Vermont Trip Generation Manual

Traffic Research Unit
Planning, Outreach and Community Affairs Division
Vermont Agency of Transportation

March 2010

Report 2010-5

Prepared by:

Bernard Byrne, Ph. D., P.E.
Traffic Research Engineer

Reviewed By:

William E. Ahearn, P.E.
Materials and Research Engineer

Date: 4/28/2010

The information contained in this report was compiled for the use of the Vermont Agency of Transportation. Conclusions and recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Agency policy. This report does not constitute a standard, specification, or regulation. The Vermont Agency of Transportation assumes no liability for its contents or the use thereof."

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
2010-5		

4. Title and Subtitle	5. Report Date
Vermont Trip Generation Manual	April 2010
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Bernard Byrne, Ph. D., P.E.	2010-5

9. Performing Organization Name and Address	10. Work Unit No.
Vermont Agency of Transportation Materials and Research Section National Life Building Montpelier, VT 05633-5001	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Federal Highway Administration Division Office Federal Building Montpelier, VT 05602	Final (2008-2010)
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The Traffic Research Unit of the Vermont Agency of Transportation (VTrans) is charged with, among other duties, the review of Traffic Impact Studies for proposed developments in the State of Vermont. In reviewing studies for repeated developments in the same area, it has been noted that measures of current traffic do not necessarily show the anticipated level of traffic projected in previous Traffic Impact Studies. Therefore, the purpose of the research reported herein is to measure Trip Generation for the most widely proposed types of development in Vermont and relate it to some measures of the intensity of the particular land uses. The result of this research is this Vermont Trip Generation Manual, to be used in conjunction with the preparation and review of Traffic Impact Studies within the state.

For the most part, the ITE Manual will overestimate Trip Generation outside Chittenden County, i.e., in rural and small urban areas. Exceptions should be made for LUC 820 (Shopping Centers), LUC 912 (Drive-up Bank) and LUC 881 (Pharmacy with Drive-up window). Within Chittenden County overestimation occurs, but not to the same extent as outside Chittenden County.

17. Key Words	18. Distribution Statement
Trip Generation Trip Rates Traffic Impact Study	No restrictions

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. Pages	22. Price
Unclassified	Unclassified	21	

TABLE OF CONTENTS

TABLE OF TABLES

Introduction

Like many other states and municipalities, Vermont requires that developers prepare a Traffic Impact Study for proposed developments. A Traffic Impact Study is an evaluation of the congestion and safety effects of a particular development on its surrounding and supporting transportation infrastructure. It is performed to ascertain if a development will have an adverse impact on its surrounding and supporting transportation infrastructure and, if so, how that impact can be ameliorated.

A critical portion of a Traffic Impact Study is estimating the amount of traffic that a proposed development will produce. This estimate is obtained by carrying out a Trip Generation analysis. The basic unit of measure of impact is the trip, a one-way movement into or out of a particular land use. The number of trips that a proposed development will produce is based on the type of land use and its intensity. Types of land use include housing, retail, institutional and services, among others. The intensity of land use indicates some measure of size, such as area, number of seats in a restaurant or number of pumps at a filling station.

The Institute of Transportation Engineers (ITE) has been collecting data on Trip Generation for a number of years and publishes its *Trip Generation Manual*, now in its eighth edition. This manual contains Trip Generation rates and equations which relate the number of trips for a specific land use, defined by a Land Use Code (LUC), to some measure of land use intensity. In some cases, more than one measure of intensity is presented. The difficulty with the ITE manual is that most of the data was collected in suburban and medium sized urban areas, which are not representative of small urban and rural areas, such as Vermont (with the exception of Chittenden County, the county in which the City of Burlington exists). In general, Chittenden County is representative of suburban areas and the rest of Vermont, outside of Chittenden County, is representative of small urban and rural areas.

The Traffic Research Unit of the Vermont Agency of Transportation (VTrans) is charged with, among other duties, the review of Traffic Impact Studies for proposed developments in the State of Vermont. In reviewing studies for repeated developments in the same area, it has been noted that measures of current traffic do not necessarily show the anticipated level of traffic projected in previous Traffic Impact Studies. This evidence is purely anecdotal, but it points out a possible flaw in previous Trip Generation analyses, namely, that the estimated Trip Generation is too large, i.e., that ITE Trip Generation rates are not truly reflective of rural and small urban areas of Vermont. Although this produces rather conservative estimates and provides a worst-case analysis, it is, nevertheless, unrealistic. It would be far better to have a truly realistic analysis of Trip Generation.

Therefore, the purpose of the research reported herein is to measure Trip Generation for the most widely proposed types of development in Vermont and relate it to some measures of the intensity of the particular land uses. The result of this research is this Vermont Trip Generation Manual, to be used in conjunction with the preparation and review of Traffic Impact Studies within the state. This could very well be the

springboard for similar research in other rural parts of the country to provide a general rural and small urban Trip Generation Manual.

The work was carried out into two phases: Data Collection and Data Analysis. Data Collection consisted of counting vehicles entering and exiting from various types of development. Data Analysis consisted of calculating Trip Generation rates for the various land uses and, where enough data exists, deriving equations relating the intensity of land use to trip making propensity.

The first step was to select those land uses for which Trip Generation rates are to be prepared. The most often proposed land uses are shown in TABLE 1. In the Data Collection phase, not all of these uses were counted. The actual data collection carried out is detailed below.

Data Collection

The actual counting of trips was conducted utilizing manual counts. The Traffic Research Unit hires a number of temporary workers during each count season to conduct turning movement counts. Using research funds, several extra temporary workers were hired during the 2008 and 2009 count seasons to conduct these Trip Generation counts. These temporary workers were trained and supervised by the same people who normally train and supervise turning movement count temporary workers. Quality control was the same as our normal turning movement count. These temporary workers were placed and rotated in the same areas as the turning movement count temporary workers. Thus Trip Generation counts were conducted in all areas of the state.

Data Analysis

The Data Analyses were conducted in accordance with Institute of Transportation Engineers (ITE) standards[1,2] with some exceptions as described below. The analyses consisted of estimating the Trip Generation rate, estimating its standard deviation, determining if the rates derived differed statistically significantly from the ITE rates, if the rates derived from Chittenden County differed statistically significantly from those rates derived from sites outside Chittenden County, and estimating regression equations where appropriate. The purpose of testing whether Trip Generation rates from Chittenden County differed from those outside Chittenden County was to test whether Trip Generation rates from suburban and urban locations in the state differed statistically significantly from rural and small urban areas in the state.

[1] Institute of Transportation Engineers, *Trip Generation, 7th Edition, User's Guide,* Washington, D.C., 2003
[2] Institute of Transportation Engineers, *Trip Generation Handbook, 2nd Edition,* Washington, D.C., 2004

Type	ITE LUC *	Use
Retail	815	Discount Store
	820	Shopping Center
	845	Gas Station w/convenience store
	850	Supermarket
	853	Convenience Market w/gas pumps
	862	Home Improvement Superstore
	880/881	Pharmacy
Services	911/912	Bank
	932	High Turnover Restaurant
	933/934	Fast food
	936/937	Coffee/Donut Shop
Housing	210	Single Unit Houses
	220	Apartment
	230	Condominium/Townhouse
	240	Mobile Home Park
	251	Senior Adult Housing
	260	Recreational Homes
	270	PUD (mixed residential)
	310	Hotel
	320	Motel
	330	Resort Hotel
Business	130	Industrial Park
	140	Manufacturing
	710	Office
	720	Medical-Dental Office Building
	750	Office Park
	770	Business Park (office/small bus.)
Institutional	520	Elementary School
	530	High School
	565	Day Care Center

*Institute of Transportation Engineers (ITE)
Land –Use Code (LUC)

TABLE 1. Initially Proposed Land Use Codes of Data Collection

As stated in both the *User's Guide*[3] and the *Trip Generation Handbook*[4], the Trip Generation rate is a weighted average of Trip Generation counts from individual sites weighted by the chosen independent variable.

Stated mathematically, this is:

$$T = \frac{\sum_{i=1}^{n} T_i}{\sum_{i=1}^{n} X_i} \quad (1)$$

where

T = Overall Trip Generation rate,
T_i= Trips generated at site i,
X_i= Value of independent variable at site i (e.g., floor area, number of seats), and
n = number of sites

Stated another way this is:

$$T = \sum_{i=1}^{n} w_i T_i \quad (2)$$

where

T, T_i and n are as above and

$$w_i = \frac{X_i}{\sum_{i=1}^{n} X_i}$$

As stated in *User's Guide*[5] and the *Trip Generation Handbook*[6] the standard deviation used in ITE trip generation is the unweighted standard deviation. As stated in the User's Guide, "In this document, the statistics reported are based on a 'weighted average' not an 'arithmetic average' and therefore, the standard deviation is an approximation and not statistically correct."[7] The statistically correct standard deviation is a weighted standard deviation,[8] which is used in this document.

