



January 19, 2024

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

Re: Traffic Letter for Twin Oak Landing Subdivision

Dear Mr. Conger:

Highway Markings, Inc is in the construction phase of the proposed Twin Oak Landing Subdivision located at 7718 and 7615 Twin Oak Lane in Knoxville, Tennessee. The development will consist of a total of 111 single family lots. Construction is proposed to take place this year and this analysis assumes full build out for the development will occur in 2026.

Access to/from the proposed subdivision will access the roadway network at the existing intersection of Twin Oak Lane at Tazewell Pike (SR 131). The intersection is located approximately 800 feet north of the Gibbs Elementary School Access Road and approximately 1,450 feet south of the intersection of Barker Road.

Sidewalks are proposed throughout the subdivision as well as along Tazewell Pike (SR 131) to allow pedestrian access to the Gibbs Schools. A copy of the latest Concept Plan layout is included in the attachments.

Fulghum, MacIndoe & Associates conducted a traffic impact study for this development "Twin Oak Landing Subdivision" revised April 26, 2017. As a result of this traffic impact study a northbound left turn lane with a 75 foot storage length and a 165 foot bay taper length was recommended to be installed at the existing intersection of Tazewell Pike (SR 131) at Twin Oak Lane during the construction of the Twin Oak Landing Subdivision.

The purpose of this traffic letter is to update the turn lane warrant analysis and recommendations per the TDOT Highway System Access Manual.

Existing Site Conditions

Tazewell Pike (SR 131) is a two-lane road at the intersection with Twin Oak Lane. Knoxville-Knox County Planning classifies Tazewell Pike (SR 131) as a Minor Arterial with an 88 feet right-of-way between Old Broadway and the Union County Line per the Major Road Plan. The posted speed limit on Tazewell Pike (SR 131) is 40 mph. Tazewell Pike

(SR 131) has no existing sidewalks or designated bike lanes in the vicinity of the proposed development.

Twin Oak Lane is a two-lane dead-end road. The Knoxville-Knox County Planning Major Road Plan does not classify Twin Oak Lane; therefore, it is considered a local street. There is no posted speed limit on Twin Oak Lane.

An aerial photo of the existing intersection of Tazewell Pike (SR 131) at Twin Oak Lane is included in the attachments.

Traffic Volumes

Fulghum, MacIndoe & Associates conducted a six-hour turning movement count at the intersection of Tazewell Pike (SR 131) and Twin Oak Lane on Wednesday March 22, 2017. The AM peak hour occurred between 7:00 a.m. and 8:00 a.m. with an AM PHF (peak hour factor) of 0.75 and the PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.89. The existing AM and PM peak hour traffic volumes are shown in Figure 1 and the count data collected is included in the attachments.

Background Growth

The annual growth rate for the TDOT station #47000006 between 2002 and 2022 is approximately 0.36% and the 2022 ADT was 8,384 vehicles per day. In order to calculate traffic for the background year 2026 an annual growth rate of 1% was used. The TDOT trend line growth chart is included in the attachments.

In addition to the background growth, the trips from the new Gibbs Middle School located near the intersection of Tazewell Pike (SR 131) and Twin Oak Lane were calculated and included in the projected background peak hour traffic. Gibbs Middle School was designed with a capacity for 800 students. Middle School/Junior High School or Land Use 522 was used to calculate site trips for the proposed Gibbs Middle School using the average rate from Trip Generation, 11th Edition, published by the Institute of Transportation Engineers. The land use worksheets are included in the attachments and a trip generation summary is shown in Table 1.

Table 1
Gibbs Middle School
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Middle School / Junior High School (Land Use 522)	800 Students	1,680	289	247	58	62

The "Twin Oak Landing Subdivision" traffic impact study conducted by Fulghum, MacIndoe & Associates and revised April 26, 2017 made the following assumptions

regarding trip distribution for the Gibbs Middle School which opened its doors to students in the Fall of 2018. "It is expected that the traffic at the intersection of Twin Oak Lane at Tazewell Pike (SR 131) will increase by approximately 15% of the entering traffic (southbound) and 15% of the exiting traffic (northbound)."

The resulting additional trips from the Gibbs Middle School were estimated to be 43 trips during the AM peak hour and 9 trips during the PM peak hour for the southbound thru movement and 37 trips during the AM peak hour and 9 trips during the PM peak hour for the northbound thru movement. The proposed background trips from the Gibbs Middle School were added to the intersection of Tazewell Pike (SR 131) and Twin Oak Lane for the background peak hour.

Figure 3 demonstrates the projected background peak hour volumes at the intersection after applying both the background growth rate and the inclusion of the additional trips from the Gibbs Middle School to the existing conditions.

Trip Generation

The Twin Oak Landing Subdivision residential development proposes 111 single family lots. Single-Family Detached Housing or Land Use 210 was used to calculate site trips for the development using the fitted curve equations from the *Trip Generation, 11th Edition*, published by the Institute of Transportation Engineers. Land use worksheets are included in the attachments.

The total combined new trips generated by the Twin Oak Landing residential development were estimated to be 1,111 daily trips. The estimated trips are 82 trips during the AM peak hour and 110 trips during the PM peak hour. A trip generation summary is shown in Table 2.

**Table 2
 Twin Oak Landing Subdivision
 Trip Generation Summary**

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Single-Family Detached Housing (LUC 210)	111 Lots	1,111	21	61	69	41

Trip Distribution

The directional distribution of the traffic generated by the proposed Twin Oak Landing Subdivision was determined using the traffic data collected for the existing conditions. The typical weekday traffic pattern is for traffic to flow heavier in one direction in the morning peak period and then for the traffic to be heavier in the opposite direction during the evening peak period. Tazewell Pike (SR 131) at the intersection with Twin Oak Lane has an

existing trip distribution of 25% northbound and 75% southbound during the AM peak hour and 65% northbound and 35% southbound during the PM peak hour.

The entering/exiting trip distribution for the proposed Twin Oak Landing subdivision was assumed to be 85% entering/exiting south towards the Gibbs Schools and the intersection of Tazewell Pike (SR 131) at E Emory Road and 15% entering/exiting north towards the Union County line.

Figure 4 shows the peak hour trip distribution. Figure 5 shows the peak hour site trips from the Twin Oak Landing Subdivision and Figure 6 shows the combined 2026 full buildout site traffic.

Turn Lane Warrant Analysis - TDOT

The intersection of Tazewell Pike (SR 131) and Twin Oak Lane was evaluated to determine if a northbound left turn lane or a southbound right turn on Tazewell Pike (SR 131) is warranted. The TDOT Highway System Access Manual (HSAM) Volume 3: Geometric Design Criteria dated April 2021 was used to analyze the information.

In order to evaluate the left turn lane warrant, the Major Highway Volume (veh/h/ln) was calculated for Tazewell Pike (SR 131) during both the AM and PM peak hours. The Major Highway Volume (veh/h/ln) was calculated as 454 veh/h/ln during the AM peak hour and 370 veh/h/ln during the PM peak hour. Per Figure 3-16: Left Turn Lane Warrant for Two-Lane Rural Roadways (Unsignalized) the existing, background and full buildout conditions warrant a left turn lane during the PM peak hour. The AM peak hour will warrant a left turn lane after 25 single-family homes are completed.

In order to evaluate the right turn lane, the Major-Road Volume, (one direction), veh/h was referenced. Tazewell Pike (SR 131) has a volume of 682 veh/h during the AM peak hour and 256 veh/h during the PM peak hour. Per Figure 3-18: Right-Turn Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control the existing, background and full buildout right turn volumes onto Twin Oak Lane do not warrant a right turn lane per the TDOT Highway System Access Manual.

The TDOT Highway System Access Manual Figures are included in the attachments.

Turn Lane Recommendation

The TDOT Highway System Access Manual (HSAM) Volume 3: Geometric Design Criteria dated April 2021 recommends a minimum storage length of 50 feet on a roadway with an approximate left turn lane peak hour volume of 60 veh/h and minimum lane change and deceleration distance of 265 feet for a roadway with a 40 mph speed limit for a total length of 315 feet. The minimum bay taper length is calculated as 147 feet based on the proposed 11-foot turn lane width and existing 40 mph speed limit.

A continuation of the existing two-way left-turn lane on Tazewell Pike (SR 131) between the Gibbs Elementary School Access Road and Twin Oak Lane should be considered as another option in lieu of installing a separate left turn lane at the intersection with Twin Oak Lane

due to the overlapping road width and turn lane transitions. The additional left turn lane storage provided by a two-way left turn lane is not a requirement of the proposed Twin Oak Landing Subdivision.

The "Twin Oak Landing Subdivision" traffic impact study conducted by Fulghum, MacIndoe & Associates and revised April 26, 2017 recommended a 75 foot storage length and a 165 foot bay taper length for the proposed left turn lane with an 11 foot width at the intersection of Tazewell Pike (SR 131) at Twin Oak Lane.

Conclusion and Recommendations

A northbound left turn lane at the intersection of Tazewell Pike (SR 131) at Twin Oak Lane is warranted after the full buildout of the Twin Oak Landing Subdivision. Ardurra calculated that 25 single family homes can be built prior to meeting the left turn lane warrant threshold per the TDOT Highway System Access Manual.

The "Twin Oak Landing Subdivision" traffic impact study conducted by Fulghum, MacIndoe & Associates and revised April 26, 2017 recommended a 75 foot storage length and a 165 foot bay taper length for the proposed left turn lane assuming an 11 foot turn lane width.

The Twin Oak Landing Concept Plan shows a northbound left turn lane on Tazewell Pike (SR 131) with a 75 foot storage length and 165 foot bay taper length.

Any future improvements to the intersection or various traffic management infrastructure, would need to be reviewed, coordinated and approved by the Tennessee Department of Transportation and Knox County Engineering and Public Works.

