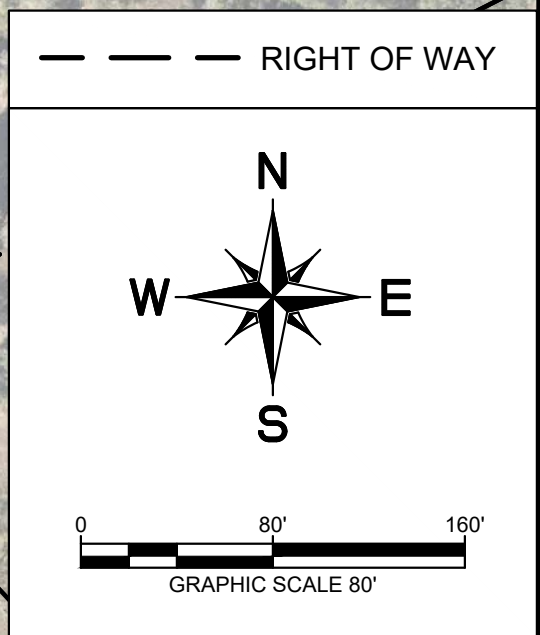
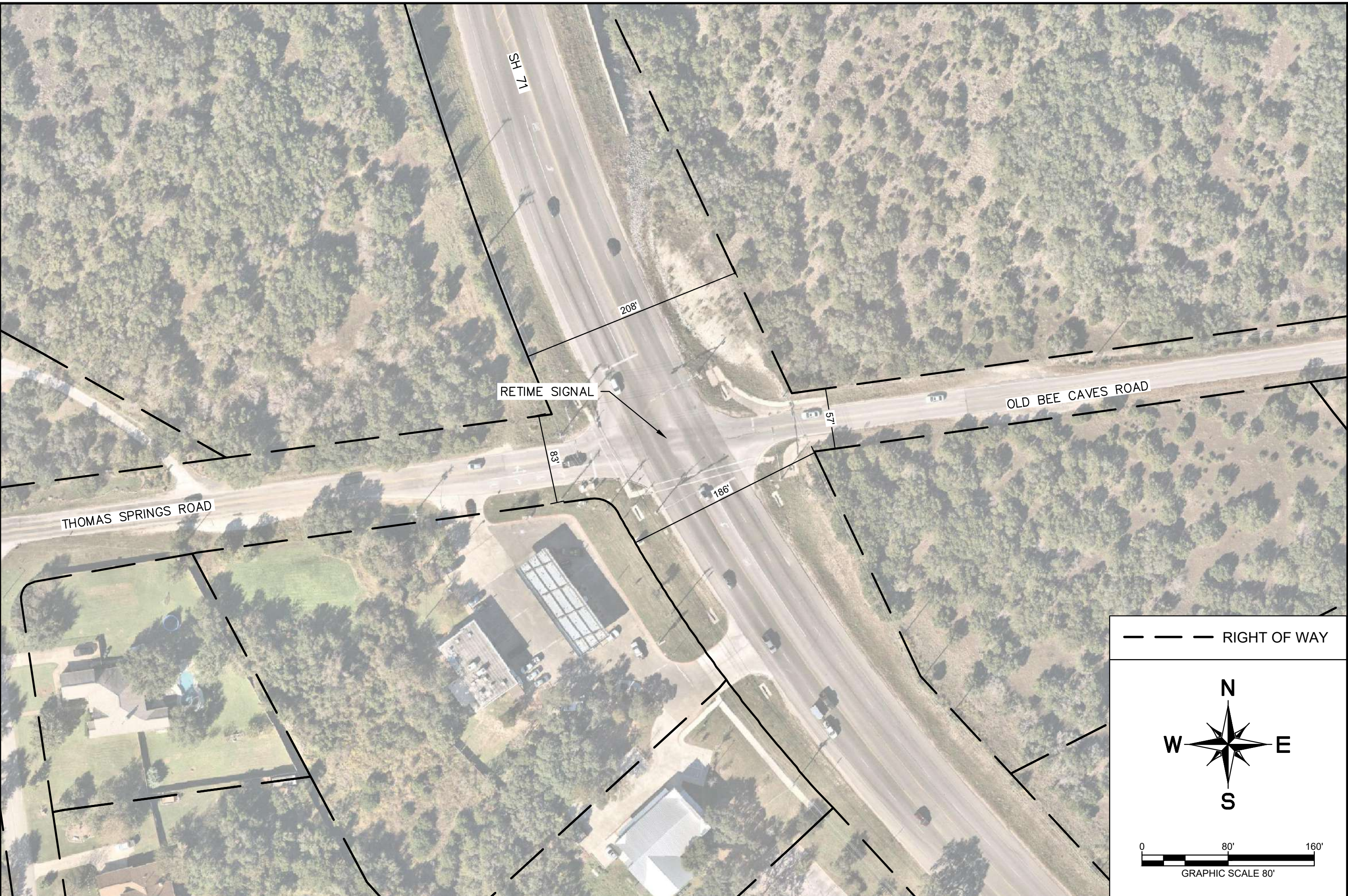
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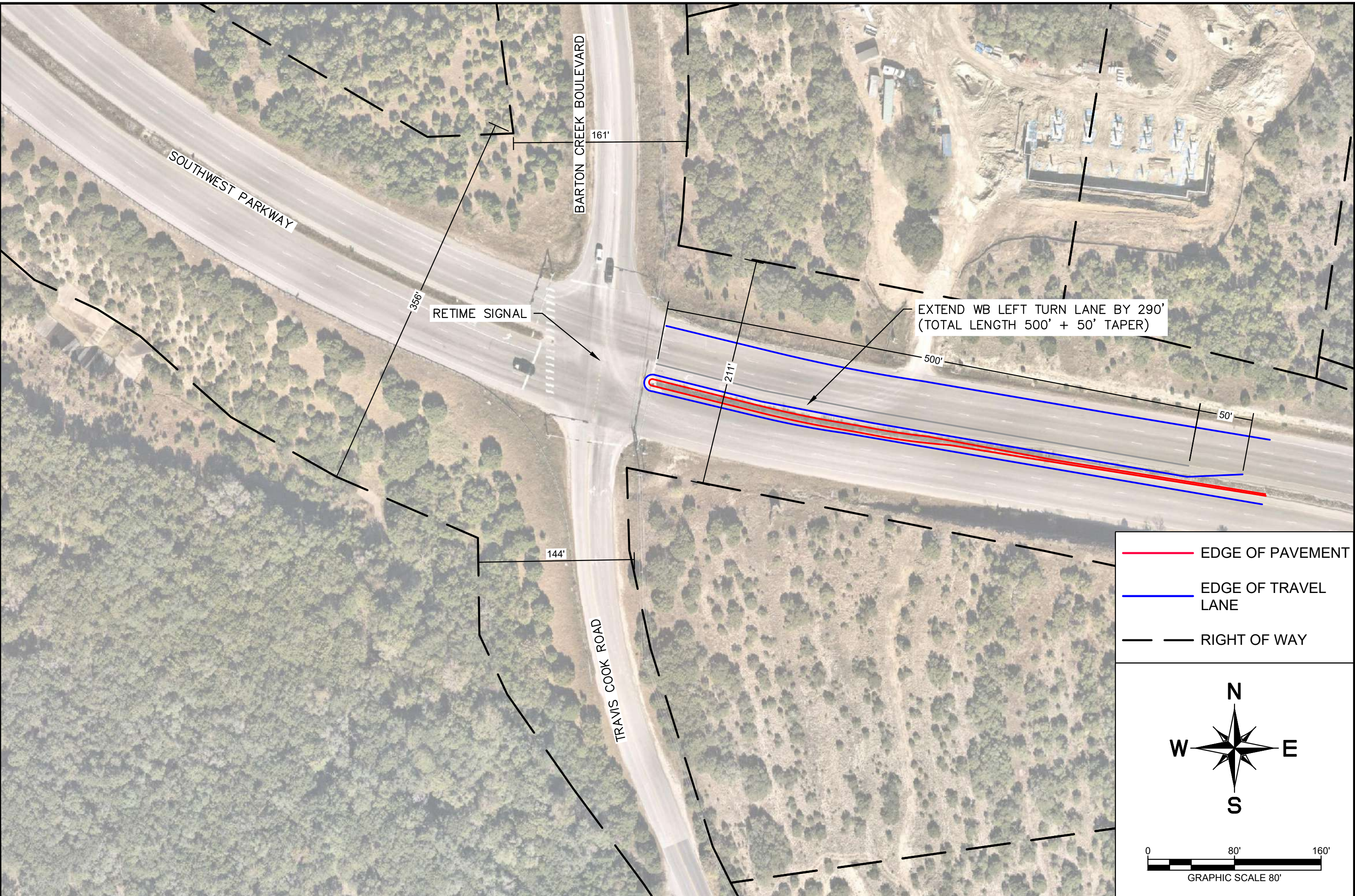
— EDGE OF TRAVEL LANE

