

**TRAFFIC IMPACT ANALYSIS FOR
PARKSIDE SUBDIVISION
NEW BRAUNFELS, TEXAS**

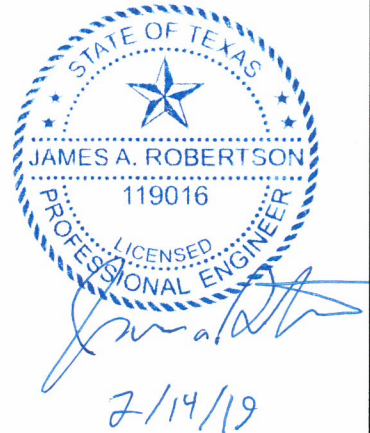
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EXECUTIVE SUMMARY

This traffic study was conducted to analyze traffic impacts of the proposed Parkside Subdivision located on the southeast side of Pieper Road approximately 0.5 miles north of SH 46 in the City of New Braunfels Extraterritorial Jurisdiction (ETJ) within Guadalupe County, Texas. The proposed development consists of up to 950 residential lots (single-family detached housing) on two tracts totaling approximately 220.84 acres and one existing single-family home on one tract totaling 22.85 acres.

The proposed Parkside Subdivision (Unit 1 thru Unit 8) consists of up to 950 lots of single-family detached housing (ITE Code 210). The development is expected to generate a total of 703 AM peak hour trips and 941 PM peak hour trips. Access will be provided by realigning the existing Pieper Road through the property and extending the existing Avery Ranch Road to connect with the realigned Pieper Road.

The existing single-family home (Unit 9) is part of the existing conditions and is not included in the analyses because it is not being modified by the proposed development.

The analysis indicates all of the study intersections currently operate at an acceptable level of service. Under Build-Out Year (2025) Background traffic conditions, the intersections are anticipated to continue operating at an acceptable level of service.

Under Build-Out Year (2025) Total traffic volumes, the analysis results indicate that all of the study intersections are anticipated to operate at an acceptable level of service except for SH 46 at Pieper Road.

The analysis indicates the following mitigation strategies are capable of mitigating the traffic impacts of site traffic on the intersection of SH 46 and Pieper Road under Build-Out Year (2025) Total traffic volumes:

- Right-turn deceleration for northbound traffic turning from SH 46 onto Pieper Road.
- Dedicated left-turn only lane for traffic turning from westbound Pieper Road to go south on SH 46.
- Signalization of the intersection of SH 46 and Pieper Road.

The development traffic prompts a need to consider a right-turn deceleration lane after the development consists of more than 40 residential lots.

The development traffic prompts a need to consider a dedicated left-turn only lane when the development consists of more than 45 residential lots.

The development traffic prompts a need to consider a traffic signal when the development consists of more than 385 residential lots.

INTRODUCTION

This traffic study was conducted to analyze the traffic impacts of the proposed Parkside Subdivision located on the southeast side of Pieper Road approximately 0.5 miles north of SH 46 in the City of New Braunfels Extraterritorial Jurisdiction (ETJ) within Guadalupe County, Texas. The proposed development consists of up to 950 residential lots (single-family detached housing) on two tracts totaling approximately 220.84 acres and one existing single-family home on one tract totaling 22.85 acres.

The existing land use for the proposed development is Agricultural/Pre-Development. The proposed land use is planned development district. A map of the study area and available study area land uses are shown in **Figure 1**. The parcels without zoning or mater plan information are outside the City of New Braunfels and are part of the ETJ within Guadalupe County.

Access to the Parkside Subdivision (Unit 1 through Unit 8) will be provided by realigning the existing Pieper Road through the proposed development and extending the existing Avery Ranch Road into the development. Access to the existing Single-Family home (Unit 9) will be provided by the existing driveway on SH 46 located approximately 1,500 feet south of Pieper Road. A site plan for this facility is shown in **Figure 2** and a larger format is provided in **Appendix A**.

This study includes the following elements:

Data Collection

- Current (July 2018) AM and PM peak-hour turning movement counts collected at:
 - SH 46 at Pieper Road.
 - Pieper Road at Avery Ranch Road.
 - Pieper Road at Dauer Ranch Road.
- Twenty-four (24) hour bi-direction volume counts on:
 - Pieper Road south of Avery Ranch Road.
 - SH 46 south of Pieper Road.
- The proposed site plan was obtained from the project engineer.
- Lee Engineering staff conducted field observations and gathered other relevant information.

Traffic Analysis

- Assessed the general accessibility of the site.
- Estimated the number of trips that will be generated by the proposed development.
- Estimated the directional distribution of traffic approaching/departing the development.
- Assigned the estimated site traffic to the proposed street network.
- Performed capacity analyses for the critical intersections within the study area.

Recommendations

- Determined if any roadway improvements are needed to accommodate projected traffic generated by the proposed development.

Documentation

- Prepared this report documenting the study procedures and results.

Figure 1. Impact Area and Existing Land Use.

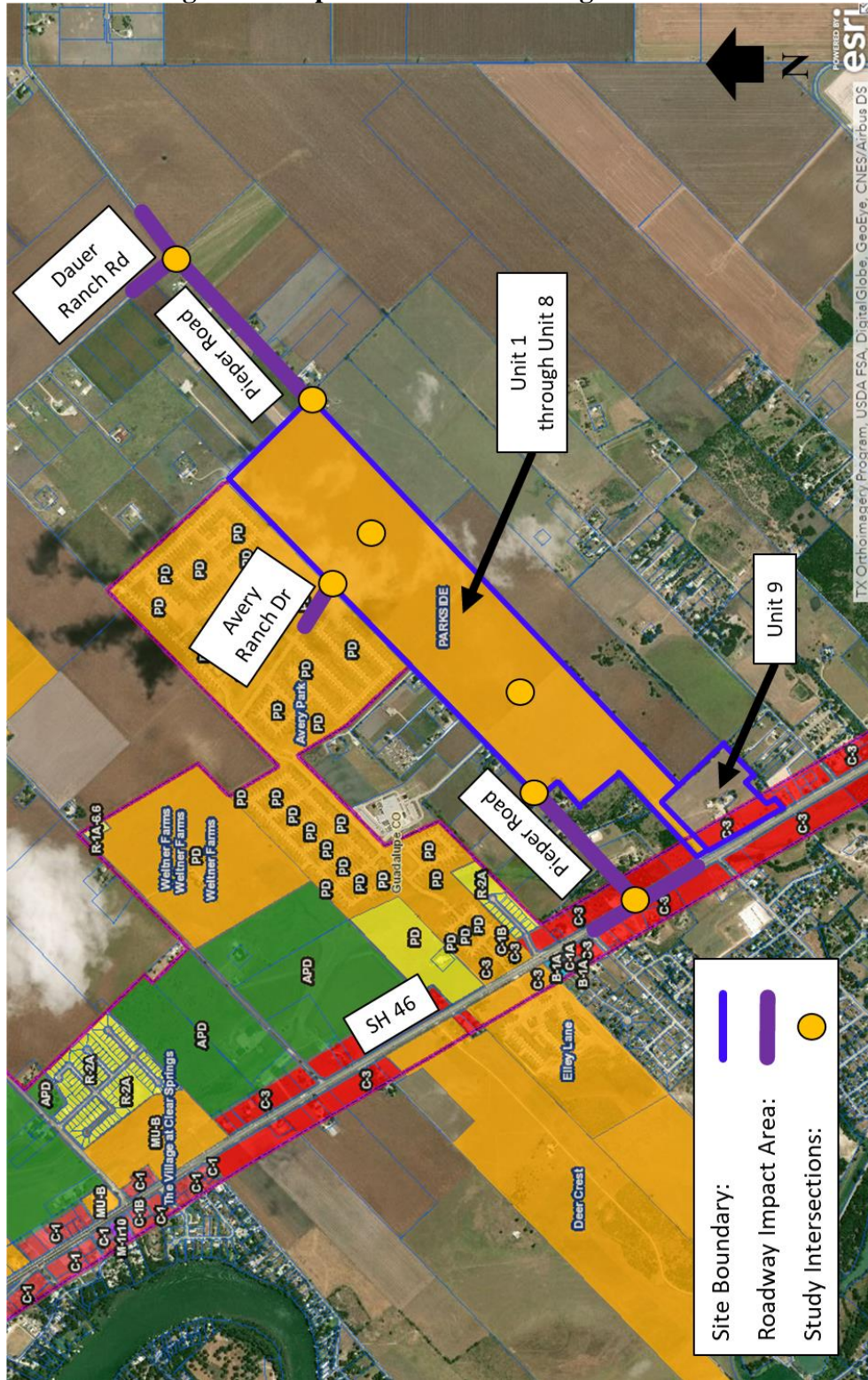
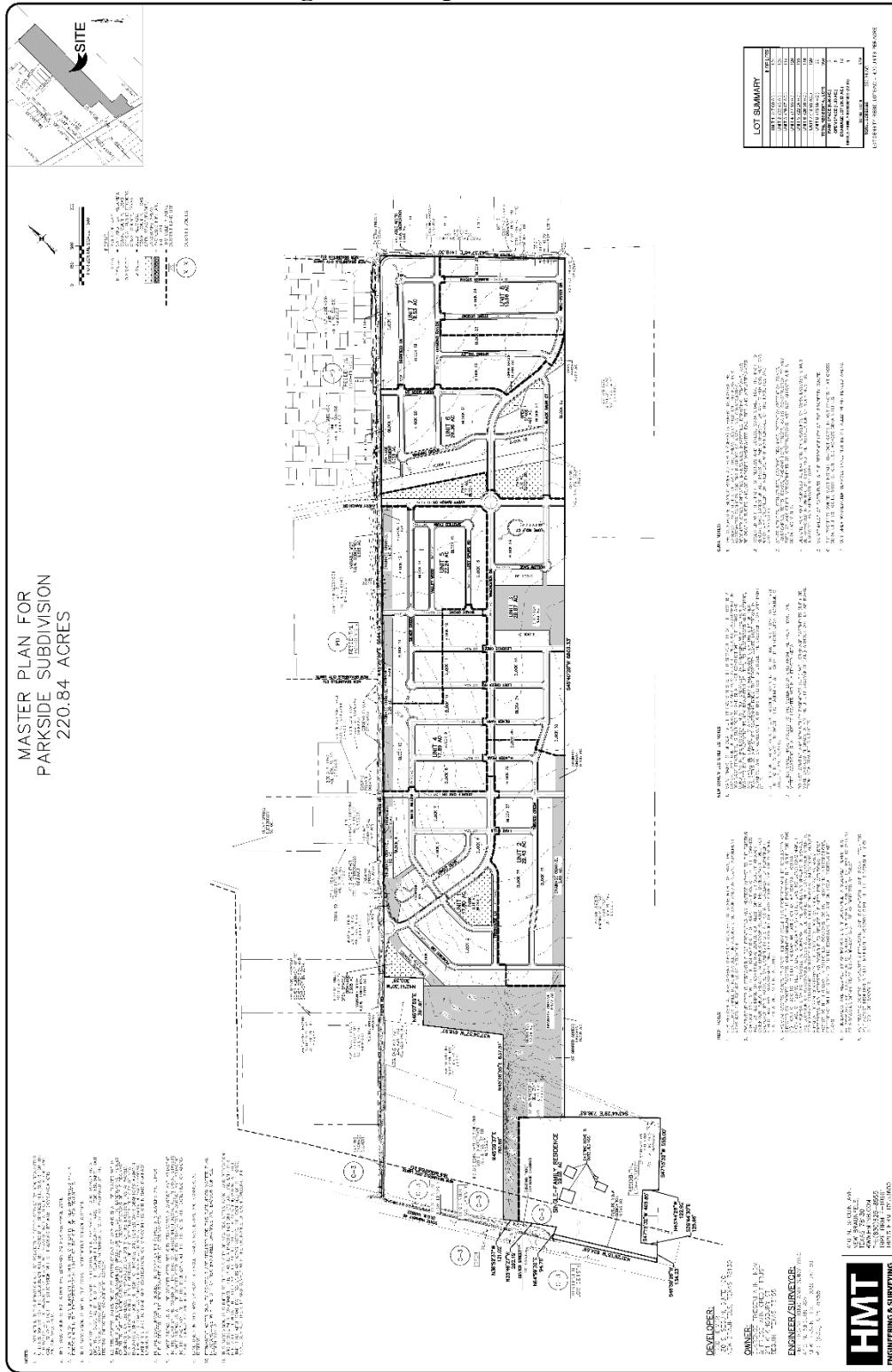


Figure 2. Proposed Site Plan.



SITE ACCESSIBILITY AND STUDY IMPACT AREA

Site accessibility describes the means by which people (vehicles) can get to and from a development. A site's accessibility is affected by the geographical location of the development with respect to other activity areas, the roadway system, and other physical constraints.

Access to the Parkside Subdivision (Unit 1 thru Unit 8) will be provided by realigning the existing Pieper Road through the property and extending the existing Avery Ranch Road to connect with the realigned Pieper Road. Access to the existing single-family home (Unit 9) will remain as it is in the existing condition.

Impact Area

The impact area for this traffic study was established during a scoping meeting that occurred on July 19, 2018. The meeting was held in the New Braunfels Public Works Conference Room and began at approximately 2:07 PM. A summary of the meeting minutes along with the sign in sheet is provided in **Appendix B**. These minutes were emailed to meeting attendees on July 20, 2018.

From the scoping meeting minutes, the impact area of the proposed development was extended from one-quarter mile to approximately 0.5 miles in order to include the following existing intersections:

- SH 46 at Pieper Road.
- Pieper Road at Avery Ranch Dr.
- Pieper Road at Dauer Ranch Road.

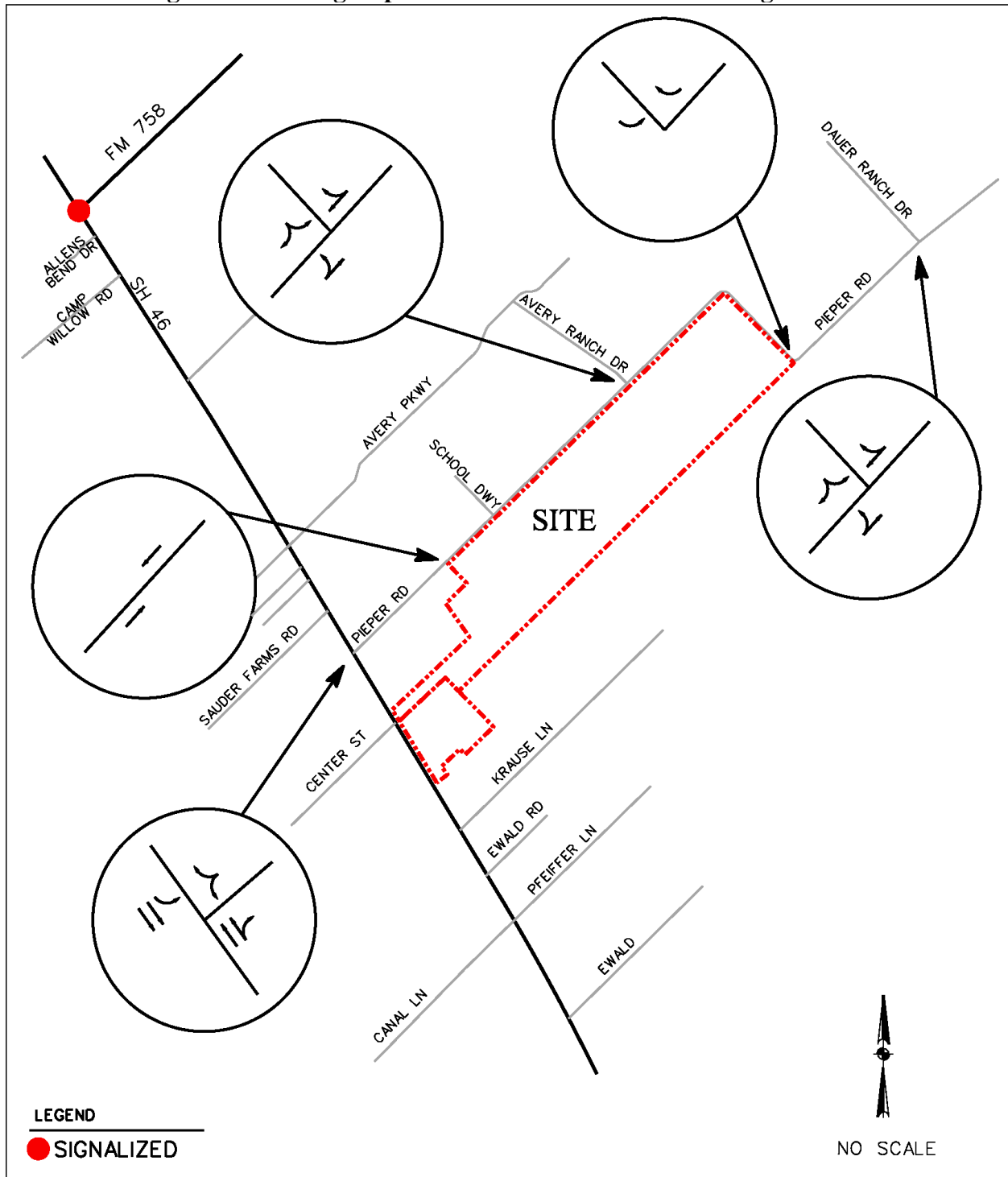
The impact area for this traffic study also includes the following development access points and internal intersections:

- Southwestern connection to the existing Pieper Road (Pieper Road at Winchester Drive approximately 0.5 miles north of SH 46).
- Northwestern connection to the existing Pieper Road (Pieper Road at Winchester Drive approximately 0.5 miles south of Dauer Ranch Road).
- Proposed Collector street at the extension of Avery Ranch Road.
- Proposed Collector Street at any proposed Roundabout.

The existing lane configuration at the study intersections is provided in **Figure 3**. A map of the impact area is provided in Figure 1.

Note: The driveway for the existing single-family home (Unit 9) is not included in the analyses because it is part of the existing conditions and is not being modified by the proposed development.

Figure 3. Existing Impact Area Intersection Lane Configurations.



Existing Roadway Configurations and Adjacent Land Use

There are four existing roadways within the impact area, they are:

- Pieper Road.
- State Highway 46 (SH 46).
- Avery Ranch Road.
- Dauer Ranch Road.

The following sections discuss the existing roadways and the land uses adjacent to these roadways.

Pieper Road

Pieper Road forms the northwest and northeast boundary of the proposed Parkside development.

Pieper Road is a 2-lane undivided roadway with one lane in each direction. The roadway surface is asphalt and it is approximately 23 feet in width with open ditch drainage. A photo of the existing Pieper Road is provided in **Figure 4**.

Pieper Road has a posted speed limit of 30 mph from SH 46 until approximately 2,300 feet past Avery Ranch Road, where the posted speed limit becomes 35 mph. It is classified as a Principal Arterial on the City of New Braunfels 2012 Regional Transportation Plan.

As shown in Figure 1, the existing land use on the northwest and northeast side of Pieper Road includes:

- Clear Spring Elementary School.
- Agricultural/Pre-Development (within the ETJ).
- Planned Development District (Avery Ranch).
- Rural residential single-family homes (within the ETJ).

Figure 4. Pieper Road Northeast of SH 46 Facing Northeast



State Highway 46 (SH 46)

State Highway 46 (SH 46) is a TxDOT maintained roadway that is approximately 0.5 miles southwest of the southwest access to the proposed Parkside Development. It also forms the southwestern boundary of the existing single-family home (Unit 9).

SH 46 is a 5-lane roadway with a center two-way left-turn lane and 2 travel lanes in each direction. The center two-way left-turn lane has a width of approximately 14 feet, the inside lanes have a width of approximately 12 feet, and the outside lanes have a width of approximately 14 feet. The pavement surface is asphalt with open ditch drainage. The roadway does not include curbs or shoulders within the study area. A photo of the existing SH 46 is provided in **Figure 5**.

SH 46 has a posted speed limit of 60 mph within the study impact area and it is classified as a Principal Arterial within the City of New Braunfels 2012 Regional Transportation Plan.

As shown in Figure 1, the existing land use and zoning along SH 46 includes:

- Commercial District (C-3).
- Planned Development District.
- Neighborhood Business District (C-1A).
- Conventional and Manufactured Home District (B-1A).
- Rural residential single-family homes.

Figure 5. State Highway 46 South of Pieper Road Facing Northwest.



Avery Ranch Road.

Avery Ranch Road intersects Pieper Road approximately 1.0 miles northeast of SH 46 at a location adjacent to the proposed development.

Avery Ranch Road is a 2-lane undivided roadway with one lane in each direction. The roadway surface is asphalt and it is approximately 28 feet in width with curb and gutter drainage. The roadway has sidewalks on both sides of the street. A photo of the existing Avery Ranch Road is provided in **Figure 6**.

Avery Ranch Road has a statutory speed limit of 30 mph within the study impact area and it is classified as a Minor Collector within the City of New Braunfels 2012 Regional Transportation Plan.

As shown in Figure 1, the existing land use and zoning along SH 46 includes:

- Planned Development District (Avery Ranch).

Figure 6. Avery Ranch Road North of Pieper Road Facing Southeast.



Dauer Ranch Road

Dauer Ranch Road is a county-maintained road that intersects with Pieper Road approximately 0.5 miles northeast of the proposed development.

Dauer Ranch Road is a 2-lane undivided roadway with one lane in each direction. The roadway surface is asphalt and it is approximately 23 feet in width with open ditch drainage. A photo of the existing Dauer Ranch Road is provided in **Figure 7**.

Dauer Ranch Road has a posted speed limit of 35 mph and is classified as Principal Arterial within the City of New Braunfels 2012 Regional Transportation Plan.

As shown in Figure 1, the roadway is in the New Braunfels ETJ and the existing land use includes:

- Agricultural/Pre-Development.
- Rural residential single-family homes (within the ETJ).

Figure 7. Dauer Ranch Road Northwest of Pieper Road Facing Northwest.

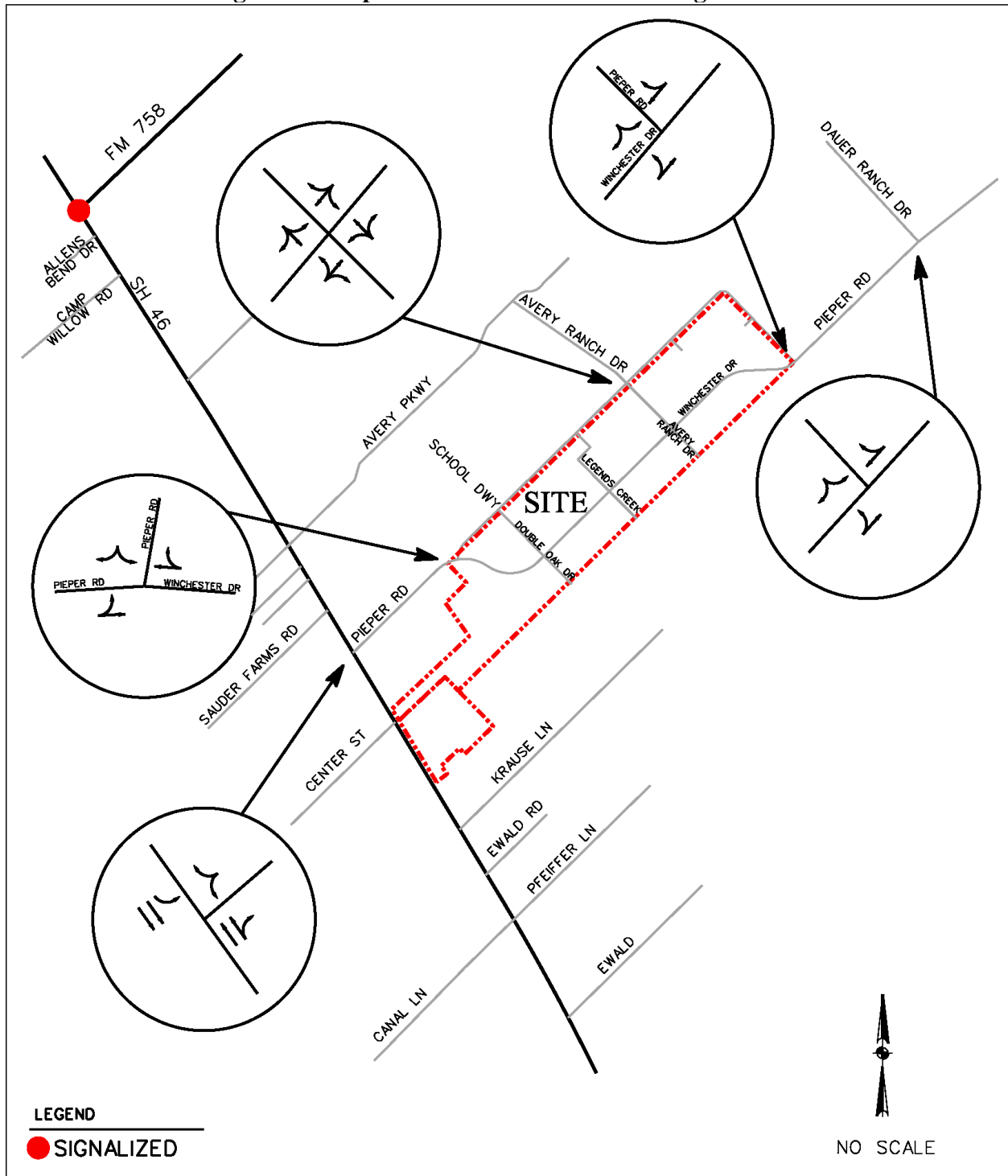


Proposed Impact Area Roadway Configurations

The existing land use for the proposed development is Agricultural/Predevelopment. The proposed land use is single-family detached housing within a Planned Development District.

The proposed impact area lane configurations are shown in **Figure 8**.

Figure 8. Proposed Intersection Lane Configurations.



PROPOSED DEVELOPMENT

The proposed Parkside Subdivision (Unit 1 thru Unit 8) consists of up to 950 residential lots (dwelling units) on two tracts totaling approximately 220.84 acres. The anticipated Build-Out Year for the proposed Parkside Subdivision is 2025. The existing land use is Agricultural/Pre-Development.

The number of vehicle trips generated by the proposed developments were estimated based on the trip generation rates provided in the *Trip Generation Manual, Tenth Edition*, which is published by the Institute of Transportation Engineers. The number of trips generated by the development is a function of the type and quantity of the land use characteristics within the development. Estimates of the number of trips generated by the site were made for the Average Weekday, the AM peak hour of the adjacent street, and the PM peak hour of the adjacent street.

Table 1 shows the trip generation rates, the directional splits, and the estimated number of trips for the proposed development. The City of New Braunfels Trip Generation Worksheet is provided in **Appendix C**. Trips for the existing Single-Family home (Unit 9) are not included in the trip generation because they are part of the existing background traffic.

Table 1. Trip Generation Characteristics for Proposed Development.

Rates ¹										
Description	ITE Code	Average Weekday			AM Peak Hour			PM Peak Hour		
Single-Family Detached Housing	210	T = 9.44*(X)			T = 0.74*(X)			T = 0.99*(X)		
Directional Split ²										
Description	ITE Code	Average Weekday			AM Peak Hour			PM Peak Hour		
Single-Family Detached Housing	210	50% / 50%			25% / 75%			63% / 37%		
Number of Trips										
Land Use	Variable	Average Weekday			AM Peak Hour			PM Peak Hour		
		Total	In	Out	Total	In	Out	Total	In	Out
Single-Family Detached Housing	950 Dwelling Units	8,968	4,484	4,484	703	176	527	941	593	348
Total Volume Added to Adjacent Streets		8,968	4,484	4,484	703	176	527	941	593	348

¹T = Trips Ends; X = Number of Dwelling Units (Lots)

²XX / YY = % entering vehicles / % exiting vehicles

TRAFFIC VOLUMES

Existing Traffic Volumes

Bi-directional 24-hour traffic volume counts were collected for Pieper Road and SH 46 on Tuesday, July 24, 2018. Turning movement counts were collected at the study intersection on Tuesday, July 24, 2018 during the AM (7:00 to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods.

From these data the peak one-hour AM and PM volumes were extracted that conform to the one-hour periods of 7:00 to 8:00 AM and 5:00 to 6:00 PM. These peak hours are consistent with the peak hour traffic volumes on Pieper Road. These data are shown in **Figure 9** as Existing (2018) Traffic Volumes. The raw traffic count data is provided in **Appendix D**.

Adjustment for Clear Spring Elementary School Traffic

The existing traffic volume data were collected during the summer when Clear Spring Elementary was not in session. To adjust for the missing school traffic, an estimated number of trips was determined using trip generation rates and equations provided in the *Trip Generation Manual, 10th Edition*, by the Institute of Transportation Engineers (ITE). Estimates of the number of trips generated were developed for the average weekday, AM Peak hour of the adjacent street, and PM Peak hour of the adjacent street. The trip generation rates and the directional splits for Clear Spring Elementary are shown in **Table 2**.

The estimated school traffic was assigned to the roadways using the directional distribution shown in **Figure 10**. The build year school traffic volume is shown in **Figure 11**. Because this traffic volume was determined through trip generation, the volumes in Figure 11 reflect both Existing (2018) and Build Year (2025) traffic volumes.

Figure 12 shows the Existing (2018) Traffic Volumes adjusted to include the estimated Clear Spring Elementary traffic.

Table 2. Trip Generation Characteristics for Clear Spring Elementary.

Rates ¹										
Description	ITE Code	Average Weekday			AM Peak Hour			PM Peak Hour		
Elementary School	520	T = 21.00*(X)			T = 7.21*(X)			T = 1.78*(X)		
Directional Split ²										
Description	ITE Code	Average Weekday			AM Peak Hour			PM Peak Hour		
Elementary School	520	50% / 50%			53% / 47%			48% / 52%		
Number of Trips										
Land Use	Variable	Average Weekday			AM Peak Hour			PM Peak Hour		
		Total	In	Out	Total	In	Out	Total	In	Out
Elementary School	60 Employees	1,260	630	630	433	229	204	107	51	56
Total Volume Added to Adjacent Streets		1,260	630	630	433	229	204	107	51	56

¹T = Trips Ends; X = Number of Employees (staff)

²XX / YY = % entering vehicles / % exiting vehicles

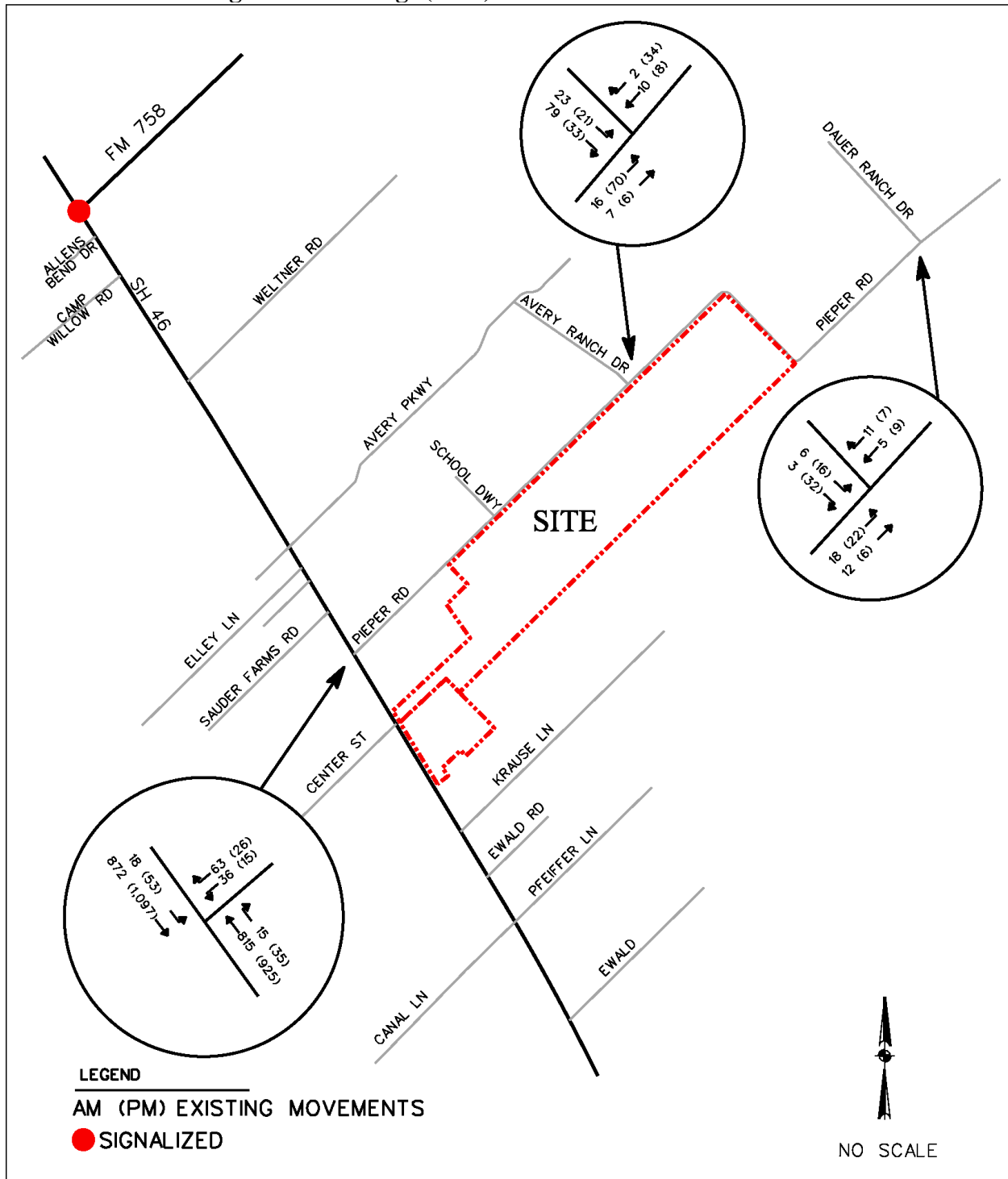
Background Traffic Volumes

Historical 24-hour traffic volumes in the study area were obtained from TxDOT traffic count maps. These volumes are presented in **Table 3**. Based upon these traffic volumes, a growth rate of approximately two percent (2.0%) was used to determine the background traffic volume in the build-out year (2025). **Figure 13** shows the Build-Out Year (2025) Background traffic volumes with School Traffic at the study intersections.