Ardurra recommends that the signs and pavement markings be installed in accordance with the standards provided in the Manual on Uniform Traffic Control Devices (MUTCD).

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

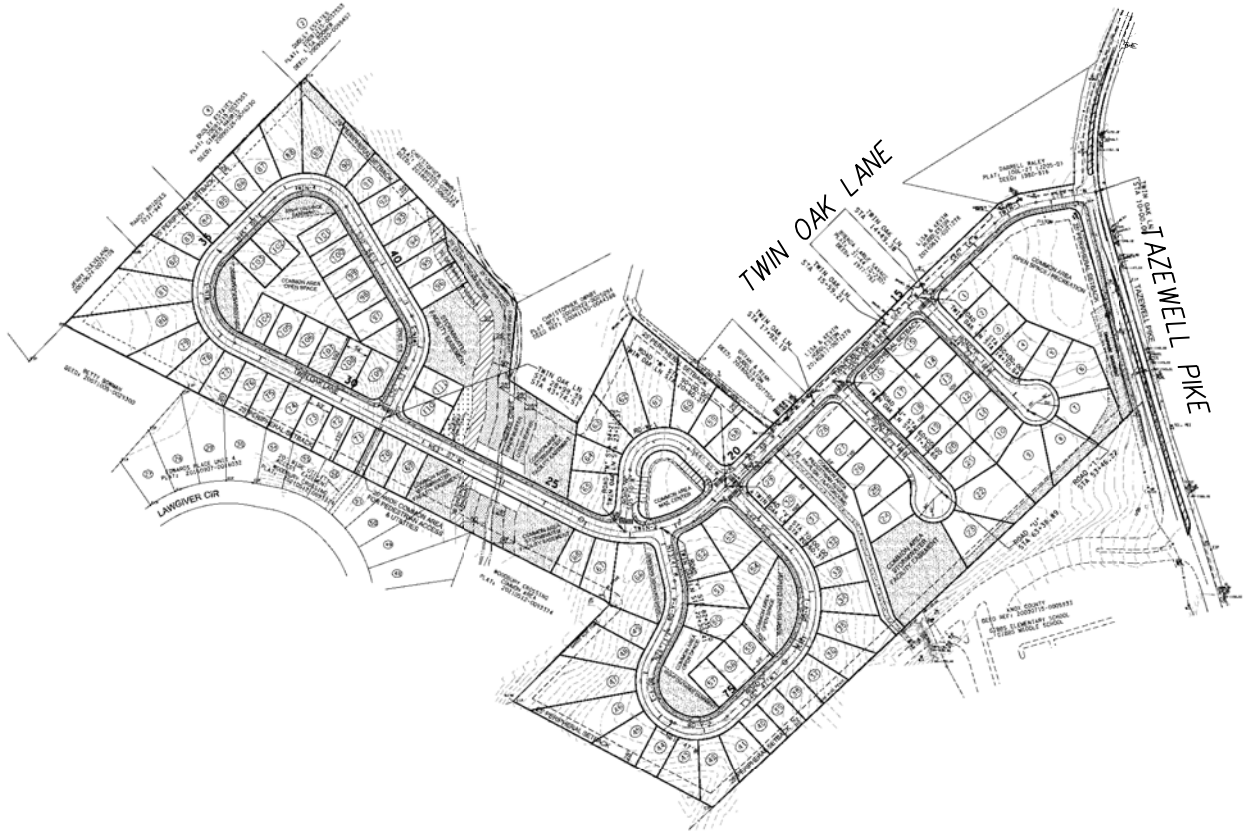
Thank you,



Addie Kirkham, P.E.
Enclosure: Attachments

Attachments

Twin Oak Landing Subdivision
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Concept Plan

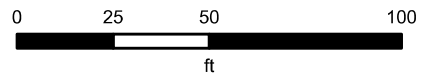


Tazewell Pike at Twin Oak Lane

Knoxville - Knox County - KUB Geographic Information System



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Project: Twin Oak Landing Subdivision

Date Conducted: 03/22/2017

Start	Tazewell Pike Northbound			Tazewell Pike Southbound			Twin Oak Lane Eastbound			Int. Total
	Left	Thru	Total	Thru	Right	Total	Left	Right	Total	
7:00 AM	0	26	26	118	0	118	0	0	0	144
7:15 AM	0	27	27	119	0	119	0	1	1	147
7:30 AM	0	62	62	151	0	151	1	0	1	214
7:45 AM	0	58	58	196	0	196	0	0	0	254
Total	0	173	173	584	0	584	1	1	2	759
8:00 AM	0	45	45	88	0	88	0	0	0	133
8:15 AM	0	46	46	97	0	97	0	0	0	143
8:30 AM	0	28	28	81	0	81	0	0	0	109
8:45 AM	0	30	30	64	0	64	0	1	1	95
Total	0	149	149	330	0	330	0	1	1	480
2:00 PM	0	58	58	52	0	52	0	0	0	110
2:15 PM	0	54	54	60	0	60	0	1	1	115
2:30 PM	1	50	51	65	0	65	0	0	0	116
2:45 PM	0	79	79	45	0	45	0	0	0	124
Total	1	241	242	222	0	222	0	1	1	465
3:00 PM	1	88	89	44	0	44	0	0	0	133
3:15 PM	0	89	89	48	0	48	0	0	0	137
3:30 PM	0	165	165	50	0	50	0	0	0	215
3:45 PM	0	99	99	53	0	53	0	0	0	152
Total	1	441	442	195	0	195	0	0	0	637
4:00 PM	1	103	104	52	0	52	0	1	1	157
4:15 PM	0	85	85	50	0	50	0	0	0	135
4:30 PM	1	84	85	52	0	52	0	0	0	137
4:45 PM	1	116	117	56	0	56	0	1	1	174
Total	3	388	391	210	0	210	0	2	2	603
5:00 PM	0	110	110	40	0	40	0	1	1	151
5:15 PM	2	91	93	54	0	54	0	0	0	147
5:30 PM	1	119	120	67	0	67	0	0	0	187
5:45 PM	3	114	117	65	0	65	0	0	0	182
Total	6	434	440	226	0	226	0	1	1	667
Grand Total	11	1826	1837	1767	0	1767	1	6	7	3611
Approach %	0.6	99.4		100.0	0.0		14.3	85.7		
Total %	0.3	50.6	50.9	48.9	0.0	48.9	0.0	0.2	0.2	

