



September 25, 2023

Mr. Mike Conger
Knoxville-Knox County Planning
400 Main Street, Suite 403
Knoxville, TN 37902

Re: Traffic Letter for Willow Place Apartments Phase III

Dear Mr. Conger:

Knox Housing Partnership dba HomeSource East Tennessee is proposing an additional 60 apartments units in Phase III for the existing Willow Place Apartment development. The existing development is located at the intersection of Oak Ridge Highway (SR 62) at Willow Bend Way in Knox County, Tennessee. The total area of development is approximately 4.9961 acres and the property is currently zoned PR (Planned Residential Zoning District). Construction is proposed to take place this year and this analysis assumes full build out for the development will occur in 2028.

The proposed driveway connection for the Willow Place Apartments Phase III will tie into Willow Bend Way and access to the site will enter/exit at the existing stop-controlled intersection of Oak Ridge Highway (SR 62) at Willow Bend Way. A copy of the site plan is included in the attachments.

The purpose of this report is to analyze the intersection of Oak Ridge Highway (SR 62) at Willow Bend Way including a turn lane warrant analysis in the form of a Transportation Impact Letter for the Willow Place Apartments Phase III residential development.

Existing Site Conditions

Oak Ridge Highway (SR 62) is a three-lane road with an existing two-way left turn lane at the intersection of Willow Bend Way. The road width is approximately 33 feet. Knoxville-Knox County Planning classifies Oak Ridge Highway (SR 62) between Pellissippi Parkway and the Anderson County Line as a Major Arterial with a 150 foot right-of-way per the Major Road Plan. The TDOT Functional Classification Map classifies Oak Ridge Highway (SR 62) as a Principal Arterial and a part of the National Highway System. The posted speed limit on Oak Ridge Highway (SR 62) is 55 mph.

Willow Bend Way is a two-way road with access to the ORNL Federal Credit Union and the existing Willow Place Apartments. The road width is approximately 26 feet at the intersection with Oak Ridge Highway (SR 62). Knoxville-Knox County Planning does not

classify Willow Bend Way; therefore, it is considered a local street per the Major Road Plan. The posted speed limit within the Willow Place Apartment development is 5 mph.

An aerial photo of the existing intersection of Oak Ridge Highway (SR 62) at Willow Bend Way is included in the attachments.

Traffic Volumes

Ardurra conducted a peak hour turning movement count at the intersection of Oak Ridge Highway (SR 62) at Willow Bend Way on Thursday September 14, 2023. The AM peak hour occurred between 7:15 a.m. and 8:15 a.m. with a peak hour factor (PHF) of 0.97 and the PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a peak hour factor (PHF) of 0.94.

Ardurra conducted a peak hour turning movement count at the intersection of Oak Ridge Highway (SR 62) at Willow Bend Way on Thursday September 14, 2023. During the AM peak hour 7:15 a.m. to 8:15 a.m. the traffic on Willow Bend Way north of the ORNL Federal Credit Union driveway was 3 vehicles exiting northbound and 2 vehicles entering southbound. During the PM peak hour 5:00 p.m. to 6:00 p.m. there were 5 vehicles entering northbound and 6 vehicles exiting southbound.

Figure 1: 2023 Existing Peak Hour Traffic and the traffic data collected are included in the attachments.

Background Growth

TDOT count station #47000262 is located on Oak Ridge Highway (SR 62) east of Willow Bend Way. The annual growth rate for this station over the last twenty years is approximately 0.09%. The 2022 ADT was 14,837 vehicles per day.

In order to calculate traffic for the background year 2028, Ardurra assumed an annual growth rate of 1.0%. Figure 2: 2028 Background Peak Hour Traffic, and the ADT trend line growth charts are included in the attachments.

Trip Generation

The Willow Place Apartments Phase III development proposes 60 apartments units. The Knoxville-Knox County Planning Commission published a memorandum ("Local Trip Generation Rates for Multi-Family Residential Uses", August 14, 2000) for the purpose of providing locally collected data for all multi-family residential developments. The fitted curve equations from the local study were used to calculate site trips for the Willow Place Apartments Phase III.

The land use worksheets are included in the attachments. A trip generation summary is shown below in Table 1 – Trip Generation Summary.

**Table 1 - Trip Generation Summary
 Willow Place Apartments – Phase III**

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Apartments (Local Trip Gen Study)	60 units	603	7	26	28	23

The total new trips generated by the Willow Place Apartments Phase III were estimated to be 603 daily trips. The estimated trips are 33 trips during the AM peak hour and 50 trips during the PM peak hour.

Trip Distribution

The existing trip distribution on Oak Ridge Highway (SR 62) at the intersection with Willow Bend Way is approximately 50% eastbound and 50% westbound during both the AM and PM peak hours.

The directional distribution of the trips generated by the Willow Place Apartments Phase III was determined using the existing traffic volumes at the intersection of Oak Ridge Highway (SR 62) at Willow Bend Way in combination with the concept plan layout. Ardurra assumed an entering trip distribution that is approximately 55% eastbound and 45% westbound and an exiting trip distribution that is approximately 30% eastbound and 70% westbound during both the AM and PM peak hours.

Figure 3: Peak Hour Apartment Distribution, Figure 4: Peak Hour Apartment Site Traffic, and Figure 5: 2028 Full Buildout Site Traffic are included in the attachments.

Turn Lane Warrant Knox County

The intersection of Oak Ridge Highway (SR 62) at Willow Bend Way was evaluated to determine if an eastbound left turn lane or a westbound right turn lane are warranted at the existing intersection. The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to analyze the information.

Oak Ridge Highway (SR 62) at the existing intersection with Willow Bend Way is a three-lane road with a two-way left turn lane.

At the intersection of Oak Ridge Highway (SR 62) at Willow Bend Way an eastbound left turn lane is warranted during the PM peak hour and a westbound right turn lane is not warranted during either the AM or PM peak hour after the full buildout of the Willow Place Apartments Phase III. The turn lane warrant worksheets and analysis are included in the attachments.

Conclusion and Recommendations

Ardurra evaluated the right and left turn lane warrants at the existing intersection of Oak Ridge Highway (SR 62) at Willow Bend Way using the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

A westbound right turn lane is not warranted during either the AM or PM peak hour. There are no recommended improvements to the existing intersection of Oak Ridge Highway (SR 62) at Willow Bend Way after the completion of the Willow Place Apartments Phase III residential development.

It should be noted based on the turning movement count collected that the existing westbound right turning traffic was highest during the hours of 12:00 p.m. to 1:00 p.m. and 3:00 p.m. to 4:00 p.m. which can be attributed to traffic entering the ORNL Federal Credit Union Bank.

I hope that this is helpful. Please contact me if you have any questions.