Table 3. Historical Traffic Counts.

Year	Location
	SH 46 north of FM 128
2014	24,573
2015	26,162
2016	25,797
Average Growth	2.0%

Figure 9. Existing¹ (2018) Peak Hour Traffic Volumes.



¹Data collected on Tuesday, July 24, 2018

Figure 10. Estimated School Traffic Directional Distributions.

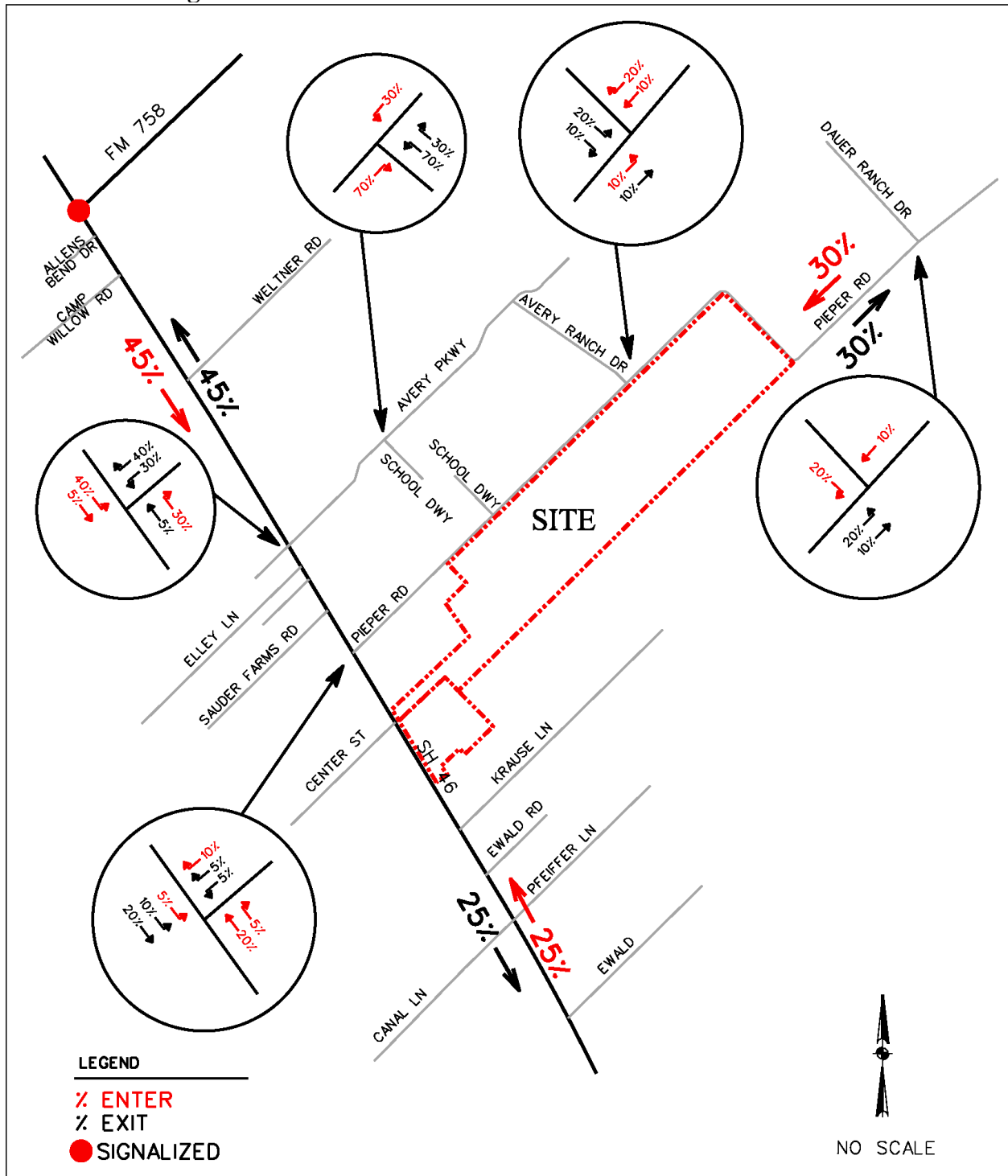


Figure 11. Estimated 2018 and 2025 School Peak Hour Traffic Volumes.

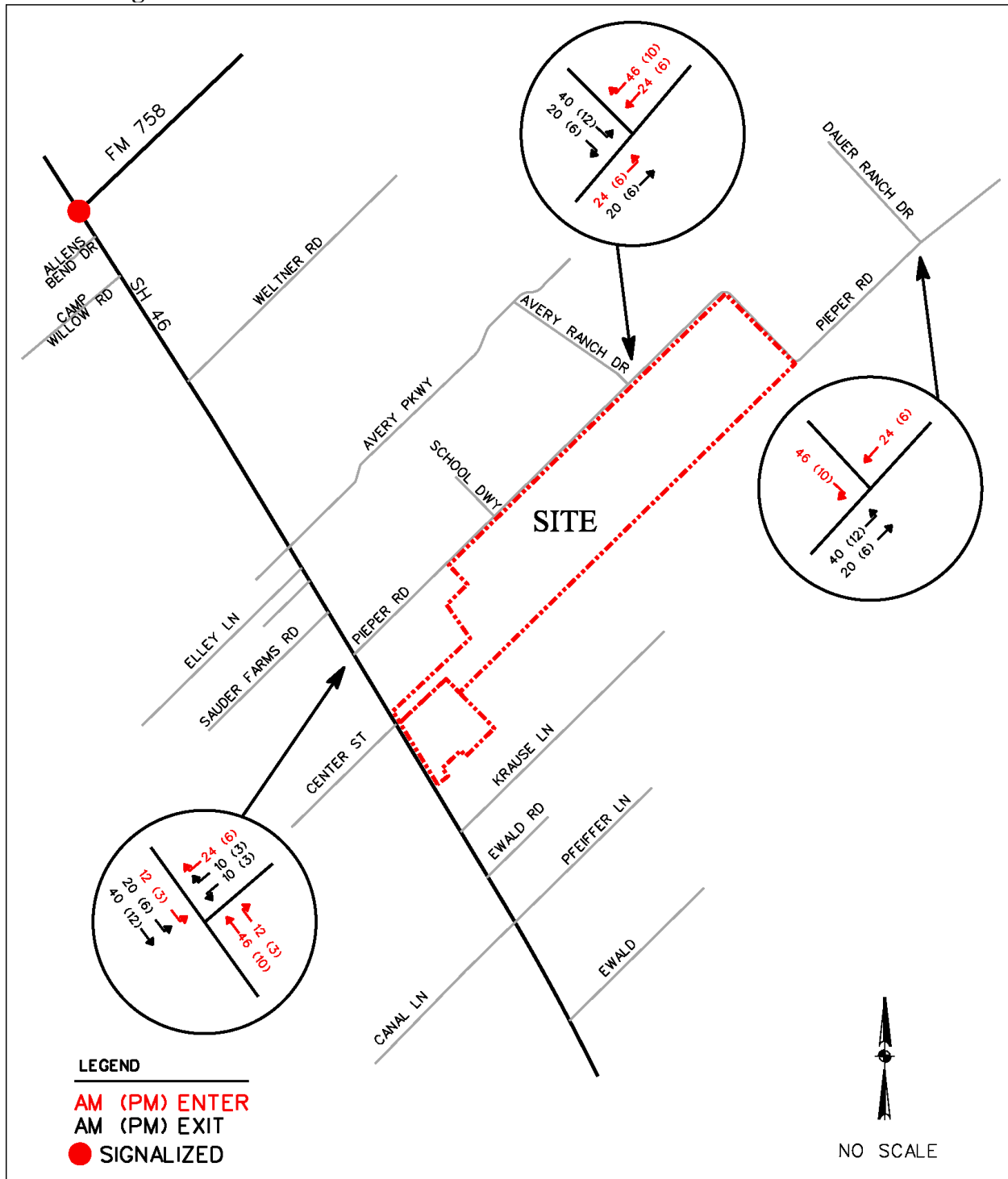


Figure 12. Existing (2018) Peak Hour Traffic Volumes with School Traffic.

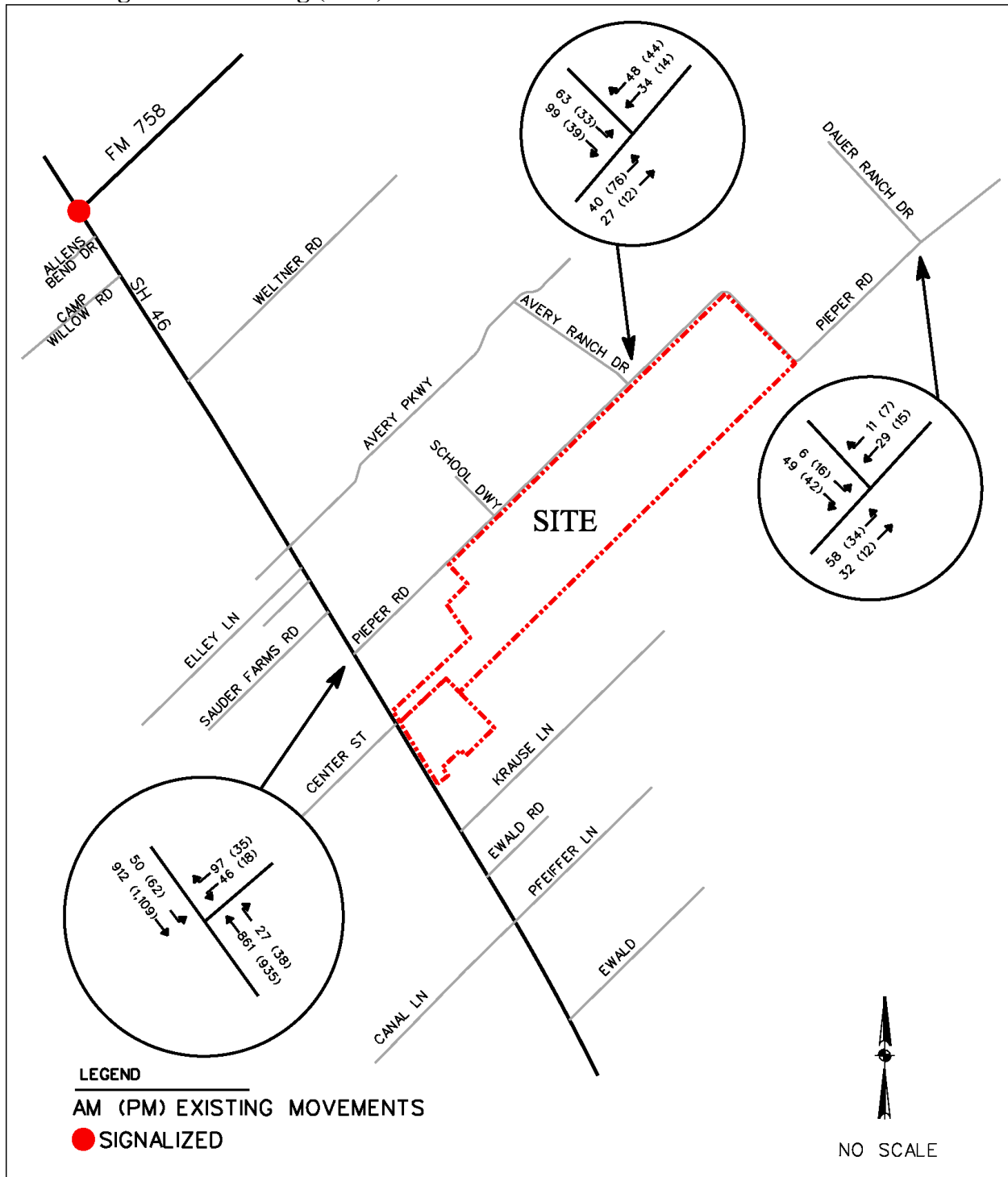
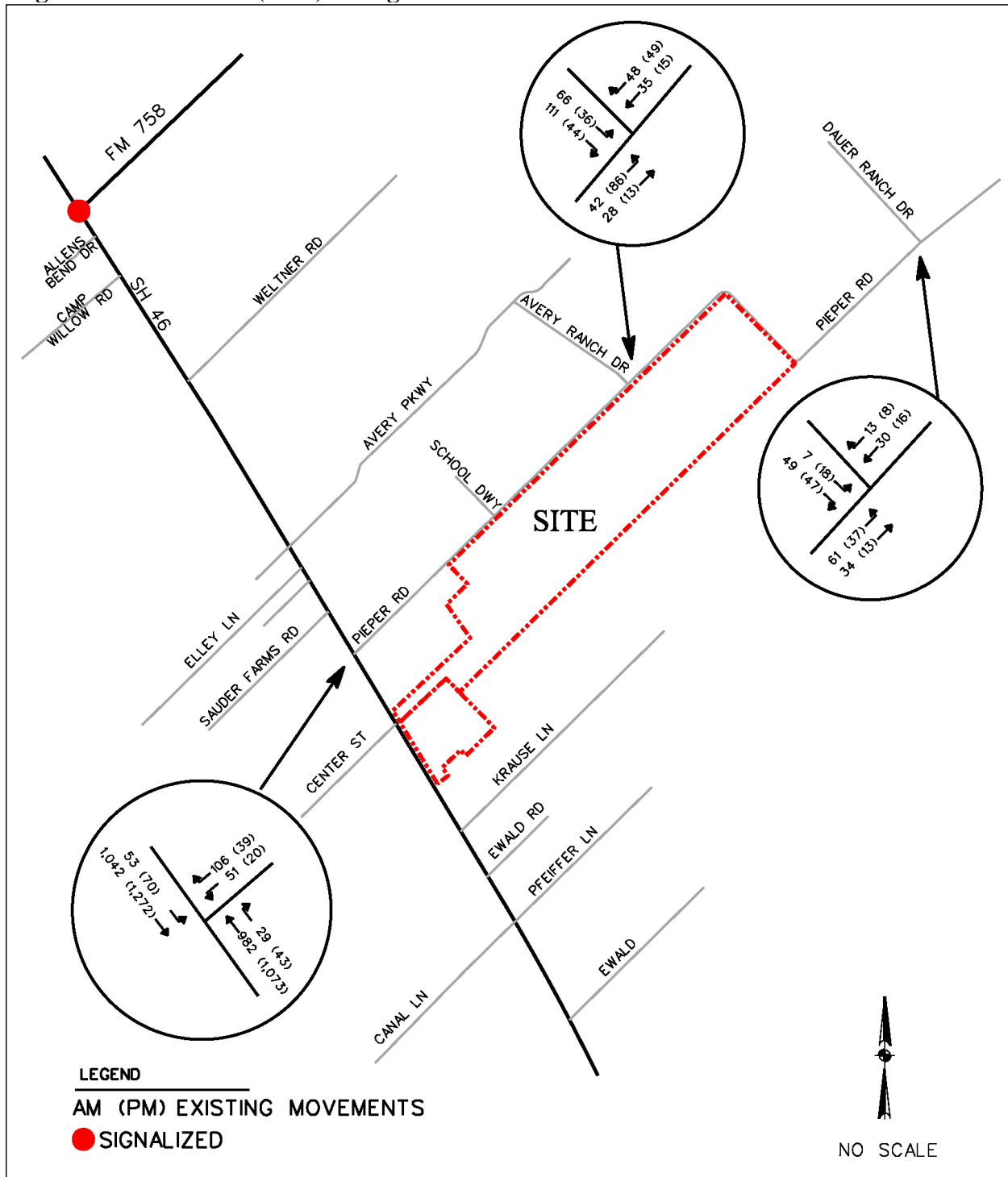


Figure 13. Build-Out (2025) Background Peak Hour Traffic Volumes with School Traffic.



TRIP DISTRIBUTION AND ASSIGNMENT

Trip Distribution

The directional distribution of site traffic was developed based upon the existing movements at the study intersections, characteristics of the surrounding area, and the proposed site plan. The site trip distribution percentages for entering trips are provided in **Figure 14** and the site trip distribution percentages for exiting trips are provided in **Figure 15**.

A 20 percent trip distribution to Dauer Ranch road was based upon the Avery Ranch Road distribution indicating that approximately 30 percent of traffic was heading to or arriving from the northeast. Additionally, at Dauer Ranch Road, approximately 66 percent of the traffic was turning left to go north on Dauer Ranch Road. Additionally, this trip distribution is reasonable in future years given current congestion on SH 46 and Dauer Ranch Road providing an alternative parallel route.

Site Trips

The estimated site generated traffic volumes were assigned to the area roadways and site access points based on the directional distributions. **Figure 16** shows the estimated entering site generated traffic volume assigned to the roadway network during the AM and PM peak hour. **Figure 17** shows the estimated exiting site generated traffic volume assigned to the roadway network during the AM and PM peak hour. **Figure 18** shows the total (entering and exiting) site generate traffic assigned to the roadway network during the AM and PM peak hour.

Trip Redistribution

For traffic using the existing Avery Ranch Drive at Pieper Road:

- Ninety percent of the Build-Out Year (2025) Background Traffic southbound left-turns were redistributed to the intersection of Street 4 and Street 1 as southbound left-turns.
- Ten percent of the Build-Year (2025) Background Traffic southbound right-turns were redistributed to the intersection of Street 4 and Street 1 as southbound right-turns.
- Ninety percent of the Build-Out Year (2025) Background Traffic eastbound right-turns were redistributed to the intersection of Street 4 and Street 1 as eastbound right-turns.
- Ten percent of the Build-Out Year (2025) Background Traffic westbound left-turns were redistributed to the intersection of Street 4 and Street ` as westbound left-turns.
- One-hundred percent of the Build-Out Year (2025) Background Traffic through movements were redistributed to Street 1 as through movements.

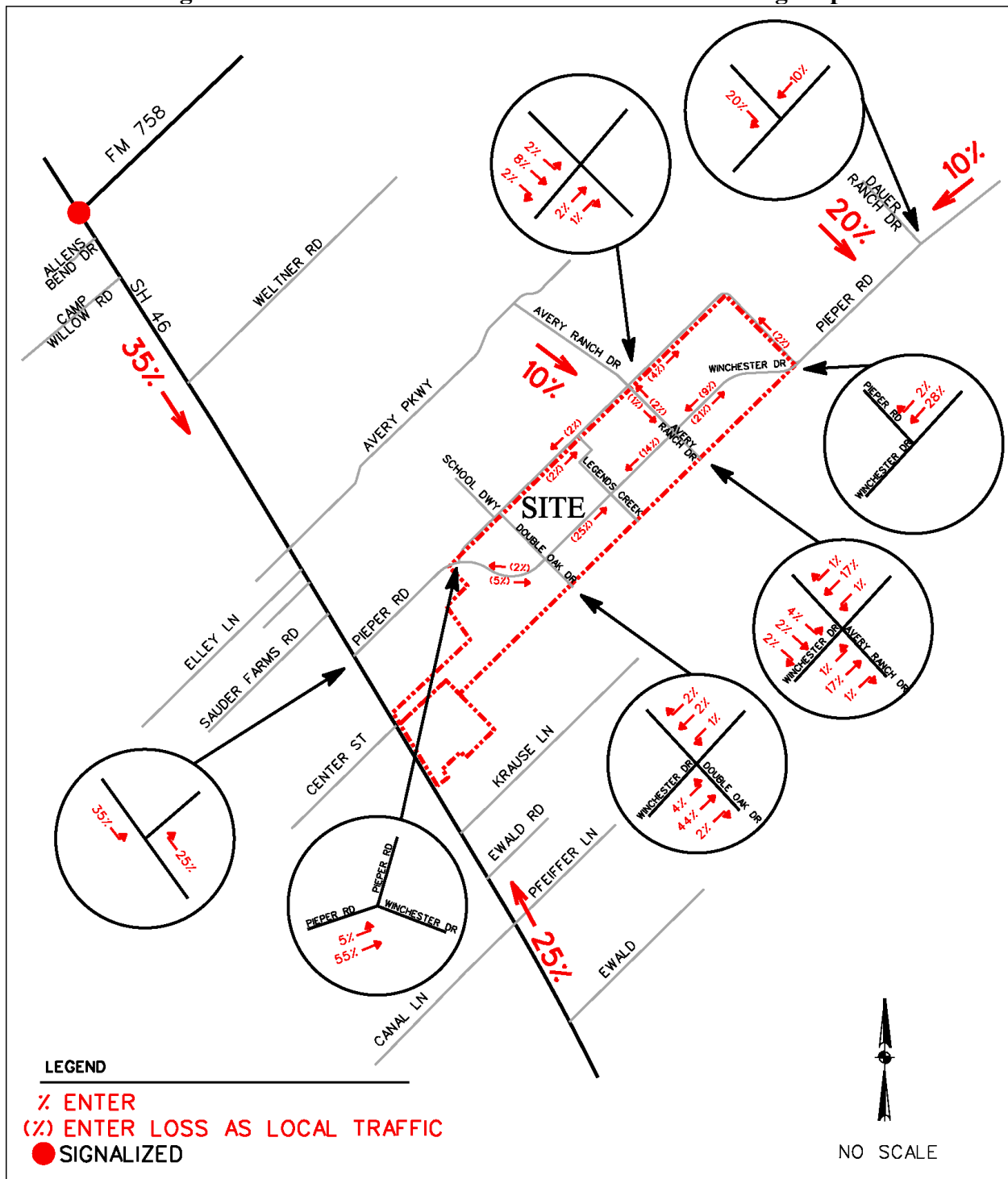
The redistributed traffic was then carried through the other study intersections in order to determine the Total Traffic Conditions.

Total Traffic Conditions

Total traffic conditions in the Build-Out Year (2025) were obtained by adding the site generated traffic volumes to the redistributed Build-Out Year (2025) Background traffic volumes. The estimated total peak hour traffic volumes for the Build-Out Year (2025) are shown in **Figure 19**.

Trip distribution tables are provided in **Appendix E**.

Figure 14. Estimated Directional Distribution – Entering Trips.



LEGEND

- % EXIT
- (%) EXIT ADDED FROM LOCAL TRAFFIC
- SIGNALIZED

NO SCALE

Figure 16. Site Generated Peak Hour Traffic Volumes – Entering Trips.

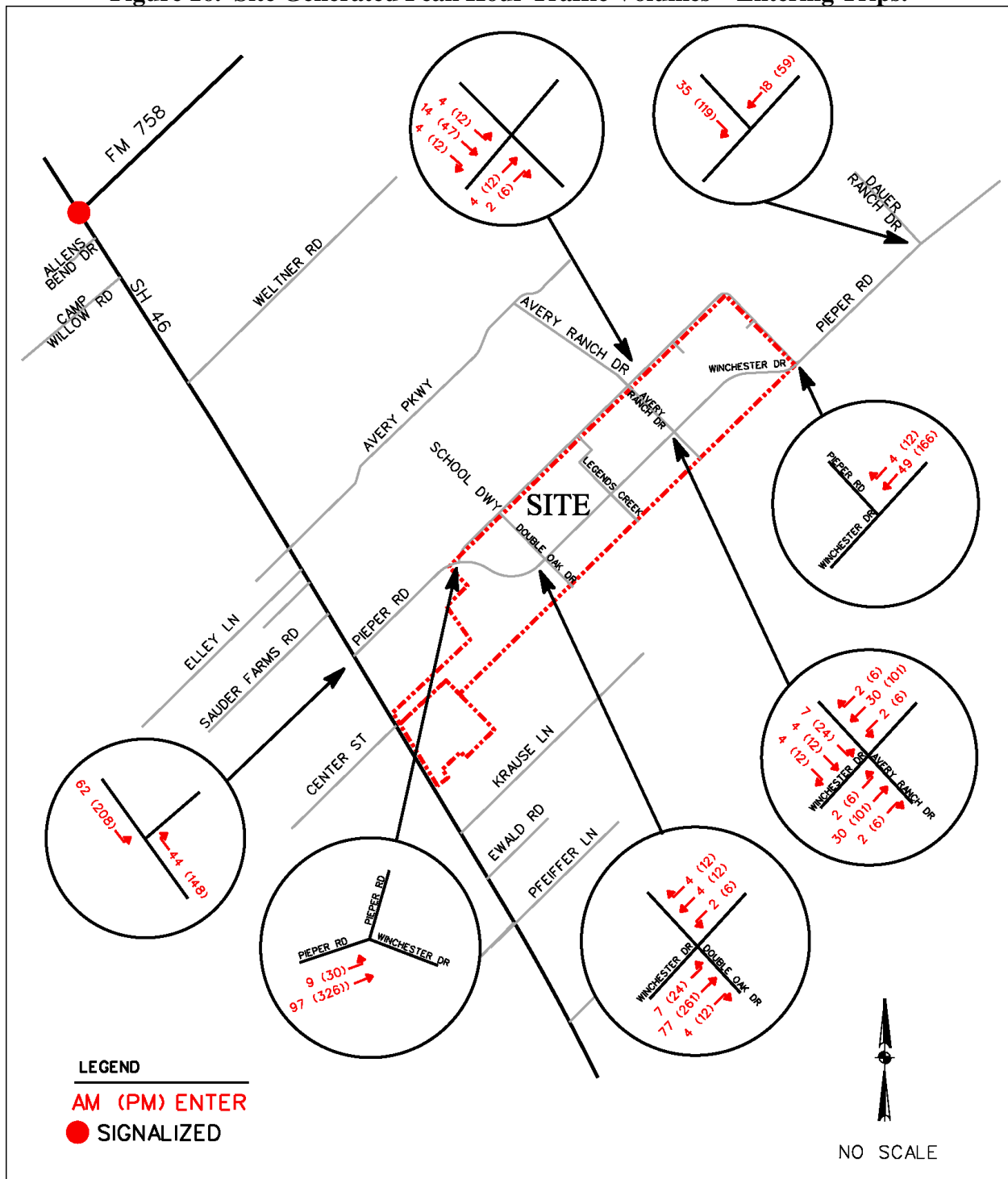


Figure 17. Site Generated Peak Hour Traffic Volume - Exiting Trips.

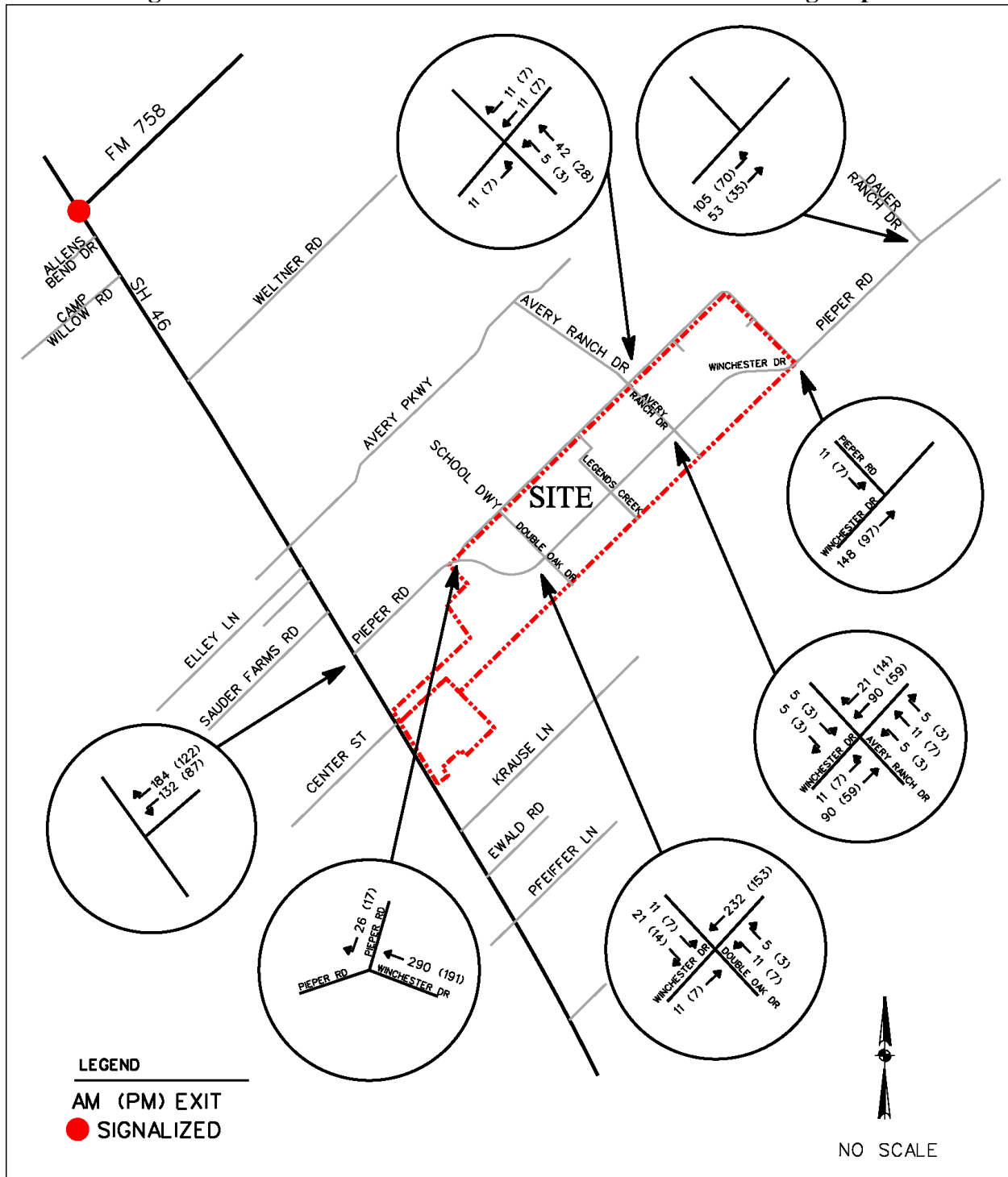


Figure 18. Site Generated Peak Hour Traffic Volume – Total Trips.