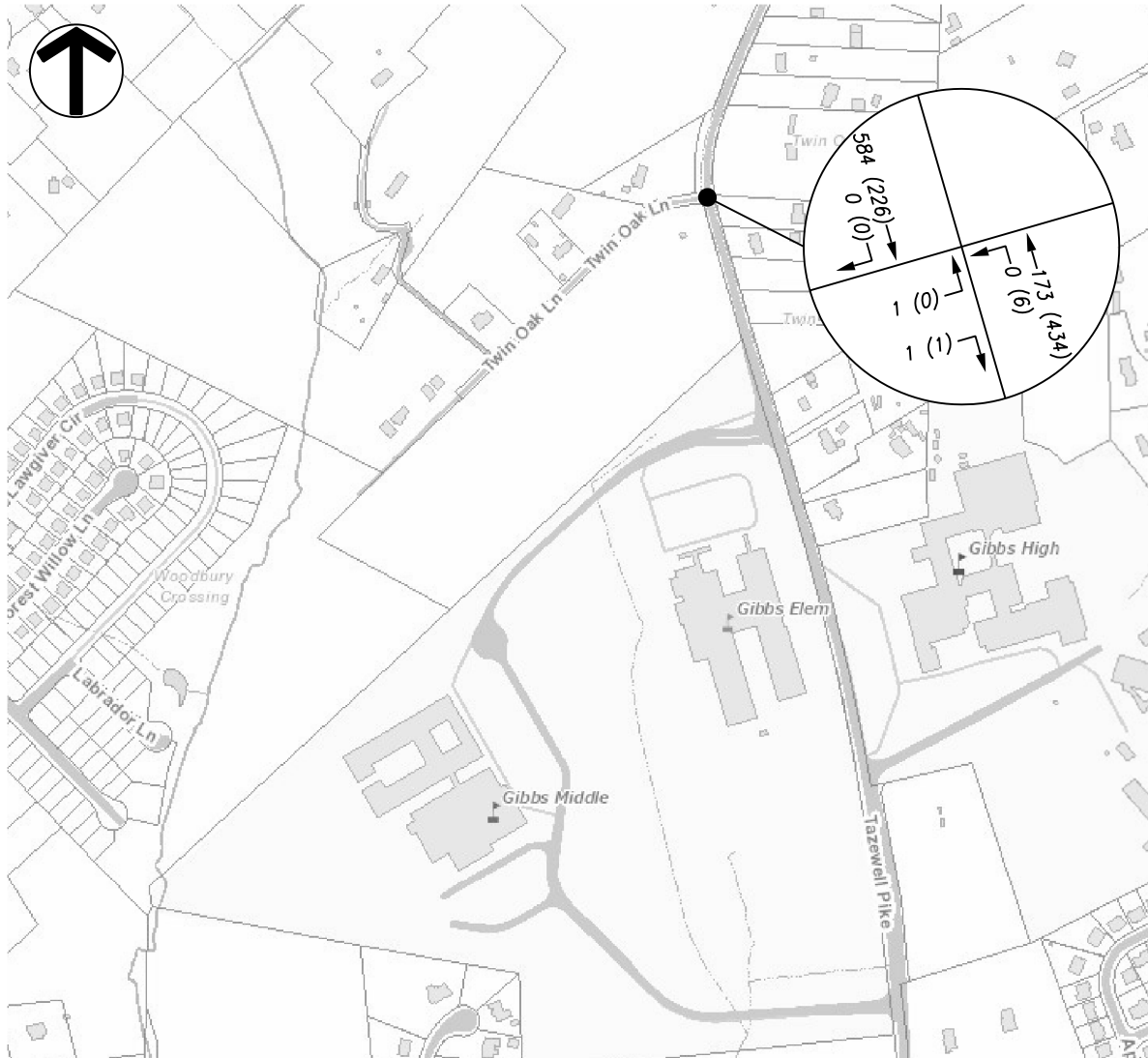
Project: Twin Oak Landing Subdivision

Date Conducted: 3/22/2017

AM Peak Hour	7:00 AM - 8:00 AM	759
PM Peak Hour	5:00 PM - 6:00 PM	667

Start	Tazewell Pike Northbound			Tazewell Pike Southbound			Twin Oak Lane Eastbound			Int. Total
	Left	Thru	App. Total	Thru	Right	App. Total	Left	Right	App. Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:30 AM										
7:00 AM	0	26	26	118	0	118	0	0	0	144
7:15 AM	0	27	27	119	0	119	0	1	1	147
7:30 AM	0	62	62	151	0	151	1	0	1	214
7:45 AM	0	58	58	196	0	196	0	0	0	254
Total Volume	0	173	173	584	0	584	1	1	2	759
Future (1% over 9 yrs)	0	189		639	0		1	1		830
PHF	-	0.70		0.74	-		0.25	0.25		0.75
Peak Hour Analysis from 3:00 PM to 6:00 PM										
PM Peak Hour begins at 5:00 PM										
5:00 PM	0	110	110	40	0	40	0	1	1	151
5:15 PM	2	91	93	54	0	54	0	0	0	147
5:30 PM	1	119	120	67	0	67	0	0	0	187
5:45 PM	3	114	117	65	0	65	0	0	0	182
Total Volume	6	434	440	226	0	226	0	1	1	667
Future (1% over 9 yrs)	7	475		247	0		0	1		729
PHF	0.50	0.91		0.84	-		-	0.25		0.89

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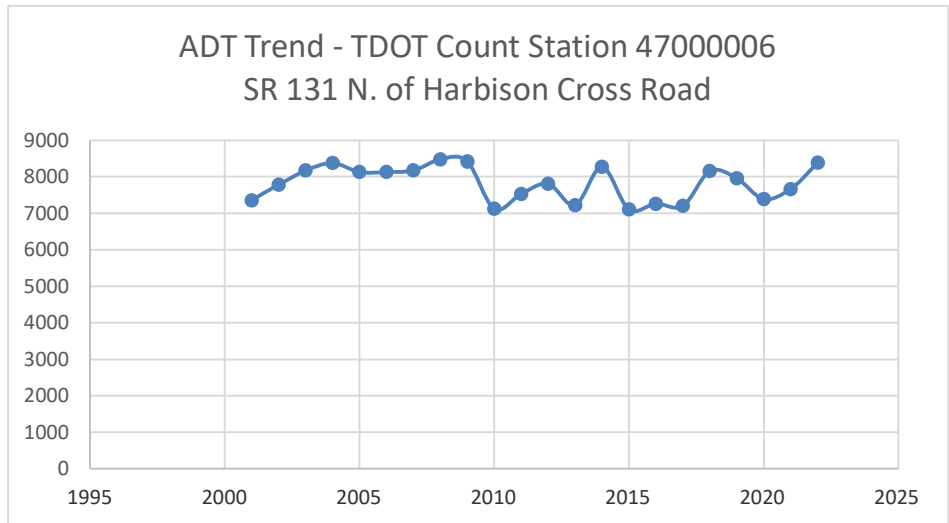


LEGEND:

← 123 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 1: 2017 Existing Peak Hour Traffic

Year	Adjusted Average Daily Traffic
2001	7353
2002	7781
2003	8169
2004	8373
2005	8129
2006	8129
2007	8169
2008	8477
2009	8417
2010	7117
2011	7527
2012	7802
2013	7215
2014	8271
2015	7103
2016	7258
2017	7202
2018	8153
2019	7958
2020	7390
2021	7660
2022	8384



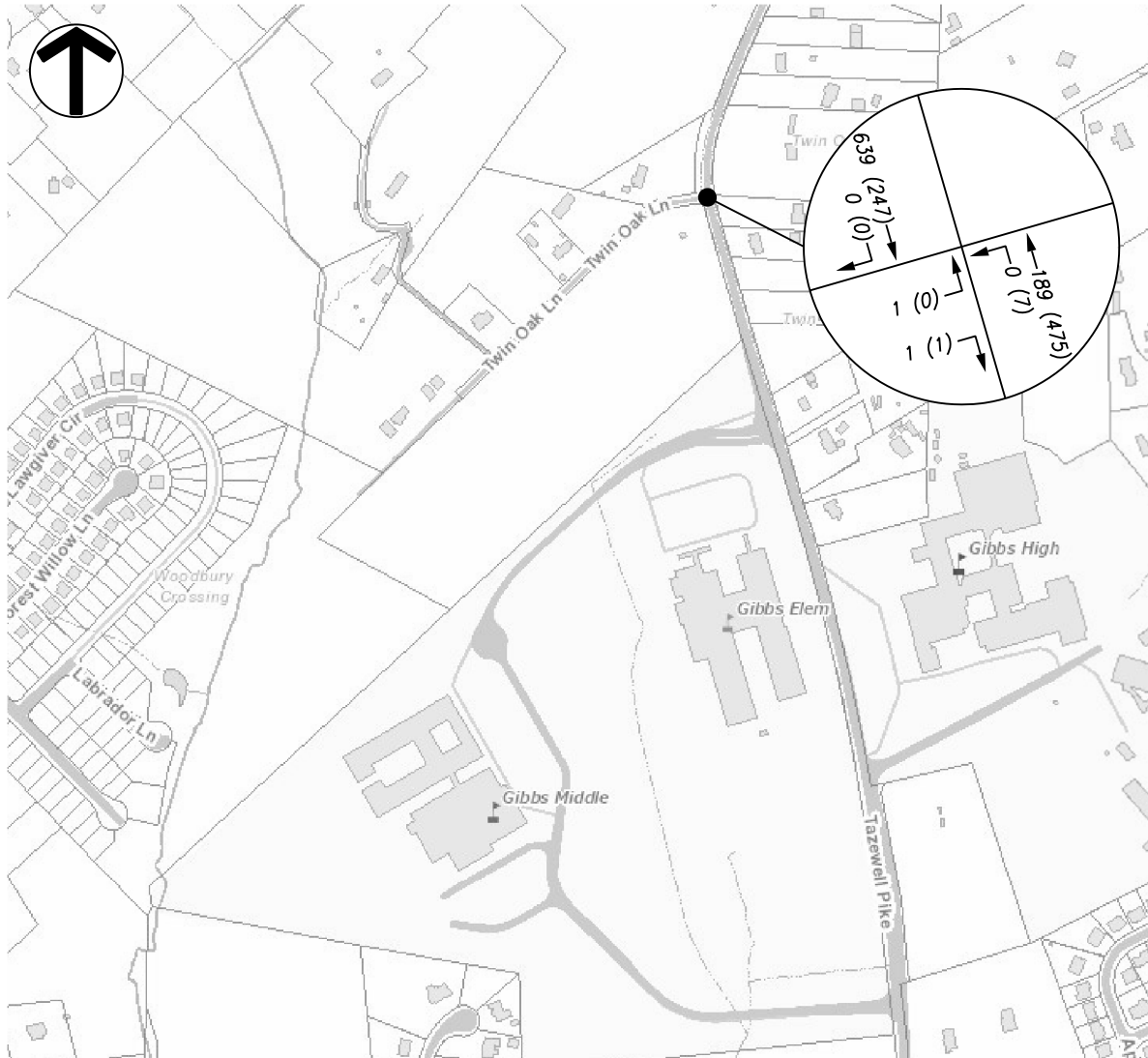
Most Recent Trend Line Growth

Year	ADT
2002	7781
2022	8384

Annual Percent Growth

0.36%

Twin Oak Landing Subdivision
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LEGEND:

← 123 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 2: 2026 Background Peak Hour Traffic

Project: Twin Oak Landing TL

Date Conducted: 2/6/2023

Middle School / Junior High School (LUC 522)

800 Students

Average Daily Traffic

Average Rate = 2.10

$T = 2.10 * 800$

$T = 1680$

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

Average Rate = 0.67

$T = 0.67 * 800$

$T = 536$

Peak Hour of Adjacent Street Traffic

One Hour Between 4 and 6 p.m.

