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ACCEPTED for FILE  
Engineering Review  
05/04/2023 1:51:30 PM  
Elicahoh Nijkamp, PE  
EPC Department of Public Works

Struthers Ranch Filing 4 Lot Nos. 1 & 2  
Traffic Impact Study  
PCD File No. PPR-2248  
(LSC #204111)  
April 4, 2023

Traffic Engineer's Statement

This traffic report and supporting information were prepared under my responsible charge and they comport with the standard of care. So far as is consistent with the standard of care, said report was prepared in general conformance with the criteria established by the County for traffic reports.



Developer's Statement

I, the Developer, have read and will comply with all commitments made on my behalf within this report.

  
\_\_\_\_\_

4-12-23  
Date

# Struthers Ranch Filing No. 4 Lots 1 & 2

## Traffic Impact Study

Prepared for:  
Lisa Peterson  
Hammers Construction  
1411 Woolsey Heights  
Colorado Springs, CO 80915

APRIL 4, 2023

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LSC Transportation Consultants  
Prepared by: Jeffrey C. Hodsdon, P.E.

LSC #204110  
PCD File No. PPR-2248



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April 4, 2023

Lisa Peterson  
Hammers Construction  
1411 Woolsey Heights  
Colorado Springs, CO 80915

RE: Struthers Ranch Filing 4 Lot Nos. 1 & 2  
Traffic Impact Study  
El Paso County, Colorado  
EPC PCD File No. PPR-2248  
LSC #204110

Dear Ms. Peterson:

LSC Transportation Consultants, Inc. has prepared this traffic impact study for the proposed Struthers Ranch Filing 4 Lot Nos. 1 and 2 development in El Paso County, Colorado. The development is planned to be located southeast of the intersection of Struthers Road/Struthers Ranch Road. The planned land use is for a 12,000-square-foot off-road vehicle dealership on 1.75 acres. The balance of the parcel is not planned for development at this time. This report has been prepared for submittal to El Paso County.

## REPORT CONTENTS

The preparation of this report included the following:

- Inventory of the existing adjacent and nearby area street and roadway system. This includes functional classifications, street widths, lane configurations, intersection traffic control, posted speed limits, pavement markings, intersection and access spacing, roadway and intersection alignments, auxiliary left- and right-turn lanes, intersection sight distances, etc.;
- A description of the proposed site land use and access locations;
- Morning and evening peak-hour traffic counts at the intersection of Struthers Road/Struthers Ranch Road;
- Estimates of short- and long-term background traffic volumes and total traffic (site traffic plus background traffic). Forecasts include estimates of buildout of adjacent potential future developments;
- Estimates of the daily and peak-hour trip generation for the proposed land use;

- Information regarding the trip generation caps established with the PUD and this project's conformance with those caps;
- The estimated directional distribution of site-generated vehicle trips on the adjacent roadway system;
- Projections of peak-hour site-generated turning-movement traffic volumes at the study-area intersections, which include:
  - Site access-point intersection on Struthers Ranch Road
  - Struthers Road/Struthers Ranch Road
  - Level of service (LOS) analysis at the study-area intersections;
  - Evaluation of the short-term and long-term projected intersection volumes to determine the potential need for any new auxiliary right-/left-turn lanes and/or the adequacy of existing lanes at the site-access-point intersections and the other study-area intersections; and
- Findings and recommendations.

## **PREVIOUS TRAFFIC STUDIES**

Nearby properties have recently been studied in the following reports:

- Struthers Ranch Tract B Plat Updated Technical Memorandum, October 2006, LSC
- Monument Ridge Lots 7 & 8, December 2020, LSC
- Monument Ridge Apartments
- Cathedral Rock Church, February 2016, LSC

This report is consistent with the above reports and includes the proposed developments in the background traffic volumes.

## **LAND USE AND ACCESS**

Figure 1 shows the site location relative to the adjacent and nearby roadways. The site plan is shown in Figure 2. The Cathedral Rock Church is planned for the adjacent Tract A on the north side of Struthers Ranch Road. As shown in Figure 2, one access point is proposed: a full-movement access onto Struthers Ranch Road across from the proposed access to Cathedral Rock Church.

The planned land use for Struthers Ranch Filing 4 Lot Nos. 1 and 2 is for a 12,000-square-foot off-road vehicle dealership on 1.75 acres. The balance of the parcel is not planned for development at this time.

## **INTERSECTION SIGHT DISTANCE**

### **Struthers Road/Struthers Ranch Road**

The intersection sight distance for the intersection of Struthers Road/Struthers Ranch Road has been based Table 2-21 of the *Engineering Criteria Manual (ECM)*. This table has a footnote that

special design considerations for situations other than intersecting two-lane roads are required. Please refer to **Appendix A** of this report for detailed calculations and application of criteria.

Based on the calculations presented in **Appendix A** of this report,

- The calculated intersection sight distance is 590 feet to the left (south)
- The calculated intersection sight distance is 640 feet to the right (north)

The field-measured **sight distance to the south**, in conjunction with the site plan/grading plan, would meet the calculated 590 feet of sight distance. This is shown in Exhibit 1.

The sight distance **to the south** will be met, provided the intersection line of sight “triangle” is kept free of site improvements (that would limit the line of sight needed to maintain 590’ of prescribed sight distance). Examples of site improvements include buildings, landscaping, monument signs, parking areas, berms, etc. Obstruction height to maintain line of sight is 18 inches to 30 inches above the flow line of the adjacent road per *ECM* 2.3.6.G.2. LSC reviewed the grading plan and the height of the section of the retaining wall at the point where the line-of-sight traverses across the site, is such that it would not impede the line of sight for the 590’ of sight distance.

The sight distance **to the north** is shown in Exhibit 2. The field-measured sight distance **to the north** at this intersection is 450 feet. Given that the field-measured sight distance is less than the calculated sight distance of 640 feet, LSC recommends posting an “intersection ahead” warning sign (MUTCD W2-2) on the southbound approach to this intersection. Note: The *ECM* (and AASHTO) **stopping** sight distance for a 50-mph design speed is 425 feet.

Also, consideration could be given to modifying the posted speed limit zones on Struthers Road near this intersection to shift the 40-mph zone north such that a 40-mph speed limit sign is posted for southbound traffic between Spanish Bit and Struthers Ranch Road.

The required sight distance for the access point onto Struthers Ranch Road is 250 feet for passenger vehicles and 425 feet for combination trucks. Sight distance analysis exhibits are attached.

## **ROAD AND TRAFFIC CONDITIONS**

### **Area Roads**

Figure 1 shows the streets in the vicinity of the site. The streets adjacent to the site are identified below, followed by a brief description of each:

**Struthers Road** is a four-lane, median-divided road that extends north from North Gate Boulevard to the intersection of Baptist Road and Jackson Creek Parkway. Struthers Road is classified as a four-lane Urban Minor Arterial on the El Paso County Major Transportation Corridors Plan and has a speed limit of 45 miles per hour (mph) about 325 feet north of Air Garden Lane (adjacent to the south portion of the site). South of this point, the posted speed limit is 40 mph.

**Struthers Ranch Road** is classified as a local roadway. Struthers Ranch Road is an east/west road that extends from Struthers Road into the Struthers Ranch residential development. The roadway has a posted speed limit of 25 mph. The intersection with Struthers Road is unsignalized. The roadway at the intersection with Struthers Road is 32.7 feet wide, which only allows for a shared westbound left/right lane on the minor street approach. Struthers Road has a 340-foot southbound left-turn deceleration lane and a 260-foot northbound right-turn deceleration lane at the intersection with Struthers Ranch Road.

### **Traffic Volumes**

Morning and evening peak-hour turning-movement traffic counts were conducted in the fall of 2022 at the intersection of Struthers Road/Struthers Ranch Road. These current morning and evening peak-hour volumes are shown in Figure 3. Traffic count reports are attached for reference.

### **Crash History**

Three years of crash data were collected at the intersection of Struthers Road/Struthers Ranch Road (through April 2020). There was only one crash during that study period. The only crash was a fixed-object type crash that resulted in property damage only. No correctable crash patterns were identified. LSC is in the process of obtaining the most recent data.

## **BACKGROUND TRAFFIC**

### **Background Traffic Volumes**

Figure 4 shows the projected 20-year, long-term background traffic volumes for the year 2040. The long-term scenario includes the developments in the short-term background. In addition, the long-term background traffic assumes a growth of approximately 4 and 5 percent per year of through traffic on Struthers Road during the AM and PM peak hours, respectively. This rate is based on growth shown in the Pikes Peak Council of Governments travel demand model and is similar to growth shown in the area in *the 2016 Major Transportation Corridors Plan (MTCP)*. No improvements to the study roads are shown in the *MTCP*.

Background traffic for the long term includes LSC estimates of potential future trips to be generated by future development on the balance of Filing No. 4 (Lots 3 and 4 – based on the estimates in Table 3) and Tract A on the north side of Struthers Ranch Road.

## TRIP GENERATION

### Filing No. 4 Lots 1 and 2

Estimates of the vehicle trips projected to be generated by the currently-proposed development for Lots 1 and 2 have been made using the nationally published trip-generation rates from land-use code “840 – Automobile Sales (New)” in *Trip Generation, 11<sup>th</sup> Edition, 2021* by the Institute of Transportation Engineers (ITE). This appeared to be the closest ITE land use to the proposed motorcycle/OHV dealership. Table 1, below, presents a summary of the estimated site trip generation on a typical weekday. The detailed trip-generation estimate for the development, including ITE rates for the proposed land use, is presented in Table 3 (attached).

Approximately 334 total vehicle trips are projected to be generated by this dealership on the average weekday during a 24-hour period. This total includes entering and exiting trips (entering and exiting are counted separately as two trips). During the morning peak hour, approximately 16 vehicles would enter and 6 vehicles would exit the site. During the evening peak hour, approximately 12 vehicles would enter and 17 vehicles would exit the site.