Thank you,

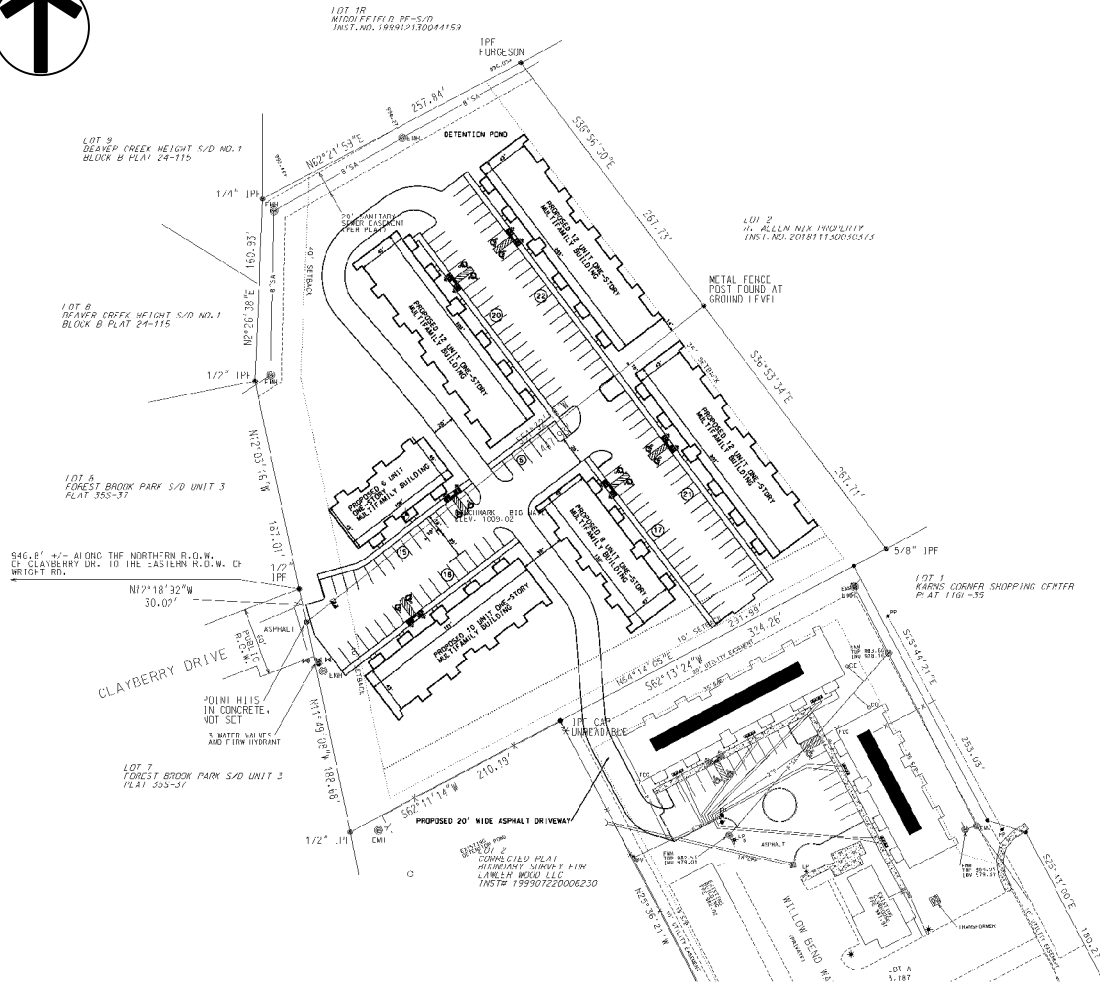


Addie Kirkham, P.E.

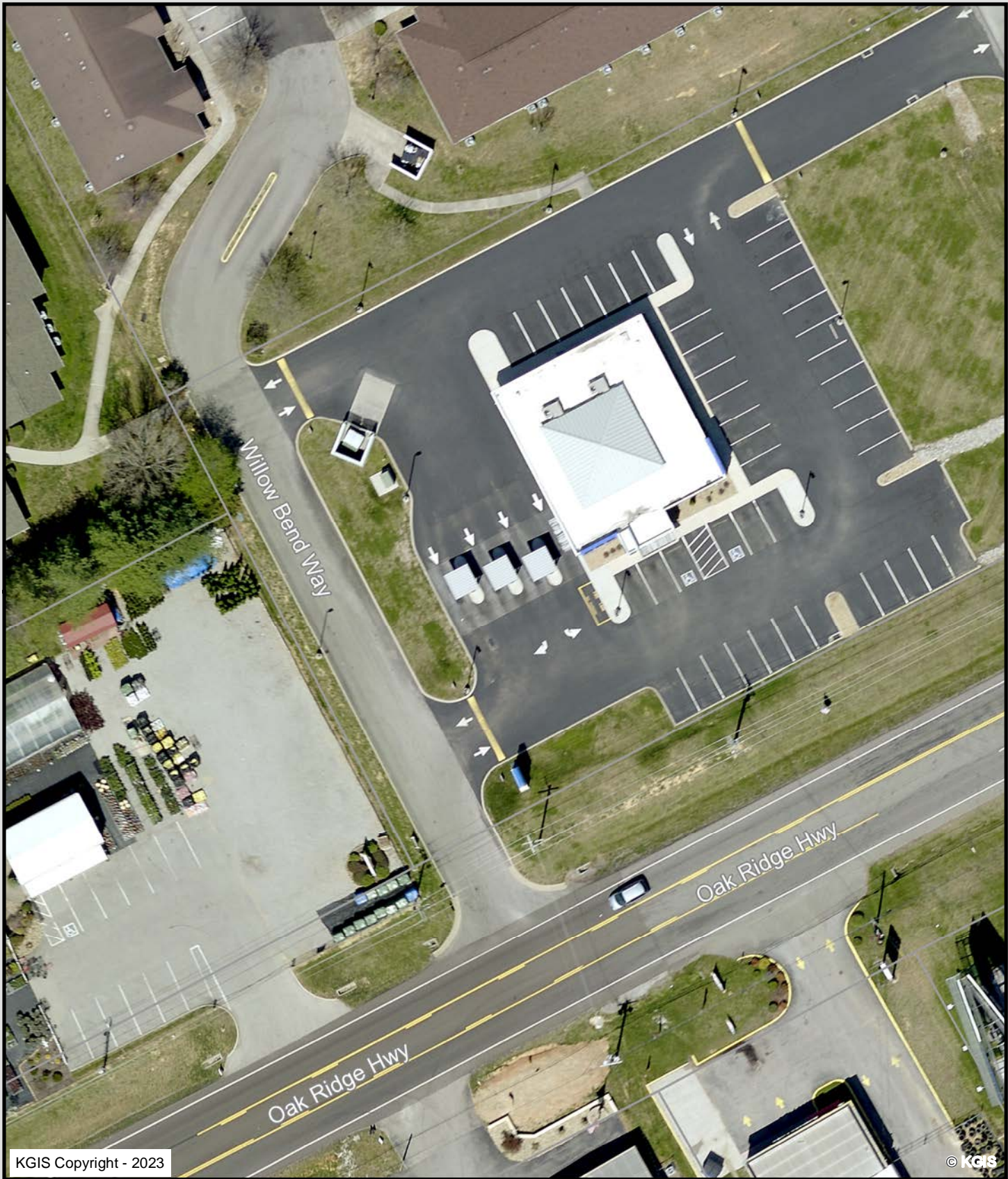
Enclosure: Attachments

Attachments

Willow Place Apartments Phase III
Traffic Letter
September 25, 2023



Apartment Site Layout

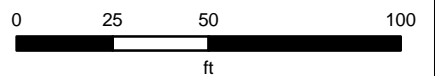


Oak Ridge Hwy at Willow Bend Way

Knoxville - Knox County - KUB Geographic Information System



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Project: 243.252 - Willow Place Apartments Phase III
Intersection: Oak Ridge Highway (SR 62) at Willow Bend Way
Date Conducted: Thursday September 14, 2023

