



## Traffic Signal Warrant Analysis

*for*  
***Carmen Avila Road***  
*at*  
***Mile 22.5 North Road***  
*in Hidalgo County, Texas*

Conducted for

**Precinct 4**  
**Hidalgo County**



11/21/2019

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***Ergonomic Transportation Solutions, Inc.***  
TEXAS REGISTERED ENGINEERING FIRM NO. F - 000625

November 2019

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## 1.0 INTRODUCTION

The intersection of Mile 22.5 North Road and Carmen Avila Road is located in Precinct 4, Hidalgo County, Texas. Mile 22.5 North Road is two-lane local collector roadway aligned in a general east-west direction across Hidalgo County. Carmen Avila Road is also a local roadway traveling in a general north-south direction with one lane in each direction and a continuous left turn lane. The west leg of Mile 22.5 North Road is actually a driveway that leads into the parking lot of Harwell Middle School. The east leg of Mile 22.5 was recently constructed to connect Carmen Avila Road to Cibolo Drive.

The Hidalgo County MPO Thoroughfare Map shows Carmen Avila Road as a New Facility Principal Arterial with 120' ROW and Mile 22.5 North Road as an Expansion Collector with 80' ROW.

L&G Engineering, as a representative of Hidalgo County, Precinct 4, has contracted Ergonomic Transportation Solutions, Inc. (ETSI) to perform a traffic signal warrant study at the intersection of Mile 22.5 North Road and Carmen Avila Road. This study will evaluate the traffic demand at the intersection of Mile 22.5 North Road and Carmen Avila Road, based on current traffic conditions. The purpose of this study is to determine if there will be substantial current traffic demand is sufficient to warrant the installation of a traffic signal at the subject intersection.

**Exhibit 1.1** shows the general location of the study area.

### 1.1 SCOPE

The following tasks are covered in this study:

- Collect traffic volume counts at the study intersections for 12 hours during a typical weekday.
- Collect speed data along the study segment by car following method.
- Conduct site investigations and record pertinent traffic data by visual inspection.
- Take photographs for each intersection approach.
- Identify posted speed limits.
- Identify presence of roadway illumination.
- Record existing intersection control, if any.
- Assess the existing geometry at the study intersection (where it exists) in order to ensure proper sight distance requirements.
- Record visible utilities, including power lines.
- Record existing development in the vicinity of the intersection.
- Record major traffic generators in the area.
- Record other features that might impact installation of a traffic signal control.
- Observe existing traffic patterns.
- Include future roadway expansions and proposed geometric changes in analysis
- Conduct traffic signal warrant analysis in accordance with the guidelines presented in the Texas Manual of Uniform Traffic Control Devices (TMUTCD), 2011 edition.
- Provide recommendations for type of intersection controls and approximate construction costs.

## **1.2 DATA SOURCES**

The analysis contained in this report follows methodologies and guidelines described in the following publications:

- *Texas Manual on Uniform Traffic Control Devices (TMUTCD), 2011 Edition*

- *Traffic Signals Manual, revised April 2011, published by Texas Department of Transportation (TxDOT)*
- *A policy on Geometric Design of Highways and Streets, 2011 edition, published by AASHTO.*

This study is also based on field data collected by ETSI and information provided by L&G Engineering.

## 2.0 ROADWAY AND INTERSECTION CONDITIONS

### 2.1 EXISTING CONDITIONS

**Mile 22.5 North Road** is considered the minor street for study purposes. Mile 22.5 North Road is a newly constructed roadway with two lanes (one in each direction) with no shoulders and side ditches. There are no speed limit signs on Mile 22.5 North Road. Overhead power lines run parallel to Mile 22.5 North Road on its north side. Street lights mounted on power poles illuminate the intersection at Carmen Avila Road. The asphalt pavement of Mile 22.5 North Road is in new condition. Currently, it appears that some type retail development is under construction on the northeast corner of the intersection. There are no pavement markings at the intersection. There are existing stop signs facing eastbound and westbound traffic on Mile 22.5 North Road that control the intersection.

**Carmen Avila Road** is considered the major street with 1 lane in each direction, plus a continuous left turn lane, aligned in a general north-south direction. There is a 20 mile per hour school zone speed limit on Carmen Avila Road. Overhead power lines run along its east side. The asphalt pavement and pavement markings on Carmen Avila Road are in good condition.

Carmen Avila Road intersects Mile 22.5 North Road at 90 degrees to form a standard four-legged intersection. No sight distance issues were identified at this intersection. Carmen Avila Road dead ends about 2,000 feet north of Mile 22.5 North Road.

The major traffic generators in the project area are:

- Harwell Middle School - Located directly west of the subject intersection
- Carmen Avila Elementary School - Located 550' south of the subject intersection.

There are no developments north of the intersection.

**Exhibit 2.1** shows the existing conditions at this intersection.

## **3.0 TRAFFIC DATA**

### **3.1 EXISTING TRAFFIC DATA**

Traffic volume counts were collected for 13 continuous hours (6:00 a.m. to 7:00 p.m.) on a typical weekday (Thursday, October 8, 2019) using video cameras to record all approaches and departures at the intersection of Mile 22.5 North Road and Carmen Avila Road.

A review of the traffic counts indicate that the predominant traffic movements at the intersection are northbound Carmen Avila Road to eastbound Mile 22.5 North Road; and westbound Mile 22.5 North Road to southbound Carmen Avila Road. As is expected, not much traffic is generated from the north leg, since Carmen Avila Road dead ends north of the intersection. However, the north leg of Carmen Avila Road is used by parent pick-up drop-off traffic. Very few pedestrians (33) were observed crossing the intersection during the 13 hour traffic counting period.

Similarly, not too much traffic is generated from the west leg (school driveway), except during peak school hours. This driveway is used primarily by school buses.

Details of the 13-hour traffic counts are provided in the **Appendix**.

### **3.2 ACCIDENT DATA**

Accident data for the Carmen Avila Road and Mile 22.5 North Road intersection were collected from TxDOT's Crash Records Information System. Only one accident was reported in the past 4 years.

## **4.0 TRAFFIC SIGNAL WARRANT ANALYSES**

The warrant analysis was conducted in accordance with the methodology presented in the 2011 Texas MUTCD. The TMUTCD provides nine (9) warrants to be evaluated before a new traffic signal is considered for installation. The TMUTCD states in Section 4C.01 that " the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic signal" and recommends that engineering judgment be used in the evaluation of the warrants to ensure that a traffic signal will improve the overall safety and / or operation of the intersection.

Warrant forms showing the warrant requirements in detail are included in the **Appendix**.

Based on the available data and existing conditions, only seven out of nine warrants were applicable to this study:

- Warrant 1: Eight-hour Vehicular Volume
- Warrant 2: Four-Hour Vehicular Volume
- Warrant 3: Peak Hour Vehicular Volume
- Warrant 4: Pedestrian Volume
- Warrant 5: School Crossing
- Warrant 7. Crash Experience
- Warrant 8: Roadway Network

#### 4.1 WARRANT ANALYSIS RESULTS

Carmen Avila Road is considered to be the major street for study purposes, with one lane in each direction. Mile 22.5 North Road is considered to be the minor street, also with one lane in each direction.