— RIGHT OF WAY

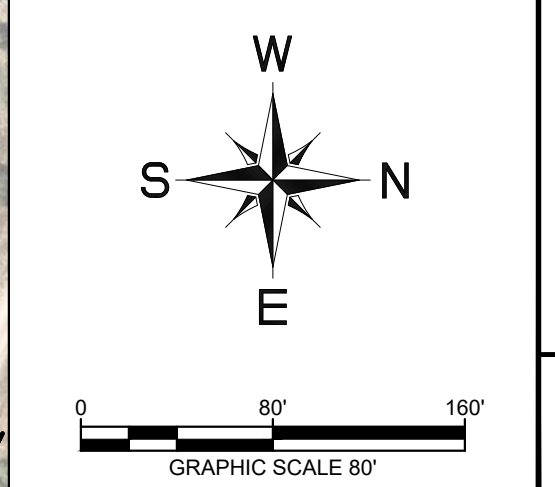
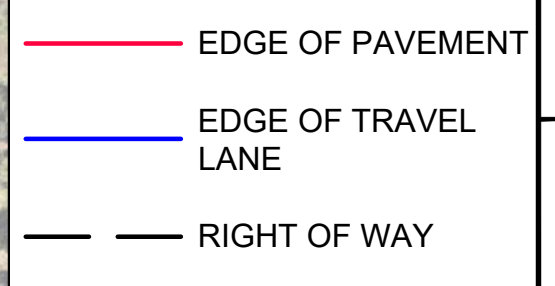
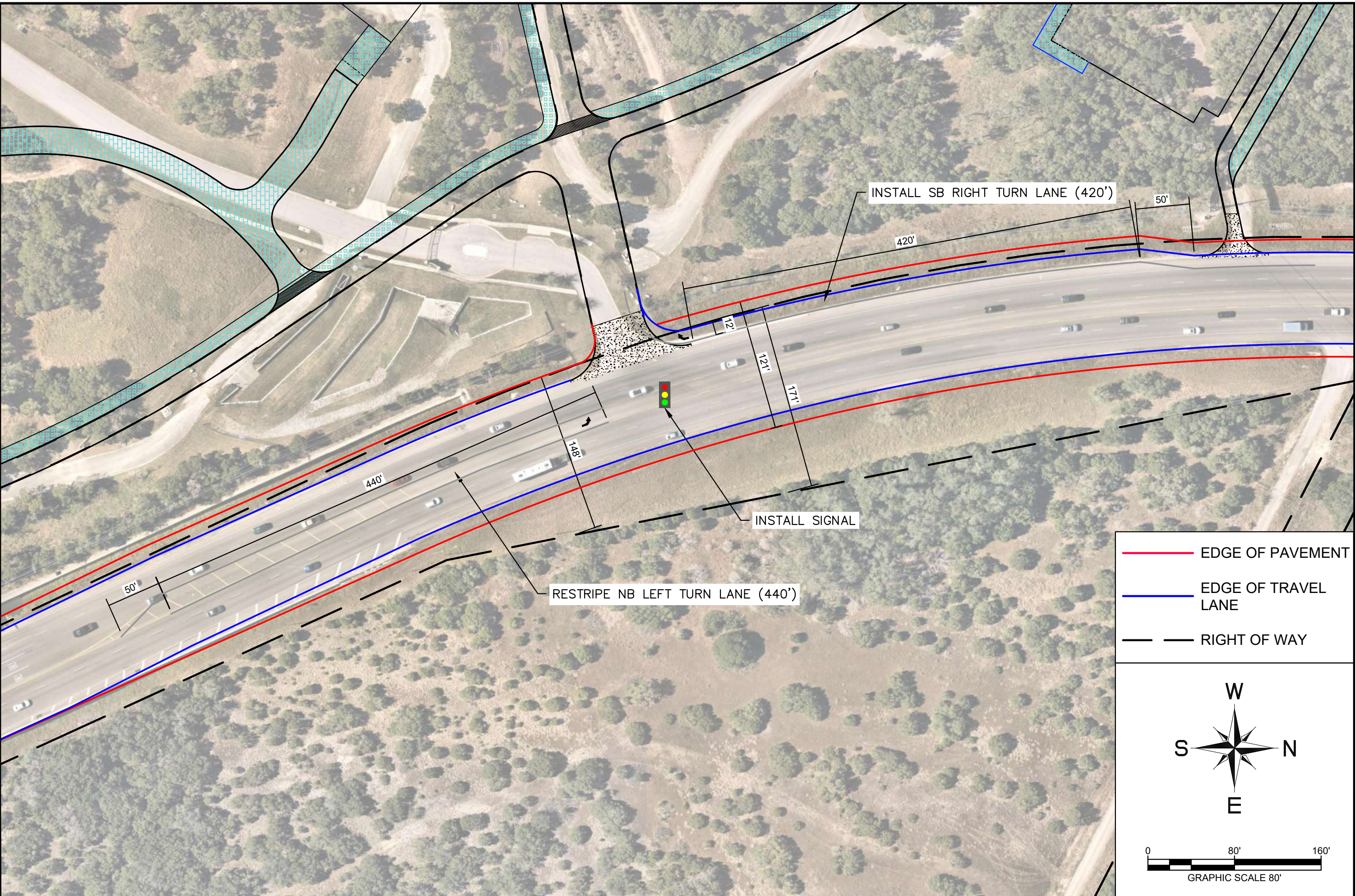
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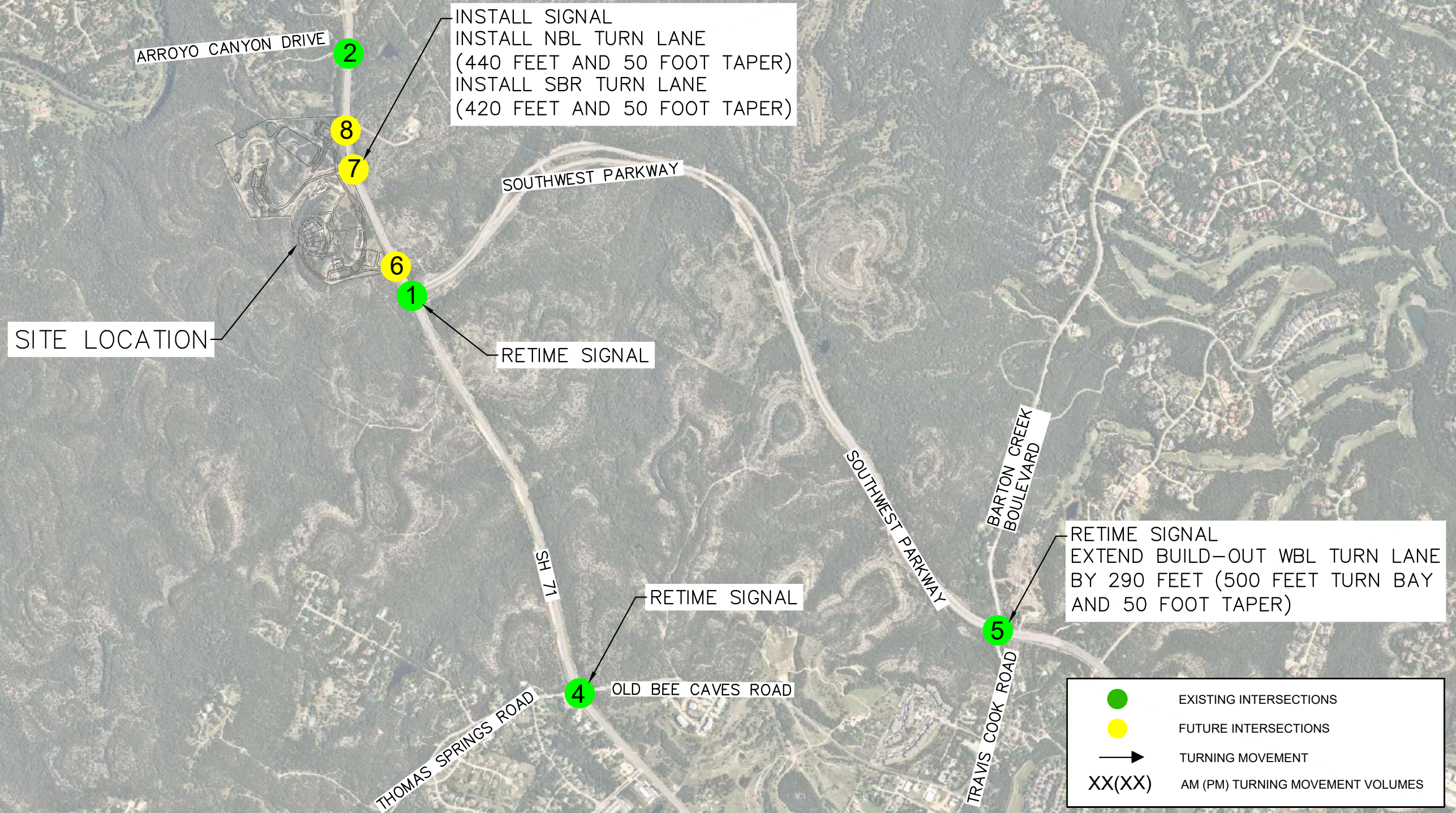
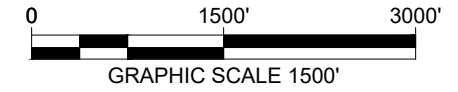
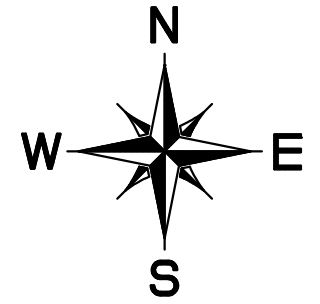
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## INTERSECTION CAPACITY ANALYSIS