**Table 1: Estimated Site Vehicle-Trip Generation**

Analysis Period	Total Trips		
	In	Out	Total
A.M. Peak Hour	16	6	22
P.M. Peak Hour	12	17	29
Daily/24-Hour	167	167	334

### Future Potential Development – Lots 3 and 4 (“Background” Trips)

Table 3 also presents trip estimates of the potential future development on the remaining lots within Filing No. 4 – Lots 3 and 4. These trips are considered “background trips” as they are not part of this application but have been included in the future background traffic (and resulting total traffic). The trip generation for Tract A has also been included in the Table. The Tract A trips are also considered “background trips” as they are not part of this application but have been included in the future background (and resulting total) traffic volumes. The totals for Lots 1 through 4 are estimated and compared to the established trip generation “cap” for Filing 4, Lots 1-4. (Formerly Tract B) from the approved PUD plan.

As shown, based on the currently-proposed end-user for Lots 1 and 2 and the trip-generation estimate for the remaining two lots, the cap would not be exceeded.

## **TRIP DISTRIBUTION AND ASSIGNMENT**

### **Trip Directional Distribution**

Estimation of the directional distribution of site-generated vehicle trips to the study-area roads and intersections is a necessary component in determining the site's traffic impacts. Figure 5 shows the short-term and long-term directional-distribution estimates for the proposed development. Estimates were based on the following factors: existing area development, the area roadway system, and the site's proposed land-use-estimated market area for the proposed dealership.

### **Site-Generated Traffic**

Site-generated traffic volumes at the study intersections have been calculated by applying the directional-distribution percentages estimated by LSC (from Figure 5) to the trip-generation estimates (from Table 1). Figure 6 shows the projected site-generated traffic volumes for the proposed development.

Note: Site-generated traffic includes **only** trips to be generated by Lots 1 & 2. The trips to be generated by lots 3 and 4 and Tract A have been included in the future background traffic (and resulting total traffic). They have not been shown as part of the site-generated traffic component, as they are not part of this application.

### **Trip Generation "Cap"**

A trip generation cap was established with the PUD for the non-residential land uses planned for Tracts A and B (Tract B is now Filing No. 4, lots 1-4), such that criteria for levels of service and vehicle queue length would not be exceeded. The trip generation was back-calculated from the intersection traffic volumes such that the criteria would be met. At that time, staff indicated that because of the difficulty of limiting vehicle trips generated by development, the land uses collectively allowed on the site should be restricted to those that are not projected to generate more vehicle trips than what is shown in the June 9, 2006 report as the trip generation cap. The cap established was 158 entering vehicles and 171 exiting vehicles during the afternoon peak hour for Tracts A and B.

The Tract B (now Filing No. 4, Lots 1-4) cap was documented in the LSC memo dated October 30, 2006. This memo showed the calculated Tract B portion of the overall cap at 71 entering vehicles and 77 exiting vehicles during the afternoon peak hour.

These caps are shown in the attached trip-generation table. The remaining Lots 1-4 "Cap" (originally Tract B) for Lots 3&4 (After Development of Lots 1 & 2) would be 59 entering vehicles and 60 exiting PM peak-hour vehicle trips.

This project is in conformance with the PUD guidelines (from the traffic impact standpoint) as the cap is not exceeded, and the land use proposed is comparable to some of the lower-intensity trip generators listed as part of the establishment of the cap.

**PROJECTED BACKGROUND AND TOTAL TRAFFIC VOLUMES**

**Short-Term Total Traffic Volumes**

Figure 7 shows the sum of **existing** traffic volumes (from Figure 3) and the site-generated peak-hour traffic volumes (shown in Figure 6). These volumes represent the projected short-term total traffic following construction and opening of the Polaris dealership.

**Long-Term Total Traffic Volumes**

Figure 8 shows the projected 2040 total traffic volumes, which are the sum of 2040 background traffic volumes (from Figure 4) plus the site-generated traffic volumes (from Figure 6).

**LEVEL OF SERVICE ANALYSIS**

Level of service (LOS) is a quantitative measure of the level of congestion or delay at an intersection and is indicated on a scale from “A” to “F.” LOS A is indicative of little congestion or delay. LOS F indicates a high level of congestion or delay. Table 2 shows the level of service delay ranges for signalized and unsignalized intersections.

**Table 2: Intersection Levels of Service Delay Ranges**

Level of Service	Signalized Intersections	Unsignalized Intersections
	Average Control Delay (seconds per vehicle)	Average Control Delay (seconds per vehicle) <sup>(1)</sup>
A	10.0 sec or less	10.0 sec or less
B	10.1-20.0 sec	10.1-15.0 sec
C	20.1-35.0 sec	15.1-25.0 sec
D	35.1-55.0 sec	25.1-35.0 sec
E	55.1-80.0 sec	35.1-50.0 sec
F	80.1 sec or more	50.1 sec or more

(1) For unsignalized intersections if V/C ratio is greater than 1.0 the level of service is LOS F regardless of the projected average control delay per vehicle.

The intersections of Struthers Road/Struthers Ranch Road, as well as the site-access points on Struthers Ranch Road, have been analyzed to determine the projected control delay and corresponding levels of service for turning movements. Figure 3 provides the existing levels of service, while Figure 4 provides background levels of service for the short-term and long-term

scenarios. Figure 7 and Figure 8 provide the levels of service of the short-term and long-term total traffic scenarios, respectively.

### **Struthers Road/Struthers Ranch Road**

#### Current and Short Term

The yielding turning movements at the unsignalized intersection of Struthers Road/Struthers Ranch Road **currently** operate at LOS B or better during both the morning and evening peak hours. In the **short-term future**, the yielding turning movements are forecast to operate at LOS B or better during both peak hours, with and without the proposed development.

#### Long Term

In the long-term future, the yielding turning movements are also forecast to operate at LOS C or better, with or without additional traffic from the proposed development.

### **Site Access/Struthers Ranch Road**

During all scenarios (short and long term, background only, and total), minor-street turning movements operate at LOS B or better during both peak hours.

### **AUXILIARY TURN LANES**

As mentioned previously, there is a 340-foot southbound left-turn deceleration lane at the intersection of Struthers Road/Struthers Ranch Road. This lane meets the *ECM* auxiliary-lane criteria and does not need to be modified with the development.

There is a 400-foot northbound right-turn deceleration lane (combined lane plus taper length) at this intersection of Struthers Road/Struthers Ranch Road. This auxiliary lane, although it exists, is not currently required per the *ECM* and is not expected to be required in the future with added site-generated traffic. The turning-volume threshold could potentially be met on Sunday mornings with the addition of future church traffic. The turn lane already exists and is about 400 feet (lane plus taper). The *ECM* requirement is 435 feet.

A northbound right-turn acceleration lane is not required on Struthers Road.

The access on Struthers Ranch Road would **not** exceed the threshold for requiring an eastbound right-turn lane per the *ECM* because the turning volume is below the 50-vph threshold.

Although not anticipated to be required based on projected volumes or levels of service, minor widening of Struthers Ranch Road in the future to allow for separate right- and left-turn lanes in the westbound direction at the intersection with Struthers Road could fit within the existing 60-

foot right-of way. The six to seven feet of additional street width (current width is 32.7 feet, not including curb and gutter) plus sidewalks could be accommodated, if needed.

### **VEHICLE QUEUING**

At the intersection of Struthers Road/Struthers Ranch Road, there are 250 feet available for vehicle queueing to the east, prior to the site access. The 95<sup>th</sup> percentile queue length for the westbound approach at the intersection is anticipated to be 30 feet, which will not impact the site access.

### **TRAFFIC CONTROL**

LSC recommends stop-sign traffic control for the northbound approach (and the future southbound approach) at the Struthers Ranch Road/site access "intersection."

### **PEDESTRIAN AND BICYCLE ACCOMMODATION**

A sidewalk exists along Struthers Road adjacent to the site. However, there are currently no sidewalks along Struthers Ranch Road adjacent to the site. It is recommended that a sidewalk be constructed adjacent to the site on Struthers Ranch Road.

There are no designated bike lanes on Struthers Road and the roadway is not planned to have bike lanes. However, there are sections of Struthers Road that have paved outside shoulders to accommodate cyclists.

### **COUNTY DEVIATION REQUESTS**

A deviation request for limited intersection sight distance to the north from Struthers Ranch Road has been included with this submittal, as this is being required by staff. However, note this is an existing condition regardless of this development. Please refer to the deviation request form (separate document).

### **COUNTY ROAD IMPROVEMENT FEE PROGRAM**

#### **Transportation Impact Fees**

*Per ECM Appendix B: State what the current applicable Transportation Impact Fees are and what option the developer will be selecting for payment.*

The applicant intends to opt out of the PID options and will pay the full-fee amount at the time of building permit. The current "full-fee" is \$4,958 per 1,000 square feet of building floor area. The total fee amount for the 12,000 square feet of commercial buildings is \$59,496.

**Reimbursable MTCP Improvements**

There are no apparent reimbursable improvements programmed in the *MTCP* in the general vicinity of this site.

**FINDINGS AND CONCLUSIONS**

- The site is projected to generate approximately 334 external vehicle trips on the average weekday.
- During the morning peak hour, approximately 16 vehicles would enter and 6 vehicles would exit the site. During the evening peak hour, approximately 12 vehicles would enter and 17 vehicles would exit the site
- Site improvements, landscaping, signage etc. will need to accommodate the driver sight-distance lines of sight necessary to meet the prescribed intersection sight distance at Struthers Road/Struthers Ranch Road. Please refer to the Sight Distance section for details.
- Turning movements at the site access/Struthers Ranch Road intersection and at the proposed site access to Struthers Ranch Road are projected to operate at acceptable levels of service in all scenarios.
- The 95<sup>th</sup> percentile queues at all study intersections are not projected to impact adjacent intersections.
- Please refer to the sight distance section for recommendations based on the sight-distance analysis.
- See Table 4 (below) for a summary of recommended improvements.