Average Rate = 0.15

$T = 0.15 * 800$

$T = 120$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1680	50%	50%	840	840
AM Peak Hour	536	54%	46%	289	247
PM Peak Hour	120	48%	52%	58	62

Middle School/Junior High School (522)

Vehicle Trip Ends vs: Students
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 14

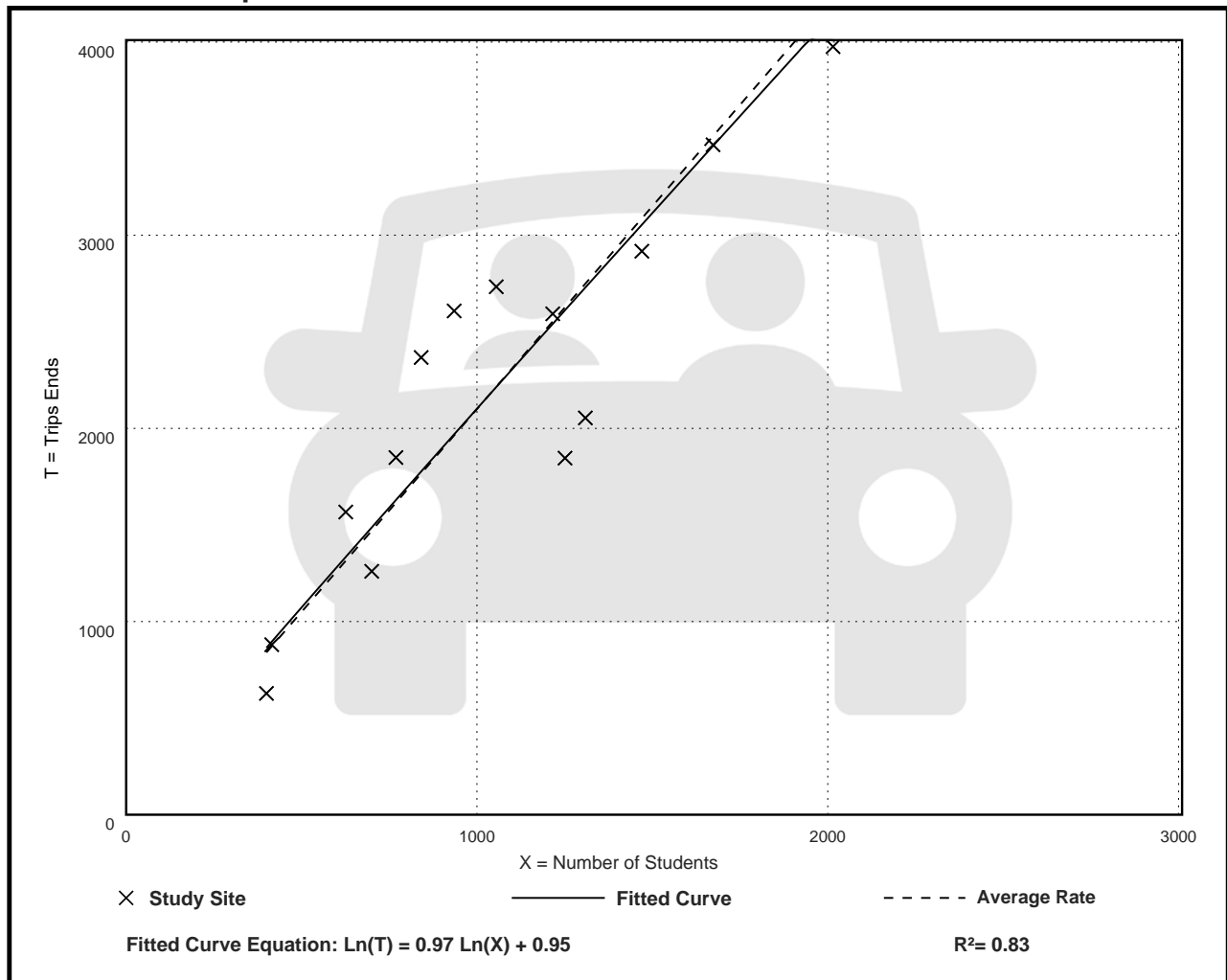
Avg. Num. of Students: 1048

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
2.10	1.48 - 2.81	0.42

Data Plot and Equation



Middle School/Junior High School (522)

Vehicle Trip Ends vs: Students

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 23

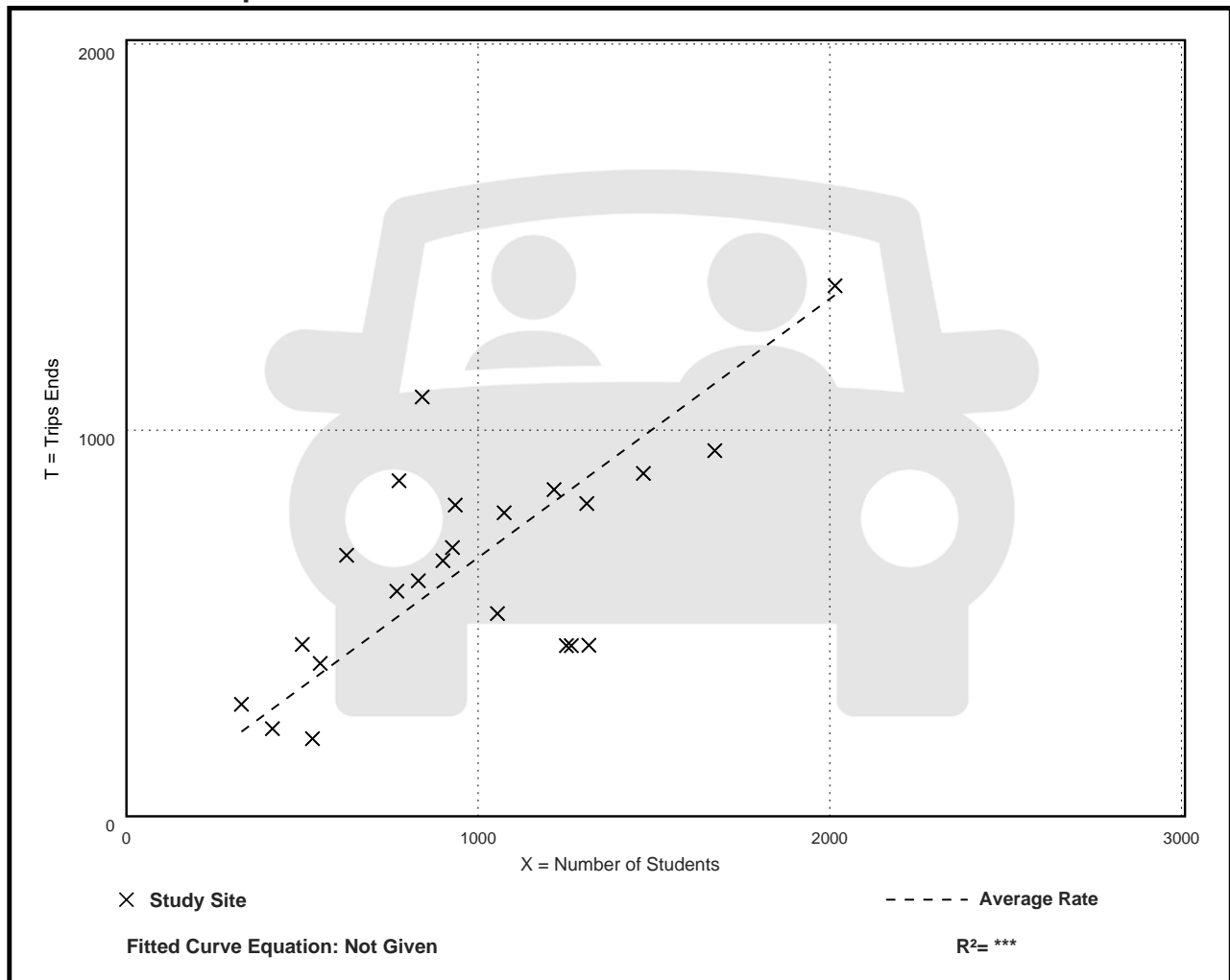
Avg. Num. of Students: 981

Directional Distribution: 54% entering, 46% exiting

Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.67	0.34 - 1.29	0.24

Data Plot and Equation



Middle School/Junior High School (522)