The weighted standard deviation is as follows:

---

[3] *User's Guide, op. cit.,* p. 15.
[4] *Trip Generation Handbook, op. cit.,* p. 7
[5] *User's Guide, op. cit.,* p. 15.
[6] *Trip Generation Handbook, op. cit.,* p. 148
[7] *User's Guide, op. cit.,* p. 15.

[8] Weighted mean. (2010, January 25). In *Wikipedia, The Free Encyclopedia*. Retrieved 16:33, February 14, 2010, from http://en.wikipedia.org/w/index.php?title=Weighted_mean&oldid=339867763

$$s = \sqrt{\frac{1}{1-V_2}\sum_{i=1}^{n} w_i (T_i - T)^2} \quad (3)$$

where

s=sample standard deviation, and
T, T_i, w_i and n are as above, and

$$V_2 = \sum_{i=1}^{n} w_i^2$$

To test whether a Trip Generation rate derived differed statistically significantly from the ITE rate a weighted *t*-test[9] was utilized. The weighted *t*-test statistic is:

$$t = \frac{T - \mu}{s/\sqrt{f}} \quad (4)$$

where

T, s and V_2 are defined as above,
μ = Trip Generation rate from ITE Manual[10], and
f = sample size, defined as
$f = 1/V_2$

To test whether Trip Generation rates from sites within Chittenden County differed statistically significantly from those sites outside Chittenden County, i.e., to test whether Trip Generation rates from suburban and urban locations in the state differed statistically significantly from rural and small urban areas in the state, a weighted two-sample *t*-test[11] was utilized. The weighted two-sample *t*-test statistic is:

$$t = \frac{T_A - T_B}{\sqrt{\hat{\alpha}_A + \hat{\alpha}_B}} \quad (5)$$

where

T_A and T_B are the Trip Generation rates from groups A and B, respectively, and
$\hat{\alpha}_A, \hat{\alpha}_B$ are defined below:

$$\hat{\alpha}_A = \frac{S_A}{n-1}$$

$$\hat{\alpha}_B = \frac{S_B}{m-1}$$

where

n = number of elements in group A,
m = number of elements in group B, and
where

$$S_A = \sum_{i=1}^{n} w (T_{Ai} - T_A)^2$$

---

[9] Madansky, Dr. Albert, "Alternative Approaches to Significance Testing with Weighted Means," from http://www.analyticalgroup.com/download/Quirks.pdf

[10] Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008

[11] Goldberg, Lisa, Kercheval, A.N. and Lee, K, "t-statistics for Weighted Means in Credit Risk Modeling," *Journal of Risk Finance*, April 28, 2005

$$S_B = \sum_{i=1}^{m} w'(T_{Bi} - T_B)^2$$

where

T_{Ai} and T_{Bi} are individual Trip Generation counts from groups A and B, respectively,
w = weights in group A, and
w' = weights in group B

Results

During the counting seasons of 2008 and 2009, over 1000 individual Trip Generation counts were conducted. The number of counts conducted in each of the Land Use Code categories by time of day are summarized in TABLE 2. The results of the calculation of Trip Generation rates and the tests of statistical significance are shown in TABLE 3 and TABLE 4.

The results of individual LUC Trip Generation analyses are contained in the appendix. For each LUC and time of day there is an individual data page. It is virtually identical to those in the ITE Manual[12]. An explanation of the data page and its various entries is shown in the User's Guide[13] and is reproduced in the appendix. Regression equations were prepared for all instances but are shown only in accordance with the guidance in the User's Guide[14], i.e., equations are shown only where $R^2 > 0.5$ and $n > 3$. Where these criteria are not met, the data page in the "Fitted Curve Equation" portion shows "Not Given."

[12] *Trip Generation, op. cit.*
[13] *User's Guide, op. cit.,* p 16
[14] *Ibid.,* p. 17

Land Use Code (LUC)	Land Use	Time of Day	Number of Counts
90	Park-and-Ride Lot	AM	6
90	Park-and-Ride Lot	Mid	6
140	Manufacturing	AM	3
140	Manufacturing	Mid	7
140	Manufacturing	PM	4
310	Hotel	AM	8
310	Hotel	Mid	15
310	Hotel	PM	8
430	Golf Course	AM	9
430	Golf Course	Mid	12
430	Golf Course	PM	3
820	Shopping Center	AM	49
820	Shopping Center	Mid	137
820	Shopping Center	PM	24
841	New Car Sales	AM	3
841	New Car Sales	Mid	6
850	Supermarket	AM	30
850	Supermarket	Mid	57
850	Supermarket	PM	31
853	Convenience Mkt. w/gas pumps	AM	63
853	Convenience Mkt. w/gas pumps	Mid	87
853	Convenience Mkt. w/gas pumps	PM	51
862	Home Improvement	AM	4
862	Home Improvement	Mid	14
862	Home Improvement	PM	6
880	Pharmacy w/o d/t	AM	5
880	Pharmacy w/o d/t	Mid	9
880	Pharmacy w/o d/t	PM	5
881	Pharmacy with d/t	AM	9
881	Pharmacy with d/t	Mid	21
881	Pharmacy with d/t	PM	10
912	Drive-in Bank	AM	30
912	Drive-in Bank	Mid	72
912	Drive-in Bank	PM	37
932	High-Turnover (Sit-Down) Restaurant	AM	22
932	High-Turnover (Sit-Down) Restaurant	Mid	54
932	High-Turnover (Sit-Down) Restaurant	PM	26
933	Fast-Food Restaurant w/o d/t	Mid	6
934	Fast-Food Restaurant w/ d/t	AM	17
934	Fast-Food Restaurant w/ d/t	Mid	37
934	Fast-Food Restaurant w/ d/t	PM	18
936	Coffee/Donut Shop w/o d/t	AM	20
937	Coffee/Donut Shop with d/t	AM	15
937	Coffee/Donut Shop with d/t	Mid	6

TABLE 2. Summary of Trip Generation Counts by Land Use Code (LUC) and Time of Day.

LUC	Time of Day	Independent Variable	ITE Rate	Statewide Rate	Number of Studies	SS* differ From ITE	Chittenden Co. Rate	Number of Studies	SS* differ From ITE	Outside of Chittenden Co. Rate	Number of Studies	SS* differ From ITE	SS* Differ Between Chittenden Co. and Outside
90	AM	Spaces	0.72	0.36	6	YES		0		0.36	6		N/A
90	Mid	Spaces	0.62	0.34	6	YES		0		0.34	6		N/A
140	AM	1000 Sq. Ft. GFA	0.78	1.21	3	NO		1			2		N/A
140	Mid	1000 Sq. Ft. GFA	0.75	3.13	7	YES	0.79	2	NO	4.83	5	YES	YES
140	PM	1000 Sq. Ft. GFA	0.75	3.81	4	NO		1			3		N/A
310	AM	Rooms	0.56	0.60	8	NO		1			7		N/A
310	Mid	Rooms	0.52	0.37	15	YES	0.59	2	NO	0.24	13	YES	NO
310	PM	Rooms	0.61	0.66	8	NO		1			7		N/A
430	AM	Holes	2.23	2.02	9	NO		0		2.02	9		N/A
430	Mid	Holes	3.01	2.79	12	NO		0		2.79	12		N/A
430	PM	Holes	3.56	2.97	3	NO		0		2.97	3		N/A
820	AM	1000 Sq. Ft. GLA	1.00	2.32	49	YES	2.56	19	YES	2.06	30	YES	NO
820	Mid	1000 Sq. Ft. GLA	3.73	3.69	137	NO	3.75	54	NO	3.62	83	NO	NO
820	PM	1000 Sq. Ft. GLA	3.73	4.04	24	NO	4.30	8	YES	3.82	16	NO	NO
841	AM	1000 Sq. Ft. GFA	2.2	2.03	3	NO		0		2.03	3		N/A
841	Mid	1000 Sq. Ft. GFA	2.72	1.84	6	YES		0		1.84	6		N/A
850	AM	1000 Sq. Ft. GFA	10.05	2.82	30	YES	3.92	6	YES	3.17	24	YES	NO
850	Mid	1000 Sq. Ft. GFA	10.05	6.27	57	YES	7.31	21	YES	5.44	36	YES	YES
850	PM	1000 Sq. Ft. GFA	10.5	7.22	31	YES	8.87	10	YES	6.39	21	YES	YES
853	AM	1000 Sq. Ft. GFA	43.9	29.25	63	YES	27.93	10	NO	29.56	53	YES	NO
853	Mid	1000 Sq. Ft. GFA	62.57	29.62	87	YES	33.57	13	YES	29.05	74	YES	NO
853	PM	1000 Sq. Ft. GFA	59.69	35.17	51	YES	53.84	9	NO	32.47	42	YES	YES