Start	Willow Bend Way Southbound			Oak Ridge Highway Westbound			Oak Ridge Highway Eastbound			Int. Total
	Left	Right	Total	Thru	Right	Total	Left	Thru	Total	
7:00 AM	0	0	0	149	0	149	0	111	111	260
7:15 AM	0	2	2	190	0	190	0	165	165	357
7:30 AM	0	4	4	168	1	169	3	182	185	358
7:45 AM	0	0	0	178	1	179	2	196	198	377
Total	0	6	6	685	2	687	5	654	659	1352
8:00 AM	0	2	2	210	1	211	1	154	155	368
8:15 AM	1	2	3	128	0	128	1	151	152	283
8:30 AM	0	2	2	152	1	153	1	119	120	275
8:45 AM	0	2	2	138	2	140	5	141	146	288
Total	1	8	9	628	4	632	8	565	573	1214
9:00 AM	1	2	3	127	1	128	8	111	119	250
9:15 AM	4	7	11	99	3	102	2	98	100	213
9:30 AM	0	2	2	108	0	108	5	93	98	208
9:45 AM	2	2	4	117	4	121	3	120	123	248
Total	7	13	20	451	8	459	18	422	440	919
10:00 AM	3	5	8	125	2	127	1	112	113	248
10:15 AM	2	4	6	113	6	119	3	100	103	228
10:30 AM	5	8	13	101	4	105	5	109	114	232
10:45 AM	2	3	5	111	2	113	1	107	108	226
Total	12	20	32	450	14	464	10	428	438	934
11:00 AM	4	10	14	110	5	115	3	122	125	254
11:15 AM	0	5	5	100	1	101	2	128	130	236
11:30 AM	2	1	3	110	4	114	4	117	121	238
11:45 AM	1	7	8	118	6	124	1	114	115	247
Total	7	23	30	438	16	454	10	481	491	975
12:00 PM	3	4	7	134	3	137	4	137	141	285
12:15 PM	5	4	9	137	4	141	2	114	116	266
12:30 PM	1	3	4	119	5	124	0	155	155	283
12:45 PM	3	4	7	141	7	148	1	129	130	285
Total	12	15	27	531	19	550	7	535	542	1119
1:00 PM	0	3	3	129	1	130	5	125	130	263
1:15 PM	1	3	4	123	4	127	3	111	114	245
1:30 PM	3	2	5	130	3	133	6	155	161	299
1:45 PM	2	4	6	137	0	137	5	145	150	293
Total	6	12	18	519	8	527	19	536	555	1100
2:00 PM	2	8	10	139	4	143	5	114	119	272
2:15 PM	5	8	13	134	5	139	3	121	124	276
2:30 PM	8	5	13	177	2	179	9	149	158	350
2:45 PM	2	3	5	138	4	142	8	179	187	334
Total	17	24	41	588	15	603	25	563	588	1232
3:00 PM	3	5	8	168	4	172	6	166	172	352
3:15 PM	1	8	9	162	8	170	3	164	167	346
3:30 PM	3	8	11	147	5	152	4	197	201	364
3:45 PM	3	5	8	135	2	137	5	216	221	366
Total	10	26	36	612	19	631	18	743	761	1428
4:00 PM	2	5	7	161	0	161	5	260	265	433
4:15 PM	2	6	8	163	3	166	8	221	229	403
4:30 PM	1	5	6	183	3	186	6	199	205	397
4:45 PM	3	6	9	171	3	174	3	207	210	393
Total	8	22	30	678	9	687	22	887	909	1626
5:00 PM	0	3	3	201	0	201	1	239	240	444
5:15 PM	2	2	4	186	2	188	2	223	225	417
5:30 PM	1	9	10	198	3	201	6	192	198	409
5:45 PM	0	7	7	209	4	213	5	178	183	403
Total	3	21	24	794	9	803	14	832	846	1673
Grand Total	83	190	273	6374	123	6497	156	6646	6802	13572
Approach %	30.4	69.6		98.1	1.9		2.3	97.7		
Total %	0.6	1.4	2.0	47.0	0.9	47.9	1.1	49.0	50.1	

Project: 243.252 - Willow Place Apartments Phase III
Intersection: Oak Ridge Highway (SR 62) at Willow Bend Way
Date Conducted: Thursday September 14, 2023

AM Peak Hour	7:15 AM - 8:15 AM	1460
PM Peak Hour	5:00 PM - 6:00 PM	1673

Start	Willow Bend Way Southbound			Oak Ridge Highway Westbound			Oak Ridge Highway Eastbound			Int. Total
	Left	Right	Total	Thru	Right	Total	Left	Thru	Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:15 AM										
7:15 AM	0	2	2	190	0	190	0	165	165	357
7:30 AM	0	4	4	168	1	169	3	182	185	358
7:45 AM	0	0	0	178	1	179	2	196	198	377
8:00 AM	0	2	2	210	1	211	1	154	155	368
Total Volume	0	8	8	746	3	749	6	697	703	1460
Future (1% over 5 yrs)	0	8		784	3		6	733		1534
PHF	-	0.50		0.89	0.75		0.50	0.89		0.97
Peak Hour Analysis from 2:00 PM to 6:00 PM										
PM Peak Hour begins at 5:00 PM										
5:00 PM	0	3	3	201	0	201	1	239	240	444
5:15 PM	2	2	4	186	2	188	2	223	225	417
5:30 PM	1	9	10	198	3	201	6	192	198	409
5:45 PM	0	7	7	209	4	213	5	178	183	403
Total Volume	3	21	24	794	9	803	14	832	846	1673
Future (1% over 5 yrs)	3	22		835	9		15	874		1758
PHF	0.38	0.58		0.95	0.56		0.58	0.87		0.94

Project: 243.252 - Willow Place Apartments Phase III
Intersection: Oak Ridge Highway (SR 62) at Willow Bend Way
Date Conducted: Thursday September 14, 2023

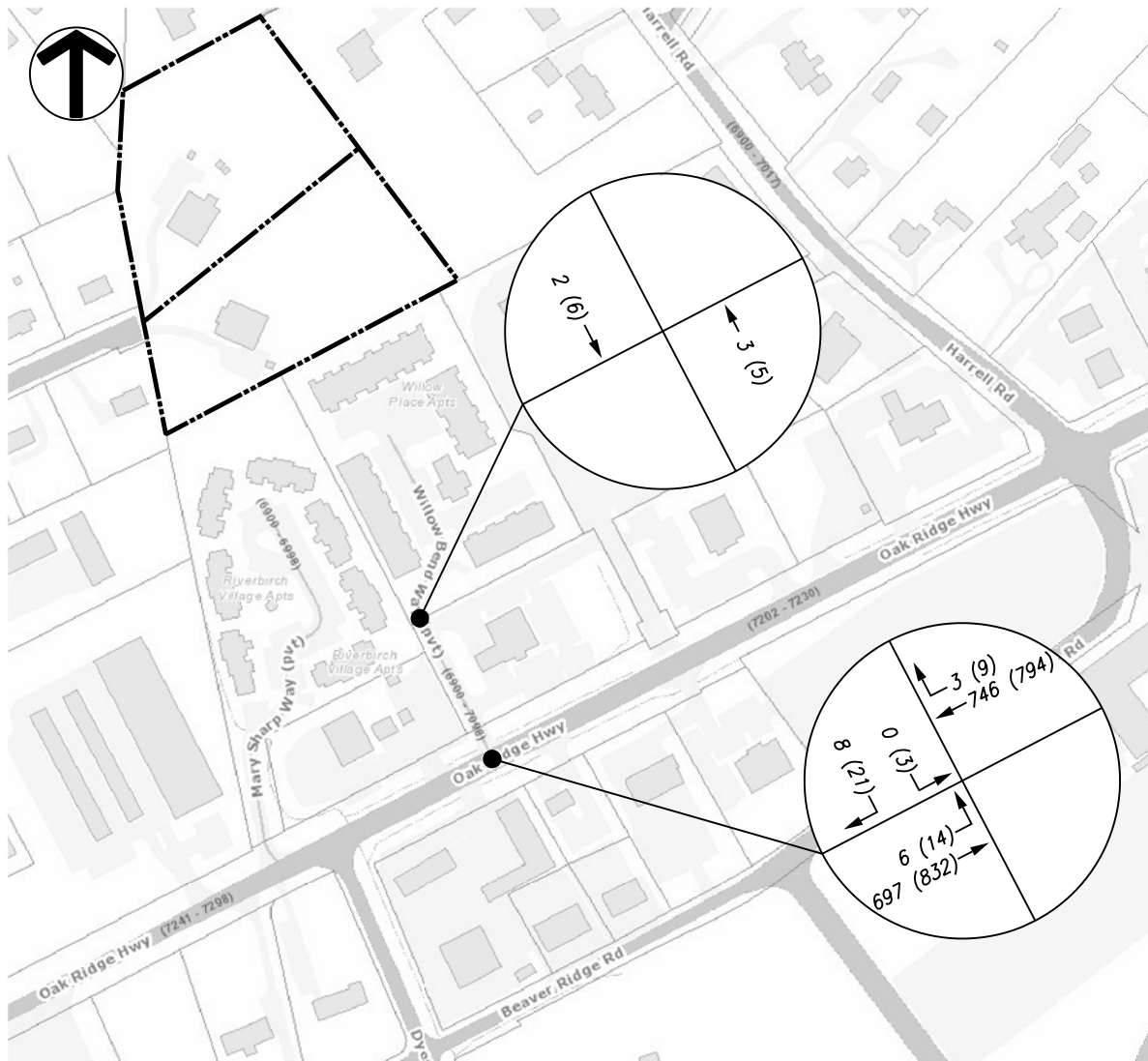
Start	Willow Bend Way Southbound			Willow Bend Way Northbound			Int. Total
	Left	Thru	Total	Thru	Right	Total	
7:15 AM	-	0	0	0	-	0	0
7:30 AM	-	0	0	1	-	1	1
7:45 AM	-	1	1	2	-	2	3
8:00 AM	-	1	1	0	-	0	1
Total	-	2	2	3	-	3	5
5:00 PM	-	1	1	1	-	1	2
5:15 PM	-	5	5	3	-	3	8
5:30 PM	-	0	0	1	-	1	1
5:45 PM	-	0	0	0	-	0	0
Total	-	6	6	5	-	5	11

