BERRY SURVEYING & ENGINEERING
335 Second Crown Point Road
Barrington, NH 03825
Phone: (603) 332-2863
Fax: (603) 335-4623
www.BerrySurveying.Com

NHDOT
District VI – Attention Mr. Jim Hewitt, P.E.
PO Box 740
Durham, NH 03824

June 14, 2021
Rev: October 12, 2021

RE: Traffic Impact Analysis & Distribution
Dove Development Group, LLC
Community Way
Tax Map 235, Lots 1-1 & 3
Barrington, NH 03825

Mr. Hewitt,

On behalf of the applicant, Dove Development Group, LLC, Berry Surveying & Engineering (BS&E) is submitting for your review a Traffic Impact Analysis for development of twenty-five multifamily mid-rise housing units and twenty mid-rise residential (apartment) units with 10,500 Sq. Ft. of commercial space on the first floor. The previously proposed bank use on Tax Map 239, Lot 2 is not currently being considered for construction and development. The point of analysis is the intersection of the existing site entrance, Community Lane, and N.H. Route 9 (Franklin Pierce Highway). Community Lane previously received approval from NHDOT as Christmas Lane in 2018, NHDOT permit #06-027-548.

The following conclusions were reached as a result Traffic Impact Analysis:

- A total of 37 vehicle trips (19 enter/18 exit) are predicted to occur at the weekday AM peak hour and 86 vehicle trips (41 enter/45 exit) at the PM peak hour.
- A total of 86 vehicle trips (44 enter/42 exit) are predicted to occur at the Saturday peak.
- The 2022 and 2032 build traffic volumes DO NOT satisfy the NCHRP 457 guidelines for the implementation of a left-turn lane for all peak hours.
- The 2022 and 2032 build traffic volumes DO NOT satisfy the NCHRP 457 guidelines for the implementation of a right-turn lane for all peak hours.
- This is an increase of 35 weekday AM peak hour trips, 53 weekday PM peak hour trips, and 52 Saturday peak hour trips.

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Proposed Development & Introduction

The proposal is to develop Tax Map 235, Lots 1-1 & 3 to contain twenty-five multifamily mid-rise housing units and twenty mid-rise residential (apartment) units with 10,500 Sq. Ft. of commercial space on the first floor. In addition to the proposed trip generation, an existing specialty retail store (The Christmas Dove) and three single-family homes utilize Community Lane for access. Community Lane is a boulevard at the entrance, with enter and exit lanes separated by a median. An exit left and right turn lane are in place for safe vehicle turning and queue waiting time. The purpose of this analysis is to determine the maximum number of trips coming to and leaving the proposed project site during certain peak periods of the day. This information is then used in determining the impact on safety as it relates to the existing roadway infrastructure. The following components of the analysis are typical for a project of this size pursuant to the Institute of Traffic Engineers (ITE) manual.

Existing Conditions

Existing Site Description

The existing site consists of two lots, Tax Map 235, Lot 1-1 & 3. These parcels contain 7.42 Ac. and 17.07 Ac. of land, respectively. Lot 1-1 contains Community Lane and the remainder is wooded land. Lot 3 entirely consists of wooded land. As previously mentioned, the "Christmas Dove", a specialty retail store and three single family detached homes utilize Community Lane for access. These uses are located on Tax Map 235, Lots 1, 2, and 4, respectively. The site is located in the town center zone, and is surrounded by other commercial and residential lots. There is a commercial driveway approximately 250 feet to the east of the existing driveway cut, the "Village Barn", and a residential driveway across from the site.

NH Route 9 Road Description

NH Route 9 is a two lane major collector road, according to the NHDOT MS2 Transportation Management System (NHDOT). This road provides access to NH Route 125 and the Barrington town center to the east and more rural parts of Barrington to the west. It has an Average Annual Daily Traffic (AADT) of approximately 9,466 (2020) divided between east and west, also as shown by the NHDOT.

NH Route 9 in the area of the project is composed of a twenty-seven foot wide paved surface with a variable shoulder widths on the north and south side of the road. There is a centerline delineation and fog / edge lines provided. The posted speed limit of the roadway is 30 miles per hour (MPH). The geometry of NH Route 9 in the project area is situated on a curve, and is super elevated to the south. The proposed driveway is on the apex of the curve to maximize sight distance. There are no existing sidewalks, crosswalks, or other pedestrian amenities in the area of the project.

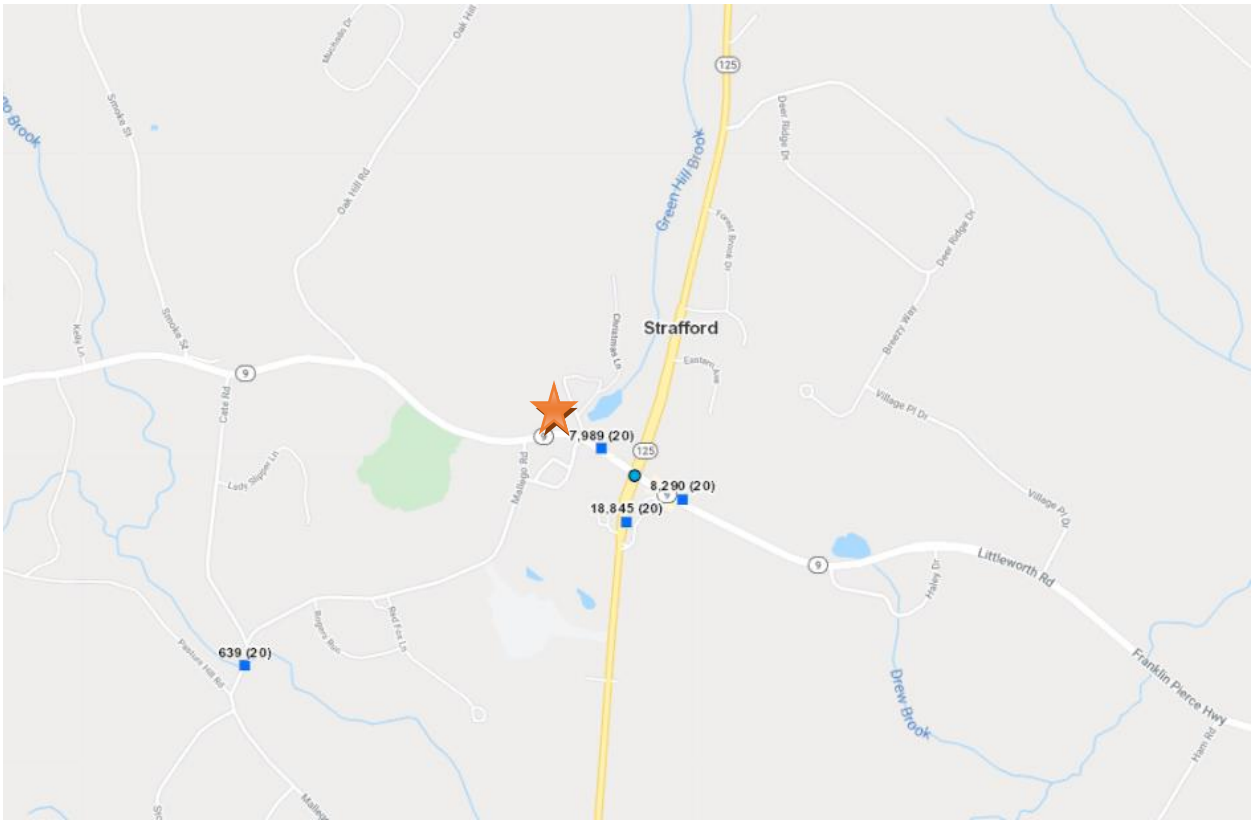


Figure 1: N.H. Route 9 with surrounding roadways (NHDOT)

Existing Traffic Volumes

According to traffic counts recorded Accurate Counts for September 25th - 27th 2019, the N.H. Route 9 AM and PM weekday two-way peaks were 788 trips and 832 trips, respectively. The Saturday two-way peak was 886 trips. Over this three day span, the ADT is 8,809. The highest weekday peak hour traffic volume on this section of N.H. Route 9 eastbound occurred from 7-8 AM with 571 vehicles and from 5-6 PM with 333 vehicles. Westbound highest weekday peak hour traffic volume occurred from 8-9 AM with 218 vehicles and from 4-5 PM with 512 vehicles. It can be seen from the directional percent distribution that the primary direction of travel during the Weekday AM peak hour is eastbound towards Dover and NH Route 16. The primary direction of travel during the PM peak hour is westbound towards Barrington and Northwood. The highest Saturday peak hour traffic volume on this section of N.H. Route 9 eastbound occurred from 11 AM – 12 PM with 465 vehicles. Westbound occurred from 11 AM – 12 PM with 421 vehicles. It can be seen from the directional distribution that nearly a 50/50 directional split occurs.

Traffic counts performed in 2021 yield results lower than the historical ADT seen for NH Route 9 due to a historical event, COVID19. To account for this, traffic counts recorded by the NHDOT for June 25th - 27th 2019 were analyzed for the difference in volumes. The N.H. Route 9 AM and PM weekday two-way peaks were 859 trips and 1,011 trips, respectively. It is shown by the NHDOT that this portion of N.H. Route 9 has an ADT of 9,466 vehicles (2019). The highest weekday peak hour traffic volume on this section of N.H. Route 9 eastbound occurred from 7-8 AM with 644 vehicles and from 4-5 PM with 359 vehicles. Westbound highest weekday peak hour traffic volume occurred from 8-9 AM with 217 vehicles and from 5-6 PM with 684 vehicles. To further analyze this reduction in vehicle trips in 2020 with past years, Table #1 shows the average vehicle trips seen from 2019-2021. With 2021 counts occurring during September being compared to 2019 counts occurring in June, a seasonal peaking factor of 1.05 is applied to the 2021 counts.

2021 Daily Vehicle Average (9/23-9/24)		2021 Daily Vehicle Avg Seasonally Peaked (1.05 Factor September)		2019 Daily Vehicle Average (6/25-6/27)	
Two-Way	8980	Two-Way	9407	Two-Way	10387
Eastbound	4611	Eastbound	4830	Eastbound	5276
Westbound	4370	Westbound	4577	Westbound	5111
# Difference between 2019 & 2021		% Difference in Pre COVID & 2021			
Two-Way	980	Two-Way	10.1	% Difference to be applied to September 2021 traffic data collected.	
Eastbound	446	Eastbound	9.0		
Westbound	534	Westbound	11.3		

Table 1: NH Route 9 Traffic Volumes 2021 vs. 2019

It can be seen from Table #1 that there is approximately a 9-11% reduction in trips from pre COVID conditions. To account for this reduction in vehicle trips during the most recent traffic count, data obtained by Accurate Counts is seasonally peaked from September to June and the percent difference is applied to the values. Table #2 shows the traffic direction breakdown of NH Route 9 2021 traffic counts and Figures #2-7 are graphical representations of the traffic variations occurring throughout the day and from 2019 to 2021. Traffic counts of NH Route 9 provided by the NHDOT and Accurate Counts are included in Appendix A as Figures 12-20.

Traffic Distribution N.H. Route 9						
Date	Eastbound		Westbound		Two-Way	
Thursday 9/23/21	AM Peak	561	AM Peak	214	AM Peak	775
	PM Peak	333	PM Peak	512	PM Peak	832
Seasonal Peak & COVID-19 Correction	AM Peak	641	AM Peak	249	AM Peak	894
	PM Peak	380	PM Peak	597	PM Peak	960
Friday 9/24/21	AM Peak	571	AM Peak	218	AM Peak	788
	PM Peak	344	PM Peak	459	PM Peak	803
Seasonal Peak & COVID-19 Correction	AM Peak	652	AM Peak	254	AM Peak	909
	PM Peak	393	PM Peak	535	PM Peak	926
Weekday Average Peak Hour Traffic	AM Peak	646	AM Peak	252	AM Peak	902
	PM Peak	387	PM Peak	566	PM Peak	943
% Distribution	AM Peak	72.0	AM Peak	28.0		
	PM Peak	40.6	PM Peak	59.4		
Saturday 9/25/21	Peak	465	Peak	421	Peak	886
Seasonal Peak & COVID-19 Correction	Peak	531	Peak	481	Peak	1022
% Distribution	Peak	52.5	Peak	47.5		

Table 2: Directional breakdown of trips occurring on NH Route 9

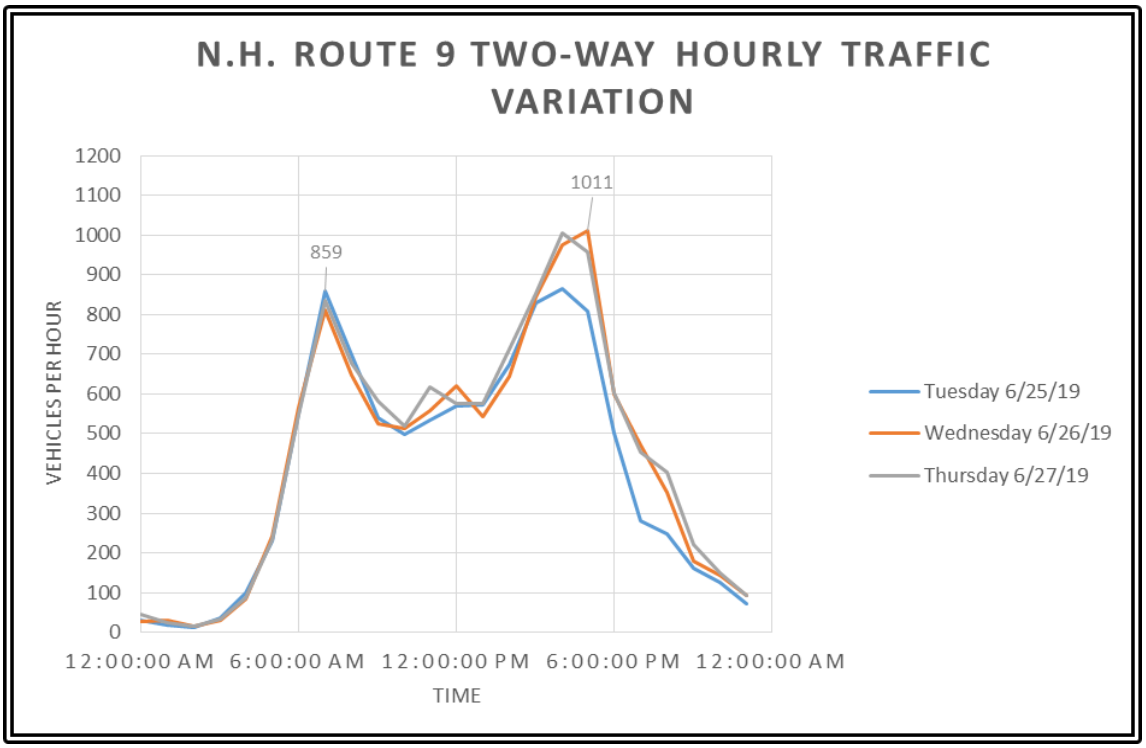


Figure 2: Graph of N.H. Route 9 two-way hourly variation (2019)

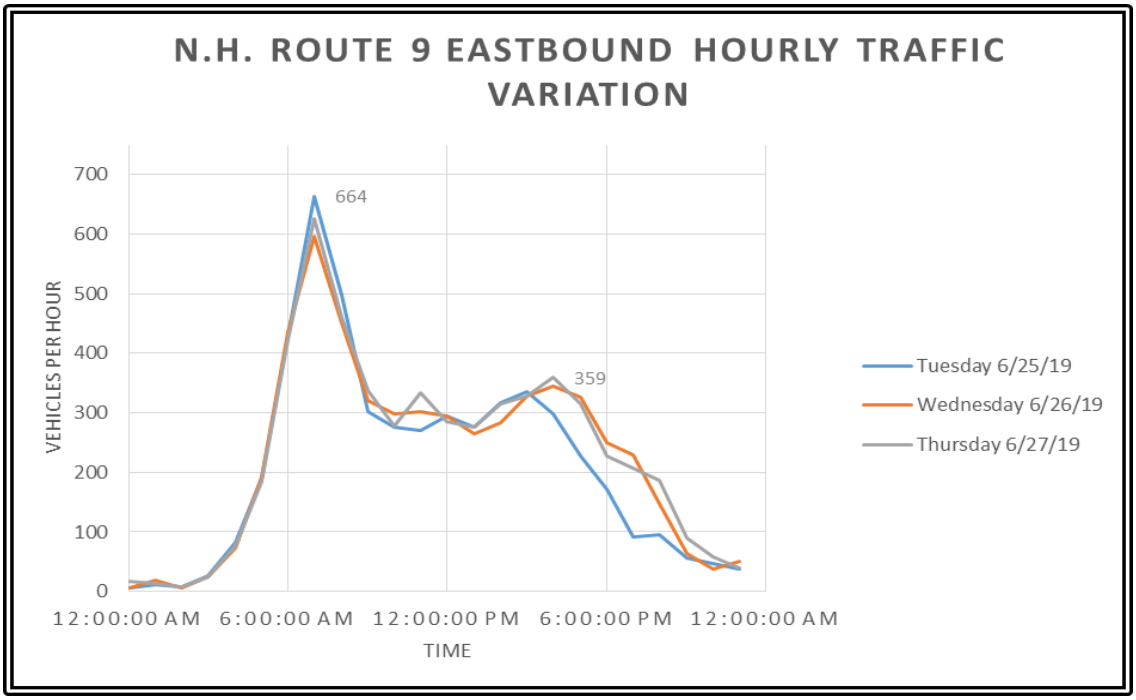


Figure 3: Graph of N.H. Route 9 eastbound hourly variation (2019)

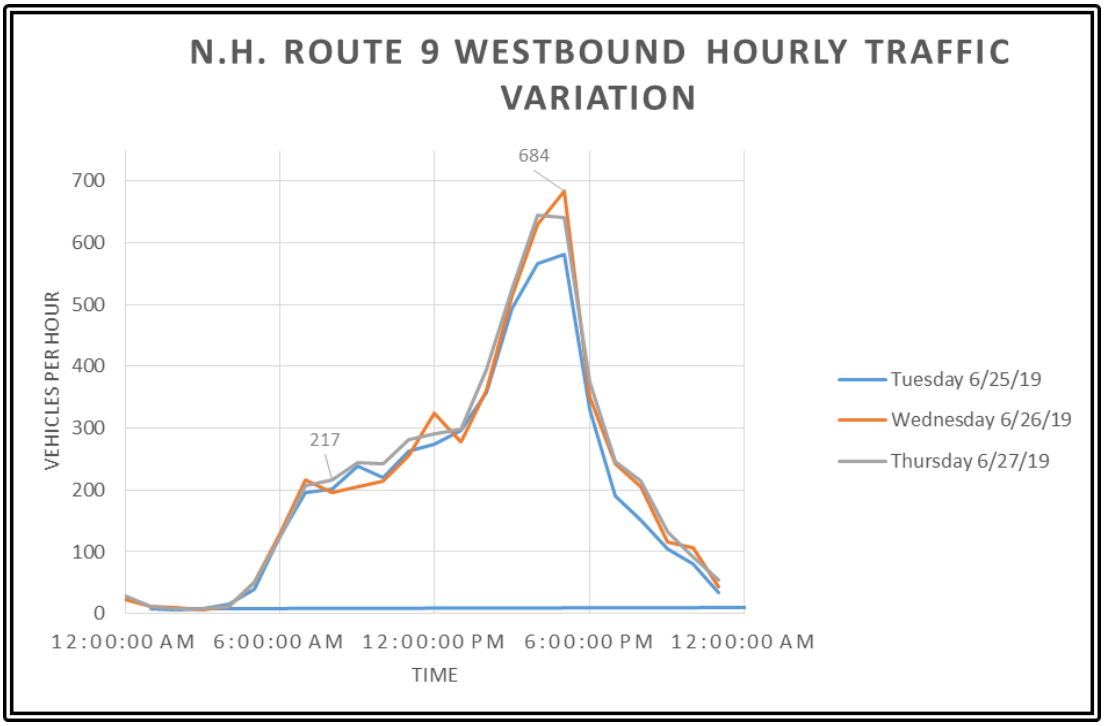


Figure 4: Graph of N.H. Route 9 westbound hourly variation with peak values (2019)