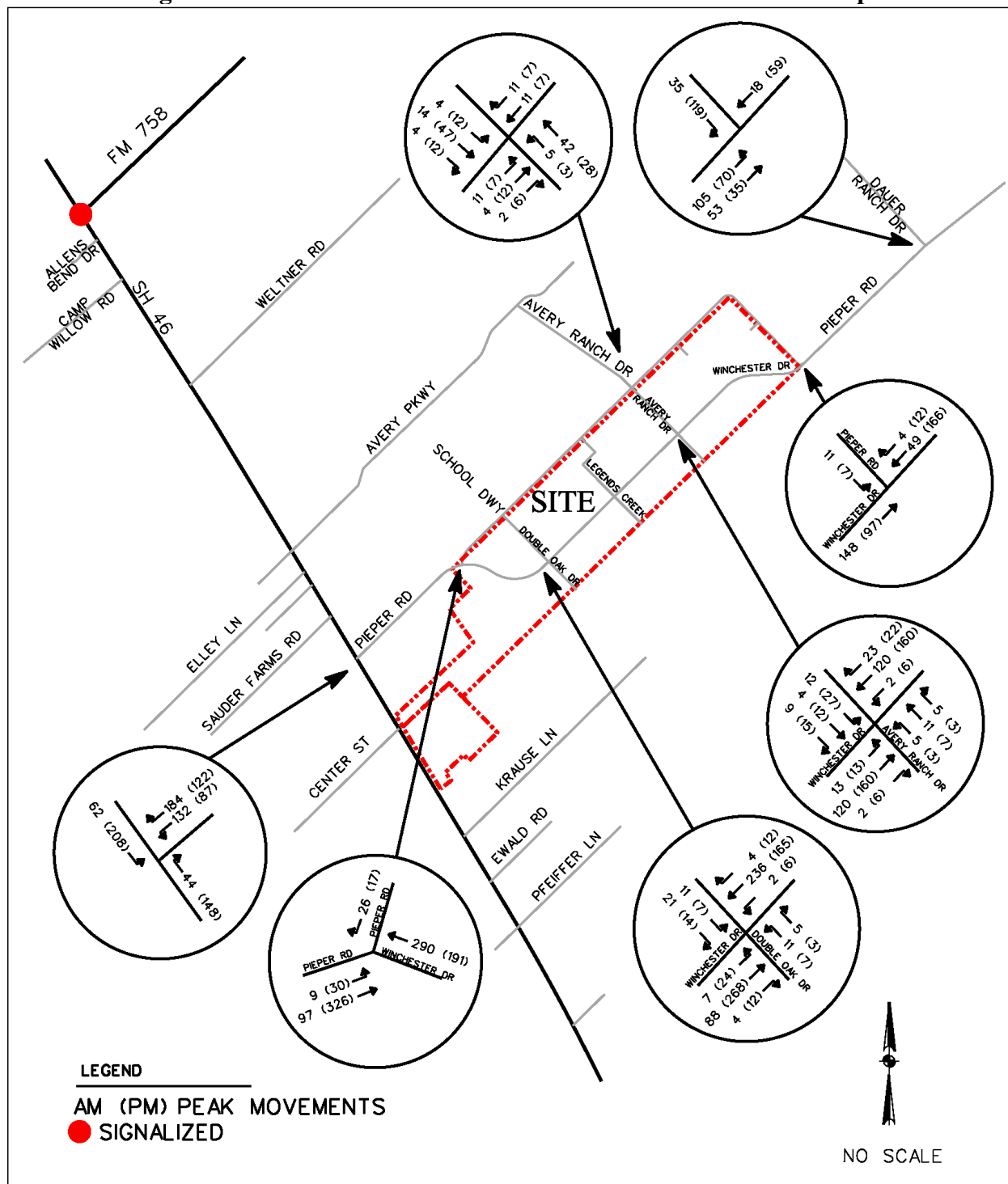
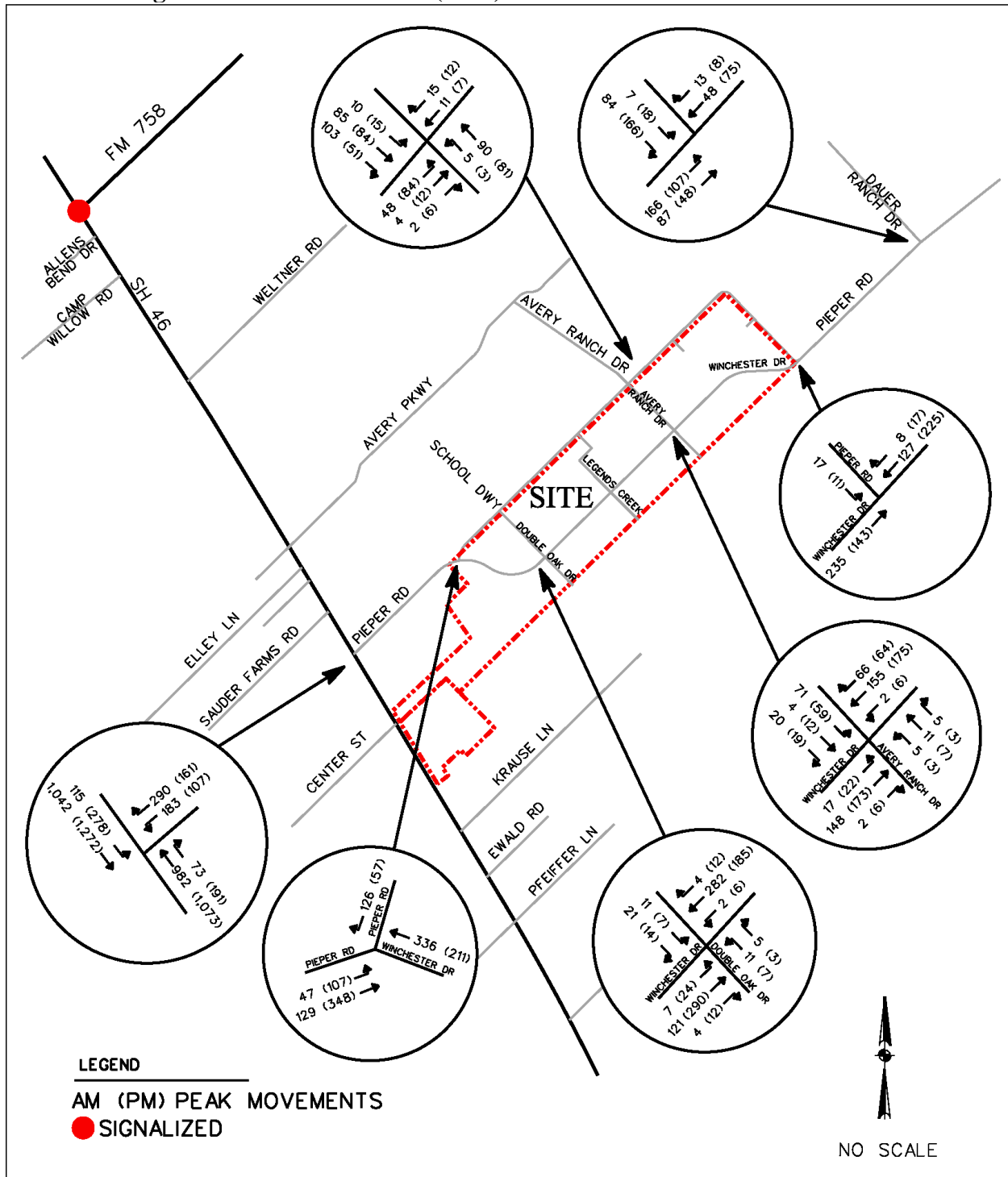


Figure 19. Build-Out Year (2025) Total Peak Hour Traffic Volumes.



ACCESS MANAGEMENT ANALYSIS

Right-Turn Deceleration Lane

As part of this study, an auxiliary lane analysis was conducted to determine a need for a right-turn deceleration lane for traffic turning from SH 46 onto Pieper Road. Guidelines in TxDOT's *Access Management Manual* state that:

- For roadways with a posted speed limit less than or equal to 45 mph, a right-turn deceleration lane should be considered when peak hour right turn volumes are greater than 60 vehicles per hour.
- For roadways with a posted speed limit greater than 45 mph, a right-turn deceleration lane should be considered when peak right-turn volumes are greater than 50 vehicles per hour.

Table 4 summarizes the projected right-turn volumes under Build Out Year (2018) Total traffic conditions and the resulting right-turn deceleration lane analysis results.

An additional analysis was conducted to determine when the development will prompt the need for the right-turn deceleration lane based upon the number of lots within the development. To be conservative, Build-Out Year (2025) Background Traffic was assumed to remain the same and any reduction in traffic volume comes from a reduction in the number of lots within the development.

Based upon this analysis, it was determined that the development traffic prompts a need to consider a right-turn deceleration lane after the development consists of more than 40 lots.

Table 5 summarizes the projected right-turn volumes under Build Out Year (2018) Background Traffic with Site Traffic from 40 residential lots.

Table 4. Right-Turn Deceleration Lane Analysis Results for Up to 950 Residential Lots.

Intersection	Approach	Speed Limit (mph)	Threshold (vph)	Volume (vph) AM (PM)	Exceeds Threshold? AM (PM)
SH 46 at Pieper Road	NB	60	50	73 (191)	Yes (Yes)

Table 5. Right-Turn Deceleration Lane Analysis Results for Up to 40 Residential Lots.

Intersection	Approach	Speed Limit (mph)	Threshold (vph)	Volume (vph) AM (PM)	Exceeds Threshold? AM (PM)
SH 46 at Pieper Road	NB	60	50	31 (49)	No (No)

As shown in Table 4, under Build-Out Year (2025) Total Traffic, the northbound SH 46 right-turn volumes exceed TxDOT's threshold for consideration of a right-turn deceleration lane in the AM peak hour and PM peak hour. As shown in Table 5, the development may consist of up to 40 residential lots before the SH 46 northbound right-turn volume exceeds TxDOT's threshold for a right-turn deceleration lane.

Based upon the anticipated volumes, a posted speed limit of 60 mph, and guidance within the TxDOT *Roadway Design Manual*, the desired right-turn lane length is 865 feet. This includes 150 feet of taper, 615 feet of deceleration, and 100 feet of storage.

While 865 feet is the desired right-turn lane length, as shown in Figure 4, there is an existing drainage structure that may limit the ability to construct a right-turn deceleration lane of this length for this approach at this intersection. The existing unpaved space between Pieper Road and the beginning of the drainage structure is 250 feet. Given this limitation, it may be acceptable to allow for a shorter right-turn deceleration lane length by assuming that turning vehicles will decelerate by more than 10 mph before clearing the through lane. TxDOT's Roadway Design Manual allows for this change within note number 2 of Table 3-13, which can be applied to right-turn deceleration lanes, specifically:

Deceleration length assumes that moderate deceleration will occur in the through traffic lane and the vehicle entering the left-turn lane will clear the through traffic lane at a speed of 10 mph (15 km/h) slower than through traffic. Where providing this deceleration length is impractical, it may be acceptable to allow turning vehicles to decelerate more than 10 mph (15km/h) before clearing the through traffic lane.

Left-Turn Deceleration Lane

As part of this study, an auxiliary lane analysis was conducted to determine the need for left-turn deceleration lanes. Guidelines in TxDOT's *Access Management Manual* direct the user to use the guidance found in Table 3-11 within TxDOT's *Roadway Design Guide*.

TxDOT's *Roadway Design Guide* states that a left-turn lane "should be considered" when the Advancing Volume in vehicles per hour (vph) exceeds the thresholds found in Table 6. The threshold values are based upon opposing traffic volume and percent left-turns as a function of the left-turns divided by the advancing volume (including left-turns). For this evaluation, the values were interpolated or extrapolated to determine the estimated Threshold Advancing

Volumes for the values not available within the provided table.

Table 6. TxDOT Roadway Design Manual Table 3-11.

Opposing Volume (vph)	Advancing Volume (vph)			
	5 % Left Turns	10 % Left Turns	20 % Left Turns	30 % Left Turns
40 mph [60 km/h] Design Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
50 mph [80 km/h] Design Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
60 mph [100 km/h] Design Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

A left-turn lane deceleration analysis for the existing Pieper Road at Dauer Ranch Road is shown in **Table 7**. A left-turn lane deceleration analysis for the Build-Year condition is shown in **Table 8**.

Table 7. Existing Condition – Left-Turn Deceleration Lane Analysis Results.

Intersection	Speed Limit (mph)	Opposing Volume (vph) AM (PM)	Left-Turn Percent (%) AM (PM)	Estimated¹ Threshold Advancing Volume (vph) AM (PM)	Advancing Volume (vph) AM (PM)	Exceeds Threshold? AM (PM)
Pieper Road at Dauer Ranch Road	35	16 (16)	60 (70)	396 (396)	30 (28)	No (No)

¹Estimates interpolated/extrapolated from values found in Table 3-11 within TxDOT's *Roadway Design Guide*.

Table 8. Build Year – Left-Turn Deceleration Lane Analysis Results.

Intersection	Speed Limit (mph)	Opposing Volume (vph) AM (PM)	Left-Turn Percent (%) AM (PM)	Estimated¹ Threshold Advancing Volume (vph) AM (PM)	Advancing Volume (vph) AM (PM)	Exceeds Threshold? AM (PM)
Pieper Road at Dauer Ranch Road	35	61 (83)	66 (69)	378 (369)	253 (155)	No (No)
Pieper Road at Winchester Drive	30	336 (211)	27 (24)	312 (375)	176 (455)	No (Yes)

¹Estimates interpolated/extrapolated from values found in Table 3-11 within TxDOT's *Roadway Design Guide*.

For Pieper Road at Dauer Ranch Road, the analysis shows that the advancing volume is less than the threshold volume for the AM and PM peak hour in both the existing conditions and build year conditions.

For Pieper Road at Winchester Drive, the analysis shows that the advancing volume is higher than the threshold volume in the PM peak hour and less than the threshold volume in the AM peak hour. To mitigate the advancing volume exceeding the threshold in the PM peak hour, it is proposed that this intersection be designed as a roundabout.

Based upon this analysis, a left-turn only lane does not need to be considered at Pieper Road and Dauer Ranch Road. Additionally, a left-turn only lane will not need to be considered at Pieper Road and Winchester Drive because it is proposed that the intersection be designed as a roundabout.

INTERSECTION CAPACITY ANALYSIS

Intersection Level of Service (LOS) is a qualitative measure of capacity and operating conditions and is directly related to vehicle delay.

LOS criteria for a signalized intersection are shown in **Table 9**. LOS is given as a letter designation ranging from A to F, with LOS A representing very short delay (less than 10 seconds of average control delay per vehicle) and LOS F representing very long delay (more than 80 seconds of average control delay per vehicle). LOS criteria for an unsignalized intersections are shown in **Table 10**.

Within the City of New Braunfels, LOS C is considered the minimum acceptable condition for an intersection before improvements might be necessary in order to mitigate the impacts of site traffic.

Capacity analyses were conducted for the study area intersections under the following scenarios:

- Existing (2018) Traffic Conditions
- Build-Out Year (2025) Background Traffic Conditions
- Build-Out Year (2025) Total Traffic Conditions

The intersection capacity analyses were conducted using HCM methodologies included within the *Synchro 10* traffic analysis software package. The Synchro Output files are provided in **Appendix F**.

Note: The driveway for the existing single-family home (Unit 9) is not included in the analyses because it is part of the existing conditions and is not being modified by the proposed development.

Table 9. Level of Service Criteria for Signalized Intersections.

Level-of-Service (LOS)	Average Control Delay (seconds/vehicle)	Description
A	≤ 10.0	Very low vehicle delays, free flow, signal progression extremely favorable, most vehicles arrive during given signal phase.
B	10.1 to 20.0	Good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	20.1 to 35.0	Stable flow, fair signal progression, significant number of vehicles stop at signals.
D	35.1 to 55.0	Congestion noticeable, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	55.1 to 80.0	Limit of acceptable delay, unstable flow, poor signal progression, traffic near roadway capacity, frequent cycle failures.
F	> 80.0	Unacceptable delays, extremely unstable flow and congestion, traffic exceeds roadway capacity, stop-and-go conditions.

SOURCE: Highway Capacity Manual, HCM 2010, Transportation Research Board, 2010

Table 10. Level of Service Criteria for Unsignalized Intersections.

Level-of-Service (LOS)	Average Control Delay (seconds/vehicle)	Description
A	≤ 10.0	No delays at intersections with continuous flow of traffic. Uncongested operations: high frequency of long gaps available for all left and right turning traffic. No observable queues.
B	10.1 to 15.0	No delays at intersections with continuous flow of traffic. Uncongested operations: high frequency of long gaps available for all left and right turning traffic. No observable queues.
C	15.1 to 25.0	Moderate delays at intersections with satisfactory to good traffic flow. Light congestion; infrequent backups on critical approaches.
D	25.1 to 35.0	Increased probability of delays along every approach. Significant congestion on critical approaches, but intersection functional. No standing long lines formed.
E	35.1 to 50.0	Heavy traffic flow condition. Heavy delays probable. No available gaps for cross-street traffic or main street turning traffic. Limit of stable flow.
F	> 50.0	Unstable traffic flow. Heavy congestion. Traffic moves in forced flow condition. Average delays greater than one minute highly probable. Total breakdown.

SOURCE: Highway Capacity Manual, HCM 2010, Transportation Research Board, 2010

Existing (2018) and Background (2025) Traffic Conditions

The existing lane configurations shown in Figure 3 (including existing lane widths), the Existing (2018) Peak Hour Traffic Volumes shown in Figure 12, and Build-Out (2025) Background traffic volumes shown in Figure 13 were used for this analysis. **Table 11** presents the analysis results for the study intersections under Existing (2018) and Build-Out Year (2025) Background traffic conditions. Traffic generated by the proposed Parkside Subdivision (Unit 1 thru Unit 8) is not included in any of the analysis results in Table 11.

The analysis results indicate that all of the study intersections currently operate at an acceptable level of service. Under Build-Out Year (2025) Background traffic conditions, all intersections are anticipated to continue operating at an acceptable level of service.

Table 11. Capacity Analysis Results – Existing and Background Traffic Conditions.

1: SH 46 and Pieper Road (Two-Way Stop Controlled)¹						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Existing (2018) Conditions	AM	1.6 (A)	--	18.9 (C)	0.0 (A)	0.5 (A)
	PM	0.7 (A)	--	16.8 (C)	0.0 (A)	0.6 (A)
Build-Out Year (2025) Background Conditions	AM	1.9 (A)	--	23.5 (C)	0.0 (A)	0.5 (A)
	PM	0.8 (A)	--	19.6 (C)	0.0 (A)	0.6 (A)
2: Pieper Road and Avery Ranch Drive (One-Way Stop Controlled)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Existing (2018) Conditions	AM	6.2 (A)	4.5 (A)	0.0 (A)	--	9.9 (A)
	PM	5.8 (A)	6.5 (A)	0.0 (A)	--	9.6 (A)
Build-Out Year (2025) Background Conditions	AM	6.4 (A)	4.6 (A)	0.0 (A)	--	10.1 (B)
	PM	5.9 (A)	6.6 (A)	0.0 (A)	--	9.7 (A)
3: Pieper Road and Dauer Ranch Road (One-Way Stop Controlled)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Existing (2018) Conditions	AM	5.0 (A)	4.9 (A)	0.0 (A)	--	8.9 (A)
	PM	6.1 (A)	5.5 (A)	0.0 (A)	--	8.9 (A)
Build-Out Year (2025) Background Conditions	AM	5.0 (A)	4.9 (A)	0.0 (A)	--	8.9 (A)
	PM	6.2 (A)	5.5 (A)	0.0 (A)	--	9.0 (A)

¹ Delay in seconds/vehicle (Level of Service)

Build-Out Year (2025) Total Traffic Condition

The proposed site access and lane configurations shown in Figure 8 and the projected Build-Out Year (2025) Total traffic volumes shown in Figure 19 were used to evaluate the traffic impacts of the proposed Parkside Subdivision (Unit 1 thru Unit 8). **Table 12** shows the capacity analysis results for these conditions. The shaded cells indicate intersections or approaches which are predicted to fall below LOS C.

Under Build-Out Year (2025) Total traffic volumes, the analysis results indicate that all of the study intersections are anticipated to operate at an acceptable level of service except for SH 46 at Pieper Road.

Note: This analysis assumes the proposed roadways meet the City of New Braunfels requirements for street design including lane widths, sidewalks, curbs, and traffic control devices.

Table 12. Capacity Analysis Results – Total Traffic Conditions.

1: SH 46 and Pieper Road (One-Way Stop Controlled)¹						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) No Mitigation	AM	59.3 (F)	--	333.5 (F)	0.0 (A)	1.2 (A)
	PM	45.4 (E)	--	499.2 (F)	0.0 (A)	4.1 (A)
2: Pieper Road and Avery Ranch Drive (Two-Way Stop Controlled)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) No Mitigation	AM	2.6 (A)	11.3 (B)	10.0 (B)	0.4 (A)	0.4 (A)
	PM	4.2 (A)	11.3 (B)	9.6 (A)	0.3 (A)	0.8 (A)
3: Pieper Road and Dauer Ranch Drive (One-Way Stop Controlled)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) No Mitigation	AM	5.5 (A)	5.3 (A)	0.0 (A)	--	9.4 (A)
	PM	6.4 (A)	5.4 (A)	0.0 (A)	--	10.1 (B)
4: Pieper Road and Winchester Drive – West Intersection (Roundabout)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) No Mitigation	AM	4.9 (A)	3.8 (A)	5.3 (A)	--	5.3 (A)
	PM	5.4 (A)	6.0 (A)	4.7 (A)	--	3.9 (A)
5: Pieper Road and Winchester Drive – East Intersection (One-Way Stop Controlled)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) No Mitigation	AM	0.5 (A)	0.0 (A)	0.0 (A)	--	11.1 (B)
	PM	0.3 (A)	0.0 (A)	0.0 (A)	--	11.1 (B)
6: Winchester Drive and Double Oak Drive (Two-Way Stop Controlled)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025)	AM	1.3 (A)	0.5 (A)	0.1 (B)	11.7 (B)	11.0 (B)
	PM	1.2 (A)	0.7 (A)	0.3 (A)	13.3 (B)	11.1 (B)
7: Winchester Drive and Avery Ranch Road (Roundabout)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025)	AM	4.1 (A)	4.1 (A)	4.3 (A)	3.6 (A)	4.0 (A)
	PM	4.2 (A)	4.4 (A)	4.1 (A)	4.0 (A)	3.6 (A)

¹ Delay in seconds/vehicle (Level of Service).

The following mitigation scenarios were considered for SH 46 at Pieper Road:

- Two-Way Stop Controlled with a northbound (NB) right-turn deceleration lane.
- Two-Way Stop Controlled with a northbound (NB) right-turn deceleration lane and a dedicated westbound (WB) left-turn lane.
- Signalized Intersection with a dedicated northbound (NB) right-turn deceleration lane.
- Signalized Intersection with a dedicated northbound (NB) right-turn deceleration lane and a dedicated westbound (WB) left-turn lane.

Table 13 shows the capacity analysis results for the evaluated mitigation scenarios. The analysis indicates that a traffic signal, dedicated northbound (NB) right-turn lane, and a dedicated westbound (WB) left-turn lane are able to mitigate the Parkside Subdivision's traffic impacts at the intersection of SH 46 and Pieper Road.

Table 13. Capacity Analysis Results – Mitigation Scenarios (950 Residential Lots).

1: SH 46 and Pieper Road (One-Way Stop Controlled)¹						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) No Mitigation	AM	59.3 (F)	--	333.5 (F)	0.0 (A)	1.2 (A)
	PM	45.4 (E)	--	499.2 (F)	0.0 (A)	4.1 (A)
Build-Out Year (2025) NB Right-Turn Lane	AM	54.0 (F)	--	303.3 (F)	0.0 (A)	1.2 (A)
	PM	41.7 (E)	--	456.1 (F)	0.0 (A)	4.1 (A)
Build-Out Year (2025) NB Right-Turn Lane & WB Left-Turn Lane	AM	9.5 (A)	--	51.1 (F)	0.0 (A)	1.2 (A)
	PM	27.4 (D)	--	291.2 (F)	0.0 (A)	4.1 (A)
1: SH 46 and Pieper Road (Signalized)						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) NB Right-Turn Lane	AM	25.5 (C)	--	43.8 (D)	29.0 (C)	14.7 (B)
	PM	22.2 (C)	--	33.3 (C)	29.0 (C)	14.7 (B)
Horizon Year (2025) NB Right-Turn Lane & WB Left-Turn Lane	AM	16.4 (B)	--	19.1 (B)	21.8 (C)	10.3 (B)
	PM	17.5 (B)	--	19.2 (B)	24.0 (C)	11.9 (B)

¹ Delay in seconds/vehicle (Level of Service).

An additional analysis was conducted to determine when the development will prompt the need for each mitigation based upon the number of lots within the development. To be conservative, Build-Out Year (2025) Background Traffic was assumed to remain the same and any reduction in traffic volume comes from a reduction in the number of lots within the development.

As stated in the Access Management Analysis, the development traffic exceeds TxDOT's threshold to consider a right-turn deceleration lane after the development consists of more than 40 residential lots.

Based upon additional analysis, it was determined that the development traffic prompts a need to consider a dedicated westbound left-turn only lane after the development consists of more than 45 residential lots. **Table 14** shows that each approach at the intersection is anticipated to operate at LOS C or better when the Parkside Subdivision consists of 45 residential lots and the intersection does not have a dedicated westbound left-turn only lane.

Based upon the anticipated volumes, a posted speed limit of 30 mph, and the City of New Braunfels Unified Development Code, the desired left-turn lane length is 310 feet. This includes 50 feet of taper, 160 feet of deceleration, and 100 feet of storage.

Table 14. Capacity Analysis Results – Mitigation Scenarios (45 Residential Lots).

1: SH 46 and Pieper Road (One-Way Stop Controlled)¹						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) NB Right-Turn Lane	AM	2.1 (A)	--	24.7 (C)	0.0 (A)	0.6 (A)
	PM	0.9 (A)	--	20.1 (C)	0.0 (A)	0.7 (A)

¹ Delay in seconds/vehicle (Level of Service).

Based upon additional analysis, it was determined that the development prompts a need to consider a traffic signal after the development consists of more than 385 residential lots. **Table 15** shows that each approach at the intersection is anticipated to operate at LOS C or better when the Parkside Subdivision consists of 385 residential lots and the intersection is not signalized. As an additional consideration, **Table 16** provides the 95th percentile queue length for the intersection of SH 46 and Pieper Road when the Parkside Subdivision consists of 385 residential lots and the intersection is not signalized. The data indicate the 95th percentile queue length in this condition is anticipated to be 67 feet, which is equivalent to a queue of approximately two or three vehicles.

Table 15. Capacity Analysis Results – Mitigation Scenarios (385 Residential Lots).

1: SH 46 and Pieper Road (One-Way Stop Controlled)¹						
Scenario	Peak Hour	Intersection	EB	WB	NB	SB
Build-Out Year (2025) NB Right-Turn Lane & WB Left-Turn Lane	AM	3.1 (A)	--	23.5 (C)	0.0 (A)	0.8 (A)
	PM	2.1 (A)	--	24.8 (C)	0.0 (A)	1.6 (A)

¹ Delay in seconds/vehicle (Level of Service).

Table 16. 95th Percentile Queue Length – Mitigation Scenario for up to 385 Lots.

1: SH 46 and Pieper Road (One-Way Stop Controlled)					
Scenario	Peak Hour	EB	WB	NB	SB
Build-Out Year (2025) NB Right-Turn Lane & WB Left-Turn Lane	AM	--	67 feet	0 feet	12 feet
	PM	--	43 feet	0 feet	33 feet

There are two existing access points on the west side of SH 46 that may need to be adjusted in order to facilitate installation of a traffic signal at SH 46 and Pieper Road. One access point is directly across from Pieper Road and appears to provide access to a residential property. The other access point is approximately 140 feet north of the intersection of SH 46 and Pieper Road and appears to provide access to property with both residential commercial uses.

When installing a traffic signal at SH 46 and Pieper Road, it would be advisable to consider signalizing the residential driveway. If the owner of the residential driveway at the intersection agrees, the driveway alignment could be adjusted to facilitate improved operations; however, its anticipated that signalization could be done without realignment of the driveway.

If the landowners agree, the driveways could be combined into a single shared access driveway that aligns with Pieper Road; however, given the existing land use, its anticipated that signalization could be done without combining these two driveways. If the land use of these parcels were to change, it would be advisable to combine these access points into a single access that aligns with Pieper Road. Such a change would better facilitate future signalization of SH 46 and Pieper Road. This change would be advisable even in the absence of the proposed Parkside Subdivision.

ROADWAY LINK CAPACITY ANALYSIS

Roadway capacity is defined as the volume of traffic that a roadway can accommodate based on the road's width, traffic control, parking conditions, and several other factors.

For residential streets, the capacity is primarily based upon resident comfort. Within the City of New Braunfels, the link capacity of a residential street is 1,000 vehicles per day. If the volume of traffic using a residential street is over 1,000 vehicles per day, then the street may need a collector cross section instead of a residential cross section.

Daily service capacity volumes per lane on controlled access facilities (freeways) are provided in and **Table 17**. Daily service capacity volumes per lane on surface streets (Arterials and Collectors) are provided in **Table 18**. These values were obtained from the Alamo Area Metropolitan Planning Organization (MPO) *Traffic Demand Model (2009)*. Level of Service values associated with Volume to Service Capacity ratios are provided in **Table 19**. Level of Service D (ranging from 0.65 to 0.80) is typically considered the minimum acceptable condition.

Table 17. Per Lane Daily Service Capacity on Controlled Access Facilities.

Facility Type	Functional Class*				
	Interstate Freeway	Other Freeway	Expressway	Frontage Road	Ramp
Radial – Mainlanes Only	25,460	25,460	13,350	n/a	n/a
Radial Toll/HOV Mainlanes	25,460	25,460	n/a	n/a	n/a
Circumferential (Loops) Mainlanes Only	25,460	25,460	13,350	n/a	n/a
Circumferential (Loops) Toll/HOV Mainlanes	25,460	25,460	n/a	n/a	n/a
Frontage Road	n/a	n/a	n/a	7,000	n/a
Frontage Road to/from Freeway	n/a	n/a	n/a	n/a	15,000
Freeway to Freeway	n/a	n/a	n/a	n/a	15,000
Freeway to/from Toll/HOV	n/a	n/a	n/a	n/a	15,000

* Daily capacity volumes taken from Alamo Area MPO Traffic Demand Model.

Table 18. Per Lane Daily Service Capacity on Surface Streets.

Facility Type	Functional Class*		
	Principle Arterial	Minor Arterial	Collector
Undivided	9,000	5,500	5,250
Continuous Left-Turn	10,000	6,000	5,750
Divided	10,000	6,000	5,750

* Daily capacity volumes taken from Alamo Area MPO Traffic Demand Model.

Table 19. Link Capacity Level of Service.

Level of Service	Volume / Service Capacity Ratio
A or B	≤ 0.45
C	> 0.45 and ≤ 0.65
D	> 0.65 and ≤ 0.80
E	> 0.80 and ≤ 1.00
F	> 1.00

Residential Street Analysis

For a single-family development, dwelling units should be distributed such that no more than 105 units are using a single segment of residential street. The estimated daily trips generated by 105 single-family detached housing lots is 992 vehicles per day. At 106 dwelling units, the estimated daily trips become 1,001 vehicles per day, which is higher than the 1,000 vehicles per day capacity.

Within the Parkside Subdivision (Unit 1 thru Unit 8), the dwelling units appear to be distributed such that the residential street segments will have fewer than 1,000 vehicles per day. Therefore, residential street cross-sections should be appropriate for these roadways.

Collector Street Analysis

Roadway link capacity analysis was performed for Winchester Drive and Avery Ranch Road. The daily volume for each road was estimated based upon the highest peak hour traffic flow along a segment of the roadway.

For Winchester Drive, the highest peak hour volume occurs between the existing Pieper Road and Double Oak Drive. The volume along this segment in the peak hour (559 vehicles in the Build-Out Year PM peak) was assumed to represent 10 percent of the daily traffic (which produces an estimated daily volume of 5,590 vehicles).

For Avery Ranch Road, the highest peak hour volume occurs on the segment between Pieper Road and Winchester Drive. The volume on this segment in the peak hour (351 vehicle in the Build-Out Year AM peak) was assumed to represent 10 percent of the daily traffic (which

produces an estimated daily volume of 3,510 vehicles).

The results of this analysis are provided in **Table 20**.