**Table 4: Recommended Improvements**

Item #	Location	Improvement	Timing
1	Struthers Ranch Road - Adjacent to the site	Sidewalk	With development of the site
2	Struthers Road southbound, north of the Struthers Ranch Road intersection (per MUTCD guidance for placement)	LSC recommends posting an "intersection ahead" warning sign (MUTCD W2-2) on the southbound approach to this intersection due to the limited intersection sight distance.	With the Site Development Plan
3	Site Access - on the northbound approach (and the future southbound approach) at the Struthers Ranch Road/site access "intersection."	LSC recommends Stop-sign traffic control for the northbound approach (and the future southbound approach) at the Struthers Ranch Road/site access "intersection."	With the Site Development Plan

Source: LSC Transportation Consultants, Inc. (Rev. 04-4-2023)

\* \* \* \* \*

Please contact me if you have any questions regarding this report.

Respectfully Submitted,

LSC TRANSPORTATION CONSULTANTS, INC.

By Jeffrey C. Hodsdon, P.E.  
Principal

JCH/JAB:jas

Enclosures: Table 3  
Figures 1-9  
Sight Distance Exhibits 1 & 2  
Traffic Count Reports  
Level of Service Reports  
Appendix A

References:

*Trip Generation Handbook - An ITE Proposed Recommended Practice*, Third Edition September 2017, Institute of Transportation Engineers  
*Trip Generation, 11<sup>th</sup> Edition, 2021*, Institute of Transportation Engineers  
*El Paso County Major Transportation Corridors Plan, 2016*

# Table 3



**Table 3: Detailed Trip-Generation Estimate – Filing No. 4**

ITE Land Uses		Value	Units <sup>1</sup>	Trip Generation Rates <sup>2</sup>				Driveway Trips Generated					
Code	Description			Average Weekday	A.M.		P.M.		Average Weekday	A.M.		P.M.	
				In	Out	In	Out		In	Out	In	Out	
<b><u>Proposed Land Use (Lots 1 + 2)</u></b>													
840	Automobile Sales (New)	12.000	KSF	27.84	1.36	0.50	0.97	1.45	334	16	6	12	17
<b><u>Additional Future Background Land Uses (Lots 3 + 4)</u></b>													
822	Strip Retail Plaza (< 40 KSF)	10.750	KSF	54.45	1.42	0.94	3.30	3.30	585	15	10	35	35
<b><u>Total for Lots 1 + 4</u></b>													
840	Automobile Sales (New)	12.000	KSF	27.84	1.36	0.50	0.97	1.45	334	16	6	12	17
822	Strip Retail Plaza (< 40 KSF)	10.750	KSF	54.45	1.42	0.94	3.30	3.30	585	15	10	35	35
								<b>Total</b>	<b>919</b>	<b>32</b>	<b>16</b>	<b>47</b>	<b>53</b>
<b><u>Established "Cap" for Trip Generation (Lots 1-4 Combined - formerly Tract B)</u></b>													
820	Shopping Center	39.500	KSF	-	-	-	1.80	1.96	-	-	-	71	77
<b><u>Remaining Lots 1-4 "Cap" for Lots 3&amp;4 (After Development of Lots 1 &amp; 2)</u></b>												59	60
<b>For Reference:</b>													
<b><u>Established "Cap" for Trip Generation (Tract A)</u></b>													
820	Shopping Center											87	94
<b><u>Established "Cap" for Trip Generation (Lots 1-4 &amp; Tract A)</u></b>													
820	Shopping Center											158	171
<sup>1</sup> KSF = 1,000 square feet													
<sup>2</sup> Source: <i>Trip Generation, 11th Edition (2021)</i> by the Institute of Transportation Engineers (ITE)													

# Figures 1-9

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NTS

Figure 1  
**Vicinity  
Map**

Struthers - Polaris RMC (LSC #204111)

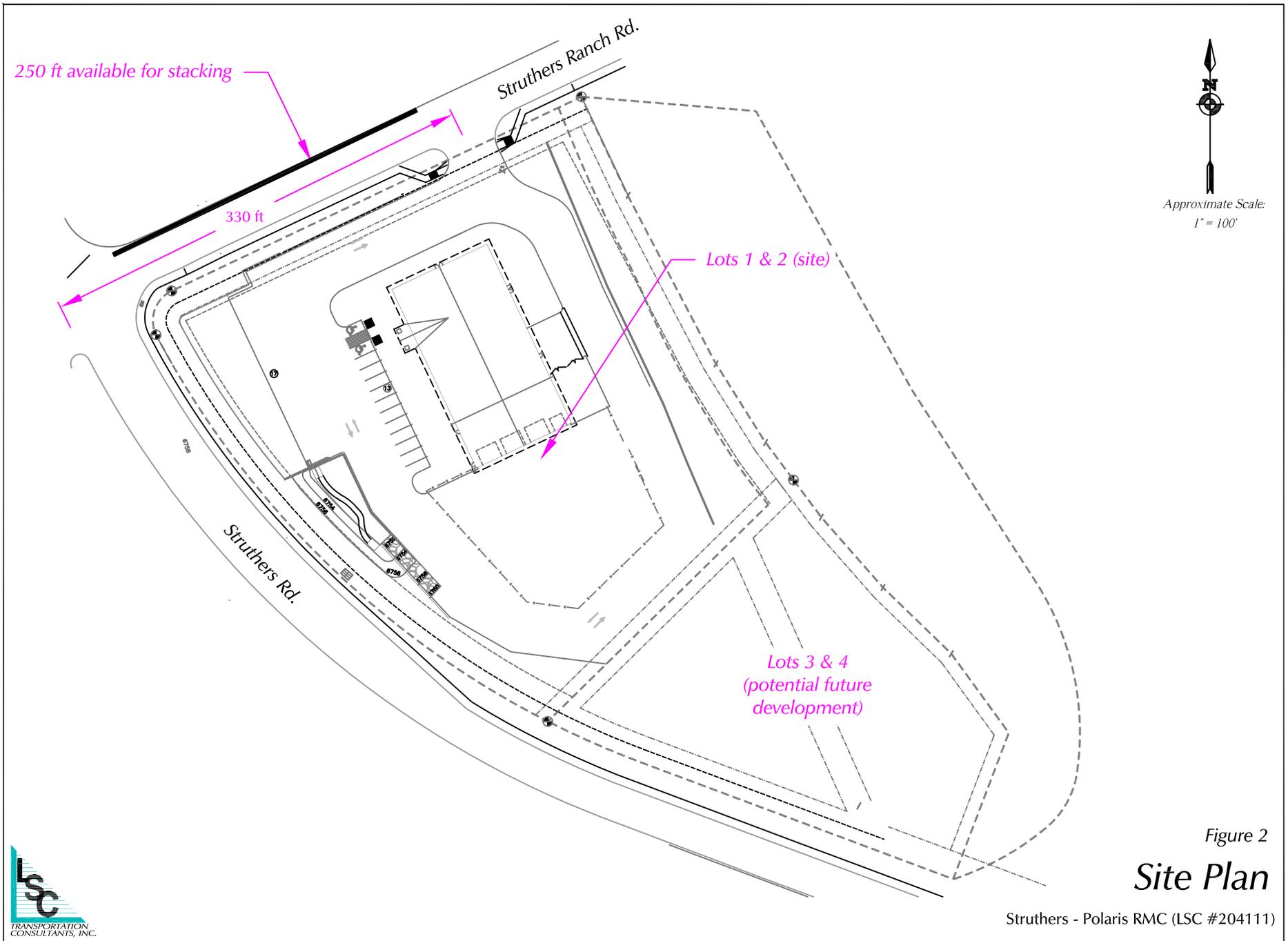
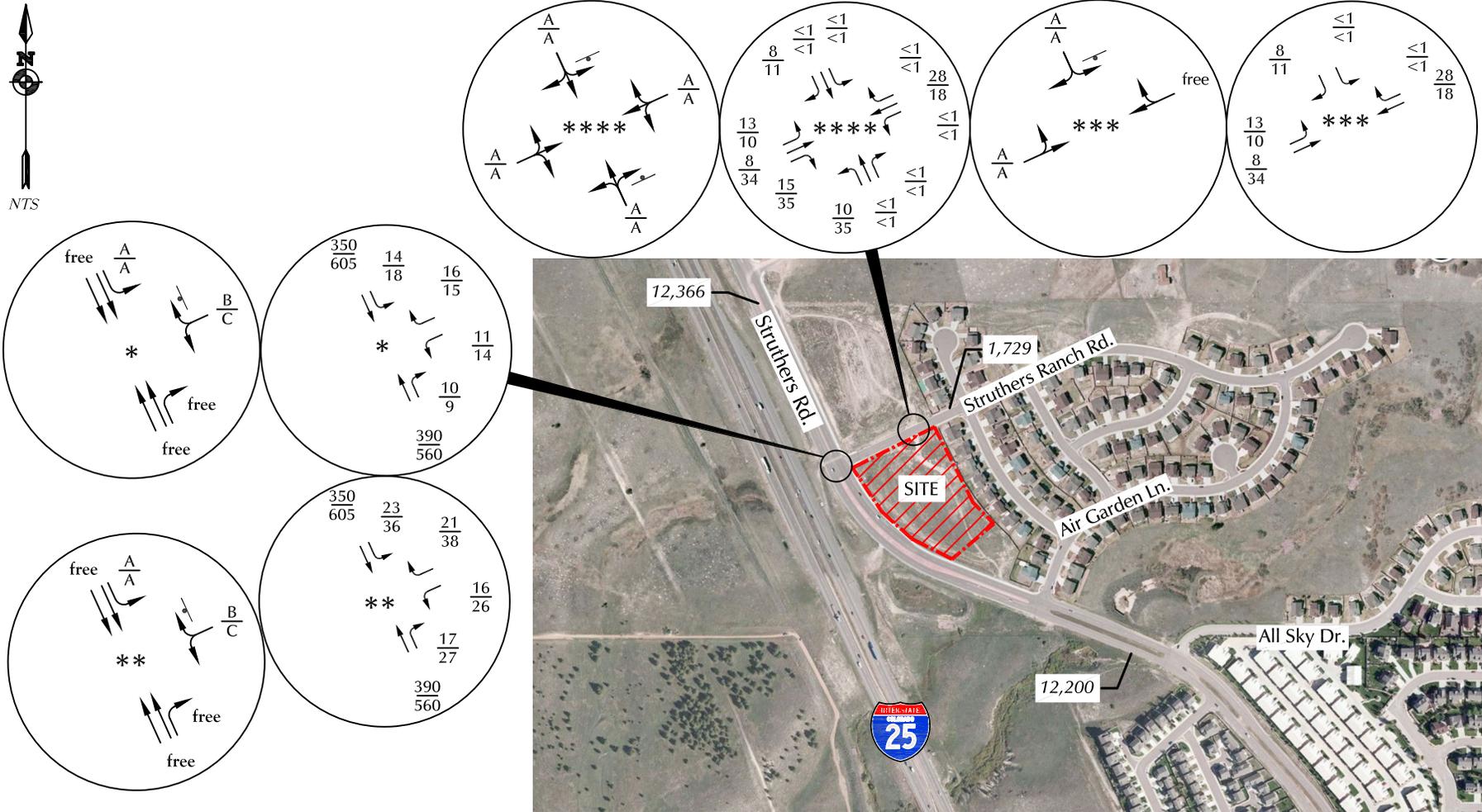