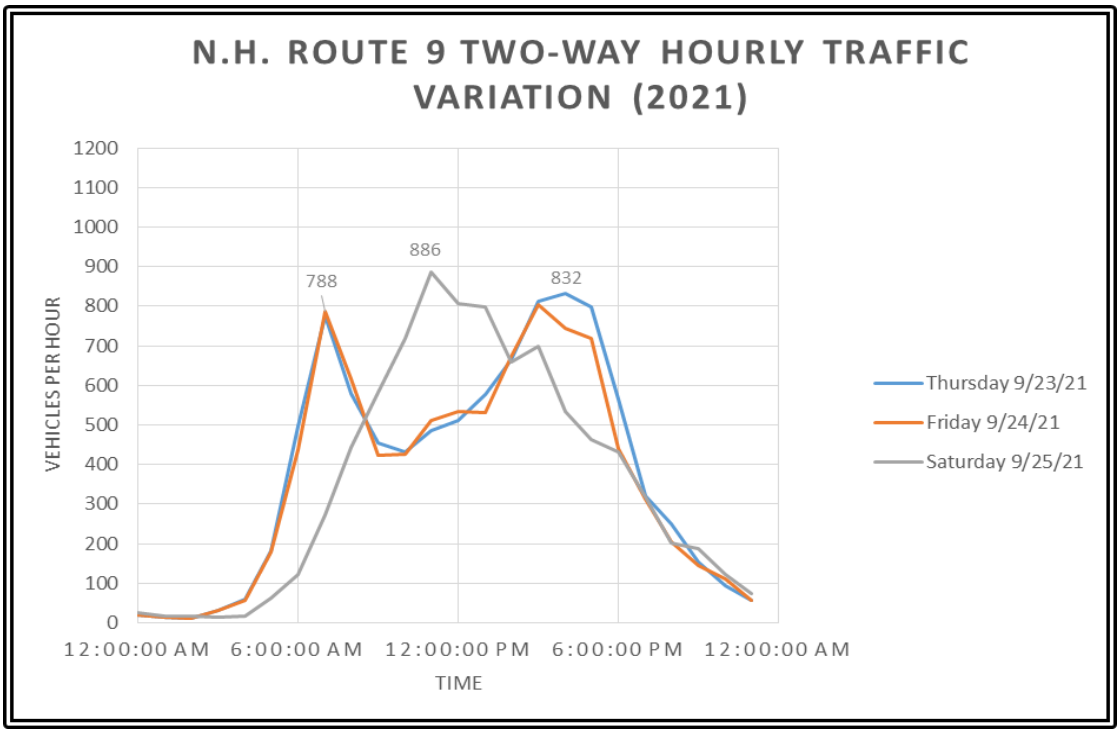


Figure 5: Graph of N.H. Route 9 two-way hourly variation (2021)

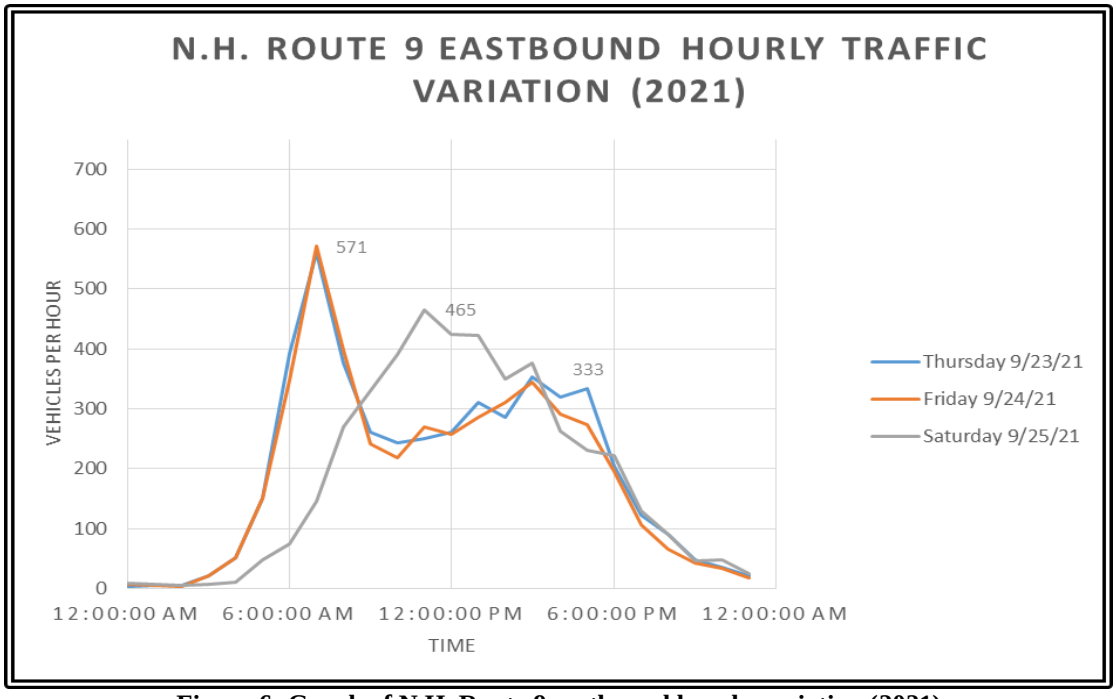


Figure 6: Graph of N.H. Route 9 eastbound hourly variation (2021)

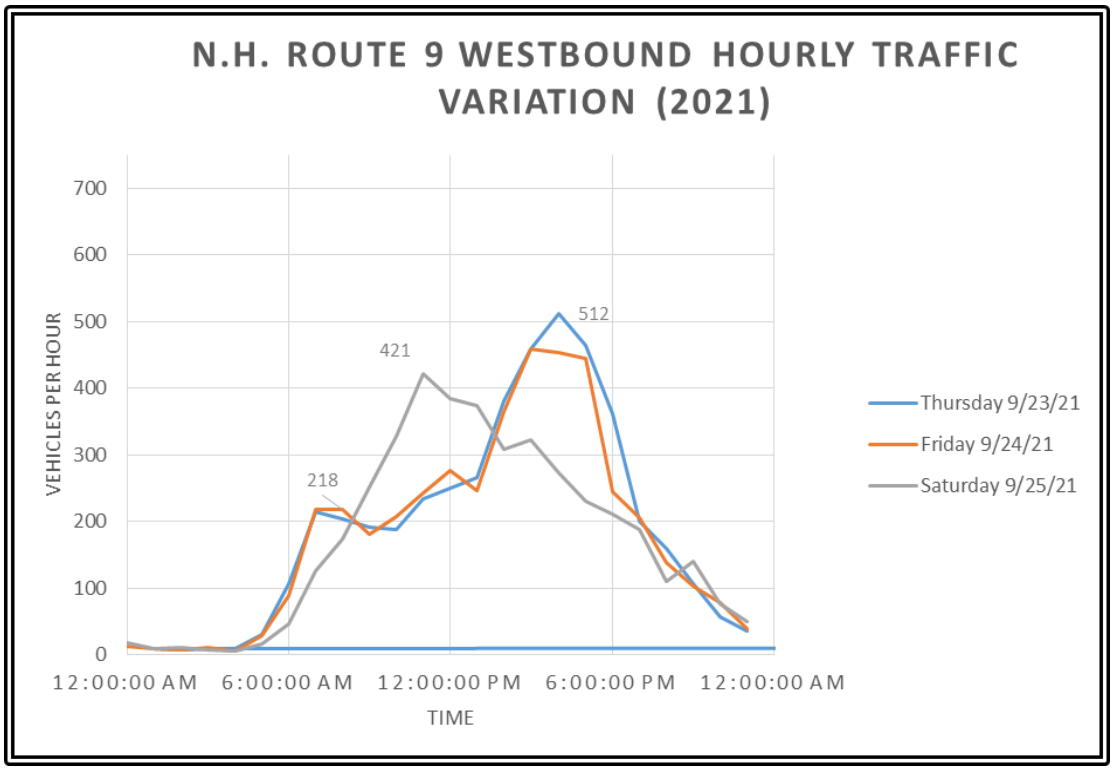


Figure 7: Graph of N.H. Route 9 eastbound hourly variation (2021)

Existing Vehicle Speeds

As previously mentioned, the posted speed limit of NH Route 9 is 30 MPH. For the purposes of the safety analysis below, the 85th percentile of speed is required. This particular section of NH Route 9 was observed by Berry Surveying & Engineering to analyze the pass by traffic, reviewing speed. Excessive speeds were rare, and most operators obeyed the posted speed limits within a deviation of 5 MPH. This is consistent with speeds found on urban roads. The 85th percentile derived by observation and consistency with general practice is 35 MPH.

Intersection of NH Route 9 and NH Route 125

Approximately 0.1 miles to the east, NH Route 9 connects to NH Route 125 at an angle of 90 degrees, where a signalized intersection is used to control traffic movements. NH Route 125 has a posted speed limit of 35 MPH and is considered a principal arterial road according to the NHDOT. NH Route 125 consists of three north bound lanes (left, through, through + right) and three south bound lanes (left, through, through + right) in the area of the intersection of NH Route 9 and NH Route 125, with an Average Annual Daily Traffic (AADT) of 18,845 (2020) divided between north and south. The directional volume split is nearly 50/50, with a north bound AADT of 9,430 (2020) and south bound AADT of 9,415 (2020) and shows an increase in the PM peak hour traffic volumes proportional to what NH Route 9 experiences.

The directional breakdown of trips entering and exiting the site has taken into account the potential draw from NH Route 125. As NH Route 125 is a principal arterial road, this intersection will influence the trips to and from the site. Turn movements must be evaluated differently than the typical directional breakdown that would be derived strictly from the pass by traffic of NH Route 9. The ratio of AADT's from NH Route 9 and NH Route 125 was used to account for this. As trips enter and exit the project site to and from NH Route 125, entrance trips will influence the NH Route 9 west bound volume and exit trips will influence the NH Route 9 east bound volume. Table 3 shows a summary of AADT values for NH Route 9 and NH Route 125.

NH Route 125 AADT (2020):	18,845
NH Route 9 AADT (2020):	7,989
Combined AADT	26,834

Table 3: AADT values for NH Route 9 and NH Route 125

These AADT's where then applied to determine what percentage of vehicles would potentially enter or exit to the east or west of the site. It was determined that 70.2% of vehicles would enter from NH Route 9 westbound, coming from the intersection of NH Route 9 and NH Route 125, and 29.8% would enter from NH Route 9 eastbound. It was then determined that 70.2% of vehicles would exit to NH Route 9 eastbound, going to the intersection of NH Route 9 and NH Route 125, and 29.8% of vehicles would exit to NH Route 9 westbound. This directional break down is used later in the document in the determination of turning movements and turn bay warrant analyses. In addition, Figure 8 shows the configuration of the intersection of NH Route 9 and NH Route 125 with surrounding roadways, including AADT values (NHDOT).

Figure 8: Intersection of NH Route 9 and NH Route 125 with AADT values (NHDOT)

Intersection of NH Route 9 and NH Route 125 Crash Data

Vehicle collision data obtained from the Barrington Police Department provided intersection crash information from 2011-2020. It was shown from this data that an average of seven vehicle collisions occur per year. Of these seven, an average of one occurs during the weekday AM peak hour, one during the PM Peak hour, and five occur off of weekday peak hours. A total of 65 document vehicle collisions occurred during the evaluation time frame with an average of one motor vehicle collision nearly every-other month. Table 4 demonstrates the breakdown of motor vehicle collisions at the intersection of NH Route 9 and NH Route 125:

Motor Vehicle Accidents Intersection of NH 9 & 125 Since 2011				
Year	AM Peak Hour	PM Peak Hour	Off Weekday Peak Hour	Total
2011	1	2	7	10
2012	0	0	4	4
2013	1	1	3	5
2014	0	3	10	13
2015	0	0	2	2
2016	0	1	2	3
2017	0	0	3	3
2018	0	1	3	4
2019	4	0	7	11
2020	5	1	4	10
Total	11	9	45	65
Average	1.1	0.9	4.5	6.5

Table 4: NH Route 9 & NH Route 125 motor vehicle collisions (Barrington PD)

Existing Trip Generation

The 9th and 10th Edition ITE Trip Generation Manual was used to determine the existing volume of trips, as well as the percentage of entrance-to-exit traffic experienced during the AM & PM peak hours between 7 and 9 AM and 4 and 6 PM and the Saturday peak hours between 11 AM and 1 PM. Land Use Codes Single Family Detached Housing (210 10th Edition) and Specialty Retail Center (826 9th Edition) were used in deriving the trip generation for the existing site. Tables 4-6 provide average trip rate, total trips generated, enter to exit ratio, and the enter to exit distribution. Given the extremely seasonal draw the Christmas Dove has, it is anticipated that the ITE generation rates given for this use, on this site, will generate a conservatively high volume of traffic for most times of the year. BS&E has witnessed far less traffic than stated below in the PM peak hour. Land Use Code 826 is not included in the 10th Edition, so the 9th Edition ITE Trip Generation Manual has been used to supplement the trip generation. This is also done to be consistent with the previously submitted TIA in 2018. Since the 9th Edition does not include a Saturday peak hour generation, the PM peak hour generation has been used for Saturday, generating a further conservative estimate.

Single Family Detached Housing Existing Trip Generation:

Time Method	AM Peak Adj. Street (Page 3) Dwelling Units			Time Method	PM Peak Adj. Street (Page 4) Dwelling Units			Time Method	Sat. Peak Generator (Page 8) Dwelling Units		
# Units	3			# Units	3			# Units	3		
Avg. Rate	0.74			Avg. Rate	0.99			Avg. Rate	0.93		
Total Trips	2.2			Total Trips	3.0			Total Trips	2.8		
% Enter	25.0	Total Enter	0.6	% Enter	63.0	Total Enter	1.9	% Enter	54.0	Total Enter	1.5
% Exit	75.0	Total Exit	1.7	% Exit	37.0	Total Exit	1.1	% Exit	46.0	Total Exit	1.3

Table 5: (Single Family Detached Housing) Peak hour of adjacent street traffic AM & PM

Specialty Retail Center Existing Trip Generation:

Time Method	AM Peak Adj. Street 1000 Sq. Ft Gross Leaseable Area			Time Method	PM Peak Adj. Street (Page 1580) 1000 Sq. Ft Gross Leaseable Area			Time Method	Sat. Peak Generator 1000 Sq. Ft Gross Leaseable Area		
GLA (Ft. Sq.)	11.45			GLA (Ft. Sq.)	11.45			GLA (Ft. Sq.)	11.45		
Avg. Rate	CLOSED			Avg. Rate	2.71			Avg. Rate	2.71		
Total Trips	0.0			Total Trips	31.0			Total Trips	31.0		
% Enter	0.0	Total Enter	0.0	% Enter	44.0	Total Enter	13.7	% Enter	50	Total Enter	15.5
% Exit	0.0	Total Exit	0.0	% Exit	56.0	Total Exit	17.4	% Exit	50	Total Exit	15.5

Table 6: (Specialty Retail Center) Peak hour of adjacent street traffic PM

Total Existing Trip Generation:

Time	AM Peak Adj. Street			Time	PM Peak Adj. Street			Time	Sat. Peak Generator		
Total Trips	2.2			Total Trips	34.0			Total Trips	33.8		
% Enter	25.0	Total Enter	0.6	% Enter	45.7	Total Enter	15.5	% Enter	50.3	Total Enter	17.0
% Exit	75.0	Total Exit	1.7	% Exit	54.3	Total Exit	18.5	% Exit	49.7	Total Exit	16.8

Table 7: Total existing trip generation peak hour of adjacent street traffic AM & PM

Proposed Trip Generation

The 10th Edition ITE Trip Generation Manual was used to determine the proposed volume of trips. Included is the percentage of entrance-to-exit traffic experienced during the weekday AM & PM peak hours between 7 and 9 AM and 4 and 6 PM and the Saturday peak hour between 11 AM and 1 PM. Land Use Codes Multifamily Housing (Mid-Rise) (221), Health/Fitness Club (492), General Office Building (710), Medical-Dental Office (720), and Apparel Store (876) were used in deriving the proposed trip generation from the project site. Tables 8-13 provide average trip rate, total trips generated, enter to exit ratio, and the enter to exit distribution. Multi-family trip generation from Overlook Drive and from the mixed-use buildings has been separated out for ease of calculation. Table 14 shows the total proposed trip generation during the weekday AM, PM peak hours, and Saturday peak hour. Table 15 shows the total trip generation of the existing plus the proposed. Table 16 shows the increase in proposed trips from the existing condition.

Multifamily Housing (Mid-rise) (Overlook Drive):

Time Method	AM Peak Adj. Street (Page 74) Dwelling Units			Time Method	PM Peak Adj. Street (Page 75) Dwelling Units			Time Method	Sat. Peak Generator (Page 79) Dwelling Units		
# Units	25			# Units	25			# Units	25		
Avg. Rate	0.36			Avg. Rate	0.44			Avg. Rate	0.44		
Total Trips	9.0			Total Trips	11.0			Total Trips	11.0		
% Enter	26.0	Total Enter	2.3	% Enter	61.0	Total Enter	6.7	% Enter	49.0	Total Enter	5.4
% Exit	74.0	Total Exit	6.7	% Exit	39.0	Total Exit	4.3	% Exit	51.0	Total Exit	5.6

Table 8: (Multifamily Housing (Mid-rise)) Peak hr of adjacent street traffic AM, PM, & Saturday gen

Multifamily Housing (Mid-rise) (Mixed-Use Building):

Time Method	AM Peak Adj. Street (Page 74) Dwelling Units			Time Method	PM Peak Adj. Street (Page 75) Dwelling Units			Time Method	Sat. Peak Generator (Page 79) Dwelling Units		
# Units	20			# Units	20			# Units	20		
Avg. Rate	0.36			Avg. Rate	0.44			Avg. Rate	0.44		
Total Trips	7.2			Total Trips	8.8			Total Trips	8.8		
% Enter	28.0	Total Enter	2.0	% Enter	70.0	Total Enter	6.2	% Enter	50.0	Total Enter	4.4
% Exit	72.0	Total Exit	5.2	% Exit	30.0	Total Exit	2.6	% Exit	50.0	Total Exit	4.4

Table 9: (Multifamily Housing (Mid-rise)) Peak hr of adjacent street traffic AM, PM, & Saturday gen

Health/Fitness Club (One Unit):

Time Method	AM Peak Adj. Street (Page 292) 1000 Sq. Ft Gross Floor Area			Time Method	PM Peak Adj. Street (Page 293) 1000 Sq. Ft Gross Floor Area			Time Method	Sat. Peak Generator (Page 296) 1000 Sq. Ft Gross Floor Area		
GFA (Ft. Sq.)	2.1			GFA (Ft. Sq.)	2.1			GFA (Ft. Sq.)	2.1		
Avg. Rate	1.31			Avg. Rate	3.45			Avg. Rate	3.19		
Total Trips	2.8			Total Trips	7.2			Total Trips	6.7		
% Enter	51.0	Total Enter	1.4	% Enter	57.0	Total Enter	4.1	% Enter	49.0	Total Enter	3.3
% Exit	49.0	Total Exit	1.3	% Exit	43.0	Total Exit	3.1	% Exit	51.0	Total Exit	3.4

Table 10: (Health/Fitness Club) Peak hr of adjacent street traffic AM, PM, & Saturday gen

General Office Building (One Unit):

Time Method	AM Peak Adj. Street (Page 4) 1000 Sq. Ft Gross Floor Area			Time Method	PM Peak Adj. Street (Page 5) 1000 Sq. Ft Gross Floor Area			Time Method	Sat. Peak Generator (Page 9) 1000 Sq. Ft Gross Floor Area		
GFA (Ft. Sq.)	2.1			GFA (Ft. Sq.)	2.1			GFA (Ft. Sq.)	2.1		
Avg. Rate	1.16			Avg. Rate	1.15			Avg. Rate	0.53		
Total Trips	2.4			Total Trips	2.4			Total Trips	1.1		
% Enter	86.0	Total Enter	2.1	% Enter	16.0	Total Enter	0.4	% Enter	54.0	Total Enter	0.6
% Exit	14.0	Total Exit	0.3	% Exit	84.0	Total Exit	2.0	% Exit	46.0	Total Exit	0.5

Table 11: (General Office Building) Peak hr of adjacent street traffic AM, PM, & Saturday gen

Medical-Dental Office (Two Units):

Time Method	AM Peak Adj. Street (Page 153) 1000 Sq. Ft Gross Floor Area			Time Method	PM Peak Adj. Street (Page 154) 1000 Sq. Ft Gross Floor Area			Time Method	Sat. Peak Generator (Page 158) 1000 Sq. Ft Gross Floor Area		
GFA (Ft. Sq.)	4.2			GFA (Ft. Sq.)	4.2			GFA (Ft. Sq.)	4.2		
Avg. Rate	2.78			Avg. Rate	3.46			Avg. Rate	3.1		
Total Trips	11.7			Total Trips	14.5			Total Trips	13.0		
% Enter	78.0	Total Enter	9.1	% Enter	28.0	Total Enter	4.1	% Enter	57.0	Total Enter	7.4
% Exit	22.0	Total Exit	2.6	% Exit	72.0	Total Exit	10.5	% Exit	43.0	Total Exit	5.6

Table 12: (Medical-Dental Office) Peak hr of adjacent street traffic AM, PM, & Saturday gen

Apparel Store (One Unit):

Time Method	AM Peak Adj. Street (Page 522) 1000 Sq. Ft Gross Floor Area			Time Method	PM Peak Adj. Street (Page 523) 1000 Sq. Ft Gross Floor Area			Time Method	Sat. Peak Generator (Page 526) 1000 Sq. Ft Gross Floor Area		
GFA (Ft. Sq.)	2.1			GFA (Ft. Sq.)	2.1			GFA (Ft. Sq.)	2.1		
Avg. Rate	1.00			Avg. Rate	4.12			Avg. Rate	5.32		
Total Trips	2.1			Total Trips	8.7			Total Trips	11.2		
% Enter	80.0	Total Enter	1.7	% Enter	51.0	Total Enter	4.4	% Enter	50.0	Total Enter	5.6
% Exit	20.0	Total Exit	0.4	% Exit	49.0	Total Exit	4.2	% Exit	50.0	Total Exit	5.6

Table 13: (Apparel Store) Peak hr of adjacent street traffic AM, PM, & Saturday gen

Total Proposed Trip Generation:

Time	AM Peak Adj. Street Traffic			Time	PM Peak Adj. Street Traffic			Time	Saturday Peak Generator		
Total Trips	35.2			Total Trips	52.6			Total Trips	51.8		
% Enter	53.0	Total Enter	18.6	% Enter	49.1	Total Enter	25.9	% Enter	51.5	Total Enter	26.7
% Exit	47.0	Total Exit	16.5	% Exit	50.9	Total Exit	26.8	% Exit	48.5	Total Exit	25.1

Table 14: Proposed trip generation from the project site during AM, PM, & Saturday gen

Total Existing & Proposed Trip Generation:

Time	AM Peak Adj. Street Traffic			Time	PM Peak Adj. Street Traffic			Time	Saturday Peak Generator		
Total Trips	37.4			Total Trips	86.6			Total Trips	85.6		
% Enter	51.4	Total Enter	19.2	% Enter	47.8	Total Enter	41.4	% Enter	51.0	Total Enter	43.7
% Exit	48.6	Total Exit	18.2	% Exit	52.2	Total Exit	45.3	% Exit	49.0	Total Exit	41.9

Table 15: Proposed trip generation from the project site Saturday & Sunday peak hour

Changes in Trip Generation:

Changes in Trip Generation	
Time	# Trips Increased
AM Peak	35.2
PM Peak	52.6
Saturday Peak	51.8

Table 16: Changes in trip generation

Build Traffic Projections and Turning Analysis

Traffic data obtained from Accurate Counts has been seasonally peaked and adjusted to Pre-COVID 2021 then projected to 2022 and ten years further to 2032. This has been done using a September peak seasonal adjustment factor of 1.05 (AM, PM & Saturday) and using an annual growth rate of 1%, compounded annually. The derivation of the peak seasonal adjustment factor comes from an average series of values from other urban highways from across New Hampshire, which can be found as Table 26 in Appendix C. Figures 9 and 10 show the build turning movements to and from the proposed site during weekday AM and PM peak hours. Figure 11 shows the build turning movements to and from the proposed site during Saturday peak hour.