Kimley-Horn conducted a traffic operations analysis to determine potential capacity deficiencies in 2024 at the study intersections. The acknowledged source for determining overall capacity is the *Highway Capacity Manual*.

### 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 8** shows the definition of level of service for signalized and unsignalized intersections. LOS D is the threshold for acceptable operations for signalized intersections.

**Table 8 – Level of Service**

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 for signalized intersections. For the unsignalized analysis, the level of service (LOS) is defined for each controlled approach.

Where possible, HCM 6<sup>th</sup> analysis is used. For intersections not possible to analyze using HCM 6<sup>th</sup>, HCM 2000 is used. Calculations for the level of service at the study intersections are provided in **Appendix G**.

## ANALYSIS RESULTS & MITIGATIONS

### 2021 EXISTING TRAFFIC OPERATIONS

Existing conditions measures of effectiveness (MOEs) are summarized in *Table 9* and *Table 10*.

### 2024 NO BUILD TRAFFIC OPERATIONS

The 2024 No Build condition represents traffic operations if this project is never built. The 2024 No Build conditions also assume traffic growth using the previously discussed growth factor and background projects have been completed.

No Build conditions MOEs are summarized in *Table 9* and *Table 10*.

### 2024 BUILD-OUT TRAFFIC OPERATIONS

Site trips from the proposed project are added to the No Build scenario for the Build-Out scenario.

Build-Out conditions MOEs are summarized in *Table 9* and *Table 10*.

### 2024 BUILD-OUT WITH MITIGATIONS TRAFFIC OPERATIONS

Intersection operations were improved to the acceptable LOS by adding the mitigations identified in the previous section.