Project: 243.252 - Willow Place Apartments Phase III
Intersection: Oak Ridge Highway (SR 62) at Willow Bend Way
Date Conducted: Thursday September 14, 2023

AM Peak Hour	7:15 AM - 8:15 AM	5
PM Peak Hour	5:00 PM - 6:00 PM	11

Start	Willow Bend Way Southbound			Oak Ridge Highway Westbound			Int. Total
	Left	Thru	Total	Thru	Right	Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM							
AM Peak Hour begins at 7:15 AM							
7:15 AM	0	0	0	0	0	0	0
7:30 AM	0	0	0	1	0	1	1
7:45 AM	0	1	1	2	0	2	3
8:00 AM	0	1	1	0	0	0	1
Total Volume	0	2	2	3	0	3	5
Future (1% over 5 yrs)	0	2		3	0		5
PHF	-	0.50		0.38	-		0.42
Peak Hour Analysis from 2:00 PM to 6:00 PM							
PM Peak Hour begins at 5:00 PM							
5:00 PM	0	1	1	1	0	1	2
5:15 PM	0	5	5	3	0	3	8
5:30 PM	0	0	0	1	0	1	1
5:45 PM	0	0	0	0	0	0	0
Total Volume	0	6	6	5	0	5	11
Future (1% over 5 yrs)	0	6		5	0		12
PHF	-	0.30		0.42	-		0.34

Willow Place Apartments Phase III
 Traffic Letter
 September 25, 2023

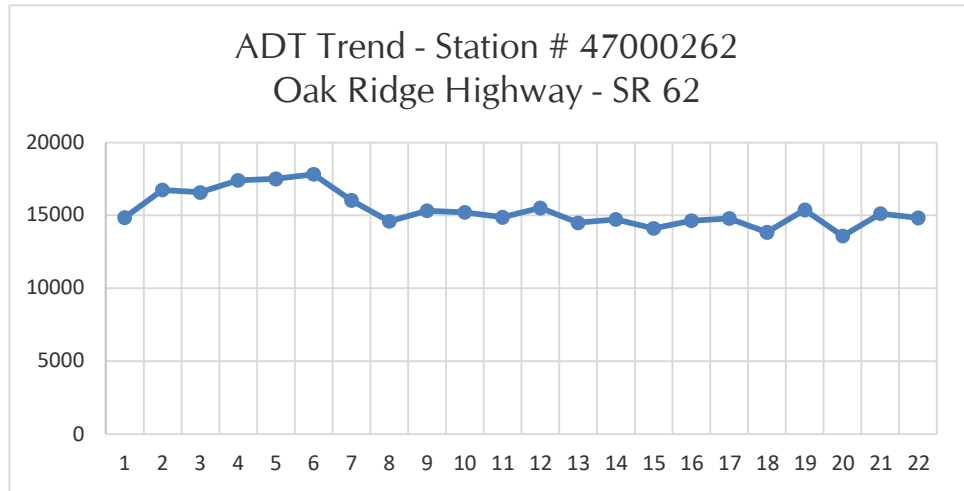


LEGEND:

← 5 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 1: 2023 Existing Peak Hour Traffic

Year	Adjusted Average Daily Traffic
2001	14864
2002	16762
2003	16593
2004	17414
2005	17506
2006	17831
2007	16032
2008	14611
2009	15324
2010	15208
2011	14876
2012	15509
2013	14490
2014	14729
2015	14118
2016	14647
2017	14793
2018	13847
2019	15374
2020	13594
2021	15134
2022	14837

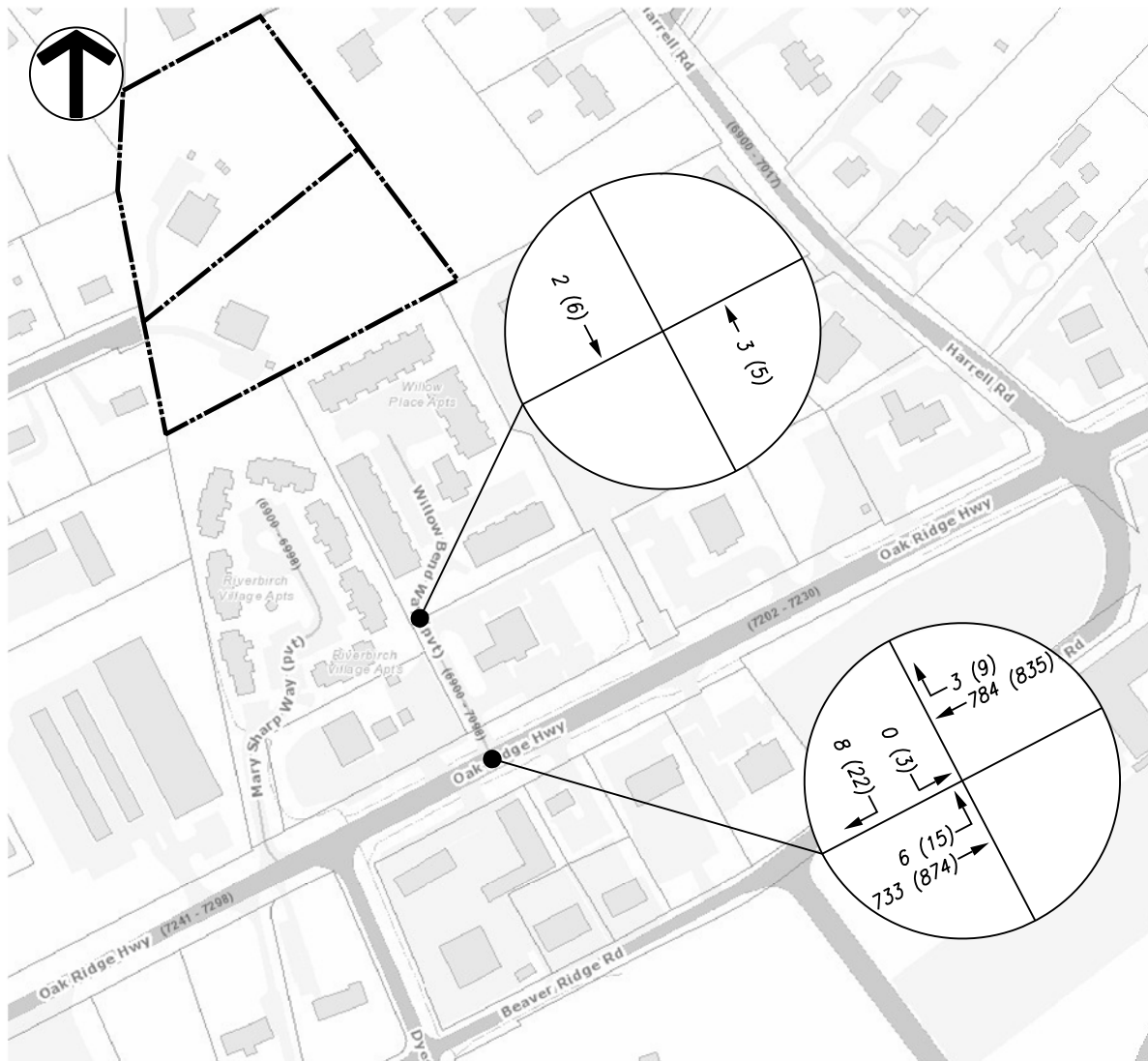


Most Recent Trend Line Growth

Year	ADT
2001	14864
2021	15134

Annual Percent Growth 0.09%

Willow Place Apartments Phase III
 Traffic Letter
 September 25, 2023



LEGEND:

← 5 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 2: 2028 Background Peak Hour Traffic

Project: Willow Place Apartments Phase III

Date Conducted: 9/13/2023

**Local Apartment Trip Generation Study
60 Apartment Units**

Average Daily Traffic

$$T = 15.193*(X)^{0.899}$$

$$T = 15.193*(60)^{0.899}$$

$$T = 603$$

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

$$T = 0.758*(X)^{0.924}$$

$$T = 0.758*(60)^{0.924}$$

$$T = 33$$

Peak Hour of Adjacent Street Traffic

One Hour Between 4 and 6 p.m.

$$T = 0.669(X) + 10.069$$

$$T = 0.669(60) + 10.069$$

$$T = 50$$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	603	50%	50%	302	302
AM Peak Hour	33	22%	78%	7	26
PM Peak Hour	50	55%	45%	28	23



MEMORANDUM

To: Traffic Impact Study Reviewers and Preparers (see attached list)

From: Mike Conger *ADC*

Date: August 14, 2000

Subject: Local Trip Generation Rates for Multi-Family Residential Uses

Attached please find a summary of the final report with data plots for the Knox County Local Apartment Trip Generation Study. As you will recall, this report was discussed when the traffic impact study group last convened this past February. A consensus was reached at that meeting that the trip generation rates developed in the local study should be used for new apartment complexes and any other "multi-family" residential uses that are being proposed.