Notes * Statistically Significantly

TABLE 3. Summary of Trip Generation Rate Results and Tests of Statistically Significant Differences

LUC	Time of Day	Independent Variable	ITE Rate	Statewide Rate	Number of Studies	SS* differ From ITE	Chittenden Co. Rate	Number of Studies	SS* differ From ITE	Outside of Chittenden Co. Rate	Number of Studies	SS* differ From ITE	SS* Differ Between Chittenden Co. and Outside
862	AM	1000 Sq. Ft. GFA	3.08	1.37	4	YES		0		1.37	4		N/A
862	Mid	1000 Sq. Ft. GFA	3.32	2.23	14	YES		0		2.23	14		N/A
862	PM	1000 Sq. Ft. GFA	3.32	2.19	6	YES		0		2.19	6		N/A
880	AM	1000 Sq. Ft. GFA	7.64	5.15	5	NO		0		5.15	5		N/A
880	Mid	1000 Sq. Ft. GFA	7.64	7.52	9	NO		0		7.52	9		N/A
880	PM	1000 Sq. Ft. GFA	11.07	7.84	5	NO		0		7.84	5		N/A
881	AM	1000 Sq. Ft. GFA	7.87	6.81	9	NO		1			8	NO	
881	Mid	1000 Sq. Ft. GFA	9.21	9.25	21	NO	7.42	6	YES	9.90	15	NO	YES
881	PM	1000 Sq. Ft. GFA	9.21	10.75	10	YES	8.13	2	NO	11.32	8	YES	NO
912	AM	1000 Sq. Ft. GFA	17.31	14.81	30	NO	20.26	8	NO	13.73	22	YES	YES
912	Mid	1000 Sq. Ft. GFA	17.31	21.96	72	YES	27.52	28	YES	19.41	44	NO	YES
912	PM	1000 Sq. Ft. GFA	26.69	21.11	38	YES	23.99	13	NO	19.92	25	YES	NO
932	AM	1000 Sq. Ft. GFA	13.53	8.05	22	YES	11.56	4	NO	7.60	18	YES	YES
932	Mid	1000 Sq. Ft. GFA	18.49	11.09	54	YES	10.48	23	YES	11.49	31	YES	NO
932	PM	1000 Sq. Ft. GFA	11.15	6.60	26	YES	6.03	11	YES	7.08	15	YES	NO
933	Mid	1000 Sq. Ft. GFA	52.4	50.74	6	NO	49.81	4	NO	58.42	2	YES	YES
934	AM	1000 Sq. Ft. GFA	54.81	23.70	17	YES	10.64	4	YES	28.72	13	YES	YES
934	Mid	1000 Sq. Ft. GFA	46.14	52.64	37	NO	46.41	15	NO	57.00	22	NO	NO
934	PM	1000 Sq. Ft. GFA	33.84	22.99	18	YES	20.54	6	YES	24.12	12	NO	NO
936	AM	1000 Sq. Ft. GFA	117.23	70.15	20	YES	61.59	13	YES	94.33	7	YES	YES
937	AM	1000 Sq. Ft. GFA	110.75	65.33	15	YES		0		65.33	15	YES	N/A
937	Mid	1000 Sq. Ft. GFA	63.5	35.83	6	YES		0		35.83	6	YES	N/A

Notes * Statistically Significantly

TABLE 4. Summary of Trip Generation Rate Results and Tests of Statistically Significant Differences (continued).

Discussion

Examining TABLE 3 and TABLE 4 for Chittenden County, it is evident that about a third of the retail and service uses, i.e., LUCs in the 800 and 900 ranges, show Trip Generation rates statistically significantly less than those in the ITE Manual.[15] Only three of the retail and service uses show Trip Generation rates statistically significantly greater than those in the ITE Manual. Those are LUC[16] 820 (Shopping Centers) in the AM and PM peak and LUC 912 (Drive-up Bank) in the midday hours (1 hour between 10:00 AM and 2:00 PM)

Examining TABLE 3 and TABLE 4 for sites outside of Chittenden County, it is evident that most (with some exceptions) of the retail and service uses, i.e., LUCs in the 800 and 900 ranges, show Trip Generation rates statistically significantly less than those in the ITE Manual. Those exceptions are LUC 820 (Shopping Centers) and LUCs 880 & 881 (Pharmacies). LUCs in the 930 range (Eating Establishments) show a mixed appearance. Only three of the retail and service uses show Trip Generation rates statistically significantly greater than those in the ITE Manual. Those are LUC 820 (Shopping Centers) in the AM peak, LUC 881 (Pharmacy with Drive-up window) in the PM peak and LUC 933 (Fast Food without Drive-up window) in the midday hours.

Examining TABLE 3 and TABLE 4 to compare sites within Chittenden County (urban) to those outside of Chittenden County (rural), it is evident that in only six out of twenty four instances are the sites within Chittenden County producing trips at a statistically significantly greater rate than that for sites outside of Chittenden County. Additionally, it is evident that in only five instances are the sites within Chittenden County producing trips at a statistically significantly lesser rate than that for sites outside of Chittenden County.

Conclusion

Herein presented are the results of an extensive Trip Generation study to determine if the ITE Manual overestimates Trip Generation in Vermont and, especially, outside of Chittenden County. For the most part, the ITE Manual will overestimate Trip Generation outside Chittenden County, i.e., in rural and small urban areas (sixteen overestimates in twenty statistically significant instances). Exceptions should be made for LUC 820 (Shopping Centers), LUC 912 (Drive-up Bank) and LUC 881 (Pharmacy with Drive-up window). Within Chittenden County overestimation occurs, but not to the same extent as outside Chittenden County (ten overestimates in thirteen statistically significant instances).

As for the question of suburban versus rural and small urban Trip Generation, there appears to be some differences but not an overwhelming number.

Recommendations for Further Study

Where it appears logically or through experience that there should be some differences either between ITE Trip Generation rates and locally derived Trip Generation rates or between suburban Trip Generation rates and rural and small urban Trip Generation rates

[15] *Trip Generation, op. cit.*
[16] "LUC" stands for Land Use Code

but were not found to be statistically significant, usually the difficulty is insufficiently large sample size. Mean Trip Generation rates and their standard deviations are found for each LUC studied are found in the data pages in the Appendix. These can be used to derive sample sizes sufficiently large to produce statistically significantly differences at whatever level of confidence one needs. Sample sizes thus derived can be quite large, so a question of economics arises. These questions have to be decided on a case-by-case basis.

Based on the results of this study as well as some of the Traffic Impact Studies reviewed by the VTrans Traffic Research Unit, it plans to use its normal funds to continue to conduct Trip Generation studies to estimate Trip Generation rates for heretofore unstudied land uses and to extend the Trip Generation studies already undertaken to attempt to answer the questions raised herein as to statistical significance. A list of such land unstudied and understudied uses is shown in TABLE 5. It is doubtful that all of these can be undertaken in one counting season.

LUC	Description
130	Industrial Park
210	Single Family Homes
230	Condominium/Townhouse
310	Hotel
311	All Suites Hotel
312	Business Hotel
330	Resort Hotel (Especially Ski Areas)
416	Campground
430	Golf Course
492	Health/Fitness Club
520	Elementary School
522	Middle School/Junior High School
530	High School
710	General Office
750	Office Park
770	Business Park
820	Shopping Center (Chittenden County)
862	Home Improvement Superstore
934	Fast Food Restaurant w/ DT Window
937	Coffee Donut Shop w/DT window
??	Laundromat

TABLE 5. List of Unstudied and Understudied Land Uses.