2024 Build-Out with Mitigations conditions MOEs are summarized in *Table 9* and *Table 10*.



Table 9 - 2021 and 2024 MOEs (AM)

INTERSECTION	MOVEMENT	2021 Existing AM					2024 No Build AM					2024 Build Out AM					2024 Mitigated AM				
		95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS
1: SH71 & Southwest Pkwy	WBL	9	-	0.04	43.8	D	9	-	0.04	44.0	D	9	-	0.04	44.0	D	10	-	0.02	59.2	E
	WBR	943	-	1.99	0.0	A	1,058	-	2.18	0.0	A	1,122	-	2.28	0.0	A	1,824	-	1.60	0.0	A
	NBT	522	-	1.09	31.1	C	588	-	1.19	46.7	D	620	-	1.23	58.3	E	1,199	-	1.45	36.3	D
	NBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBL	483	TWLTL	1.45	148.7	F	531	TWLTL	1.57	196.5	F	562	TWLTL	1.64	225.1	F	1,065	TWLTL	1.90	141.1	F
	SBT	78	-	0.31	2.0	A	90	-	0.35	2.1	A	98	-	0.38	2.2	A	289	-	0.46	1.6	A
Intersection		-	-	1.70	67.2	E	-	-	1.87	90.0	F	-	-	1.97	104.6	F	-	-	1.74	65.6	E
2: SH71/SH 71 & Arroyo Canyon	EBL	5	-	0.06	32.7	D	5	-	0.07	38.6	E	5	-	0.08	43.3	E	5	-	0.07	39.9	E
	EBT	5	-	0.06	32.7	D	5	-	0.07	38.6	E	5	-	0.08	43.3	E	5	-	0.07	39.9	E
	EBR	5	-	0.06	32.7	D	5	-	0.07	38.6	E	5	-	0.08	43.3	E	5	-	0.07	39.9	E
	NBL	0	TWLTL	0.01	14.3	B	0	TWLTL	0.01	15.7	C	0	TWLTL	0.01	16.9	C	0	TWLTL	0.01	16.9	C
	NBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
Intersection		-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig
3: SH 71 & Spearfish Canyon/Preserve Way	EBL	0	-	0.01	16.9	C	0	-	0.02	18.5	C	0	-	0.02	19.8	C	0	-	0.02	19.8	C
	EBT	0	-	0.01	16.9	C	0	-	0.02	18.5	C	0	-	0.02	19.8	C	0	-	0.02	19.8	C
	EBR	0	-	0.01	16.9	C	0	-	0.02	18.5	C	0	-	0.02	19.8	C	0	-	0.02	19.8	C
	WBL	173	-	5.51	2,933.9	F	193	-	9.57	5,262.2	F	190	-	15.28	8,725.5	F	190	-	15.28	8,725.5	F
	WBT	173	-	5.51	2,933.9	F	193	-	9.57	5,262.2	F	190	-	15.28	8,725.5	F	190	-	15.28	8,725.5	F
	WBR	173	-	5.51	2,933.9	F	193	-	9.57	5,262.2	F	190	-	15.28	8,725.5	F	190	-	15.28	8,725.5	F
	NBL	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A
	NBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	NBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBL	5	TWLTL	0.07	38.0	E	8	TWLTL	0.09	47.3	E	8	TWLTL	0.10	53.6	F	8	TWLTL	0.10	53.6	F
Intersection		-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig
4: SH 71 & Thomas Springs Rd/Old Bee Caves Rd	EBL	0	100	0.00	0.0	A	0	100	0.00	0.0	A	0	100	0.00	0.0	A	0	100	0.00	0.0	A
	EBT	623	-	1.56	315.4	F	729	-	1.98	510.7	F	745	-	2.03	532.8	F	1,184	-	1.57	317.4	F
	EBR	0	-	0.08	18.0	B	0	-	0.08	18.9	B	0	-	0.08	18.9	B	0	-	0.07	25.6	C
	WBL	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	WBT	260	-	1.20	179.6	F	426	-	5.03	2,723.7	F	423	-	5.00	2,706.5	F	593	-	2.81	982.6	F
	WBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	NBL	17	TWLTL	0.16	14.2	B	18	TWLTL	0.18	14.3	B	17	TWLTL	0.20	14.4	B	30	TWLTL	0.21	25.8	C
	NBT	314	-	0.76	24.0	C	418	-	0.89	29.4	C	444	-	0.92	32.5	C	690	-	0.93	51.7	D
	NBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBL	17	250	0.19	15.3	B	32	250	0.53	20.4	C	32	250	0.52	19.9	B	56	250	0.63	37.2	D
Intersection		-	-	1.14	104.4	F	-	-	3.44	452.4	F	-	-	3.44	442.1	F	-	-	1.92	210.6	F

Table 9 - 2021 and 2024 MOEs (AM)

INTERSECTION	MOVEMENT	2021 Existing AM					2024 No Build AM					2024 Build Out AM					2024 Mitigated AM				
		95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS
5: Travis Cook Rd/Barton Creek Blvd & Southwest Pkwy	EBL	148	200	0.94	14.3	B	173	200	1.03	16.7	B	176	200	1.04	17.6	B	189	200	1.18	18.3	B
	EBT	230	-	0.47	13.9	B	253	-	0.50	13.9	B	268	-	0.52	13.9	B	346	-	0.77	14.6	B
	EBR	0	-	0.00	14.1	B	0	-	0.00	14.1	B	0	-	0.00	14.0	B	0	-	0.00	14.8	B
	WBL	74	210	0.47	10.6	B	88	210	0.61	10.5	B	87	210	0.63	10.5	B	157	500	0.81	10.9	B
	WBT	383	-	0.77	17.2	B	429	-	0.80	17.4	B	452	-	0.82	17.6	B	632	-	1.11	19.4	B
	WBR	0	-	0.00	17.8	B	0	-	0.00	18.2	B	0	-	0.00	18.5	B	0	-	0.00	21.8	C
	NBL	0	-	0.00	29.5	C	0	-	0.00	37.0	D	0	-	0.00	38.2	D	0	-	0.00	27.3	C
	NBT	596	-	3.51	0.0	A	669	-	4.56	0.0	A	658	-	4.11	0.0	A	530	-	1.49	0.0	A
	NBR	119	175	0.64	30.5	C	174	175	0.76	38.8	D	176	175	0.76	40.6	D	146	175	0.50	27.1	C
	SBL	273	TWLTL	0.99	130.4	F	371	TWLTL	1.36	443.9	F	369	TWLTL	1.36	466.1	F	376	TWLTL	1.46	329.6	F
SBT	170	-	0.56	0.0	A	264	-	0.78	0.0	A	262	-	0.79	0.0	A	273	-	0.84	0.0	A	
SBR	0	-	0.00	24.7	C	0	-	0.00	29.0	C	0	-	0.00	29.9	C	0	-	0.00	25.7	C	
Intersection	-	-	1.48	23.7	C	-	-	1.80	43.2	D	-	-	1.72	43.9	D	-	-	1.32	35.9	D	
6: SH71 & DWY1	EBL	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	EBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	NBL	-	-	-	-	-	-	-	-	-	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	
	NBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
Intersection	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	
7: SH71 & DWY2	EBL	-	-	-	-	-	-	-	-	-	580	-	3.41	1,218.9	F	146	-	0.49	41.9	D	
	EBR	-	-	-	-	-	-	-	-	-	580	-	3.41	1,218.9	F	54	-	0.37	44.7	D	
	NBL	-	-	-	-	-	-	-	-	-	50	TWLTL	0.42	27.1	D	177	TWLTL	0.54	48.0	D	
	NBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	351	-	0.71	4.0	A	
	SBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	343	-	0.65	8.0	A	
	SBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	18	450	0.10	5.2	A	
Intersection	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	0.72	8.3	A	
8: SH71 & DWY3	EBL	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	EBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	NBL	-	-	-	-	-	-	-	-	-	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	
	NBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
Intersection	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	