Vehicle Trip Ends vs: Students

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 21

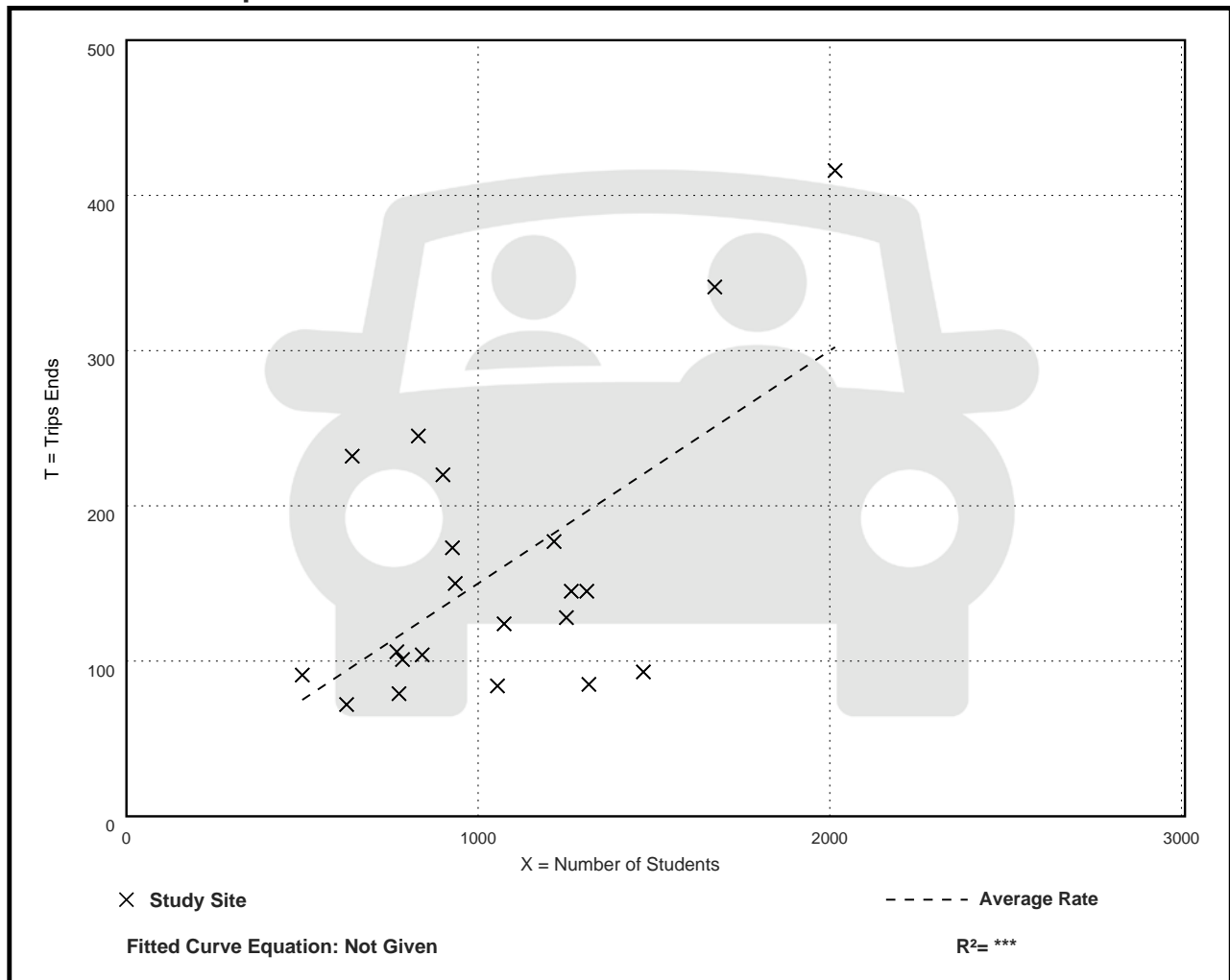
Avg. Num. of Students: 1056

Directional Distribution: 48% entering, 52% exiting

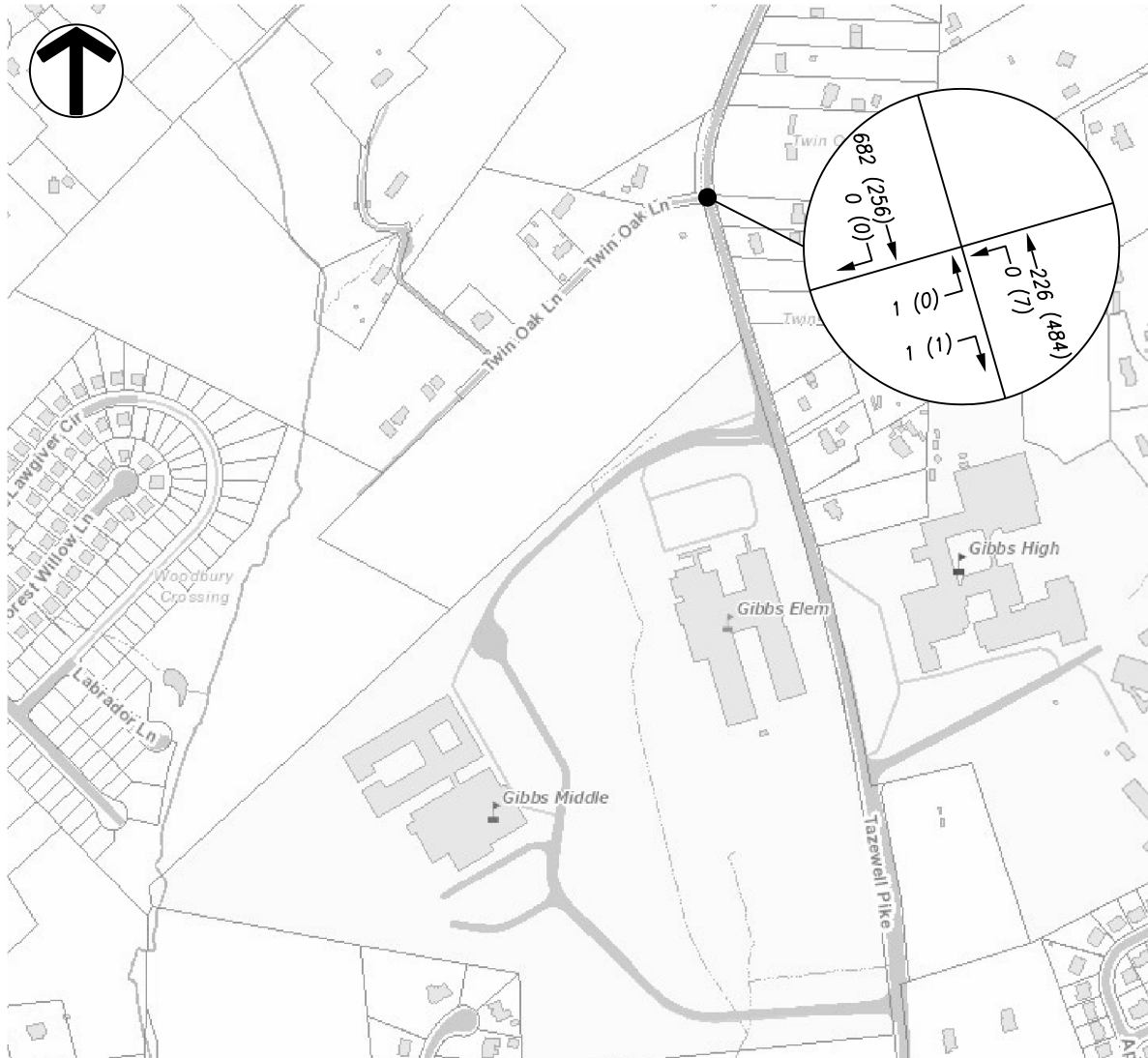
Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.15	0.06 - 0.36	0.07

Data Plot and Equation



Twin Oak Landing Subdivision
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LEGEND:

← 123 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 3: 2026 Background + Middle School Peak Hour Traffic

Project: Twin Oak Landing TL

Date Conducted: 12/18/2023

Single-Family Detached Housing (LUC 210)

111 Single Family Lots

Average Daily Traffic

$$\ln(T) = 0.92\ln(X) + 2.68$$

$$\ln(T) = 0.92\ln(111) + 2.68$$

$$T = 1111$$

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

$$\ln(T) = 0.91\ln(X) + 0.12$$

$$\ln(T) = 0.91\ln(111) + 0.12$$

$$T = 82$$

Peak Hour of Adjacent Street Traffic

One Hour Between 4 and 6 p.m.

$$\ln(T) = 0.94\ln(X) + 0.27$$

$$\ln(T) = 0.94\ln(111) + 0.27$$

$$T = 110$$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1111	50%	50%	556	556
AM Peak Hour	82	26%	74%	21	61
PM Peak Hour	110	63%	37%	69	41

Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 174

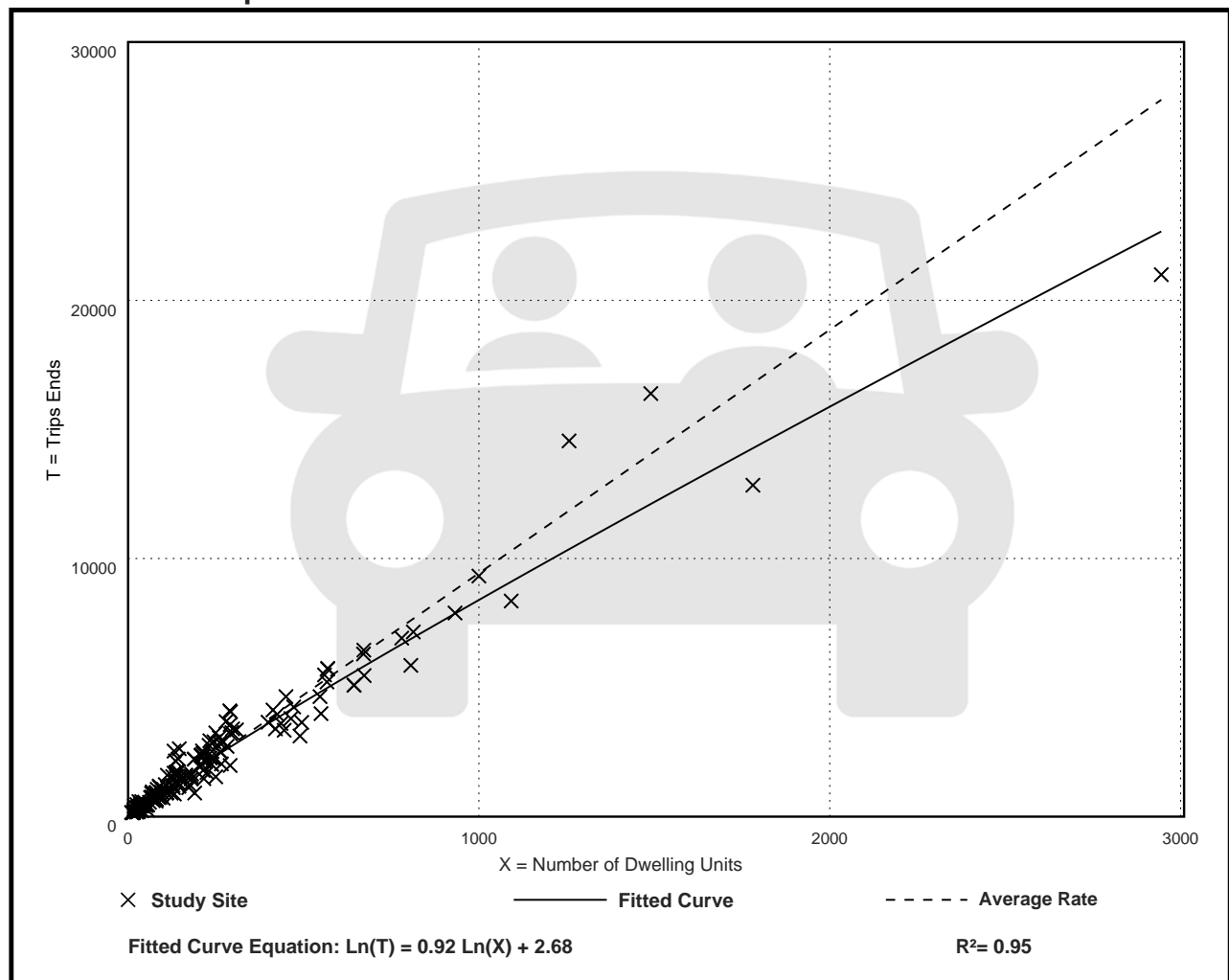
Avg. Num. of Dwelling Units: 246

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

Data Plot and Equation



Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 192

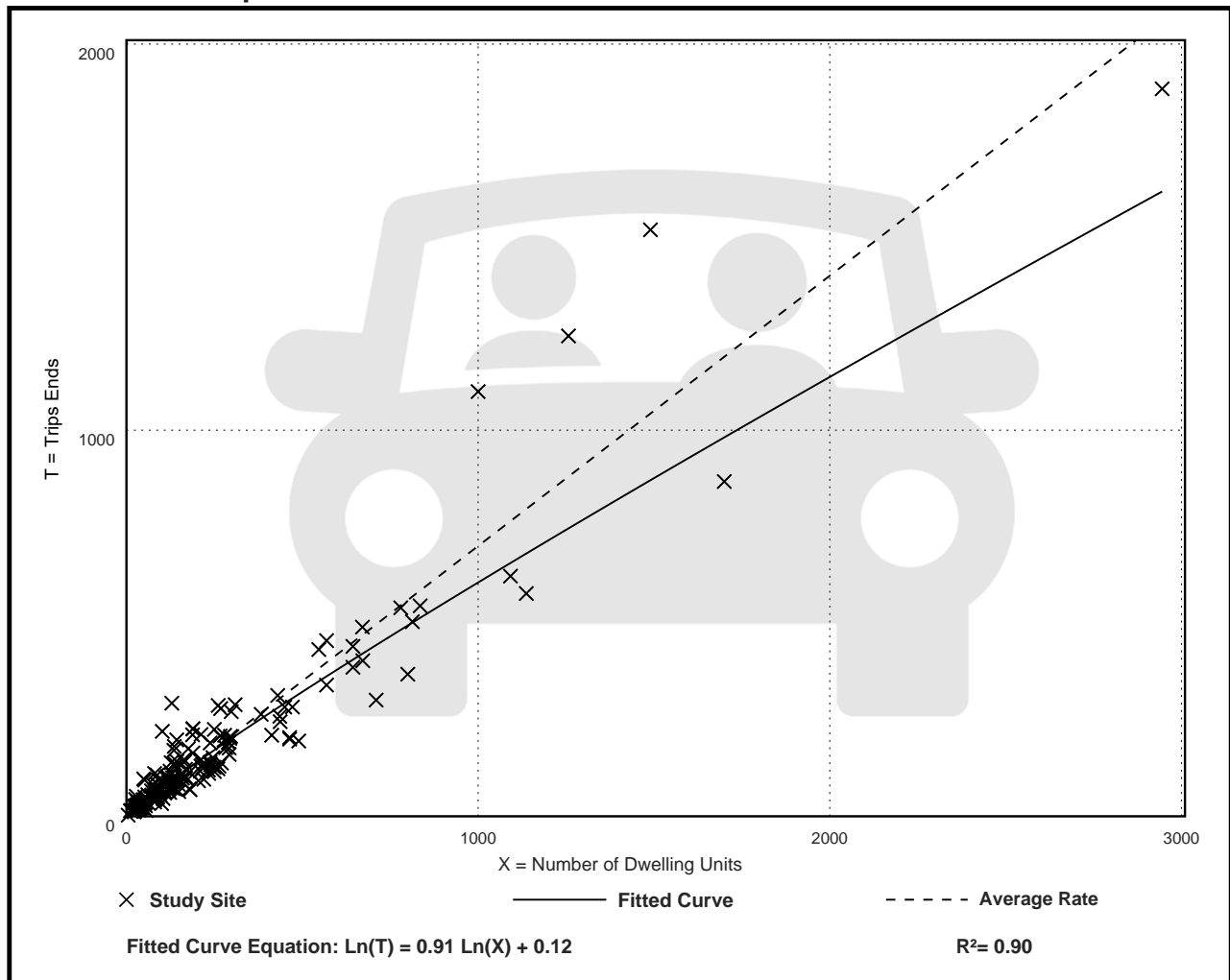
Avg. Num. of Dwelling Units: 226

Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 208

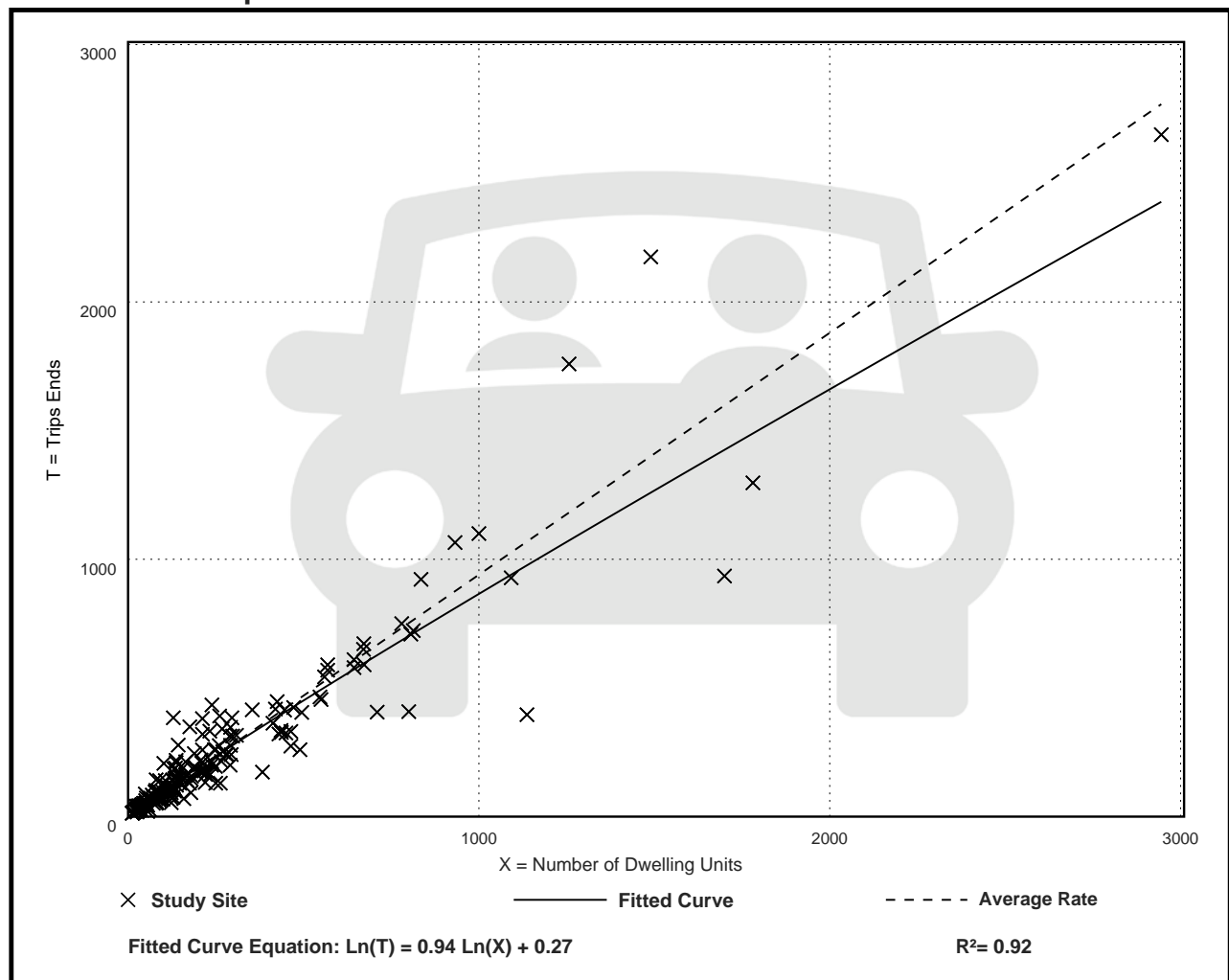
Avg. Num. of Dwelling Units: 248