Appendix
Vermont Trip Generation Manual

Traffic Research Unit
Planning, Outreach and Community Affairs Division
Vermont Agency of Transportation

Introduction

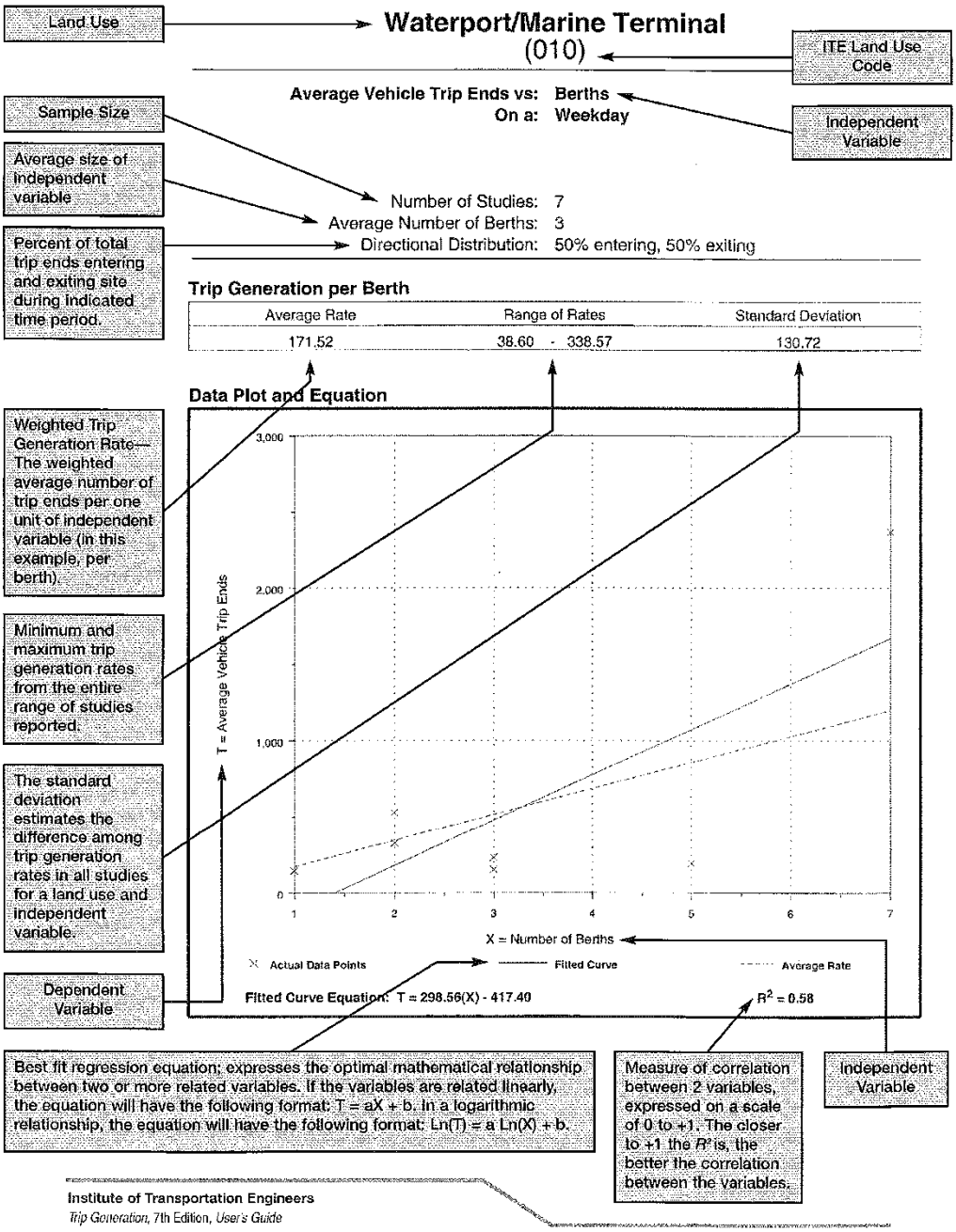
The results of individual Land Use Code (LUC) Trip Generation analyses are contained in this appendix. For each LUC and time of day (AM Peak, PM Peak, Midday) there is an individual data page with some exceptions, as explained below. It is virtually identical to those in the ITE Manual[17]. An explanation of the data page and its various entries is shown in the User's Guide[18] and is reproduced on the following page. Regression equations were prepared for all instances but are shown only in accordance with the guidance in the User's Guide[19], i.e., equations are shown only where $R^2 > 0.5$ and $n > 3$. Where these criteria are not met, the data page in the "Fitted Curve Equation" portion shows "Not Given"

Individual data pages are not presented whenever the "Number of Studies" column in TABLE 3 or TABLE 4 is one or zero. No statistical tests can be performed in these cases.

In all other instances, which individual data pages are presented depends upon whether Trip Generation rates in Chittenden County differ statistically significantly from those for sites outside Chittenden County. See the last column in TABLE 3 or TABLE 4. This applies across time periods. If, in any particular LUC and time period, the Trip Generation rate in Chittenden County differs statistically significantly from that for sites outside Chittenden County, then individual data pages are presented separately for sites in Chittenden County and for sites outside Chittenden County. Otherwise, a single individual data page is presented for the statewide rate.

[17] Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008
[18] Institute of Transportation Engineers, *Trip Generation, 7th Edition, User's Guide,* Washington, D.C., 2003., p 16
[19] *Ibid.,* p. 17

Figure V-I: Sample Data Page



Land Use: 090

Park-and-Ride Lot with Bus Service[20]

[20] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008, Volume 2 of 3, p. 75

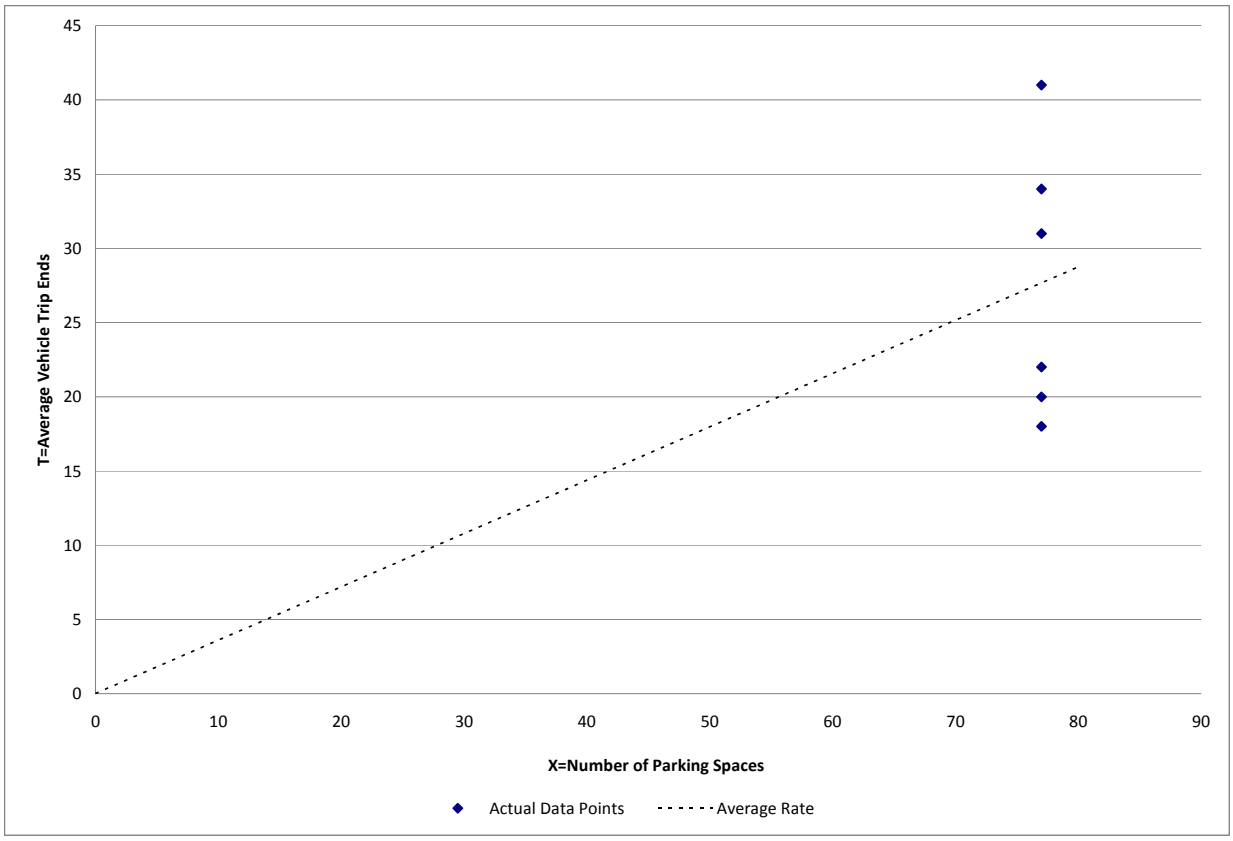
Park-and-Ride Lot with Bus Services - Statewide
(90)