Table 10 - 2021 and 2024 MOEs (PM)

INTERSECTION	MOVEMENT	2021 Existing PM					2024 No Build PM					2024 Build Out PM					2024 Mitigated PM				
		95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS
1: SH71 & Southwest Pkwy	WBL	33	-	0.13	28.9	C	36	-	0.15	29.5	C	37	-	0.15	30.3	C	45	-	0.08	39.2	D
	WBR	813	-	1.72	0.0	A	960	-	1.92	0.0	A	1,055	-	2.06	0.0	A	1,754	-	1.56	0.0	A
	NBT	182	-	0.74	19.1	B	210	-	0.77	19.5	B	230	-	0.80	19.5	B	462	-	0.94	25.7	C
	NBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBL	507	TWLTL	1.34	78.2	E	589	TWLTL	1.50	127.2	F	642	TWLTL	1.61	172.7	F	1,197	TWLTL	1.96	52.7	D
	SBT	218	-	0.65	4.0	A	255	-	0.70	4.3	A	277	-	0.72	4.4	A	807	-	0.95	3.6	A
Intersection		-	-	1.45	33.9	C	-	-	1.61	51.2	D	-	-	1.72	67.3	E	-	-	1.52	26.0	C
2: SH71/SH 71 & Arroyo Canyon	EBL	10	-	0.14	75.4	F	15	-	0.18	101.6	F	18	-	0.21	119.7	F	18	-	0.21	119.7	F
	EBT	10	-	0.14	75.4	F	15	-	0.18	101.6	F	18	-	0.21	119.7	F	18	-	0.21	119.7	F
	EBR	10	-	0.14	75.4	F	15	-	0.18	101.6	F	18	-	0.21	119.7	F	18	-	0.21	119.7	F
	NBL	3	TWLTL	0.02	26.4	D	3	TWLTL	0.03	31.5	D	3	TWLTL	0.03	35.0	D	3	TWLTL	0.03	35.0	D
	NBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
Intersection		-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig
3: SH 71 & Spearfish Canyon/Preserve Way	EBL	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	EBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	EBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	WBL	115	-	3.08	1,753.7	F	128	-	5.77	3,534.9	F	128	-	9.25	5,965.9	F	128	-	9.25	5,965.9	F
	WBT	115	-	3.08	1,753.7	F	128	-	5.77	3,534.9	F	128	-	9.25	5,965.9	F	128	-	9.25	5,965.9	F
	WBR	115	-	3.08	1,753.7	F	128	-	5.77	3,534.9	F	128	-	9.25	5,965.9	F	128	-	9.25	5,965.9	F
	NBL	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A
	NBT	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	NBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBL	5	TWLTL	0.06	18.1	C	5	TWLTL	0.07	20.9	C	5	TWLTL	0.08	23.5	C	5	TWLTL	0.08	23.5	C
Intersection		-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig
4: SH 71 & Thomas Springs Rd/Old Bee Caves Rd	EBL	0	100	0.00	0.0	A	0	100	0.00	0.0	A	0	100	0.00	0.0	A	0	100	0.00	0.0	A
	EBT	372	-	1.15	133.8	F	443	-	1.45	259.9	F	463	-	1.53	294.4	F	608	-	0.93	184.4	F
	EBR	0	-	0.08	18.2	B	0	-	0.09	18.3	B	0	-	0.09	18.3	B	0	-	0.08	28.1	C
	WBL	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	WBT	319	-	0.82	35.5	D	658	-	1.93	482.9	F	663	-	2.01	527.2	F	1,188	-	4.66	364.1	F
	WBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	NBL	24	TWLTL	0.42	18.7	B	26	TWLTL	0.45	19.9	B	26	TWLTL	0.45	19.9	B	43	TWLTL	0.32	46.8	D
	NBT	112	-	0.34	17.1	B	127	-	0.43	18.0	B	142	-	0.47	18.4	B	258	-	0.43	32.5	C
	NBR	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A	0	-	0.00	0.0	A
	SBL	57	250	0.30	14.8	B	70	250	0.43	15.4	B	70	250	0.46	15.9	B	202	250	0.82	21.3	C
Intersection		-	-	1.06	50.7	D	-	-	1.46	159.0	F	-	-	1.53	177.0	F	-	-	1.31	126.8	F

Table 10 - 2021 and 2024 MOEs (PM)

INTERSECTION	MOVEMENT	2021 Existing PM					2024 No Build PM					2024 Build Out PM					2024 Mitigated PM				
		95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS	95% QUEUE (ft)	TURN BAY LENGTH (ft)	V/C RATIO	DELAY (s)	LOS
5: Travis Cook Rd/Barton Creek Blvd & Southwest Pkwy	EBL	38	200	0.32	11.9	B	40	200	0.37	12.1	B	39	200	0.38	12.3	B	39	200	0.38	12.3	B
	EBT	284	-	0.69	16.7	B	321	-	0.72	17.3	B	343	-	0.74	17.7	B	343	-	0.74	17.7	B
	EBR	0	-	0.00	16.9	B	0	-	0.00	17.7	B	0	-	0.00	18.1	B	0	-	0.00	18.1	B
	WBL	262	210	1.30	17.4	B	379	210	1.62	33.0	C	400	210	1.70	38.6	D	400	500	1.70	38.6	D
	WBT	289	-	0.65	14.9	B	316	-	0.67	15.4	B	335	-	0.68	15.7	B	335	-	0.68	15.7	B
	WBR	0	-	0.00	15.2	B	0	-	0.00	15.7	B	0	-	0.00	16.0	B	0	-	0.00	16.0	B
	NBL	0	-	0.00	21.5	C	0	-	0.00	22.2	C	0	-	0.00	22.1	C	0	-	0.00	22.1	C
	NBT	184	-	1.21	0.0	A	271	-	1.90	0.0	A	268	-	1.76	0.0	A	268	-	1.76	0.0	A
	NBR	72	175	0.39	22.4	C	98	175	0.45	22.8	C	98	175	0.46	22.8	C	98	175	0.46	22.8	C
	SBL	439	TWLTL	1.23	290.8	F	537	TWLTL	1.49	645.1	F	549	TWLTL	1.51	622.2	F	549	TWLTL	1.51	622.2	F
	SBT	461	-	1.01	0.0	A	586	-	1.21	0.0	A	599	-	1.22	0.0	A	599	-	1.22	0.0	A
SBR	0	-	0.00	30.2	C	0	-	0.00	40.1	D	0	-	0.00	39.5	D	0	-	0.00	39.5	D	
Intersection	-	-	1.29	39.8	D	-	-	1.69	71.7	E	-	-	1.71	68.6	E	-	-	1.71	68.6	E	
6: SH71 & DWY1	EBL	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	EBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	NBL	-	-	-	-	-	-	-	-	-	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	
	NBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
Intersection	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	
7: SH71 & DWY2	EBL	-	-	-	-	-	-	-	-	-	895	-	3.14	1,041.7	F	163	-	0.65	36.2	D	
	EBR	-	-	-	-	-	-	-	-	-	895	-	3.14	1,041.7	F	54	-	0.45	40.4	D	
	NBL	-	-	-	-	-	-	-	-	-	273	TWLTL	1.34	265.3	F	175	TWLTL	0.70	47.2	D	
	NBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	193	-	0.51	4.4	A	
	SBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	730	-	1.01	24.8	C	
	SBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	27	450	0.14	8.2	A	
Intersection	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	0.89	18.7	B	
8: SH71 & DWY3	EBL	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	EBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	NBL	-	-	-	-	-	-	-	-	-	0	TWLTL	0.00	0.0	A	0	TWLTL	0.00	0.0	A	
	NBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBT	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
	SBR	-	-	-	-	-	-	-	-	-	0	-	0.00	0.0	A	0	-	0.00	0.0	A	
Intersection	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	-	-	N/A - Unsig	N/A - Unsig	N/A - Unsig	

