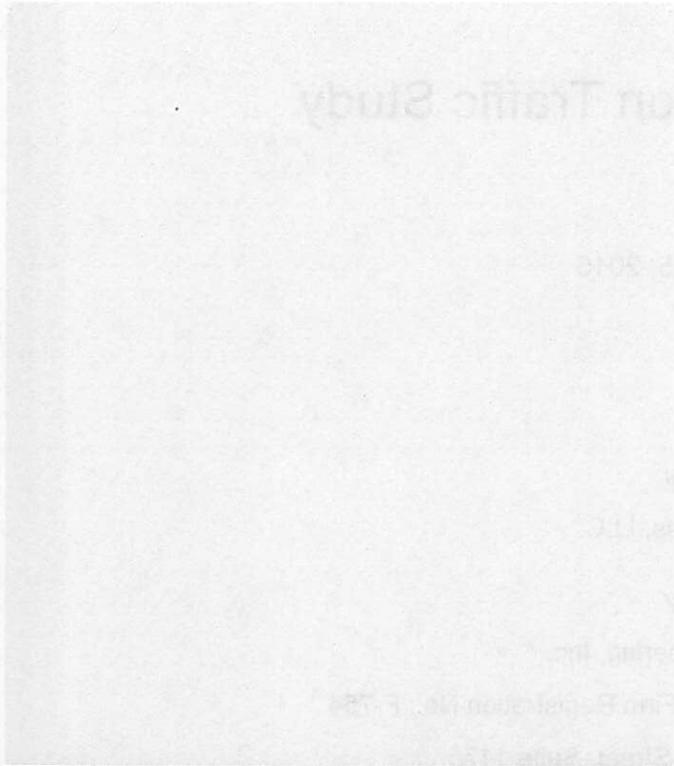




# Thornton Traffic Study

*Austin, Texas*  
November 25, 2015



# Thornton Traffic Study

*Austin, Texas*  
November 25, 2015

*Prepared for*  
Oden|Hughes, LLC.

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## Introduction

HDR Engineering, Inc. has been retained by Oden Hughes, LLC to perform a traffic study for a proposed development (Zoning Case C14-2015-0047) in Austin, Texas, located at 2303 and 2309 Thornton Road, south of Oltorf Street as shown in Figure 1. The development is proposed to consist of 212 apartment dwelling units and is expected to open in 2017. Parking for residents and guests of the apartments will be served on site. Access to the development is proposed via one driveway on Thornton Road. The property is currently improved with 39,622 square feet of industrial park. Additional industrial park development is anticipated for the site if the zoning change is not approved.

## Existing Thoroughfare System

Thornton Road – Thornton Road currently operates as a 2-lane undivided roadway with a speed limit of 25 mph. According to traffic count data collected on June 2, 2015, the traffic volume on Thornton Road is approximately 2,600 vehicles per day (vpd) south of Oltorf Street. It should be noted that AISD was in session during the data collection. The City of Austin classifies Thornton Road as a Collector Street as it exhibits traffic volumes and the operational characteristics of a collector as defined by the City of Austin Transportation Criteria Manual. However, the existing roadway width (approximately 28' to 30') and right-of-way width (varies 50'- 60') is closer to that of a Local Street. City of Austin design criteria for these street classifications are included in the Appendix. Parking is currently allowed on both sides of the street with the exception of approximately 100' on the east side of Thornton Road along the existing roadway curve. Vehicles park along both sides of Thornton Road essentially narrowing the street to one travel lane.

Additional details on traffic volumes are provided in Table 1. Complete traffic count information is included in the Appendix.

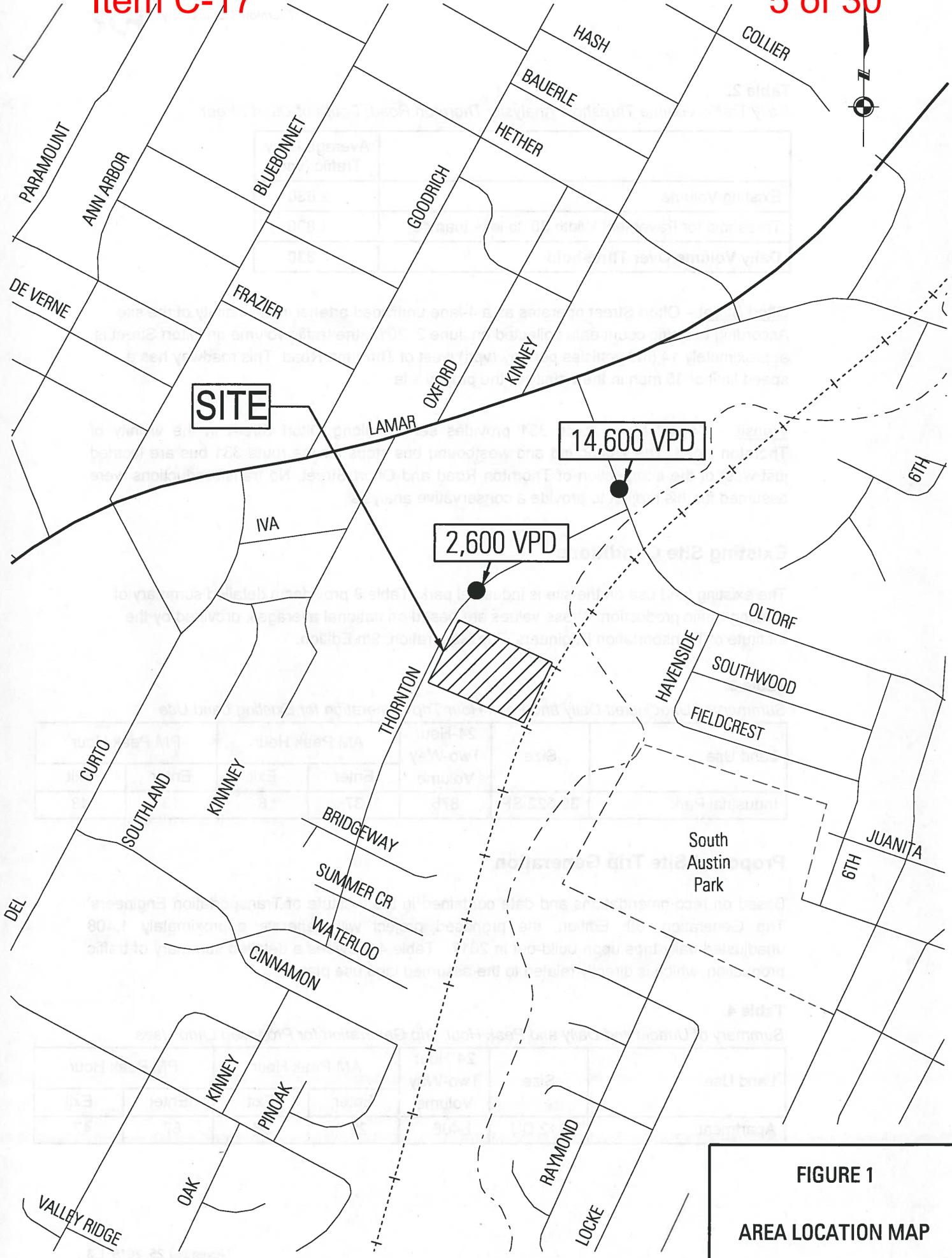
**Table 1.**

*June 2015 Existing Traffic Volume Summary: Thornton Road, South of Oltorf Street*

	Daily (vehicles)	AM Peak (vehicles)	PM Peak (vehicles)
Northbound	1,271	114	97
Southbound	1,359	48	94
<b>Total</b>	<b>2,630</b>	<b>162</b>	<b>191</b>

### City of Austin Roadway Volume Threshold

Section 25-6-116 of the City of Austin Land Development Code defines volume thresholds for desirable operating levels for streets with various pavement widths. A street with a pavement width of 30 feet should not exceed 1,800 vpd to remain operating at the City's defined desirable level. The existing volume on Thornton Road is 2,630 vpd. Therefore, Thornton Road is currently over the City's defined threshold by 830 vpd. The results are summarized in Table 2.