Directional Distribution: 63% entering, 37% exiting

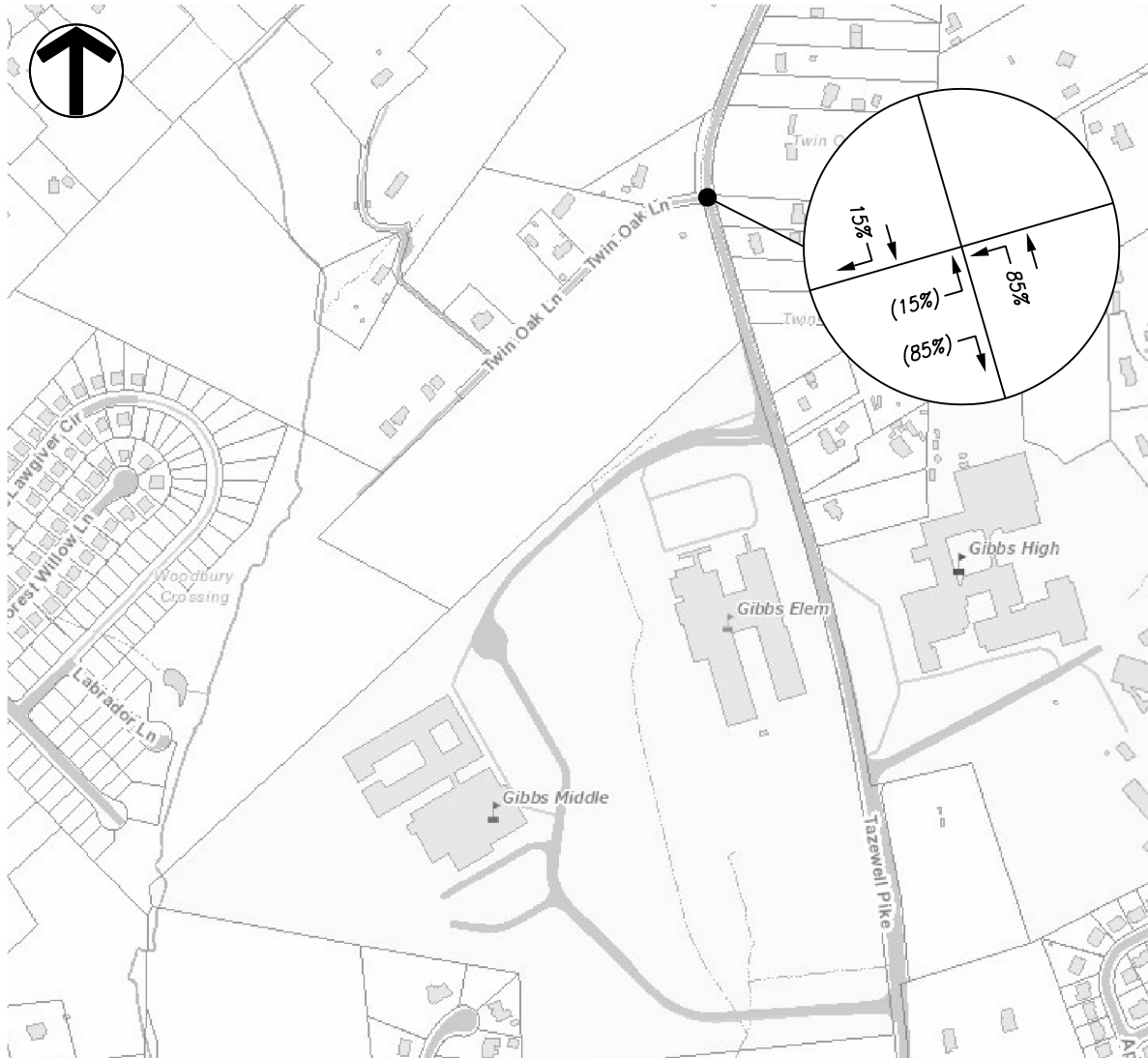
Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



Twin Oak Landing Subdivision
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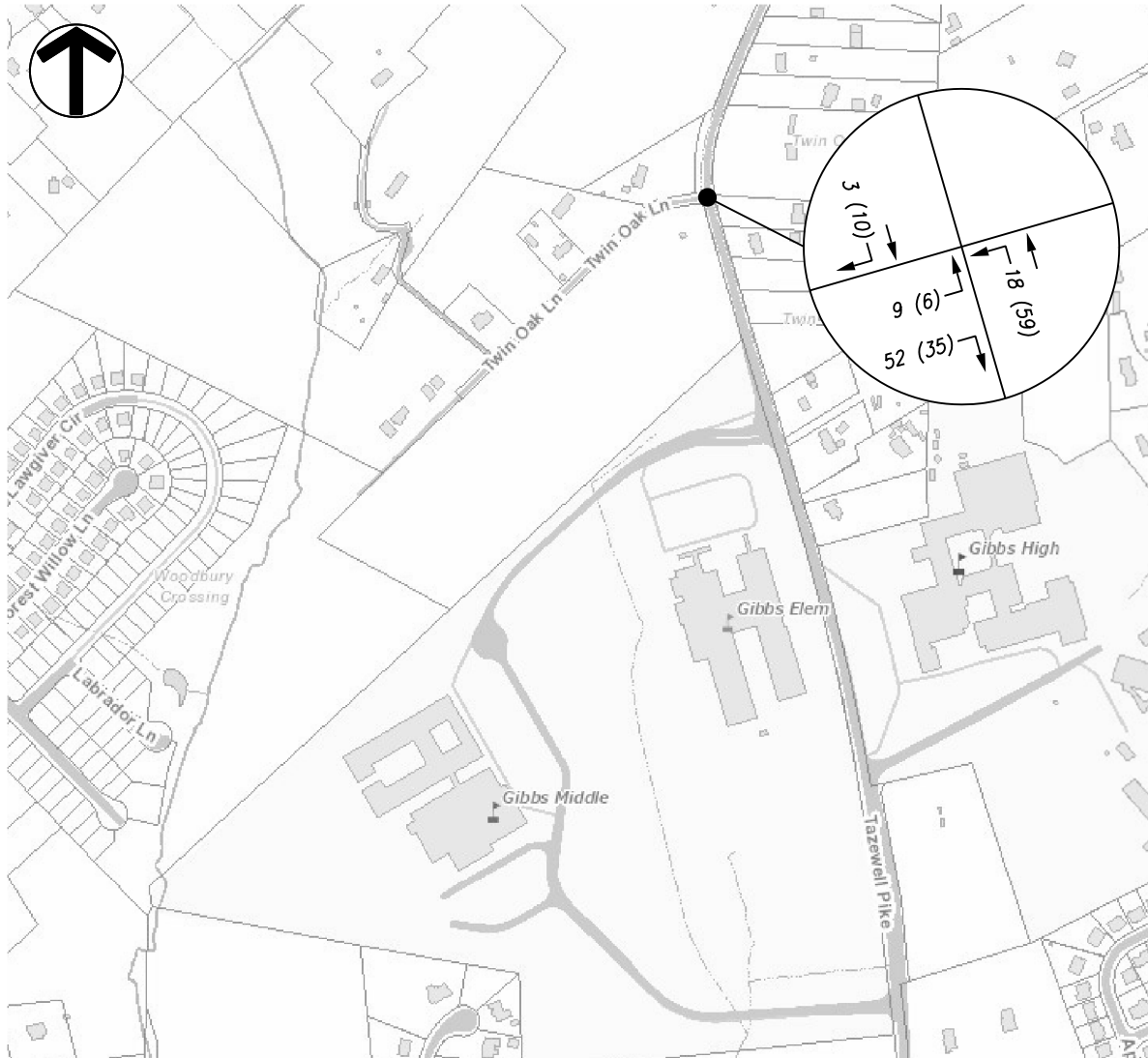


LEGEND:

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

Figure 4: Peak Hour Trip Distribution

Twin Oak Landing Subdivision
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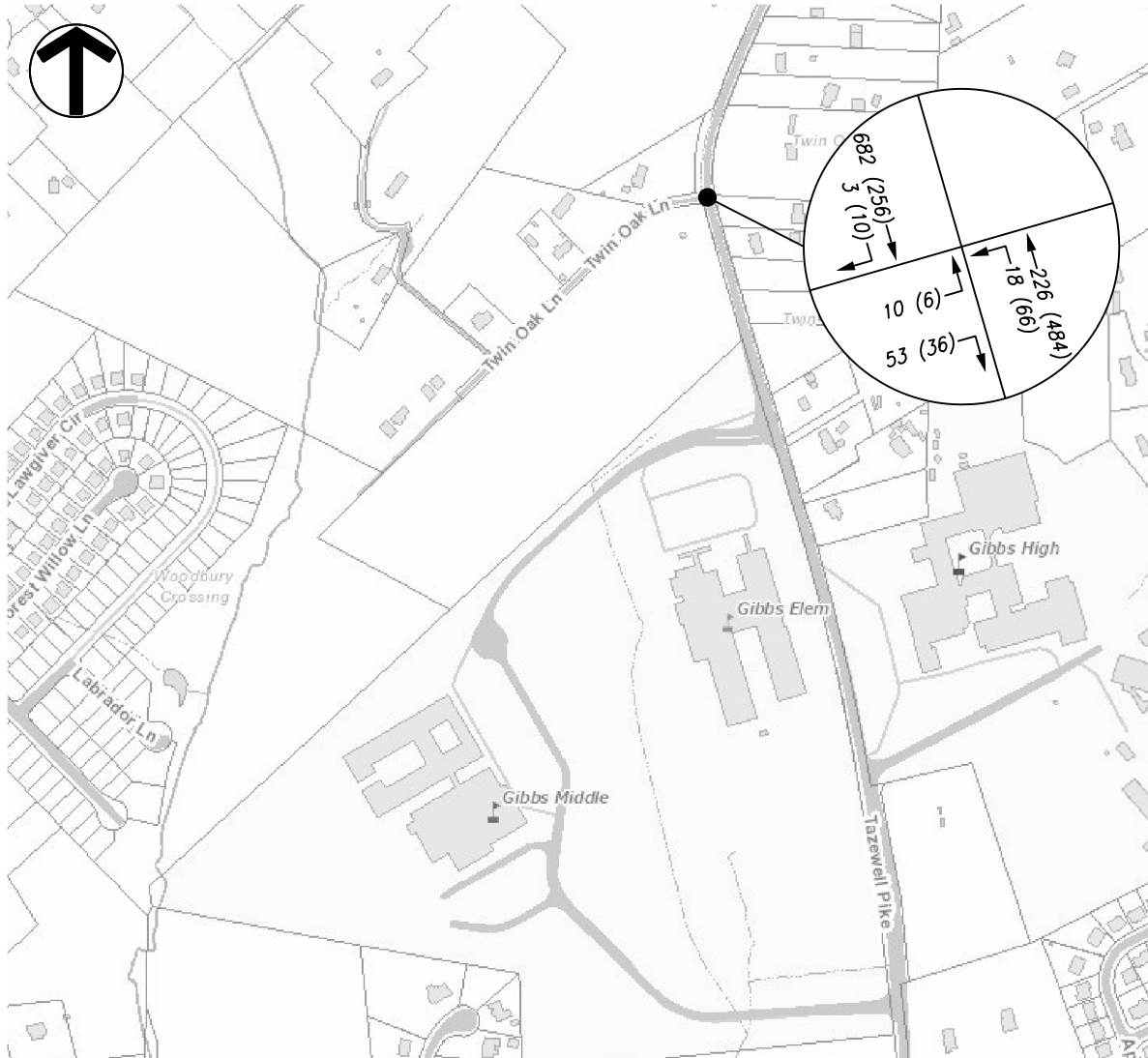