Average Vehicle Trip Ends vs:	**Parking Spaces**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Number of Studies	6
Average Number of Parking Spaces	77
Directional Distribution	58% entering; 42% exiting

Trip Generation

Average Rate	Range of Rates	Standard Deviation
0.36	0.53 – 0.23	0.12

Data Plot and Equation



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

Park-and-Ride Lot with Bus Services - Statewide
(90)

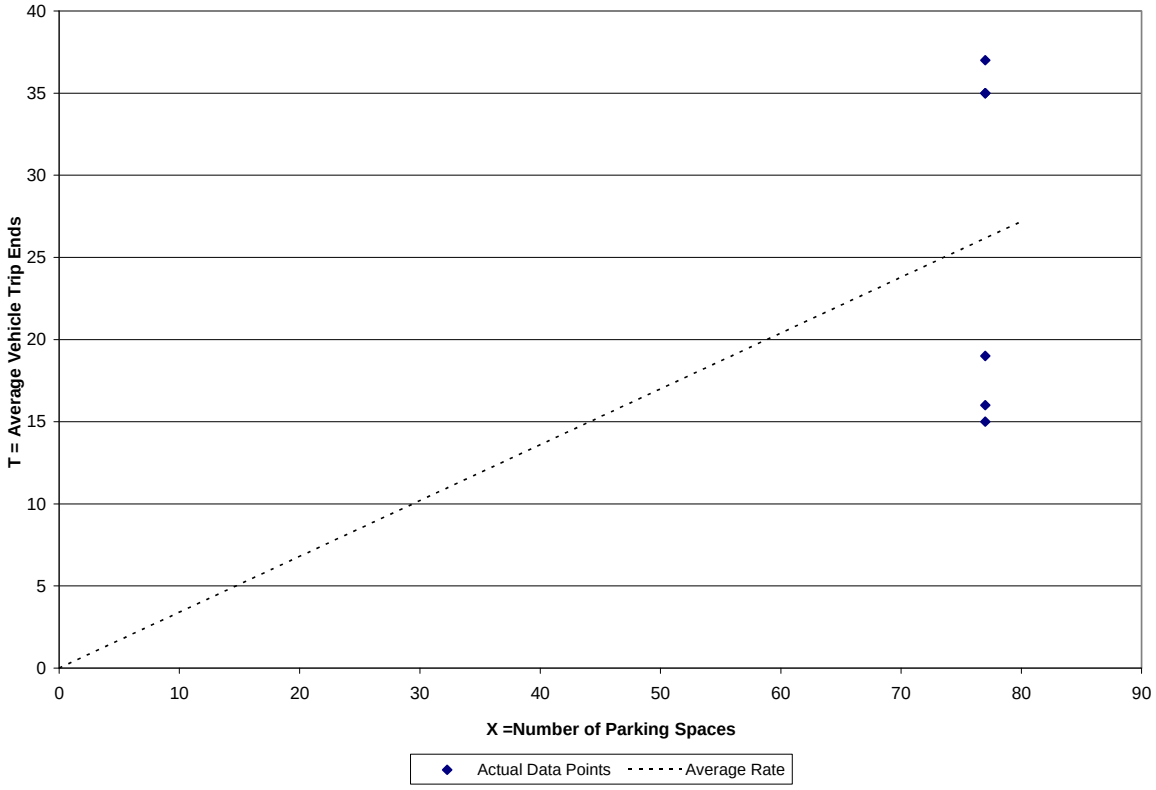
Average Vehicle Trip Ends vs: **Parking Spaces**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies	6
Average Number of Parking Spaces	77
Directional Distribution	53% entering; 47% exiting

Trip Generation

Average Rate	Range of Rates	Standard Deviation
0.34	0.48 – 0.19	0.14

Data Plot and Equation



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

Land Use: 140

Manufacturing[21]

[21] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 2 of 3, p. 160

Manufacturing - Statewide
(140)

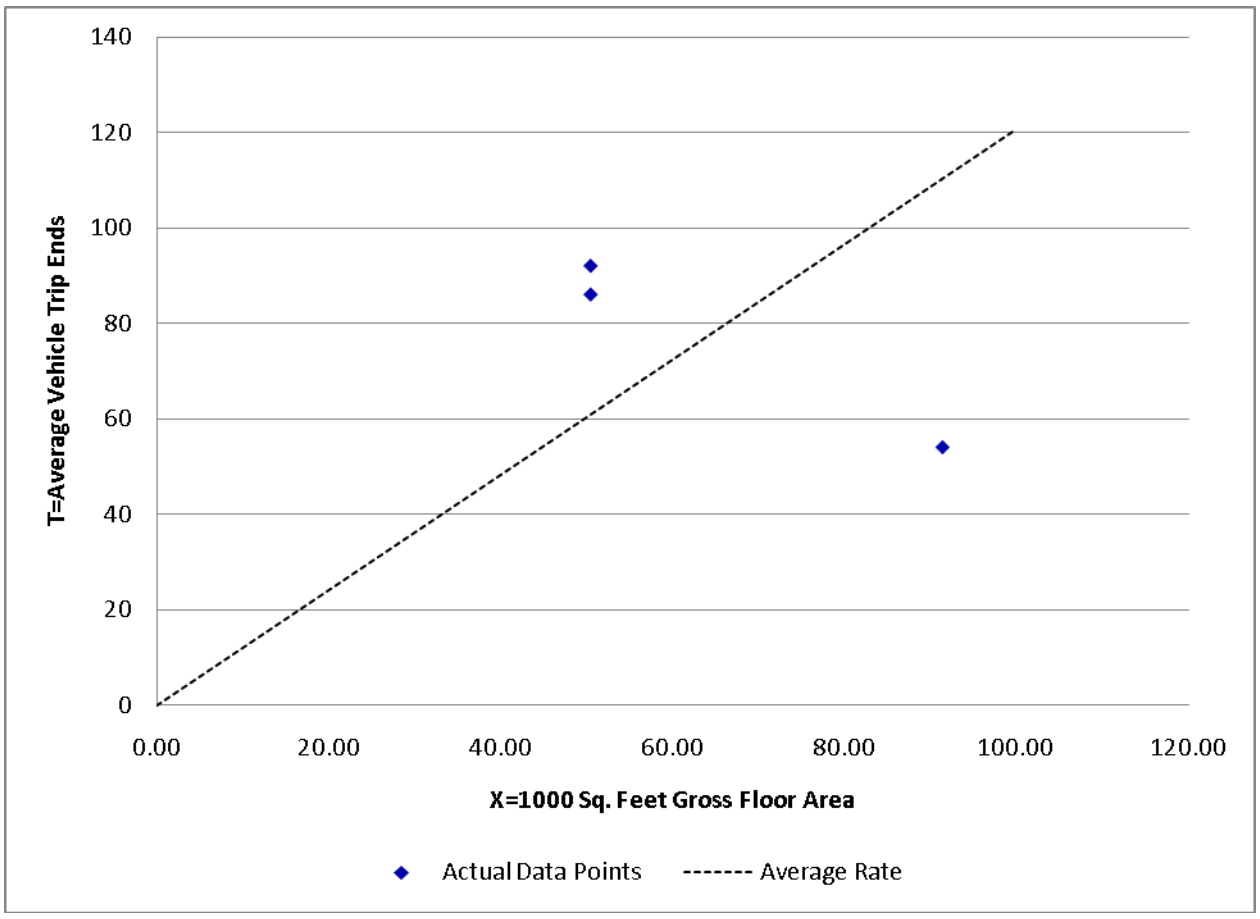
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies 3
Average 1000 Sq. Feet of GFA 64.06
Directional Distribution 86% entering; 14% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.21	0.59 – 1.83	0.74

Data Plot and Equation



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

Manufacturing - Chittenden County
(140)