Table 20. Roadway Link Capacity Analysis Results

Winchester Drive (Pieper Road to Double Oak Drive) – Collector Street						
Scenario	Facility Type	Number of Lanes	Capacity	Volume	V/C	LOS
Build-Out Year (2025) Total Traffic	Undivided	2	10,500	5,590	0.53	C
Build-Out Year (2025) Total Traffic	Continuous Left-Turn	2	11,500	5,590	0.49	C
Avery Ranch Road (Pieper Road to Winchester Drive) – Collector Street						
Scenario	Facility Type	Number of Lanes	Capacity	Volume	V/C	LOS
Build-Out Year (2025) Total Traffic	Undivided	2	10,500	1,820	0.17	A or B
Build-Out Year (2025) Total Traffic	Continuous Left-Turn	2	11,500	1,820	0.16	A or B

As an undivided collector with 2 travel lanes, Winchester Drive is anticipated to have a service capacity ratio of 0.53 (LOS C). This suggests the roadway could be operated with or without a continuous left-turn lane.

As an undivided collector with 2 travel lanes, Avery Ranch Drive is anticipated to have a service capacity ratio of 0.17 (LOS A or B). This suggests the roadway could be operated with or without a continuous left-turn lane.

NEIGHBORHOOD TRAFFIC PLAN

A neighborhood traffic plan provides means for improving quality of life within a neighborhood through design features and traffic control strategies. For this analysis, the design features and control strategies considered are pavement markings, modern roundabouts, and STOP signs.

Pavement Markings

It's anticipated that Winchester Drive and Avery Ranch Road will be constructed as collector streets and have a paved width of 40 feet. Given the context of the proposed Parkside Subdivision, it would be advisable to provide pavement markings along Winchester Drive and Avery Ranch Road in order to encourage lower vehicle travel speeds.

An option for striping a street with a width of 40 feet includes a 3-lane cross-section with a continuous left-turn lane and one travel lane in each direction or a 2-lane cross-section with parking.

If a 3-lane cross-section is desired, a through lane width of 11 feet would aid in managing travel speeds along the roadways. To achieve a through lane width of 11 feet, the continuous left-turn lane could have a width of 16 feet and a white edge line could be installed such that the width of the through lane is 11 feet.

If a 2-lane cross-section is desired, a through lane width of 11 feet would aid in managing travel speeds along the roadways. To achieve a through lane width of 11 feet, an edge line delineating the parking lane could be installed such that the width of the through lane is 11 feet.

Modern Roundabouts

Potential benefits of modern roundabouts include reductions in anticipated numbers of crashes, lower travel speeds, improved traffic flow, lower maintenance costs, and improved aesthetics. Within residential neighborhoods, these are desirable outcomes.

To manage vehicle travel speeds along Winchester Drive and to improve aesthetics within the neighborhood, the proposed Parkside Subdivision includes roundabouts at two intersections. One of the proposed roundabouts is a mini roundabout at the intersection of Winchester Road/Pieper Road (the proposed collector segments) and Pieper Road (the proposed local street). The second proposed roundabout is a single lane roundabout at the intersection of Winchester Drive (a collector street) and Avery Ranch Road (a collector street).

The Intersection Capacity Analysis within this report indicates that these intersections are anticipated to operate at level of service C or better. This supports the consideration of roundabouts at these locations.

STOP Signs

STOP signs are an important part of facilitating the orderly movement of traffic through an intersection. Types of stop-controlled intersections include: one-way stop control, two-way stop control, and all-way stop control.

Within the Parkside Subdivision, it would be advisable to provide intersection control in the form of STOP signs for any residential street at its intersection Winchester Drive or Avery Ranch Drive. These STOP signs would notify drivers that vehicles on Winchester Drive (a collector street) or Avery Ranch Drive (a collector street) have priority over the lower volume residential streets.

When two residential streets meet and form an intersection with three legs, there can be value in controlling the one of the streets through the use of STOP sign by creating a one-way stop-controlled intersection. The STOP sign should be placed on the approach that forms the bottom of the T shaped intersection.

When two residential streets meet and form an intersection with four legs, there can be value in controlling one of the two streets through the use of STOP signs by creating a two-way stop-controlled intersection. Within the proposed Parkside Subdivision, the following intersection control strategy could be considered (Note: Street names in this list come from the information provided in the proposed Master Plan included in **Appendix A** and have the potential to change):

- Sweet Olive stops for White Willow.
- White Willow stops for Double Oak Drive.
- Twisted Creek stops for Double Oak Drive.
- Silver Creek stops for Shady Grove.
- Deerfield Lane stops for Ivory Moon Drive.
- Diamond Ranch stops for Ivory Moon Drive.
- Summer Stone stops for Diamond Ranch.

As a region grows, there could be a need to consider all-way stop control at intersections that initially had one-way control or two-way stop control. For the proposed Parkside Subdivision, all-way stop control could be considered for the following intersections in the future (Note: Note: Street names in this list come from the information provided in the proposed Master Plan included in **Appendix A** and have the potential to change):

- Winchester Drive at Legends Creek.
- Winchester Drive at Double Oak Drive.
- Avery Ranch Road at Pieper Road.

The decision to install all-way stop control at these intersections should be justified through a warrant analysis.

CONCLUSIONS

The existing single-family home (Unit 9) driveway was not included in the analyses because it is part of the existing conditions and is not being modified by the proposed Parkside Subdivision (Unit 1 thru Unit 8).

Based on the analysis of the proposed site plan and characteristics of the Parkside Subdivision facility (Unit 1 thru Unit 8), the following conclusions can be made:

- The proposed Parkside Subdivision (Unit 1 thru Unit 8) consists of up to 950 lots of single-family detached housing (ITE Code 210). The development is expected to generate a total of 703 AM peak hour trips and 941 PM peak hour trips. Access will be provided by realigning the existing Pieper Road through the property and extending the existing Avery Ranch Road to connect with the realigned Pieper Road.

Access Management Analysis

1. The right-turn volume for the northbound right-turn movement from SH 46 onto Pieper Road is anticipated to exceed TxDOT's threshold for the consideration of a right-turn deceleration lane. As indicated in the analysis, the development may consist of up to 40 residential lots before the right-turn volume exceeds TxDOT's threshold for a right-turn deceleration lane. The desired length of the right-turn lane is 865 feet.
2. While 865 feet is the desired right-turn lane length, there is an existing drainage structure that may limit the ability to construct a right-turn deceleration lane of this length for this approach. The existing unpaved space between Pieper Road and the beginning of the drainage structure is 250 feet. Given this limitation, it may be acceptable to allow for a shorter right-turn deceleration lane length by assuming that turning vehicles will decelerate by more than 10 mph before clearing the through lane.

Intersection Capacity Analysis

1. The analysis indicates that all of the study intersections currently operate at an acceptable level of service. Under Build-Out Year (2025) Background traffic conditions, the intersections are anticipated to continue operating at an acceptable level of service.
2. Under Build-Out Year (2025) Total traffic volumes, the analysis results indicate that all of the study intersections are anticipated to operate at an acceptable level of service except for SH 46 at Pieper Road.
3. The analysis indicates the following mitigation strategies are capable of mitigating the traffic impacts of site traffic on the intersection of SH 46 and Pieper Road under Build-Out Year (2025) Total traffic volumes:
 - a. Right-turn deceleration for northbound traffic turning from SH 46 onto Pieper Road.
 - b. Dedicated left-turn only lane for traffic turning from westbound Pieper Road to go south on SH 46.
 - c. Signalization of the intersection of SH 46 and Pieper Road

4. As indicated in the Access Management Analysis, the development traffic prompts a need to consider a right-turn deceleration lane after the development consists of more than 40 residential lots.
5. The development traffic prompts a need to consider a dedicated left-turn only lane when the development consists of more than 45 residential lots. The desired left-turn lane length is 310 feet. This includes 50 feet of taper, 160 feet of deceleration, and 100 feet of storage.
6. The development traffic prompts a need to consider a traffic signal when the development consists of more than 385 residential lots.
7. There are two existing access points on the west side of SH 46 that may need to be adjusted in order to facilitate installation of a traffic signal at SH 46 and Pieper Road. If the landowners agree, the driveways could be combined into a single shared access driveway that aligns with Pieper Road; however, given the existing land use, it is anticipated that signalization could be done without combining these two driveways. If the land use of these parcels were to change, it would be advisable to combine these access points into a single access that aligns with Pieper Road.

Roadway Link Capacity Analysis

1. Within the Parkside Subdivision, the dwelling units appear to be distributed such that the residential street segments will have a traffic volume under 1,000 vehicles per day.
2. Winchester Drive is anticipated to have a daily volume of 5,590 vehicles. It is anticipated that the roadway could be striped with bicycle lanes instead of a continuous left-turn lane.
3. Avery Ranch Road is anticipated to have a daily volume of 3,510 vehicles. It is anticipated that the roadway could be striped with bicycle lanes instead of a continuous left-turn lane.

Neighborhood Traffic Plan

1. It would be advisable to provide pavement markings along Winchester Drive and Avery Ranch Road in order to encourage lower vehicle travel speeds. Given the results of the Link Capacity Analysis, the cross-section for these streets could be with or without a continuous left-turn lane.
2. The proposed Parkside development includes two modern roundabouts. One of the proposed roundabouts is a mini roundabout at the intersection of Pieper Road/Winchester Drive (collector streets) and Pieper Road (a local street). The second proposed roundabout is a single lane roundabout at the intersection of Winchester Drive (a collector street) and Pieper Road (a collector street). The Intersection Capacity Analysis within this report indicates that these intersections are anticipated to operate at level of service C or better.
3. Within the Parkside Subdivision, it would be advisable to provide intersection control in the form of STOP signs for any residential street at its intersection with Winchester Drive or Avery Ranch Road. These STOP signs would notify drivers that vehicles on

Winchester Drive (a collector street) or Avery Ranch Road (a collector street) have priority over the lower volume residential streets.

4. Within the Parkside Subdivision, it would be advisable to provide intersection control at T-intersections of residential streets in the form of a STOP sign for the street forming the bottom of the T.
5. Within the Parkside Subdivision, the following control strategy could be considered:
 - Sweet Olive stops for White Willow.
 - White Willow stops for Double Oak Drive.
 - Twisted Creek stops for Double Oak Drive.
 - Silver Creek stops for Shady Grove.
 - Deerfield Lane stops for Ivory Moon Drive.
 - Diamond Ranch stops for Ivory Moon Drive.
 - Summer Stone stops for Diamond Ranch.
6. For the proposed Parkside Subdivision, all-way stop control could be considered at the following intersections in the future (if justified through a warrant analysis):
 - Winchester Drive at Legends Creek.
 - Winchester Drive at Double Oak Drive.
 - Avery Ranch Road at Pieper Road.

RECOMMENDATIONS

Based on this study, the following recommendations are made:

1. Construct a northbound right-turn lane at the intersection of SH 46 and Pieper Road before the development consists of more than 40 residential lots. The desired length of the right-turn lane is 865 feet; however, an existing drainage structure may limit the ability to construct a right-turn deceleration lane of this length on this approach and a shorter length may need to be considered.
2. Construct a dedicated left-turn lane at the intersection of SH 46 and Pieper Road before the development consists of more than 45 residential lots. The desired left-turn lane length is 310 feet.
3. Construct a traffic signal at the intersection of SH 46 and Pieper Road before the development consists of more than 385 residential lots. Include signal indications for the residential driveway on the west side of SH 46. If possible, adjust the driveway to improve its alignment with Pieper Road.

APPENDIX A – SCOPING MEETING SUMMARY



ARIZONA
TEXAS
NEW MEXICO
OKLAHOMA

MEMORANDUM

To: Garry Ford, PE, City of New Braunfels
Mary Hamann, PE, City of New Braunfels
Jessica Perry, City of New Braunfels
Brien Hoher, PE, TxDOT
Thor Thornhill, HMT Engineering and Surveying
Stephen Hanz, PE, MBA, HMT Engineering and Surveying
Fred Heimer, Symmetry Ventures

From: James Robertson, PhD, PE, Lee Engineering
Cc: Monica Marroquin, Lee Engineering

Re: July 19, 2018, Friesenhahn TIA Scoping Meeting in New Braunfels, TX

Date: July 20, 2018

Overview

On July 19, 2018, City of New Braunfels and TxDOT Staff met with representatives from Lee Engineering, HMT Engineering and Surveying, and Symmetry Ventures to confirm the scope for the Friesenhahn TIA. The meeting took place in the New Braunfels Public Works Conference Room and began at approximately 2:07 PM. A sign-in sheet for the meeting is included at the end.

Development Description

The proposed Friesenhahn Development includes approximately 900 residential lots. It's anticipated that the site will provide a collector street that reflects the alignment shown within the City of New Braunfels thoroughfare plan. The specific name of this collector might be Pieper Road or it could be a segment of street with a different name.

TIA Scope

- Trip Generation will be based on the 10th Edition of the *ITE Trip Generation Manual*. The land use for this development will be Single Family Detached Housing (Code 290).
- AM and PM Peak Hour Turning Movement Counts will be collected at:
 - SH 46 at Pieper Rd.
 - Pieper Rd at Avery Ranch Rd.
 - Pieper Rd at Dauer Ranch Rd.

- 24 Hour Bi-Directional Volume Counts will be collected on:
 - SH 46 southeast of Pieper Rd.
 - Pieper Rd southwest of Avery Ranch Dr.
- Trip Distribution will be based upon the distribution of existing traffic.
- Base condition traffic volumes will be adjusted to account for school (Clear Spring Elementary) not being in session at the time of data collection.
- Background traffic will be based upon a 2% growth rate.
- The TIA will focus on the following:
 - Existing Intersections:
 - SH 46 at Pieper Rd.
 - Pieper Road at Avery Ranch Dr.
 - Pieper Road at Dauer Ranch Rd.
 - Development Access Points:
 - Southwestern connection to the existing Pieper Rd.
 - Northeastern connection to the existing Pieper Rd.
 - Development Internal Intersections:
 - Proposed collector street at the extension of Avery Ranch Rd.
 - Proposed collector street at any proposed roundabout.
- The TIA will provide an Area Traffic Management Plan that discusses recommendations for traffic control at internal intersections with a focus on traffic control at internal intersections. For example, potential one-way stops, two-way stops, and all-way stops.
- The TIA will indicate when traffic mitigations become necessary based upon number of lots. This information can then be used to determine which development phases trigger the need for mitigation. This information will be incorporated into the Master Plan and Plat.
- The TIA will discuss options for addressing the driveway on the southwest side of SH 46 that creates a fourth leg at the intersection of SH 46 with Pieper Road.
- The City will receive 1 hard copy and 1 electronic (PDF) of the report. Synchro outputs will not be included in the hard copy.
- TxDOT will receive an electronic (PDF) of the report emailed to Brien Hoher, PE.

Other Discussions

- The City indicated all curvature of the collector street should occur within the proposed development.
- The developer only needs to improve Pieper Road up to the point where the collector street enters the proposed development. For example, if the realignment of Pieper Rd begins at the Clear Spring Elementary driveway, Pieper Rd would only need to be improved from SH46 to the Clear Spring Elementary driveway.
- The City's preference is to minimize the number of residential lots fronting on the proposed collector street.
- If roundabouts are proposed, residential driveways will need to be outside the functional area of the roundabout.
- The City indicated the traffic volume on proposed residential streets needs to be under 1,000 vehicles per day. Otherwise, a collector street cross-section may be required.

Friesenhahn TIA Scoping Meeting 7/19/18

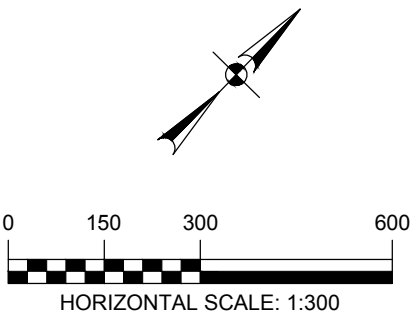
Name		Email
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James Robertson	Lee	jrobertson@lee-eng.com
Thor Thornhill	HMT	thor@hmtnb.com
STEPHEN HAUZ	HMT	stephenh@hmtnb.com
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Monica Marroquin	Lee	mmarroquin@Lee-eng.com
GARRY FORD	CoNB	GFord@NBTexas.org
Jessica Perry	CoNB	JPerry@NBTexas.org
Brian Hocher	TUDOR	brian.hocher@txdot.gov

APPENDIX B – PROPOSED MASTER PLAN

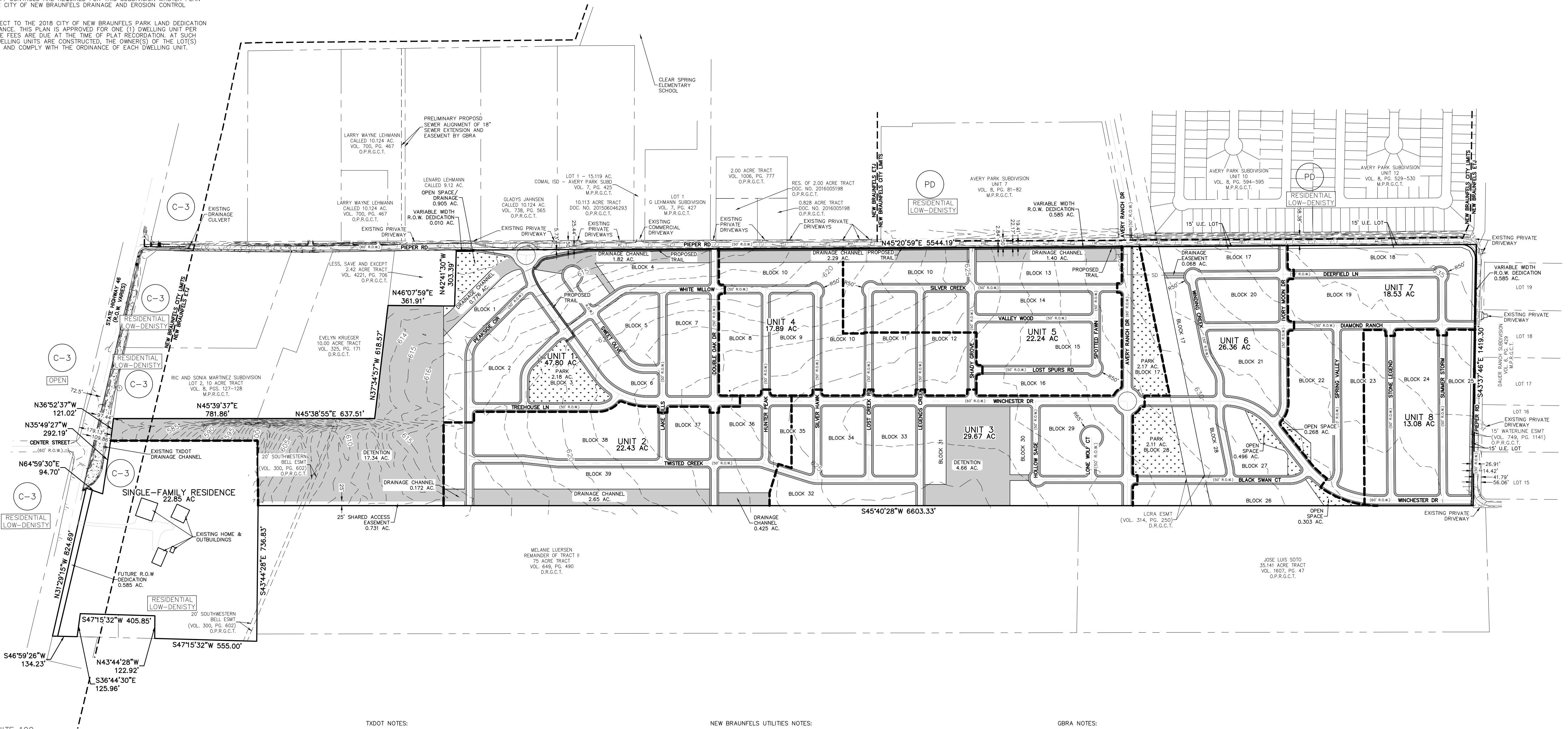
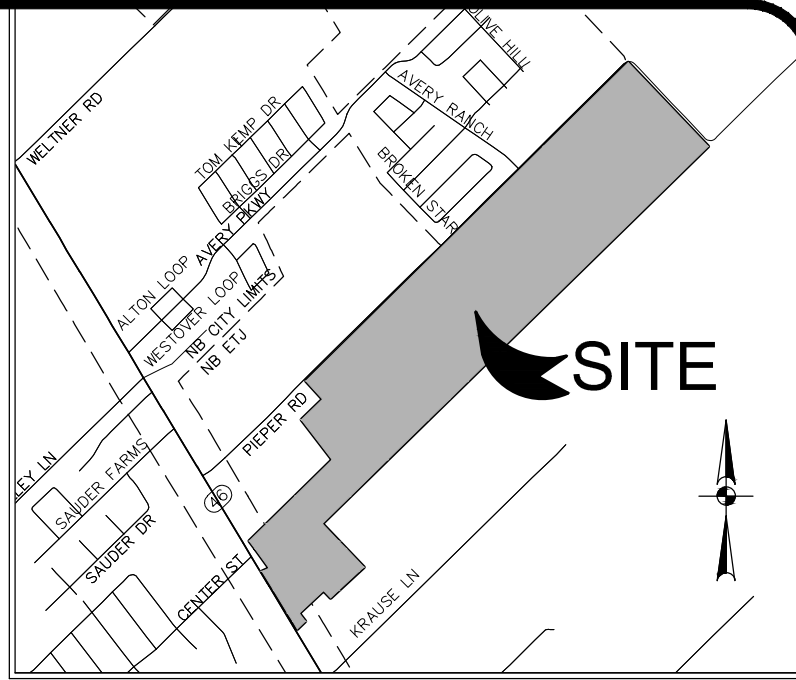
NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED ELECTRIC SERVICE BY NEW BRAUNFELS UTILITIES. WATER FOR THE SUBDIVISION WILL BE PROVIDED BY SPRINGS HILL. SEWER FOR THE SUBDIVISION WILL BE PROVIDED BY GUADALUPE-BLANCO RIVER AUTHORITY. TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T COMMUNICATIONS AND/OR SPECTRUM.
2. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
3. A PORTION OF THIS SUBDIVISION IS WITHIN THE CITY LIMITS OF NEW BRAUNFELS AND A PORTION WITHIN THE EXTRATERRITORIAL LIMITS OF THE CITY OF NEW BRAUNFELS.
4. THIS SUBDIVISION IS WITHIN THE COMAL INDEPENDENT SCHOOL DISTRICT.
5. NO PORTION OF THIS SUBDIVISION IS LOCATED WITHIN ANY SPECIAL FLOOD HAZARD AREA (100 YR. FLOOD), AS DEFINED BY THE GUADALUPE COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48187C0120F, EFFECTIVE DATE NOVEMBER 2, 2007 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
6. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTOR'S ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
7. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
8. 4' WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ALONGSIDE AND ADJACENT TO THE CURB BY THE OWNER AT THE TIME OF DEVELOPMENT ALONG ALL INTERNAL STREETS. 4' WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ALONGSIDE AND ADJACENT TO THE PROPERTY LINE BY THE DEVELOPER AT THE TIME OF STREET CONSTRUCTION ALONG STATE HIGHWAY 46 AND PIEPER ROAD.
9. LAND USE FOR THIS MASTER PLAN IS SINGLE-FAMILY RESIDENTIAL AND COMMERCIAL RESERVE.
10. PERMANENT WATER QUALITY CONTROLS ARE REQUIRED FOR THIS SUBDIVISION MASTER PLAN IN ACCORDANCE WITH THE CITY OF NEW BRAUNFELS DRAINAGE AND EROSION CONTROL DESIGN MANUAL.
11. THIS SUBDIVISION IS SUBJECT TO THE 2018 CITY OF NEW BRAUNFELS PARK LAND DEDICATION AND DEVELOPMENT ORDINANCE. THIS PLAN IS APPROVED FOR ONE (1) DWELLING UNIT PER BUILDABLE LOT WHERE THE FEES ARE DUE AT THE TIME OF PLAT RECORDATION. AT SUCH TIME THAT ADDITIONAL DWELLING UNITS ARE CONSTRUCTED, THE OWNER(S) OF THE LOT(S) SHALL CONTACT THE CITY AND COMPLY WITH THE ORDINANCE OF EACH DWELLING UNIT.

MASTER PLAN FOR PARKSIDE SUBDIVISION 220.84 ACRES



- LEGEND:**
- R.O.W. = RIGHT-OF-WAY
 - M.P.R.C.C.T. = MAP AND PLAT RECORDS, COMAL COUNTY, TEXAS
 - O.P.R.C.C.T. = OFFICIAL PUBLIC RECORDS, COMAL COUNTY, TEXAS
 - D.R.C.C.T. = DEED RECORDS, COMAL COUNTY, TEXAS
 - OPEN SPACE/PARKS/ LANDSCAPE AREAS
 - PROPOSED HIKE AND BIKE TRAIL
 - PROPOSED PHASING
 - CURRENT ZONING



DEVELOPER:
FRED HEIMER
130 S. SEGUIN, SUITE 100
NEW BRAUNFELS, TEXAS 78130

OWNER:
CLARENCE FRIESENHAHN, INDV.
& FRIESEHAHN CREDIT TRUST
211 W KINGSBURY ST
SEGUIN, TEXAS 78155

ENGINEER/SURVEYOR:
HMT ENGINEERING AND SURVEYING
410 N. SEGUIN AVE.
NEW BRAUNFELS, TEXAS 78130
PH: (830) 625-8555



410 N. SEGUIN AVE.
NEW BRAUNFELS,
TEXAS 78130
WWW.HMTNB.COM
PH: (830) 625-8555
TBPE FIRM F-10961
TBPLS FIRM 10153600

TXDOT NOTES:

1. FOR RESIDENTIAL DEVELOPMENT DIRECTLY ADJACENT TO STATE RIGHT-OF-WAY, THE DEVELOPER SHALL BE RESPONSIBLE FOR ADEQUATE SETBACK AND/OR SOUND ABATEMENT MEASURES FOR FUTURE NOISE MITIGATION.
2. OWNER/DEVELOPER IS RESPONSIBLE FOR PREVENTING ANY ADVERSE IMPACT TO THE EXISTING DRAINAGE SYSTEM WITHIN THE HIGHWAY RIGHT-OF-WAY. FOR PROJECTS IN THE EDWARDS AQUIFER RECHARGE OR CONTRIBUTING ZONES, OUTFALLS FOR WATER QUALITY AND/OR DETENTION PONDS TREATING IMPERVIOUS COVER RELATED TO THE DEVELOPMENT, WILL NOT ENCRoACH BY STRUCTURE OR GRADING INTO STATE R.O.W. PLACEMENT OF PERMANENT STRUCTURAL BEST MANAGEMENT PRACTICE DEVICES OR VEGETATIVE FILTER STRIPS WITHIN STATE R.O.W. WILL NOT BE ALLOWED.
3. MAXIMUM ACCESS POINTS TO STATE HIGHWAY FROM THIS PROPERTY WILL BE REGULATED AS DIRECTED BY TXDOT'S "ACCESS MANAGEMENT MANUAL". THIS PROPERTY IS ELIGIBLE FOR MAKE IT INAPPROPRIATE OR NOT FEASIBLE TO CONFORM TO THE CONNECTION SPACING INTERVALS, THE LOCATION OF REASONABLE ACCESS WILL BE DETERMINED WITH CONSIDERATION GIVEN TO TOPOGRAPHY, ESTABLISHED PROPERTY OWNERSHIPS, UNIQUE PHYSICAL LIMITATIONS, AND/OR PHYSICAL DESIGN CONSTRAINTS. THE SELECTED LOCATION SHOULD SERVE AS MANY PROPERTIES AND INTERESTS AS POSSIBLE TO REDUCE THE NEED FOR ADDITIONAL DIRECT ACCESS TO THE HIGHWAY. IN SELECTING LOCATIONS FOR FULL MOVEMENT INTERSECTIONS, PREFERENCE WILL BE GIVEN TO PUBLIC ROADWAYS THAT ARE ON LOCAL THOROUGHFARE PLANS.
4. IF SIDEWALKS ARE REQUIRED BY APPROPRIATE CITY ORDINANCE, A SIDEWALK PERMIT MUST BE APPROVED BY TXDOT, PRIOR TO CONSTRUCTION WITHIN STATE RIGHT-OF-WAY. LOCATIONS OF SIDEWALKS WITHIN STATE RIGHT-OF-WAY SHALL BE AS DIRECTED BY TXDOT.
5. ANY TRAFFIC CONTROL MEASURES (LEFT-TURN LANE, RIGHT-TURN LANE, SIGNAL, ETC.) FOR ANY ACCESS FRONTING A STATE MAINTAINED ROADWAY SHALL BE THE RESPONSIBILITY OF THE DEVELOPER/OWNER.

NEW BRAUNFELS UTILITIES NOTES:

1. MAINTENANCE OF DEDICATED UTILITY EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER. ANY USE OF AN EASEMENT OR ANY PORTION OF IT, INCLUDING LANDSCAPING OR DRAINAGE FEATURES, IS SUBJECT TO AND SHALL NOT CONFLICT WITH THE TERMS AND CONDITIONS IN THE EASEMENT, MUST NOT ENDANGER OR INTERFERE WITH THE RIGHTS GRANTED BY THE EASEMENT TO NEW BRAUNFELS UTILITIES, ITS SUCCESSORS AND ASSIGNS, AND SHALL BE SUBJECT TO APPLICABLE PERMIT REQUIREMENTS OF THE CITY OF NEW BRAUNFELS OR ANY OTHER GOVERNING BODY. THE PROPERTY OWNER MUST OBTAIN, IN ADVANCE, WRITTEN AGREEMENT WITH THE UTILITIES TO UTILIZE THE EASEMENT, OR ANY PART OF IT.
2. UTILITIES WILL POSSESS A 5' WIDE SERVICE EASEMENT TO THE DWELLING ALONG THE SERVICE LINE TO THE SERVICE ENTRANCE. THIS EASEMENT WILL VARY DEPENDING UPON LOCATION OF DWELLING AND SERVICE.
3. UTILITIES SHALL HAVE ACCESS TO THE METER LOCATIONS FROM THE FRONT YARD AND METER LOCATIONS SHALL NOT BE LOCATED WITHIN A FENCED AREA.
4. DO NOT COMBINE ANY NEW UTILITY EASEMENTS (U.E.) WITH DRAINAGE EASEMENTS (D.E.) OR MAKE CHANGES IN GRADE WITHIN THE UTILITY EASEMENTS (U.E.) WITHOUT WRITTEN APPROVAL FROM NEW BRAUNFELS UTILITIES.

GBRA NOTES:

1. THE GUADALUPE-BLANCO RIVER AUTHORITY (GBRA) IS HEREBY DEDICATED THE EASEMENT AND RIGHTS-OF-WAY IN THE AREAS DESIGNATED ON THIS PLAN FOR WASTEWATER FACILITIES FOR THE PURPOSE OF INSTALLING, CONSTRUCTING, RECONSTRUCTING, OPERATING, MAINTAINING, INSPECTING, REPAIRING, REMOVING, AND RELOCATING BURIED AND/OR EXPOSED WASTEWATER FACILITIES AND APPURTENANCES.
2. TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS, GBRA SHALL HAVE THE RIGHT TO REMOVE SAID LANDS OF ALL TREES OR PARTS THEREOF, OR ANY OTHER OBSTRUCTIONS WHICH MAY ENDANGER, OR INTERFERE WITH MAINTENANCE OF THE FACILITIES AND APPURTENANCES.
3. OTHER UTILITIES, STRUCTURES, GRADING, DRAINAGE, DETENTION/RETENTION PONDS, LANDSCAPING, TREES, ROADS, PARKING LOTS, FENCES, WALLS, CONSTRUCTION OF ANY TYPE, OR ANY OTHER IMPROVEMENTS OR OBSTRUCTIONS, ARE NOT ALLOWED WITHIN GBRA EASEMENTS.
4. DESIGNS FOR ANY PROPOSED ALTERATIONS OR CROSSINGS OF GBRA EASEMENTS MUST BE APPROVED IN WRITING BY GBRA AND THE INSTALLATION OF SUCH MUST BE INSPECTED AND APPROVED BY GBRA.
5. MAINTENANCE OF EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER.
6. THE PROPERTY OWNER MUST INSTALL 16-FOOT GATES IN ANY FENCES THAT CROSS GBRA UTILITIES; GATES MUST BE CENTERED ACROSS GBRA UTILITIES.
7. CUSTOMER WASTEWATER SERVICES SHALL NOT BE INSTALLED WITHIN FENCED AREAS.