The MPC voted at its July 2000 meeting to officially amend the Traffic Impact Study Guidelines with language which reads that "trip generation rates for proposed uses shall be calculated using the latest edition of the ITE Trip Generation Manual, or using local data when it is available". This amendment allows the full implementation of the new rates, and they should be used for future proposed multi-family developments unless it can be demonstrated otherwise.

Thanks for your assistance and cooperation in this matter, if there are any questions or comments, please let me know.

TRAFFIC IMPACT STUDY REVIEWER & PREPARER GROUP

Name	Organization	Phone Number
Daniel Armstrong	Wilbur Smith	584-8584
Rusty Baksa	Land Dev. Solutions	671-2281
Kim Henry Begg	SITE, inc.	693-5010
Mark Best	TDOT	594-9170
Alan Childers	Cannon & Cannon	988-4818
Steve Drummer	Barge Waggoner	637-2810
Mark Geldmeier	City of Knoxville	215-6100
John Gould	Wilbur Smith	584-8584
Barbara Hatcher	SITE, inc.	693-5010
John Heid	AR/TEC	681-8848
Bill Kervin	Allen Hoshall	694-1834
Hollis Loveday	Wilbur Smith	584-8584
David McGinley	City of Knoxville	215-2148
David Moore	TDOT	594-9170
Linda Mosch	Consultant	777-2025
Amanda Rule	TDOT	594-9170
Cindy Pionke	Knox County	215-5800
Pam Porter	TDOT	594-9170
John Sexton	Allen Hoshall	694-1834
Jim Snowden	Knox County	215-5800
Darcy Sullivan	SITE, inc.	693-5010
Jeff Welch	MPC	215-2500

KNOX COUNTY
LOCAL APARTMENT TRIP GENERATION STUDY

PURPOSE

A Traffic Impact Study (TIS) is currently required in Knox County when a proposed development is projected to generate in excess of 750 trips per day. The determinations of when the threshold is met as well as all subsequent analyses in the TIS are performed using the rates and equations given in the Institute of Transportation Engineers (ITE) Trip Generation Manual. Local governmental agencies rely heavily on the accuracy of these trip generation rates in order to correctly predict the impacts of a proposed development on the transportation system. Therefore, in certain instances, it is logical to verify whether the “national” rates and equations given in the ITE Trip Generation Manual are appropriate for use in a specific local area or region.

The decision was made to study the local trip-making characteristics of apartments because of the discrepancy between the trip generation rates for apartments and single family residential land uses as given in the ITE Trip Generation Manual. While these two land uses are similar in nature, the Trip Generation Manual predicts about three less trips per dwelling unit generated by apartments for the average weekday. Additionally the Trip Generation Manual points out that due to the age of their database, which dates back to the 1960’s, “the rates for apartments probably had changed over time”. It is also assumed that some of the ITE data had come from larger metropolitan areas with denser development and greater transit use than Knox County, which would contribute to lower trip generation rates. Therefore, this study will be used to either verify the rates given in the Trip Generation Manual or generate new ones that can be applied to locally proposed apartment developments.

PROCEDURE

The procedures recommended by ITE in conducting local trip generation studies were generally followed for this study, along with some important assumptions that have made. ITE has published a proposed recommended practice entitled “Trip Generation Handbook” which specifically outlines procedures for conducting local trip generation studies and establishing new rates and equations.

The first step in the study was to define the number and location of the sites to be studied, as well as the counting methodology. Initially 14 sites were selected, although one apartment complex – the College Park Apartments – was later omitted due to uncharacteristically high traffic generation numbers. The number of sites used in this study far exceeds the recommended minimum amount suggested by ITE, which is five sites. Traffic counts were taken for week-long periods at 15-minute intervals between July 22, 1996 and August 9, 1996 at the access points to the apartment complexes. A Technical Appendix to this report contains the traffic count data collected at each apartment complex.

RESULTS

The traffic count data was analyzed using spreadsheets in order to determine the weighted average rates and regression equations. In order to be considered valid, the local rates and equations for each time period of analysis that were generated must meet certain statistical criteria. First, the standard deviation of the independent variable (dwelling units) should be no more than 110 percent of the weighted average rate; and secondly, the regression equations require a computed coefficient of determination (R^2) value of at least 0.75 before good data fit is indicated. This statistical criteria is met by the local data results, and in fact it often exceeds the level of data fit given by their counterparts in the ITE Trip Generation Manual. Finally, in order to simplify the use of the local data, plots were generated that appear identical to the actual ones in the ITE Trip Generation Manual.

The resulting rates and equations calculated from the local data indicate that the average weekday trip generation of apartments in this area is well above the national rates reported in the ITE manual. For example, the locally computed average rate for number of trips generated during a weekday is 35% higher than the rate given by ITE (increase from 6.63 trips per dwelling unit to 9.03 trips per dwelling unit). The trip generation rates do not increase as much for the AM and PM peak hours however. The local rate is roughly 8% higher for the AM peak, and 16% higher for the PM peak. The plots from the ITE Trip Generation Manual are included in the Technical Appendix for comparison purposes.

ASSUMPTIONS MADE

Some important assumptions have been made which may affect the results of the local data that was collected:

- It is important to note that the local trip generation rates were computed for the *total* number of dwelling units in the apartment complex, and not necessarily for the number of *occupied* dwelling units. There are several reasons why this was done, chiefly because of the need for comparability with the rates given in ITE Trip Generation Manual, as it does not specify whether the dwelling units are occupied. According to ITE procedures the selected sites must only be of “reasonably full occupancy (i.e. at least 85%)”. The Apartment Association of Greater Knoxville (AAGK) publishes quarterly reports on occupancy levels of apartment complexes, and the report covering the period of the data collection was reviewed to determine occupancy levels. According to the AAGK report from July 1, 1996 – September 30, 1996 all of the apartment complexes surveyed in this study met the minimum 85% occupancy level, with an average occupancy rate for all sites studied of 94%.
- The count data that was collected at each apartment complex was used “raw” meaning that it was not factored for possible daily or seasonal variations. Once again, according to an ITE representative it is not known whether the data used in the Trip Generation Manual was factored or not, so therefore in order to be able to compare

local rates to those in the manual you must assume that count data should not be factored. Additionally, it was felt that apartment complexes would generally not be as susceptible to major seasonal fluctuations as other land uses might be. The local rates were also developed using count data that was collected and averaged over an entire week, which should limit some of the daily variations. Finally, reliable local daily and seasonal variation factors do not truly exist.

CONCLUSION

The local apartment study methodology and results were distributed for comment to a group of local transportation professionals who are directly responsible for either preparing or reviewing traffic impact studies. A meeting was held between this group on February 16, 2000 in order to gather comments and discuss the study in greater detail. The following conclusions are based on the discussion and consensus reached at this meeting:

1. The trip generation rates and equations meet statistical requirements and resulted from a study that followed accepted procedures; therefore they should be adopted for future use. Furthermore, the rates and equations are recommended for use in reviewing the traffic impact of any development termed as “multi-family”, such as townhouse and condominium developments due to their similarity to apartment complexes.
2. The Traffic Access and Impact Study Guidelines and Procedures adopted by MPC should be amended with the language that local data should be used when available, which will allow the implementation of these new multi-family trip generation rates.
3. The following suggestions were made for future consideration:
 - This study should be updated with data collected from local townhouse and condominium developments in order to further justify the use of the new trip generation rates.
 - A statistical comparison should be made between any newly developed rates and the ITE single family trip generation rates to determine if there is a significant difference. If there is no difference then perhaps ITE single-family rates could be used for any residential development proposed in Knox County.