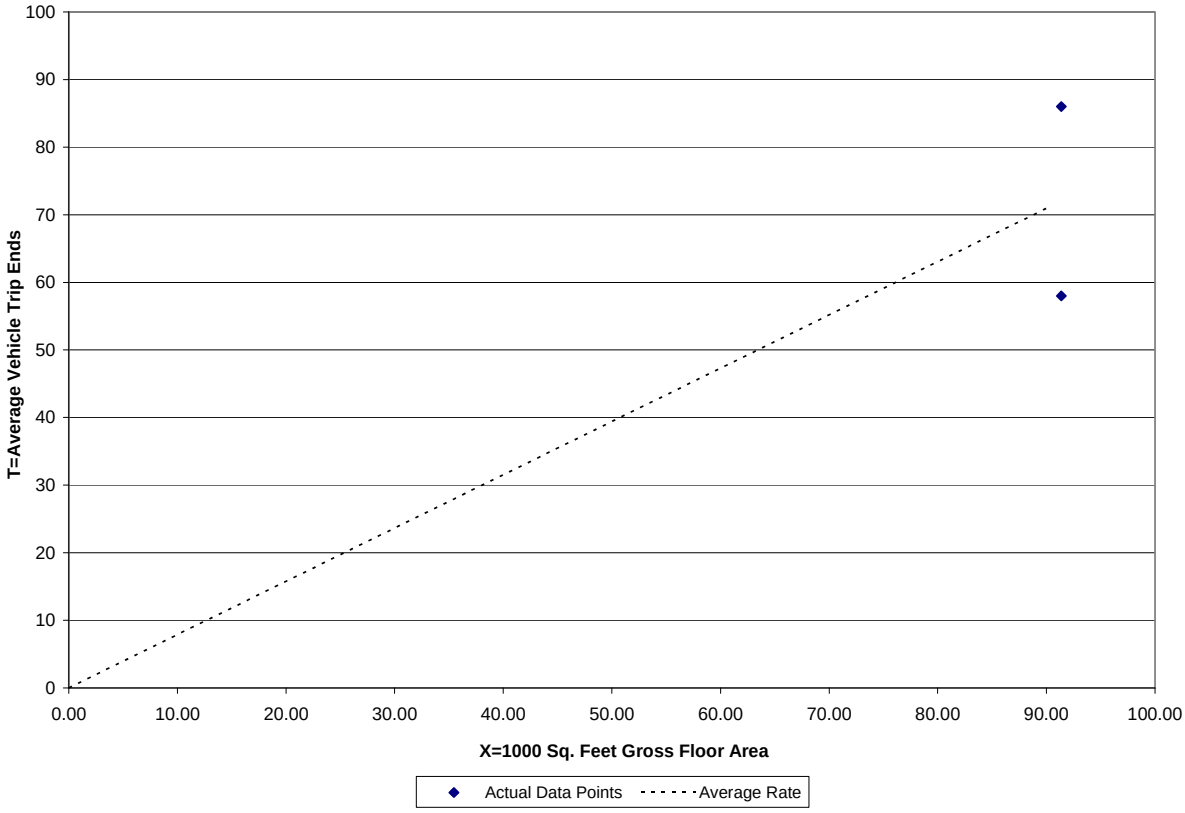
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies 2
Average 1000 Sq. Feet of GFA 91.37
Directional Distribution 45% entering; 55% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.79	0.79 – 0.79	0.22

Data Plot and Equation



Fitted Curve Equation: T = Not Given **R^2 = *****

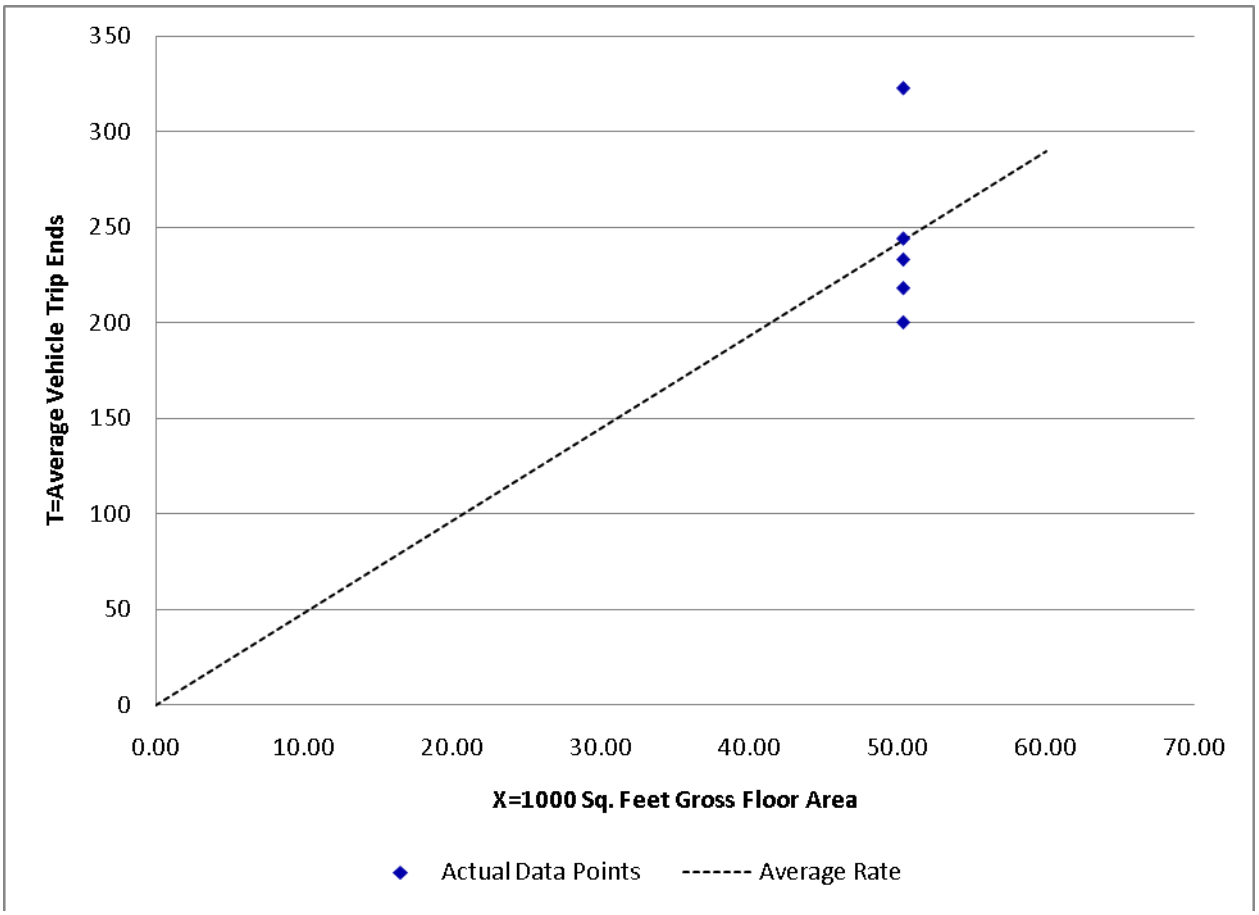
Manufacturing – Other than Chittenden County
(140)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic
	One Hour Between 11 a.m. and 2 p.m.
Number Studies	5
Average 1000 Sq. Feet of GFA	50.40
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
4.83	3.97 – 6.41	0.94

Data Plot and Equation



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

Manufacturing - Statewide
(140)