A summary of the warrants tested and the analysis results are shown in **Table 4.1**.

Signal Warrant	Analysis Results
1. Eight-Hour Vehicular Volume	<i>Not Satisfied</i>
2. Four Hour Vehicular Volume	<i>Not Satisfied</i>
3. Peak Hour Vehicular Volume	<i>Not Satisfied</i>
4. Pedestrian Volume	<i>Not Satisfied</i>
5. School Crossing	<i>Not Satisfied</i>
6. Coordinated Signal System	<i>Not Applicable</i>
7. Crash Experience	<i>Not Satisfied</i>
8. Roadway Network	<i>Not Satisfied</i>
9. Intersection Near a Grade Crossing	<i>Not Applicable</i>

**Table 4.1:** *Warrant Analysis Summary – Carmen Avila Road at Mile 22.5 North Road*

Considering the above analysis results, it is concluded that none of the warrants are satisfied.

## 5.0 CONCLUSIONS & RECOMMENDATIONS

Based on the signal warrant analyses results none of the warrants are satisfied at the intersection of Mile 22.5 North Road and Carmen Avila Road. Accordingly, traffic signal control is not recommended at this intersection.

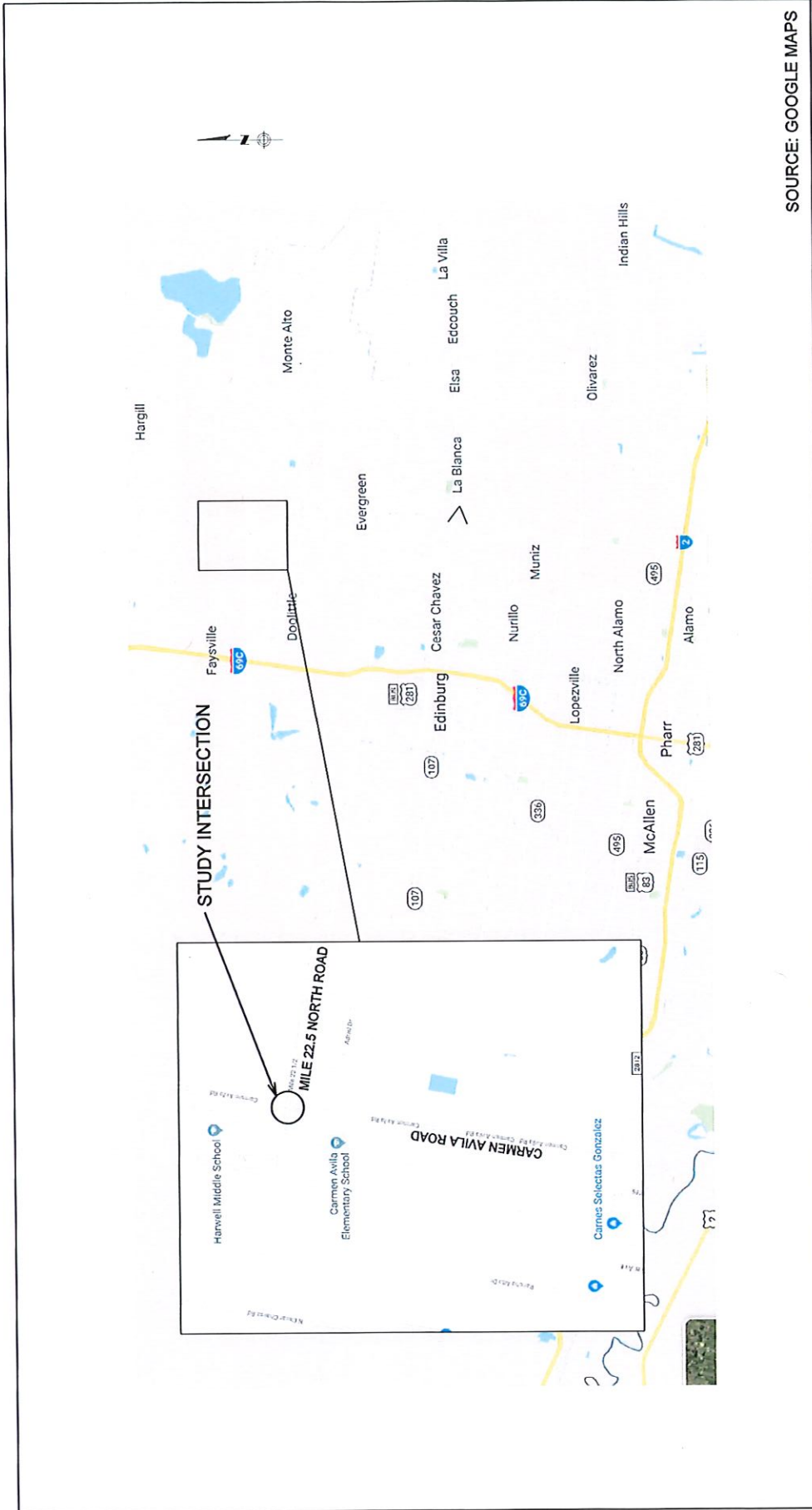
Considering the adjacent school traffic and the predominant traffic movements NB-EB and WB-SB, it is recommended that a four-way stop control be installed at this intersection, although traffic volumes are not high enough to warrant such control. The recommended four way stop control would not create additional delays to the predominant movements, but would enhance safety and provide gaps to school buses, while entering/exiting the west side driveway during peak school periods. Stop ahead signs (W3-1) should be placed ahead of the intersection on all approaches.

Further, it is recommended that an all red flashing beacon be installed at this intersection along with safety lighting and stop bars, crosswalks and curb ramps on all approaches. Left turn bays should be striped in the northbound and southbound directions, where the continuous left turn lane currently is. A centerline should also be striped on Mile 22.5 North Road.

To enhance pedestrian safety, sidewalks are recommended on both sides on Carmen Avila Road and Mile 22.5 North Road. The sidewalks need to be constructed at the time local developments take place. The sidewalk improvements will require extension of the culverts across the intersection and possibly some additional pavement. Additional engineering analysis should be conducted to determine costs for the sidewalk and related improvements. The installation of the 4way stop control and flashing beacon are estimated to cost approximately \$40,000.