Local Apartment Trip Generation Study

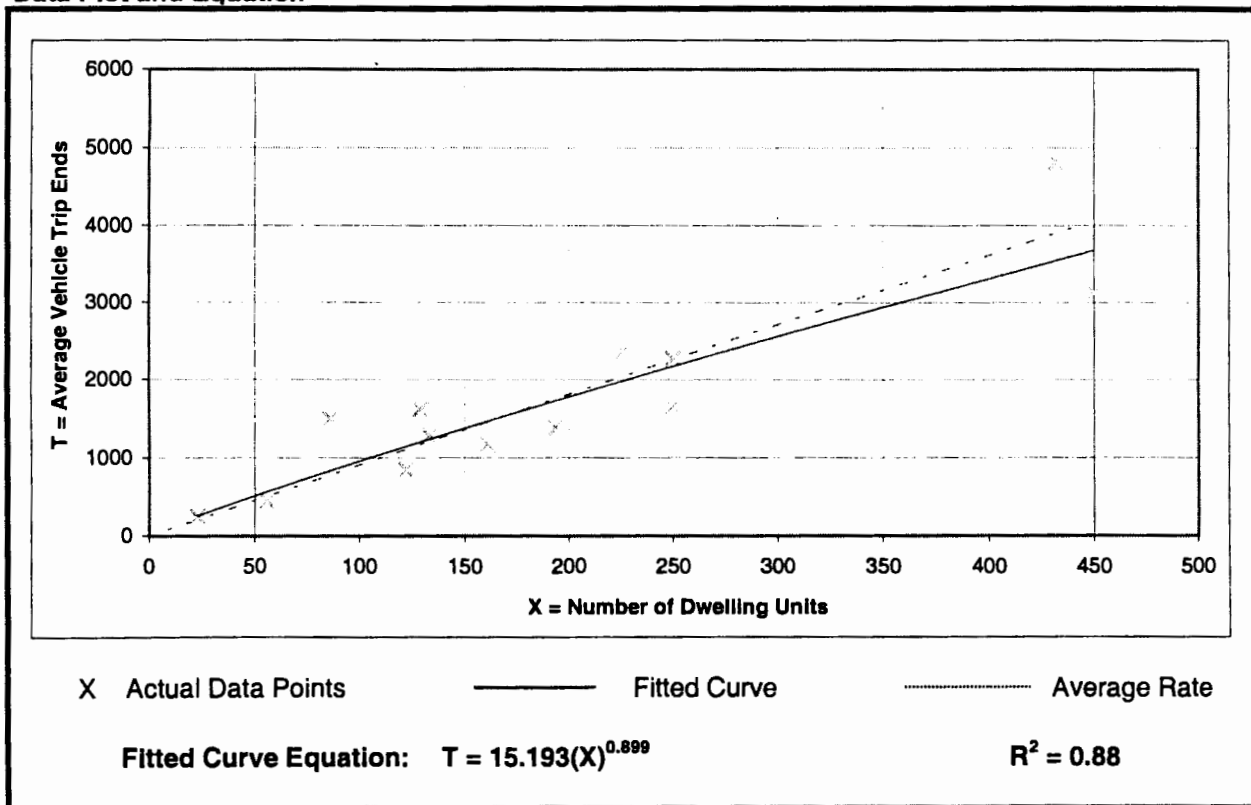
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 13
Average Number of Dwelling Units: 193
Directional Distribution: 50% entering, 50% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
9.03	6.59 - 17.41	2.47

Data Plot and Equation



Local Apartment Trip Generation Study

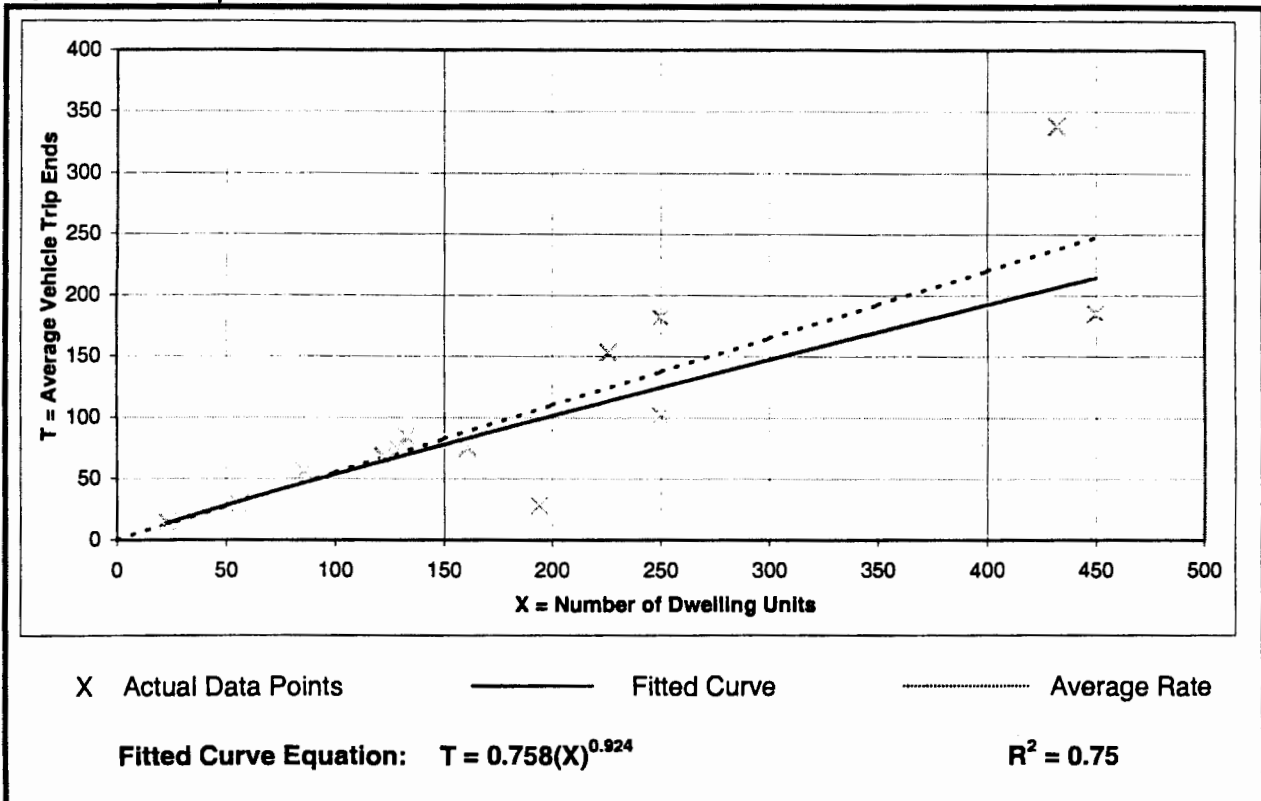
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 7 and 9 a.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 22% entering, 78% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.55	0.14 - 0.78	0.18