## ROAD SIZING ANALYSIS

Per the project scope, a roadway sizing analysis must be performed for this development as a part of this study to determine the most appropriate size and type of roadway for the following roadways:

- SH 71 from Arroyo Canyon Drive to Old Bee Cave Road/Thomas Springs Road
- Thomas Springs Road from SH 71 to Circle Drive
- All connecting internal roadways

The Austin Transportation Criteria Manual (TCM) was used to perform the road sizing analyses.

Projected peak hour volumes for the 2024 Build-Out Scenario were used to compare the average daily traffic (ADT) to TCM. Link ADT was calculated by taking the highest combination of turning movements at each end of the segment. A k-factor of 0.09 was then used to calculate daily traffic from peak hour traffic. ADT calculations can be found in **Appendix L. Table 11** shows the 2024 daily bi-directional traffic based on peak hour factors along SH 71, Thomas Springs Road, Driveway 2, and Driveway 3. Driveway 1 was not analyzed since it is an emergency access only driveway.

**Figure 13** shows Figure 1-37E from the TCM which most closely matches the current lane geometry of SH 71 between Arroyo Canyon Drive and Southwest Parkway. The maximum ADT acceptable for this cross section is 35,500 vehicles per day. The ADT volumes on SH 71 between Arroyo Canyon Drive and Southwest Parkway currently exceed and are expected in 2024 to exceed the maximum of 35,500 vehicles per day; therefore, a four-lane cross section is not adequate for this highway. It is proposed to expand SH 71 between Arroyo Canyon Drive and Southwest Parkway to a six-lane cross section, like Figure 1-38 from the TCM, shown in **Figure 14**. The maximum ADT acceptable for this cross section is 53,250 vehicles per day. The ADT volumes on SH 71 between Arroyo Canyon Drive and Southwest Parkway currently exceed and are not expected in 2024 to exceed the maximum of 53,250 vehicles per day; therefore, a six-lane cross section is adequate for this highway.

**Figure 15** shows Figure 1-36A from the TCM which most closely matches the current lane geometry of SH 71 between Southwest Parkway and Old Bee Cave Road/Thomas Springs Road. The maximum ADT acceptable for this cross section is 34,000 vehicles per day. The ADT volumes on SH 71 between Southwest Parkway and Old Bee Cave Road/Thomas Springs Road are not expected in 2024 to exceed the maximum of 34,000 vehicles per day; therefore, a four-lane cross section is adequate for this highway.

**Figure 15** shows Figure 1-34C from the TCM which most closely matches the current lane geometry of Thomas Springs Road, Driveway 2, and Driveway 3. The maximum ADT acceptable for this cross section is 15,250 vehicles per day. The ADT volumes on Thomas Springs Road, Driveway 2, and Driveway 3 are not expected in 2024 to exceed the maximum of 15,250 vehicles per day; therefore, two-lane cross sections are adequate for these roadways.

Thomas Springs Road currently has a pavement width of about 22 feet for most of its length. This pavement width would be considered insufficient according to the TCM cross-section. However, road widening is infeasible for this section. There is insufficient right of way along most of the roadway, and there are overhead power poles along both sides of the roadway within 30 ft of each other. In addition, site traffic along this roadway is 3 percent or less during both peak hours. Therefore, a widening of Thomas Springs Road is not recommended.

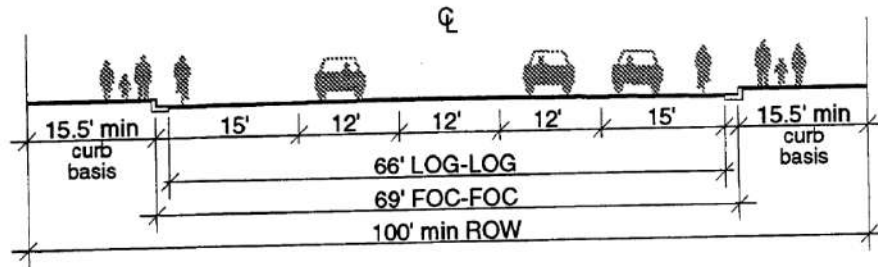
**Table 11 – 2024 Road Sizing Analysis Results**

Roadway Segment	SH 71 from Arroyo Canyon Drive to Driveway 2	SH 71 from Driveway 2 to Southwest Parkway	SH 71 from Southwest Parkway to Old Bee Cave Road/Thomas Springs Road	Thomas Springs Road from SH 71 to Circle Drive	Driveway 2 from SH 71 to Internal	Driveway 3 from SH 71 to Internal
AM (ADT)	50,167	50,406	24,605	10,660	4,428	239
PM (ADT)	52,122	51,907	25,331	11,274	5,385	263
<b>Maximum (ADT)</b>	<b>52,122</b>	<b>51,907</b>	<b>25,331</b>	<b>11,274</b>	<b>5,385</b>	<b>263</b>
Existing Geometry	5 Lane w/ TWLTL	5 Lane w/ TWLTL	4 Lane	2 Lane	2 Lane	2 Lane
Proposed Geometry	6 Lane	5 Lane w/ TWLTL	4 Lane	2 Lane	2 Lane	2 Lane

**Figure 13: TCM Figure 1-37E Design Criteria for MAD 4: Four Lanes, Divided Major Arterial Streets with Two-Way Left-Turn Lane and Shared Wide Curb Lanes**

Typical ADT Range, 5000-35500  
 Design speed, 45 mph  
 Typical Spacing Between Intersections, 1300'  
 Minimum Centerline Radius, See Page 1-8  
 Minimum Tangent Length Between Horizontal Curves, 200'  
 Minimum Curb Basis, 15.5'