**Exhibit 5.1** shows the recommended improvements in conceptual form.

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SOURCE: GOOGLE MAPS

<p>EXHIBIT 1.1</p>	<p>STUDY AREA</p>	
<p>CARMEN AVILA ROAD AT MILE 22.5 NORTH ROAD</p>		<p>NOT TO SCALE</p>
<p><b>ETSI</b>          Ergonomic Transportation Solutions, Inc.          TEXAS REGISTERED ENGINEERING FIRM NO. F - 000625</p> <p>5300 Hollister Road, Suite 220          Houston, Texas 77040          Tel. (713) 956-9601 Fax (713) 956-9667</p>		



EXHIBIT 2.1

EXISTING CONDITIONS  
CARMEN AVILA ROAD AT MILE 22.5 NORTH ROAD

NOT TO SCALE



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**ETSI**  
*Ergonomic Transportation Solutions, Inc.*  
TEXAS REGISTERED ENGINEERING FIRM F-625

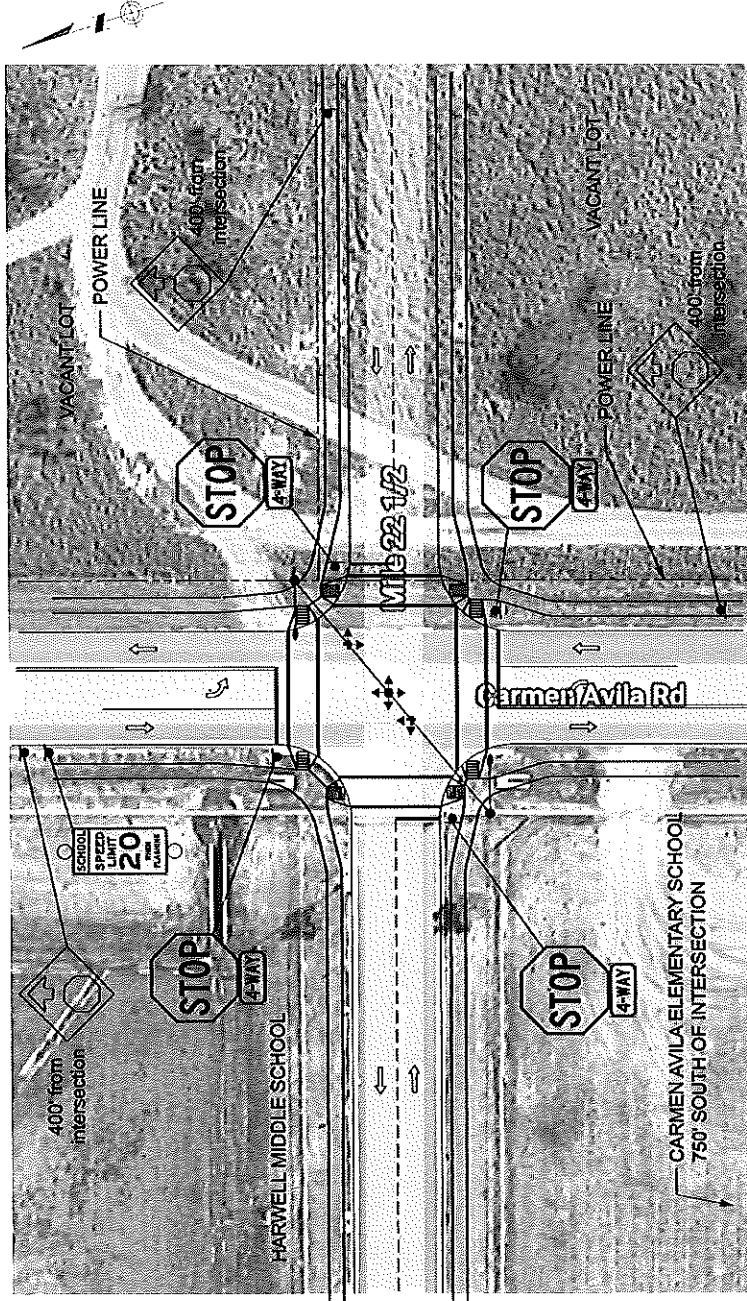


EXHIBIT 5.1

RECOMMENDED IMPROVEMENTS  
 CARMEN AVILA ROAD AT MILE 22.5 NORTH ROAD

NOT TO SCALE

**ETSI**  
 Ergonomic Transportation Solutions, Inc.  
 TEXAS REGISTERED ENGINEERING FIRM F-525

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 Houston, Texas 77092  
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**APPENDIX A**  
**Warrant Analyses Forms**

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# Traffic Survey — Count Analysis

## 2011 TMUTCD Warrants

County: Hidalgo, Precinct 4 District: Pharr

City: Unincorporated Population: Less than 10,000 Survey Date: October 8, 2019

	Route #	Name	Control	Section	Speed Limit
Major		Carmen Avila Road	N/A	N/A	20 MPH (SCHOOL ZONE)
Minor	N/A	Mile 22.5 North Road	N/A	N/A	

**Eight Highest Hours:** Include the same 8 hours for the Major and Minor St. volumes.

Time Ends	Major St. — Both App.		Minor St.— Hi. Vol. App.		Comments:
	Veh. Total	Ped. Total	Veh. Total	Ped. Total	
7:00 AM	611	2	106	0	Major Street - 8th Highest Hour – 50  Minor Street - 8th Highest Hour - 22
8:00 AM	163	0	30	0	
10:00 AM	50	1	35	0	
12:00 PM	76	1	22	0	
3:00 PM	227	10	54	0	
4:00 PM	248	5	92	0	
5:00 PM	183	0	71	0	
6:00 PM	61	9	40	0	

### Warrant 1. Eight Hour Vehicular Volume – Not Satisfied

- Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) or 100%<sup>a</sup> (regardless of speed) of condition A.
- or-*
- Yes  No Meets 70%<sup>c</sup> (and major-street speed exceeds 40 mph or population less than 10,000) or 100%<sup>a</sup> (regardless of speed) of condition B.
- or-*
- Yes  No Meets 80%<sup>b</sup> for Conditions A and B
- or-*
- Yes  No Meets 56%<sup>d</sup> of condition A and B (and major-street speed exceeds 40 mph or population less than 10,000)

### Condition A – Minimum Vehicle Volume

Number of Lanes		Major Street — Both Approaches 8th Highest Hour					Minor Street — High Vol. Appr. 8th Highest Hour				
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		10%	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	
1	1	500	400	350	280	50	150	120	105	84	22
2 or more	1	600	480	420	336		150	120	105	84	
2 or more	2 or more	600	480	420	336			160	140	112	
1	2 or more	500	400	350	280		200	160	140	112	

### Condition B – Interruption of Continuous Traffic

Number of Lanes		Major Street — Both Approaches 8th Highest Hour					Minor Street — High Vol. Appr. 8th Highest Hour				
Major Street	Minor Street	Required				Existing	Required				Existing
		100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>		7%	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	
1	1	750	600	525	420	50	75	60	53	42	22
2 or more	1	900	720	630	504		75	60	53	42	
2 or more	2 or more	900	720	630	504		100	80	70	56	
1	2 or more	750	600	525	420		100	80	70	56	

<sup>a</sup> Basic minimum hourly volume.

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures.