Figure 2  
**Site Plan**

Struthers - Polaris RMC (LSC #204111)







\* With through traffic, future Tract A trips and residential traffic (zero Filing 4 traffic)  
 \*\* With through traffic, residential traffic, future Tract A trips, and future Lots 3 and 4 traffic.

\*\*\* With future Tract A trips and residential traffic only  
 \*\*\*\* With residential traffic, future Tract A trips, and future Lots 3 and 4 traffic.

**LEGEND:**

⊥ = Stop Sign

$\frac{XX}{XX}$  = AM Weekday Peak-Hour Traffic (vehicles per hour)

$\frac{XX}{XX}$  = PM Weekday Peak-Hour Traffic (vehicles per hour)

$\frac{A}{A}$  = AM Individual Movement Peak-Hour Level of Service

$\frac{B}{B}$  = PM Individual Movement Peak-Hour Level of Service

X,XXX = Average Weekday Traffic (vehicles per day)

Figure 4

# Long-Term Background Traffic Conditions

Struthers - Polaris RMC (LSC #204111)



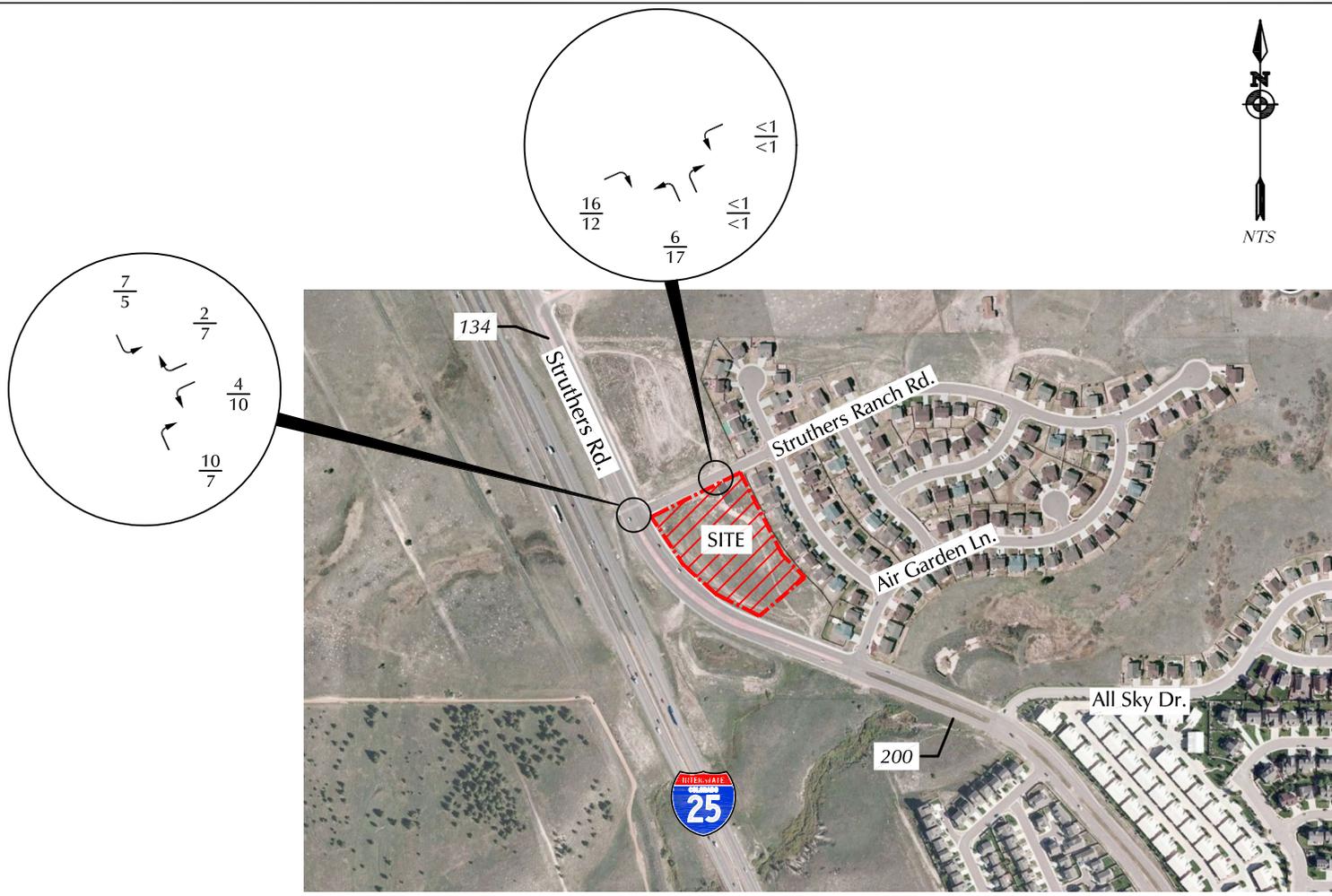
LEGEND:

XX% = Percent Directional Distribution (RMC Distribution)



Figure 5  
*Directional Distribution  
of Site-Generated Traffic*

Struthers - Polaris RMC (LSC #204111)



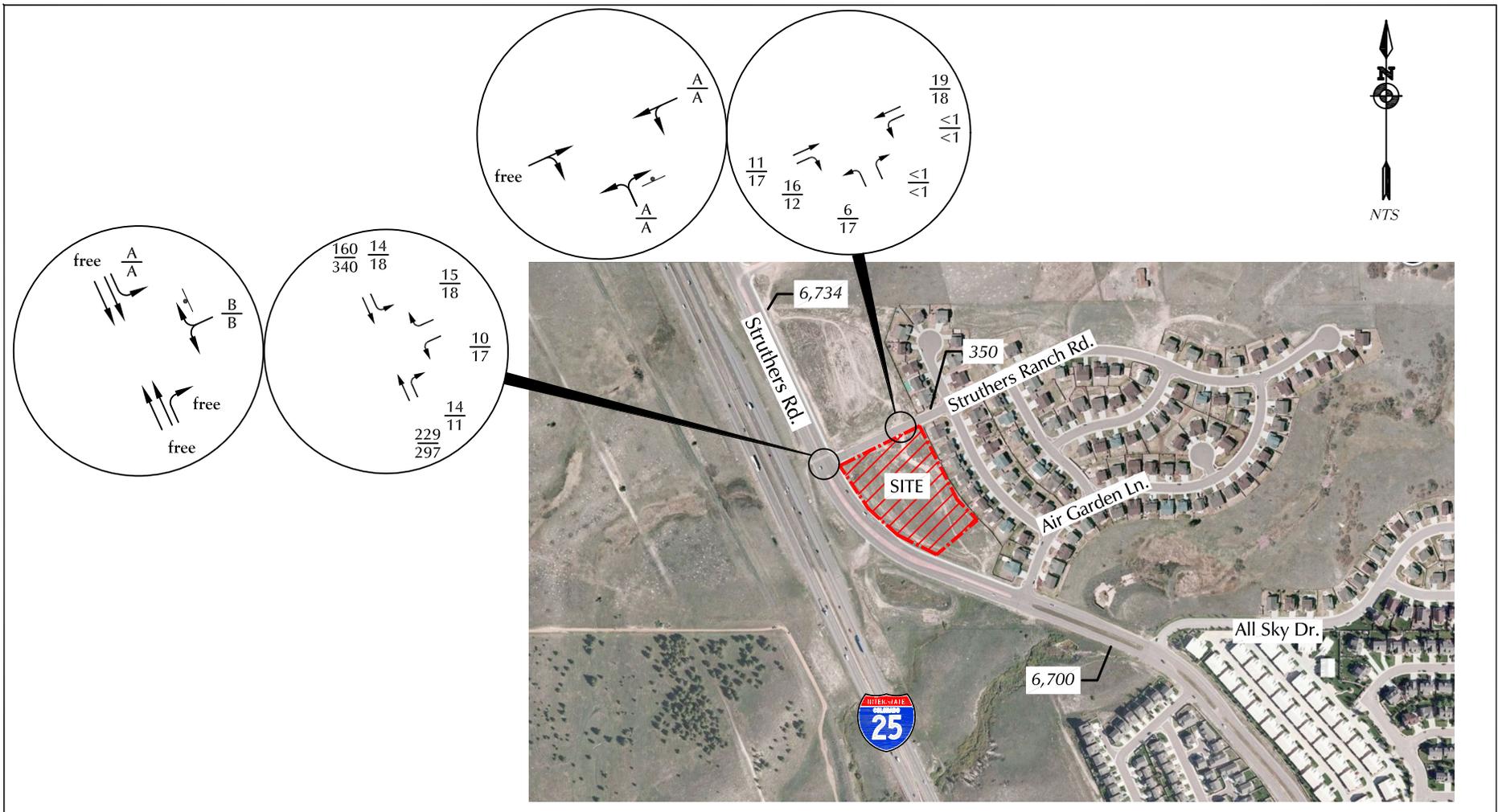
LEGEND:

- $\frac{XX}{XX}$  = AM Weekday Peak-Hour Traffic (vehicles per hour)
- $\frac{XX}{XX}$  = PM Weekday Peak-Hour Traffic (vehicles per hour)
- X,XXX = Average Weekday Traffic (vehicles per day)



Figure 6  
*Site-Generated  
 Traffic Volumes*

Struthers - Polaris RMC (LSC #204111)



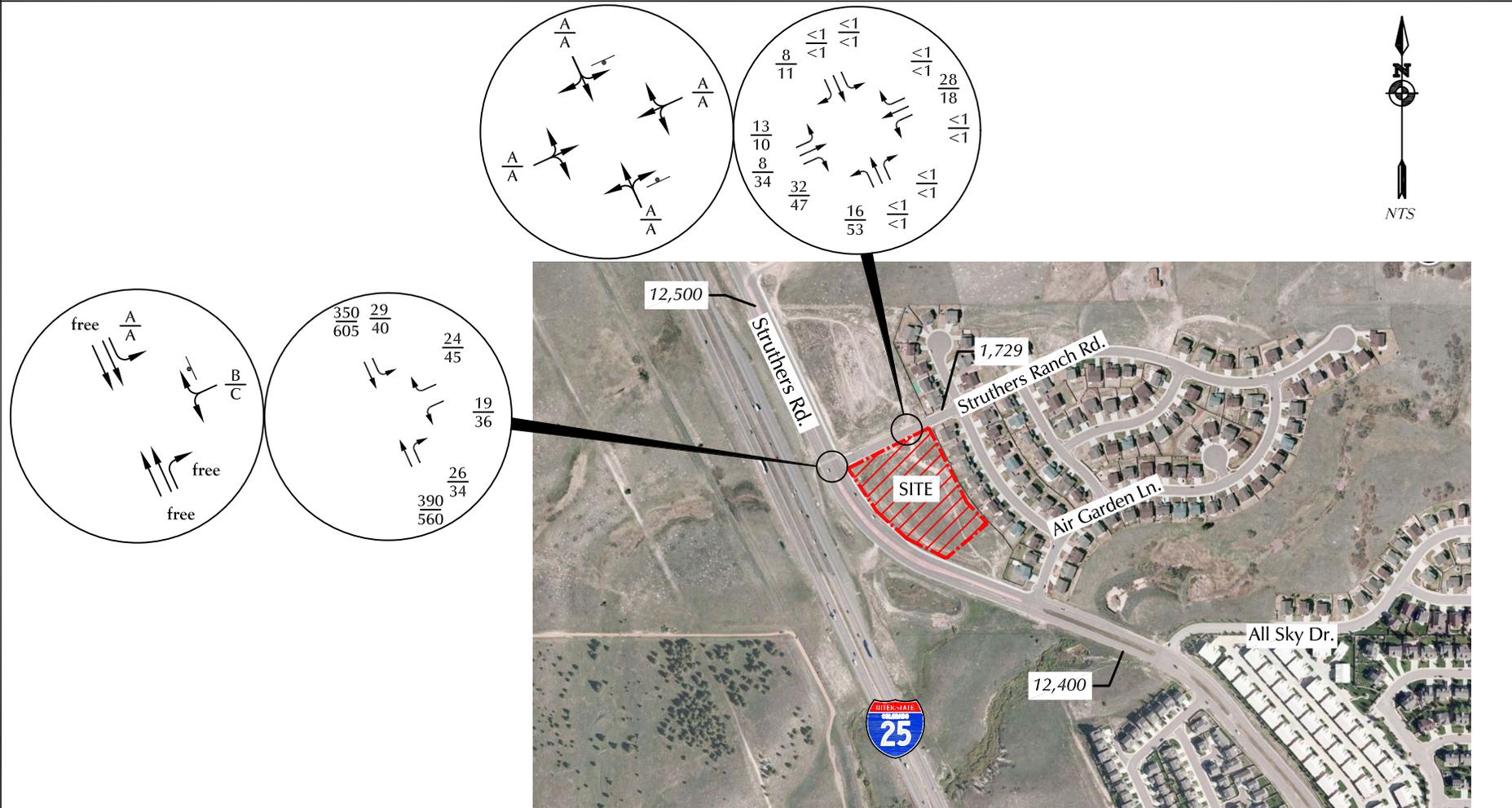
LEGEND:

- | = Stop Sign
- $\frac{XX}{XX}$  = AM Weekday Peak-Hour Traffic (vehicles per hour)  
PM Weekday Peak-Hour Traffic (vehicles per hour)
- $\frac{A}{B}$  = AM Individual Movement Peak-Hour Level of Service  
PM Individual Movement Peak-Hour Level of Service
- X,XXX = Average Weekday Traffic (vehicles per day)

Figure 7

# Short-Term Total Traffic Conditions

Struthers - Polaris RMC (LSC #204111)



LEGEND:

⊥ = Stop Sign

$\frac{XX}{XX}$  = AM Weekday Peak-Hour Traffic (vehicles per hour)  
 PM Weekday Peak-Hour Traffic (vehicles per hour)

$\frac{A}{B}$  = AM Individual Movement Peak-Hour Level of Service  
 PM Individual Movement Peak-Hour Level of Service

X,XXX = Average Weekday Traffic (vehicles per day)

Figure 8

# Long-Term Total Traffic Conditions

Struthers - Polaris RMC (LSC #204111)



Appendix Figure 1

## Directional Distribution of Future Lost 3 and 4 Trips

Struthers - Polaris RMC (LSC #204111)

LEGEND:

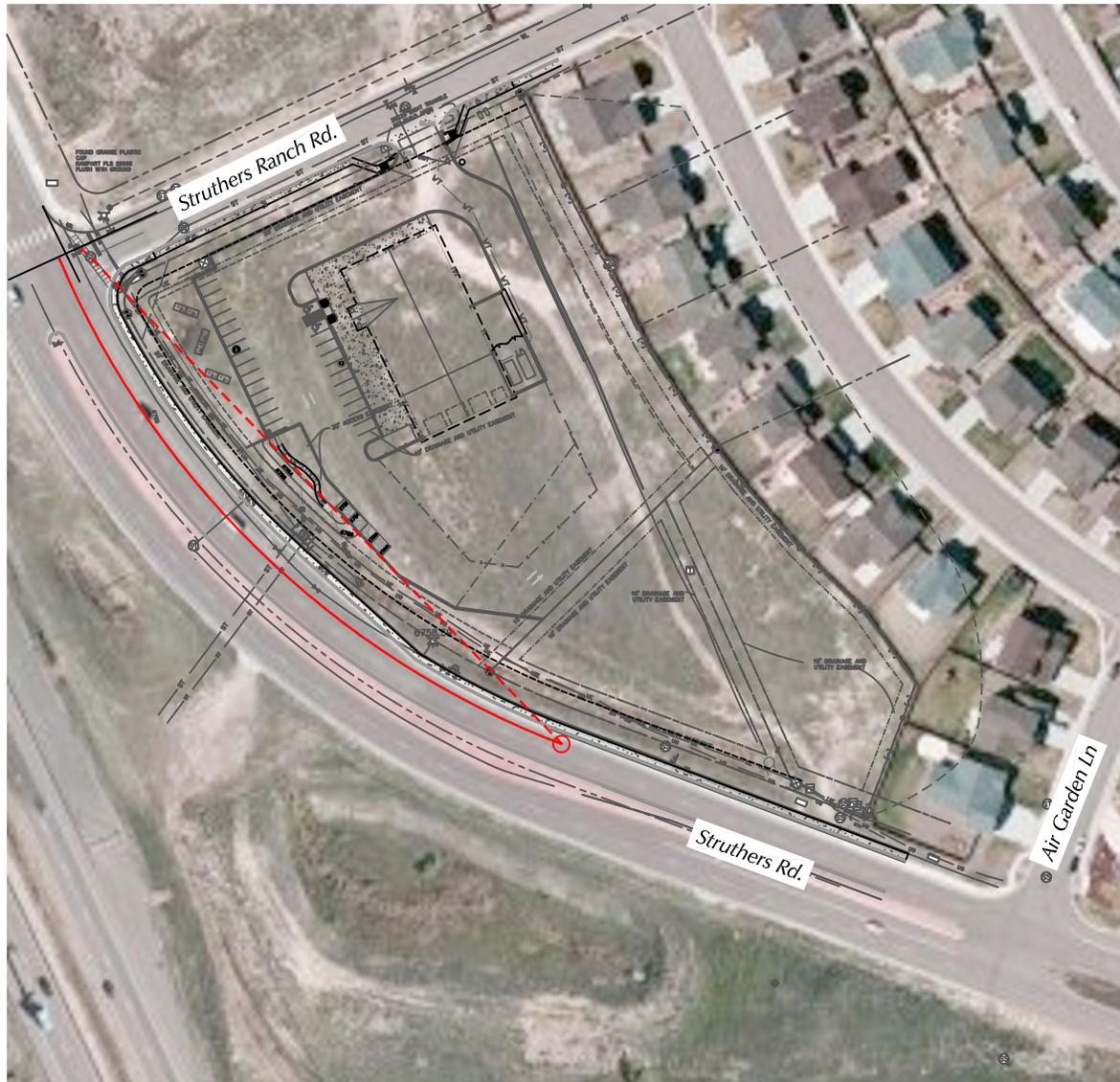
$\frac{XX}{XX}$  =  $\frac{\text{AM Percent Directional Distribution}}{\text{PM Percent Directional Distribution}}$



# Sight Distance Exhibits 1 & 2

---





Approximate Scale  
1" = 150'

- = 590' Required Sight Distance
- - - - = Line of Sight for 590' of Intersection Sight Distance

*Exhibit 1*  
**Intersection Sight Distance**  
*(Struthers Ranch Rd to the South)*

Struthers - Polaris RMC (LSC #204111)





  
 Approximate Scale  
 1" = 150'

- = 645' Required Intersection Sight Distance
- - - = Line of Sight for 590' of Intersection Sight Distance
- = 450' Field-Measured Sight Distance
- - - = Line of sight for existing field measured sight distance

Exhibit 2  
*Intersection Sight Distance*  
*(Struthers Ranch Rd to the North)*

Struthers - Polaris RMC (LSC #204111)

# Traffic Counts

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# LSC Transportation Consultants, Inc.