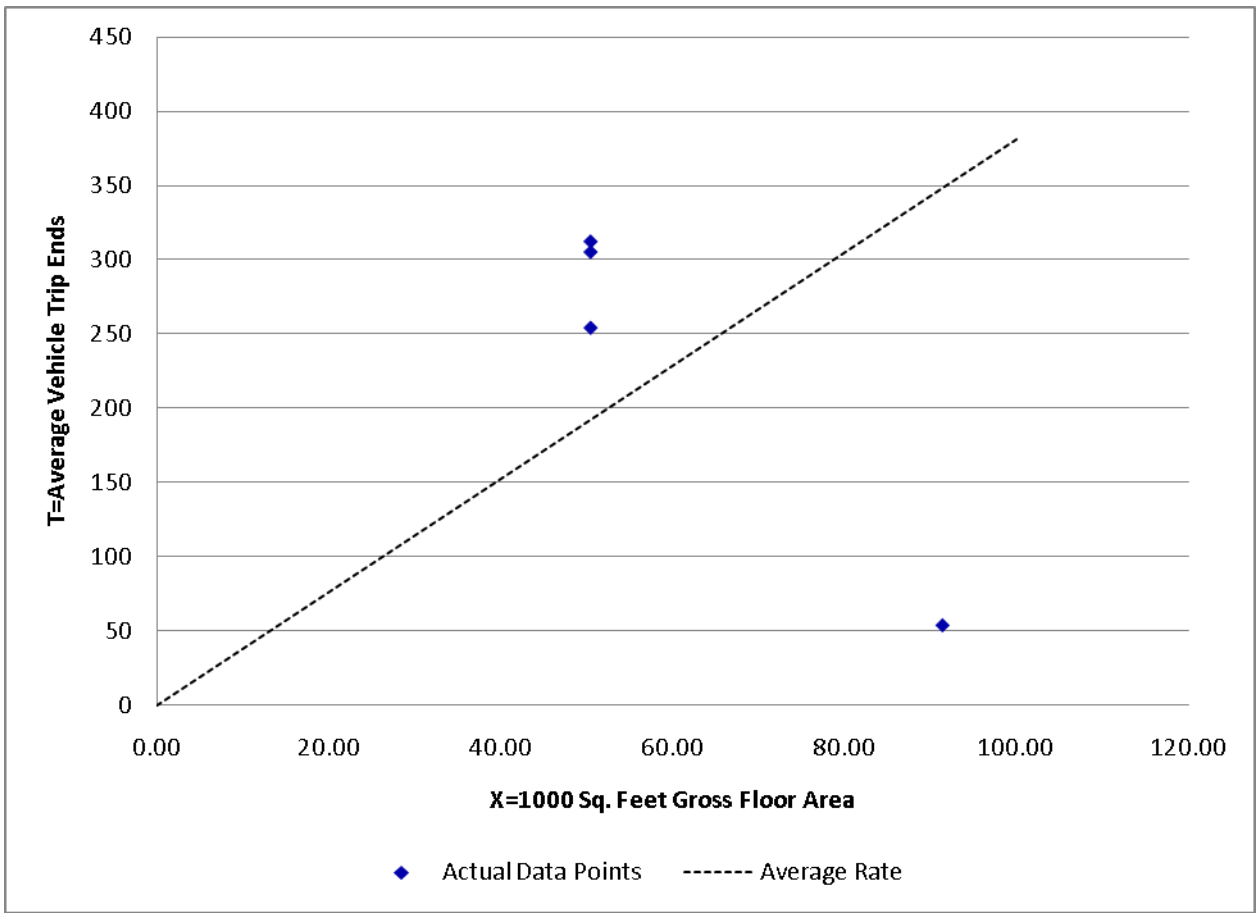
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
P.M. Peak Hour of Generator

Number of Studies	4
Average 1000 Sq. Feet of GFA	60.64
Directional Distribution	45% entering; 55% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
3.81	0.59 – 6.19	2.97

Data Plot and Equation



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

Land Use: 310

Hotel[22]

[22] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 2 of 3, p. 570

Hotel - Statewide
(310)

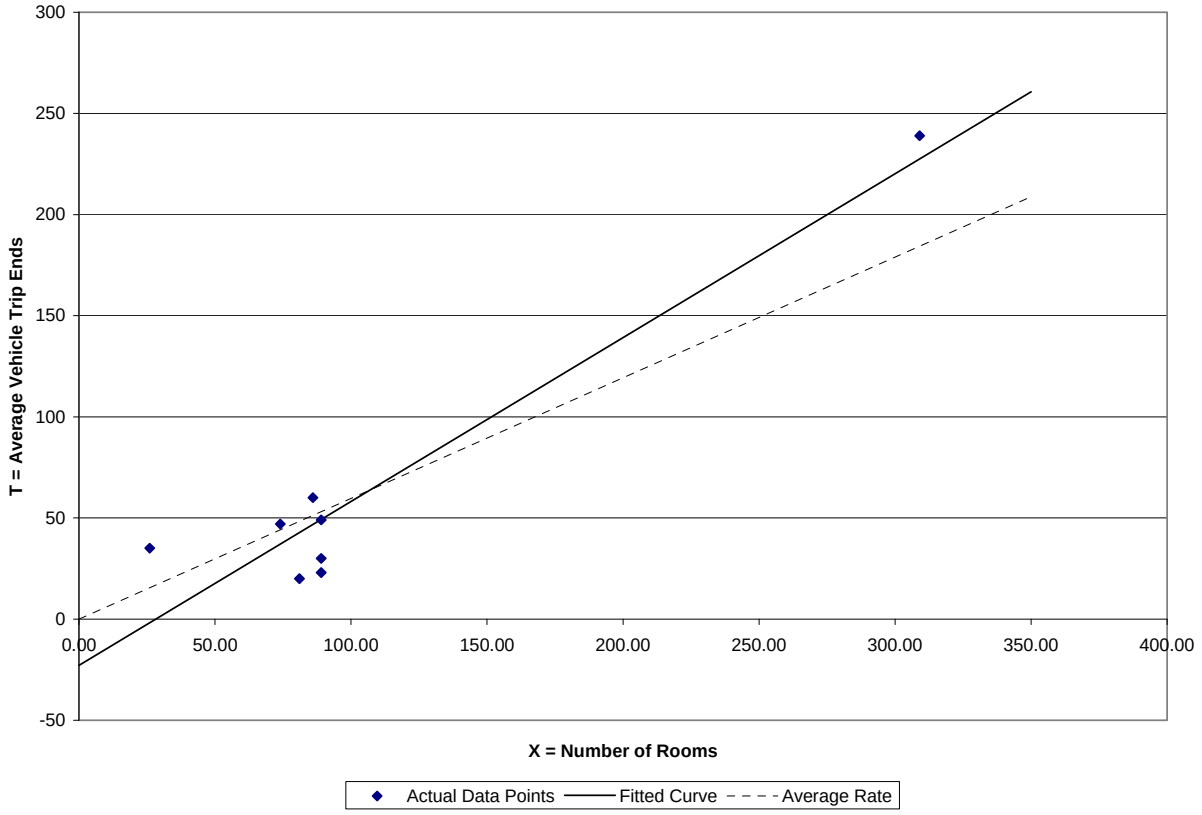
Average Vehicle Trip Ends vs: **Rooms**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 7and 9 a.m.

Number of Studies 8
Average Number of Rooms 105
Directional Distribution 53% entering; 47% exiting

Trip Generation per Room

Average Rate	Range of Rates	Standard Deviation
0.60	0.25 – 1.35	0.51

Data Plot and Equation



Fitted Curve Equation: T = 0.81 X – 22.83 **R^2 = 0.91**

Hotel - Statewide
(310)

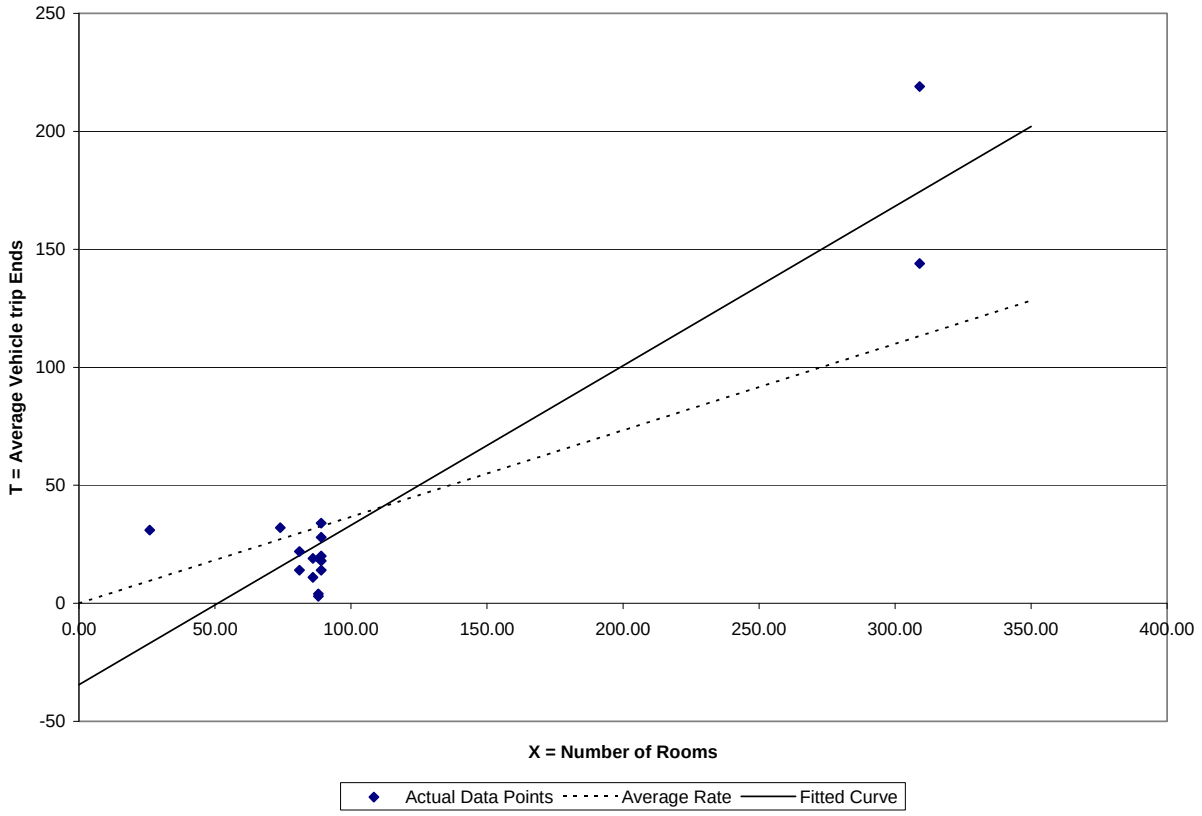
Average Vehicle Trip Ends vs: **Rooms**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies	15
Average Number of Rooms	112
Directional Distribution	48% entering; 52% exiting