These figures also show the projected volume of traffic eastbound and westbound on N.H. Route 9 for 2022 and 2032. This data is then used to preform NCHRP 457 left-turn and right-turn bay warrant analyses. Appendix B contains the data that was used to conduct the analyses as Figures 21-23 and 30-32. A visual of these turning movements is shown in the following figures.

Figure 9: 2022 & 2032 build projected traffic volumes and turning movements weekday AM peak hour

Figure 10: 2022 & 2032 build projected traffic volumes and turning movements weekday PM peak hour

Figure 11: 2022 & 2032 build projected traffic volumes and turning movements Saturday peak hour

Tables 17-19 show in a tabular format the total trips that are calculated to occur to and from the proposed site entrance are shown at the three peak hours analyzed in a build situation. These trips are further broken down into enter and exit to and from the site as well as percentage of left and right turns.

Time	AM Peak Hour	# Trips	Turn Type	% Distribution
Total Trips	37.4			
Trips Enter from Route 9 Eastbound		5.7	Left	15.3
Trips Enter from Route 9 Westbound		13.5	Right	36.1
Trips Exit to Route 9 Eastbound		12.8	Left	34.2
Trips Exit to Route 9 Westbound		5.4	Right	14.5

Table 17: Weekday AM peak hour build turning movements to and from the project site

Time	PM Peak Hour	# Trips	Turn Type	% Distribution
Total Trips	86.6			
Trips Enter from Route 9 Eastbound		12.3	Left	14.2
Trips Enter from Route 9 Westbound		29.1	Right	33.5
Trips Exit to Route 9 Eastbound		31.8	Left	36.7
Trips Exit to Route 9 Westbound		13.5	Right	15.5

Table 18: Weekday PM peak hour build turning movements to and from the project site

Time	Saturday Peak Hour	# Trips	Turn Type	% Distribution
Total Trips	85.6			
Trips Enter from Route 9 Eastbound		13.0	Left	15.2
Trips Enter from Route 9 Westbound		30.7	Right	35.8
Trips Exit to Route 9 Eastbound		29.4	Left	34.4
Trips Exit to Route 9 Westbound		12.5	Right	14.6

Table 19: Saturday peak hour build turning movements to and from the project site

Left-Turn Warrants Analysis

Depending on vehicle speed, advancing vehicular volumes, opposing vehicular volumes, and the percent of left turns that vehicles are predicted to make, certain roadways may require special treatment for vehicles making left turning maneuvers. The determination of this special treatment is determined by the NCHRP 457 left-turn bay guidelines. Calibration constants of 3.0 seconds are used for average left turn time, 5.0 seconds for critical headway, and 1.9 seconds for vehicles to clear the advancing lane. If warranted, the left turn bay would allow for deceleration of vehicles and storage in the queue to wait safely for advancing traffic to pass.

The traffic volumes obtained from Accurate Counts from 2021 projected to 2022 and 2032 were used to determine if a left-turn bay is warranted to safely enter the site. It has been calculated that approximately 6 trips are to occur turning left into the site during the weekday AM peak hour and 12 trips during the PM peak hour. It has also been calculated that approximately 13 trips are to occur turning left into the site during the Saturday peak hour. The projection of the traffic

volumes and data used to conduct the left-turn bay warrant analyses are included in Appendix B as Figures 21-23. The full warrant analyses can be found in Appendix B as Figures 24-29. Tables 20-22 are summaries of the left-turn bay warrant analyses for the proposed site entrance. Using the 85th percentile speed of 35 MPH, it was determined that a left-turn bay IS NOT warranted to safely enter the proposed site.

Left-Turn Lane Warrants Analysis N.H. Route 9		
Factors	2022 Weekday AM Build Volume	2032 Weekday AM Build Volume
Left-Turn Volume (EB)	6	6
Advancing Volume (EB) (L+TR+R)	672	740
Opposing Volume (WB) (TR+R)	268	294
Percent Lefts	1%	1%
85th Percentile Speed (MPH)	35	35
Limiting Adv. Volume (veh/hr)	1,543	1,496
Left-Turn Bay Warranted	NO	NO

Table 20: Summary of Weekday AM peak hour NCHRP 457 left-turn bay analysis

Left-Turn Lane Warrants Analysis N.H. Route 9		
Factors	2022 Weekday PM Build Volume	2032 Weekday PM Build Volume
Left-Turn Volume (EB)	12	12
Advancing Volume (EB) (L+TR+R)	432	473
Opposing Volume (WB) (TR+R)	601	660
Percent Lefts	3%	3%
85th Percentile Speed (MPH)	35	35
Limiting Adv. Volume (veh/hr)	597	562
Left-Turn Bay Warranted	NO	NO

Table 21: Summary of Weekday PM peak hour NCHRP 457 left-turn bay analysis

Left-Turn Lane Warrants Analysis N.H. Route 9		
Factors	2022 Saturday Peak Build Volume	2032 Saturday Peak Build Volume
Left-Turn Volume (EB)	13	13
Advancing Volume (EB) (L+TR+R)	580	636
Opposing Volume (WB) (TR+R)	516	567
Percent Lefts	2%	2%
85th Percentile Speed (MPH)	35	35
Limiting Adv. Volume (veh/hr)	700	695
Left-Turn Bay Warranted	NO	NO

Table 22: Summary of Saturday peak hour NCHRP 457 left-turn bay analysis

Right-Turn Warrants Analysis

Depending on vehicle speed, advancing vehicular volumes, and the percent of right turns that vehicles are predicted to make, certain roadways may require special treatment for vehicles making right turning maneuvers. The determination of this special treatment is determined by the NCHRP 457 right turn bay guidelines. If warranted, the right-turn bay would allow for deceleration of vehicles and storage in the queue to wait safely for right turning traffic to clear.

The traffic volumes obtained from Accurate Counts from 2021 projected to 2022 and 2032 were used to determine if a right-turn bay is warranted to safely enter the site. It has been calculated that approximately 13 trips are to occur turning right into the site during the weekday AM peak hour and 29 trips during the PM peak hour. It has also been calculated that approximately 31 trips are to occur turning right into the site during the Saturday peak hour. The projection of the traffic volumes and data used to conduct the right-turn bay warrant analyses are included in Appendix B as Figures 30-32. The full warrant analyses can be found in Appendix B as Figures 33-38. Tables 23-25 are summaries of the right-turn bay warrant analyses for the proposed site entrance. Using the 85th percentile speed of 35 MPH, it was determined that a right-turn bay IS NOT warranted to safely enter the proposed site.

Right-Turn Lane Warrants Analysis N.H. Route 9		
Factors	2022 Weekday AM Build Volume	2032 Weekday AM Build Volume
Right-Turn Volume (WB)	13	13
Advancing Volume (WB) (FWL+TR+R)	273	300
85th Percentile Speed (MPH)	35	35
Limiting Right-Turn Volume (veh/hr)	1844	1316
Right-Turn Bay Warranted	NO	YES

Table 23: Summary of Weekday AM peak hour NCHRP 457 right-turn bay analysis

Right-Turn Lane Warrants Analysis N.H. Route 9		
Factors	2022 Weekday PM Build Volume	2032 Weekday PM Build Volume
Right-Turn Volume (WB)	29	29
Advancing Volume (WB) (L+TR+R)	613	673
85th Percentile Speed (MPH)	35	35
Limiting Right-Turn Volume (veh/hr)	98	70
Right-Turn Bay Warranted	NO	NO

Table 24: Summary of Weekday PM peak hour NCHRP 457 right-turn bay analysis

Right-Turn Lane Warrants Analysis N.H. Route 9		
Factors	2022 Saturday Peak Build Volume	2032 Saturday Peak Build Volume
Right-Turn Volume (WB)	31	31
Advancing Volume (WB) (L+TR+R)	529	580
85th Percentile Speed (MPH)	35	35
Limiting Right-Turn Volume (veh/hr)	167	120
Right-Turn Bay Warranted	NO	NO

Table 25: Summary of Saturday peak hour NCHRP 457 right-turn bay analysis

Sight Distance and Safety Analysis

The proposed driveway is located at the apex of the road curve to maximize sight distance. Sight distance to the east and west, as well as driveway alignment are the two determining factors of safety. Sight distance to the east is un-obstructed for well over 400 feet (measured) while sight distance to the west is un-obstructed for well over 400 feet (measured.) Using Exhibit 3-1 (Stopping Sight Distance) (Figure 39) in the Geometric Design Manual, a 35 mph 85th percentile speed requires the stopping sight distance be 250 feet from the both directions. The standard sight distance required by NHDOT is 400 feet in cases where the Geometric Design Manual would not require more. In this instance both the easterly and westerly sight distances meet the design required warrant as well as the standard practice of NHDOT of 400 feet. There are no improvements required to maintain this site distance.

With respect to general safety of NH Route 9 in relation to the peak hour trip generation and AADT, it is our assessment that the cross section of pavement and shoulder widths are appropriate.
*****AASHTO Geometric Design of Highways and Streets (2011)

Conclusions and Recommendations

1.) A total of 37 vehicle trips (19 enter/18 exit) are predicted to occur at the weekday AM peak hour and 86 vehicle trips (41 enter/45 exit) at the PM peak hour.

2.) A total of 86 vehicle trips (44 enter/42 exit) are predicted to occur at the Saturday peak hour.

3.) The 2022 and 2032 build traffic volumes DO NOT satisfy the NCHRP 457 guidelines for the implementation of a left-turn lane for all peak hours.

4.) The 2022 and 2032 build traffic volumes DO NOT satisfy the NCHRP 457 guidelines for the implementation of a right-turn lane for all peak hours.

5.) This is an increase of 35 weekday AM peak hour trips, 53 weekday PM peak hour trips, and 52 Saturday peak hour trips.

Respectfully Submitted,

BERRY SURVEYING & ENGINEERING

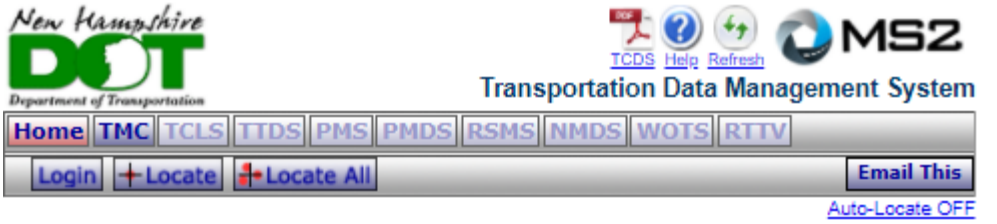
Christopher R. Berry, SIT
Principal, President

Kenneth A. Berry, PE, LLS,
CPSWQ, CPESC, CESSWI
Principal, VP-Technical Operations

KRP/krp

Appendix A

Traffic Counts



List View | All DIRs

Record 1 of 1 Goto Record go

Location ID	82027056	MPO ID	
Type	SPOT	HPMS ID	
On NHS	No	On HPMS	No
LRS ID	S0000009__	LRS Loc Pt.	
SF Group	02	Route Type	
AF Group	02	Route	NH 9
GF Group	E	Active	Yes
Class Dist Grp	Default	Category	3
Seas Clss Grp	Default		
WIM Group	Default		
QC Group	Default		
Fnct'l Class	Major Collector	Milepost	
Located On	Franklin Pierce Hwy		
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)		

More Detail

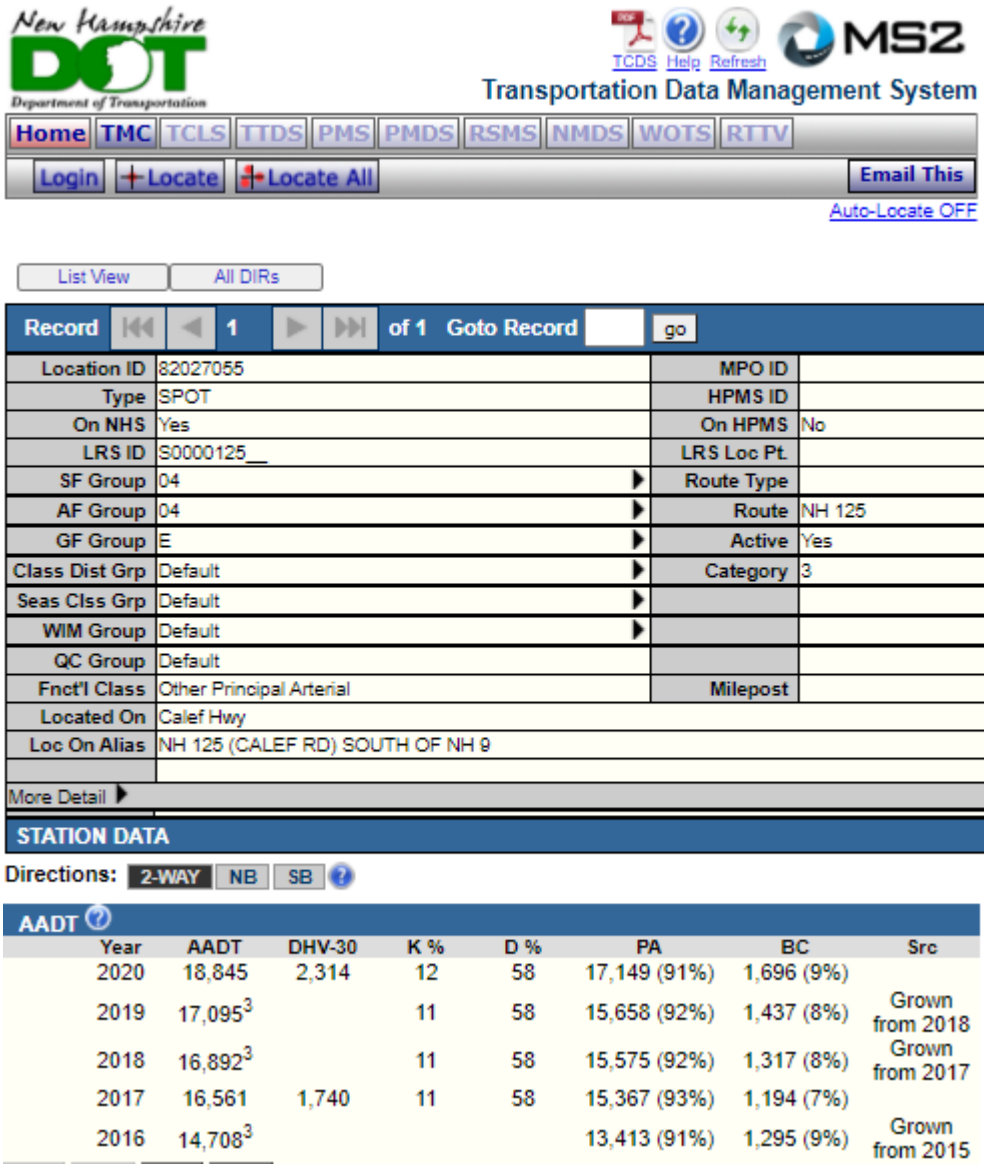
STATION DATA

Directions: 2-WAY EB WB

AADT

Year	AADT	DHV-30	K %	D %	PA	BC	Src
2020	7,989[3]		11	68	7,270 (91%)	719 (9%)	Grown from 2019
2019	9,466	1,011	11	68	8,670 (92%)	796 (8%)	
2018	6,482[3]		13	71	5,977 (92%)	505 (8%)	Grown from 2017
2017	6,355[3]		13	71	5,899 (93%)	456 (7%)	Grown from 2016
2016	6,230	821	13	71	5,682 (91%)	548 (9%)	

Figure 12: History of AADT values and classification for N.H. Route 9



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Record 1 of 1 Goto Record go

Location ID	82027055	MPO ID	
Type	SPOT	HPMS ID	
On NHS	Yes	On HPMS	No
LRS ID	S0000125__	LRS Loc Pt.	
SF Group	04	Route Type	
AF Group	04	Route	NH 125
GF Group	E	Active	Yes
Class Dist Grp	Default	Category	3
Seas Clss Grp	Default		
WIM Group	Default		
QC Group	Default		
Fnct'l Class	Other Principal Arterial	Milepost	
Located On	Calef Hwy		
Loc On Alias	NH 125 (CALEF RD) SOUTH OF NH 9		

More Detail

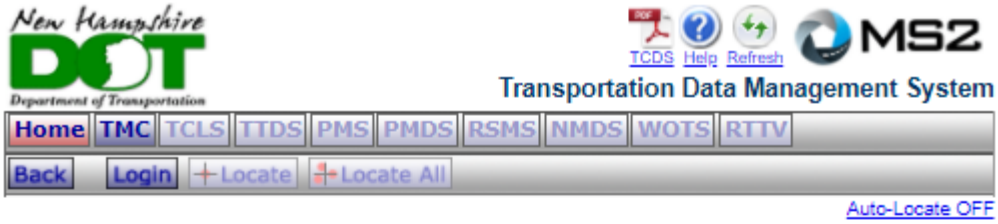
STATION DATA

Directions: 2-WAY | NB | SB

AADT

Year	AADT	DHV-30	K %	D %	PA	BC	Src
2020	18,845	2,314	12	58	17,149 (91%)	1,696 (9%)	
2019	17,095[3]		11	58	15,658 (92%)	1,437 (8%)	Grown from 2018
2018	16,892[3]		11	58	15,575 (92%)	1,317 (8%)	Grown from 2017
2017	16,561	1,740	11	58	15,367 (93%)	1,194 (7%)	
2016	14,708[3]				13,413 (91%)	1,295 (9%)	Grown from 2015