2504 E. Pikes Peak Ave, Suite 304  
 Colorado Springs, CO 80909  
 719-633-2868

File Name : struthers rd - struthers ranch rd am pm 10-22

Site Code : S204111

Start Date : 11/1/2022

Page No : 1

## Groups Printed- Unshifted

Start Time	Struthers Rd Southbound					Struthers Ranch Rd Westbound					Struthers Rd Northbound					Eastbound					Int. Total	
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total		
06:30	0	10	0	0	10	3	0	1	0	4	0	24	0	0	24	0	0	0	0	0	0	38
06:45	0	14	0	0	14	0	0	0	0	0	0	21	0	0	21	0	0	0	0	0	0	35
Total	0	24	0	0	24	3	0	1	0	4	0	45	0	0	45	0	0	0	0	0	0	73
07:00	0	30	1	0	31	1	0	0	0	1	0	24	0	0	24	0	0	0	0	0	0	56
07:15	0	32	0	0	32	2	0	4	0	6	1	45	0	0	46	0	0	0	0	0	0	84
07:30	0	36	3	0	39	4	0	0	0	4	1	49	0	0	50	0	0	0	0	0	0	93
07:45	0	38	2	0	40	4	0	2	0	6	0	74	0	0	74	0	0	0	0	0	0	120
Total	0	136	6	0	142	11	0	6	0	17	2	192	0	0	194	0	0	0	0	0	0	353
08:00	0	45	0	0	45	1	0	0	0	1	1	44	0	0	45	0	0	0	0	0	0	91
08:15	0	41	2	0	43	4	0	0	0	4	2	62	0	0	64	0	0	0	0	0	0	111
*** BREAK ***																						
Total	0	86	2	0	88	5	0	0	0	5	3	106	0	0	109	0	0	0	0	0	0	202
*** BREAK ***																						
16:00	0	110	6	0	116	4	0	4	0	8	1	63	0	0	64	0	0	0	0	0	0	188
16:15	0	93	3	0	96	2	0	1	0	3	2	86	0	0	88	0	0	0	0	0	0	187
16:30	0	71	3	0	74	3	0	1	0	4	0	59	0	0	59	0	0	0	0	0	0	137
16:45	0	66	1	1	68	2	0	1	0	3	1	89	0	0	90	0	0	0	0	0	0	161
Total	0	340	13	1	354	11	0	7	0	18	4	297	0	0	301	0	0	0	0	0	0	673
17:00	0	82	4	0	86	0	0	1	0	1	3	74	0	0	77	0	0	0	0	0	0	164
17:15	0	72	1	0	73	0	0	0	0	0	0	75	0	0	75	0	0	0	0	0	0	148
17:30	0	98	4	0	102	2	0	2	0	4	5	60	0	0	65	0	0	0	0	0	0	171
17:45	0	89	7	0	96	1	0	0	0	1	1	55	0	0	56	0	0	0	0	0	0	153
Total	0	341	16	0	357	3	0	3	0	6	9	264	0	0	273	0	0	0	0	0	0	636
Grand Total	0	927	37	1	965	33	0	17	0	50	18	904	0	0	922	0	0	0	0	0	0	1937
Apprch %	0	96.1	3.8	0.1		66	0	34	0		2	98	0	0		0	0	0	0	0	0	
Total %	0	47.9	1.9	0.1	49.8	1.7	0	0.9	0	2.6	0.9	46.7	0	0	47.6	0	0	0	0	0	0	

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2504 E. Pikes Peak Ave, Suite 304  
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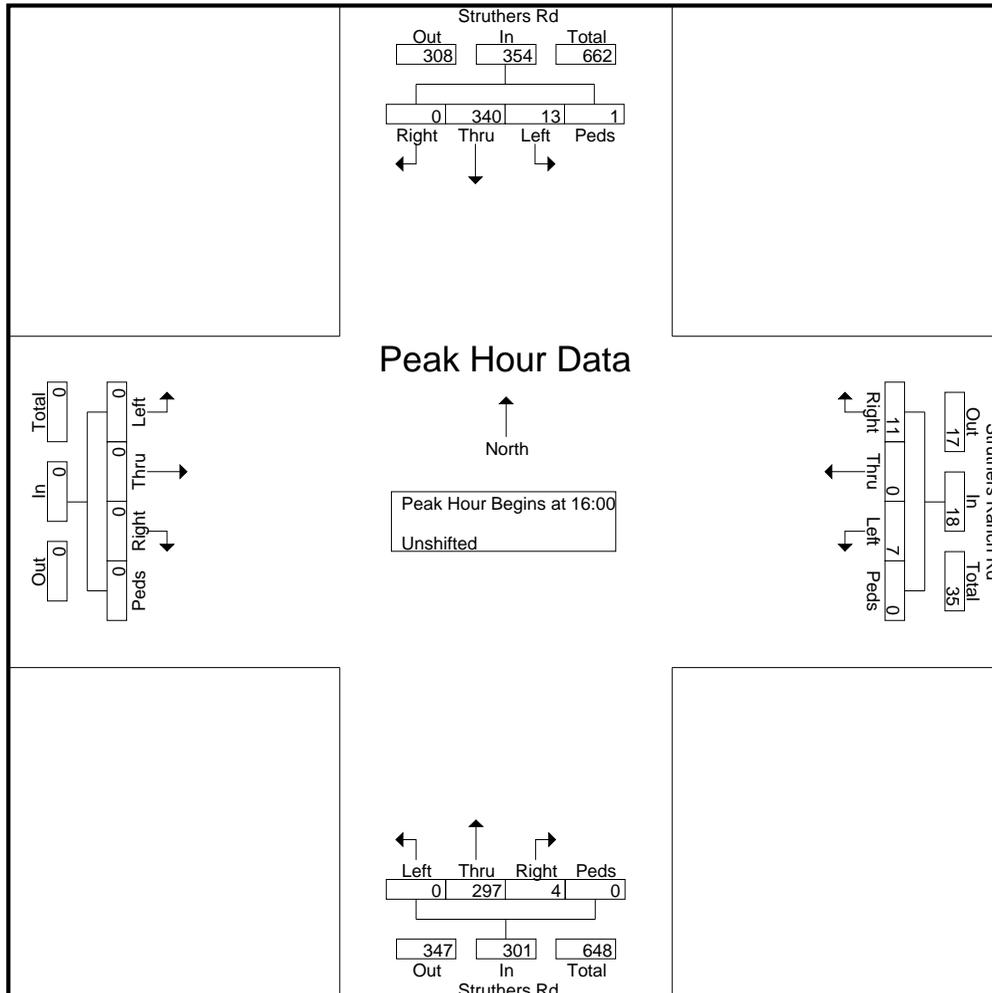
File Name : struthers rd - struthers ranch rd am pm 10-22

Site Code : S204111

Start Date : 11/1/2022

Page No : 2

Start Time	Struthers Rd Southbound					Struthers Ranch Rd Westbound					Struthers Rd Northbound					Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
Peak Hour Analysis From 6:30:00 AM to 5:45:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 4:00:00 PM																					
4:00:00 PM	0	110	6	0	116	4	0	4	0	8	1	63	0	0	64	0	0	0	0	0	188
4:15:00 PM	0	93	3	0	96	2	0	1	0	3	2	86	0	0	88	0	0	0	0	0	187
4:30:00 PM	0	71	3	0	74	3	0	1	0	4	0	59	0	0	59	0	0	0	0	0	137
4:45:00 PM	0	66	1	1	68	2	0	1	0	3	1	89	0	0	90	0	0	0	0	0	161
Total Volume	0	340	13	1	354	11	0	7	0	18	4	297	0	0	301	0	0	0	0	0	673
% App. Total	0	96	3.7	0.3		61.1	0	38.9	0		1.3	98.7	0	0		0	0	0	0		
PHF	.000	.773	.542	.250	.763	.688	.000	.438	.000	.563	.500	.834	.000	.000	.836	.000	.000	.000	.000	.000	.895



# Levels of Service

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Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	6	13	229	4	7	160
Future Vol, veh/h	6	13	229	4	7	160
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	17	263	5	8	184