LEGEND:

← 123 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 5: Peak Hour Site Traffic

Twin Oak Landing Subdivision
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LEGEND:

← 123 (23) TURNING MOVEMENT VOLUME AM (PM)

Figure 6: 2026 Full Buildout Site Traffic

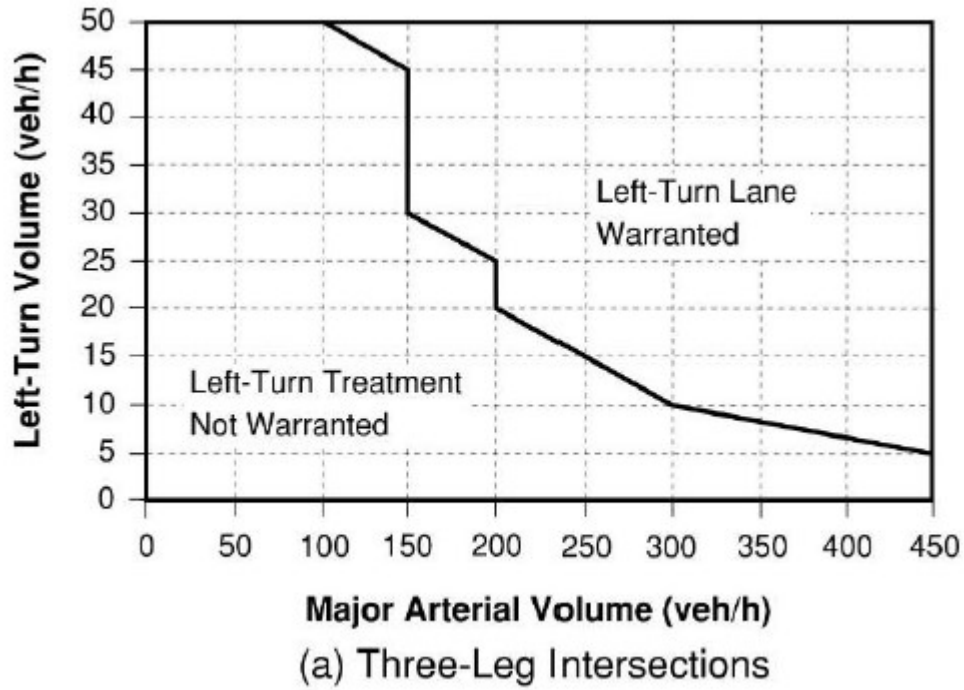


Figure 3-15: Left Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)

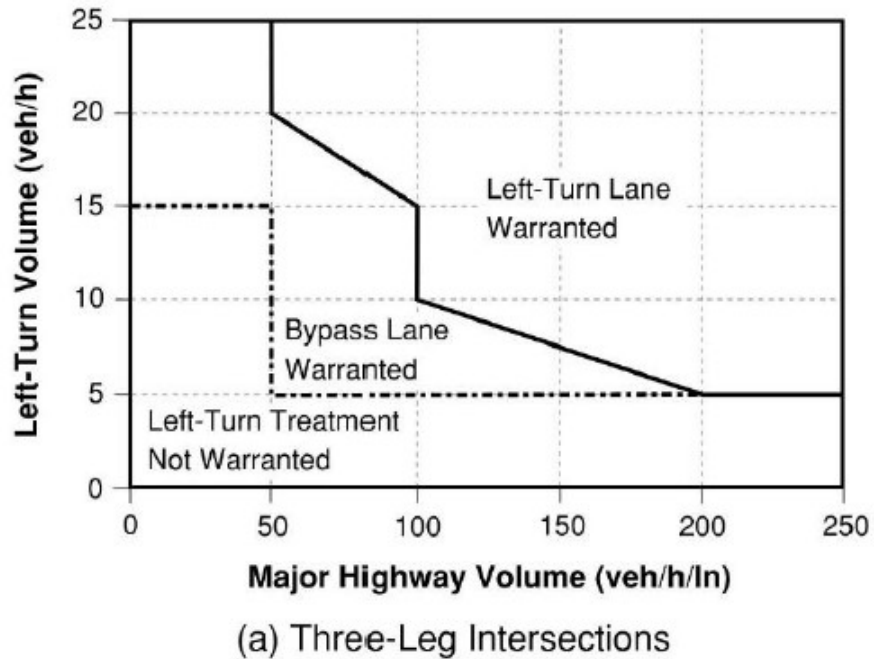


Figure 3-16: Left Turn Lane Warrant for Two-Lane Rural Roadways (Unsignalized)

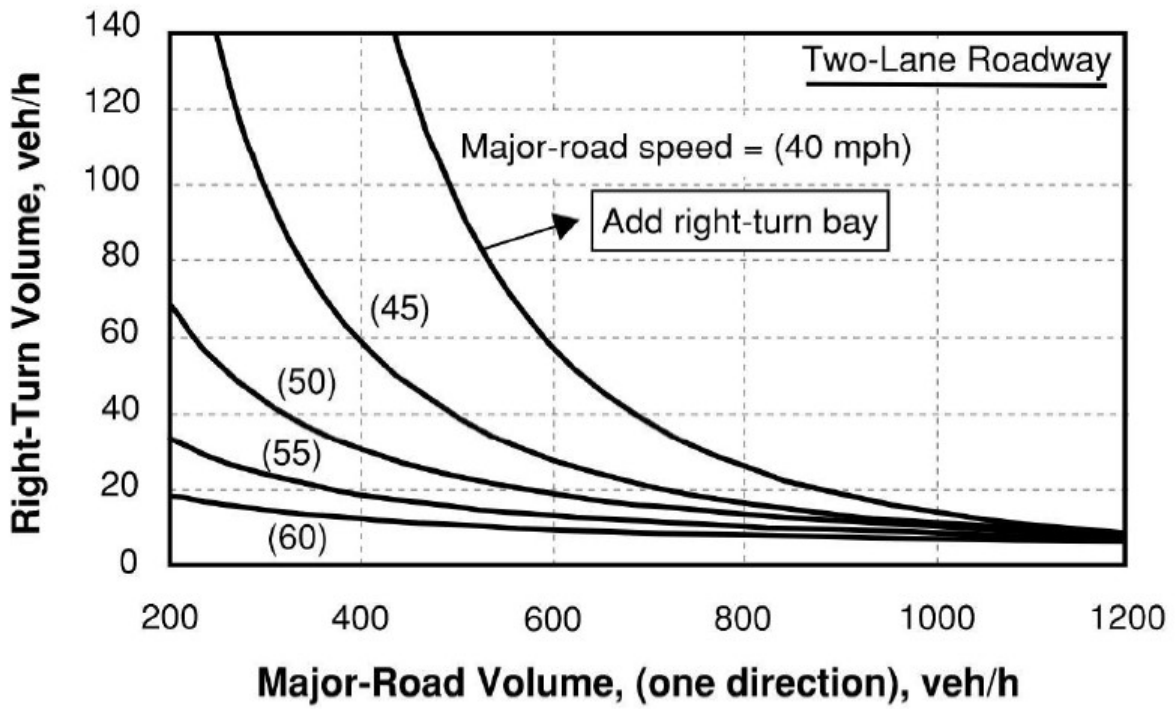


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)



January 19, 2024

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

Re: Twin Oak Landing Subdivision TIL Comments (2-SD-24-C/2-D-24-DP)

Dear Knoxville-Knox County Planning staff:

The following comment response letter is submitted to address comments dated January 12, 2024:

Knoxville-Knox County Planning Comments

Comment 1: It would be our preference for the TIL to be based on a current, updated turning movement count however since it is unlikely to impact the threshold for the turn lane warrants as described in a subsequent comment it has been determined that this is an optional item.

Response 1: Given the weather conditions the week of January 16th thru January 19th I elected to not collect a new turning movement count.

Comment 2: TDOT staff have reviewed the TIL's evaluation of left turn lane warrants per the TDOT HSAM, Volume 3 and question whether the correct methodology and resulting threshold have been utilized. TDOT's assessment is that there would need to be a minimum of 5 left turns in both the AM and PM peak hours to warrant a left turn. After a quick review of the numbers in this TIL, we estimate the number is further reduced from their proposed 49 single family homes to somewhere around 28, but the TIL needs to verify this.

Response 2: I updated the turn lane warrants to reflect the recommendations per the TDOT Highway System Access Manual instead of the Knox County "Access Control and Driveway Design Policy Handbook."

Comment 3: The submitted site plan shows the proposed new NB left turn lane as well as an apparent extension of the SB right turn lane at the school entrance immediately to the south. Please document these design details in terms of storage and taper lengths and ensure that they match the recommendations from the TIL. Additionally, please provide an assessment/recommendation for utilizing a continuous center turn lane in this section of SR-331 given the multiple transition points and necessary turn lane shadowing that may provide enough width to make a full center turn lane more desirable than individual turn lanes.

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Response 3: Added the design details from the concept plan for the northbound left turn lane and the following statement regarding the TWLTL, "A continuation of the existing two-way left-turn lane on Tazewell Pike (SR 131) between the Gibbs Elementary School Access Road and Twin Oak Lane should be considered as another option in lieu of installing a separate left turn lane at the intersection with Twin Oak Lane due to the overlapping road width and turn lane transitions. The additional left turn lane storage provided by a two-way left turn lane is not a requirement of the proposed Twin Oak Landing Subdivision.

Thank you,



Addie Kirkham, P.E.