### TYPICAL CROSS-SECTION

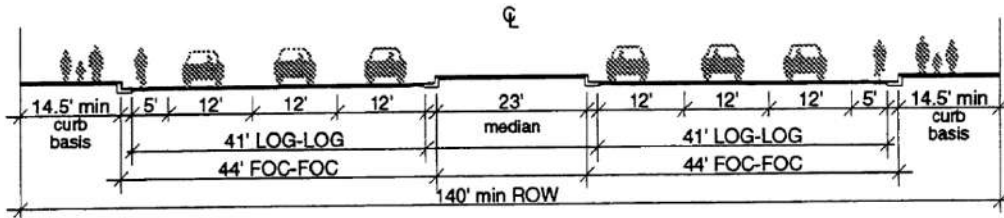


Source: City of Austin Department of Public Works and Transportation

**Figure 14: TCM Figure 1-38 Design Criteria for MAD 6: Six Lanes, Divided Major Arterial Streets with Bike Lanes and Raised Median**

Typical ADT Range, 18000-53250  
 Design speed, 50 mph  
 Typical Spacing Between Intersections, 1300'  
 Minimum Centerline Radius, See Page 1-8  
 Minimum Tangent Length Between Horizontal Curves, 200'  
 Minimum Curb Basis, 14.5'

### TYPICAL CROSS-SECTION



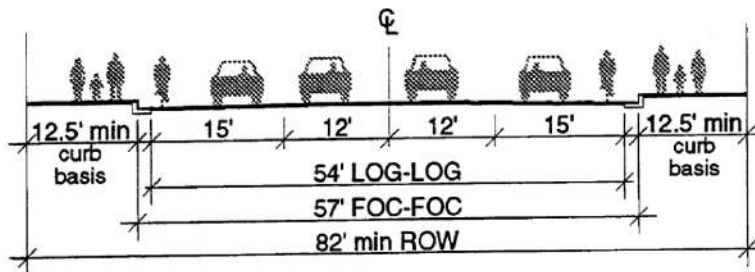
Source: City of Austin Department of Public Works and Transportation



**Figure 15: TCM Figure 1-36A Design Criteria for MAU 4: Four Lanes, Undivided Major Arterial Streets with Shared Wide Curb Lanes**

Typical ADT Range, 3900-34000  
 Design speed, 45 mph  
 Typical Spacing Between Intersections, 1000'  
 Minimum Centerline Radius, See Page 1-8  
 Minimum Tangent Length Between Horizontal Curves, 150'  
 Minimum Curb Basis, 12.5'

### TYPICAL CROSS-SECTION

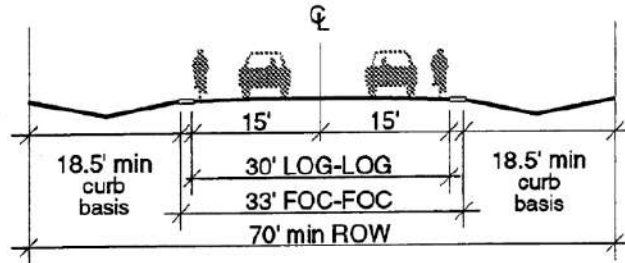


Source: City of Austin Department of Public Works and Transportation

Figure 16: TCM Figure 1-34C Design Criteria – Minor Arterial

Typical ADT Range, 1750-15250  
Design speed, 45 mph  
Typical Spacing Between Intersections, 1000'  
Minimum Centerline Radius, See Page 1-8  
Minimum Tangent Length Between Horizontal Curves, 150'  
Minimum Curb Basis, 18.5'

### TYPICAL CROSS-SECTION



Source: City of Austin Department of Public Works and Transportation

## TURN LANE ANALYSIS

TxDOT defines right turn deceleration auxiliary lane thresholds as 50 vehicles per hour for roads with a posted speed of greater than 45 mph and 60 vehicles per hour for roads with a posted speed of less than or equal to 45 mph. SH 71, a TxDOT road, has a posted speed limit of 55 mph. TxDOT's guidelines for left turn lanes consist of an analysis of advancing traffic volume, the percent of this volume that is left turning, and opposing volume. For driveways with fewer than the minimum threshold of right- or left-turning vehicles per hour, a right- or left-turn auxiliary deceleration lane is not required. The detailed TxDOT analysis for both driveways is provided in **Appendix H**.

Results of the analysis for both the morning and afternoon peak periods for is summarized below:

- Driveway 1 & SH 71
  - Left-turn lane not analyzed – no left-turning traffic into the driveway.
  - Right-turn lane not analyzed – no right-turning traffic into the driveway.
- Driveway 2 & SH 71
  - Left-turn lane warranted.
  - Right-turn lane warranted.
- Driveway 3 & SH 71
  - Left-turn lane not analyzed – no left-turning traffic into the driveway.
  - Right-turn lane not warranted.

## ADDITIONAL ANALYSIS

To determine the impact of the development, the following additional analysis were completed at intersection and roadways per the approved scope:

- Sight distance analysis
- Signal warrant analysis
- Queuing analysis

A safety/geometric review and access management analysis were not included in the project's scope. The subsequent sections detail the results of each of this analysis.

### 2024 SIGHT DISTANCE ANALYSIS

As SH 71 is a TxDOT roadway, American Association of State Highway and Transportation Officials (AASHTO) guidelines for sight distance were utilized in this analysis. Initial site observations indicate that adequate Stopping Sight Distance (SSD) is possible at all site driveways. Per AASHTO, SSD should be measured from a 3.5-foot height of the driver's eye (as they are approaching the proposed driveway) to an object 3.5 feet above the roadway surface (located at the proposed driveway). Per the AASHTO document *A Policy on Geometric Design of Highways and Streets*, a passenger car approaching any site driveway needs a desirable minimum of 495 feet of SSD.

Aerial photography and vertical contours were used to determine SSD for vehicles traveling along SH 71 to Driveways 1-3. Existing contours are also available for the proposed location. Figures showing the Intersection Sight Distance and Vertical Sight Distance are included in ***Appendix I***.

When the signal design at the intersection at SH 71 & Driveway 2 is completed, the engineer should determine if sight distance is adequate. Per the MUTCD, when sight distance is not adequate at a signalized intersection, supplemental signal faces and/or supplemental warning beacons should be used. If required, these solutions to sight distance issues are not expected to add significant cost to the design or construction of the proposed signal.

## 2024 SIGNAL WARRANT ANALYSIS

Per the project scope, a signal warrant analysis was performed for the 2021 existing, 2024 no build, and 2024 build-out conditions for Driveways 1, 2, and 3. All three driveways are future intersections which were analyzed for build-out conditions only. In addition, neither Driveway 1 nor Driveway 3 has any outbound traffic, meaning there are no minor street volumes at either driveway. The only signal warrant performed was for Driveway 2 build-out conditions.