Data Plot and Equation



Local Apartment Trip Generation Study

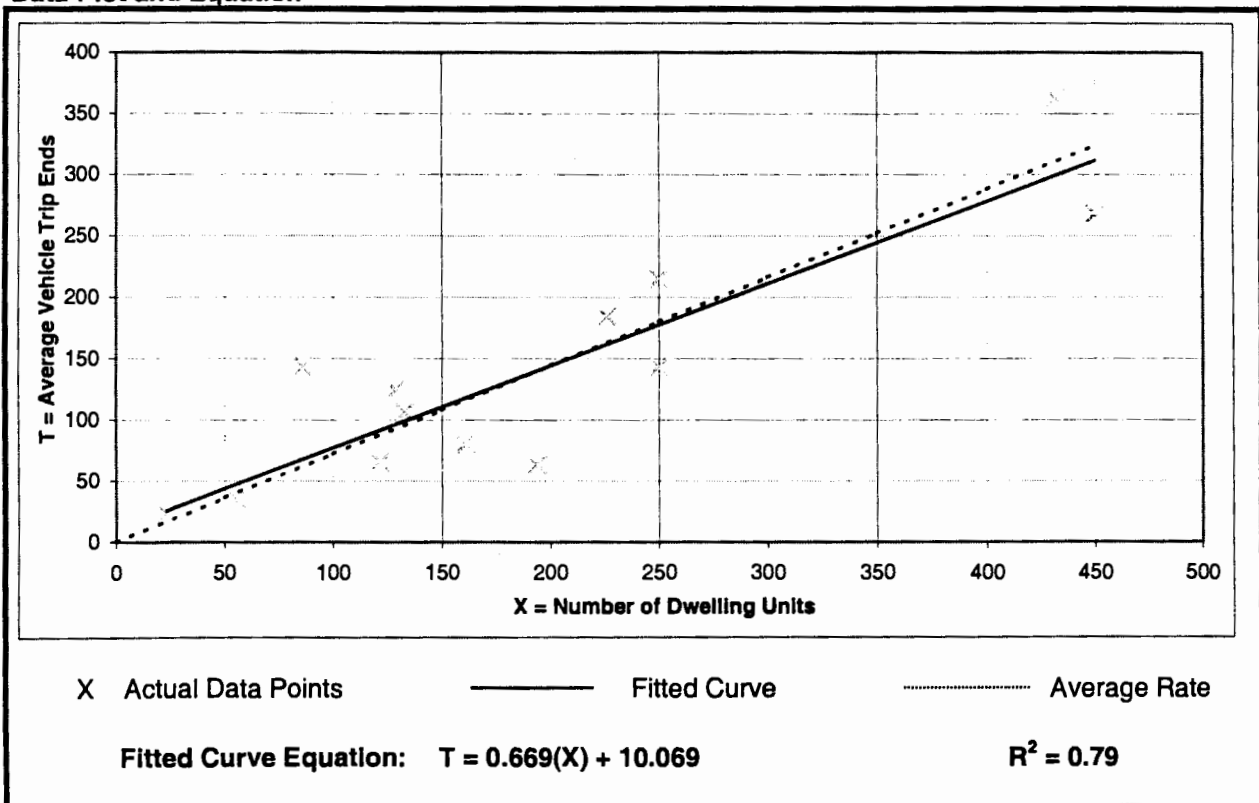
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 55% entering, 45% exiting

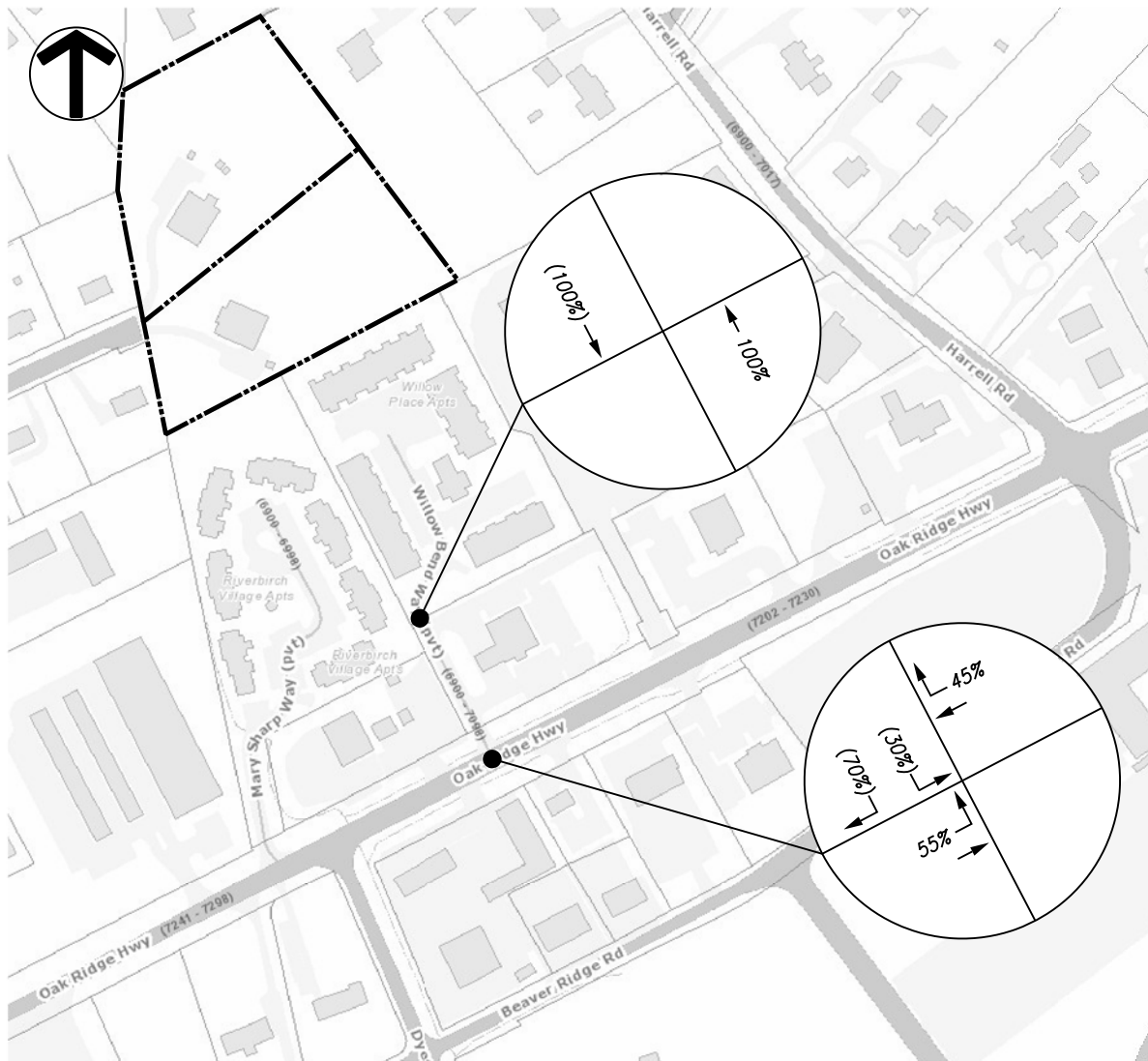
Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.72	0.32 - 1.66	0.25