LOT SUMMARY	
LOT	# OF LOTS
UNIT 1 (47.80 AC.)	124
UNIT 2 (22.43 AC.)	124
UNIT 3 (29.67 AC.)	114
UNIT 4 (17.89 AC.)	120
UNIT 5 (22.24 AC.)	133
UNIT 6 (26.36 AC.)	116
UNIT 7 (18.53 AC.)	120
UNIT 8 (13.08 AC.)	99
TOTAL RESIDENTIAL LOTS	950
PARK SPACE (6.46 AC.)	3
OPEN SPACE (1.83 AC.)	5
DRAINAGE LOT (0.15 AC.)	10
SINGLE-FAMILY RESIDENCE (22.88)	1
TOTAL LOTS	969
TOTAL ACREAGE	220.84 AC.

LOT DENSITY (RESID. LOTS/AC) = 4.30 UNITS PER ACRE

APPENDIX C – TRIP GENERATION WORKBOOK

CITY OF NEW BRAUNFELS TRAFFIC IMPACT ANALYSIS (TIA) WORKSHEET

Complete this worksheet as a requirement for zoning, master plan, plat and permit as specified in City of New Braunfels Code of Ordinances Sections 114-99 and 118-46.

Note: The Code provides the minimum information for a TIA report and it is recommended that a scoping meeting be scheduled with the Engineering Division.

Section 1: General Information

General Information												
Project Name: Parkside										Date: 02/14/2019		
Subdivision Plat Name: Parkside					Project Address/Location: South side of Pieper Road approximately 0.5 miles northeast of SH 46							
Location?		<input type="checkbox"/> City of New Braunfels			<input checked="" type="checkbox"/> New Braunfels ETJ			<input type="checkbox"/> Comal County		<input checked="" type="checkbox"/> Guadalupe County		
Owner Name: Clarence Friesenhahn Owner, HMT Engineering (Agent)					Owner Email: (Agent) plats@hmtnb.com							
Owner Address: (Agent) 410 N. Seguin Ave. NB, TX 78130					Owner Phone: (830) 625-8555							
Preparer Company: Lee Engineering, LLC												
Preparer Name: James Robertson, PhD, PE					Preparer Email: jrobertson@lee-eng.com							
Preparer Address: 9901 IH 10W, Suite 680, San Antonio, TX 78230					Preparer Phone: (210) 625-7418							
TIA Report scoping meeting with City Engineering Division staff?					<input checked="" type="checkbox"/> Yes. Date: 07/20/2018			<input type="checkbox"/> No.		TIA Worksheet/Report approved with previous zoning, plan, plat or permit?		
										<input checked="" type="checkbox"/> No. Complete Page 1 only.		
										<input type="checkbox"/> Yes. Complete Pages 1 and 2.		
Application Type or Reason for TIA Worksheet/Report												
<input type="checkbox"/> Zoning/Concept Plan/Detail Plan <input checked="" type="checkbox"/> Master Plan <input type="checkbox"/> Preliminary Plat <input type="checkbox"/> Final Plat <input type="checkbox"/> Permit <input type="checkbox"/> Other												
TIA Submittal Type (A TIA Worksheet is required with all zoning, plan, plat and permit applications)												
<input type="checkbox"/> TIA Worksheet Only (100 peak hour trips or less)						<input type="checkbox"/> Level 1 TIA Report (101-500 peak hour trips)						
<input type="checkbox"/> TIA Worksheet Only – Previous TIA Report Approved						<input checked="" type="checkbox"/> Level 2 TIA Report (501-1,000 peak hour trips)						
<input type="checkbox"/> TIA Worksheet Only – Previous TIA Report not required (supporting documentation may be required)						<input type="checkbox"/> Level 3 TIA Report (1,001 or more peak hour trips)						

Section 2: Proposed Land Use and Trip Information for Application

Unit	Land Use	ITE Code ¹	ITE Unit ²	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKD Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKD Peak Hour Trips	Daily Trips
1	Single-Family Detached Housing	210	Dwelling Units	153	PM	0.74	0.99	0.93	9.44	113	151	142	1,444
2	Single-Family Detached Housing	210	Dwelling Units	105	PM	0.74	0.99	0.93	9.44	78	104	98	991
3	Single-Family Detached Housing	210	Dwelling Units	115	PM	0.74	0.99	0.93	9.44	85	114	107	1,086
4	Single-Family Detached Housing	210	Dwelling Units	107	PM	0.74	0.99	0.93	9.44	79	106	100	1,010
5	Single-Family Detached Housing	210	Dwelling Units	133	PM	0.74	0.99	0.93	9.44	98	132	124	1,256
6	Single-Family Detached Housing	210	Dwelling Units	116	PM	0.74	0.99	0.93	9.44	86	115	108	1,095
7	Single-Family Detached Housing	210	Dwelling Units	120	PM	0.74	0.99	0.93	9.44	89	119	112	1,133
Total from additional tabulation sheet (if necessary):										75	100	93	953
Total:										703	941	884	8,968

¹Institute of Transportation Engineers (ITE) Trip Generation, 9th Edition or most recent; ²E.g., Dwelling Units, Acres, Employees, KSF, etc.

Internal Use Only	Reviewed by:			Date:
	<input type="checkbox"/> TIA Worksheet is acceptable.	<input type="checkbox"/> TIA Worksheet requires corrections.	<input type="checkbox"/> TIA Report required.	<input type="checkbox"/> TIA Report not required.

CITY OF NEW BRAUNFELS TRAFFIC IMPACT ANALYSIS (TIA) WORKSHEET

Complete this worksheet as a requirement for zoning, master plan, plat and permit as specified in City of New Braunfels Code of Ordinances Sections 114-99 and 118-46.
Note: The Code provides the minimum information for a TIA report and it is recommended that a scoping meeting be scheduled with the Engineering Division.

Section 1: General Information

General Information			
Project Name: Parkside			Date: 02/14/2019
Subdivision Plat Name: Parkside		Project Address/Location: South side of Pieper Road approximately 0.5 miles northeast of SH 46	
Location?	<input type="checkbox"/> City of New Braunfels	<input checked="" type="checkbox"/> New Braunfels ETJ	<input type="checkbox"/> Comal County <input checked="" type="checkbox"/> Guadalupe County
Owner Name: Clarence Friesenhahn Owner, HMT Engineering (Agent)		Owner Email: (Agent) plats@hmtnb.com	
Owner Address: (Agent) 410 N. Seguin Ave. NB, TX 78130		Owner Phone: (830) 625-8555	
Preparer Company: Lee Engineering, LLC			
Preparer Name: James Robertson, PhD, PE		Preparer Email: jrobertson@lee-eng.com	
Preparer Address: 9901 IH 10W, Suite 680, San Antonio, TX 78230		Preparer Phone: (210) 625-7418	
TIA Report scoping meeting with City Engineering Division staff?		TIA Worksheet/Report approved with previous zoning, plan, plat or permit?	
<input checked="" type="checkbox"/> Yes. Date: 07/20/2018 <input type="checkbox"/> No.		<input checked="" type="checkbox"/> No. Complete Page 1 only. <input type="checkbox"/> Yes. Complete Pages 1 and 2.	
Application Type or Reason for TIA Worksheet/Report			
<input type="checkbox"/> Zoning/Concept Plan/Detail Plan <input checked="" type="checkbox"/> Master Plan <input type="checkbox"/> Preliminary Plat <input type="checkbox"/> Final Plat <input type="checkbox"/> Permit <input type="checkbox"/> Other			
TIA Submittal Type (A TIA Worksheet is required with all zoning, plan, plat and permit applications)			
<input type="checkbox"/> TIA Worksheet Only (100 peak hour trips or less)		<input type="checkbox"/> Level 1 TIA Report (101-500 peak hour trips)	
<input type="checkbox"/> TIA Worksheet Only – Previous TIA Report Approved		<input checked="" type="checkbox"/> Level 2 TIA Report (501-1,000 peak hour trips)	
<input type="checkbox"/> TIA Worksheet Only – Previous TIA Report not required (supporting documentation may be required)		<input type="checkbox"/> Level 3 TIA Report (1,001 or more peak hour trips)	

Section 2: Proposed Land Use and Trip Information for Application

Unit	Land Use	ITE Code ¹	ITE Unit ²	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKD Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKD Peak Hour Trips	Daily Trips
8	Single-Family Detached Housing	210	Dwelling Units	153	PM	0.74	0.99	0.93	9.44	75	100	93	953
<i>Total from additional tabulation sheet (if necessary):</i>													
Total:										75	100	93	953

¹Institute of Transportation Engineers (ITE) Trip Generation, 9th Edition or most recent; ²E.g., Dwelling Units, Acres, Employees, KSF, etc.

Internal Use Only	Reviewed by:			Date:
	<input type="checkbox"/> TIA Worksheet is acceptable.	<input type="checkbox"/> TIA Worksheet requires corrections.	<input type="checkbox"/> TIA Report required.	<input type="checkbox"/> TIA Report not required.

Approved TIA Worksheet/Report				
Project Name:				
Preparer Company:		Preparer Name:		Date:
Type:	<input type="checkbox"/> TIA Worksheet Only	<input type="checkbox"/> Level 1 TIA Report	<input type="checkbox"/> Level 2 TIA Report	<input type="checkbox"/> Level 3 TIA Report
Approved with:	<input type="checkbox"/> Zoning/Concept Plan/Detail Plan	<input type="checkbox"/> Master Plan	<input type="checkbox"/> Plat	<input type="checkbox"/> Permit <input type="checkbox"/> Other

Unit	Land Use	Status ³	ITE Code ¹	ITE Unit ²	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKD Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKD Peak Hour Trips	Daily Trips
Total from additional tabulation sheet (if necessary):														
Total:														

³Specify current *approved* status of unit: PLAN – Zoning/Concept Plan/Detail Plan/Master Plan, PP – Preliminary Plat, FP – Final Plat, P – Permit, C – Completed, A – With this Application (current)

Approved TIA Conformance	AM Peak Hour Trips	PM Peak Hour Trips	WKD Peak Hour Trips	Daily Trips
Approved development total:				
Updated development total:				
Difference development total:				
New TIA Report Required?				
Increase in Peak Hour Trips over 100?		<input type="checkbox"/> Yes. New TIA Report required to be approved prior to approval. <input type="checkbox"/> No.		

Mitigation Measures	Unit
1. Right-Turn Deceleration Lane for NB SH 46	1
2. Dedicated Left-Turn Lane for WB Pieper Road	1
3. Traffic signal at SH 46 & Pieper Road	4
4.	

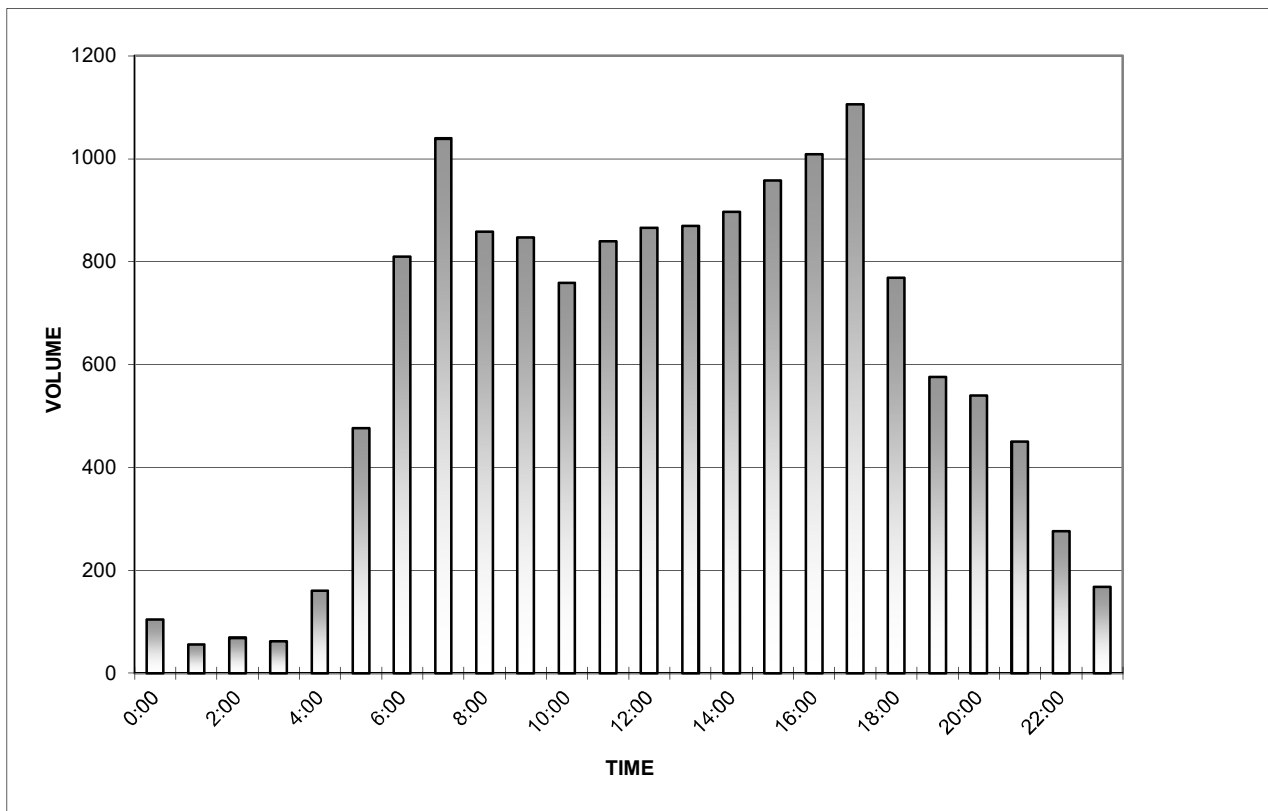
APPENDIX D – TRAFFIC COUNT DATA

Southbound SH 46 south of Pieper Rr

Date Began:
7/24/2018

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	28	32	19	25	104
1:00	9	6	22	19	56
2:00	17	17	22	13	69
3:00	8	15	12	27	62
4:00	35	28	59	38	160
5:00	51	103	171	151	476
6:00	154	205	251	199	809
7:00	213	259	278	289	1039
8:00	245	197	174	242	858
9:00	210	222	195	220	847
10:00	189	187	181	202	759
11:00	211	187	221	220	839
12:00	209	180	223	254	866
13:00	230	190	227	222	869
14:00	209	175	252	261	897
15:00	242	224	223	269	958
16:00	263	267	221	257	1008
17:00	245	324	280	256	1105
18:00	216	179	208	165	768
19:00	144	158	142	132	576
20:00	154	144	121	121	540
21:00	123	122	112	93	450
22:00	77	76	76	47	276
23:00	41	44	53	30	168
TOTAL:					14559

The A.M. peak hour from 7:15 to 8:15 is 1071
The P.M. peak hour from 16:45 to 17:45 is 1106

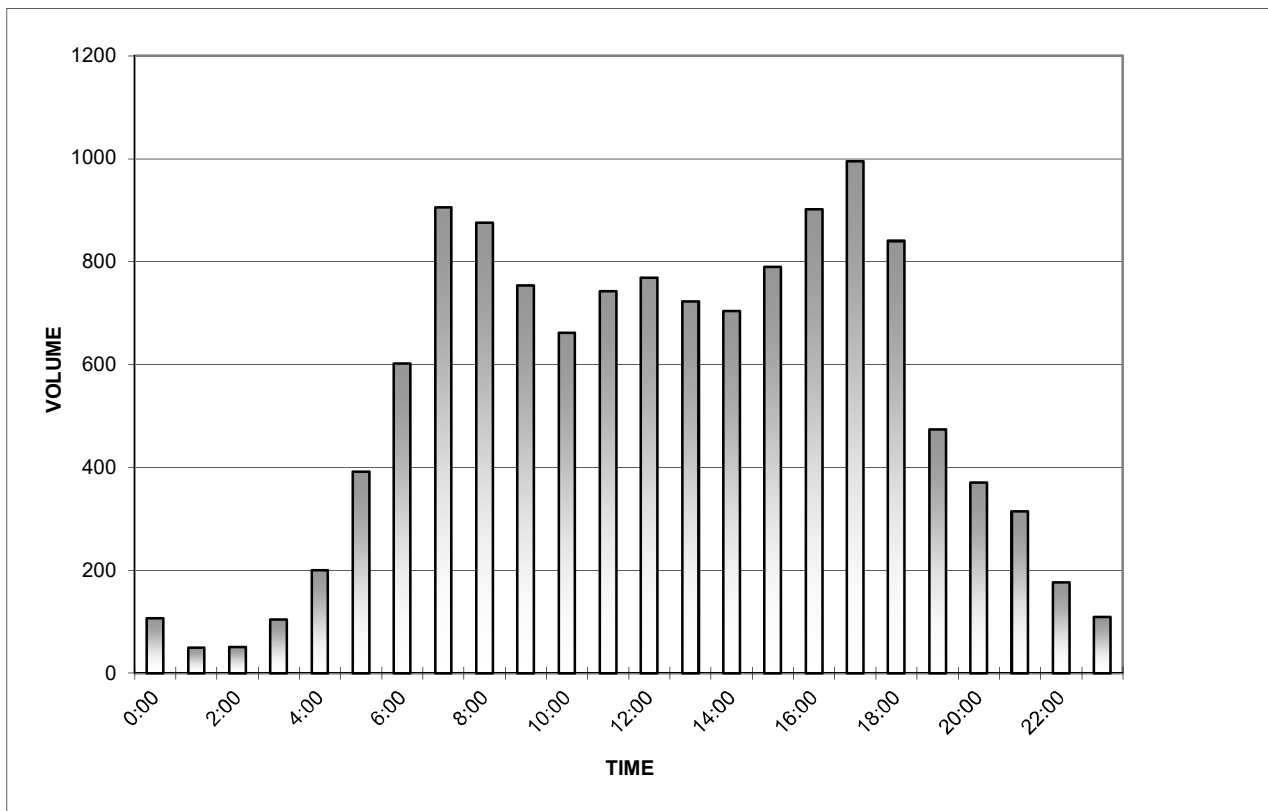


Northbound SH 46 south of Pieper Rc

Date Began:
7/24/2018

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	33	30	24	20	107
1:00	18	2	10	20	50
2:00	10	20	15	6	51
3:00	27	29	23	25	104
4:00	42	24	55	79	200
5:00	68	82	125	117	392
6:00	98	153	194	157	602
7:00	214	259	224	208	905
8:00	196	223	234	222	875
9:00	207	207	171	168	753
10:00	146	154	180	182	662
11:00	157	173	192	220	742
12:00	193	166	225	185	769
13:00	179	182	199	163	723
14:00	186	166	194	158	704
15:00	195	189	201	205	790
16:00	193	223	237	248	901
17:00	228	273	269	225	995
18:00	243	232	201	164	840
19:00	151	114	113	96	474
20:00	87	91	102	90	370
21:00	86	85	69	75	315
22:00	51	49	42	34	176
23:00	28	25	35	21	109
TOTAL:					12609

The A.M. peak hour from 7:00 to 8:00 is 905
The P.M. peak hour from 16:45 to 17:45 is 1018

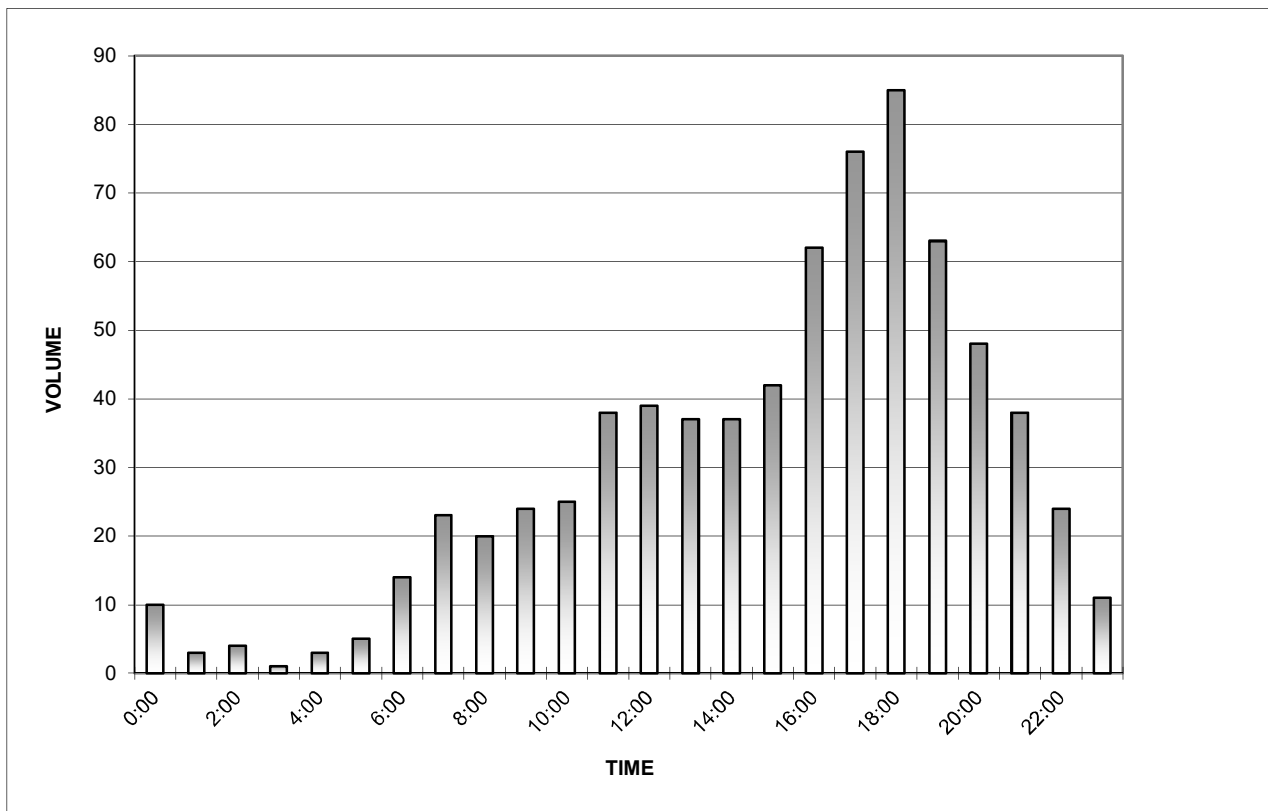


Eastbound Pieper Rd west of Avery Ranch

Date Began:
7/24/2018

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	3	3	2	2	10
1:00	0	2	1	0	3
2:00	2	1	0	1	4
3:00	1	0	0	0	1
4:00	2	1	0	0	3
5:00	1	1	3	0	5
6:00	2	5	4	3	14
7:00	3	10	6	4	23
8:00	7	4	6	3	20
9:00	8	6	5	5	24
10:00	4	4	8	9	25
11:00	10	5	11	12	38
12:00	8	14	7	10	39
13:00	9	13	8	7	37
14:00	7	11	7	12	37
15:00	10	10	12	10	42
16:00	14	14	19	15	62
17:00	17	14	18	27	76
18:00	30	25	15	15	85
19:00	13	23	10	17	63
20:00	11	8	14	15	48
21:00	12	10	7	9	38
22:00	8	8	4	4	24
23:00	3	1	3	4	11
TOTAL:					732

The A.M. peak hour from 7:15 to 8:15 is 27
The P.M. peak hour from 17:30 to 18:30 is 100

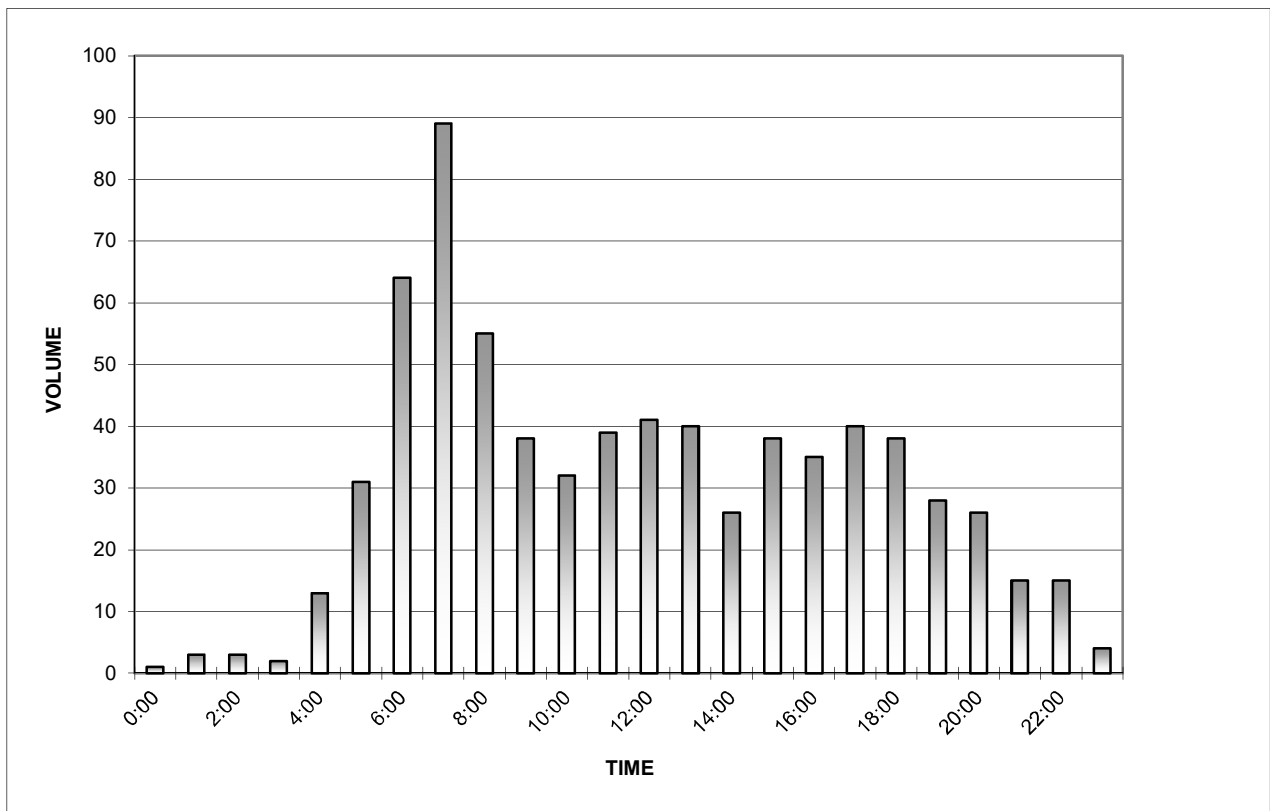


Westbound Pieper Rd west of Avery Ranch

Date Began:
7/24/2018

TIME	0:00	0:15	0:30	0:45	TOTAL
0:00	0	0	0	1	1
1:00	0	1	2	0	3
2:00	2	0	0	1	3
3:00	0	0	0	2	2
4:00	1	4	3	5	13
5:00	4	8	11	8	31
6:00	6	19	16	23	64
7:00	24	23	26	16	89
8:00	11	15	15	14	55
9:00	14	10	9	5	38
10:00	7	8	13	4	32
11:00	13	9	10	7	39
12:00	13	4	15	9	41
13:00	10	13	10	7	40
14:00	5	5	10	6	26
15:00	12	6	11	9	38
16:00	7	12	11	5	35
17:00	9	9	11	11	40
18:00	12	9	8	9	38
19:00	9	6	7	6	28
20:00	5	9	8	4	26
21:00	4	3	5	3	15
22:00	4	6	2	3	15
23:00	2	0	1	1	4
TOTAL:					716

The A.M. peak hour from 6:45 to 7:45 is 96
The P.M. peak hour from 17:30 to 18:30 is 43



SH 46 at Pieper Rd - TMC

Tue Jul 24, 2018

Full Length (7AM-9AM, 4PM-6PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547692, Location: 29.659383, -98.047932, Site Code: 1



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	SH 46 Southbound						Pieper Rd Westbound						SH 46 Northbound						Personal Drwy Eastbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2018-07-24																									
7:00AM	0	158	7	0	165	0	18	0	11	0	29	0	3	189	0	0	192	0	0	0	0	0	0	0	386
7:15AM	0	223	5	0	228	0	15	0	8	0	23	0	6	243	0	0	249	0	0	0	0	0	0	0	500
7:30AM	0	253	3	0	256	0	20	0	8	0	28	0	4	199	0	0	203	0	0	0	0	0	0	0	487
7:45AM	0	238	3	1	242	0	10	0	9	0	19	0	2	184	0	0	186	0	0	0	0	0	0	0	447
Hourly Total	0	872	18	1	891	0	63	0	36	0	99	0	15	815	0	0	830	0	0	0	0	0	0	0	1820
8:00AM	0	208	5	0	213	0	9	0	4	0	13	0	4	169	0	0	173	0	0	0	0	0	0	0	399
8:15AM	0	165	3	0	168	0	6	0	6	0	12	0	2	195	0	0	197	0	0	0	0	0	0	0	377
8:30AM	0	149	3	0	152	0	12	0	5	0	17	0	3	203	0	0	206	0	0	0	0	0	0	0	375
8:45AM	0	177	3	0	180	0	11	0	7	0	18	0	0	198	0	0	198	0	0	0	0	0	0	0	396
Hourly Total	0	699	14	0	713	0	38	0	22	0	60	0	9	765	0	0	774	0	0	0	0	0	0	0	1547
4:00PM	0	252	8	0	260	0	8	0	3	0	11	0	9	167	0	0	176	0	0	0	0	0	0	0	447
4:15PM	0	235	14	0	249	0	10	0	5	0	15	0	2	211	0	0	213	0	0	0	0	0	0	0	477
4:30PM	0	216	8	0	224	0	10	0	4	0	14	0	10	221	0	0	231	0	0	0	0	0	0	0	469
4:45PM	0	239	8	0	247	0	5	0	2	0	7	0	8	225	0	0	233	0	0	0	0	0	0	0	487
Hourly Total	0	942	38	0	980	0	33	0	14	0	47	0	29	824	0	0	853	0	0	0	0	0	0	0	1880
5:00PM	0	255	10	0	265	0	5	0	3	0	8	0	8	219	0	0	227	0	0	0	0	0	0	0	500
5:15PM	0	317	10	0	327	0	3	0	5	0	8	0	5	255	0	0	260	0	0	0	0	0	0	0	595
5:30PM	0	285	6	0	291	0	9	0	3	0	12	0	11	239	0	0	250	0	0	0	0	0	0	0	553
5:45PM	0	240	27	0	267	0	9	0	4	0	13	0	11	212	0	0	223	0	0	0	0	0	0	0	503
Hourly Total	0	1097	53	0	1150	0	26	0	15	0	41	0	35	925	0	0	960	0	0	0	0	0	0	0	2151
Total	0	3610	123	1	3734	0	160	0	87	0	247	0	88	3329	0	0	3417	0	0	0	0	0	0	0	7398
% Approach	0%	96.7%	3.3%	0%	-	-	64.8%	0%	35.2%	0%	-	-	2.6%	97.4%	0%	0%	-	-	0%	0%	0%	0%	-	-	-
% Total	0%	48.8%	1.7%	0%	50.5%	-	2.2%	0%	1.2%	0%	3.3%	-	1.2%	45.0%	0%	0%	46.2%	-	0%	0%	0%	0%	0%	-	-
Lights	0	3244	122	1	3367	-	159	0	85	0	244	-	85	3067	0	0	3152	-	0	0	0	0	0	-	6763
% Lights	0%	89.9%	99.2%	100%	90.2%	-	99.4%	0%	97.7%	0%	98.8%	-	96.6%	92.1%	0%	0%	92.2%	-	0%	0%	0%	0%	-	-	91.4%
Articulated Trucks	0	295	1	0	296	-	0	0	0	0	0	-	0	209	0	0	209	-	0	0	0	0	0	-	505
% Articulated Trucks	0%	8.2%	0.8%	0%	7.9%	-	0%	0%	0%	0%	0%	-	0%	6.3%	0%	0%	6.1%	-	0%	0%	0%	0%	-	-	6.8%
Buses and Single-Unit Trucks	0	71	0	0	71	-	1	0	2	0	3	-	3	53	0	0	56	-	0	0	0	0	0	-	130
% Buses and Single-Unit Trucks	0%	2.0%	0%	0%	1.9%	-	0.6%	0%	2.3%	0%	1.2%	-	3.4%	1.6%	0%	0%	1.6%	-	0%	0%	0%	0%	-	-	1.8%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