The peak hour counts and 24-hour counts used for analysis are in **Appendix C**. The signal warrant analysis reports and volume projections are provided in **Appendix J**, and the results are summarized as follows:

Driveway 2 meets signal warrants 1, 2, and 3 in the build-out analysis scenario. Therefore, a traffic signal **is recommended** for the intersection beginning in the build-out condition (2024). This intersection should be signalized based on real counts and should not be signalized if the Violet Crown development is not complete and generating sufficient traffic volumes. The volume warrants are summarized in **Table 12** for each of the 2024 analysis scenarios.

In addition to the scoped intersections, 2024 no build and build-out signal warrant analysis was considered for the intersections of SH 71 & Arroyo Canyon Drive and SH 71 & Preserve Way based on unacceptable LOS for these stop-controlled intersections. However, volumes at these two intersections are well below the threshold to satisfy any signal warrants. At SH 71 & Arroyo Canyon Drive, side street traffic in build-out conditions is fewer than 10 vehicles in each peak hour. At SH 71 & Preserve Way, side street traffic in build-out conditions is fewer than 30 vehicles in each peak hour. Since both 10 and 30 peak hour vehicles are below all warrant thresholds, warrant analyses were not performed for these intersections.

A pro-rata cost share for the traffic signal was calculated based on the percentage of site traffic compared to the total traffic present at the overall intersection in the peak hour build-out scenario. The pro-rata cost share is provided in **Table 13**. The pro-rata cost share for this signal is based on the percentage of site traffic compared to the total traffic present at the overall intersection in the peak hour build-out scenario.

**Table 12 – 2024 Signal Warrant Analysis Summary**

Warrant		2024 No Build		2024 Build-Out	
		Condition Met	Hours Satisfied	Condition Met	Hours Satisfied
<b>SH 71 &amp; Driveway 2</b>					
1A	8-Hour Vehicular Volume Condition A (Minor Street Volumes)	N/A	N/A	Yes	12
1B	8-Hour Vehicular Volume Condition B (Major Street Volumes)	N/A	N/A	Yes	15
2	4-Hour Vehicular Volume	N/A	N/A	Yes	15
3B	Peak-Hour	N/A	N/A	Yes	13

## QUEUING ANALYSIS

When evaluating the traffic operations in the study area, the queue lengths were calculated using *Synchro 11*<sup>TM</sup>. The queue lengths are summarized for the AM and PM peak hours in the Analysis Results & Mitigation section in **Table 9** and **Table 10**, respectively. The queues shown in red are projected to exceed capacity.

All queues that exceed capacity were mitigated and shown to be at or below the No Build in the Build-Out Mitigated 2024 scenario.

The lengths of proposed turn lanes were determined based on the maximum 95<sup>th</sup> percentile queue, TxDOT design requirements, AASHTO design requirements, and existing geometries.

## RECOMMENDATIONS, MITIGATIONS, AND CONCLUSIONS

This study analyzes traffic impacts of the proposed Violet Crown development located in the ETJ of City of Austin, Travis County, Texas. The scenarios studied include – Existing conditions, 2024 No Build, and 2024 Build-Out.

Analysis of the 2024 Build-Out scenario showed some study intersections operate below acceptable LOS D. To restore operating conditions to acceptable LOS, the following mitigations are recommended:

- SH 71 & Southwest Parkway
  - a. Retime signal.
- SH 71 & Old Bee Caves Road / Thomas Springs Road
  - a. Retime signal.
- Southwest Parkway & Barton Creek Boulevard / Travis Cook Road
  - a. Retime signal.
  - b. Extend westbound left turn lane by 290 feet (500' turn bay and 50' taper).
- SH 71 & Site Driveway 2
  - a. Install traffic signal.
  - b. Restripe northbound approach to create northbound left turn lane (440' turn bay and 50' taper).
  - c. Install southbound right turn lane (420' turn bay and 50' taper).
- SH 71 – Based on sub-standard roadway cross section
  - a. Addition of one lane per direction between Southwest Parkway and Arroyo Canyon Drive – Approximately 3,500 feet (**Appendix L**).

The above intersection mitigations bring most movements to an acceptable LOS or reduce delay below No Build conditions where feasible. It should be noted that the intersection of SH 71 & Southwest Parkway is projected to perform with failing LOS and delays greater than the no build analysis scenario for the WBL movement in the AM scenario. However, the AM peak WBL volume is only 4 vehicles. The V/C ratio for this movement is 0.55, and there are no signal timing improvements which can be made to reduce all movements to an acceptable LOS or reduce delay below No Build conditions. It does not make sense to utilize geometric improvements to reduce delay for four vehicles during one peak hour.

It should also be noted that the intersections of SH 71 & Arroyo Canyon Drive and SH 71 & Preserve Way are also projected to perform with failing LOS and delays greater than the no build analysis scenario. However, volumes at these two intersections are well below the threshold to satisfy any signal warrants. At SH 71 & Arroyo Canyon Drive, side street traffic is fewer than 10 vehicles in each peak hour. At SH 71 & Preserve Way, side street traffic is fewer than 30 vehicles in each peak hour. No other geometric improvements were found to improve each movements' LOS to an acceptable level.

For the above mitigation measures, the total contribution by the developer is broken down in **Table 13**. Pro-rata values are shown with the traffic volume calculations in **Appendix F**.

**Table 13 – Mitigation Cost Estimate**

Intersection	Approach	Mitigation Measure	Unit Cost	Total Estimated Cost	% Site Traffic at Location	Pro-Rata Cost Share
SH 71 from Southwest Parkway to Arroyo Canyon Drive		Widen roadway from 4 lane section to 6 lane section (~3,500')	\$400 per linear lane-foot	\$2,800,000	5%	\$ 152,330
SH 71 & Southwest Parkway	All	Retime Signal	\$5,000 per signal	\$5,000	5%	\$ 270
SH 71 & Old Bee Caves Road / Thomas Springs Road	All	Retime Signal	\$5,000 per signal	\$5,000	4%	\$ 216
Southwest Parkway & Barton Creek Boulevard / Travis Cook Road	All	Retime Signal	\$5,000 per signal	\$5,000	3%	\$ 170
	WB	Extend westbound left turn lane by 290 feet (500' turn bay and 50' taper)	\$400 per linear lane-foot	\$136,000	4%	\$ 5,315
SH 71 & Site Driveway 2	All	Install Signal	\$350,000 per signal	\$350,000	10%	\$ 34,600
	NB	Restripe approach for northbound left turn lane (440' turn bay and 50' taper)	Site access improvements to be built by the developer.			
	SB	Install southbound right turn lane (420' turn bay and 50' taper)	Site access improvements to be built by the developer.			
<b>TOTAL</b>				<b>\$3,301,000</b>	<b>-</b>	<b>\$ 192,901</b>



## CERTIFICATION STATEMENT

I hereby certify that this report complies with the County Code and with applicable technical requirements of Travis County and is complete to the best of my knowledge.

KIMLEY-HORN AND ASSOCIATES

A handwritten signature in blue ink that reads "Santiago A. Araque Rojas". The signature is written in a cursive style.

Santiago Araque, P.E.  
Project Manager