Data Plot and Equation



Willow Place Apartments Phase III
 Traffic Letter
 September 25, 2023

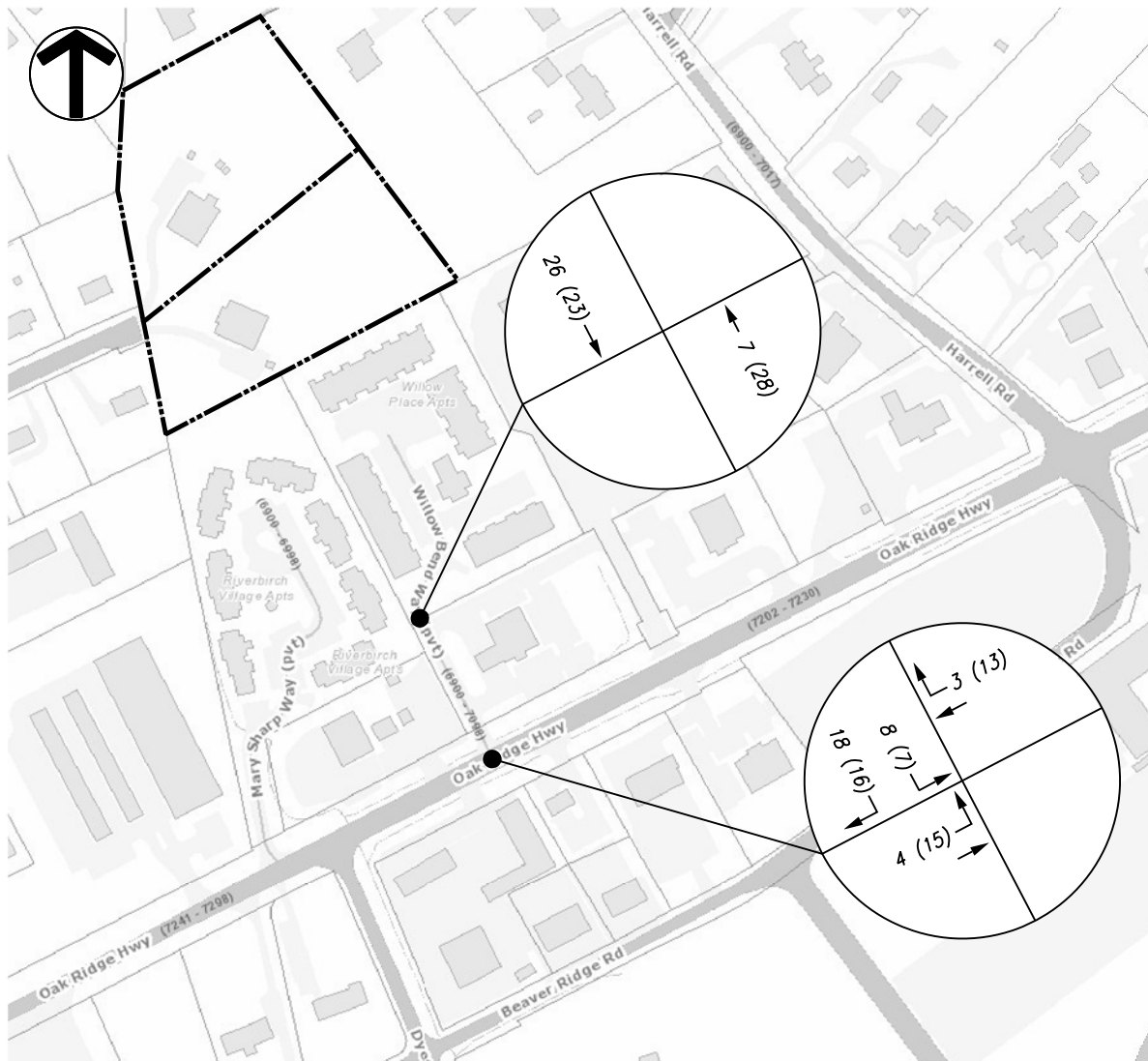


LEGEND:

← 50% (50%) TRIP DISTRIBUTION ENTER (EXIT)

Figure 3: Peak Hour Apartment Trip Distribution

Willow Place Apartments Phase III
 Traffic Letter
 September 25, 2023

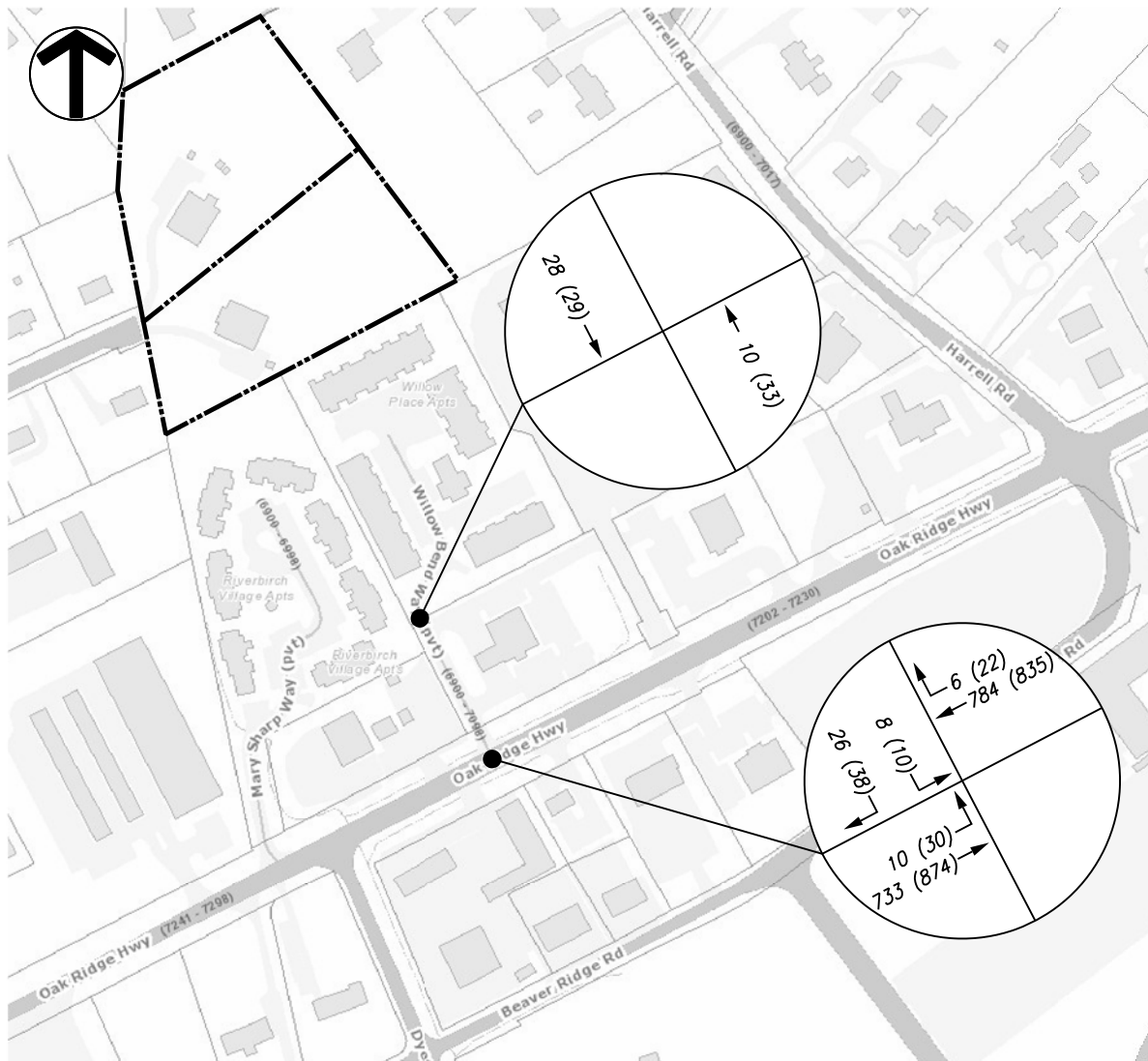


LEGEND:

← 5 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 4: Peak Hour Apartment Site Traffic

Willow Place Apartments Phase III
 Traffic Letter
 September 25, 2023



LEGEND:

← 5 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 5: 2028 Full Buildout Site Traffic

Project: Willow Place Apartments Phase III

Oak Ridge Highway (SR 62) at Willow Bend Way

**Oak Ridge Highway (SR 62)
at Willow Bend Way**

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	790	733	10	15	NO
PM	857	874	30	15	YES

**Oak Ridge Highway (SR 62)
at Willow Bend Way**

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	784	6	25	NO
PM	835	22	25	NO

TABLE 6A

LEFT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 MPH

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	210	140	100	75	60	50
150 - 199	175	120	85	65	55	45
200 - 249	150	100	75	60	50	40
250 - 299	130	85	65	55	45	35
300 - 349	110	75	60	50	40	30
350 - 399	95	65	55	45	35	25
400 - 449	80	60	50	40	30	25
450 - 499	70	55	45	35	25	20
500 - 549	60	50	40	30	25	20
550 - 599	50	45	35	25	20	20
600 - 649	45	40	30	25	20	20
650 - 699	40	35	30	20	20	20
700 - 749	35	35	25	20	20	15
750 or More	35	35	25	20	15	15

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149	50	45	40	35	30	25
150 - 199	45	40	35	30	30	25
200 - 249	40	35	30	25	25	20
250 - 299	35	35	30	25	25	20
300 - 349	30	30	25	25	20	20
350 - 399	25	25	25	20	20	20
400 - 449	25	25	20	20	20	15
450 - 499	20	20	20	20	20	15
500 - 549	20	20	20	20	15	15
550 - 599	20	20	20	15	15	15
600 - 649	20	20	15	15	15	15
650 - 699	20	15	15	15	15	15
700 - 749	15	15	15	15	15	15
750 or More	15	15	15	15	15	15

* Or through volume only if a right-turn lane exists.

AM Peak 10 LT
PM Peak 30 LT

TABLE 6B

RIGHT-TURN LANE VOLUME THRESHOLDS:
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 MPH

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99						
100 - 149 150 - 199						Yes
200 - 249 250 - 299				Yes	Yes	Yes
300 - 349 350 - 399			Yes	Yes	Yes	Yes
400 - 449 450 - 499		Yes	Yes	Yes	Yes	Yes
500 - 549 550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99			Yes	Yes	Yes	Yes
100 - 149 150 - 199	Yes	Yes	Yes	Yes	Yes	Yes
200 - 249 250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349 350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449 450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549 550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

AM Peak 6 RT
PM Peak 22 RT

* Or through volume only if a left-turn lane exists.