**FIGURE 1**  
**AREA LOCATION MAP**

**Table 2.**

*Daily Traffic Volume Threshold Analysis: Thornton Road, South of Oltorf Street*

	Average Daily Traffic (vpd)
Existing Volume	2,630
Threshold for Pavement Width 30' to less than 40'	1,800
<b>Daily Volume Over Threshold</b>	<b>830</b>

Oltorf Street – Oltorf Street operates as a 4-lane undivided arterial in the vicinity of the site. According to traffic count data collected on June 2, 2015, the traffic volume on Oltorf Street is approximately 14,600 vehicles per day (vpd) west of Thornton Road. This roadway has a speed limit of 35 mph in the vicinity of the project site.

Transit – Capital Metro route 331 provides service along Oltorf Street in the vicinity of Thornton Road. The eastbound and westbound bus stops for the route 331 bus are located just west of the intersection of Thornton Road and Oltorf Street. No transit reductions were assumed for this project to provide a conservative analysis.

**Existing Site Conditions**

The existing land use on the site is industrial park. Table 3 provides a detailed summary of existing traffic production. These values are based on national averages, provided by the Institute of Transportation Engineers' Trip Generation, 9th Edition.

**Table 3.**

*Summary of Unadjusted Daily and Peak Hour Trip Generation for Existing Land Use*

Land Use	Size	24-Hour Two-Way Volume	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Industrial Park	39,622 SF	876	37	8	13	48

**Proposed Site Trip Generation**

Based on recommendations and data contained in the Institute of Transportation Engineers' Trip Generation, 9th Edition, the proposed project will generate approximately 1,408 unadjusted daily trips upon build-out in 2017. Table 4 provides a detailed summary of traffic production, which is directly related to the assumed land use plan.

**Table 4.**

*Summary of Unadjusted Daily and Peak Hour Trip Generation for Proposed Land Uses*

Land Use	Size	24-Hour Two-Way Volume	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Apartment	212 DU	1,408	22	86	87	47

### Traffic Analysis

The impact of the proposed development on Thornton Road and Oltorf Street was analyzed. Two (2) time periods and three (3) travel conditions were evaluated:

- 2015 Existing Conditions
- 2017 Forecasted (without Site) Conditions
- 2017 Site Plus Forecasted Conditions

Based on historical 24-hour traffic counts obtained from TxDOT, a 1.5% annual growth rate was assumed for the study. In addition, the following projects were included as background traffic under forecasted (without site) traffic conditions:

- Thornton Apartments (SP-2013-0278C.SH)
  - 104 Apartment Dwelling Units
- Future Development at Lamar Boulevard and Oltorf Street (TBD)
  - 10,675 SF of General Light Industrial
  - 7,152 SF of Specialty Retail Center
  - 20,185 SF of Shopping Center
  - 32,366 SF of General Office Building

### Roadway Threshold Analysis

To provide an evaluation of the impact of the site on Thornton Road, a comparison of traffic volumes and City of Austin operational thresholds based on roadway classifications was completed. It should be noted that the operation of Thornton Road are primarily defined by the peak hours and the constraint points at the stop-controlled intersection of Thornton Road and Oltorf Street. Table 5 provide a summary of the average daily traffic volumes for existing and forecasted (without site) conditions. Table 6 incorporates the proposed development and documents site plus forecasted conditions.

**Table 5.**  
*Average Daily Traffic – Forecasted (without site) Traffic Conditions*

Scenario	Average Daily Traffic (vpd)
2015 Existing	2,630
2017 Existing with Growth	2,709
Thornton Apartments Development	754
2017 Forecasted	3,463
<b>Daily Volume Over Threshold</b>	<b>1,663</b>

As shown in Table 5, Thornton Road is expected to operate with average daily traffic volumes of approximately 3,500 vpd in 2017. Thornton Road will exceed the City's operating threshold of a 30' roadway (1,800 vpd) by 1,663 vpd. 2017 traffic volumes are in line with operations of a Neighborhood Collector (2,000 – 6,000 vpd).

**Table 6.***Average Daily Traffic – Site Plus Forecasted Traffic Conditions*

Scenario	Average Daily Traffic (vpd)
2015 Existing	2,630
2017 Existing with Growth	2,709
Thornton Apartments Development	754
Existing Site	(876)
Site	1,408
2017 Site + Forecasted	3,995
<b>Daily Volume Over Threshold</b>	<b>2,195</b>

With the addition of traffic due to annual growth, surrounding developments, and the proposed development, Thornton Road's traffic volumes will continue to fall within the range of a Neighborhood Collector (2,000 – 6,000 vpd). Thornton Road will exceed the City's operating threshold of a 30' roadway (1,800 vpd) by 2,195 vpd. The City of Austin's LDC 25-6-116 recommends a 40' section for streets with traffic volumes up to 4,000 vpd.

**To mitigate the increased volumes in accordance with LDC Sec. 25-6-141(C), the development is proposing widening of Thornton Road to a 34' section within 200' of the Oltorf Street intersection in addition to other infrastructure improvements (pedestrian safety, intersection operations, and parking), as discussed in more detail on pages 7 and 8.**

#### Intersection Analysis

While daily traffic volumes provide a planning level view of corridor operations, the evaluation of intersections along the corridor provide a more detailed, quantitative analysis of peak-hour operations. Two types of intersections to be evaluated are signalized and unsignalized, which use different criteria for assessment of operating levels.

#### *Signalized Intersection Level of Service*

Signalized intersection LOS is defined in terms of delay, which is a direct and/or indirect measure of driver discomfort, frustration, fuel consumption, and lost travel time. The levels of service have been established based on driver acceptability of various delays. The City of Austin considers overall intersection levels of service A to D to be acceptable, while overall LOS of E and F is unacceptable. Table 7 summarizes the levels of service that are appropriate for different levels of average control delay, and a qualitative description for each.

**Table 7.**  
*Signalized Intersection: Level of Service Measurement*

Level of Service	Control Delay Per Vehicle (sec)	Qualitative Description
A	< 10	Good progression and short cycle lengths
B	> 10 and < 20	Good progression or short cycle lengths, more vehicle stops
C	> 20 and < 35	Fair progression and/or longer cycle lengths, some cycle failures
D	> 35 and < 55	Congestion becomes noticeable, high volume to capacity ratio
E	> 55 and < 80	Limit of acceptable delay, poor progression, long cycles, and/or high volume
F	> 80	Unacceptable to drivers, volume greater than capacity

*Unsignalized Intersection Level of Service*

Unsignalized intersection LOS is defined in terms of average control delay and, in some cases, v/c ratio. Control delay is that portion of total delay attributed to traffic control measures, either traffic signals or stop signs. Table 8 shows the relationship between the average control delay and the LOS. The LOS range for unsignalized intersections is different than that for signalized intersections. This difference is due to the fact that drivers expect different levels of performance from different kinds of transportation facilities.

**Table 8.**  
*Unsignalized Intersection: Level of Service Measurement*

Level of Service	Control Delay Per Vehicle (sec)
A	< 10
B	> 10 and < 15
C	> 15 and < 25
D	> 25 and < 35
E	> 35 and < 50
F	> 50

This study analyzed the intersection of Thornton Road and Oltorf Street, the primary access point for vehicles entering and exiting the development. This intersection is a T-intersection with Thornton Road operating as the stop-controlled approach. The intersection of Thornton Road and Oltorf Street was then analyzed with recommended improvements which include widening Thornton Road to separate right-turn and left-turn movements at Oltorf Street, and installing a signal at the intersection of Thornton Road and Oltorf Street. The results are summarized in Tables 9 and 10. Additional detail on each of these improvements follows.