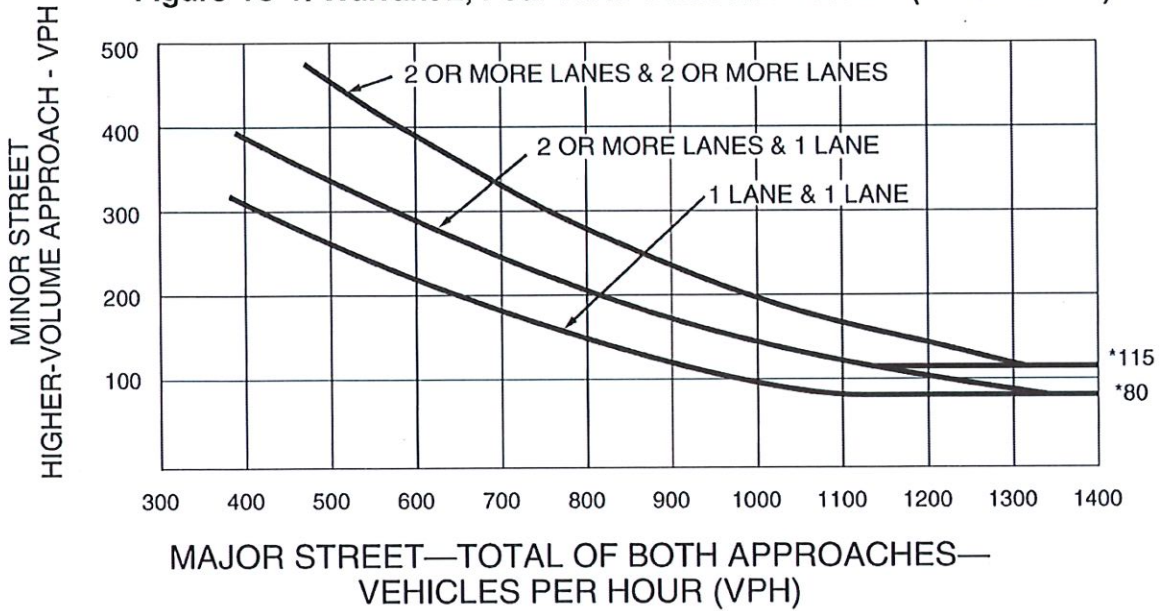
<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in a community with a population of less than 10,000.

<sup>d</sup> May be used for combination of conditions A and B after adequate trial of other remedial measures when major street exceeds 40 mph or in an isolated community with a population of less than 10,000.

**Warrant 2. Four-Hour Vehicular Volumes – Not Satisfied**

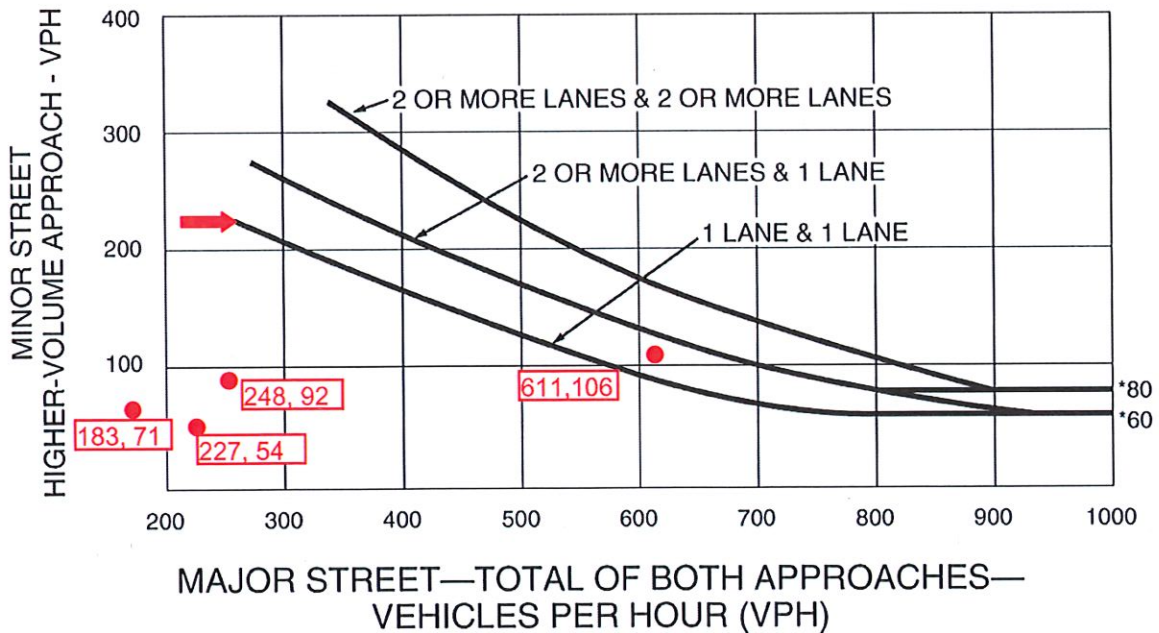
Yes  No Meets each of 4 Highest Hours (Warrant 2 — see Figure 4C-2).

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume (100% Factor)**



\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)  
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)**

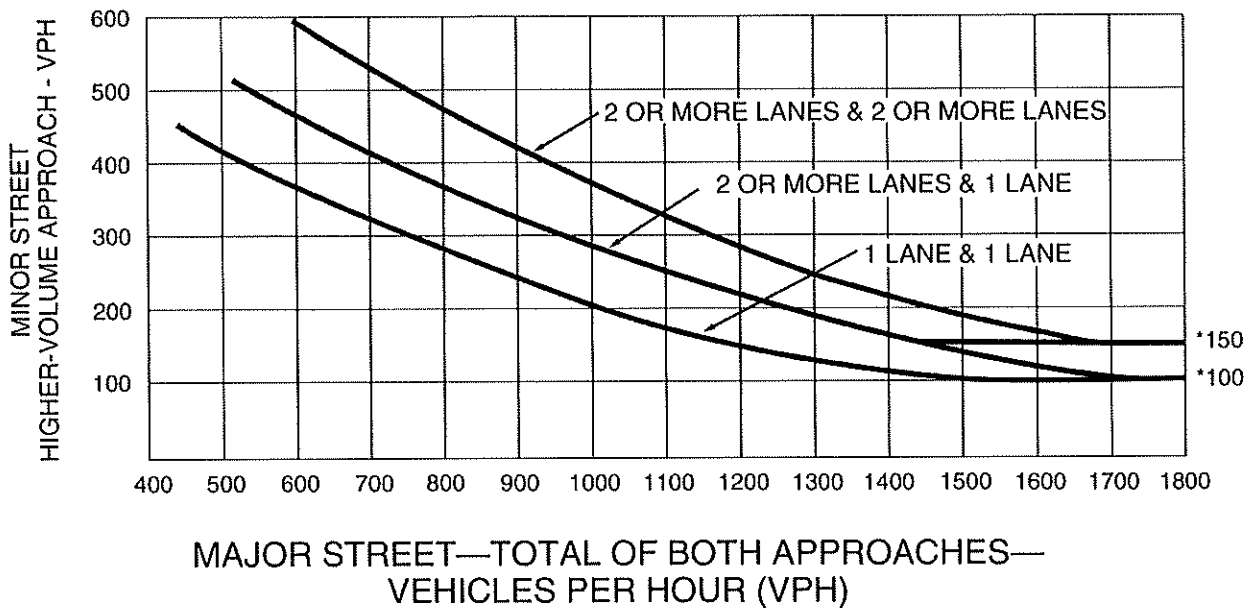


\*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Warrant 3. Peak Hour — Not Satisfied**