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	371	132	0	0	268	0
Stage 1	263	-	-	-	-	-
Stage 2	108	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	603	893	-	-	1293	-
Stage 1	757	-	-	-	-	-
Stage 2	904	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	599	893	-	-	1293	-
Mov Cap-2 Maneuver	599	-	-	-	-	-
Stage 1	757	-	-	-	-	-
Stage 2	899	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.8	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	773	1293
HCM Lane V/C Ratio	-	-	0.032	0.006
HCM Control Delay (s)	-	-	9.8	7.8
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection						
Int Delay, s/veh	0.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	7	11	297	4	13	340
Future Vol, veh/h	7	11	297	4	13	340
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	14	323	4	14	370

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	536	162	0	0	327	0
Stage 1	323	-	-	-	-	-
Stage 2	213	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	475	854	-	-	1229	-
Stage 1	706	-	-	-	-	-
Stage 2	802	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	470	854	-	-	1229	-
Mov Cap-2 Maneuver	470	-	-	-	-	-
Stage 1	706	-	-	-	-	-
Stage 2	793	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	648	1229
HCM Lane V/C Ratio	-	-	0.036	0.011
HCM Control Delay (s)	-	-	10.8	8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection						
Int Delay, s/veh	1.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	11	16	1	19	6	1
Future Vol, veh/h	11	16	1	19	6	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	21	1	24	8	1

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	35	0	51
Stage 1	-	-	-	-	25
Stage 2	-	-	-	-	26
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1576	-	958
Stage 1	-	-	-	-	998
Stage 2	-	-	-	-	997
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1576	-	957
Mov Cap-2 Maneuver	-	-	-	-	957
Stage 1	-	-	-	-	998
Stage 2	-	-	-	-	996

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	969	-	-	1576	-
HCM Lane V/C Ratio	0.009	-	-	0.001	-
HCM Control Delay (s)	8.8	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	10	15	229	14	14	160
Future Vol, veh/h	10	15	229	14	14	160
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	19	249	15	15	174

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	366	125	0	0	264
Stage 1	249	-	-	-	-
Stage 2	117	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22
Pot Cap-1 Maneuver	607	902	-	-	1297
Stage 1	769	-	-	-	-
Stage 2	895	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	600	902	-	-	1297
Mov Cap-2 Maneuver	600	-	-	-	-
Stage 1	769	-	-	-	-
Stage 2	884	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	751	1297
HCM Lane V/C Ratio	-	-	0.043	0.012
HCM Control Delay (s)	-	-	10	7.8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Intersection						
Int Delay, s/veh	2.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	17	12	1	18	17	1
Future Vol, veh/h	17	12	1	18	17	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	15	1	23	22	1

Major/Minor	Major1	Major2	Minor1	Minor2	Minor3
Conflicting Flow All	0	0	37	0	55
Stage 1	-	-	-	-	30
Stage 2	-	-	-	-	25
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1574	-	953
Stage 1	-	-	-	-	993
Stage 2	-	-	-	-	998
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1574	-	952
Mov Cap-2 Maneuver	-	-	-	-	952
Stage 1	-	-	-	-	993
Stage 2	-	-	-	-	997

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	8.9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	957	-	-	1574	-
HCM Lane V/C Ratio	0.024	-	-	0.001	-
HCM Control Delay (s)	8.9	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	17	18	297	11	18	340
Future Vol, veh/h	17	18	297	11	18	340
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	23	323	12	20	370

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	548	162	0	0	335	0
Stage 1	323	-	-	-	-	-
Stage 2	225	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	466	854	-	-	1221	-
Stage 1	706	-	-	-	-	-
Stage 2	791	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	459	854	-	-	1221	-
Mov Cap-2 Maneuver	459	-	-	-	-	-
Stage 1	706	-	-	-	-	-
Stage 2	778	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.5	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	602	1221
HCM Lane V/C Ratio	-	-	0.075	0.016
HCM Control Delay (s)	-	-	11.5	8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.2	0

Intersection						
Int Delay, s/veh	2.9					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	13	8	28	1	1	8
Future Vol, veh/h	13	8	28	1	1	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	10	36	1	1	10

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	37	0	-	0	81 37
Stage 1	-	-	-	-	37 -
Stage 2	-	-	-	-	44 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1574	-	-	-	921 1035
Stage 1	-	-	-	-	985 -
Stage 2	-	-	-	-	978 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1574	-	-	-	911 1035
Mov Cap-2 Maneuver	-	-	-	-	911 -
Stage 1	-	-	-	-	974 -
Stage 2	-	-	-	-	978 -

Approach	EB	WB	SB
HCM Control Delay, s	4.5	0	8.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1574	-	-	-	1020
HCM Lane V/C Ratio	0.011	-	-	-	0.011
HCM Control Delay (s)	7.3	0	-	-	8.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	11	18	390	11	14	350
Future Vol, veh/h	11	18	390	11	14	350
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	23	424	12	15	380

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	644	212	0	0	436
Stage 1	424	-	-	-	-
Stage 2	220	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22
Pot Cap-1 Maneuver	405	793	-	-	1120
Stage 1	628	-	-	-	-
Stage 2	795	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	400	793	-	-	1120
Mov Cap-2 Maneuver	400	-	-	-	-
Stage 1	628	-	-	-	-
Stage 2	785	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	578	1120
HCM Lane V/C Ratio	-	-	0.064	0.014
HCM Control Delay (s)	-	-	11.7	8.3
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.2	0

Intersection						
Int Delay, s/veh	2.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	10	34	18	1	1	11
Future Vol, veh/h	10	34	18	1	1	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	44	23	1	1	14

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	24	0	-	0	94
Stage 1	-	-	-	-	24
Stage 2	-	-	-	-	70
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1591	-	-	-	906
Stage 1	-	-	-	-	999
Stage 2	-	-	-	-	953
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1591	-	-	-	899
Mov Cap-2 Maneuver	-	-	-	-	899
Stage 1	-	-	-	-	991
Stage 2	-	-	-	-	953

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	8.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1591	-	-	-	1037
HCM Lane V/C Ratio	0.008	-	-	-	0.015
HCM Control Delay (s)	7.3	0	-	-	8.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	14	15	560	9	18	605
Future Vol, veh/h	14	15	560	9	18	605
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	19	602	10	19	651

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	966	301	0	0	612	0
Stage 1	602	-	-	-	-	-
Stage 2	364	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	252	695	-	-	963	-
Stage 1	510	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	247	695	-	-	963	-
Mov Cap-2 Maneuver	247	-	-	-	-	-
Stage 1	510	-	-	-	-	-
Stage 2	660	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.8	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	371	963
HCM Lane V/C Ratio	-	-	0.1	0.02
HCM Control Delay (s)	-	-	15.8	8.8
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1

Intersection												
Int Delay, s/veh	3.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	13	8	15	1	28	1	10	1	8	1	1	1
Future Vol, veh/h	13	8	15	1	28	1	10	1	8	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	10	19	1	36	1	13	1	10	1	1	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	37	0	0	29	0	0	94	93	20	98	102	37
Stage 1	-	-	-	-	-	-	54	54	-	39	39	-
Stage 2	-	-	-	-	-	-	40	39	-	59	63	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1574	-	-	1584	-	-	889	797	1058	884	788	1035
Stage 1	-	-	-	-	-	-	958	850	-	976	862	-
Stage 2	-	-	-	-	-	-	975	862	-	953	842	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1574	-	-	1584	-	-	878	787	1058	866	779	1035
Mov Cap-2 Maneuver	-	-	-	-	-	-	878	787	-	866	779	-
Stage 1	-	-	-	-	-	-	947	841	-	965	861	-
Stage 2	-	-	-	-	-	-	971	861	-	932	833	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	2.6			0.2			8.9			9.1		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	940	1574	-	-	1584	-	-	881
HCM Lane V/C Ratio	0.026	0.011	-	-	0.001	-	-	0.004
HCM Control Delay (s)	8.9	7.3	0	-	7.3	0	-	9.1
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	16	21	390	17	23	350
Future Vol, veh/h	16	21	390	17	23	350
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	27	424	18	25	380

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	664	212	0	0	442	0
Stage 1	424	-	-	-	-	-
Stage 2	240	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	394	793	-	-	1114	-
Stage 1	628	-	-	-	-	-
Stage 2	777	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	385	793	-	-	1114	-
Mov Cap-2 Maneuver	385	-	-	-	-	-
Stage 1	628	-	-	-	-	-
Stage 2	760	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.2	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	544	1114
HCM Lane V/C Ratio	-	-	0.087	0.022
HCM Control Delay (s)	-	-	12.2	8.3
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1

Intersection												
Int Delay, s/veh	3.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	34	35	1	18	1	35	1	1	1	1	11
Future Vol, veh/h	10	34	35	1	18	1	35	1	1	1	1	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	41	42	1	23	1	45	1	1	1	1	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	24	0	0	83	0	0	119	112	62	113	133	24
Stage 1	-	-	-	-	-	-	86	86	-	26	26	-
Stage 2	-	-	-	-	-	-	33	26	-	87	107	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1591	-	-	1514	-	-	857	778	1003	864	758	1052
Stage 1	-	-	-	-	-	-	922	824	-	992	874	-
Stage 2	-	-	-	-	-	-	983	874	-	921	807	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1591	-	-	1514	-	-	839	771	1003	856	751	1052
Mov Cap-2 Maneuver	-	-	-	-	-	-	839	771	-	856	751	-
Stage 1	-	-	-	-	-	-	915	817	-	984	873	-
Stage 2	-	-	-	-	-	-	967	873	-	911	801	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.9			0.4			9.5			8.7		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	841	1591	-	-	1514	-	-	1003
HCM Lane V/C Ratio	0.056	0.008	-	-	0.001	-	-	0.017
HCM Control Delay (s)	9.5	7.3	0	-	7.4	0	-	8.7
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑	↑	↑	↑↑
Traffic Vol, veh/h	26	38	560	27	36	605
Future Vol, veh/h	26	38	560	27	36	605
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	49	602	29	39	651