Figure 13: History of AADT values and classification for N.H. Route 125



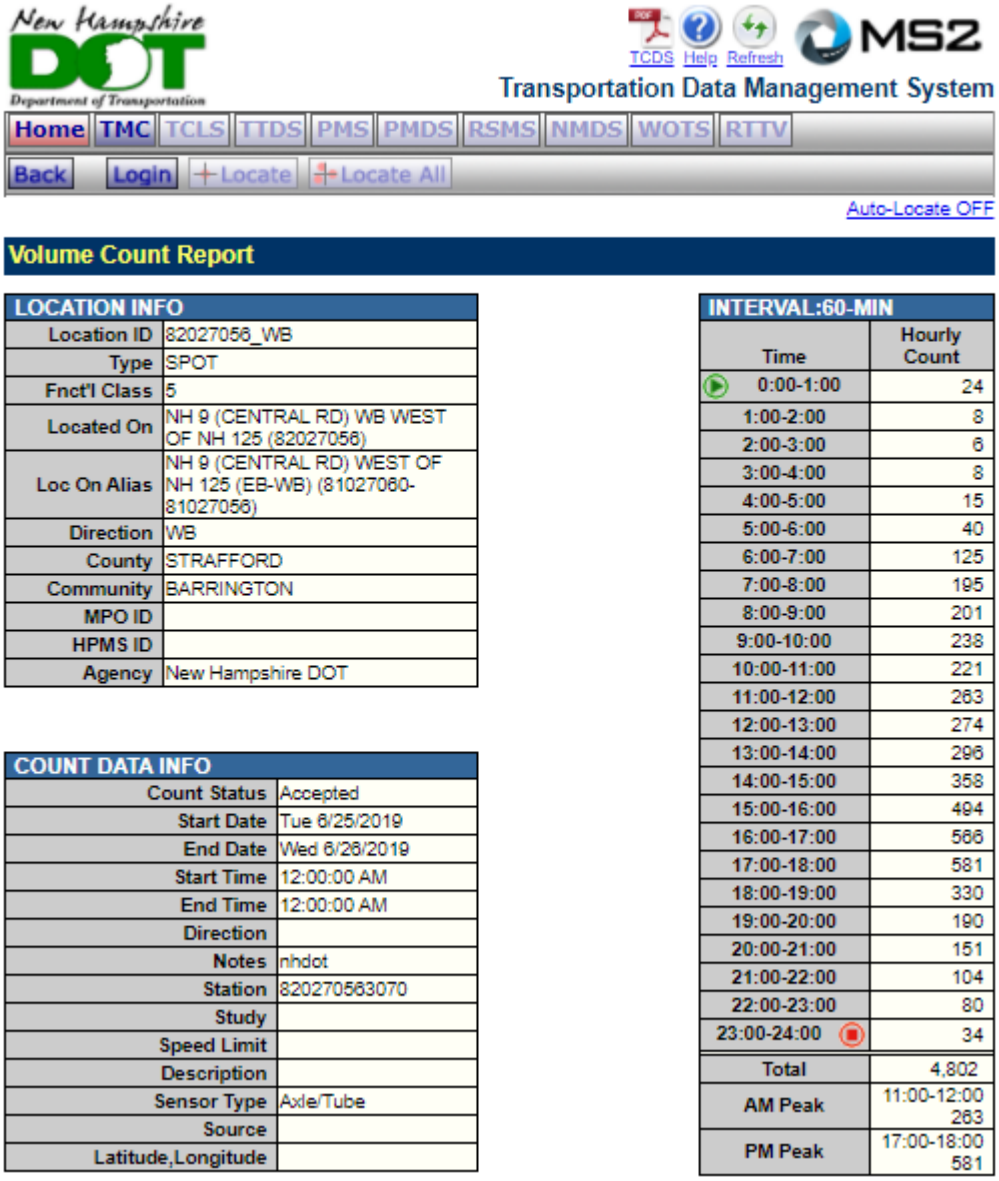
Volume Count Report

LOCATION INFO	
Location ID	82027056_EB
Type	SPOT
Fnct'l Class	5
Located On	NH 9 (CENTRAL RD) EB WEST OF NH 125 (82027056)
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)
Direction	EB
County	STRAFFORD
Community	BARRINGTON
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 6/25/2019
End Date	Wed 6/26/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	nhdot
Station	820270563070
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	11
1:00-2:00	11
2:00-3:00	7
3:00-4:00	27
4:00-5:00	83
5:00-6:00	191
6:00-7:00	428
7:00-8:00	664
8:00-9:00	497
9:00-10:00	303
10:00-11:00	276
11:00-12:00	271
12:00-13:00	295
13:00-14:00	276
14:00-15:00	317
15:00-16:00	335
16:00-17:00	298
17:00-18:00	228
18:00-19:00	171
19:00-20:00	91
20:00-21:00	96
21:00-22:00	56
22:00-23:00	46
23:00-24:00	38
Total	5,016
AM Peak	07:00-08:00 664
PM Peak	15:00-16:00 335

Figure 14: Tuesday June 25, 2019 NH Route 9 eastbound hourly traffic count



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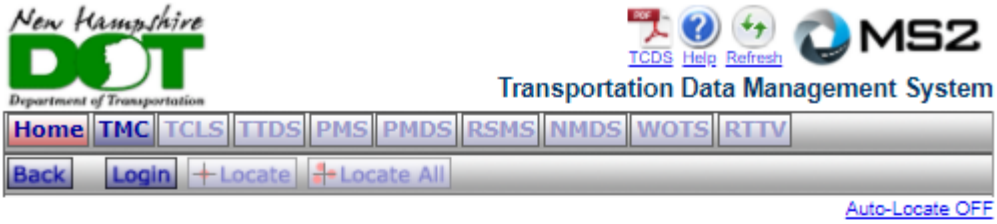
Volume Count Report

LOCATION INFO	
Location ID	82027056_WB
Type	SPOT
Fnct'l Class	5
Located On	NH 9 (CENTRAL RD) WB WEST OF NH 125 (82027056)
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)
Direction	WB
County	STRAFFORD
Community	BARRINGTON
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Tue 6/25/2019
End Date	Wed 6/26/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	nhdot
Station	820270563070
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	24
1:00-2:00	8
2:00-3:00	6
3:00-4:00	8
4:00-5:00	15
5:00-6:00	40
6:00-7:00	125
7:00-8:00	195
8:00-9:00	201
9:00-10:00	238
10:00-11:00	221
11:00-12:00	263
12:00-13:00	274
13:00-14:00	296
14:00-15:00	358
15:00-16:00	494
16:00-17:00	566
17:00-18:00	581
18:00-19:00	330
19:00-20:00	190
20:00-21:00	151
21:00-22:00	104
22:00-23:00	80
23:00-24:00	34
Total	4,802
AM Peak	11:00-12:00 263
PM Peak	17:00-18:00 581

Figure 15: Tuesday June 25, 2019 NH Route 9 westbound hourly traffic count



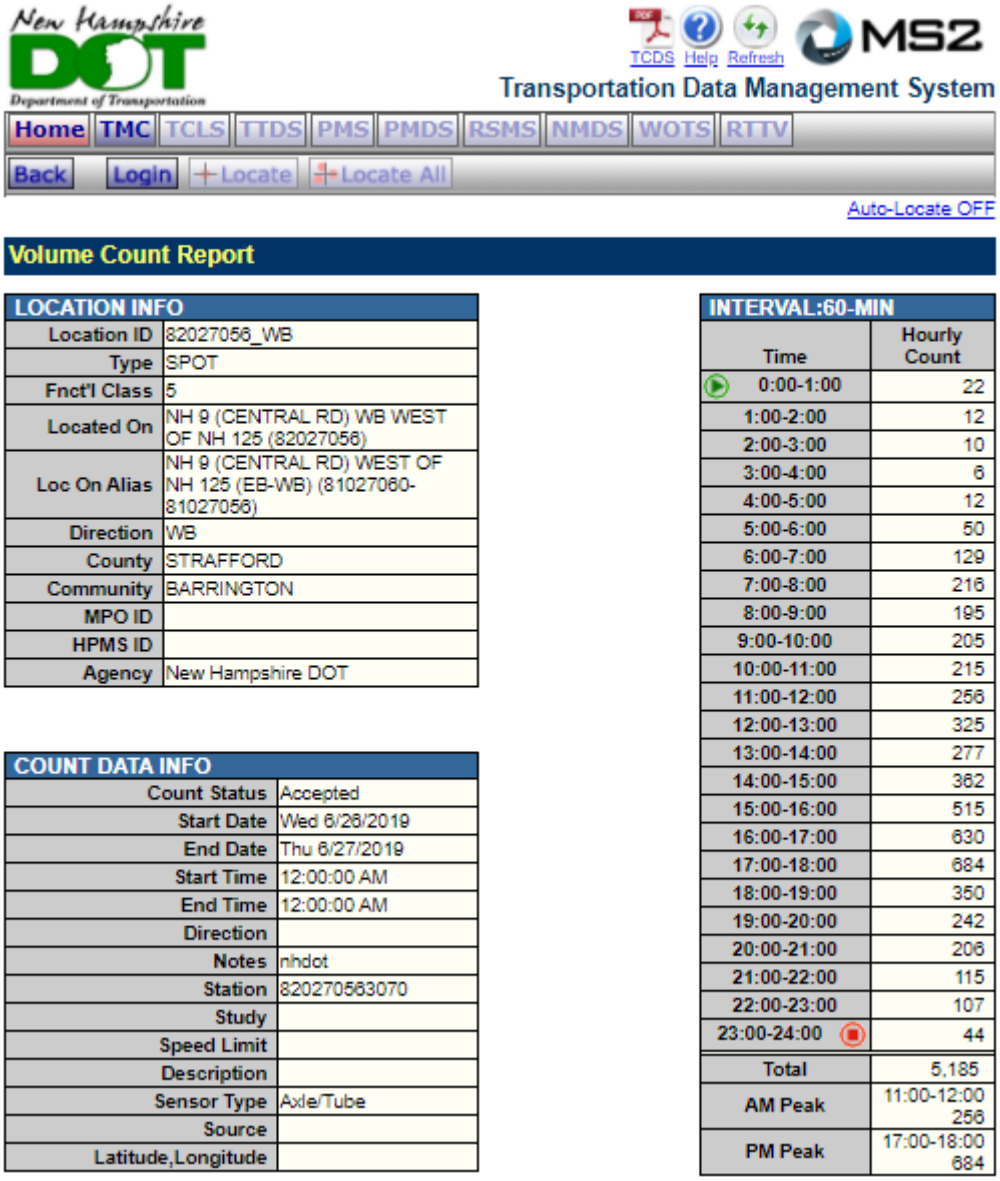
Volume Count Report

LOCATION INFO	
Location ID	82027056_EB
Type	SPOT
Fnct'l Class	5
Located On	NH 9 (CENTRAL RD) EB WEST OF NH 125 (82027056)
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)
Direction	EB
County	STRAFFORD
Community	BARRINGTON
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 6/26/2019
End Date	Thu 6/27/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	nhdot
Station	820270563070
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	6
1:00-2:00	18
2:00-3:00	6
3:00-4:00	24
4:00-5:00	73
5:00-6:00	193
6:00-7:00	437
7:00-8:00	596
8:00-9:00	451
9:00-10:00	321
10:00-11:00	299
11:00-12:00	303
12:00-13:00	295
13:00-14:00	265
14:00-15:00	283
15:00-16:00	328
16:00-17:00	344
17:00-18:00	327
18:00-19:00	250
19:00-20:00	230
20:00-21:00	147
21:00-22:00	63
22:00-23:00	37
23:00-24:00	50
Total	5,346
AM Peak	07:00-08:00 596
PM Peak	16:00-17:00 344

Figure 16: Wednesday June 26, 2019 NH Route 9 eastbound hourly traffic count



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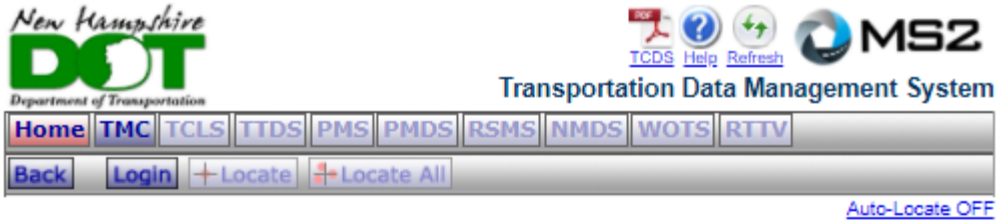
Volume Count Report

LOCATION INFO	
Location ID	82027056_WB
Type	SPOT
Fnct'l Class	5
Located On	NH 9 (CENTRAL RD) WB WEST OF NH 125 (82027056)
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)
Direction	WB
County	STRAFFORD
Community	BARRINGTON
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 6/26/2019
End Date	Thu 6/27/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	nhdot
Station	820270563070
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	22
1:00-2:00	12
2:00-3:00	10
3:00-4:00	6
4:00-5:00	12
5:00-6:00	50
6:00-7:00	129
7:00-8:00	216
8:00-9:00	195
9:00-10:00	205
10:00-11:00	215
11:00-12:00	256
12:00-13:00	325
13:00-14:00	277
14:00-15:00	362
15:00-16:00	515
16:00-17:00	630
17:00-18:00	684
18:00-19:00	350
19:00-20:00	242
20:00-21:00	206
21:00-22:00	115
22:00-23:00	107
23:00-24:00	44
Total	5,185
AM Peak	11:00-12:00 256
PM Peak	17:00-18:00 684

Figure 17: Wednesday June 26, 2019 NH Route 9 westbound hourly traffic count



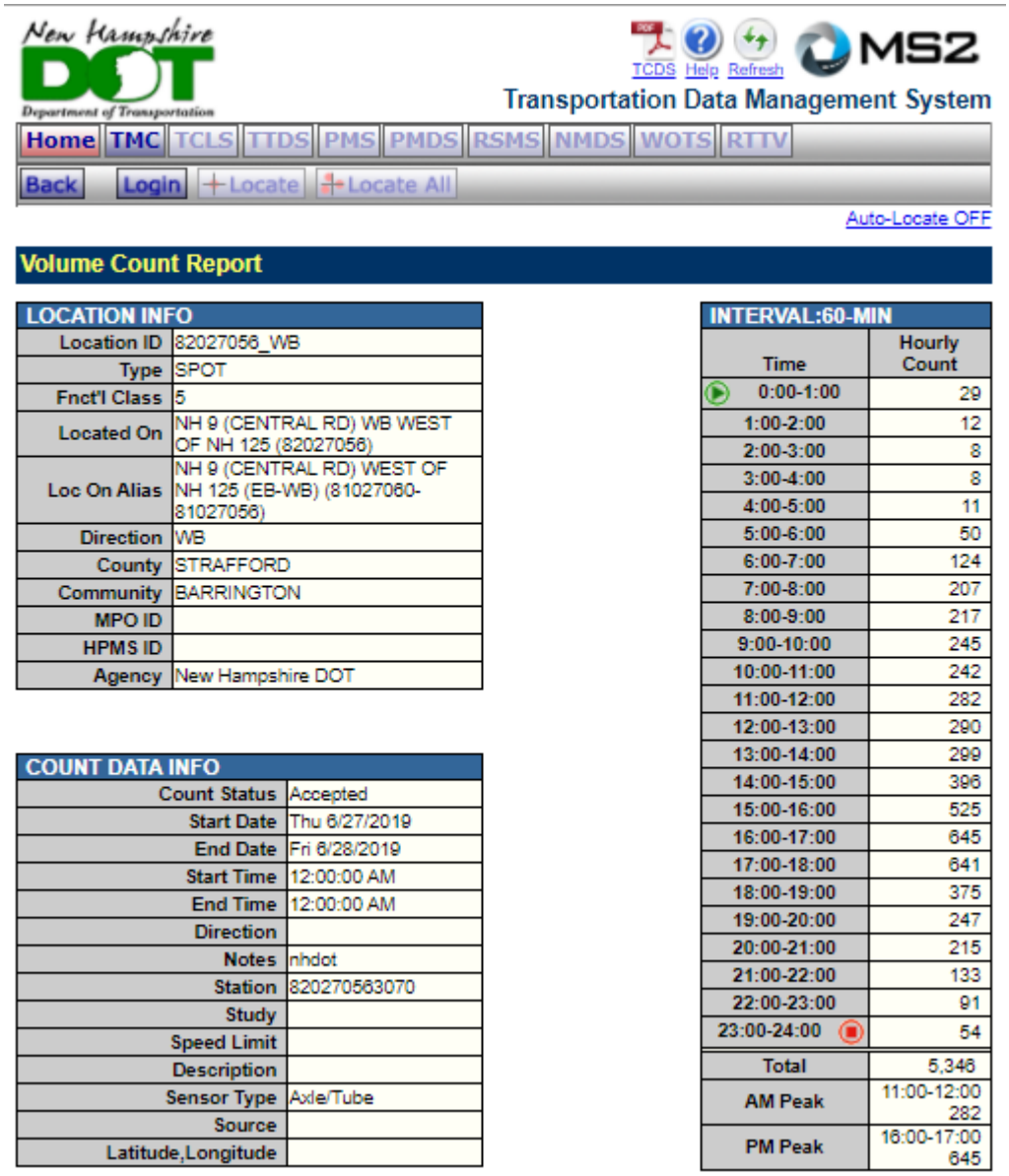
Volume Count Report

LOCATION INFO	
Location ID	82027056_EB
Type	SPOT
Fnct'l Class	5
Located On	NH 9 (CENTRAL RD) EB WEST OF NH 125 (82027056)
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)
Direction	EB
County	STRAFFORD
Community	BARRINGTON
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 6/27/2019
End Date	Fri 6/28/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	nhdot
Station	820270563070
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	17
1:00-2:00	13
2:00-3:00	7
3:00-4:00	24
4:00-5:00	76
5:00-6:00	184
6:00-7:00	424
7:00-8:00	627
8:00-9:00	461
9:00-10:00	338
10:00-11:00	278
11:00-12:00	334
12:00-13:00	285
13:00-14:00	276
14:00-15:00	316
15:00-16:00	329
16:00-17:00	359
17:00-18:00	315
18:00-19:00	228
19:00-20:00	207
20:00-21:00	187
21:00-22:00	89
22:00-23:00	58
23:00-24:00	40
Total	5,472
AM Peak	07:00-08:00 627
PM Peak	16:00-17:00 359

Figure 18: Thursday June 27, 2019 NH Route 9 eastbound hourly traffic count



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Volume Count Report

LOCATION INFO	
Location ID	82027056_WB
Type	SPOT
Fnct'l Class	5
Located On	NH 9 (CENTRAL RD) WB WEST OF NH 125 (82027056)
Loc On Alias	NH 9 (CENTRAL RD) WEST OF NH 125 (EB-WB) (81027060-81027056)
Direction	WB
County	STRAFFORD
Community	BARRINGTON
MPO ID	
HPMS ID	
Agency	New Hampshire DOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 6/27/2019
End Date	Fri 6/28/2019
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	nhdot
Station	820270563070
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	Hourly Count
0:00-1:00	29
1:00-2:00	12
2:00-3:00	8
3:00-4:00	8
4:00-5:00	11
5:00-6:00	50
6:00-7:00	124
7:00-8:00	207
8:00-9:00	217
9:00-10:00	245
10:00-11:00	242
11:00-12:00	282
12:00-13:00	290
13:00-14:00	299
14:00-15:00	396
15:00-16:00	525
16:00-17:00	645
17:00-18:00	641
18:00-19:00	375
19:00-20:00	247
20:00-21:00	215
21:00-22:00	133
22:00-23:00	91
23:00-24:00	54
Total	5,348
AM Peak	11:00-12:00 282
PM Peak	16:00-17:00 645

Figure 19: Thursday June 27, 2019 NH Route 9 westbound hourly traffic count

Accurate Counts

Location : Route 9
Location : West of Route 125
City/State: Barrington, NH

20097001

9/20/2021	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Week Average	
Time	WB,	EB,	WB,	EB,	WB,	EB,	WB,	EB,	WB,	EB,	WB,	EB,	WB,	EB,	WB,	EB,
12:00 AM	*	*	*	*	*	*	16	4	12	7	17	8	*	*	15	6
1:00	*	*	*	*	*	*	8	5	8	6	9	7	*	*	8	6
2:00	*	*	*	*	*	*	7	5	7	4	11	5	*	*	8	5
3:00	*	*	*	*	*	*	9	22	11	21	7	7	*	*	9	17
4:00	*	*	*	*	*	*	8	52	5	52	6	10	*	*	6	38
5:00	*	*	*	*	*	*	30	151	28	151	16	47	*	*	25	116
6:00	*	*	*	*	*	*	106	392	88	348	46	75	*	*	80	272
7:00	*	*	*	*	*	*	214	561	217	571	126	146	*	*	186	426
8:00	*	*	*	*	*	*	203	377	218	397	174	270	*	*	198	348
9:00	*	*	*	*	*	*	192	261	181	242	251	331	*	*	208	278
10:00	*	*	*	*	*	*	188	244	207	219	328	391	*	*	241	285
11:00	*	*	*	*	*	*	234	251	242	269	421	465	*	*	299	328
12:00 PM	*	*	*	*	*	*	250	261	277	258	384	424	*	*	304	314
1:00	*	*	*	*	*	*	265	311	246	286	374	423	*	*	295	340
2:00	*	*	*	*	*	*	380	286	364	310	309	350	*	*	351	315
3:00	*	*	*	*	*	*	459	354	459	344	322	376	*	*	413	358
4:00	*	*	*	*	*	*	512	320	454	291	272	262	*	*	413	291
5:00	*	*	*	*	*	*	464	333	444	274	231	231	*	*	380	279
6:00	*	*	*	*	*	*	361	204	244	196	211	221	*	*	272	207
7:00	*	*	*	*	*	*	200	122	205	106	187	130	*	*	197	119
8:00	*	*	*	*	*	*	160	90	139	65	110	91	*	*	136	82
9:00	*	*	*	*	*	*	106	48	102	42	140	46	*	*	116	45
10:00	*	*	*	*	*	*	57	36	78	34	76	47	*	*	70	39
11:00	*	*	*	*	*	*	35	21	39	17	50	25	*	*	41	21
Total	0	0	0	0	0	0	4464	4711	4275	4510	4078	4388	0	0	4271	4535
Day	0		0		0		9175		8785		8466		0		8806	
AM Peak							11:00	7:00	11:00	7:00	11:00	11:00			11:00	7:00
Volume							234	561	242	571	421	465			299	426
PM Peak							4:00	3:00	3:00	3:00	12:00 PM	12:00 PM			3:00	3:00
Volume							512	354	459	344	384	424			413	358
Comb Total	0		0		0		9175		8785		8466		0		8806	
ADT	ADT: 8,809		AADT: 8,809													