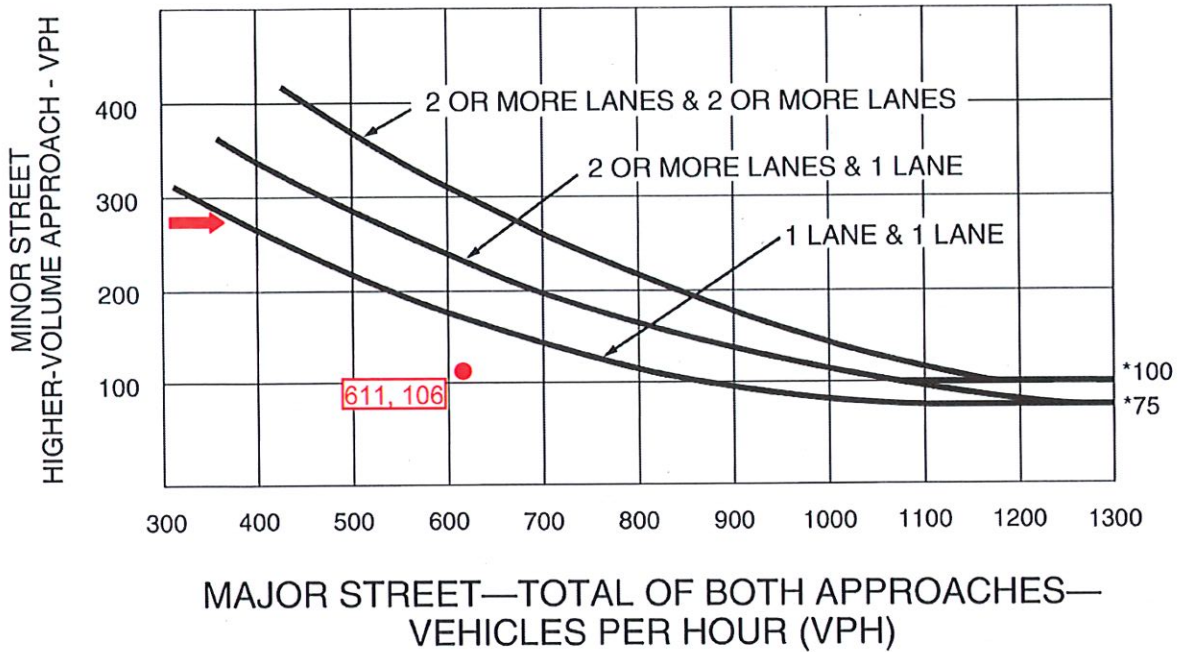
<input type="checkbox"/> Yes	<input type="checkbox"/> No	Are all of the following conditions true for any four consecutive 15-minute periods?
<p>1. The total stopped time delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds 4 vehicle-hours for a one-lane approach and 5 vehicle-hours for a two-lane approach, <i>and</i></p> <p>2. The volume of the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, <i>and</i></p> <p>3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four (or more) approaches.</p> <p>— <i>or</i> —</p>		
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Meets one High Hour (Warrant 3 — see Figure 4C-4).

**Figure 4C-3. Warrant 3, Peak Hour**



\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Figure 4C-4. Warrant 3, Peak Hour (70% Factor)**  
 (COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



\*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Warrant 4. Pedestrian Volume - Not Satisfied**

Pedestrian Volume Crossing the Major Street or mid-block location

Yes  No Is the pedestrian volume 100\* or more for each of any 4 hours?

Yes  No *-or-* Is the pedestrian volume 190\* or more during any 1 hour?

\* For predominant pedestrian crossing speeds less than 4 ft./sec., the volume may be reduced by 50%.

*-and-*

Yes  No Are there less than 60 gaps per hour of adequate length for the pedestrians to cross the street?

*-and-*

Yes  No Is the nearest signal on the major street located more than 300 feet away?

(This warrant may be applied, if the proposed signal is less than 300 feet and does not restrict the progressive movement of traffic).

**Warrant 5. School Crossing - Not Satisfied**

Yes  No Is the number of adequate gaps in traffic stream during the period when the children are using the crossing less than the number of minutes in the same period?

*-and-*

Yes  No Are there a minimum of 20 students during the highest crossing hour?

*-and-*

Yes  No Is the nearest signal on the major street located more than 300 feet away?

(This warrant may be applied, if the proposed signal is less than 300 feet and does not restrict the progressive movement of traffic)

**Warrant 6. Coordinated Signal System - Not Applicable**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	On a one-way street or a street with traffic predominantly in one direction, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur?
<i>-or-</i>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	On a two-way street, are the adjacent signals far enough apart that the necessary degree of vehicle platooning does not occur and would the proposed and adjacent traffic control signal provide a progressive operation?

**Warrant 7. Crash Experience – Not Satisfied**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is one of the following conditions met?
<ul style="list-style-type: none"> <li>• 80 % of condition A or condition B in warrant 1</li> <li>• 56% condition A or B in Warrant 1 (Major street speed exceeding 40 mph and population less than 10,000)</li> <li>• 80% or more of Warrant 4</li> </ul>		
<i>-and-</i>		
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Have there been more than 5 crashes susceptible to correction by a traffic signal in 12 months?

Note: Warranted based on 8 incidents at or near this intersection. Specific cause and location information are unavailable.

**Warrant 8. Roadway Network – Not Satisfied**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	Is the total existing, or immediately projected, entering volume on all approaches greater than 1000 vehicles for each of any 5 hours of a Saturday and/or Sunday.
<i>- or -</i>		
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	Is the total existing, or immediately projected, entering volume greater than 1000 vehicles for the peak hour of a typical weekday, and do the 5 year projected traffic volumes meet one or more of Warrants 1, 2, and 3 during an average weekday?
Check applicable characteristics of each route:		
Major <u>Street</u>	Minor <u>Street</u>	
<input type="checkbox"/>	<input type="checkbox"/>	It is part of street or highway system that serves as the principal roadway network for through traffic flow.
<input type="checkbox"/>	<input type="checkbox"/>	It includes rural or suburban highways outside, entering, or traversing a city.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.
<input type="checkbox"/>	<input type="checkbox"/>	It connects areas of principal traffic generation
<input type="checkbox"/>	<input type="checkbox"/>	It has surface street freeway or expressway ramp terminals