**Table 9.**

*Minor-Street Approach Level of Service and Delay (sec/veh) at Thornton Road and Oltorf Street*

Approach	2015 Existing		2017 Forecasted (Without Site)		2017 Site + Forecasted		2017 Site + Forecasted with Widening		2017 Site + Forecasted with Signal and Widening	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Northbound Thornton	B	F	C	F	C	F	C	F	A	B
	13.2	61.8	15.8	221.6	23.0	758.0	16.4	453.5	8.2	15.7

As shown in Table 9, the intersection of Thornton Road and Oltorf Street has an overall Level of Service (LOS) F in the PM peak period under 2015 existing, 2017 forecasted, and 2017 site plus forecasted traffic conditions. **Widening Thornton Road to provide two outbound lanes will improve reduce northbound delays at the intersection. Additionally, installation of a traffic signal significantly reduces delays and improves the Thornton Road operations from LOS C and F under 2017 Forecasted (without site) traffic conditions to LOS A and B under 2017 Site plus Forecasted traffic conditions in the AM and PM peak periods, respectively.**

**Table 10.**

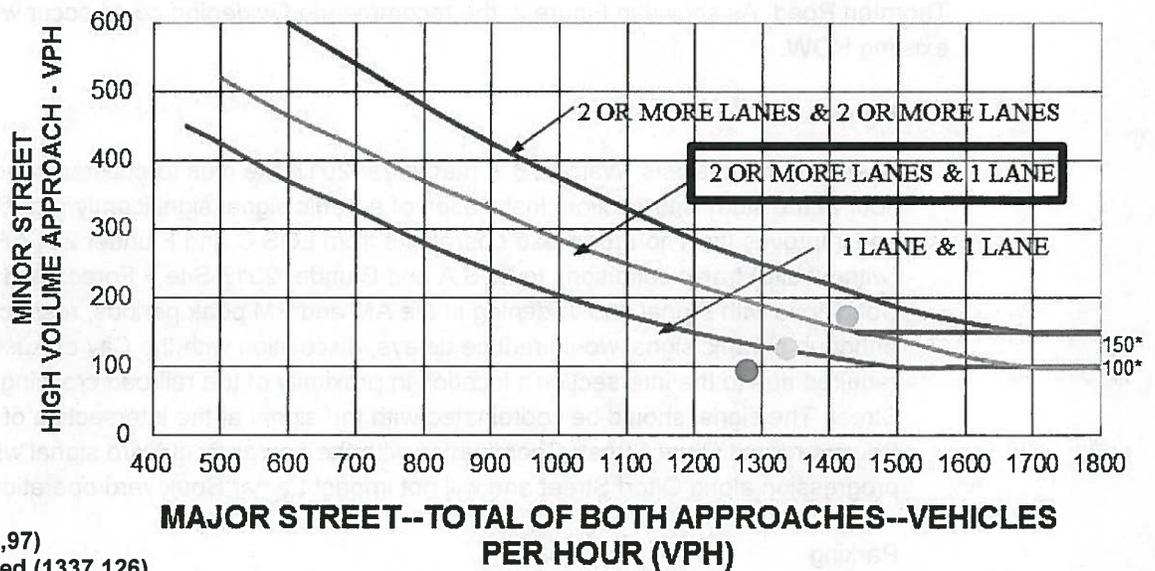
*Minor-Street Movement Service Measurements at Thornton Road and Oltorf Street*

Movement	2017 Site + Forecasted with Widening		2017 Site + Forecasted with Signal and Widening	
	AM	PM	AM	PM
Level of Service / Delay (sec/veh)				
Northbound Left Turn Thornton	C	F	B	C
	24.1	743.0	13.2	21.6
Northbound Right Turn Thornton	B	B	A	A
	10.9	12.9	4.6	6.8
95 <sup>th</sup> Percentile Queue Length				
Northbound Left Turn Thornton	AM	PM	AM	PM
	34 feet	264 feet	46 feet	70 feet
Northbound Right Turn Thornton	AM	PM	AM	PM
	16 feet	12 feet	28 feet	22 feet

Table 10 highlights the major source of intersection delay as the northbound left-turn movement from Thornton Road onto Oltorf Street. **Installation of a traffic signal improves northbound left-turn operations from LOS C and F under 2017 Site plus Forecasted with Widening to LOS B and C under 2017 Site plus Forecasted with Signal and Widening during the AM and PM peak periods, respectively. Correspondingly, the northbound left-turn delays reduce from 743.0 seconds per vehicle under 2017 Site plus Forecasted with Widening to 21.6 seconds per vehicle under 2017 Site plus Forecasted with Signal and Widening during the PM peak period.** Queue lengths are provided as guidance for the required length of widening.

Signal Warrant Analysis

To determine the need for a traffic signal at the intersection of Thornton Road and Oltorf Street, a peak hour signal warrant analysis (Warrant 3) was completed based on 2015 existing, 2017 forecasted (without site), and 2017 site plus forecasted conditions. Based on the analysis, Warrant 3 is met under 2017 site plus forecasted condition at the study intersection. A summary of the warrant analysis results are shown in Figure 2.



**\*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 2: Peak Hour Volume Warrant. (Warrant 3)

## Recommendations

### Roadway and Intersection Operations

The stop-controlled Thornton Road approach currently operates at LOS F in the PM peak period. Delays are experienced by both left-turning and right-turning vehicles approaching Oltorf Street. Delays can be extended when trains are present on the adjacent railroad track. Separating right-turn and left-turn movements will result in improved operations as right-turning vehicles that are more likely to find gaps in opposing traffic and will not be delayed by left-turning vehicles. To separate right-turn and left-turn movements at Oltorf Street, it is recommended that Thornton Road be widened to a 34'-section within 200' of the intersection of Oltorf Street. The recommended cross-section for the widened roadway width will allow for 1-14' inbound lane and 2-10' outbound lanes. Widening of Thornton Road will reduce approach delays and improve the northbound right-turn operations from LOS F to LOS B during both the AM and PM peak periods. More specifically, the roadway widening reduces the northbound right-turn delay from 221.6 seconds per vehicle under 2017 Forecasted (without site) traffic conditions to 12.9 seconds per vehicle under 2017 Site + Forecasted with Widening traffic conditions during the PM peak period. Parking would need to be restricted within 200' of the intersection. Figure 2 depicts the proposed roadway configuration along Thornton Road. As shown in Figure 2, the recommended widening could occur within the existing ROW.

### Signalization

Based on the analysis, Warrant 3 is met under 2017 site plus forecasted condition peak hour at the study intersection. Installation of a traffic signal significantly reduces delays and improves the Thornton Road operations from LOS C and F under 2017 Forecasted (without site) traffic conditions to LOS A and B under 2017 Site + Forecasted Traffic Conditions with Signal and Widening in the AM and PM peak periods, respectively. Although a traffic signal would reduce delays, discussion with the City of Austin would be required due to the intersection's location in proximity of the railroad crossing on Oltorf Street. The signal should be coordinated with the signal at the intersection of Lamar Boulevard and Oltorf Street. Coordination with the Lamar Boulevard signal will allow for progression along Oltorf Street and will not impact Lamar Boulevard operations.