Figure 20: September 23-25, 2021 NH Route 9 hourly traffic count

Appendix B

Data Used in Left-Turn Bay Warrants Analysis

Year	Advancing Volume (TR)	Left Turns (L)	Right Turns (R)	Total Advancing Volume (L+TR+R)	% of Left Turn
2021	646	5.7	13.5	665.7	0.01
2022	653	5.7	13.5	672.1	0.01
2023	659	5.7	13.5	678.7	0.01
2024	666	5.7	13.5	685.3	0.01
2025	673	5.7	13.5	691.9	0.01
2026	679	5.7	13.5	698.7	0.01
2027	686	5.7	13.5	705.5	0.01
2028	693	5.7	13.5	712.3	0.01
2029	700	5.7	13.5	719.2	0.01
2030	707	5.7	13.5	726.2	0.01
2031	714	5.7	13.5	733.3	0.01
2032	721	5.7	13.5	740.5	0.01
Year	Opposing Volume (TR)	Right Turns (R)		Total Opposing Volume (TR+R)	
2021	252	13.5		265.2	
2022	254	13.5		267.7	
2023	257	13.5		270.3	
2024	259	13.5		272.9	
2025	262	13.5		275.5	
2026	265	13.5		278.1	
2027	267	13.5		280.7	
2028	270	13.5		283.4	
2029	273	13.5		286.1	
2030	275	13.5		288.8	
2031	278	13.5		291.6	
2032	281	13.5		294.4	

Figure 21: Data used for Weekday AM peak hour left-turn warrant analyses

Year	Advancing Volume (TR)	Left Turns (L)	Right Turns (R)	Total Advancing Volume (L+TR+R)	% of Left Turn
2021	387	12.3	29.1	428.0	0.03
2022	390	12.3	29.1	431.9	0.03
2023	394	12.3	29.1	435.8	0.03
2024	398	12.3	29.1	439.7	0.03
2025	402	12.3	29.1	443.7	0.03
2026	406	12.3	29.1	447.7	0.03
2027	410	12.3	29.1	451.8	0.03
2028	415	12.3	29.1	455.9	0.03
2029	419	12.3	29.1	460.1	0.03
2030	423	12.3	29.1	464.2	0.03
2031	427	12.3	29.1	468.5	0.03
2032	431	12.3	29.1	472.7	0.03
Year	Opposing Volume (TR)	Right Turns (R)		Total Opposing Volume (TR+R)	
2021	566	29.1		594.9	
2022	572	29.1		600.6	
2023	577	29.1		606.3	
2024	583	29.1		612.1	
2025	589	29.1		617.9	
2026	595	29.1		623.8	
2027	601	29.1		629.7	
2028	607	29.1		635.7	
2029	613	29.1		641.8	
2030	619	29.1		647.9	
2031	625	29.1		654.1	
2032	631	29.1		660.4	

Figure 22: Data used for Weekday PM peak hour left-turn warrant analyses

Year	Advancing Volume (TR)	Left Turns (L)	Right Turns (R)	Total Advancing Volume (L+TR+R)	% of Left Turn
2021	531	13.0	30.7	574.8	0.02
2022	536	13.0	30.7	580.1	0.02
2023	542	13.0	30.7	585.5	0.02
2024	547	13.0	30.7	590.9	0.02
2025	553	13.0	30.7	596.4	0.02
2026	558	13.0	30.7	601.9	0.02
2027	564	13.0	30.7	607.5	0.02
2028	569	13.0	30.7	613.1	0.02
2029	575	13.0	30.7	618.8	0.02
2030	581	13.0	30.7	624.6	0.02
2031	587	13.0	30.7	630.4	0.02
2032	593	13.0	30.7	636.3	0.02
Year	Opposing Volume (TR)	Right Turns (R)		Total Opposing Volume (TR+R)	
2021	481	30.7		511.6	
2022	486	30.7		516.4	
2023	491	30.7		521.2	
2024	495	30.7		526.1	
2025	500	30.7		531.1	
2026	505	30.7		536.1	
2027	510	30.7		541.1	
2028	516	30.7		546.2	
2029	521	30.7		551.4	
2030	526	30.7		556.6	
2031	531	30.7		561.9	
2032	536	30.7		567.2	

Figure 23: Data used for Saturday peak hour left-turn warrant analyses

Left-Turn Bay Warrants Analysis

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

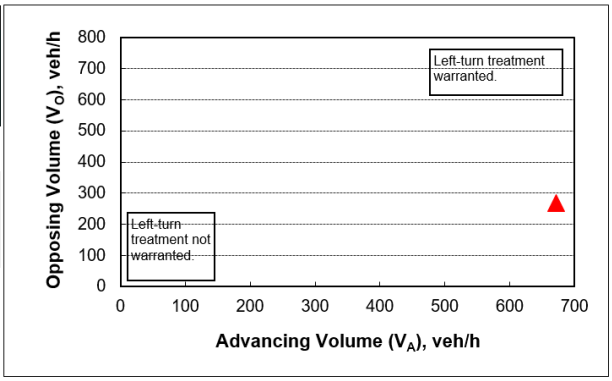
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	1%
Advancing volume (V_A), veh/h:	672
Opposing volume (V_O), veh/h:	268

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	1543
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 24: 2022 Weekday AM peak hour NCHRP 457 left-turn bay warrant analysis

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

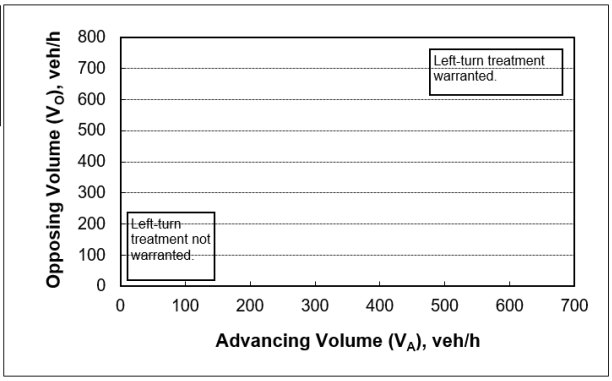
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	1%
Advancing volume (V_A), veh/h:	740
Opposing volume (V_O), veh/h:	294

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	1498
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 25: 2032 Weekday AM peak hour NCHRP 457 left-turn bay warrant analysis

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

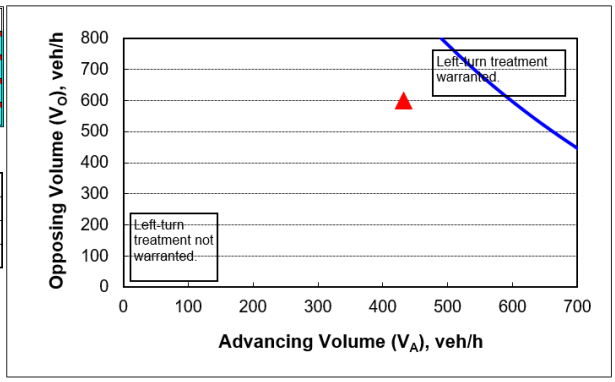
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	3%
Advancing volume (V_A), veh/h:	432
Opposing volume (V_O), veh/h:	601

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	597
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 26: 2022 Weekday PM peak hour NCHRP 457 left-turn bay warrant analysis

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

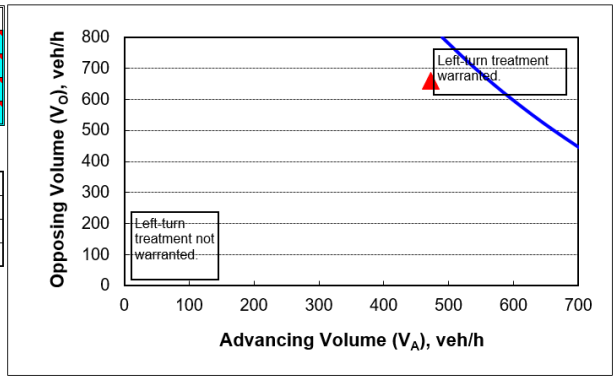
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	3%
Advancing volume (V_A), veh/h:	473
Opposing volume (V_O), veh/h:	660

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	562
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 27: 2032 Weekday PM peak hour NCHRP 457 left-turn bay warrant analysis

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

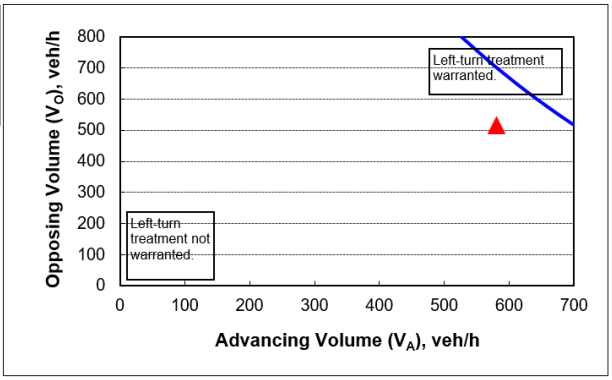
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	2%
Advancing volume (V_A), veh/h:	580
Opposing volume (V_O), veh/h:	516

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	700
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 28: 2022 Saturday peak hour NCHRP 457 left-turn bay warrant analysis

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

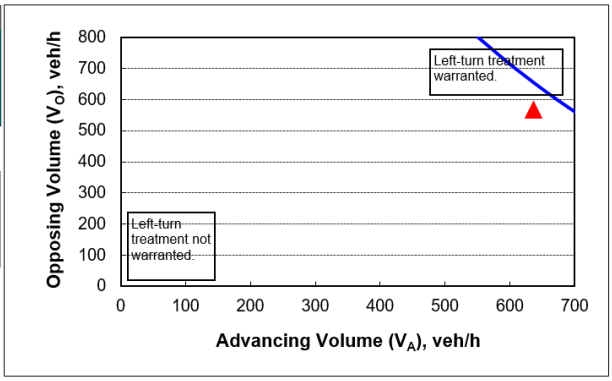
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	2%
Advancing volume (V_A), veh/h:	636
Opposing volume (V_O), veh/h:	567

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	695
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 29: 2032 Saturday peak hour NCHRP 457 left-turn bay warrant analysis

Data Used in Right-Turn Bay Warrants Analysis

Year	Advancing Volume (TR)	Left Turns (L)	Right Turns (R)	Total Advancing Volume (L+TR+R)
2021	252	5.7	13.5	270.9
2022	254	5.7	13.5	273.5
2023	257	5.7	13.5	276.0
2024	259	5.7	13.5	278.6
2025	262	5.7	13.5	281.2
2026	265	5.7	13.5	283.8
2027	267	5.7	13.5	286.4
2028	270	5.7	13.5	289.1
2029	273	5.7	13.5	291.8
2030	275	5.7	13.5	294.5
2031	278	5.7	13.5	297.3
2032	281	5.7	13.5	300.1

Figure 30: Data used for Weekday AM peak hour right-turn warrant analyses

Year	Advancing Volume (TR)	Left Turns (L)	Right Turns (R)	Total Advancing Volume (L+TR+R)
2021	566	12.3	29.1	607.2
2022	572	12.3	29.1	612.9
2023	577	12.3	29.1	618.6
2024	583	12.3	29.1	624.4
2025	589	12.3	29.1	630.2
2026	595	12.3	29.1	636.1
2027	601	12.3	29.1	642.1
2028	607	12.3	29.1	648.1
2029	613	12.3	29.1	654.1
2030	619	12.3	29.1	660.3
2031	625	12.3	29.1	666.4
2032	631	12.3	29.1	672.7

Figure 31: Data used for Weekday PM peak hour right-turn warrant analyses

Year	Advancing Volume (TR)	Left Turns (L)	Right Turns (R)	Total Advancing Volume (L+TR+R)
2021	481	13.0	30.7	524.6
2022	486	13.0	30.7	529.4
2023	491	13.0	30.7	534.2
2024	495	13.0	30.7	539.1
2025	500	13.0	30.7	544.1
2026	505	13.0	30.7	549.1
2027	510	13.0	30.7	554.1
2028	516	13.0	30.7	559.3
2029	521	13.0	30.7	564.4
2030	526	13.0	30.7	569.6
2031	531	13.0	30.7	574.9
2032	536	13.0	30.7	580.2

Figure 32: Data used for Saturday peak hour right-turn warrant analyses

Right-Turn Bay Warrants Analysis

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	273
Right-turn volume, veh/h:	13

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	1844
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	

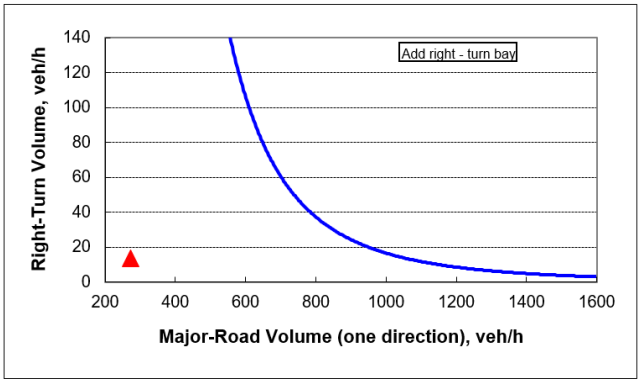


Figure 33: 2022 Weekday AM peak hour NCHRP 457 right-turn bay warrant analysis

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	300
Right-turn volume, veh/h:	13

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	1316
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	

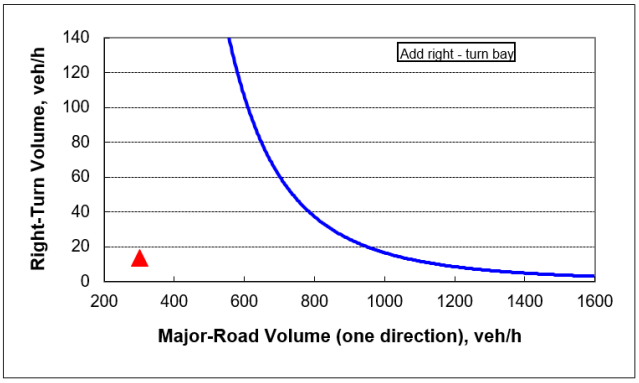


Figure 34: 2032 Weekday AM peak hour NCHRP 457 right-turn bay warrant analysis

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	613
Right-turn volume, veh/h:	29

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	98
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	

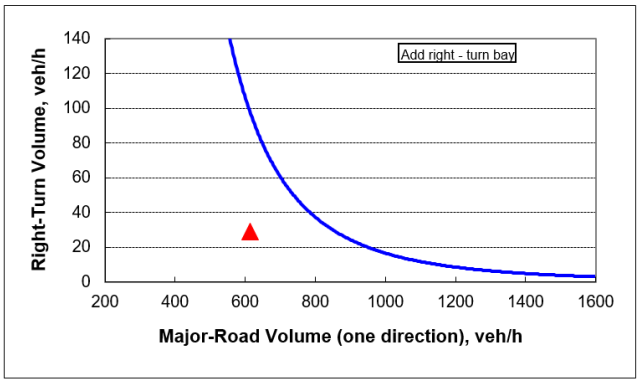


Figure 35: 2022 Weekday PM peak hour NCHRP 457 right-turn bay warrant analysis

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	673
Right-turn volume, veh/h:	29

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	70
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	

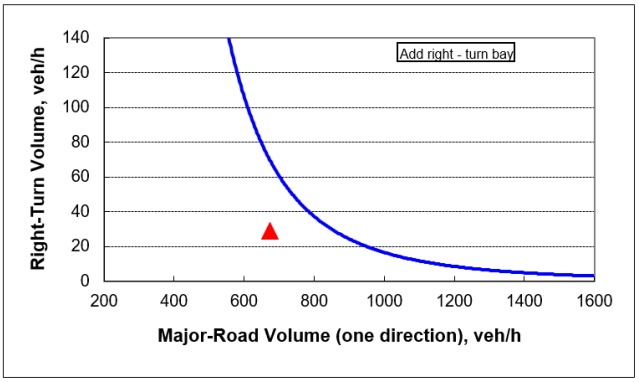


Figure 36: 2032 Weekday PM peak hour NCHRP 457 right-turn bay warrant analysis

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	529
Right-turn volume, veh/h:	31

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	167
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	

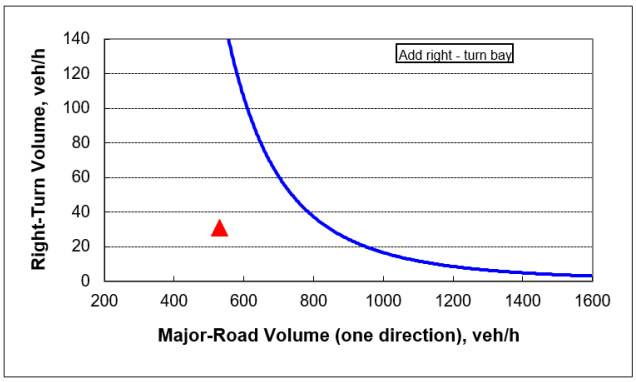


Figure 37: 2022 Saturday peak hour NCHRP 457 right-turn bay warrant analysis

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	35
Major-road volume (one direction), veh/h:	580
Right-turn volume, veh/h:	31

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	120
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	

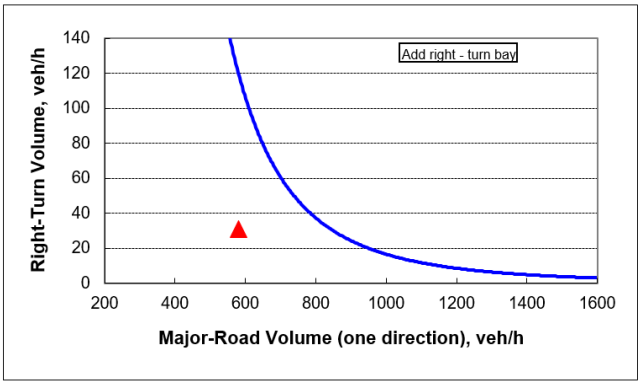


Figure 38: 2032 Saturday peak hour NCHRP 457 right-turn bay warrant analysis

Appendix C

Miscellaneous

Year 2019 Monthly Data Group 4 Averages: Urban Highways			
		Adjustment to	
Month	ADT	Average	Peak
January	11431	1.12	1.23
February	11848	1.08	1.18
March	12141	1.06	1.15
April	12860	1.00	1.09
May	13551	0.95	1.03
June	13785	0.93	1.02
July	13942	0.92	1.01
August	14016	0.92	1.00
September	13379	0.96	1.05
October	13339	0.96	1.05
November	12265	1.05	1.14
December	11496	1.12	1.22
Average ADT:	12838		
Peak ADT:	14016		

Table 26: Derivation of the seasonal peaking factor

Table 3-1. Stopping Sight Distance on Level Roadways

U.S. Customary				
Design Speed (mph)	Brake Reaction Distance (ft)	Braking Distance on Level (ft)	Stopping Sight Distance	
			Calculated (ft)	Design (ft)
15	55.1	21.6	76.7	80
20	73.5	38.4	111.9	115
25	91.9	60.0	151.9	155
30	110.3	86.4	196.7	200
35	128.6	117.6	246.2	250
40	147.0	153.6	300.6	305
45	165.4	194.4	359.8	360
50	183.8	240.0	423.8	425
55	202.1	290.3	492.4	495
60	220.5	345.5	566.0	570
65	238.9	405.5	644.4	645
70	257.3	470.3	727.6	730
75	275.6	539.9	815.5	820
80	294.0	614.3	908.3	910
85	313.5	693.5	1007.0	1010

Metric				
Design Speed (km/h)	Brake Reaction Distance (m)	Braking Distance on Level (m)	Stopping Sight Distance	
			Calculated (m)	Design (m)
20	13.9	4.6	18.5	20
30	20.9	10.3	31.2	35
40	27.8	18.4	46.2	50
50	34.8	28.7	63.5	65
60	41.7	41.3	83.0	85
70	48.7	56.2	104.9	105
80	55.6	73.4	129.0	130
90	62.6	92.9	155.5	160
100	69.5	114.7	184.2	185
110	76.5	138.8	215.3	220
120	83.4	165.2	248.6	250
130	90.4	193.8	284.2	285
140	97.3	224.8	322.1	325

Note: Brake reaction distance predicated on a time of 2.5 s; deceleration rate of 11.2 ft/s² [3.4 m/s²] used to determine calculated sight distance.