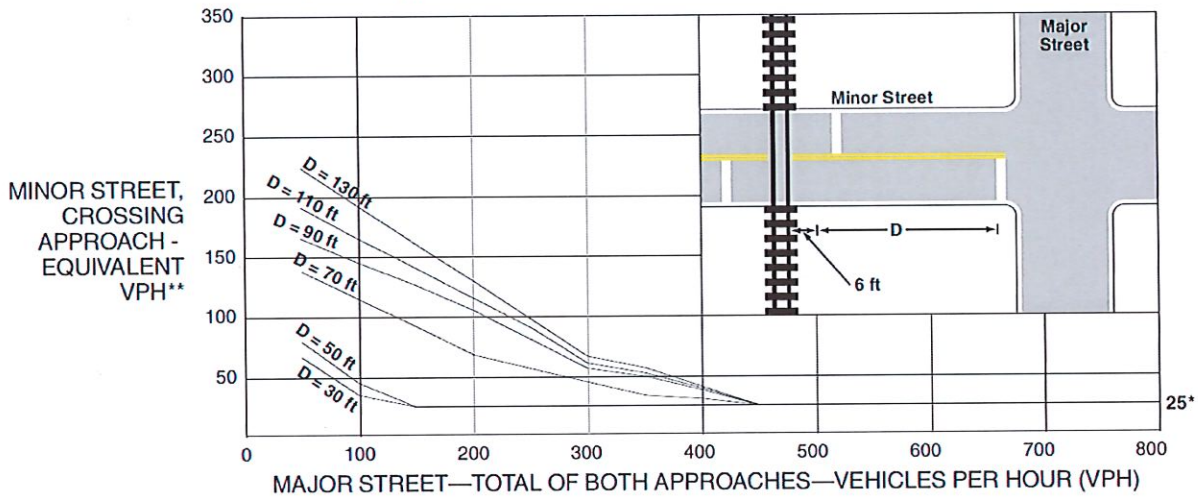
**Warrant 9. Intersection Near a Grade Crossing - Not Applicable**

<input type="checkbox"/> Yes	<input type="checkbox"/> No	The grade crossing exists on an approach controlled by a STOP or YIELD sign.
<i>-and-</i>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	The center of the track nearest the intersection is within 140 feet of the stop or yield line on the approach
<i>-and-</i>		
<input type="checkbox"/> Yes	<input type="checkbox"/> No	One high hour falls above applicable curve in Figure 5 or Figure 6

Traffic Survey — Count Analysis

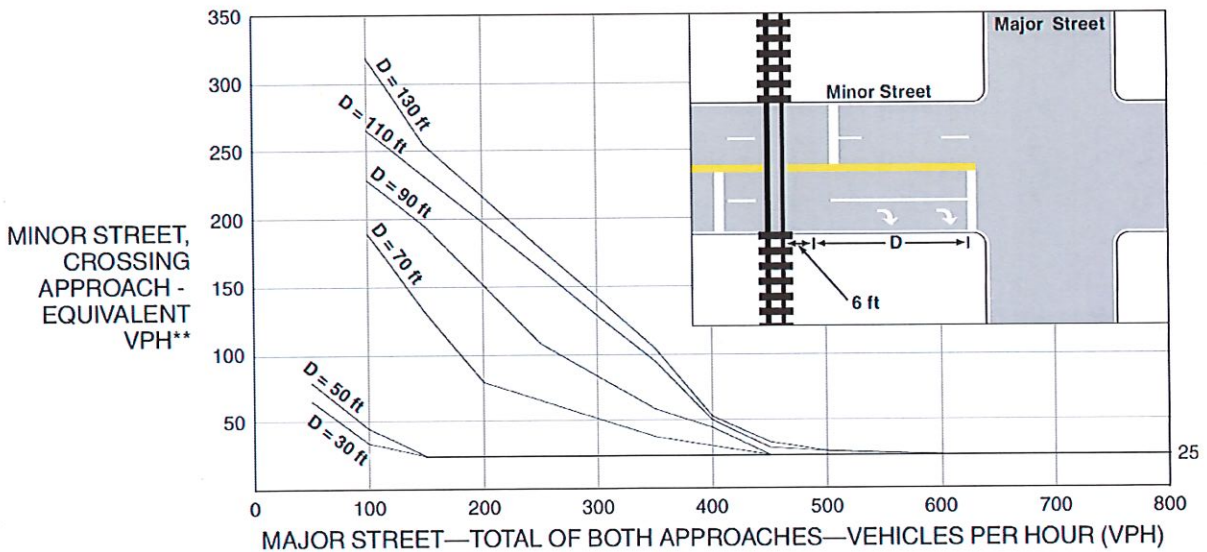
Minor Street Volume Adjustment Factors		Adjustment Factor		Adjustment Factor		Adjustment Factor	
Rail Traffic Per Day	Adjustment Factor	% of Tractor-Trailer Trucks on Minor-Street Approach	D Less Than 70 Feet	D of 70 Feet or More	% of High Occupancy Buses on Minor-Street Approach	Adjustment Factor	
1	0.67	0% to 2.5%	0.50	0.50	0%	1.00	
2	0.91	2.6% to 7.5%	0.75	0.75	2%	1.09	
3 to 5	1.00	7.6% to 12.5%	1.00	1.00	4%	1.19	
6 to 8	1.18	12.6% to 17.5%	2.30	1.15	6% or more	1.32	
9 to 11	1.25	17.6% to 22.5%	2.70	1.35			
12 or more	1.33	22.6% to 27.5%	3.28	1.64			
		more than 27.5%	4.18	2.09			
Distance from intersection to track		Minor Street VPH With Adjustment					
Minor street VPH on the approach that crosses the track (one direction only)							
Major street VPH (total of both approaches)							

Figure 4C-9. Warrant 9, Intersection Near a Grade Crossing (One Approach Lane at the Track Crossing)



\* 25 vph applies as the lower threshold volume  
 \*\* VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

Figure 4C-10. Warrant 9, Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing)



\* 25 vph applies as the lower threshold volume  
 \*\* VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

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**APPENDIX B**  
**Traffic Volume Counts**

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# GRAM Traffic Counting, Inc.

3753 FM 1105, Bldg. A  
Georgetown, TX 78626  
512-832-8650

File Name : Site 1 - Carmen Avila Rd & Mile 22  
Site Code : 1  
Start Date : 10/8/2019  
Page No : 1