### Parking

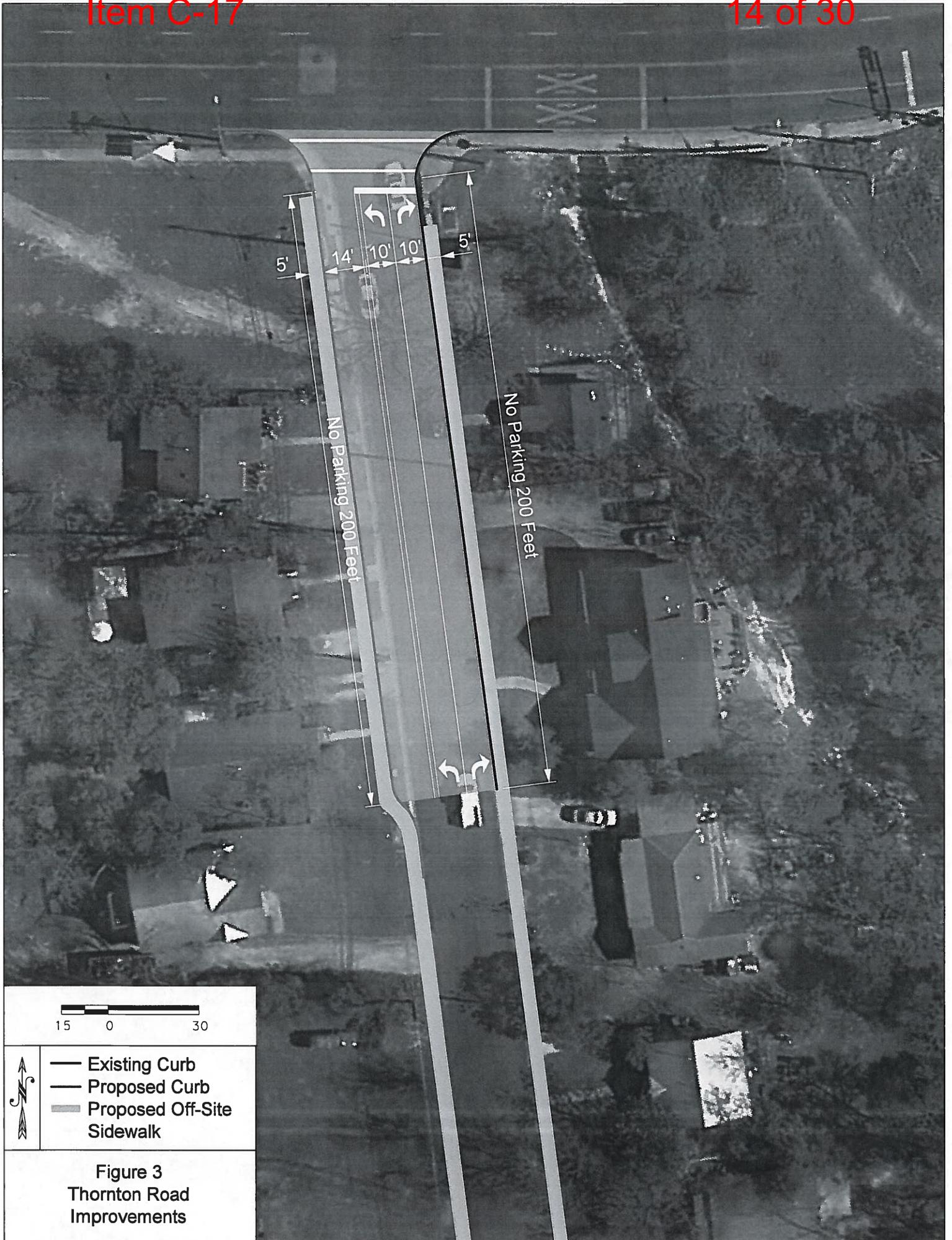
Residents are currently discussing residential parking permits along a portion of Thornton Road. This will reduce parking turnover and deter commercial parking for businesses on adjacent streets. Due to parking being a contributing source of the congestion along Thornton Road, it is recommended that parking be further restricted to one side of Thornton Road to allow sufficient width for vehicles to travel in both directions when the parking is occupied. Neighborhood support would be required for these parking modifications. Eliminating parking within 200' of Oltorf Street will allow for a two-lane approach to the intersection. It should be noted that an on-site parking garage and inset street-parking are proposed by the project which will accommodate residents and guests of the apartments. Figure 3 depicts the existing and proposed sidewalk infrastructure along Thornton Road.

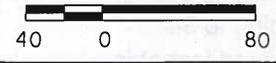
### Pedestrian Safety

Sidewalk facilities are very limited on Thornton Road causing pedestrians to walk in the roadway. It is recommended that sidewalks be installed on Thornton Road, connecting the proposed development with existing pedestrian facilities along Oltorf Street, including the Capital Metro Bus Stop. This would improve pedestrian safety and increase connectivity which has the potential to decrease access to the site by automobile. It should be noted that the Thornton Apartments development to the south has plans to install sidewalks along the east side of Thornton Road. Sidewalks along the west side of Thornton Road should be installed with roadway widening.

As pedestrian volumes increase in the vicinity of the project area due to the proposed and surrounding developments, a Pedestrian Hybrid Beacon should be considered, across the east leg of Oltorf Street at Thornton Road to facilitate pedestrian crossings. The beacon should be installed when pedestrian and vehicular volumes in the field warrant installation. Guidelines for the Installation of Pedestrian Hybrid Beacons are provided in the Appendix. If a traffic signal is warranted and installed in the field, the pedestrian hybrid beacon would not be required.

The beacon and sidewalk access to Oltorf Street will create safer dedicated space for pedestrians and help to provide connectivity to local bus stops which have the potential to decrease access to the site by automobile.





- Existing Sidewalk
- Proposed Off-Site Sidewalk
- CAPMETRO Bus Stop #2261

Figure 4  
Thornton Road  
Sidewalk Assessment

## Summary and Recommendations

Existing Thornton Road volumes do not fall within the desirable operating threshold defined by the City of Austin. Based on field observations, the most substantial contributors to the current operational issues are pedestrian safety, stopped delays at the Oltorf Street intersection, and the presence of on-street parking. These issues are proposed to be mitigated by the Developer in accordance with LDC Sec. 25-6-141(C), with the following recommended improvements. See excerpts of data from Tables 9 and 10 summarized below in Tables 11 and 12.

### Pedestrian Safety

- Pedestrian improvements, including installation of sidewalks and a pedestrian hybrid beacon (if a traffic signal is not installed) are recommended to improve pedestrian safety and increase connectivity. These improvements have the potential to decrease access to the site by automobile.

### Intersection Operations

- The stop-controlled approach of Thornton Road at Oltorf Street operates at LOS F under existing conditions.
- Widening the approach to provide two lanes will improve northbound right-turn operations from LOS C and F (Table 11) to LOS B (Table 12).
- Installation of a signal should be considered once warrants are met in the field. This will improve Thornton Road operations from LOS C and F to LOS B and C (Table 11). Discussion with the City of Austin would be required to obtain approval due to the intersection's location in proximity to the railroad crossing on Oltorf Street.

### Roadway Operations

- The existing daily traffic volume of Thornton Road is 2,630 vehicles, exceeding the LDC 25-6-116 threshold of 1,800 vehicles for pavement widths 30 feet to less than 40 feet.
- The proposed development will add approximately 1,408 vehicles per day on Thornton Road for a total estimated 2017 traffic volume of 4,000 vehicles per day. This is within the City of Austin threshold for a Neighborhood Collector.
- Additional parking restrictions could provide for improved operations along Thornton Road and will require neighborhood support.
- Widening of the entire Thornton Road segment to the site to a 40'-section would be required to meet City of Austin's LDC 25-6-116 desirable operating thresholds. The roadway widening is not recommended; instead widening at the intersection is recommended to improve operations at this constraint point. Improved interactions between parked vehicles and through vehicles will be accomplished via the parking restrictions recommended. The recommended roadway section (widening to 34' within 200' of Oltorf Street, allowing 1-14' inbound lane and 2-10' outbound lanes) is in line with current agency trends to effectively utilize the roadway section for all modes and not to focus solely on vehicular throughput. Additionally, the limited widening reduces unintended consequences such as increased travel speeds along Thornton Road.