Figure 39: Derivation of stopping sight distance requirements

Appendix D

Trip Generation Derivation

Specialty Retail Center
(826)

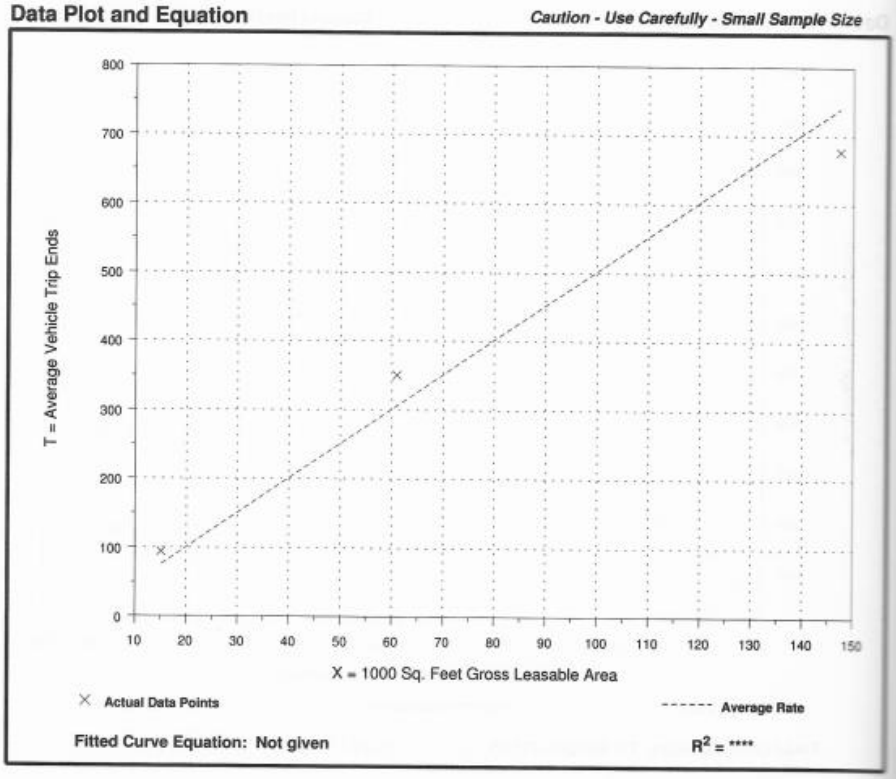
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Leasable Area**
On a: **Weekday,**
P.M. Peak Hour of Generator

Number of Studies: 3
Average 1000 Sq. Feet GLA: 75
Directional Distribution: 56% entering, 44% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
5.02	4.59 - 6.18	2.31

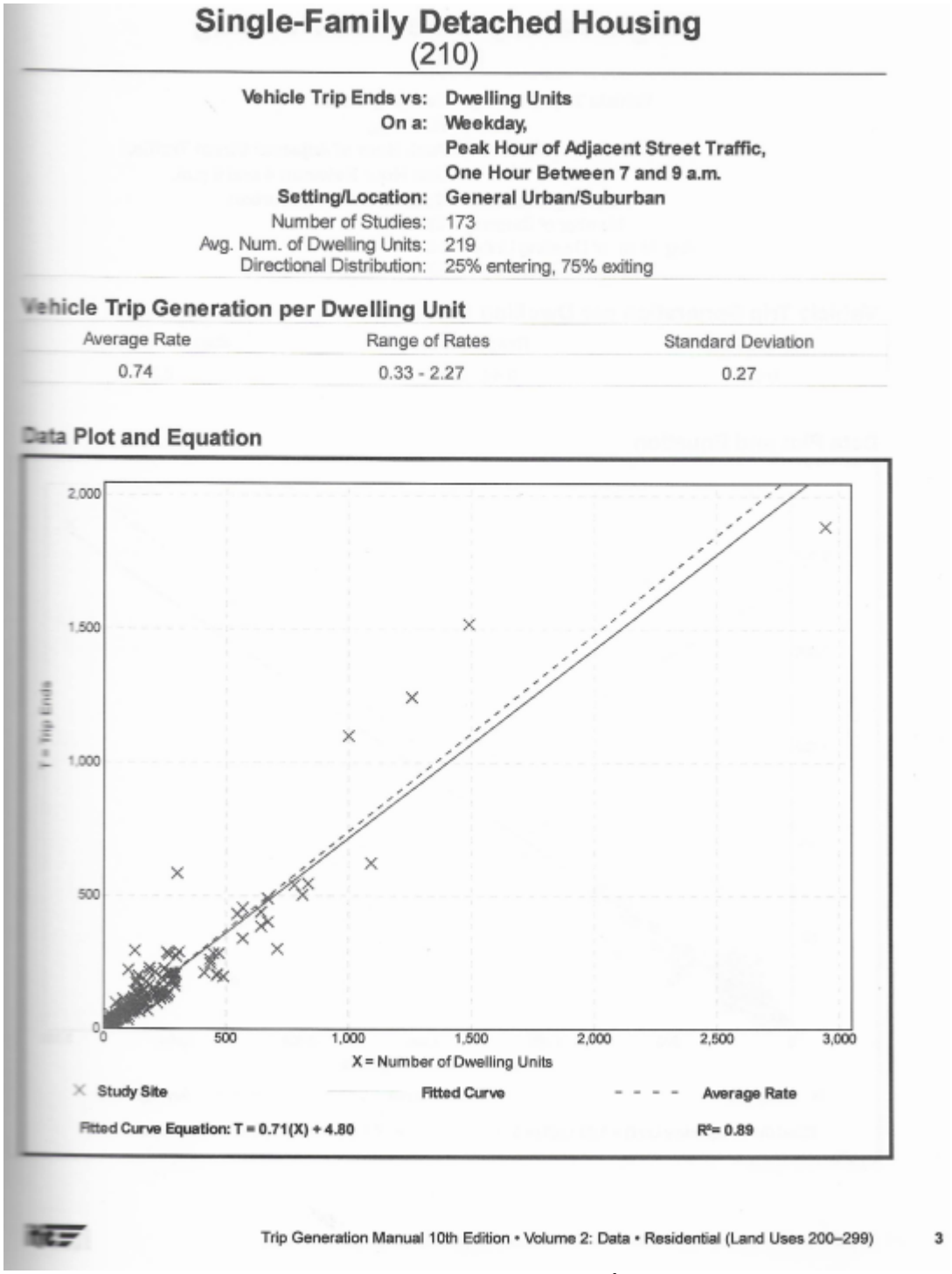
Data Plot and Equation *Caution - Use Carefully - Small Sample Size*



Fitted Curve Equation: Not given R^2 = ****

1582 *Trip Generation*, 9th Edition • Institute of Transportation Engineers

Figure 40: ITE Trip Generation, 9th Edition



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: 173
Avg. Num. of Dwelling Units: 219
Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

Data Plot and Equation

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Figure 41: ITE Trip Generation, 10th Edition

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:	190
Avg. Num. of Dwelling Units:	242
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

Data Plot and Equation

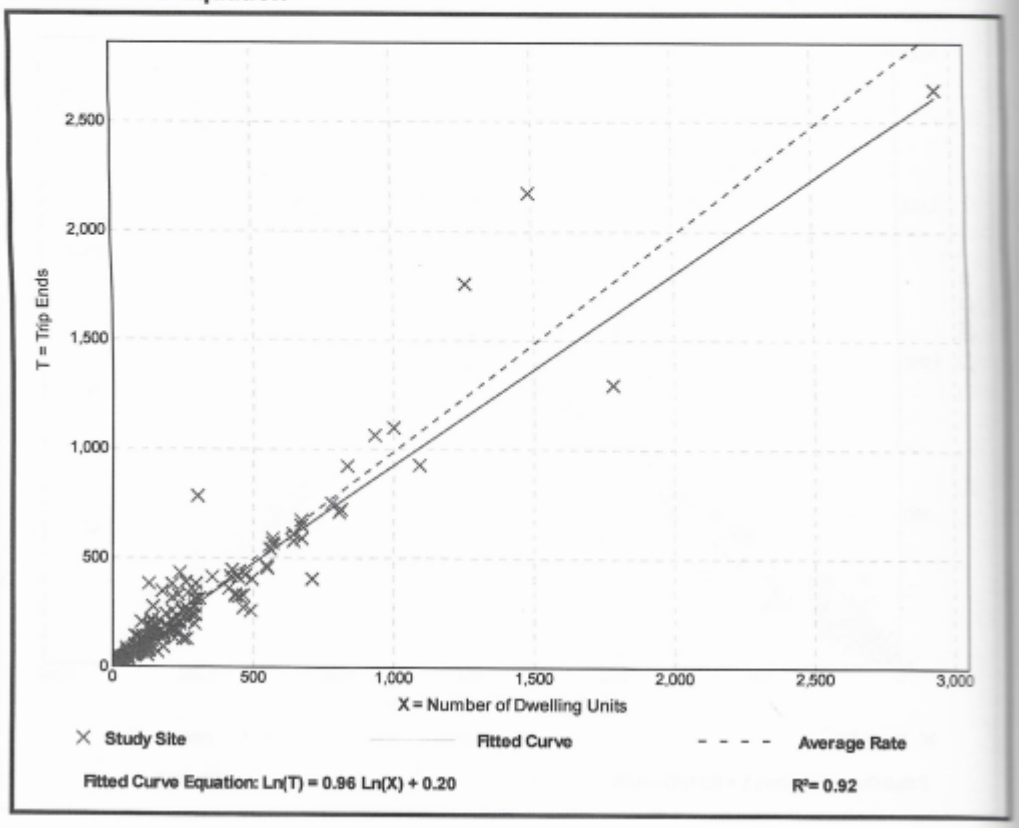

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Figure 42: ITE Trip Generation, 10th Edition

Single-Family Detached Housing
(210)

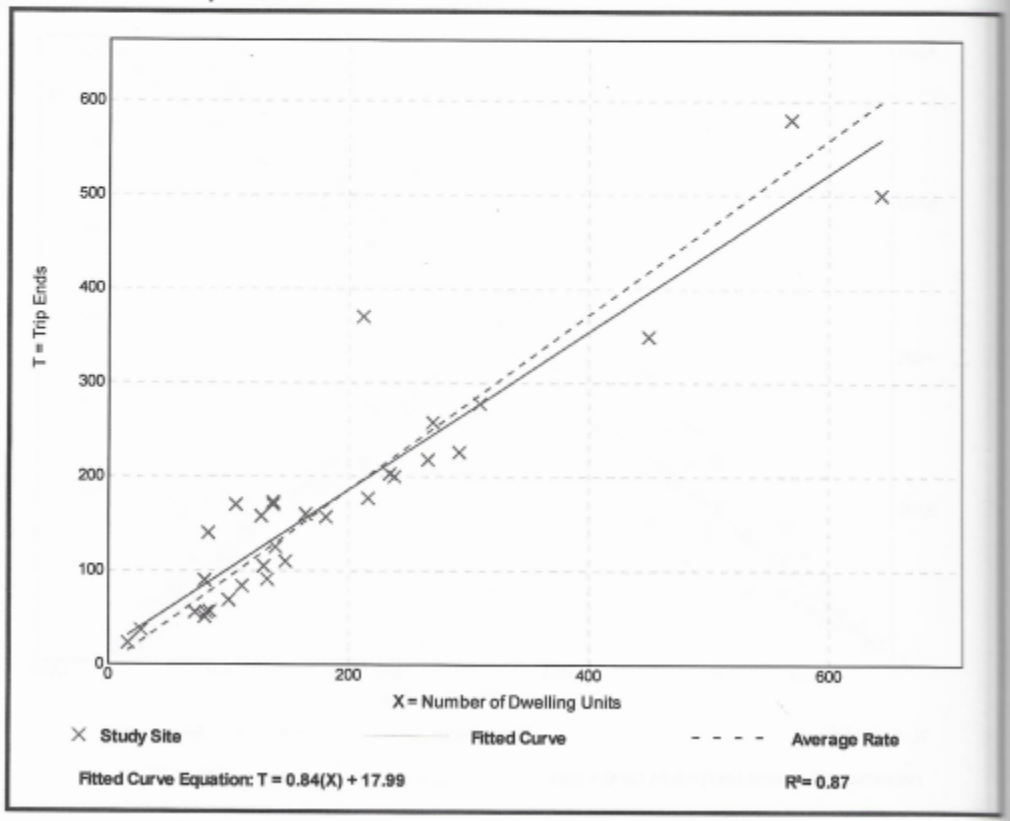
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 31
Avg. Num. of Dwelling Units: 188
Directional Distribution: 54% entering, 46% exiting

Vehicle Trip Generation per Dwelling Unit

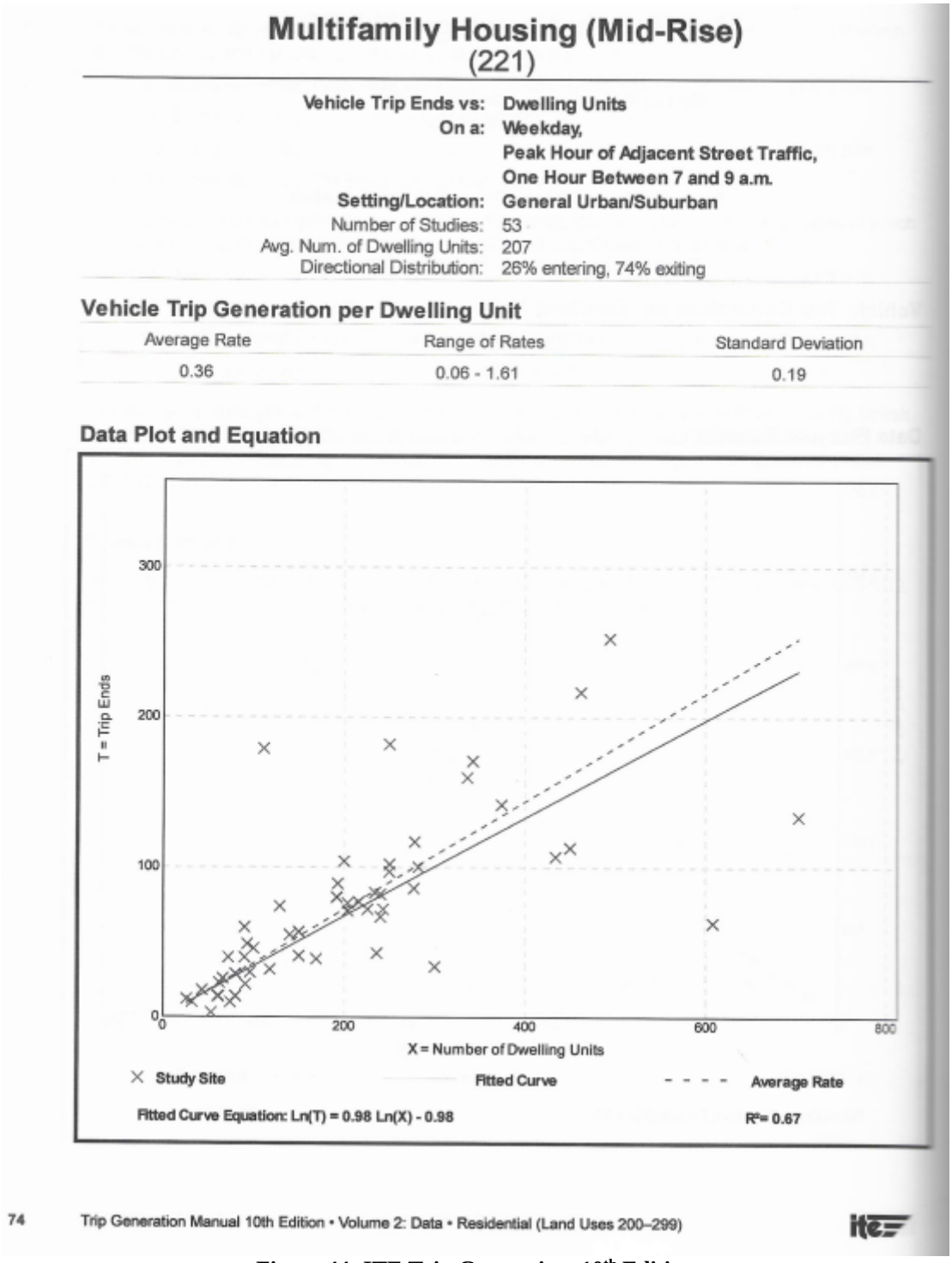
Average Rate	Range of Rates	Standard Deviation
0.93	0.64 - 1.75	0.26

Data Plot and Equation



8 Trip Generation Manual 10th Edition • Volume 2: Data • Residential (Land Uses 200–299)

Figure 43: ITE Trip Generation, 10th Edition



Multifamily Housing (Mid-Rise)
(221)

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: 53
Avg. Num. of Dwelling Units: 207
Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.36	0.06 - 1.61	0.19

Data Plot and Equation

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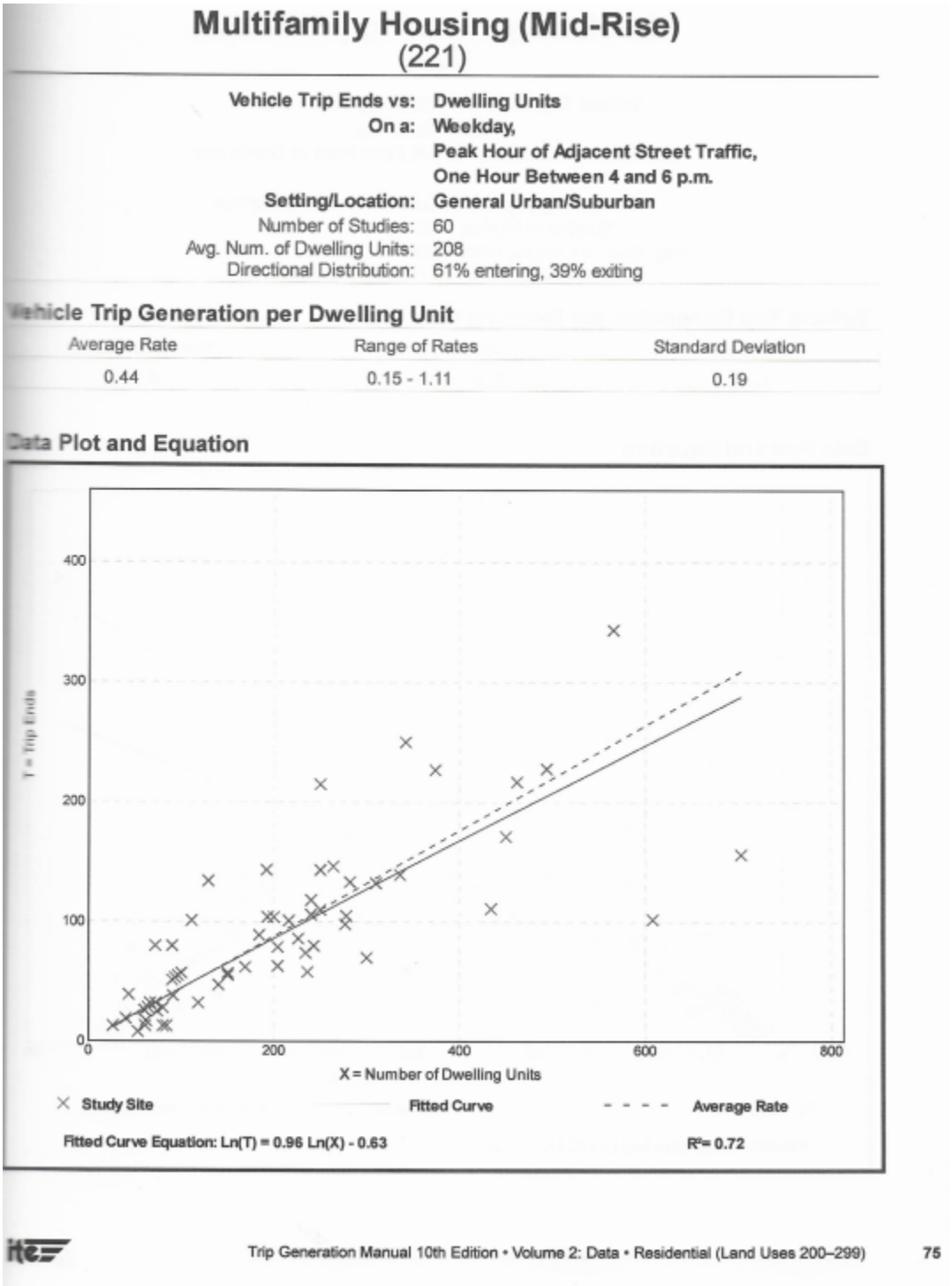
Figure 44: ITE Trip Generation, 10th Edition



Multifamily Housing (Mid-Rise)
(221)

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:	60
Avg. Num. of Dwelling Units:	208
Directional Distribution:	61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.11	0.19

Data Plot and Equation

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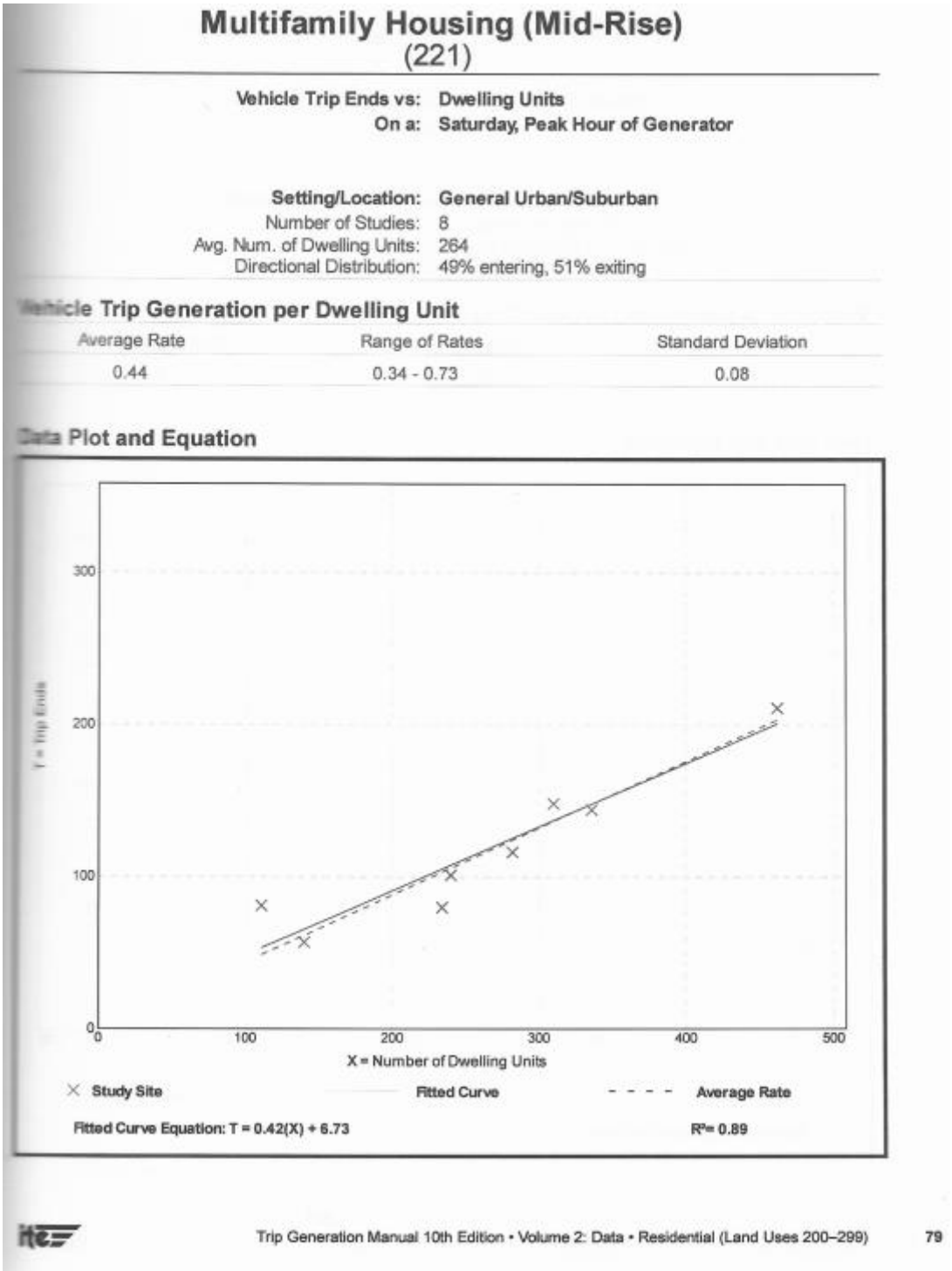
Figure 45: ITE Trip Generation, 10th Edition