## Groups Printed- Vehicles - Heavy Vehicles - School Bus

Start Time	Carmen Avila Rd Southbound					Mile 22 1/2 Westbound					Carmen Avila Rd Northbound					Mile 22 1/2 Eastbound					Int. Total
	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	
06:00 AM	0	1	0	0	1	2	0	0	0	2	2	0	3	0	5	0	0	0	0	0	8
06:15 AM	0	0	0	0	0	10	1	0	0	11	2	6	1	0	9	0	0	0	0	0	20
06:30 AM	0	16	1	0	17	8	0	1	0	9	3	15	1	0	19	0	0	1	0	1	46
06:45 AM	0	5	0	0	5	7	0	1	0	8	6	5	3	0	14	0	0	0	0	0	27
<b>Total</b>	<b>0</b>	<b>22</b>	<b>1</b>	<b>0</b>	<b>23</b>	<b>27</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>30</b>	<b>13</b>	<b>26</b>	<b>8</b>	<b>0</b>	<b>47</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>101</b>
07:00 AM	2	12	0	0	14	9	1	2	0	12	17	27	1	0	45	0	0	1	0	1	72
07:15 AM	5	50	0	0	55	15	0	10	0	25	42	52	1	0	95	0	0	3	0	3	178
07:30 AM	4	66	0	0	70	29	1	12	0	42	48	76	7	0	131	0	1	10	0	11	254
07:45 AM	9	77	0	0	86	16	0	11	0	27	32	74	9	0	115	0	1	16	0	17	245
<b>Total</b>	<b>20</b>	<b>205</b>	<b>0</b>	<b>0</b>	<b>225</b>	<b>69</b>	<b>2</b>	<b>35</b>	<b>0</b>	<b>106</b>	<b>139</b>	<b>229</b>	<b>18</b>	<b>0</b>	<b>386</b>	<b>0</b>	<b>2</b>	<b>30</b>	<b>0</b>	<b>32</b>	<b>749</b>
08:00 AM	3	49	0	0	52	6	0	3	0	9	4	44	6	0	54	0	0	1	0	1	116
08:15 AM	1	12	0	0	13	7	0	1	0	8	3	11	6	0	20	0	0	0	0	0	41
08:30 AM	1	4	0	0	5	7	0	0	0	7	2	5	2	0	9	0	0	2	0	2	23
08:45 AM	0	2	0	0	2	5	0	1	0	6	1	4	3	0	8	0	0	1	0	1	17
<b>Total</b>	<b>5</b>	<b>67</b>	<b>0</b>	<b>0</b>	<b>72</b>	<b>25</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>30</b>	<b>10</b>	<b>64</b>	<b>17</b>	<b>0</b>	<b>91</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>197</b>
09:00 AM	0	1	0	0	1	3	0	0	0	3	0	2	3	0	5	0	0	0	0	0	9
09:15 AM	0	5	0	0	5	3	0	0	0	3	2	8	1	0	11	0	0	1	0	1	20
09:30 AM	0	8	1	0	9	5	0	0	0	5	1	6	1	0	8	0	0	2	0	2	24
09:45 AM	0	5	0	0	5	5	1	0	0	6	0	7	4	0	11	0	0	1	0	1	23
<b>Total</b>	<b>0</b>	<b>19</b>	<b>1</b>	<b>0</b>	<b>20</b>	<b>16</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>3</b>	<b>23</b>	<b>9</b>	<b>0</b>	<b>35</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>76</b>
10:00 AM	0	3	0	0	3	8	0	1	0	9	0	3	3	0	6	0	0	0	0	0	18
10:15 AM	2	4	0	0	6	7	0	4	0	11	2	7	2	0	11	0	0	2	0	2	30
10:30 AM	0	3	0	0	3	7	1	0	0	8	2	0	3	0	5	0	0	5	0	5	21
10:45 AM	0	2	0	0	2	6	0	1	0	7	6	3	5	0	14	0	0	2	0	2	25
<b>Total</b>	<b>2</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>28</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>35</b>	<b>10</b>	<b>13</b>	<b>13</b>	<b>0</b>	<b>36</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>94</b>
11:00 AM	0	5	0	0	5	8	0	0	0	8	5	4	5	1	15	0	0	0	0	0	28
11:15 AM	0	5	0	0	5	4	0	0	0	4	1	5	5	0	11	1	0	4	0	5	25
11:30 AM	0	8	0	0	8	2	0	0	0	2	4	2	3	0	9	0	0	4	0	4	23
11:45 AM	0	5	0	0	5	6	0	0	0	6	0	4	4	0	8	0	0	1	0	1	20
<b>Total</b>	<b>0</b>	<b>23</b>	<b>0</b>	<b>0</b>	<b>23</b>	<b>20</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>	<b>15</b>	<b>17</b>	<b>1</b>	<b>43</b>	<b>1</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>10</b>	<b>96</b>
12:00 PM	1	5	0	0	6	5	0	0	0	5	1	6	5	0	12	0	0	5	0	5	28
12:15 PM	0	5	0	0	5	7	0	1	0	8	4	3	5	0	12	0	0	4	1	5	30
12:30 PM	0	8	1	0	9	2	0	3	0	5	4	9	4	0	17	0	0	1	0	1	32
12:45 PM	1	4	0	0	5	2	0	2	0	4	3	3	4	0	10	1	0	1	0	2	21
<b>Total</b>	<b>2</b>	<b>22</b>	<b>1</b>	<b>0</b>	<b>25</b>	<b>16</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>22</b>	<b>12</b>	<b>21</b>	<b>18</b>	<b>0</b>	<b>51</b>	<b>1</b>	<b>0</b>	<b>11</b>	<b>1</b>	<b>13</b>	<b>111</b>
01:00 PM	0	6	0	0	6	8	0	0	0	8	1	6	5	0	12	0	0	2	0	2	28
01:15 PM	0	3	0	0	3	9	0	1	0	10	0	4	3	0	7	0	0	1	0	1	21
01:30 PM	0	3	0	0	3	4	0	2	0	6	1	5	5	0	11	0	0	2	0	2	22
01:45 PM	1	2	0	0	3	6	0	0	0	6	3	2	10	0	15	0	0	1	0	1	25
<b>Total</b>	<b>1</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>15</b>	<b>27</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>30</b>	<b>5</b>	<b>17</b>	<b>23</b>	<b>0</b>	<b>45</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>6</b>	<b>96</b>
02:00 PM	0	2	0	0	2	4	0	0	0	4	2	4	3	0	9	0	0	1	0	1	16
02:15 PM	1	4	0	0	5	4	0	0	0	4	0	4	8	0	12	0	0	4	0	4	25
02:30 PM	1	2	0	0	3	10	0	1	0	11	0	2	6	0	8	0	0	9	0	9	31

# GRAM Traffic Counting, Inc.

3753 FM 1105, Bldg. A  
Georgetown, TX 78626  
512-832-8650

File Name : Site 1 - Carmen Avila Rd & Mile 22  
Site Code : 1  
Start Date : 10/8/2019  
Page No : 2