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1006	301	0	0	631
Stage 1	602	-	-	-	-
Stage 2	404	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22
Pot Cap-1 Maneuver	238	695	-	-	947
Stage 1	510	-	-	-	-
Stage 2	643	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	228	695	-	-	947
Mov Cap-2 Maneuver	228	-	-	-	-
Stage 1	510	-	-	-	-
Stage 2	617	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.1	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	379	947
HCM Lane V/C Ratio	-	-	0.216	0.041
HCM Control Delay (s)	-	-	17.1	9
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	0.8	0.1

Intersection												
Int Delay, s/veh	3.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	13	8	32	1	28	1	16	1	1	1	1	8
Future Vol, veh/h	13	8	32	1	28	1	16	1	1	1	1	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	10	39	1	36	1	21	1	1	1	1	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	37	0	0	49	0	0	106	101	30	102	120	37
Stage 1	-	-	-	-	-	-	62	62	-	39	39	-
Stage 2	-	-	-	-	-	-	44	39	-	63	81	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1574	-	-	1558	-	-	873	789	1044	879	770	1035
Stage 1	-	-	-	-	-	-	949	843	-	976	862	-
Stage 2	-	-	-	-	-	-	970	862	-	948	828	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1574	-	-	1558	-	-	856	780	1044	869	762	1035
Mov Cap-2 Maneuver	-	-	-	-	-	-	856	780	-	869	762	-
Stage 1	-	-	-	-	-	-	940	835	-	966	861	-
Stage 2	-	-	-	-	-	-	958	861	-	936	820	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.8			0.2			9.3			8.7		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	860	1574	-	-	1558	-	-	981
HCM Lane V/C Ratio	0.027	0.01	-	-	0.001	-	-	0.013
HCM Control Delay (s)	9.3	7.3	0	-	7.3	0	-	8.7
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection						
Int Delay, s/veh	1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↙		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	19	24	390	26	29	350
Future Vol, veh/h	19	24	390	26	29	350
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	31	419	28	31	376

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	669	210	0	0	447	0
Stage 1	419	-	-	-	-	-
Stage 2	250	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	391	796	-	-	1110	-
Stage 1	632	-	-	-	-	-
Stage 2	768	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	380	796	-	-	1110	-
Mov Cap-2 Maneuver	380	-	-	-	-	-
Stage 1	632	-	-	-	-	-
Stage 2	746	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.5	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	536	1110
HCM Lane V/C Ratio	-	-	0.103	0.028
HCM Control Delay (s)	-	-	12.5	8.3
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1

Intersection												
Int Delay, s/veh	4.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	34	47	1	18	1	53	1	1	1	1	11
Future Vol, veh/h	10	34	47	1	18	1	53	1	1	1	1	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	41	57	1	23	1	68	1	1	1	1	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	24	0	0	98	0	0	127	120	70	121	148	24
Stage 1	-	-	-	-	-	-	94	94	-	26	26	-
Stage 2	-	-	-	-	-	-	33	26	-	95	122	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1591	-	-	1495	-	-	846	770	993	854	743	1052
Stage 1	-	-	-	-	-	-	913	817	-	992	874	-
Stage 2	-	-	-	-	-	-	983	874	-	912	795	-
Platoon blocked, %		-	-	-	-	-						
Mov Cap-1 Maneuver	1591	-	-	1495	-	-	828	763	993	846	736	1052
Mov Cap-2 Maneuver	-	-	-	-	-	-	828	763	-	846	736	-
Stage 1	-	-	-	-	-	-	906	810	-	984	873	-
Stage 2	-	-	-	-	-	-	967	873	-	902	789	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.8			0.4			9.7			8.7		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	829	1591	-	-	1495	-	-	1000
HCM Lane V/C Ratio	0.085	0.008	-	-	0.001	-	-	0.017
HCM Control Delay (s)	9.7	7.3	0	-	7.4	0	-	8.7
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.1

Intersection						
Int Delay, s/veh	1.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↗		↑↑	↗	↘	↑↑
Traffic Vol, veh/h	36	45	560	34	40	605
Future Vol, veh/h	36	45	560	34	40	605
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	260	340	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	78	78	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	46	58	602	37	43	651

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1014	301	0	0	639
Stage 1	602	-	-	-	-
Stage 2	412	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22
Pot Cap-1 Maneuver	235	695	-	-	941
Stage 1	510	-	-	-	-
Stage 2	637	-	-	-	-
Platoon blocked, %					
Mov Cap-1 Maneuver	224	695	-	-	941
Mov Cap-2 Maneuver	224	-	-	-	-
Stage 1	510	-	-	-	-
Stage 2	608	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.1	0	0.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	359	941
HCM Lane V/C Ratio	-	-	0.289	0.046
HCM Control Delay (s)	-	-	19.1	9
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	1.2	0.1

# Appendix A

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## Appendix A - Intersection Sight Distance Calculations

Intersection sight distance contained in Table 2-21 in section 2.3.6.G of the *Engineering Criteria Manual (ECM)* reads:

***“Intersection sight distance.*** *This section applies to intersections where one public road meets a second public road. The intersection sight distance provides for vehicles to enter traffic and accelerate to the average running speed. Intersection sight distances shall be measured as shown on Figure 2-23. The intersection sight distance shall be as shown in Table 2-21.”*

Table 2.21 shows Intersection sight distance of 555’ for design speed of 50 mph. However, Table 2.21 contains a footnote No. 3 which reads: *“<sup>3</sup>These values only apply to two-lane roads with stop control, all other situations require special design considerations.”*

As the 555’ in the *ECM* for 50 mph along an intersecting two-lane roadway is based on the criteria in *“A Policy on Geometric Design of Highways and Streets” (The Green Book)* 2018, 7th Edition, published by the American Association of State Highway & Transportation Officials (AASHTO), LSC has utilized this same criteria for this “other situation” requiring special design consideration.

Note: Section 1.5 of the *ECM* Standards Adopted by Reference: American Association of State Highway & Transportation Officials (AASHTO) including Roadway Design Guide and Bicycle Design.

Section 9.5 of The Green Book contains **Intersection Sight Distance and Section 9.5.3.2.1 Case B1-Left Turn from the Minor Road (p 9.43)** applies.

Intersection sight distance is calculated using the formula  $d = 1.47 * V_m * t_c$ , where  $V_m$  is the design speed in miles per hour and  $t_c$  is the gap for drivers entering the major roadway (in seconds).

Table 9-6 identifies a time gap of 7.5 sec. for a two-lane highway (same as the case in the *ECM* table 2-21).

However, as Struthers Road has two through lanes in each direction plus a center median of about 18 feet, the time gap has been adjusted based on the following note in Table 9-6:

*For multilane roadways or medians—For left turns onto two-way roadways with more than two lanes, including turn lanes, add 0.5 s for passenger cars or 0.7 s for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle. Median widths should be converted to an equivalent number of lanes in applying the 0.5 and 0.7 s criteria presented above; for example, an 18-ft [5.5-m] median is equivalent to one and a half lanes, and would require an additional 0.75 s for a passenger to cross and an additional 1.05 s for a truck to cross.*

Also, on page 9-44,

*In applying Table 9-6, it can usually be assumed that the minor-road vehicle is a passenger car. However, where substantial volumes of heavy vehicles enter the major road, such as from a ramp terminal, the use of tabulated values for single-unit or combination trucks should be considered.*

This intersection sight-distance analysis for passenger vehicles will be sufficient:

- Given the example in AASHTO of a situation with “substantial volumes” of heavy vehicles, Struthers Ranch Road and the proposed non-residential uses would not generate the level of truck traffic such that a vehicle other than a passenger car should be assumed when applying Table 9-6.
- Table 2-21 does not call out the need for specific analysis of Single and Multi-unit trucks at intersections. AASHTO used as the *ECM* does not provide sufficient detail for sight distance along a four-lane road.
- Truck drivers on the side street will have a higher drivers eye (about 7.5 feet above the roadway) and except in unusual circumstances, truck drivers will be able to see to the north or to the south across the site parking area to the oncoming traffic in the northbound lanes.
- Not even considering the bullet above, trucks on the side street and turning from the side street are much larger and easier to spot than passenger vehicles. There is sufficient stopping sight distance for drivers along the roadway to slow or stop for the infrequent truck entering the roadway.

### **Sight Distance to the south**

Based on Figure 9-17 on page 9-38, the departure sight triangle to the left at Struthers Ranch Road requires an increase in the “base” time gap of an additional 0.5 seconds as there is one additional lane in excess of one to be crossed in the northbound direction by the left-turning vehicle. Thus, the time gap is adjusted to 8.0 seconds for the sight distance calculation looking left.

Using the formula above, **the calculated intersection sight distance is 590 feet to the left.**

### **Sight Distance to the north**

Looking north, the sight distance needs to cover the northbound lanes plus the width of the median. Based on Figure 9-17 on page 9-38, the departure sight triangle to the right at Struthers Ranch Road requires an increase in the “base” time gap of an additional 1.25 seconds to account for:

- 0.5 seconds for **one** additional lane in excess of one to be crossed in the northbound direction by the left-turning vehicle plus
- 0.75 seconds for the width of the median (1.5 lanes equivalent)

Thus, the time gap is adjusted to 1.25 seconds for the sight distance calculation looking right ( $0.5 \text{ sec} + (1.5 * 0.5 \text{ sec})$ ). The acceptable gap time has been increased from the typical 7.5 seconds for a passenger vehicle on a two-lane road to 8.75 seconds to account for multiple lanes and the median.

Using the formula above, **the calculated intersection sight distance is 640 feet to the right.**

**Regarding the decision point (“driver’s eye” location), the following is AASHTO guidance:** *“The vertex (decision point) of the departure sight triangle on the minor road should be 14.5 ft [4.4 m] from the edge of the major-road traveled way. This represents the typical position of the minor-road driver’s eye when a vehicle is stopped relatively close to the major road.” (p. 9-43)*