**Table 11.**

*Minor-Street Approach Level of Service at Thornton Road and Oltorf Street*

Approach	2017 Forecasted (Without Site)		2017 Site + Forecasted with Signal and Widening	
	AM	PM	AM	PM
Northbound Thornton	C	F	A	B

**Table 12.**

*Minor-Street Movement Level of Service at Thornton Road and Oltorf Street*

Movement	2017 Site + Forecasted with Widening		2017 Site + Forecasted with Signal and Widening	
	AM	PM	AM	PM
	Level of Service / Delay (sec/veh)			
Northbound Left Turn Thornton	C	F	B	C
Northbound Right Turn Thornton	B	B	A	A

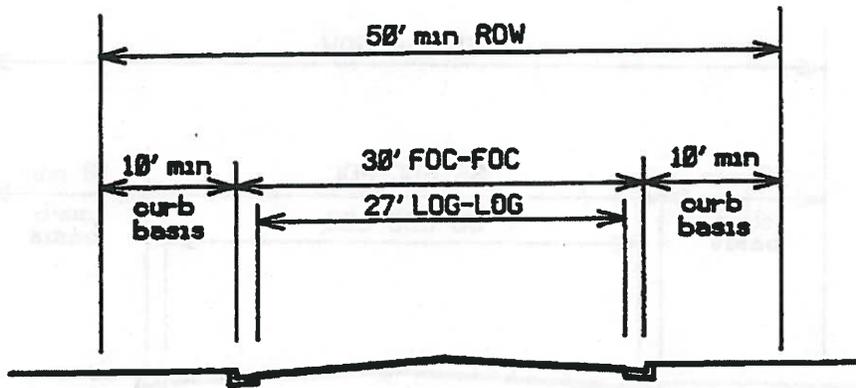
# Appendix A. Technical Addendum

Station	Direction	Count	Time	Notes
1000	North	120	08:00-09:00	Peak
1000	South	110	08:00-09:00	Peak
1000	North	130	09:00-10:00	Peak
1000	South	125	09:00-10:00	Peak
1000	North	140	10:00-11:00	Peak
1000	South	135	10:00-11:00	Peak
1000	North	150	11:00-12:00	Peak
1000	South	145	11:00-12:00	Peak
1000	North	160	12:00-13:00	Peak
1000	South	155	12:00-13:00	Peak
1000	North	170	13:00-14:00	Peak
1000	South	165	13:00-14:00	Peak
1000	North	180	14:00-15:00	Peak
1000	South	175	14:00-15:00	Peak
1000	North	190	15:00-16:00	Peak
1000	South	185	15:00-16:00	Peak
1000	North	200	16:00-17:00	Peak
1000	South	195	16:00-17:00	Peak
1000	North	210	17:00-18:00	Peak
1000	South	205	17:00-18:00	Peak
1000	North	220	18:00-19:00	Peak
1000	South	215	18:00-19:00	Peak
1000	North	230	19:00-20:00	Peak
1000	South	225	19:00-20:00	Peak
1000	North	240	20:00-21:00	Peak
1000	South	235	20:00-21:00	Peak
1000	North	250	21:00-22:00	Peak
1000	South	245	21:00-22:00	Peak
1000	North	260	22:00-23:00	Peak
1000	South	255	22:00-23:00	Peak
1000	North	270	23:00-00:00	Peak
1000	South	265	23:00-00:00	Peak

Figure 1-22 Design Criteria For Local Streets (SF-1 or SF-2)

Typical ADT Range, less than 1000  
 Design Speed, 25, 30 mph  
 General Length, less than 1500'  
 Minimum Centerline Radius, See Page 1-8  
 Minimum Tangent Length Between Horizontal Curves, 50'  
 Minimum Curb Basis, 10'  
 Zoning, SF-1 or SF-2 (Or comparable land use) \*

### TYPICAL CROSS-SECTION



\* NOTE: See Figure 1-23, for design criteria for local street where SF-3 thru SF-6 zoning is proposed.

Figure 1-23 Design Criteria for Local Streets (SF-3 thru SF-6)

Typical ADT Range, less than 1000

Design Speed, 25, 30 mph

General Length, less than 1500'

Minimum Centerline Radius, See Page 1-8

Minimum Tangent Length Between Horizontal Curves, 50'

Minimum Curb Basis, 10'

Zoning, SF-3 thru SF-6 (Or comparable land use)

### TYPICAL CROSS-SECTION

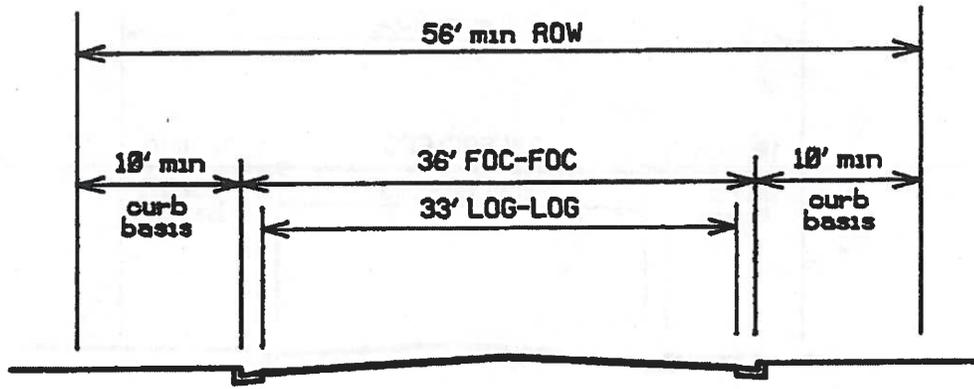
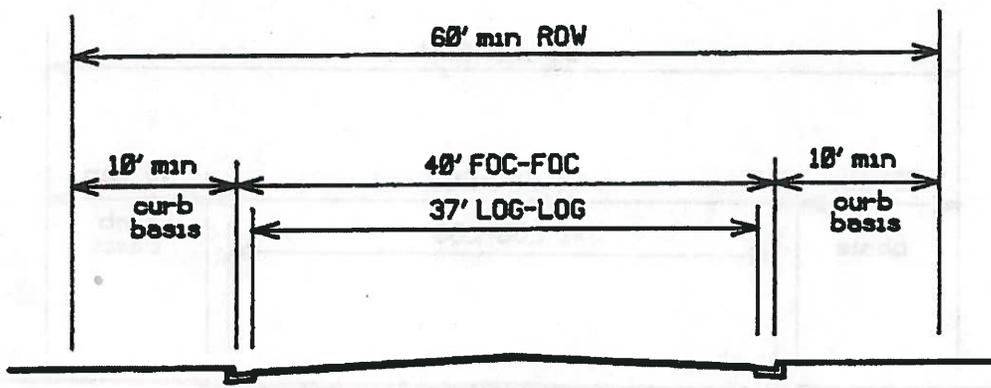


Figure 1-27 Design Criteria for Residential Collector Streets

- Typical ADT Range, 500 to 3000
- Design Speed, 30, 35 mph
- General Length, less than 1 mile
- Typical Spacing Between Residential Collectors, 1/4 mile
- Typical Spacing Between Intersections, 300'
- Minimum Centerline Radius, See Page 1-8
- Minimum Tangent Length Between Horizontal Curves, 100'
- Minimum Curb Basis, 10'
- Zoning, SF-1 thru SF-6, MF-1 (Or comparable land use)