Groups Printed- Vehicles - Heavy Vehicles - School Bus

Start Time	Carmen Avila Rd Southbound					Mile 22 1/2 Westbound					Carmen Avila Rd Northbound					Mile 22 1/2 Eastbound					Int. Total
	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	
02:45 PM	1	5	0	0	6	8	0	0	0	8	0	6	8	0	14	0	0	0	0	0	28
Total	3	13	0	0	16	26	0	1	0	27	2	16	25	0	43	0	0	14	0	14	100
03:00 PM	0	1	0	0	1	4	0	1	0	5	0	9	7	0	16	0	0	8	0	8	30
03:15 PM	1	3	0	0	4	17	0	3	0	20	0	10	17	0	27	0	0	1	0	1	52
03:30 PM	1	1	0	0	2	15	0	3	0	18	5	39	16	0	60	0	0	2	0	2	82
03:45 PM	8	63	1	0	72	7	0	4	0	11	14	25	6	0	45	0	0	1	0	1	129
Total	10	68	1	0	79	43	0	11	0	54	19	83	46	0	148	0	0	12	0	12	293
04:00 PM	5	46	0	0	51	5	0	7	0	12	5	33	6	0	44	1	3	36	0	40	147
04:15 PM	3	34	1	0	38	4	0	2	0	6	9	22	8	0	39	0	0	14	0	14	97
04:30 PM	3	16	2	0	21	2	0	0	0	2	5	7	7	0	19	1	1	19	0	21	63
04:45 PM	3	13	0	0	16	10	2	3	0	15	8	7	5	0	20	0	0	17	0	17	68
Total	14	109	3	0	126	21	2	12	0	35	27	69	26	0	122	2	4	86	0	92	375
05:00 PM	0	15	0	0	15	6	2	0	0	8	10	11	11	0	32	0	1	17	0	18	73
05:15 PM	1	5	0	0	6	3	1	1	0	5	3	14	15	0	32	0	1	14	0	15	58
05:30 PM	5	34	1	0	40	6	0	2	0	8	2	19	10	0	31	1	1	22	0	24	103
05:45 PM	2	9	1	0	12	5	0	1	0	6	3	4	8	0	15	0	1	13	0	14	47
Total	8	63	2	0	73	20	3	4	0	27	18	48	44	0	110	1	4	66	0	71	281
06:00 PM	1	3	0	0	4	15	0	0	0	15	3	2	8	0	13	0	3	9	0	12	44
06:15 PM	0	1	0	0	1	9	0	0	0	9	0	0	15	0	15	0	0	2	0	2	27
06:30 PM	0	1	0	0	1	8	0	0	0	8	0	1	12	0	13	0	0	1	0	1	23
06:45 PM	0	1	0	0	1	7	0	1	0	8	0	1	12	0	13	0	0	0	0	0	22
Total	1	6	0	0	7	39	0	1	0	40	3	4	47	0	54	0	3	12	0	15	116
Grand Total	66	643	9	0	718	377	10	86	0	473	271	628	311	1	1211	5	13	264	1	283	2685
Apprch %	9.2	89.6	1.3	0		79.7	2.1	18.2	0		22.4	51.9	25.7	0.1		1.8	4.6	93.3	0.4		
Total %	2.5	23.9	0.3	0	26.7	14	0.4	3.2	0	17.6	10.1	23.4	11.6	0	45.1	0.2	0.5	9.8	0	10.5	
Vehicles	66	631	9	0	706	373	10	84	0	467	201	620	303	1	1125	5	4	196	1	206	2504
% Vehicles	100	98.1	100	0	98.3	98.9	100	97.7	0	98.7	74.2	98.7	97.4	100	92.9	100	30.8	74.2	100	72.8	93.3
Heavy Vehicles	0	5	0	0	5	4	0	2	0	6	4	4	3	0	11	0	0	4	0	4	26
% Heavy Vehicles	0	0.8	0	0	0.7	1.1	0	2.3	0	1.3	1.5	0.6	1	0	0.9	0	0	1.5	0	1.4	1
School Bus	0	7	0	0	7	0	0	0	0	0	66	4	5	0	75	0	9	64	0	73	155
% School Bus	0	1.1	0	0	1	0	0	0	0	0	24.4	0.6	1.6	0	6.2	0	69.2	24.2	0	25.8	5.8

# GRAM Traffic Counting, Inc.

3753 FM 1105, Bldg. A  
Georgetown, TX 78626  
512-832-8650

File Name : Site 1 - Carmen Avila Rd & Mile 22  
Site Code : 1  
Start Date : 10/8/2019  
Page No : 3

Start Time	Carmen Avila Rd Southbound					Mile 22 1/2 Westbound					Carmen Avila Rd Northbound					Mile 22 1/2 Eastbound					Int. Total
	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	Left	Thru	Right	U-TURN	App. Total	
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	5	50	0	0	55	15	0	10	0	25	42	52	1	0	95	0	0	3	0	3	178
07:30 AM	4	66	0	0	70	29	1	12	0	42	48	76	7	0	131	0	1	10	0	11	254
07:45 AM	9	77	0	0	86	16	0	11	0	27	32	74	9	0	115	0	1	16	0	17	245
08:00 AM	3	49	0	0	52	6	0	3	0	9	4	44	6	0	54	0	0	1	0	1	116
Total Volume	21	242	0	0	263	66	1	36	0	103	126	246	23	0	395	0	2	30	0	32	793
% App. Total	8	92	0	0		64.1	1	35	0		31.9	62.3	5.8	0		0	6.2	93.8	0		
PHF	.583	.786	.000	.000	.765	.569	.250	.750	.000	.613	.656	.809	.639	.000	.754	.000	.500	.469	.000	.471	.781
Vehicles	21	241	0	0	262	66	1	36	0	103	98	245	22	0	365	0	0	2	0	2	732
% Vehicles	100	99.6	0	0	99.6	100	100	100	0	100	77.8	99.6	95.7	0	92.4	0	0	6.7	0	6.3	92.3
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0.3	0	0	0	0	0	0.1
School Bus	0	1	0	0	1	0	0	0	0	0	27	1	1	0	29	0	2	28	0	30	60
% School Bus	0	0.4	0	0	0.4	0	0	0	0	0	21.4	0.4	4.3	0	7.3	0	100	93.3	0	93.8	7.6

Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1  
Peak Hour for Each Approach Begins at:

	07:15 AM					07:00 AM					07:15 AM					07:00 AM				
+0 mins.	5	50	0	0	55	9	1	2	0	12	42	52	1	0	95	0	0	1	0	1
+15 mins.	4	66	0	0	70	15	0	10	0	25	48	76	7	0	131	0	0	3	0	3
+30 mins.	9	77	0	0	86	29	1	12	0	42	32	74	9	0	115	0	1	10	0	11
+45 mins.	3	49	0	0	52	16	0	11	0	27	4	44	6	0	54	0	1	16	0	17
Total Volume	21	242	0	0	263	69	2	35	0	106	126	246	23	0	395	0	2	30	0	32
% App. Total	8	92	0	0		65.1	1.9	33	0		31.9	62.3	5.8	0		0	6.2	93.8	0	
PHF	.583	.786	.000	.000	.765	.595	.500	.729	.000	.631	.656	.809	.639	.000	.754	.000	.500	.469	.000	.471
Vehicles	21	241	0	0	262	69	2	35	0	106	98	245	22	0	365	0	0	2	0	2
% Vehicles	100	99.6	0	0	99.6	100	100	100	0	100	77.8	99.6	95.7	0	92.4	0	0	6.7	0	6.2
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0.3	0	0	0	0	0
School Bus	0	1	0	0	1	0	0	0	0	0	27	1	1	0	29	0	2	28	0	30
% School Bus	0	0.4	0	0	0.4	0	0	0	0	0	21.4	0.4	4.3	0	7.3	0	100	93.3	0	93.8

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**APPENDIX C**  
**Intersection Photos**

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*Traffic Signal Warrant Analysis – Carmen Avila Road at Mile 22.5 North Road*



Looking east on Mile 22.5 North Road, from west of Carmen Avila Road



Looking south on Carmen Avila Road, from north of Mile 22.5 North Road

*Traffic Signal Warrant Analysis – Carmen Avila Road at Mile 22.5 North Road*



Looking west on Mile 22.5 North Road, from east of Carmen Avila Road



Looking north on Carmen Avila Road, from south of Mile 22.5 North Road