SH 46 at Pieper Rd - TMC

Tue Jul 24, 2018

Full Length (7AM-9AM, 4PM-6PM)

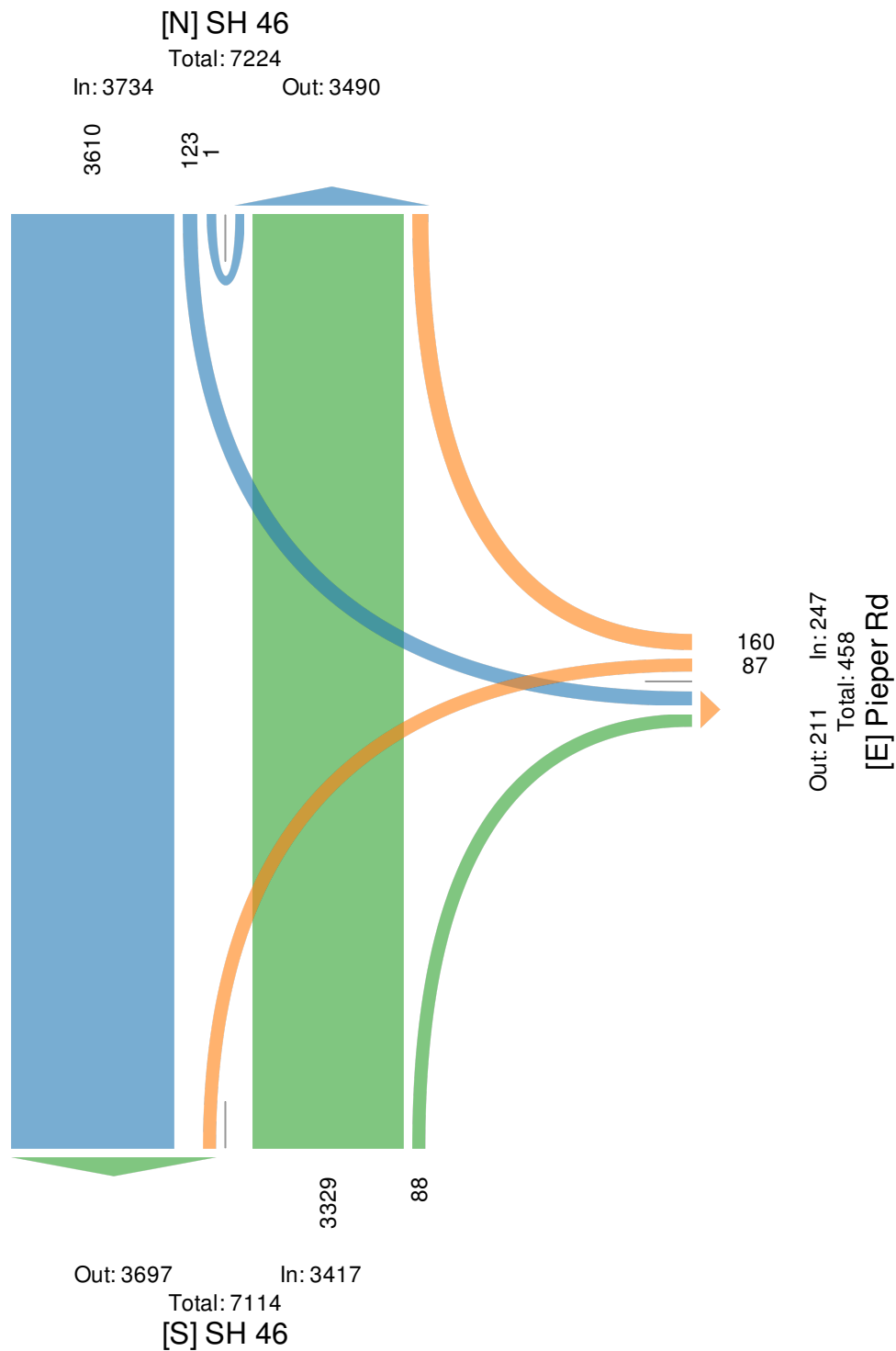
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547692, Location: 29.659383, -98.047932, Site Code: 1



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US



SH 46 at Pieper Rd - TMC

Tue Jul 24, 2018

AM Peak (7:15AM - 8:15AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547692, Location: 29.659383, -98.047932, Site Code: 1



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	SH 46 Southbound						Pieper Rd Westbound						SH 46 Northbound						Personal Drwy Eastbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2018-07-24																									
7:15AM	0	223	5	0	228	0	15	0	8	0	23	0	6	243	0	0	249	0	0	0	0	0	0	0	500
7:30AM	0	253	3	0	256	0	20	0	8	0	28	0	4	199	0	0	203	0	0	0	0	0	0	0	487
7:45AM	0	238	3	1	242	0	10	0	9	0	19	0	2	184	0	0	186	0	0	0	0	0	0	0	447
8:00AM	0	208	5	0	213	0	9	0	4	0	13	0	4	169	0	0	173	0	0	0	0	0	0	0	399
Total	0	922	16	1	939	0	54	0	29	0	83	0	16	795	0	0	811	0	0	0	0	0	0	0	1833
% Approach	0%	98.2%	1.7%	0.1%	-	-	65.1%	0%	34.9%	0%	-	-	2.0%	98.0%	0%	0%	-	-	0%	0%	0%	0%	-	-	-
% Total	0%	50.3%	0.9%	0.1%	51.2%	-	2.9%	0%	1.6%	0%	4.5%	-	0.9%	43.4%	0%	0%	44.2%	-	0%	0%	0%	0%	0%	-	-
PHF	-	0.911	0.800	0.250	0.917	-	0.675	-	0.806	-	0.741	-	0.667	0.818	-	-	0.814	-	-	-	-	-	-	-	0.917
Lights	0	783	16	1	800	-	54	0	29	0	83	-	16	726	0	0	742	-	0	0	0	0	0	-	1625
% Lights	0%	84.9%	100%	100%	85.2%	-	100%	0%	100%	0%	100%	-	100%	91.3%	0%	0%	91.5%	-	0%	0%	0%	0%	-	-	88.7%
Articulated Trucks	0	121	0	0	121	-	0	0	0	0	0	-	0	60	0	0	60	-	0	0	0	0	0	-	181
% Articulated Trucks	0%	13.1%	0%	0%	12.9%	-	0%	0%	0%	0%	0%	-	0%	7.5%	0%	0%	7.4%	-	0%	0%	0%	0%	-	-	9.9%
Buses and Single-Unit Trucks	0	18	0	0	18	-	0	0	0	0	0	-	0	9	0	0	9	-	0	0	0	0	0	-	27
% Buses and Single-Unit Trucks	0%	2.0%	0%	0%	1.9%	-	0%	0%	0%	0%	0%	-	0%	1.1%	0%	0%	1.1%	-	0%	0%	0%	0%	-	-	1.5%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

SH 46 at Pieper Rd - TMC

Tue Jul 24, 2018

AM Peak (7:15AM - 8:15AM)

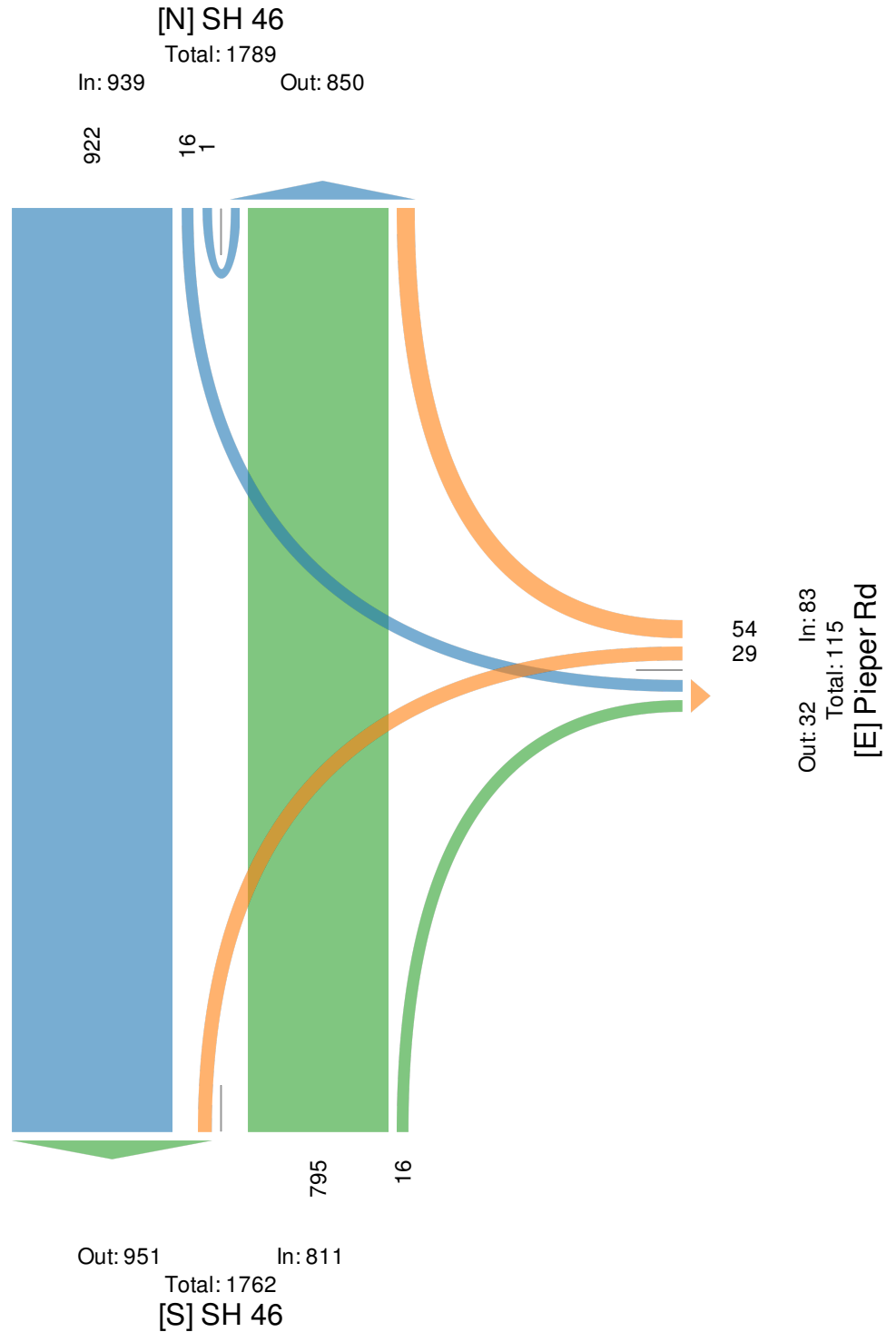
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547692, Location: 29.659383, -98.047932, Site Code: 1



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US



SH 46 at Pieper Rd - TMC

Tue Jul 24, 2018

PM Peak (5PM - 6PM) - Overall Peak Hour

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547692, Location: 29.659383, -98.047932, Site Code: 1



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	SH 46 Southbound						Pieper Rd Westbound						SH 46 Northbound						Personal Drwy Eastbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2018-07-24																									
5:00PM	0	255	10	0	265	0	5	0	3	0	8	0	8	219	0	0	227	0	0	0	0	0	0	0	500
5:15PM	0	317	10	0	327	0	3	0	5	0	8	0	5	255	0	0	260	0	0	0	0	0	0	0	595
5:30PM	0	285	6	0	291	0	9	0	3	0	12	0	11	239	0	0	250	0	0	0	0	0	0	0	553
5:45PM	0	240	27	0	267	0	9	0	4	0	13	0	11	212	0	0	223	0	0	0	0	0	0	0	503
Total	0	1097	53	0	1150	0	26	0	15	0	41	0	35	925	0	0	960	0	0	0	0	0	0	0	2151
% Approach	0%	95.4%	4.6%	0%	-	-	63.4%	0%	36.6%	0%	-	-	3.6%	96.4%	0%	0%	-	-	0%	0%	0%	0%	-	-	-
% Total	0%	51.0%	2.5%	0%	53.5%	-	1.2%	0%	0.7%	0%	1.9%	-	1.6%	43.0%	0%	0%	44.6%	-	0%	0%	0%	0%	0%	-	-
PHF	-	0.865	0.491	-	0.879	-	0.722	-	0.750	-	0.788	-	0.795	0.907	-	-	0.923	-	-	-	-	-	-	-	0.904
Lights	0	1069	52	0	1121	-	26	0	15	0	41	-	34	891	0	0	925	-	0	0	0	0	0	-	2087
% Lights	0%	97.4%	98.1%	0%	97.5%	-	100%	0%	100%	0%	100%	-	97.1%	96.3%	0%	0%	96.4%	-	0%	0%	0%	0%	-	-	97.0%
Articulated Trucks	0	15	1	0	16	-	0	0	0	0	0	-	0	27	0	0	27	-	0	0	0	0	0	-	43
% Articulated Trucks	0%	1.4%	1.9%	0%	1.4%	-	0%	0%	0%	0%	0%	-	0%	2.9%	0%	0%	2.8%	-	0%	0%	0%	0%	-	-	2.0%
Buses and Single-Unit Trucks	0	13	0	0	13	-	0	0	0	0	0	-	1	7	0	0	8	-	0	0	0	0	0	-	21
% Buses and Single-Unit Trucks	0%	1.2%	0%	0%	1.1%	-	0%	0%	0%	0%	0%	-	2.9%	0.8%	0%	0%	0.8%	-	0%	0%	0%	0%	-	-	1.0%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

SH 46 at Pieper Rd - TMC

Tue Jul 24, 2018

PM Peak (5PM - 6PM) - Overall Peak Hour

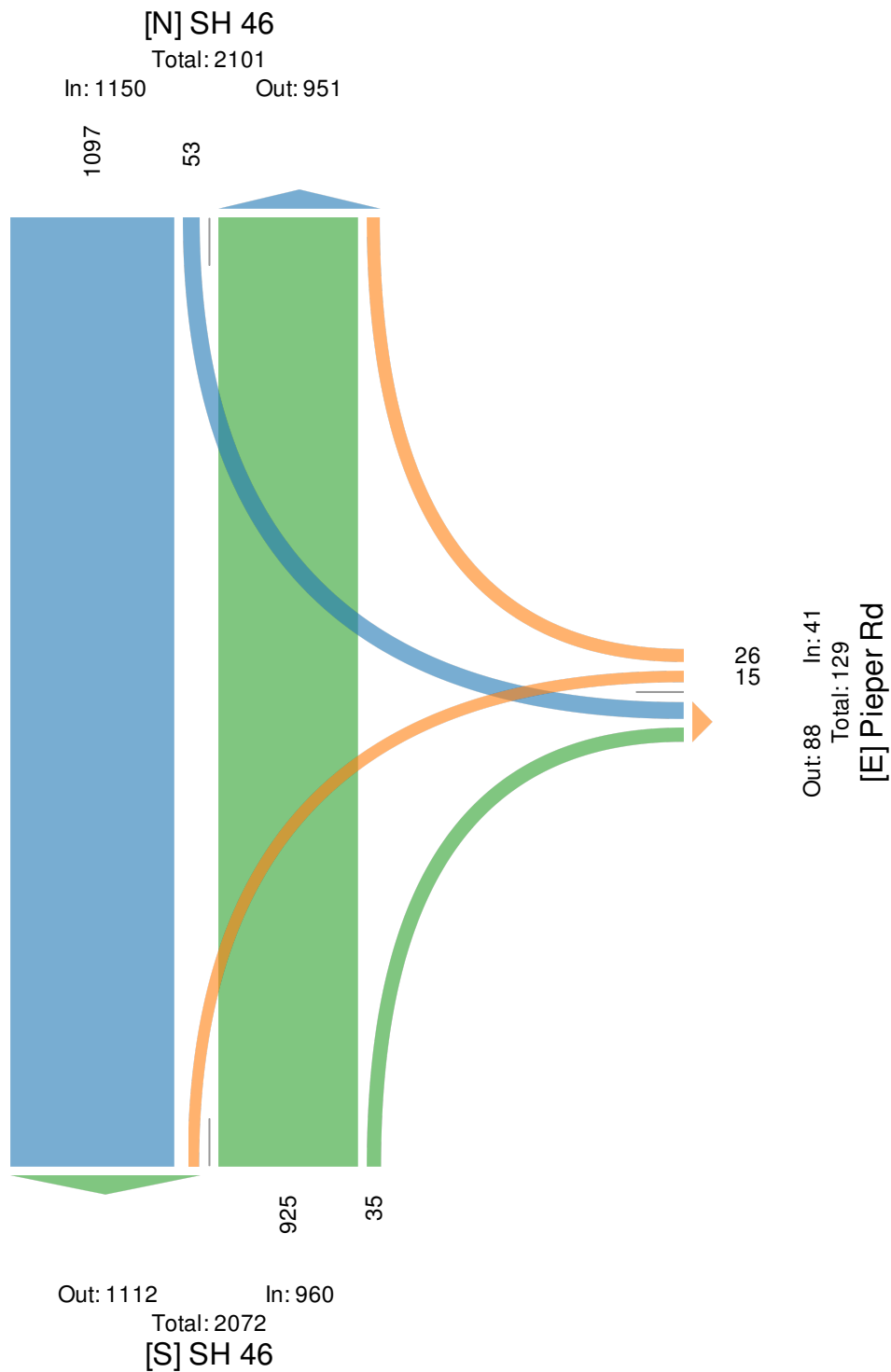
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547692, Location: 29.659383, -98.047932, Site Code: 1



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US



Pieper Rd at Avery Ranch - TMC

Tue Jul 24, 2018

Full Length (7AM-9AM, 4PM-6PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547693, Location: 29.669609, -98.035756, Site Code: 2



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	Avery Ranch Southbound					Pieper Rd Westbound					Pieper Rd Eastbound					
Time	R	L	U	App	Ped*	R	T	U	App	Ped*	T	L	U	App	Ped*	Int
2018-07-24 7:00AM	21	1	0	22	0	0	3	0	3	0	1	2	0	3	0	28
7:15AM	22	7	0	29	0	0	1	0	1	0	3	6	0	9	0	39
7:30AM	24	7	0	31	0	0	2	0	2	0	2	5	0	7	0	40
7:45AM	12	8	0	20	0	2	4	0	6	0	1	3	0	4	0	30
Hourly Total	79	23	0	102	0	2	10	0	12	0	7	16	0	23	0	137
8:00AM	11	4	0	15	0	0	0	0	0	0	0	7	0	7	0	22
8:15AM	14	4	1	19	0	3	1	0	4	0	2	2	0	4	0	27
8:30AM	13	3	0	16	1	1	2	0	3	0	0	6	0	6	0	25
8:45AM	14	3	0	17	0	1	0	0	1	0	1	2	0	3	0	21
Hourly Total	52	14	1	67	1	5	3	0	8	0	3	17	0	20	0	95
4:00PM	6	2	0	8	0	6	1	0	7	0	4	9	0	13	0	28
4:15PM	11	3	0	14	0	4	1	0	5	0	2	13	0	15	0	34
4:30PM	9	5	0	14	0	10	2	0	12	0	2	17	0	19	0	45
4:45PM	6	3	0	9	0	12	0	0	12	0	1	15	0	16	0	37
Hourly Total	32	13	0	45	0	32	4	0	36	0	9	54	0	63	0	144
5:00PM	6	8	1	15	0	11	2	0	13	0	3	14	0	17	0	45
5:15PM	5	5	0	10	0	4	4	0	8	0	1	13	0	14	0	32
5:30PM	11	6	0	17	0	11	0	0	11	0	2	16	0	18	0	46
5:45PM	11	2	0	13	0	8	2	0	10	0	0	27	0	27	0	50
Hourly Total	33	21	1	55	0	34	8	0	42	0	6	70	0	76	0	173
Total	196	71	2	269	1	73	25	0	98	0	25	157	0	182	0	549
% Approach	72.9%	26.4%	0.7%	-	-	74.5%	25.5%	0%	-	-	13.7%	86.3%	0%	-	-	-
% Total	35.7%	12.9%	0.4%	49.0%	-	13.3%	4.6%	0%	17.9%	-	4.6%	28.6%	0%	33.2%	-	-
Lights	196	71	2	269	-	72	24	0	96	-	24	156	0	180	-	545
% Lights	100%	100%	100%	100%	-	98.6%	96.0%	0%	98.0%	-	96.0%	99.4%	0%	98.9%	-	99.3%
Articulated Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Articulated Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Buses and Single-Unit Trucks	0	0	0	0	-	1	1	0	2	-	1	1	0	2	-	4
% Buses and Single-Unit Trucks	0%	0%	0%	0%	-	1.4%	4.0%	0%	2.0%	-	4.0%	0.6%	0%	1.1%	-	0.7%
Pedestrians	-	-	-	-	1	-	-	-	-	0	-	-	-	-	0	-
% Pedestrians	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Pieper Rd at Avery Ranch - TMC

Tue Jul 24, 2018

Full Length (7AM-9AM, 4PM-6PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547693, Location: 29.669609, -98.035756, Site Code: 2



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

[N] Avery Ranch

Total: 501

In: 269

Out: 232

196

71

2

1

[W] Pieper Rd

Total: 403

Out: 221

In: 182

157

25

73

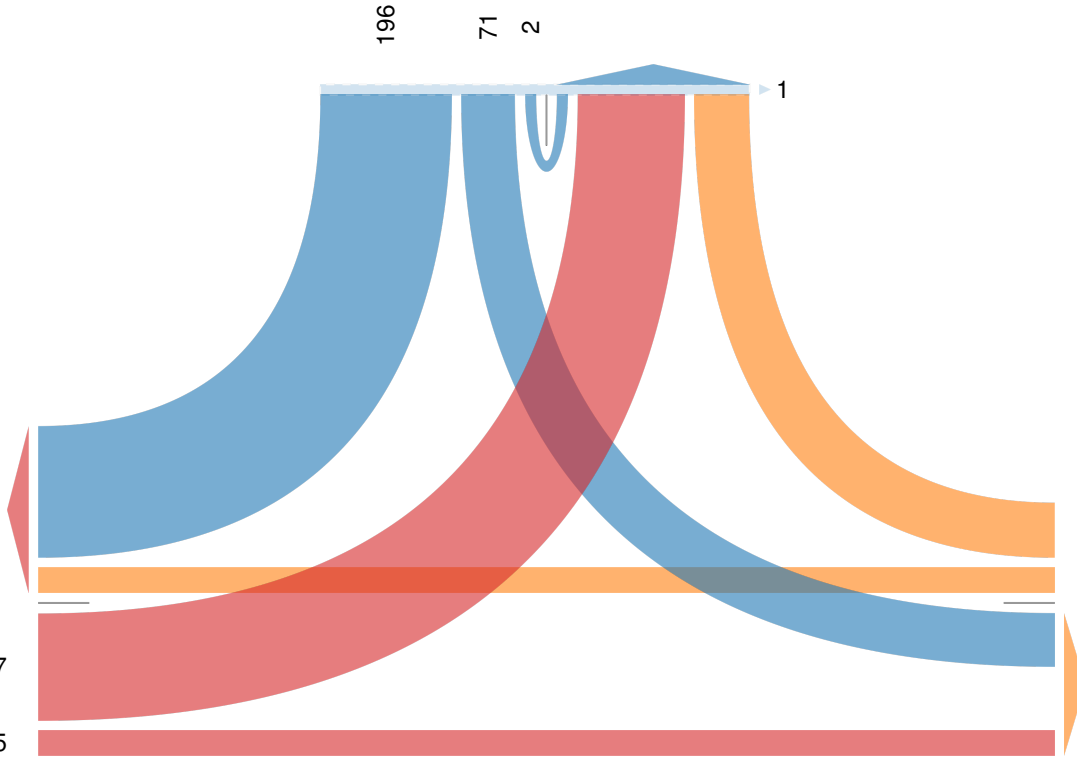
25

Out: 96

In: 98

Total: 194

[E] Pieper Rd



Pieper Rd at Avery Ranch - TMC

Tue Jul 24, 2018

AM Peak (7AM - 8AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547693, Location: 29.669609, -98.035756, Site Code: 2



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	Avery Ranch Southbound					Pieper Rd Westbound					Pieper Rd Eastbound					
Time	R	L	U	App	Ped*	R	T	U	App	Ped*	T	L	U	App	Ped*	Int
2018-07-24 7:00AM	21	1	0	22	0	0	3	0	3	0	1	2	0	3	0	28
7:15AM	22	7	0	29	0	0	1	0	1	0	3	6	0	9	0	39
7:30AM	24	7	0	31	0	0	2	0	2	0	2	5	0	7	0	40
7:45AM	12	8	0	20	0	2	4	0	6	0	1	3	0	4	0	30
Total	79	23	0	102	0	2	10	0	12	0	7	16	0	23	0	137
% Approach	77.5%	22.5%	0%	-	-	16.7%	83.3%	0%	-	-	30.4%	69.6%	0%	-	-	-
% Total	57.7%	16.8%	0%	74.5%	-	1.5%	7.3%	0%	8.8%	-	5.1%	11.7%	0%	16.8%	-	-
PHF	0.823	0.719	-	0.823	-	0.250	0.625	-	0.500	-	0.583	0.667	-	0.639	-	0.856
Lights	79	23	0	102	-	2	10	0	12	-	7	16	0	23	-	137
% Lights	100%	100%	0%	100%	-	100%	100%	0%	100%	-	100%	100%	0%	100%	-	100%
Articulated Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Articulated Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Buses and Single-Unit Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Buses and Single-Unit Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Pieper Rd at Avery Ranch - TMC

Tue Jul 24, 2018

AM Peak (7AM - 8AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks,
Pedestrians)

All Movements

ID: 547693, Location: 29.669609, -98.035756, Site Code: 2



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

[N] Avery Ranch

Total: 120

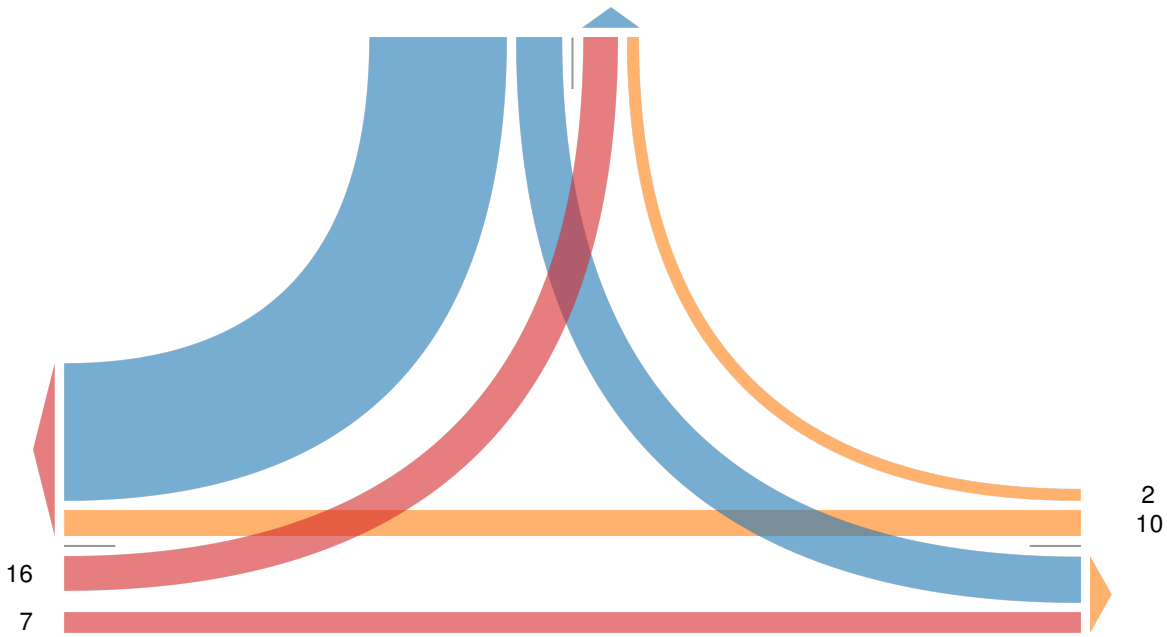
In: 102

Out: 18

79

23

[W] Pieper Rd
Total: 112
In: 23
Out: 89



Out: 30 In: 12
Total: 42
[E] Pieper Rd

Pieper Rd at Avery Ranch - TMC

Tue Jul 24, 2018

PM Peak (5PM - 6PM) - Overall Peak Hour

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547693, Location: 29.669609, -98.035756, Site Code: 2



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	Avery Ranch Southbound					Pieper Rd Westbound					Pieper Rd Eastbound					
Time	R	L	U	App	Ped*	R	T	U	App	Ped*	T	L	U	App	Ped*	Int
2018-07-24 5:00PM	6	8	1	15	0	11	2	0	13	0	3	14	0	17	0	45
5:15PM	5	5	0	10	0	4	4	0	8	0	1	13	0	14	0	32
5:30PM	11	6	0	17	0	11	0	0	11	0	2	16	0	18	0	46
5:45PM	11	2	0	13	0	8	2	0	10	0	0	27	0	27	0	50
Total	33	21	1	55	0	34	8	0	42	0	6	70	0	76	0	173
% Approach	60.0%	38.2%	1.8%	-	-	81.0%	19.0%	0%	-	-	7.9%	92.1%	0%	-	-	-
% Total	19.1%	12.1%	0.6%	31.8%	-	19.7%	4.6%	0%	24.3%	-	3.5%	40.5%	0%	43.9%	-	-
PHF	0.750	0.656	0.250	0.809	-	0.773	0.500	-	0.808	-	0.500	0.648	-	0.704	-	0.865
Lights	33	21	1	55	-	33	8	0	41	-	5	70	0	75	-	171
% Lights	100%	100%	100%	100%	-	97.1%	100%	0%	97.6%	-	83.3%	100%	0%	98.7%	-	98.8%
Articulated Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Articulated Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Buses and Single-Unit Trucks	0	0	0	0	-	1	0	0	1	-	1	0	0	1	-	2
% Buses and Single-Unit Trucks	0%	0%	0%	0%	-	2.9%	0%	0%	2.4%	-	16.7%	0%	0%	1.3%	-	1.2%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Pieper Rd at Avery Ranch - TMC

Tue Jul 24, 2018

PM Peak (5PM - 6PM) - Overall Peak Hour

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547693, Location: 29.669609, -98.035756, Site Code: 2