### TYPICAL CROSS-SECTION

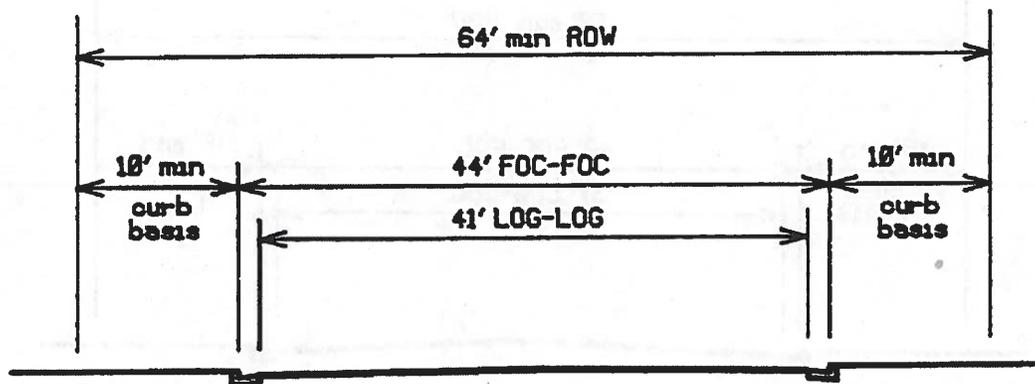


Source: City of Austin Transportation and Public Services Department

Figure 1-28 Design Criteria for Neighborhood Collector Streets

- Typical ADT Range, from 2000 to 6000
- Design Speed, 35 mph
- General Length, 1-2 miles
- Typical Spacing Between Intersections, 500'
- Typical Spacing Between Neighborhood Collectors, 1/2 mile
- Minimum Centerline Radius, See Page 1-8
- Minimum Tangent Length Between Horizontal Curves, 100'
- Minimum Curb Basis, 10'

### TYPICAL CROSS-SECTION



Groups Printed- Autos - Heavy Vehicles

Start Time	Oltorf St Southbound						Westbound						Oltorf St Northbound						Thrnnton Rd Eastbound						
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		
07:00	0	21	0	0	21		0	0	0	0	0		0	20	0	0	20		4	0	2	0	6		47
07:15	0	62	1	0	63		0	0	0	0	0		7	78	0	0	85		11	0	20	0	31		179
07:30	0	68	3	0	71		0	0	0	0	0		6	106	0	0	112		12	0	16	0	28		211
07:45	0	98	2	0	100		0	0	0	0	0		5	89	0	0	94		10	0	12	0	22		216
Total	0	249	6	0	255		0	0	0	0	0		18	293	0	0	311		37	0	50	0	87		653
08:00	0	80	3	0	83		0	0	0	0	0		6	106	0	0	112		7	0	23	0	30		225
08:15	0	95	3	0	98		0	0	0	0	0		12	90	0	0	102		11	0	21	0	32		232
08:30	0	91	2	0	93		0	0	0	0	0		5	109	0	0	114		10	0	17	0	27		234
08:45	0	105	9	0	114		0	0	0	0	0		8	116	0	0	124		9	0	16	0	25		263
Total	0	371	17	0	388		0	0	0	0	0		31	421	0	0	452		37	0	77	0	114		954
Grand Total	0	620	23	0	643		0	0	0	0	0		49	714	0	0	763		74	0	127	0	201		1607
Approch %	0	96.4	3.6	0	40		0	0	0	0	0		6.4	93.6	0	0	47.5		36.8	0	63.2	0	12.5		1573
Total %	0	38.6	1.4	0	40		0	0	0	0	0		3	44.4	0	0	74.5		4.6	0	7.9	0	99		97.9
Autos	0	607	22	0	629		0	0	0	0	0		47	698	0	0	97.6		73	0	126	0	199		1573
% Autos	0	97.9	95.7	0	97.8		0	0	0	0	0		95.9	97.8	0	0	18		98.6	0	99.2	0	99		97.9
Heavy Vehicles	0	13	1	0	14		0	0	0	0	0		2	16	0	0	2.4		1	0	1	0	2		34
% Heavy Vehicles	0	2.1	4.3	0	2.2		0	0	0	0	0		4.1	2.2	0	0	2.4		1.4	0	0.8	0	1		2.1

Start Time	Oltorf St Southbound						Westbound						Oltorf St Northbound						Thrnnton Rd Eastbound						
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		
08:00	0	80	3	0	83		0	0	0	0	0		6	106	0	0	112		7	0	23	0	30		225
08:15	0	95	3	0	98		0	0	0	0	0		12	90	0	0	102		11	0	21	0	32		232
08:30	0	91	2	0	93		0	0	0	0	0		5	109	0	0	114		10	0	17	0	27		234
08:45	0	105	9	0	114		0	0	0	0	0		8	116	0	0	124		9	0	16	0	25		263
Total Volume	0	371	17	0	388		0	0	0	0	0		31	421	0	0	452		37	0	77	0	114		954
% App. Total	0	95.6	4.4	0	851		0	0	0	0	0		6.9	93.1	0	0	.911		32.5	0	67.5	0	.891		.907
PHF	.000	.883	.472	.000	.851		.000	.000	.000	.000	.000		.646	.907	.000	.000	.911		.841	.000	.837	.000	.891		.907

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1  
Peak Hour for Entire Intersection Begins at 08:00

File Name : HDR-OltorfandThornton-Ann  
 Site Code : 00000028  
 Start Date : 6/2/2015  
 Page No : 2

Start Time	Oltorf St Southbound				Westbound				Oltorf St Northbound				Thrnton Rd Eastbound								
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	07:00				07:00				08:00				08:00				08:00				
+0 mins.	0	80	3	0	83	0	0	0	0	0	6	106	0	0	112	7	0	23	0	30	
+15 mins.	0	95	3	0	98	0	0	0	0	0	12	90	0	0	102	11	0	21	0	32	
+30 mins.	0	91	2	0	93	0	0	0	0	0	5	109	0	0	114	10	0	17	0	27	
+45 mins.	0	105	9	0	114	0	0	0	0	0	8	116	0	0	124	9	0	16	0	25	
Total Volume	0	371	17	0	388	0	0	0	0	0	31	421	0	0	452	37	0	77	0	114	
% App. Total	0	95.6	4.4	0	851	0	0	0	0	0	6.9	93.1	0	0	911	32.5	0	67.5	0	891	
PHF	.000	.883	.472	.000	.851	.000	.000	.000	.000	.000	.646	.907	.000	.000	.911	.841	.000	.837	.000	.891	