Multifamily Housing (Mid-Rise)
(221)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 8
Avg. Num. of Dwelling Units: 264
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.34 - 0.73	0.08

Data Plot and Equation

Figure 46: ITE Trip Generation, 10th Edition

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Health/Fitness Club
(492)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
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:	6
1000 Sq. Ft. GFA:	44
Directional Distribution:	51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.31	0.30 - 2.00	0.64

Data Plot and Equation

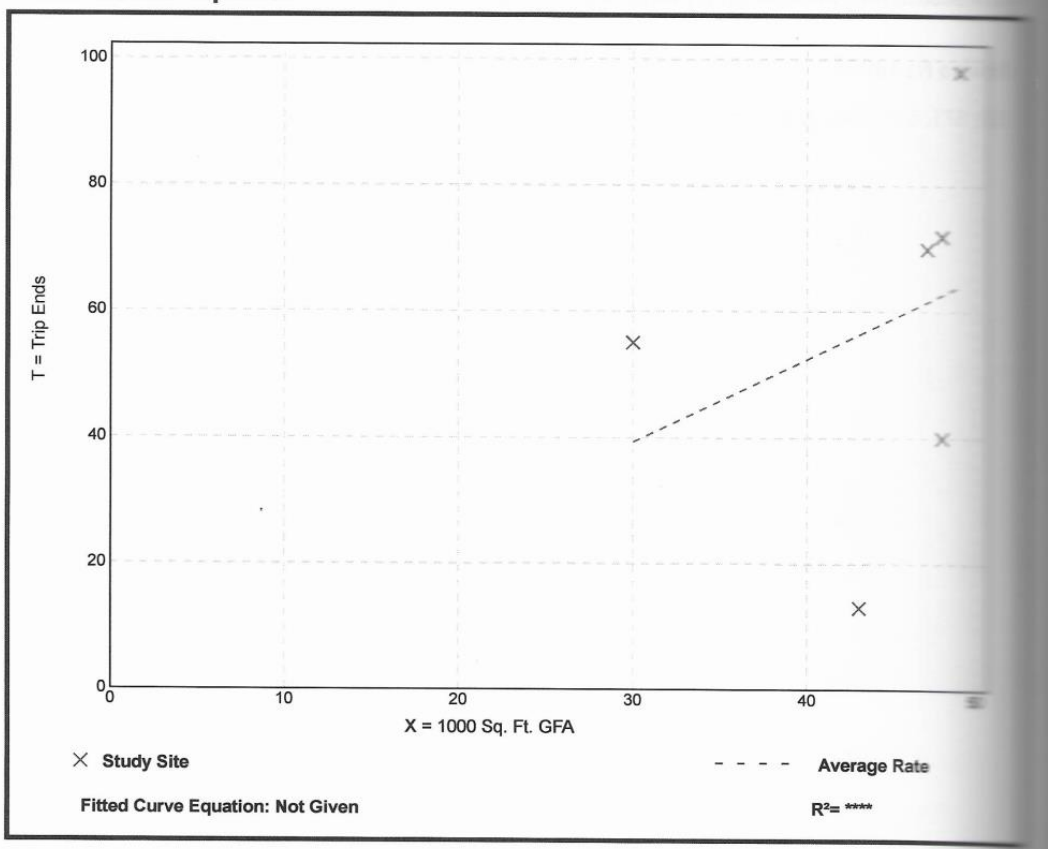

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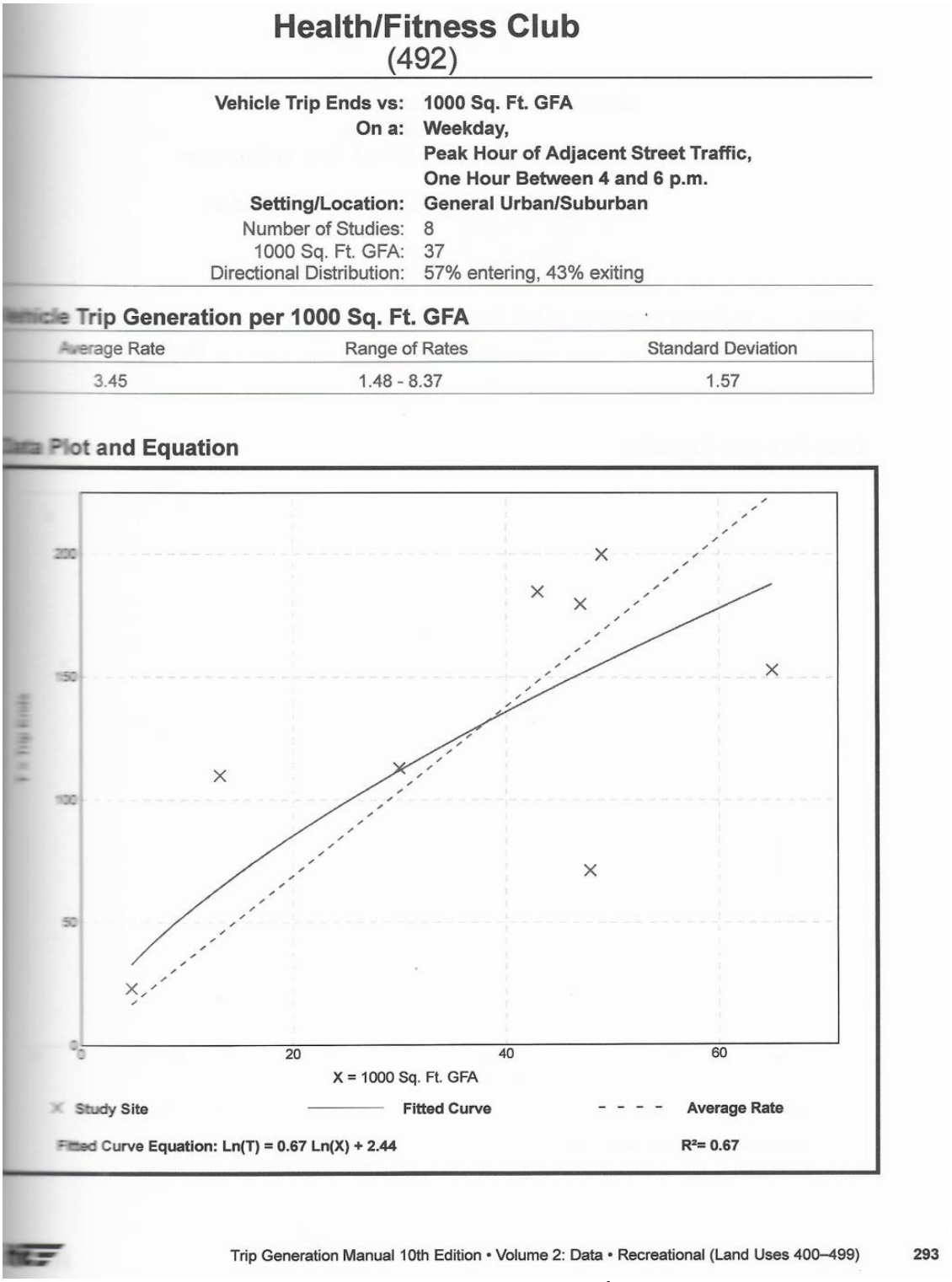
Figure 47: ITE Trip Generation, 10th Edition



Health/Fitness Club
(492)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
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: 8
1000 Sq. Ft. GFA: 37
Directional Distribution: 57% entering, 43% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.45	1.48 - 8.37	1.57

Data Plot and Equation

Fitted Curve Equation: Ln(T) = 0.67 Ln(X) + 2.44 R^2= 0.67

Figure 48: ITE Trip Generation, 10th Edition

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Health/Fitness Club
(492)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 3
1000 Sq. Ft. GFA: 16
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.19	2.87 - 4.03	4.06

Data Plot and Equation

Caution – Small Sample S

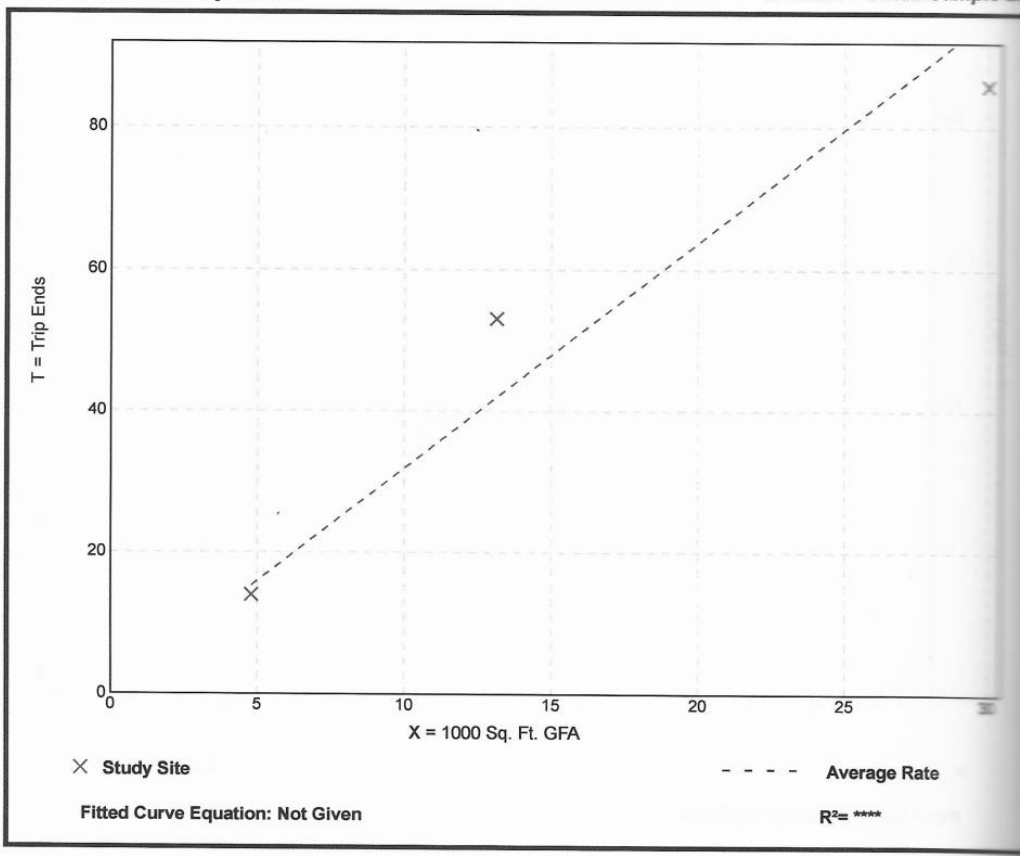

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Figure 49: ITE Trip Generation, 10th Edition

General Office Building
(710)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
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:	35
1000 Sq. Ft. GFA:	117
Directional Distribution:	86% entering, 14% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.16	0.37 - 4.23	0.47

Data Plot and Equation

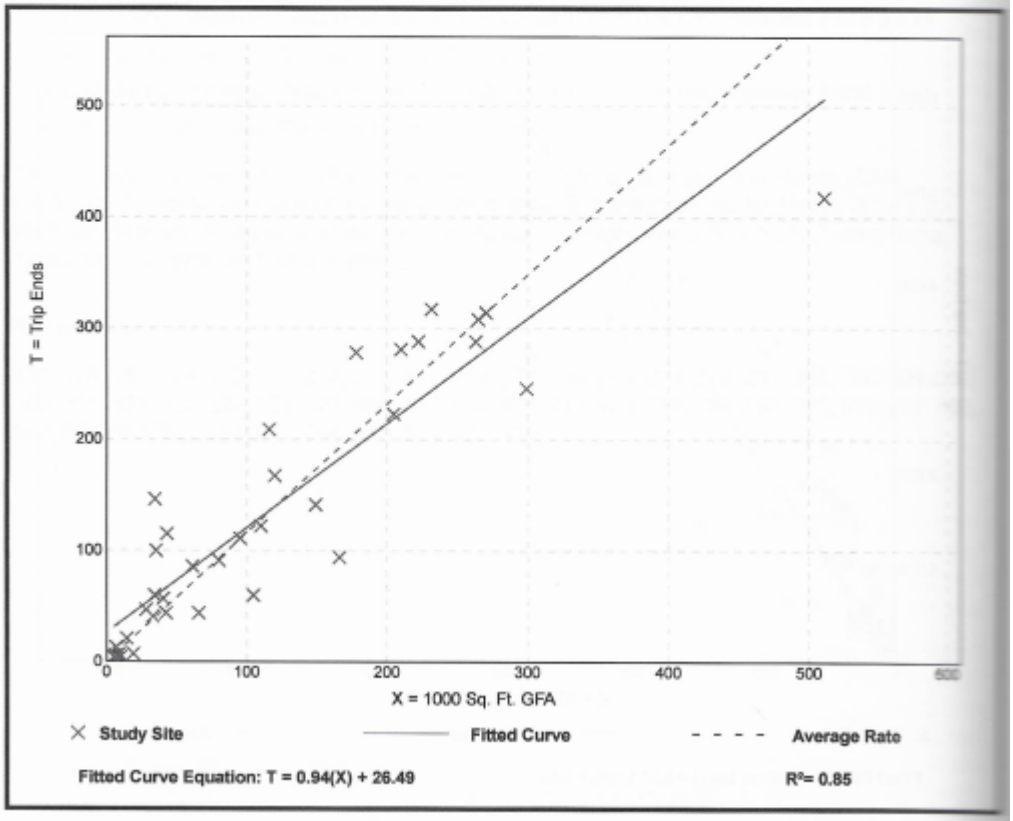

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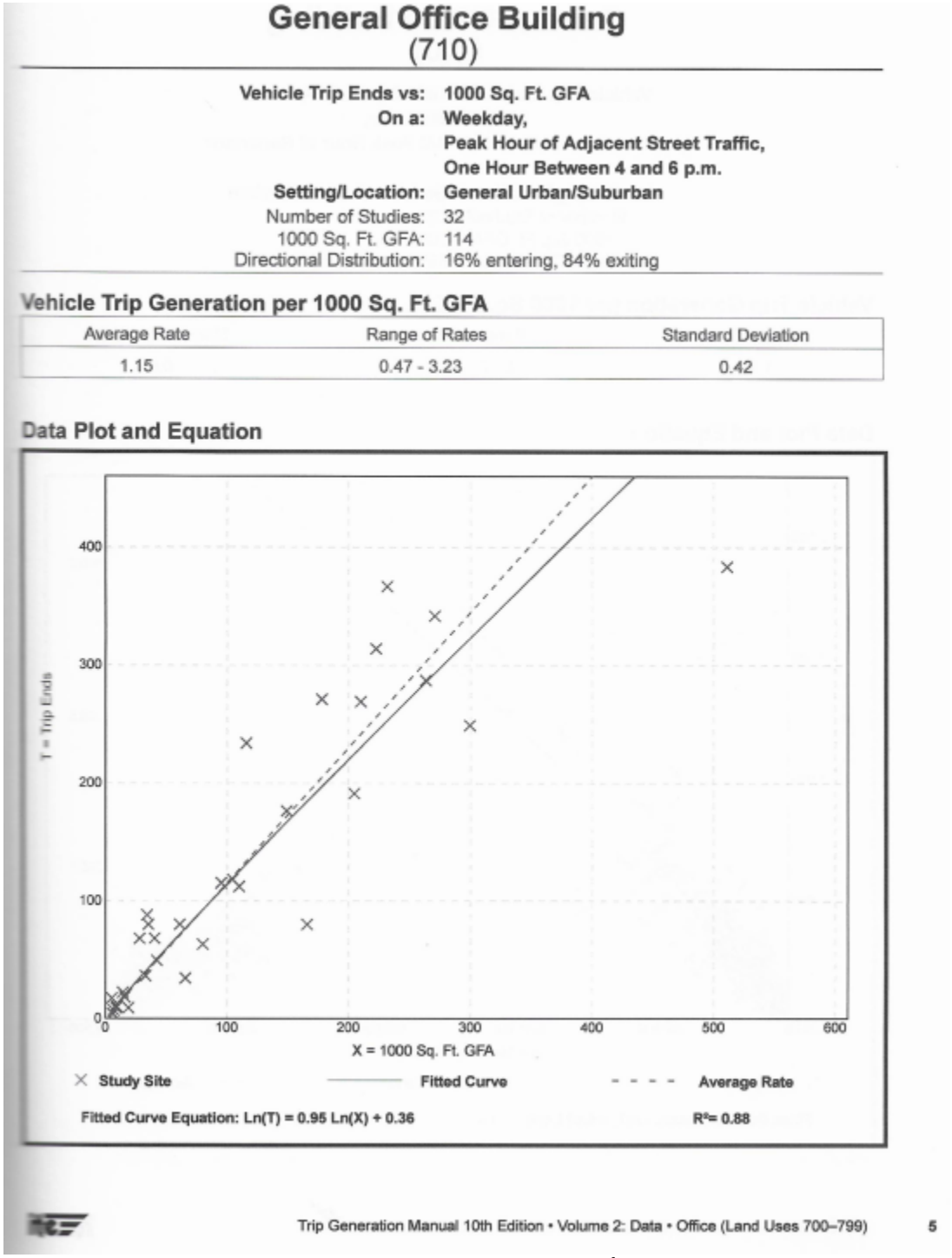
Figure 50: ITE Trip Generation, 10th Edition



General Office Building
(710)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
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: 32
1000 Sq. Ft. GFA: 114
Directional Distribution: 16% entering, 84% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.15	0.47 - 3.23	0.42

Data Plot and Equation

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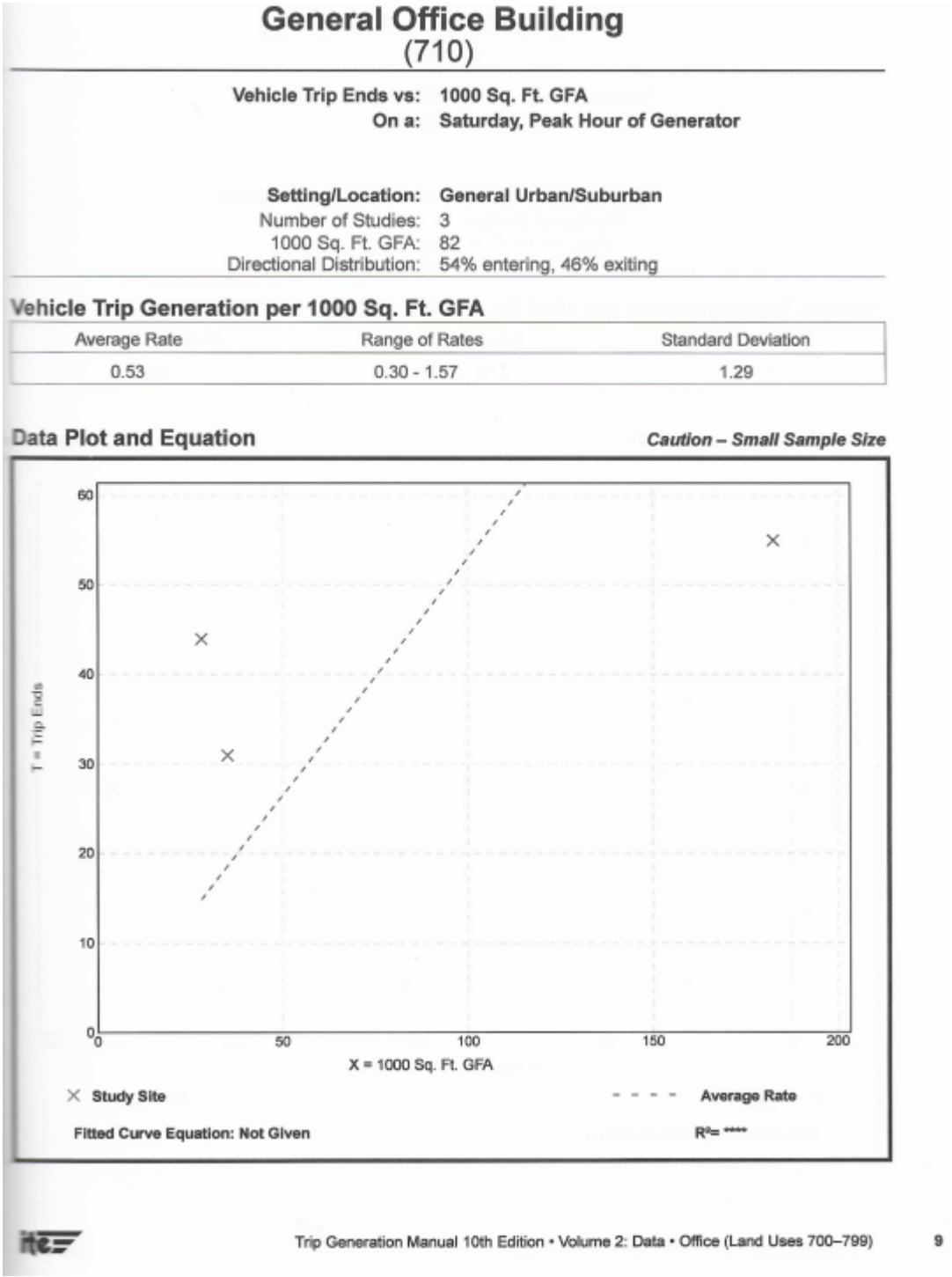
Figure 51: ITE Trip Generation, 10th Edition