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

[N] Avery Ranch

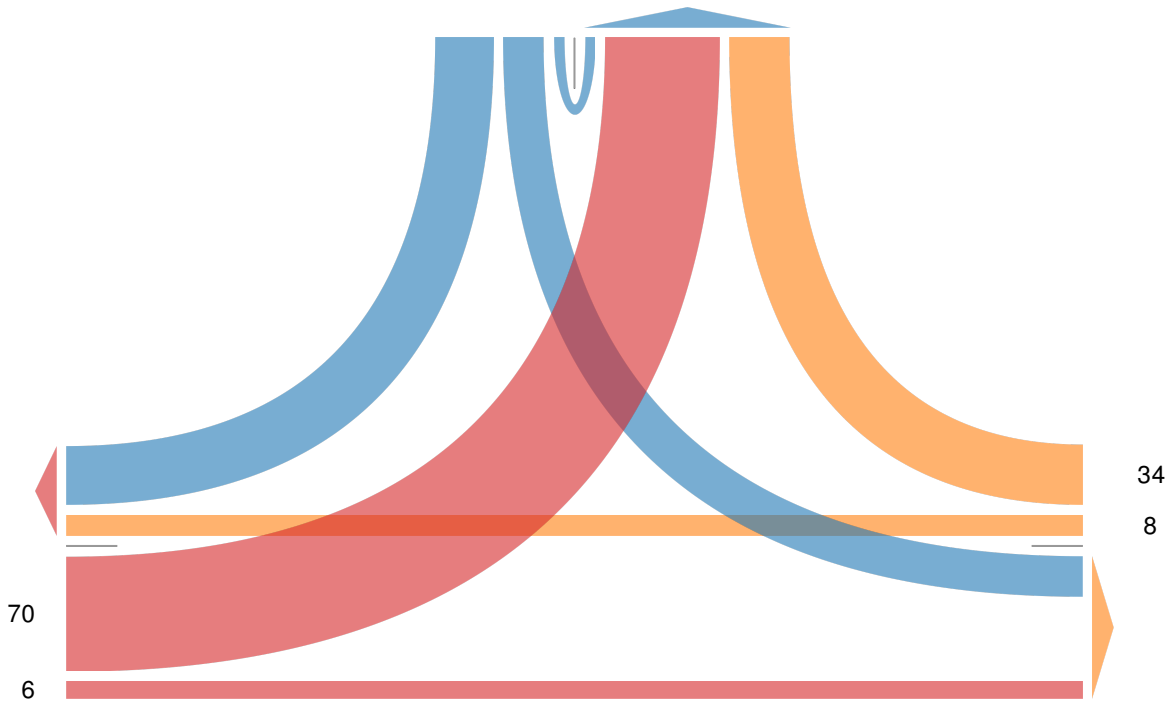
Total: 160

In: 55

Out: 105

33 21 1

[W] Pieper Rd
Total: 117
In: 76
Out: 41



34
8
Out: 27 In: 42
Total: 69
[E] Pieper Rd

Pieper Rd at Dauer Ranch - TMC

Tue Jul 24, 2018

Full Length (7AM-9AM, 4PM-6PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547694, Location: 29.675058, -98.022705, Site Code: 3



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	Dauer Ranch Southbound					Pieper Rd Westbound					Pieper Rd Eastbound					
Time	R	L	U	App	Ped*	R	T	U	App	Ped*	T	L	U	App	Ped*	Int
2018-07-24 7:00AM	0	0	0	0	0	4	2	0	6	0	5	1	0	6	0	12
7:15AM	1	3	0	4	0	2	0	0	2	0	5	3	0	8	0	14
7:30AM	1	2	0	3	0	3	0	0	3	0	1	6	0	7	0	13
7:45AM	1	1	0	2	0	2	3	0	5	0	1	8	0	9	0	16
Hourly Total	3	6	0	9	0	11	5	0	16	0	12	18	0	30	0	55
8:00AM	1	0	0	1	0	3	0	0	3	0	3	4	0	7	0	11
8:15AM	2	3	0	5	0	4	1	0	5	0	1	4	0	5	0	15
8:30AM	1	1	0	2	0	1	1	0	2	0	2	1	0	3	0	7
8:45AM	1	1	0	2	0	0	0	0	0	0	0	3	0	3	0	5
Hourly Total	5	5	0	10	0	8	2	0	10	0	6	12	0	18	0	38
4:00PM	4	0	0	4	0	3	1	0	4	0	0	3	0	3	0	11
4:15PM	4	2	0	6	0	2	2	0	4	0	2	3	0	5	0	15
4:30PM	9	0	0	9	0	1	4	0	5	0	1	4	0	5	0	19
4:45PM	9	2	0	11	0	2	3	0	5	0	0	0	0	0	0	16
Hourly Total	26	4	0	30	0	8	10	0	18	0	3	10	0	13	0	61
5:00PM	10	3	0	13	0	2	2	0	4	0	2	8	0	10	0	27
5:15PM	6	6	0	12	0	2	3	0	5	0	2	5	0	7	0	24
5:30PM	8	2	0	10	0	2	1	0	3	0	0	7	0	7	0	20
5:45PM	8	5	0	13	0	1	3	0	4	0	2	2	0	4	0	21
Hourly Total	32	16	0	48	0	7	9	0	16	0	6	22	0	28	0	92
Total	66	31	0	97	0	34	26	0	60	0	27	62	0	89	0	246
% Approach	68.0%	32.0%	0%	-	-	56.7%	43.3%	0%	-	-	30.3%	69.7%	0%	-	-	-
% Total	26.8%	12.6%	0%	39.4%	-	13.8%	10.6%	0%	24.4%	-	11.0%	25.2%	0%	36.2%	-	-
Lights	65	30	0	95	-	34	26	0	60	-	27	62	0	89	-	244
% Lights	98.5%	96.8%	0%	97.9%	-	100%	100%	0%	100%	-	100%	100%	0%	100%	-	99.2%
Articulated Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Articulated Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Buses and Single-Unit Trucks	1	1	0	2	-	0	0	0	0	-	0	0	0	0	-	2
% Buses and Single-Unit Trucks	1.5%	3.2%	0%	2.1%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0.8%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Pieper Rd at Dauer Ranch - TMC

Tue Jul 24, 2018

Full Length (7AM-9AM, 4PM-6PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547694, Location: 29.675058, -98.022705, Site Code: 3



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

[N] Dauer Ranch

Total: 193

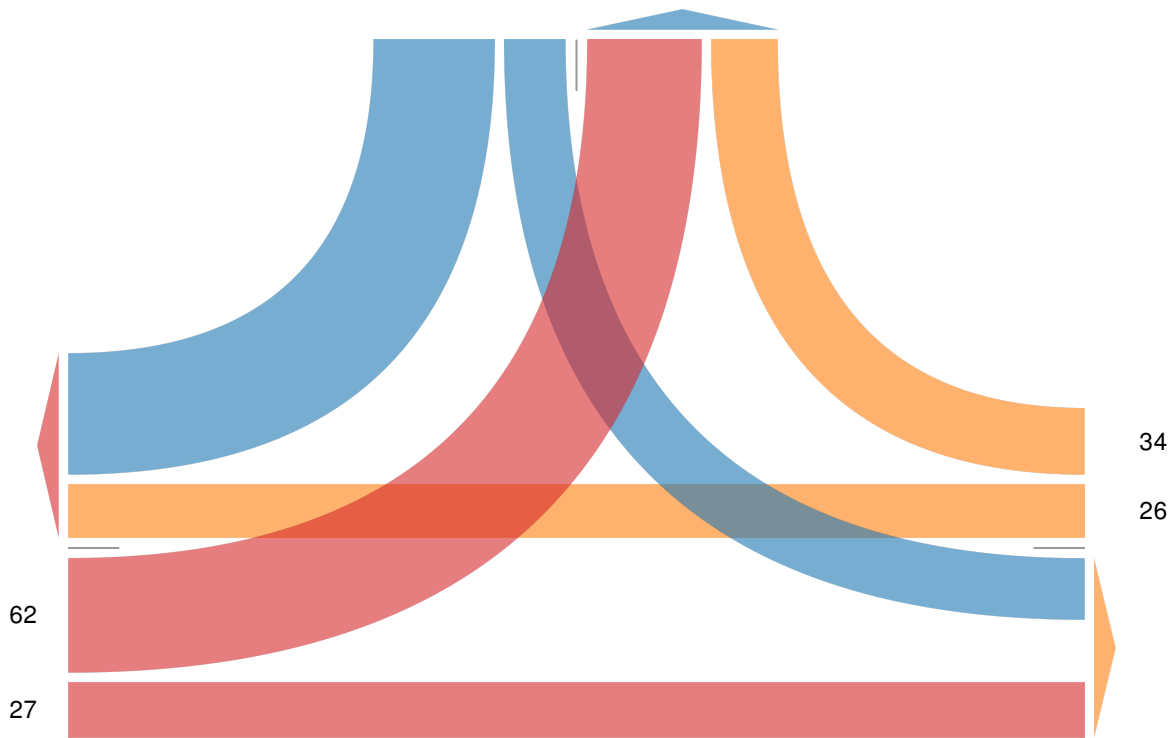
In: 97

Out: 96

66

31

[W] Pieper Rd
Total: 181
In: 89
Out: 92



Pieper Rd at Dauer Ranch - TMC

Tue Jul 24, 2018

AM Peak (7AM - 8AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547694, Location: 29.675058, -98.022705, Site Code: 3



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Leg Direction	Dauer Ranch Southbound					Pieper Rd Westbound					Pieper Rd Eastbound					
Time	R	L	U	App	Ped*	R	T	U	App	Ped*	T	L	U	App	Ped*	Int
2018-07-24 7:00AM	0	0	0	0	0	4	2	0	6	0	5	1	0	6	0	12
7:15AM	1	3	0	4	0	2	0	0	2	0	5	3	0	8	0	14
7:30AM	1	2	0	3	0	3	0	0	3	0	1	6	0	7	0	13
7:45AM	1	1	0	2	0	2	3	0	5	0	1	8	0	9	0	16
Total	3	6	0	9	0	11	5	0	16	0	12	18	0	30	0	55
% Approach	33.3%	66.7%	0%	-	-	68.8%	31.3%	0%	-	-	40.0%	60.0%	0%	-	-	-
% Total	5.5%	10.9%	0%	16.4%	-	20.0%	9.1%	0%	29.1%	-	21.8%	32.7%	0%	54.5%	-	-
PHF	0.750	0.500	-	0.563	-	0.688	0.417	-	0.667	-	0.600	0.563	-	0.833	-	0.859
Lights	3	6	0	9	-	11	5	0	16	-	12	18	0	30	-	55
% Lights	100%	100%	0%	100%	-	100%	100%	0%	100%	-	100%	100%	0%	100%	-	100%
Articulated Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Articulated Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Buses and Single-Unit Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Buses and Single-Unit Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Pieper Rd at Dauer Ranch - TMC

Tue Jul 24, 2018

AM Peak (7AM - 8AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547694, Location: 29.675058, -98.022705, Site Code: 3



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

[N] Dauer Ranch

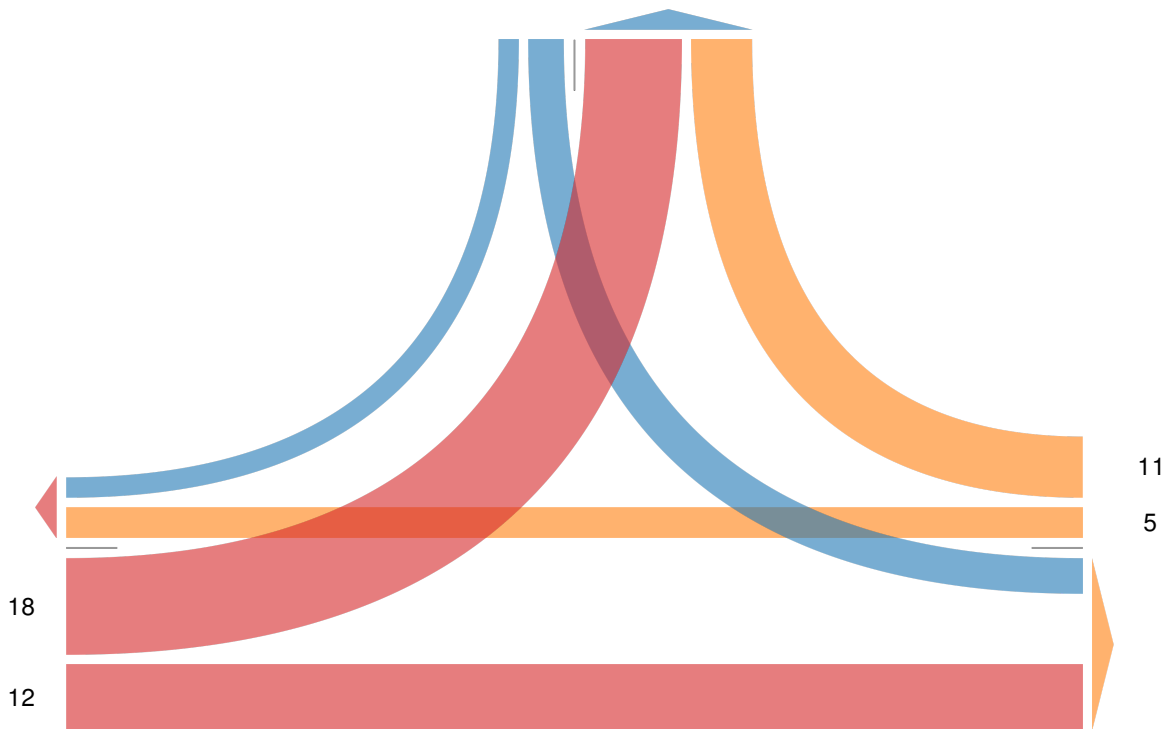
Total: 38

In: 9

Out: 29

3 6

[W] Pieper Rd
Total: 38
In: 30
Out: 8



Out: 18
In: 16
Total: 34
[E] Pieper Rd

Pieper Rd at Dauer Ranch - TMC

Tue Jul 24, 2018

PM Peak (5PM - 6PM) - Overall Peak Hour

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547694, Location: 29.675058, -98.022705, Site Code: 3



Provided by: C. J. Hensch & Associates Inc.

5215 Sycamore Ave.,
Pasadena, TX, 77503, US

Le g Direction	Dauer Ranch Southbound					Pieper Rd Westbound					Pieper Rd Eastbound					
Time	R	L	U	App	Ped*	R	T	U	App	Ped*	T	L	U	App	Ped*	Int
2018-07-24 5:00PM	10	3	0	13	0	2	2	0	4	0	2	8	0	10	0	27
5:15PM	6	6	0	12	0	2	3	0	5	0	2	5	0	7	0	24
5:30PM	8	2	0	10	0	2	1	0	3	0	0	7	0	7	0	20
5:45PM	8	5	0	13	0	1	3	0	4	0	2	2	0	4	0	21
Total	32	16	0	48	0	7	9	0	16	0	6	22	0	28	0	92
% Approach	66.7%	33.3%	0%	-	-	43.8%	56.3%	0%	-	-	21.4%	78.6%	0%	-	-	-
% Total	34.8%	17.4%	0%	52.2%	-	7.6%	9.8%	0%	17.4%	-	6.5%	23.9%	0%	30.4%	-	-
PHF	0.800	0.667	-	0.923	-	0.875	0.750	-	0.800	-	0.750	0.688	-	0.700	-	0.852
Lights	32	16	0	48	-	7	9	0	16	-	6	22	0	28	-	92
% Lights	100%	100%	0%	100%	-	100%	100%	0%	100%	-	100%	100%	0%	100%	-	100%
Articulated Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Articulated Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Buses and Single-Unit Trucks	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0
% Buses and Single-Unit Trucks	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%	0%	0%	0%	-	0%
Pedestrians	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Pieper Rd at Dauer Ranch - TMC

Tue Jul 24, 2018

PM Peak (5PM - 6PM) - Overall Peak Hour

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks, Pedestrians)

All Movements

ID: 547694, Location: 29.675058, -98.022705, Site Code: 3



Provided by: C. J. Hensch & Associates Inc.
5215 Sycamore Ave.,
Pasadena, TX, 77503, US

[N] Dauer Ranch

Total: 77

In: 48

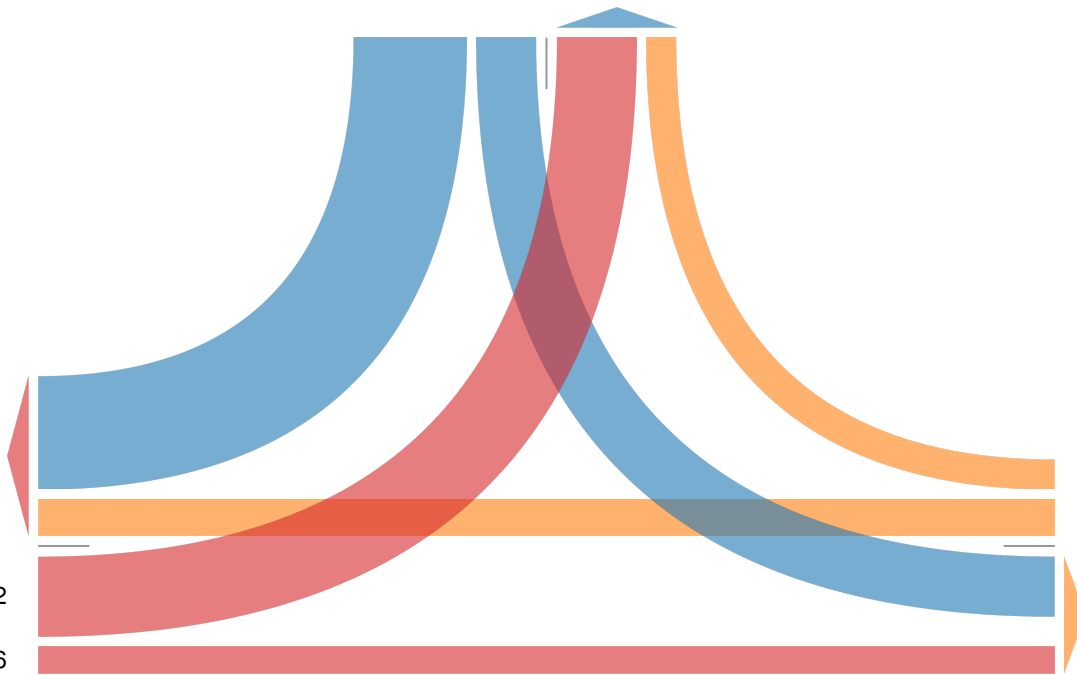
Out: 29

32

16

[W] Pieper Rd
Total: 69
In: 28
Out: 41

22
6



7
9

Out: 22 In: 16
Total: 38
[E] Pieper Rd

APPENDIX E – TRIP DISTRIBUTION TABLES

Table 21. Trip Distribution Table for State Highway 46 at Pieper Road.

Existing 2018 Traffic	State Highway 46						Pieper Road					
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	815	15	18	872	--	--	--	--	36	--	63
PM	--	925	35	53	1097	--	--	--	--	15	--	26
Existing + School Traffic	NB			SB			EB			WB		
AM	--	861	27	50	912	--	--	--	--	46	--	97
PM	--	935	38	62	1109	--	--	--	--	18	--	35
Background + School Traffic	NB			SB			EB			WB		
AM	--	982	29	53	1042	--	--	--	--	51	--	106
PM	--	1073	43	70	1272	--	--	--	--	20	--	39
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	25%	35%	--	--	--	--	--	--	--	--
Distribution % Exit	--	--	--	--	--	--	--	--	--	25%	--	35%
AM Trips	--	--	44	62	--	--	--	--	--	132	--	184
PM Trips	--	--	148	208	--	--	--	--	--	87	--	122
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	--	982	73	115	1042	--	--	--	--	183	--	290
PM	--	1073	191	278	1272	--	--	--	--	107	--	161

Table 22. Trip Distribution Table for Avery Ranch Road at Pieper Road.

Existing 2018 Traffic	Avery Ranch Road						Pieper Road					
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	--	--	23	--	79	16	7	--	--	10	2
PM	--	--	--	21	--	33	70	6	--	--	8	34
Existing + School Traffic	NB			SB			EB			WB		
AM	--	--	--	63	--	99	40	27	--	--	34	48
PM	--	--	--	33	--	39	76	12	--	--	14	44
Background + School Traffic	NB			SB			EB			WB		
AM	--	--	--	66	--	111	42	28	--	--	35	48
PM	--	--	--	36	--	44	86	13	--	--	15	49
Background Redistribution	NB			SB			EB			WB		
AM	0	47	0	7	71	100	38	0	0	0	0	5
PM	0	53	0	4	37	40	77	0	0	0	0	5
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	--	2%	8%	2%	--	2%	1%	--	--	--
Distribution % Exit	1%	8%	--	--	--	--	2%	--	--	--	2%	2%
AM Trips	5	42	0	4	14	4	11	4	2	0	11	11
PM Trips	3	28	0	12	47	12	7	12	6	0	7	7
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	5	90	0	10	85	103	48	4	2	0	11	15
PM	3	81	0	15	84	51	84	12	6	0	7	12

Table 23. Trip Distribution Table for Dauer Ranch Road at Pieper Road.

Existing 2018 Traffic	Dauer Ranch Road						Pieper Road					
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	--	--	6	--	3	18	12	--	--	5	11
PM	--	--	--	16	--	32	22	6	--	--	9	7
Existing + School Traffic	NB			SB			EB			WB		
AM	--	--	--	6	--	49	58	32	--	--	29	11
PM	--	--	--	16	--	42	34	12	--	--	15	7
Background + School Traffic	NB			SB			EB			WB		
AM	--	--	--	7	--	49	61	34	--	--	30	13
PM	--	--	--	18	--	47	37	13	--	--	16	8
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	--	--	--	20%	--	--	--	--	10%	--
Distribution % Exit	--	--	--	--	--	--	20%	10%	--	--	--	--
AM Trips	--	--	--	--	--	35	105	53	--	--	18	--
PM Trips	--	--	--	--	--	119	70	35	--	--	59	--
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	--	--	--	7	--	84	166	87	--	--	48	13
PM	--	--	--	18	--	166	107	48	--	--	75	8

Table 24. Trip Distribution Table for Winchester Drive at Pieper Road (West).

Background + School Traffic	Winchester Drive						Pieper Road					
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	--	--	--	--	--	--	70	--	--	--	146
PM	--	--	--	--	--	--	--	99	--	--	--	59
Background + School Traffic Redistribution	NB			SB			EB			WB		
AM	--	46	--	--	--	--	38	32	--	--	--	100
PM	--	19	--	--	--	--	77	22	--	--	--	40
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	--	--	--	--	5%	55%	--	--	--	--
Distribution % Exit	--	55%	--	--	--	--	--	--	--	--	--	5%
AM Trips	--	290	0	--	--	--	9	97	--	0	--	26
PM Trips	--	191	0	--	--	--	30	326	--	0	--	17
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	--	336	0	--	--	--	47	129	--	0	--	126
PM	--	211	0	--	--	--	107	348	--	0	--	57

Table 25. Trip Distribution Table for Winchester Drive at Pieper Road (East).

Background + School Traffic	Pieper Road						Winchester Drive			Pieper Road		
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	--	--	94	--	--	--	--	--	--	--	83
PM	--	--	--	49	--	--	--	--	--	--	--	64
Background + School Traffic Redistribution	NB			SB			EB			WB		
AM	--	--	--	7	--	--	--	87	--	--	78	5
PM	--	--	--	4	--	--	--	45	--	--	59	5
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	--	--	--	--	--	--	--	--	28%	2%
Distribution % Exit	--	--	--	2%	--	--	--	28%	--	--	--	--
AM Trips	--	--	--	11	--	--	--	148	--	--	49	4
PM Trips	--	--	--	7	--	--	--	97	--	--	166	12
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	--	--	--	17	--	0	0	235	--	--	127	8
PM	--	--	--	11	--	0	0	143	--	--	225	17

Table 26. Trip Distribution Table for Winchester Drive at Double Oak Drive.

Background + School Traffic	Pieper Road						Winchester Drive					
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	--	--	--	--	--	--	--	--	--	--	--
PM	--	--	--	--	--	--	--	--	--	--	--	--
Background + School Traffic Redistribution	NB			SB			EB			WB		
AM	--	--	--	--	--	--	--	32	--	--	46	--
PM	--	--	--	--	--	--	--	22	--	--	19	--
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	--	--	--	--	4%	44%	2%	1%	2%	2%
Distribution % Exit	2%	--	1%	2%	--	4%	--	2%	--	--	44%	--
AM Trips	11	0	5	11	0	21	7	88	4	2	235	4
PM Trips	7	0	3	7	0	14	24	268	12	6	165	12
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	11	0	5	11	0	21	7	120	4	2	282	4
PM	7	0	3	7	0	14	24	289	12	6	184	12

Table 27. Trip Distribution Table for Winchester Drive at Avery Ranch Road.

Background + School Traffic	Avery Ranch Road						Winchester Drive					
	NB			SB			EB			WB		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
AM	--	--	--	--	--	--	--	--	--	--	--	--
PM	--	--	--	--	--	--	--	--	--	--	--	--
Background + School Traffic Redistribution	NB			SB			EB			WB		
AM	--	--	--	59	--	11	4	28	--	--	35	43
PM	--	--	--	32	--	4	9	13	--	--	15	44
Site Traffic	NB			SB			EB			WB		
Distribution % Enter	--	--	--	4%	2%	2%	1%	17%	1%	1%	17%	1%
Distribution % Exit	1%	2%	1%	1%	--	1%	2%	17%	--	--	17%	4%
AM Trips	5	11	5	12	4	9	12	120	2	2	120	23
PM Trips	3	7	3	27	12	15	13	160	6	6	160	20
Site Traffic + Background + School Traffic	NB			SB			EB			WB		
AM	5	11	5	72	4	20	17	148	2	2	155	66
PM	3	7	3	60	12	20	21	173	6	6	175	64

APPENDIX F – SYNCHRO OUTPUTS

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

11/19/2018

	↑	↗	↘	↓	↙	↖
Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑		↘	↑↑	↘	
Traffic Volume (veh/h)	861	27	50	912	46	97
Future Volume (Veh/h)	861	27	50	912	46	97
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	936	29	54	991	50	105
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLT		
Median storage veh				2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			965		1554	482
vC1, stage 1 conf vol					950	
vC2, stage 2 conf vol					604	
vCu, unblocked vol			965		1554	482
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			92		82	80
cM capacity (veh/h)			709		281	530
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1
Volume Total	624	341	54	496	496	155
Volume Left	0	0	54	0	0	50
Volume Right	0	29	0	0	0	105
cSH	1700	1700	709	1700	1700	412
Volume to Capacity	0.37	0.20	0.08	0.29	0.29	0.38
Queue Length 95th (ft)	0	0	6	0	0	43
Control Delay (s)	0.0	0.0	10.5	0.0	0.0	18.9
Lane LOS			B			C
Approach Delay (s)	0.0		0.5			18.9
Approach LOS						C
Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utilization			46.5%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Pieper Rd & Avery Ranch Dr

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	63	99	40	27	34	48
Future Volume (Veh/h)	63	99	40	27	34	48
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	68	108	43	29	37	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	178	63	89			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	178	63	89			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	91	89	97			
cM capacity (veh/h)	788	1002	1506			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	176	72	89			
Volume Left	68	43	0			
Volume Right	108	0	52			
cSH	907	1506	1700			
Volume to Capacity	0.19	0.03	0.05			
Queue Length 95th (ft)	18	2	0			
Control Delay (s)	9.9	4.5	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.9	4.5	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			6.2			
Intersection Capacity Utilization			26.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Pieper Rd & Dauer Ranch Rd

11/19/2018













Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	6	49	58	32	29	11
Future Volume (Veh/h)	6	49	58	32	29	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	7	57	67	37	34	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	212	40	47			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	212	40	47			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	94	96			
cM capacity (veh/h)	743	1031	1560			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	64	104	47			
Volume Left	7	67	0			
Volume Right	57	0	13			
cSH	989	1560	1700			
Volume to Capacity	0.06	0.04	0.03			
Queue Length 95th (ft)	5	3	0			
Control Delay (s)	8.9	4.9	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.9	4.9	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization			21.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

11/19/2018

										
Movement	NBT	NBR	SBL	SBT	SWL	SWR				
Lane Configurations										
Traffic Volume (veh/h)	935	38	62	1109	18	35				
Future Volume (Veh/h)	935	38	62	1109	18	35				
Sign Control	Free			Free	Stop					
Grade	0%			0%	0%					
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				
Hourly flow rate (vph)	1016	41	67	1205	20	38				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None		TWLTL							
Median storage veh	2									
Upstream signal (ft)										
pX, platoon unblocked										
vC, conflicting volume			1057	1773		528				
vC1, stage 1 conf vol			1036							
vC2, stage 2 conf vol			736							
vCu, unblocked vol			1057	1773		528				
tC, single (s)			4.1	6.8		6.9				
tC, 2 stage (s)			5.8							
tF (s)			2.2	3.5		3.3				
p0 queue free %			90	92		92				
cM capacity (veh/h)			655	241		495				
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1				
Volume Total	677	380	67	602	602	58				
Volume Left	0	0	67	0	0	20				
Volume Right	0	41	0	0	0	38				
cSH	1700	1700	655	1700	1700	363				
Volume to Capacity	0.40	0.22	0.10	0.35	0.35	0.16				
Queue Length 95th (ft)	0	0	9	0	0	14				
Control Delay (s)	0.0	0.0	11.1	0.0	0.0	16.8				
Lane LOS			B			C				
Approach Delay (s)	0.0	0.6				16.8				
Approach LOS			C							
Intersection Summary										
Average Delay							0.7			
Intersection Capacity Utilization			43.8%	ICU Level of Service		A				
Analysis Period (min)			15							

HCM Unsignalized Intersection Capacity Analysis

2: Pieper Rd & Avery Ranch Dr

11/19/2018

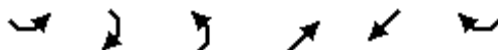


Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	33	39	76	12	14	44
Future Volume (Veh/h)	33	39	76	12	14	44
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	42	83	13	15	48
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	218	39	63			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	218	39	63			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	96	95			
cM capacity (veh/h)	729	1033	1540			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	78	96	63			
Volume Left	36	83	0			
Volume Right	42	0	48			
cSH	866	1540	1700			
Volume to Capacity	0.09	0.05	0.04			
Queue Length 95th (ft)	7	4	0			
Control Delay (s)	9.6	6.5	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.6	6.5	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.8			
Intersection Capacity Utilization		22.4%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Pieper Rd & Dauer Ranch Rd

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	16	42	34	12	15	7
Future Volume (Veh/h)	16	42	34	12	15	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	19	49	40	14	17	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	115	21	25			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	115	21	25			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	95	97			
cM capacity (veh/h)	859	1056	1589			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	68	54	25			
Volume Left	19	40	0			
Volume Right	49	0	8			
cSH	993	1589	1700			
Volume to Capacity	0.07	0.03	0.01			
Queue Length 95th (ft)	6	2	0			
Control Delay (s)	8.9	5.5	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.9	5.5	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			6.1			
Intersection Capacity Utilization			19.3%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

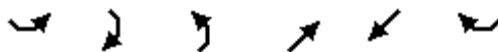
11/19/2018

	↑	↗	↘	↓	↙	↖
Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑		↘	↑↑	↘	
Traffic Volume (veh/h)	982	29	53	1042	51	106
Future Volume (Veh/h)	982	29	53	1042	51	106
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1067	32	58	1133	55	115
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLT		
Median storage veh				2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1099		1766	550
vC1, stage 1 conf vol					1083	
vC2, stage 2 conf vol					682	
vCu, unblocked vol			1099		1766	550
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		77	76
cM capacity (veh/h)			631		239	479
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1
Volume Total	711	388	58	566	566	170
Volume Left	0	0	58	0	0	55
Volume Right	0	32	0	0	0	115
cSH	1700	1700	631	1700	1700	361
Volume to Capacity	0.42	0.23	0.09	0.33	0.33	0.47
Queue Length 95th (ft)	0	0	8	0	0	61
Control Delay (s)	0.0	0.0	11.3	0.0	0.0	23.5
Lane LOS			B			C
Approach Delay (s)	0.0		0.5			23.5
Approach LOS						C
Intersection Summary						
Average Delay			1.9			
Intersection Capacity Utilization			50.7%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Pieper Rd & Avery Ranch Dr

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	66	111	42	28	35	48
Future Volume (Veh/h)	66	111	42	28	35	48
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	121	46	30	38	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	186	64	90			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	186	64	90			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	91	88	97			
cM capacity (veh/h)	779	1000	1505			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	193	76	90			
Volume Left	72	46	0			
Volume Right	121	0	52			
cSH	904	1505	1700			
Volume to Capacity	0.21	0.03	0.05			
Queue Length 95th (ft)	20	2	0			
Control Delay (s)	10.1	4.6	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.1	4.6	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			6.4			
Intersection Capacity Utilization			27.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Pieper Rd & Dauer Ranch Rd

11/19/2018













Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	7	49	61	34	30	13
Future Volume (Veh/h)	7	49	61	34	30	13
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	8	57	71	40	35	15
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	224	42	50			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	224	42	50			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	94	95			
cM capacity (veh/h)	729	1028	1557			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	65	111	50			
Volume Left	8	71	0			
Volume Right	57	0	15			
cSH	979	1557	1700			
Volume to Capacity	0.07	0.05	0.03			
Queue Length 95th (ft)	5	4	0			
Control Delay (s)	8.9	4.9	0.0			
Lane LOS	A	A				
Approach Delay (s)	8.9	4.9	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization			21.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