**Groups Printed- Autos - Heavy Vehicles**

Start Time	Oltorf Southbound						Westbound						Oltorf Northbound						Thornton Rd Eastbound					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	
16:00	0	106	13	0	119	0	0	0	0	0	0	9	84	0	0	93	8	0	9	0	17	229		
16:15	0	152	7	0	159	0	0	0	0	0	0	10	109	0	0	119	8	0	10	0	18	296		
16:30	0	136	8	0	144	0	0	0	0	0	0	20	120	0	0	140	3	0	9	0	12	296		
16:45	0	113	11	0	124	0	0	0	0	0	0	15	117	0	0	132	3	0	8	0	11	267		
Total	0	507	39	0	546	0	0	0	0	0	0	54	430	0	0	484	22	0	36	0	58	1088		
17:00	0	134	9	0	143	0	0	0	0	0	0	14	117	0	0	131	10	0	7	0	17	291		
17:15	0	182	2	0	184	0	0	0	0	0	0	3	222	0	0	225	21	0	3	0	24	433		
17:30	0	132	7	0	139	0	0	0	0	0	0	21	134	0	0	155	7	0	8	0	15	309		
17:45	0	136	17	0	153	0	0	0	0	0	0	21	126	0	0	147	28	0	13	0	41	341		
Total	0	584	35	0	619	0	0	0	0	0	0	59	599	0	0	658	66	0	31	0	97	1374		
Grand Total	0	1091	74	0	1165	0	0	0	0	0	0	113	1029	0	0	1142	88	0	67	0	155	2462		
Approch % Total %	0	93.6	6.4	0	47.3	0	0	0	0	0	0	9.9	90.1	0	0	46.4	56.8	0	43.2	0	6.3			
% Autos	0	1082	70	0	1152	0	0	0	0	0	0	111	1018	0	0	1129	86	0	65	0	151	2432		
% Heavy Vehicles	0	99.2	94.6	0	98.9	0	0	0	0	0	0	98.2	98.9	0	0	98.9	97.7	0	97	0	97.4	98.8		
% Heavy Vehicles	0	9	4	0	13	0	0	0	0	0	0	2	11	0	0	13	2	0	2	0	4	30		
% Heavy Vehicles	0	0.8	5.4	0	1.1	0	0	0	0	0	0	1.8	1.1	0	0	1.1	2.3	0	3	0	2.6	1.2		

Start Time	Oltorf Southbound						Westbound						Oltorf Northbound						Thornton Rd Eastbound					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	
17:00	0	134	9	0	143	0	0	0	0	0	0	14	117	0	0	131	10	0	7	0	17	291		
17:15	0	182	2	0	184	0	0	0	0	0	0	3	222	0	0	225	21	0	3	0	24	433		
17:30	0	132	7	0	139	0	0	0	0	0	0	21	134	0	0	155	7	0	8	0	15	309		
17:45	0	136	17	0	153	0	0	0	0	0	0	21	126	0	0	147	28	0	13	0	41	341		
Total Volume	0	584	35	0	619	0	0	0	0	0	0	59	599	0	0	658	66	0	31	0	97	1374		
% App. Total	0	94.3	5.7	0	841	0	0	0	0	0	0	9	91	0	0	731	68	0	32	0	97	1374		
PHF	.000	.802	.515	.000	.841	.000	.000	.000	.000	.000	.000	.702	.675	.000	.000	.731	.589	.000	.596	.000	.591	.793		

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1  
Peak Hour for Entire Intersection Begins at 17:00

**G.R.A.M. Traffic, Inc.**  
 3751 FM 1105 Bldg A  
 Georgetown, TX 78626  
 512-832-8650

File Name : HDR-OltorfandThornton-PM  
 Site Code : 00000028  
 Start Date : 6/2/2015  
 Page No : 2

Start Time	Oltorf Southbound				Westbound				Oltorf Northbound				Thornton Rd Eastbound								
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Each Approach Begins at:																					
	17:00				16:00				17:00				17:00				17:00				
+0 mins.	0	134	9	0	143	0	0	0	0	0	14	117	0	0	131	10	0	7	0	17	
+15 mins.	0	182	2	0	184	0	0	0	0	3	222	0	0	0	225	21	0	3	0	24	
+30 mins.	0	132	7	0	139	0	0	0	0	21	134	0	0	0	155	7	0	8	0	15	
+45 mins.	0	136	17	0	153	0	0	0	0	21	126	0	0	0	147	28	0	13	0	41	
Total Volume	0	584	35	0	619	0	0	0	0	59	599	0	0	0	658	66	0	31	0	97	
% App. Total	0	94.3	5.7	0	841	0	0	0	0	9	91	0	0	0	731	68	0	32	0	591	
PHF	.000	.802	.515	.000	.841	.000	.000	.000	.000	.702	.675	.000	.000	.000	.731	.589	.000	.596	.000	.591	

**GRAM Traffic, Inc.**

3751 FM 1105 Bldg A  
Georgetown, TX 78626  
512-832-8650

Site Code: 727  
Station ID:  
Thornton Rd  
South of of Oltorf  
Latitude: 0' 0.0000 Undefined

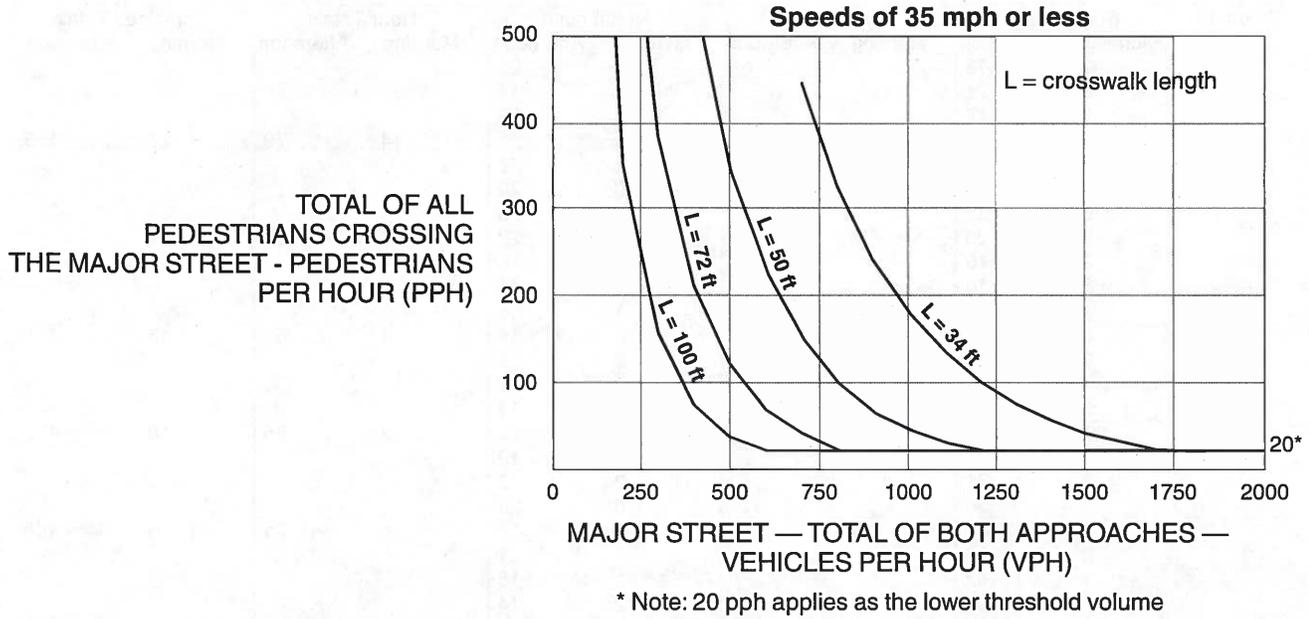
Start Time	02-Jun-15 Tue	Southbound		Hour Totals		Northbound		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		2	15			4	21				
12:15		6	21			2	14				
12:30		2	17			3	23				
12:45		3	24	13	77	5	21	14	79	27	156
01:00		5	29			1	23				
01:15		4	15			0	20				
01:30		0	32			1	20				
01:45		0	20	9	96	1	22	3	85	12	181
02:00		2	16			3	14				
02:15		3	18			0	14				
02:30		4	22			1	16				
02:45		0	17	9	73	0	14	4	58	13	131
03:00		0	21			2	28				
03:15		3	24			0	21				
03:30		2	21			0	13				
03:45		2	19	7	85	1	23	3	85	10	170
04:00		0	31			2	19				
04:15		0	21			2	19				
04:30		1	30			0	20				
04:45		0	31	1	113	1	17	5	75	6	188
05:00		0	25			1	21				
05:15		1	42			1	18				
05:30		2	33			2	14				
05:45		2	55	5	155	7	23	11	76	16	231
06:00		4	26			2	24				
06:15		1	29			2	16				
06:30		7	33			4	15				
06:45		1	30	13	118	6	16	14	71	27	189
07:00		11	18			9	22				
07:15		2	27			32	26				
07:30		13	21			26	21				
07:45		9	21	35	87	24	21	91	90	126	177
08:00		20	19			26	24				
08:15		13	15			33	10				
08:30		16	12			26	20				
08:45		18	18	67	64	27	9	112	63	179	127
09:00		10	21			21	9				
09:15		19	17			20	11				
09:30		17	20			28	8				
09:45		15	19	61	77	33	4	102	32	163	109
10:00		11	14			22	3				
10:15		21	15			15	12				
10:30		22	14			14	8				
10:45		9	4	63	47	25	4	76	27	139	74
11:00		14	10			25	8				
11:15		14	1			16	4				
11:30		14	1			13	0				
11:45		26	4	68	16	24	5	78	17	146	33
<b>Total</b>		<b>351</b>	<b>1008</b>			<b>513</b>	<b>758</b>			<b>864</b>	<b>1766</b>
<b>Percent</b>		<b>25.8%</b>	<b>74.2%</b>			<b>40.4%</b>	<b>59.6%</b>			<b>32.9%</b>	<b>67.1%</b>
<b>Grand Total</b>		<b>351</b>	<b>1008</b>			<b>513</b>	<b>758</b>			<b>864</b>	<b>1766</b>
<b>Percent</b>		<b>25.8%</b>	<b>74.2%</b>			<b>40.4%</b>	<b>59.6%</b>			<b>32.9%</b>	<b>67.1%</b>