General Office Building
(710)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 3
1000 Sq. Ft. GFA: 82
Directional Distribution: 54% entering, 46% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.53	0.30 - 1.57	1.29

Data Plot and Equation ***Caution – Small Sample Size***

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Figure 52: ITE Trip Generation, 10th Edition

Medical-Dental Office Building
(720)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
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: 44
1000 Sq. Ft. GFA: 32
Directional Distribution: 78% entering, 22% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.78	0.85 - 14.30	1.28

Data Plot and Equation

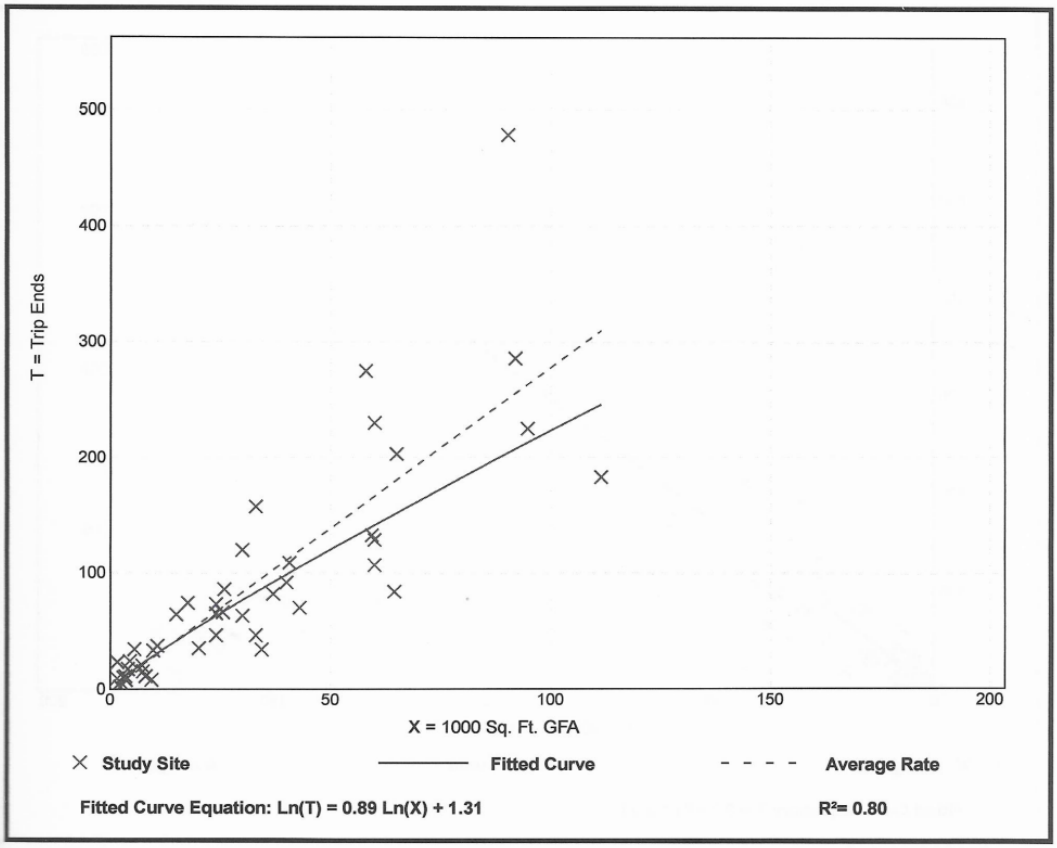

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Figure 53: ITE Trip Generation, 10th Edition

Medical-Dental Office Building
(720)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
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: 65
1000 Sq. Ft. GFA: 28
Directional Distribution: 28% entering, 72% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.46	0.25 - 8.86	1.58

Data Plot and Equation

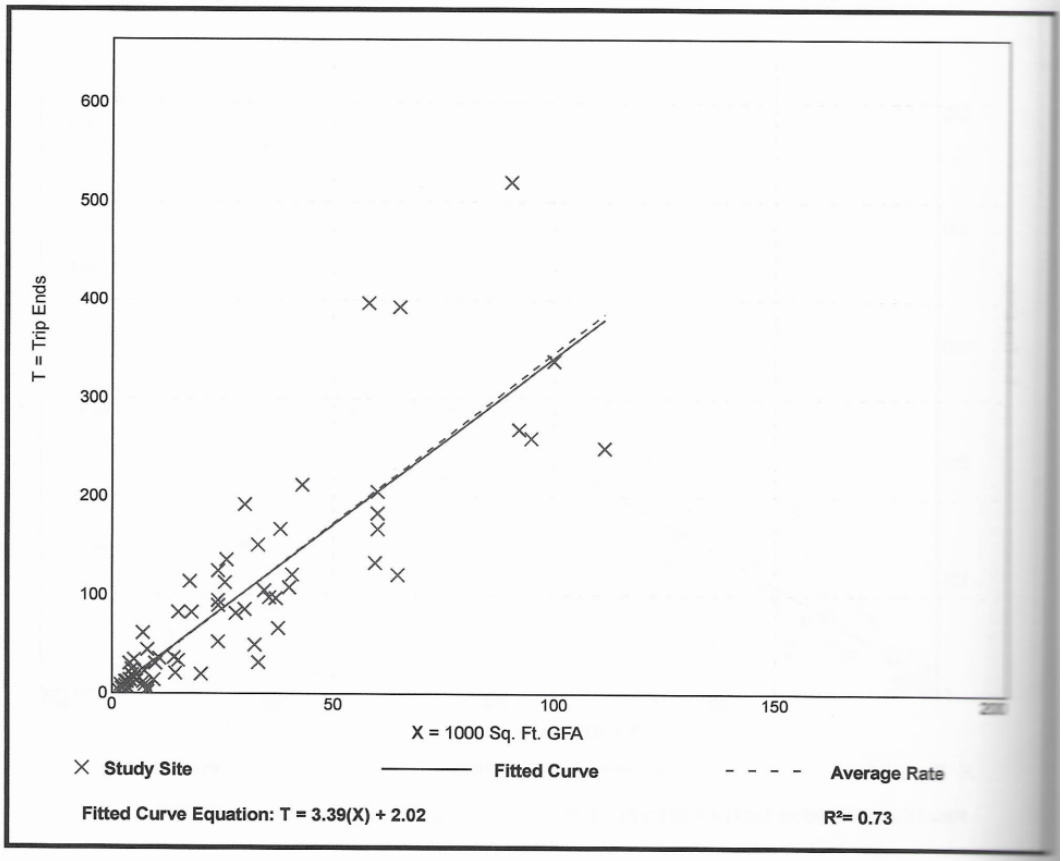

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Figure 54: ITE Trip Generation, 10th Edition

Medical-Dental Office Building
(720)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 4
1000 Sq. Ft. GFA: 28
Directional Distribution: 57% entering, 43% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.10	1.33 - 4.02	1.20

Data Plot and Equation

Caution – Small Sample Size

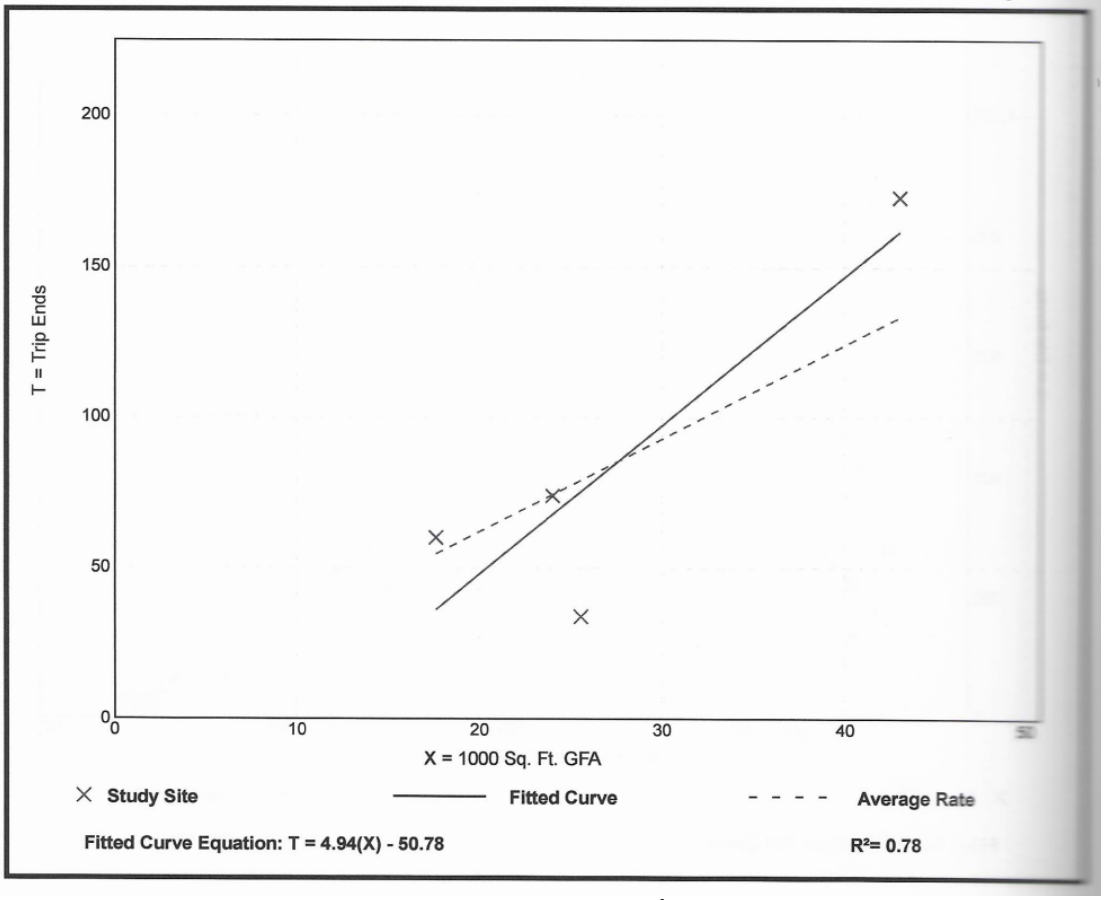

Figure 55: ITE Trip Generation, 10th Edition

Apparel Store
(876)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
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:	1
1000 Sq. Ft. GFA:	5
Directional Distribution:	80% entering, 20% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.00	1.00 - 1.00	*

Data Plot and Equation

Caution – Small Sample Size

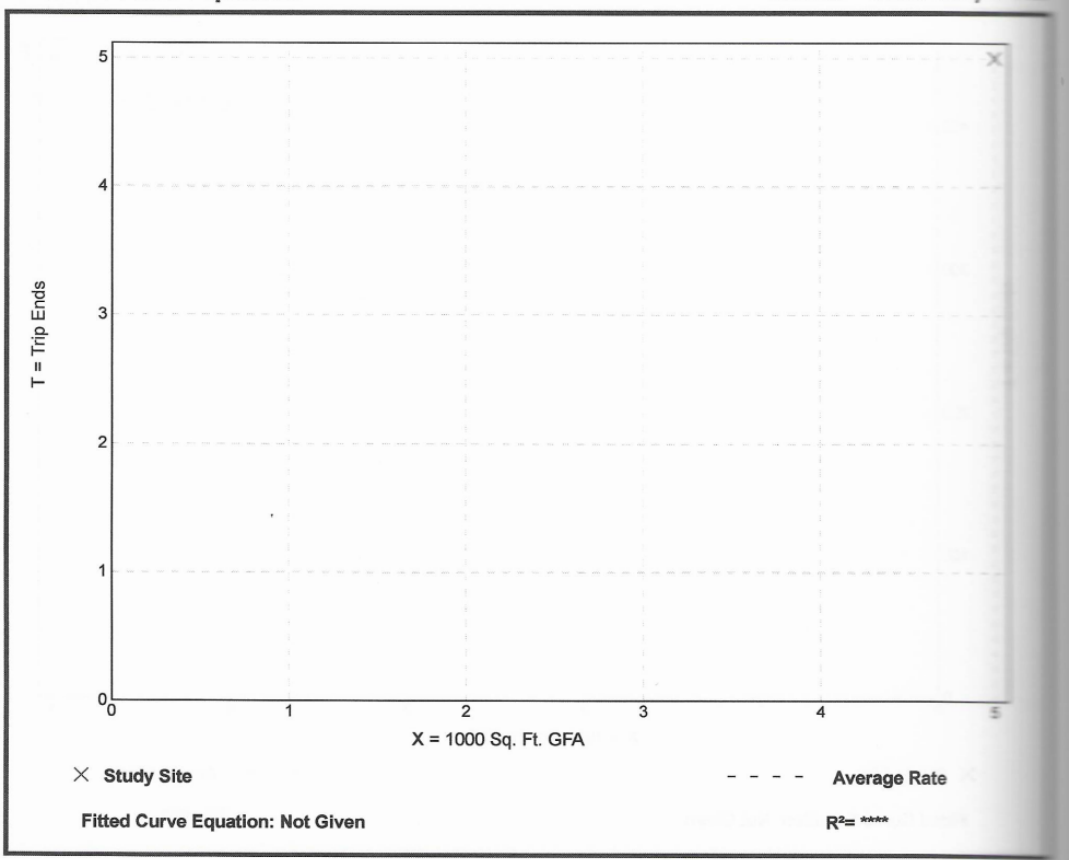

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Figure 56: ITE Trip Generation, 10th Edition

Apparel Store
(876)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
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:	9
1000 Sq. Ft. GFA:	5
Directional Distribution:	51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
4.12	1.50 - 6.80	2.18

Data Plot and Equation

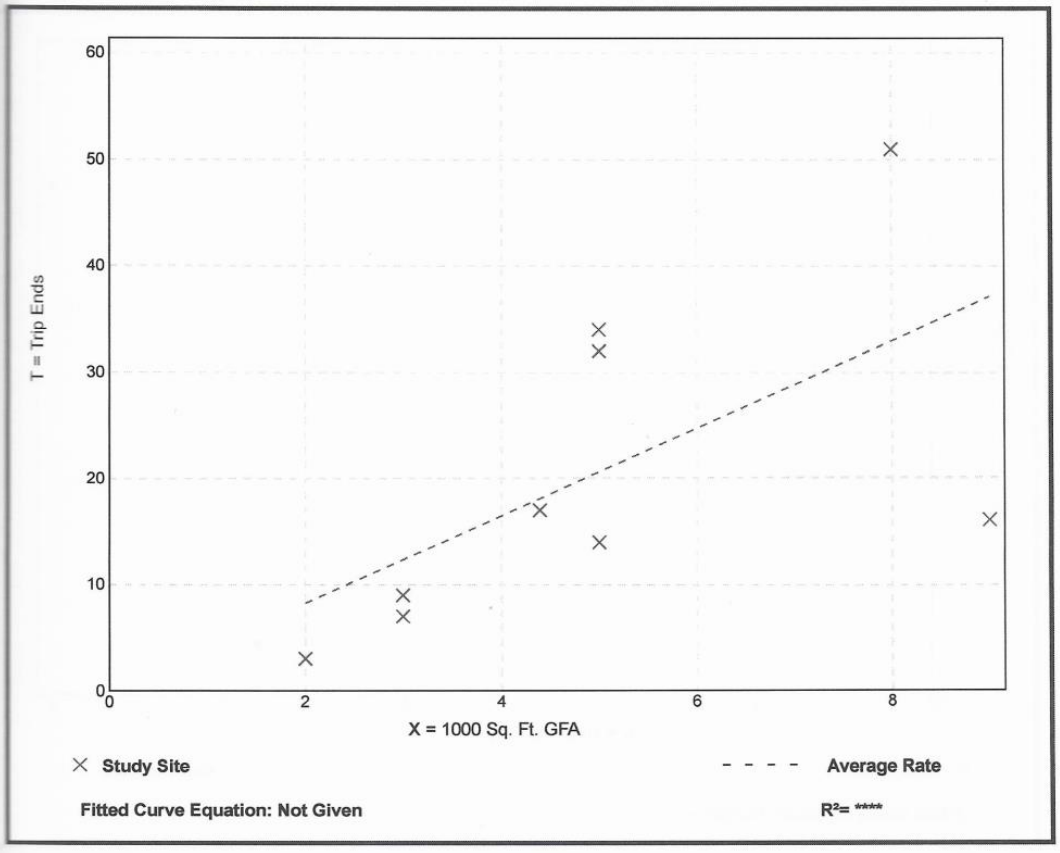

Figure 57: ITE Trip Generation, 10th Edition

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Apparel Store
(876)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 2
1000 Sq. Ft. GFA: 5
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
5.32	5.24 - 5.40	*

Data Plot and Equation

Caution – Small Sample Size

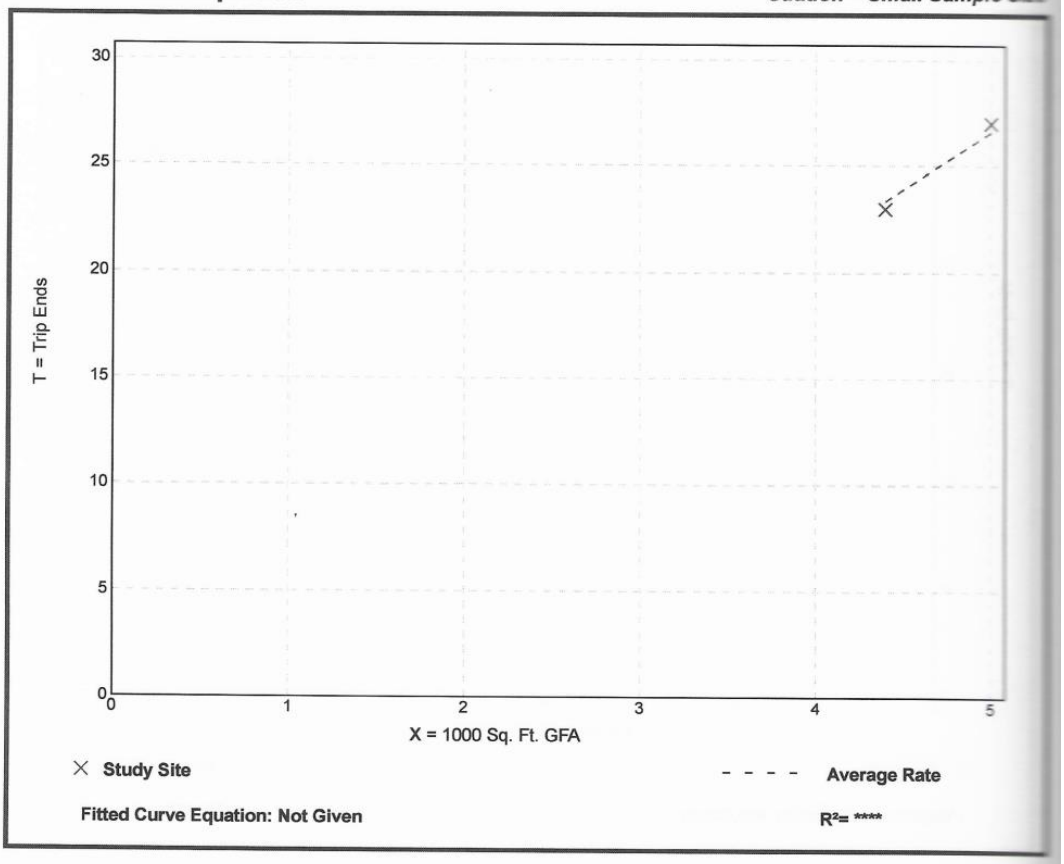

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Figure 58: ITE Trip Generation, 10th Edition