11/19/2018

						
Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	1073	43	70	1272	20	39
Future Volume (Veh/h)	1073	43	70	1272	20	39
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1166	47	76	1383	22	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		TWLTL			
Median storage veh	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1213		2033	606
vC1, stage 1 conf vol					1190	
vC2, stage 2 conf vol					844	
vCu, unblocked vol			1213		2033	606
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			87		89	90
cM capacity (veh/h)			571		198	440
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1
Volume Total	777	436	76	692	692	64
Volume Left	0	0	76	0	0	22
Volume Right	0	47	0	0	0	42
cSH	1700	1700	571	1700	1700	310
Volume to Capacity	0.46	0.26	0.13	0.41	0.41	0.21
Queue Length 95th (ft)	0	0	11	0	0	19
Control Delay (s)	0.0	0.0	12.3	0.0	0.0	19.6
Lane LOS			B			C
Approach Delay (s)	0.0		0.6			19.6
Approach LOS						C
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			48.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Pieper Rd & Avery Ranch Dr

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	36	44	86	13	15	49
Future Volume (Veh/h)	36	44	86	13	15	49
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	48	93	14	16	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	242	42	69			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	242	42	69			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	95	94			
cM capacity (veh/h)	701	1028	1532			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	87	107	69			
Volume Left	39	93	0			
Volume Right	48	0	53			
cSH	850	1532	1700			
Volume to Capacity	0.10	0.06	0.04			
Queue Length 95th (ft)	9	5	0			
Control Delay (s)	9.7	6.6	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.7	6.6	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.9			
Intersection Capacity Utilization		23.5%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

3: Pieper Rd & Dauer Ranch Rd

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	18	47	37	13	16	8
Future Volume (Veh/h)	18	47	37	13	16	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	21	55	43	15	19	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	124	24	28			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	124	24	28			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	95	97			
cM capacity (veh/h)	847	1053	1585			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	76	58	28			
Volume Left	21	43	0			
Volume Right	55	0	9			
cSH	987	1585	1700			
Volume to Capacity	0.08	0.03	0.02			
Queue Length 95th (ft)	6	2	0			
Control Delay (s)	9.0	5.5	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.0	5.5	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			6.2			
Intersection Capacity Utilization			20.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

















11/19/2018

	↑	↗	↖	↓	↙	↘
Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑		↖	↑↑	↘	
Traffic Volume (veh/h)	982	73	115	1042	183	290
Future Volume (Veh/h)	982	73	115	1042	183	290
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1067	79	125	1133	199	315
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLT			TWLT		
Median storage veh	2			2		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1146		1923	573
vC1, stage 1 conf vol					1106	
vC2, stage 2 conf vol					816	
vCu, unblocked vol			1146		1923	573
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			79		4	32
cM capacity (veh/h)			605		207	463
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1
Volume Total	711	435	125	566	566	514
Volume Left	0	0	125	0	0	199
Volume Right	0	79	0	0	0	315
cSH	1700	1700	605	1700	1700	313
Volume to Capacity	0.42	0.26	0.21	0.33	0.33	1.64
Queue Length 95th (ft)	0	0	19	0	0	783
Control Delay (s)	0.0	0.0	12.5	0.0	0.0	333.5
Lane LOS			B			F
Approach Delay (s)	0.0		1.2			333.5
Approach LOS						F
Intersection Summary						
Average Delay			59.3			
Intersection Capacity Utilization			73.8%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Pieper Rd & Avery Ranch Dr

11/19/2018

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	10	85	103	5	90	0	48	4	2	0	11	15
Future Volume (Veh/h)	10	85	103	5	90	0	48	4	2	0	11	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	92	112	5	98	0	52	4	2	0	12	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	98			204			300	278	148	282	334	98
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	98			204			300	278	148	282	334	98
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			92	99	100	100	98	98
cM capacity (veh/h)	1495			1368			626	623	899	660	580	958
Direction, Lane #	SE 1	NW 1	NE 1	SW 1								
Volume Total	215	103	58	28								
Volume Left	11	5	52	0								
Volume Right	112	0	2	16								
cSH	1495	1368	632	749								
Volume to Capacity	0.01	0.00	0.09	0.04								
Queue Length 95th (ft)	1	0	8	3								
Control Delay (s)	0.4	0.4	11.3	10.0								
Lane LOS	A	A	B	A								
Approach Delay (s)	0.4	0.4	11.3	10.0								
Approach LOS			B	A								
Intersection Summary												
Average Delay			2.6									
Intersection Capacity Utilization			30.6%	ICU Level of Service					A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Winchester Dr & Dauer Ranch Rd

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	7	84	166	87	48	13
Future Volume (Veh/h)	7	84	166	87	48	13
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	91	180	95	52	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	514	59	66			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	514	59	66			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	91	88			
cM capacity (veh/h)	460	1007	1536			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	99	275	66			
Volume Left	8	180	0			
Volume Right	91	0	14			
cSH	918	1536	1700			
Volume to Capacity	0.11	0.12	0.04			
Queue Length 95th (ft)	9	10	0			
Control Delay (s)	9.4	5.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.4	5.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.5			
Intersection Capacity Utilization			32.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM 6th Roundabout
4: Pieper Rd & Winchester Dr

11/19/2018

Intersection			
Intersection Delay, s/veh	4.9		
Intersection LOS	A		
Approach	EB	WB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	191	365	137
Demand Flow Rate, veh/h	195	372	140
Vehicles Circulating, veh/h	0	52	372
Vehicles Exiting, veh/h	512	143	52
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	3.8	5.3	5.3
Approach LOS	A	A	A
Lane	Left	Left	Left
Designated Moves	LT	TR	LR
Assumed Moves	LT	TR	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	195	372	140
Cap Entry Lane, veh/h	1380	1309	944
Entry HV Adj Factor	0.980	0.980	0.979
Flow Entry, veh/h	191	365	137
Cap Entry, veh/h	1353	1283	924
V/C Ratio	0.141	0.284	0.148
Control Delay, s/veh	3.8	5.3	5.3
LOS	A	A	A
95th %tile Queue, veh	0	1	1

HCM Unsignalized Intersection Capacity Analysis

5: Winchester Dr & Pieper Rd

11/19/2018



















Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	17	0	0	235	127	8
Future Volume (Veh/h)	17	0	0	235	127	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	0	0	255	138	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	398	142	147			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	398	142	147			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	100	100			
cM capacity (veh/h)	608	905	1435			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	18	255	147			
Volume Left	18	0	0			
Volume Right	0	0	9			
cSH	608	1435	1700			
Volume to Capacity	0.03	0.00	0.09			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	11.1	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	11.1	0.0	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			22.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: Winchester Dr & Double Oak Dr

11/19/2018

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	11	0	21	11	0	5	7	121	4	2	282	4
Future Volume (Veh/h)	11	0	21	11	0	5	7	121	4	2	282	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	0	23	12	0	5	8	132	4	2	307	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	468	465	309	486	465	134	311			136		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	468	465	309	486	465	134	311			136		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	97	97	100	99	99			100		
cM capacity (veh/h)	500	491	731	473	491	915	1249			1448		
Direction, Lane #	SE 1	NW 1	NE 1	SW 1								
Volume Total	35	17	144	313								
Volume Left	12	12	8	2								
Volume Right	23	5	4	4								
cSH	631	552	1249	1448								
Volume to Capacity	0.06	0.03	0.01	0.00								
Queue Length 95th (ft)	4	2	0	0								
Control Delay (s)	11.0	11.7	0.5	0.1								
Lane LOS	B	B	A	A								
Approach Delay (s)	11.0	11.7	0.5	0.1								
Approach LOS	B	B										
Intersection Summary												
Average Delay			1.3									
Intersection Capacity Utilization			25.7%	ICU Level of Service				A				
Analysis Period (min)			15									

HCM 6th Roundabout
7: Winchester Dr & Avery Ranch Dr











11/19/2018

Intersection				
Intersection Delay, s/veh	4.1			
Intersection LOS	A			
Approach	SE	NW	NE	SW
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	103	22	181	242
Demand Flow Rate, veh/h	105	22	184	246
Vehicles Circulating, veh/h	178	261	85	35
Vehicles Exiting, veh/h	103	8	198	248
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	4.0	3.6	4.1	4.3
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	105	22	184	246
Cap Entry Lane, veh/h	1151	1057	1265	1331
Entry HV Adj Factor	0.980	0.989	0.983	0.982
Flow Entry, veh/h	103	22	181	242
Cap Entry, veh/h	1128	1046	1243	1308
V/C Ratio	0.091	0.021	0.145	0.185
Control Delay, s/veh	4.0	3.6	4.1	4.3
LOS	A	A	A	A
95th %tile Queue, veh	0	0	1	1

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

















11/19/2018

						
Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	1073	191	278	1272	107	161
Future Volume (Veh/h)	1073	191	278	1272	107	161
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1166	208	302	1383	116	175
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh)	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1374		2566	687
vC1, stage 1 conf vol					1270	
vC2, stage 2 conf vol					1296	
vCu, unblocked vol			1374		2566	687
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			39		0	55
cM capacity (veh/h)			495		78	389
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3	SW 1
Volume Total	777	597	302	692	692	291
Volume Left	0	0	302	0	0	116
Volume Right	0	208	0	0	0	175
cSH	1700	1700	495	1700	1700	150
Volume to Capacity	0.46	0.35	0.61	0.41	0.41	1.95
Queue Length 95th (ft)	0	0	100	0	0	563
Control Delay (s)	0.0	0.0	23.0	0.0	0.0	499.2
Lane LOS			C			F
Approach Delay (s)	0.0		4.1			499.2
Approach LOS						F
Intersection Summary						
Average Delay			45.4			
Intersection Capacity Utilization			77.0%	ICU Level of Service		D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Pieper Rd & Avery Ranch Rd

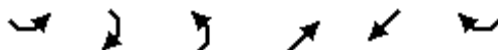
11/19/2018

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	15	84	51	3	81	0	84	12	6	0	7	12
Future Volume (Veh/h)	15	84	51	3	81	0	84	12	6	0	7	12
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	91	55	3	88	0	91	13	7	0	8	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	88			146			262	244	118	258	272	88
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	88			146			262	244	118	258	272	88
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			86	98	99	100	99	99
cM capacity (veh/h)	1508			1436			669	649	933	673	627	970
Direction, Lane #	SE 1	NW 1	NE 1	SW 1								
Volume Total	162	91	111	21								
Volume Left	16	3	91	0								
Volume Right	55	0	7	13								
cSH	1508	1436	679	803								
Volume to Capacity	0.01	0.00	0.16	0.03								
Queue Length 95th (ft)	1	0	15	2								
Control Delay (s)	0.8	0.3	11.3	9.6								
Lane LOS	A	A	B	A								
Approach Delay (s)	0.8	0.3	11.3	9.6								
Approach LOS			B	A								
Intersection Summary												
Average Delay			4.2									
Intersection Capacity Utilization			33.2%	ICU Level of Service				A				
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Pieper Rd & Dauer Ranch Rd

11/19/2018



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	18	166	107	48	75	8
Future Volume (Veh/h)	18	166	107	48	75	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	180	116	52	82	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	370	86	91			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	370	86	91			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	81	92			
cM capacity (veh/h)	581	972	1504			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	200	168	91			
Volume Left	20	116	0			
Volume Right	180	0	9			
cSH	911	1504	1700			
Volume to Capacity	0.22	0.08	0.05			
Queue Length 95th (ft)	21	6	0			
Control Delay (s)	10.1	5.4	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.1	5.4	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			6.4			
Intersection Capacity Utilization			33.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM 6th Roundabout
4: Pieper Rd & Winchester Dr

11/19/2018

Intersection			
Intersection Delay, s/veh	5.4		
Intersection LOS	A		
Approach	EB	WB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	494	229	62
Demand Flow Rate, veh/h	504	234	63
Vehicles Circulating, veh/h	0	118	234
Vehicles Exiting, veh/h	297	386	118
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	6.0	4.7	3.9
Approach LOS	A	A	A
Lane	Left	Left	Left
Designated Moves	LT	TR	LR
Assumed Moves	LT	TR	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	504	234	63
Cap Entry Lane, veh/h	1380	1223	1087
Entry HV Adj Factor	0.981	0.980	0.984
Flow Entry, veh/h	494	229	62
Cap Entry, veh/h	1354	1199	1070
V/C Ratio	0.365	0.191	0.058
Control Delay, s/veh	6.0	4.7	3.9
LOS	A	A	A
95th %tile Queue, veh	2	1	0

HCM Unsignalized Intersection Capacity Analysis

5: Winchester Dr & Pieper Rd

11/19/2018



















Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	11	0	0	143	225	17
Future Volume (Veh/h)	11	0	0	143	225	17
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	0	0	155	245	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	409	254	263			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	409	254	263			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	100	100			
cM capacity (veh/h)	599	785	1301			
Direction, Lane #	SE 1	NE 1	SW 1			
Volume Total	12	155	263			
Volume Left	12	0	0			
Volume Right	0	0	18			
cSH	599	1301	1700			
Volume to Capacity	0.02	0.00	0.15			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	11.1	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	11.1	0.0	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			22.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: Winchester Dr & Double Oak Dr

11/19/2018

												
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	7	0	14	7	0	3	24	290	12	6	185	12
Future Volume (Veh/h)	7	0	14	7	0	3	24	290	12	6	185	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	15	8	0	3	26	315	13	7	201	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	598	602	208	610	602	322	214			328		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	598	602	208	610	602	322	214			328		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	98	98	100	100	98			99		
cM capacity (veh/h)	405	404	833	392	404	719	1356			1232		
Direction, Lane #	SE 1	NW 1	NE 1	SW 1								
Volume Total	23	11	354	221								
Volume Left	8	8	26	7								
Volume Right	15	3	13	13								
cSH	609	447	1356	1232								
Volume to Capacity	0.04	0.02	0.02	0.01								
Queue Length 95th (ft)	3	2	1	0								
Control Delay (s)	11.1	13.3	0.7	0.3								
Lane LOS	B	B	A	A								
Approach Delay (s)	11.1	13.3	0.7	0.3								
Approach LOS	B	B										
Intersection Summary												
Average Delay			1.2									
Intersection Capacity Utilization			36.9%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM 6th Roundabout
7: Winchester Dr & Avery Ranch Rd












11/19/2018

Intersection				
Intersection Delay, s/veh	4.2			
Intersection LOS	A			
Approach	SE	NW	NE	SW
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	98	14	219	215
Demand Flow Rate, veh/h	99	14	223	219
Vehicles Circulating, veh/h	204	281	85	35
Vehicles Exiting, veh/h	50	27	218	260
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	4.0	3.6	4.4	4.1
Approach LOS	A	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	99	14	223	219
Cap Entry Lane, veh/h	1121	1036	1265	1331
Entry HV Adj Factor	0.987	0.989	0.983	0.983
Flow Entry, veh/h	98	14	219	215
Cap Entry, veh/h	1106	1024	1244	1308
V/C Ratio	0.088	0.014	0.176	0.164
Control Delay, s/veh	4.0	3.6	4.4	4.1
LOS	A	A	A	A
95th %tile Queue, veh	0	0	1	1

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd












11/19/2018

							
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations							
Traffic Volume (veh/h)	982	73	115	1042	183	290	
Future Volume (Veh/h)	982	73	115	1042	183	290	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1067	79	125	1133	199	315	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	TWLTL		TWLTL				
Median storage veh	2		2				
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1146		1884	534	
vC1, stage 1 conf vol					1067		
vC2, stage 2 conf vol					816		
vCu, unblocked vol			1146		1884	534	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			79		6	36	
cM capacity (veh/h)			605		213	491	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	534	534	79	125	566	566	514
Volume Left	0	0	0	125	0	0	199
Volume Right	0	0	79	0	0	0	315
cSH	1700	1700	1700	605	1700	1700	326
Volume to Capacity	0.31	0.31	0.05	0.21	0.33	0.33	1.58
Queue Length 95th (ft)	0	0	0	19	0	0	749
Control Delay (s)	0.0	0.0	0.0	12.5	0.0	0.0	303.3
Lane LOS				B	F		
Approach Delay (s)	0.0			1.2			303.3
Approach LOS					F		
Intersection Summary							
Average Delay			54.0				
Intersection Capacity Utilization			71.5%	ICU Level of Service		C	
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd













11/19/2018

							
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations							
Traffic Volume (veh/h)	1073	191	278	1272	107	161	
Future Volume (Veh/h)	1073	191	278	1272	107	161	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1166	208	302	1383	116	175	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	TWLT			TWLT			
Median storage veh)	2			2			
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1374		2462	583	
vC1, stage 1 conf vol					1166		
vC2, stage 2 conf vol					1296		
vCu, unblocked vol			1374		2462	583	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			39		0	62	
cM capacity (veh/h)			495		79	456	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	583	583	208	302	692	692	291
Volume Left	0	0	0	302	0	0	116
Volume Right	0	0	208	0	0	0	175
cSH	1700	1700	1700	495	1700	1700	157
Volume to Capacity	0.34	0.34	0.12	0.61	0.41	0.41	1.85
Queue Length 95th (ft)	0	0	0	100	0	0	544
Control Delay (s)	0.0	0.0	0.0	23.0	0.0	0.0	456.1
Lane LOS				C			F
Approach Delay (s)	0.0			4.1			456.1
Approach LOS							F
Intersection Summary							
Average Delay			41.7				
Intersection Capacity Utilization			70.9%		ICU Level of Service		C
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd













11/19/2018

											
Movement	NBT	NBR	SBL	SBT	SWL	SWR					
Lane Configurations											
Traffic Volume (veh/h)	982	73	115	1042	183	290					
Future Volume (Veh/h)	982	73	115	1042	183	290					
Sign Control	Free			Free	Stop						
Grade	0%			0%	0%						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92					
Hourly flow rate (vph)	1067	79	125	1133	199	315					
Pedestrians											
Lane Width (ft)											
Walking Speed (ft/s)											
Percent Blockage											
Right turn flare (veh)							12				
Median type	TWLTL		TWLTL								
Median storage veh)	2		2								
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume			1146			1884	534				
vC1, stage 1 conf vol			1067								
vC2, stage 2 conf vol			816								
vCu, unblocked vol			1146			1884	534				
tC, single (s)			4.1			6.8	6.9				
tC, 2 stage (s)			5.8								
tF (s)			2.2			3.5	3.3				
p0 queue free %			79			6	36				
cM capacity (veh/h)			605			213	491				
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1				
Volume Total	534	534	79	125	566	566	514				
Volume Left	0	0	0	125	0	0	199				
Volume Right	0	0	79	0	0	0	315				
cSH	1700	1700	1700	605	1700	1700	549				
Volume to Capacity	0.31	0.31	0.05	0.21	0.33	0.33	0.94				
Queue Length 95th (ft)	0	0	0	19	0	0	296				
Control Delay (s)	0.0	0.0	0.0	12.5	0.0	0.0	51.1				
Lane LOS				B			F				
Approach Delay (s)	0.0			1.2			51.1				
Approach LOS							F				
Intersection Summary											
Average Delay	9.5										
Intersection Capacity Utilization	53.7%			ICU Level of Service			A				
Analysis Period (min)	15										

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

11/19/2018

							
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations							
Traffic Volume (veh/h)	1073	191	278	1272	107	161	
Future Volume (Veh/h)	1073	191	278	1272	107	161	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1166	208	302	1383	116	175	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)						12	
Median type	TWLT			TWLT			
Median storage veh)	2			2			
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1374		2462	583	
vC1, stage 1 conf vol					1166		
vC2, stage 2 conf vol					1296		
vCu, unblocked vol			1374		2462	583	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			39		0	62	
cM capacity (veh/h)			495		79	456	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	583	583	208	302	692	692	291
Volume Left	0	0	0	302	0	0	116
Volume Right	0	0	208	0	0	0	175
cSH	1700	1700	1700	495	1700	1700	195
Volume to Capacity	0.34	0.34	0.12	0.61	0.41	0.41	1.49
Queue Length 95th (ft)	0	0	0	100	0	0	451
Control Delay (s)	0.0	0.0	0.0	23.0	0.0	0.0	291.2
Lane LOS				C			F
Approach Delay (s)	0.0			4.1			291.2
Approach LOS							F
Intersection Summary							
Average Delay			27.4				
Intersection Capacity Utilization			61.0%		ICU Level of Service		B
Analysis Period (min)			15				

Timings

1: SH 46 & Pieper Rd

11/19/2018

	↑	↗	↘	↓	↙
Lane Group	NBT	NBR	SBL	SBT	SWL
Lane Configurations	↑↑	↗	↘	↑↑	↙
Traffic Volume (vph)	982	73	115	1042	183
Future Volume (vph)	982	73	115	1042	183
Turn Type	NA	Perm	pm+pt	NA	Prot
Protected Phases	2		1	6	8
Permitted Phases		2	6		
Detector Phase	2	2	1	6	8
Switch Phase					
Minimum Initial (s)	15.0	15.0	7.0	15.0	7.0
Minimum Split (s)	25.0	25.0	15.0	25.0	25.0
Total Split (s)	35.0	35.0	15.0	50.0	30.0
Total Split (%)	43.8%	43.8%	18.8%	62.5%	37.5%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	Min	Min	None	Min	None
Act Effect Green (s)	26.3	26.3	37.2	37.2	21.9
Actuated g/C Ratio	0.36	0.36	0.50	0.50	0.30
v/c Ratio	0.85	0.13	0.45	0.63	0.90
Control Delay	30.8	5.2	14.6	14.7	43.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	30.8	5.2	14.6	14.7	43.8
LOS	C	A	B	B	D
Approach Delay	29.0			14.7	43.8
Approach LOS	C			B	D

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 73.7

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 25.5

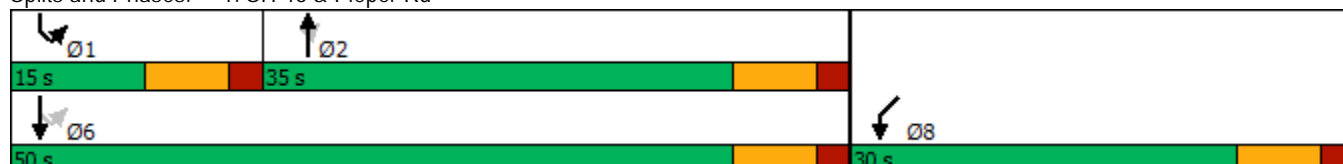
Intersection LOS: C

Intersection Capacity Utilization 79.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 1: SH 46 & Pieper Rd



Timings

1: SH 46 & Pieper Rd

11/19/2018

	↑	↗	↘	↓	↙
Lane Group	NBT	NBR	SBL	SBT	SWL
Lane Configurations	↑↑	↗	↘	↑↑	↙
Traffic Volume (vph)	1073	191	278	1272	107
Future Volume (vph)	1073	191	278	1272	107
Turn Type	NA	Perm	pm+pt	NA	Prot
Protected Phases	2		1	6	8
Permitted Phases		2	6		
Detector Phase	2	2	1	6	8
Switch Phase					
Minimum Initial (s)	15.0	15.0	7.0	15.0	7.0
Minimum Split (s)	25.0	25.0	15.0	25.0	25.0
Total Split (s)	35.0	35.0	20.0	55.0	25.0
Total Split (%)	43.8%	43.8%	25.0%	68.8%	31.3%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		
Recall Mode	Min	Min	None	Min	None
Act Effect Green (s)	27.5	27.5	46.2	46.2	13.8
Actuated g/C Ratio	0.37	0.37	0.62	0.62	0.19
v/c Ratio	0.89	0.29	0.80	0.63	0.76
Control Delay	33.4	4.2	32.6	10.8	33.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	33.4	4.2	32.6	10.8	33.3
LOS	C	A	C	B	C
Approach Delay	29.0			14.7	33.3
Approach LOS	C			B	C

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 74.1

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 22.2

Intersection LOS: C

Intersection Capacity Utilization 78.4%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 1: SH 46 & Pieper Rd



Timings

1: SH 46 & Pieper Rd

11/19/2018

	↑	↗	↘	↓	↙	↖
Lane Group	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑	↗	↘	↑↑	↙	↖
Traffic Volume (vph)	982	73	115	1042	183	290
Future Volume (vph)	982	73	115	1042	183	290
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	7.0	15.0	7.0	7.0
Minimum Split (s)	25.0	25.0	15.0	25.0	25.0	25.0
Total Split (s)	35.0	35.0	15.0	50.0	30.0	30.0
Total Split (%)	43.8%	43.8%	18.8%	62.5%	37.5%	37.5%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Recall Mode	Min	Min	None	Min	None	None
Act Effect Green (s)	25.0	25.0	35.6	35.6	13.1	13.1
Actuated g/C Ratio	0.39	0.39	0.56	0.56	0.21	0.21
v/c Ratio	0.77	0.12	0.39	0.57	0.55	0.60
Control Delay	23.0	4.8	10.4	10.3	31.1	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	4.8	10.4	10.3	31.1	11.5
LOS	C	A	B	B	C	B
Approach Delay	21.8			10.3	19.1	
Approach LOS	C			B	B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 63.7

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 16.4

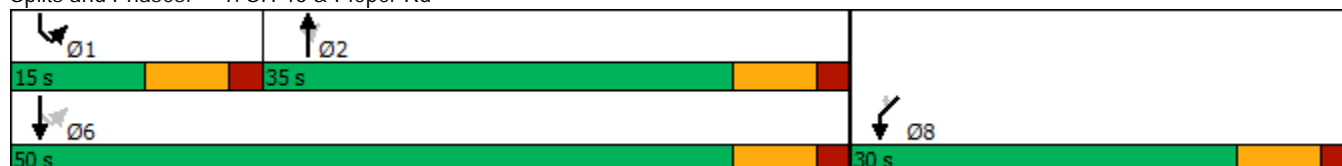
Intersection LOS: B

Intersection Capacity Utilization 61.2%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: SH 46 & Pieper Rd



Timings

1: SH 46 & Pieper Rd

11/19/2018

	↑	↗	↘	↓	↙	↖
Lane Group	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations	↑↑	↗	↘	↑↑	↙	↖
Traffic Volume (vph)	1073	191	278	1272	107	161
Future Volume (vph)	1073	191	278	1272	107	161
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	7.0	15.0	7.0	7.0
Minimum Split (s)	25.0	25.0	15.0	25.0	25.0	25.0
Total Split (s)	35.0	35.0	20.0	55.0	25.0	25.0
Total Split (%)	43.8%	43.8%	25.0%	68.8%	31.3%	31.3%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Recall Mode	Min	Min	None	Min	None	None
Act Effect Green (s)	27.4	27.4	45.9	45.9	10.1	10.1
Actuated g/C Ratio	0.39	0.39	0.65	0.65	0.14	0.14
v/c Ratio	0.84	0.28	0.76	0.60	0.46	0.46
Control Delay	27.6	3.8	27.7	8.5	34.1	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	3.8	27.7	8.5	34.1	9.3
LOS	C	A	C	A	C	A
Approach Delay	24.0			11.9	19.2	
Approach LOS	C			B	B	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 70.1

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 17.5

Intersection LOS: B

Intersection Capacity Utilization 68.5%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: SH 46 & Pieper Rd



HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd












11/19/2018

	↑	↗	↘	↓	↙	↖	
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations	↑↑	↗	↘	↑↑	↙	↖	
Traffic Volume (veh/h)	982	31	56	1042	57	115	
Future Volume (Veh/h)	982	31	56	1042	57	115	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1067	34	61	1133	62	125	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	TWLT			TWLT			
Median storage veh)	2			2			
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1101		1756	534	
vC1, stage 1 conf vol					1067		
vC2, stage 2 conf vol					688		
vCu, unblocked vol			1101		1756	534	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			90		74	75	
cM capacity (veh/h)			630		241	491	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	534	534	34	61	566	566	187
Volume Left	0	0	0	61	0	0	62
Volume Right	0	0	34	0	0	0	125
cSH	1700	1700	1700	630	1700	1700	365
Volume to Capacity	0.31	0.31	0.02	0.10	0.33	0.33	0.51
Queue Length 95th (ft)	0	0	0	8	0	0	70
Control Delay (s)	0.0	0.0	0.0	11.3	0.0	0.0	24.7
Lane LOS				B			C
Approach Delay (s)	0.0			0.6			24.7
Approach LOS							C
Intersection Summary							
Average Delay			2.1				
Intersection Capacity Utilization			50.7%		ICU Level of Service		A
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd













11/19/2018

							
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations							
Traffic Volume (veh/h)	1073	50	80	1272	24	45	
Future Volume (Veh/h)	1073	50	80	1272	24	45	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1166	54	87	1383	26	49	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	TWLT			TWLT			
Median storage veh	2			2			
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1220		2032	583	
vC1, stage 1 conf vol					1166		
vC2, stage 2 conf vol					866		
vCu, unblocked vol			1220		2032	583	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			85		87	89	
cM capacity (veh/h)			567		198	456	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	583	583	54	87	692	692	75
Volume Left	0	0	0	87	0	0	26
Volume Right	0	0	54	0	0	0	49
cSH	1700	1700	1700	567	1700	1700	314
Volume to Capacity	0.34	0.34	0.03	0.15	0.41	0.41	0.24
Queue Length 95th (ft)	0	0	0	13	0	0	23
Control Delay (s)	0.0	0.0	0.0	12.5	0.0	0.0	20.1
Lane LOS				B			C
Approach Delay (s)	0.0			0.7			20.1
Approach LOS							C
Intersection Summary							
Average Delay			0.9				
Intersection Capacity Utilization			48.2%		ICU Level of Service		A
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

11/19/2018

							
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations							
Traffic Volume (veh/h)	982	47	78	1042	104	181	
Future Volume (Veh/h)	982	47	78	1042	104	181	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1067	51	85	1133	113	197	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)						12	
Median type	TWLTL		TWLTL				
Median storage veh)	2		2				
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1118		1804	534	
vC1, stage 1 conf vol					1067		
vC2, stage 2 conf vol					736		
vCu, unblocked vol			1118		1804	534	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			86		51	60	
cM capacity (veh/h)			620		231	491	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	534	534	51	85	566	566	310
Volume Left	0	0	0	85	0	0	113
Volume Right	0	0	51	0	0	0	197
cSH	1700	1700	1700	620	1700	1700	635
Volume to Capacity	0.31	0.31	0.03	0.14	0.33	0.33	0.49
Queue Length 95th (ft)	0	0	0	12	0	0	67
Control Delay (s)	0.0	0.0	0.0	11.7	0.0	0.0	23.5
Lane LOS				B			C
Approach Delay (s)	0.0			0.8			23.5
Approach LOS							C
Intersection Summary							
Average Delay			3.1				
Intersection Capacity Utilization			47.2%		ICU Level of Service		A
Analysis Period (min)			15				

HCM Unsignalized Intersection Capacity Analysis

1: SH 46 & Pieper Rd

11/19/2018

	↑	↗	↖	↓	↙	↘	
Movement	NBT	NBR	SBL	SBT	SWL	SWR	
Lane Configurations	↑↑	↗	↖	↑↑	↙	↘	
Traffic Volume (veh/h)	1073	103	154	1272	55	88	
Future Volume (Veh/h)	1073	103	154	1272	55	88	
Sign Control	Free			Free	Stop		
Grade	0%			0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	1166	112	167	1383	60	96	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)						12	
Median type	TWLT			TWLT			
Median storage veh	2			2			
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume			1278		2192	583	
vC1, stage 1 conf vol					1166		
vC2, stage 2 conf vol					1026		
vCu, unblocked vol			1278		2192	583	
tC, single (s)			4.1		6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)			2.2		3.5	3.3	
p0 queue free %			69		62	79	
cM capacity (veh/h)			539		159	456	
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SW 1
Volume Total	583	583	112	167	692	692	156
Volume Left	0	0	0	167	0	0	60
Volume Right	0	0	112	0	0	0	96
cSH	1700	1700	1700	539	1700	1700	415
Volume to Capacity	0.34	0.34	0.07	0.31	0.41	0.41	0.38
Queue Length 95th (ft)	0	0	0	33	0	0	43
Control Delay (s)	0.0	0.0	0.0	14.6	0.0	0.0	24.8
Lane LOS				B			C
Approach Delay (s)	0.0			1.6			24.8
Approach LOS							C
Intersection Summary							
Average Delay			2.1				
Intersection Capacity Utilization			51.5%		ICU Level of Service		A
Analysis Period (min)			15				