ADT

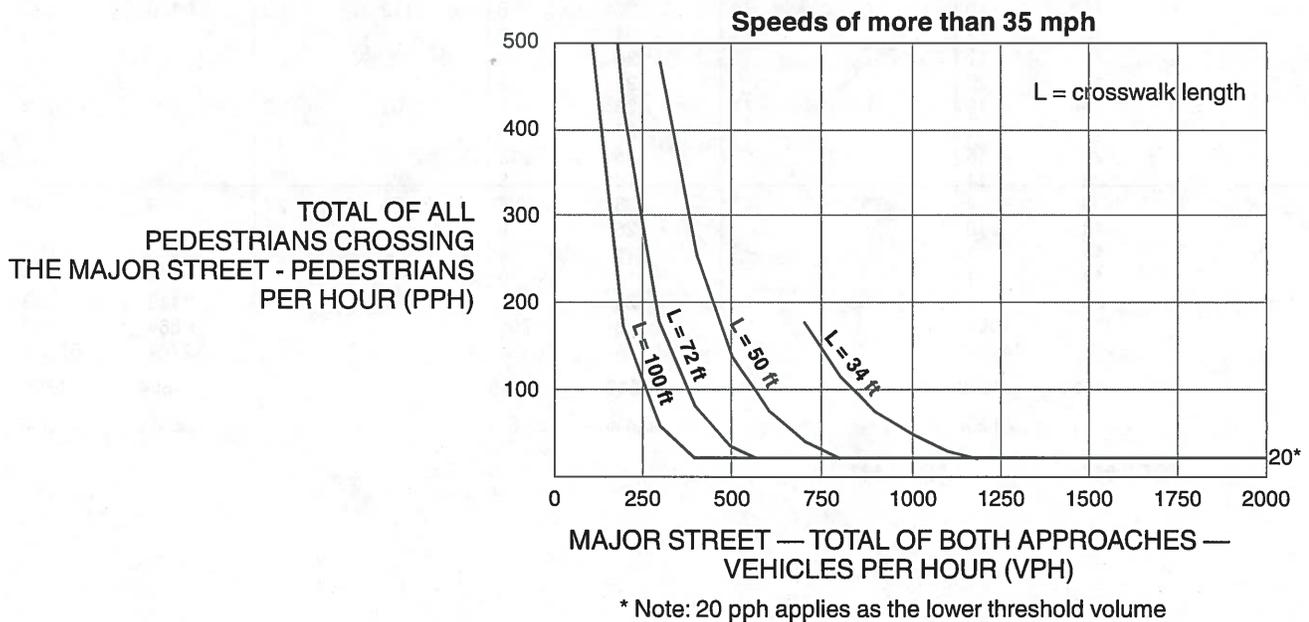
ADT 2,587

AADT 2,587

**Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways**



**Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways**



Item C-17

Crash_Date	Crash_Time	Rpt_Street_Name	Rpt_Street_Sfx	Crash_Speed_Limit	Rpt_Street_Name	Rpt_Street_Sfx	FHE_Collsn_ID	Crash_Sev_ID	Day_of_Week
7/16/2010	6:20 PM	OLORF	ST	35	THORNTON	RD	20 SD BOTH GOING STRAIGHT-REAR END	2	NON-INCAPACITATING
1/11/2011	11:35 AM	OLORF	ST	35	THORNTON	RD	21 SD BOTH GOING STRAIGHT-SIDESWIPE	5	NOT INJURED
4/20/2011	8:06 PM	OLORF	ST	35	THORNTON	RD	34 OD ONE STRAIGHT-ONE LEFT TURN	2	NON-INCAPACITATING
5/22/2011	8:54 PM	THORNTON	RD	0	OLORF	ST	1 OMV VEHICLE GOING STRAIGHT	0	UNKNOWN
11/1/2011	6:11 PM	THORNTON	RD	0	NOT REPORTED	RD	3 OMV VEHICLE TURNING LEFT	5	NOT INJURED
3/23/2012	5:46 PM	OLORF	ST	35	THORNTON	RD	20 SD BOTH GOING STRAIGHT-REAR END	5	NOT INJURED
4/1/2012	11:23 AM	OLORF	ST	35	THORNTON	RD	1 OMV VEHICLE GOING STRAIGHT	2	NON-INCAPACITATING
5/25/2012	3:15 AM	THORNTON	RD	30	OLORF	RD	5 OMV OTHER	0	UNKNOWN
6/13/2012	4:44 PM	OLORF	ST	35	THORNTON	RD	10 ANGLE - BOTH GOING STRAIGHT	5	NOT INJURED
8/1/2012	12:06 PM	OLORF	ST	35	THORNTON	RD	22 SD ONE STRAIGHT-ONE STOPPED	2	NON-INCAPACITATING
9/23/2012	3:30 AM	THORNTON	RD	35	OLORF	ST	1 OMV VEHICLE GOING STRAIGHT	5	NOT INJURED
11/2/2013	3:54 AM	THORNTON	RD	30	OLORF	ST	1 OMV VEHICLE GOING STRAIGHT	5	NOT INJURED
2/15/2014	7:21 PM	OLORF	ST	35	THORNTON	RD	22 SD ONE STRAIGHT-ONE STOPPED	3	POSSIBLE INJURY
8/18/2014	5:51 PM	OLORF	ST	30	THORNTON	RD	21 SD BOTH GOING STRAIGHT-SIDESWIPE	5	NOT INJURED
9/15/2014	2:59 AM	THORNTON	RD	25	W OLORF	ST	1 OMV VEHICLE GOING STRAIGHT	0	UNKNOWN
11/20/2014	8:02 PM	THORNTON RD	RD	-1	W OLORF ST	ST	11 ANGLE - ONE STRAIGHT-ONE BACKING	2	NON-INCAPACITATING
12/19/2014	1:05 PM	OLORF	ST	35	THORNTON	RD	22 SD ONE STRAIGHT-ONE STOPPED	3	POSSIBLE INJURY
1/8/2015	12:59 PM	OLORF	ST	30	THORNTON	ST	22 SD ONE STRAIGHT-ONE STOPPED	3	POSSIBLE INJURY