Trip Generation per Room

Average Rate	Range of Rates	Standard Deviation
0.37	0.03 – 1.19	0.25

Data Plot and Equation



Fitted Curve Equation: T = 0.68 X – 34.54 **R^2 = 0.86**

Hotel - Statewide
(310)

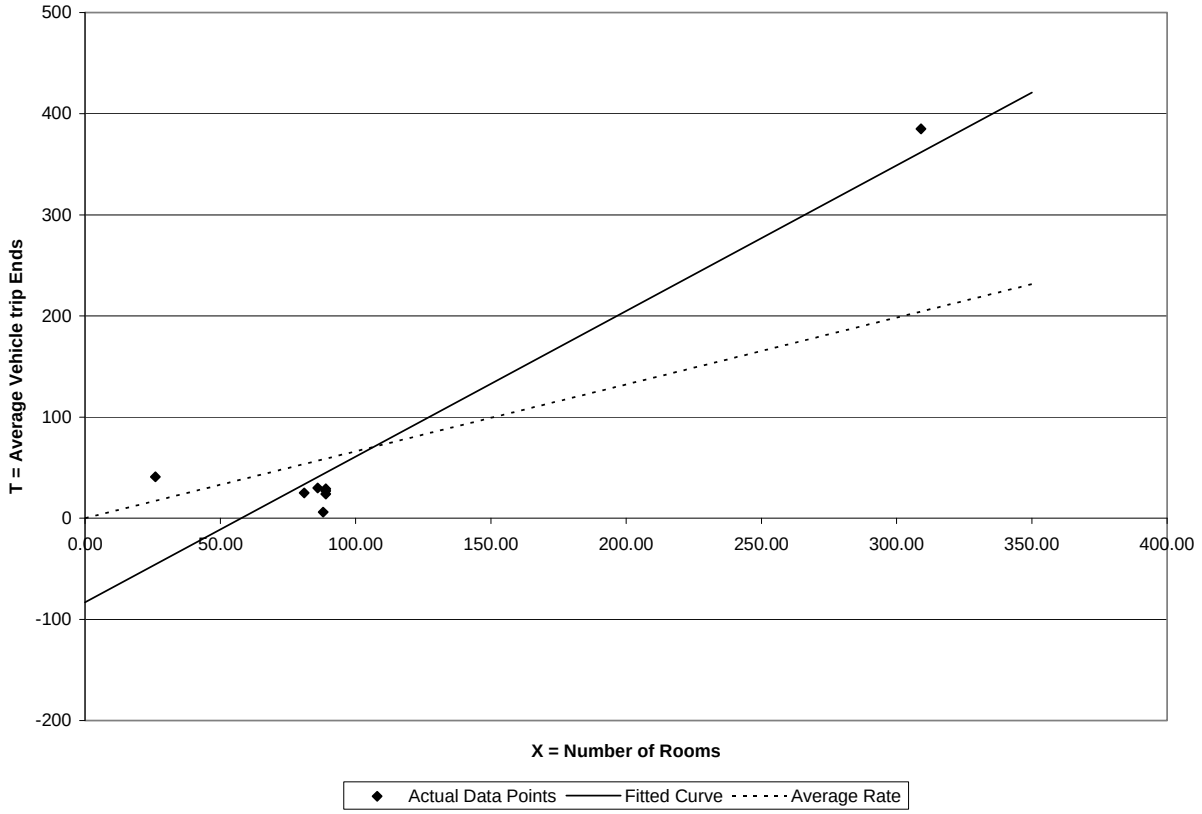
Average Vehicle Trip Ends vs: Rooms
On a: Weekday
P.M. Peak Hour of Generator

Number of Studies 8
Average Number of Rooms 107
Directional Distribution 32% entering; 68% exiting

Trip Generation per Room

Average Rate	Range of Rates	Standard Deviation
0.66	0.07 – 1.58	0.55

Data Plot and Equation



Fitted Curve Equation: T = 1.44 X – 82.98 **R^2 = 0.91**

Land Use: 430

Golf Course[23]

[23] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 2 of 3, p. 744

Golf Course - Statewide
(430)

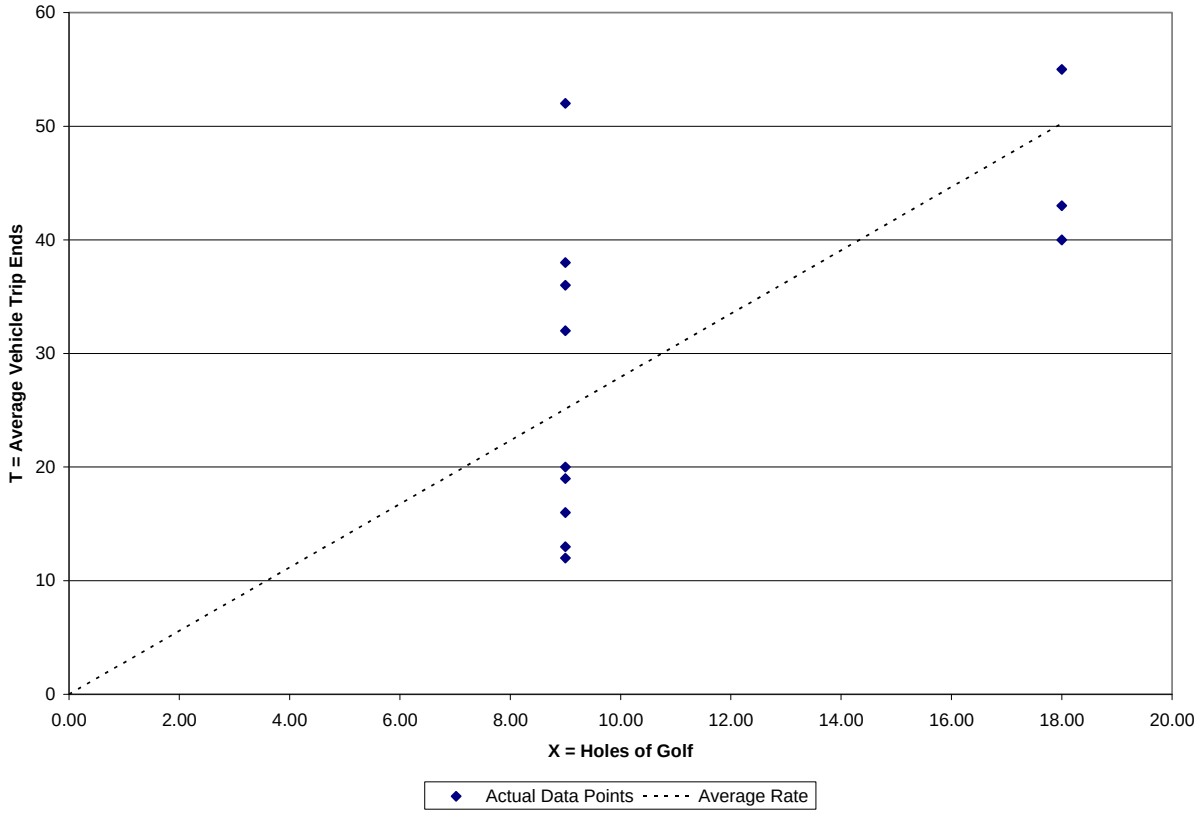
Average Vehicle Trip Ends vs: **Holes of Golf**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 7and 9 a.m.

Number of Studies 9
Average Number of Holes 11
Directional Distribution 74% entering; 26% exiting

Trip Generation per Holes of Golf

Average Rate	Range of Rates	Standard Deviation
2.02	0.89 – 2.89	0.73

Data Plot and Equation



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

Golf Course - Statewide
(430)

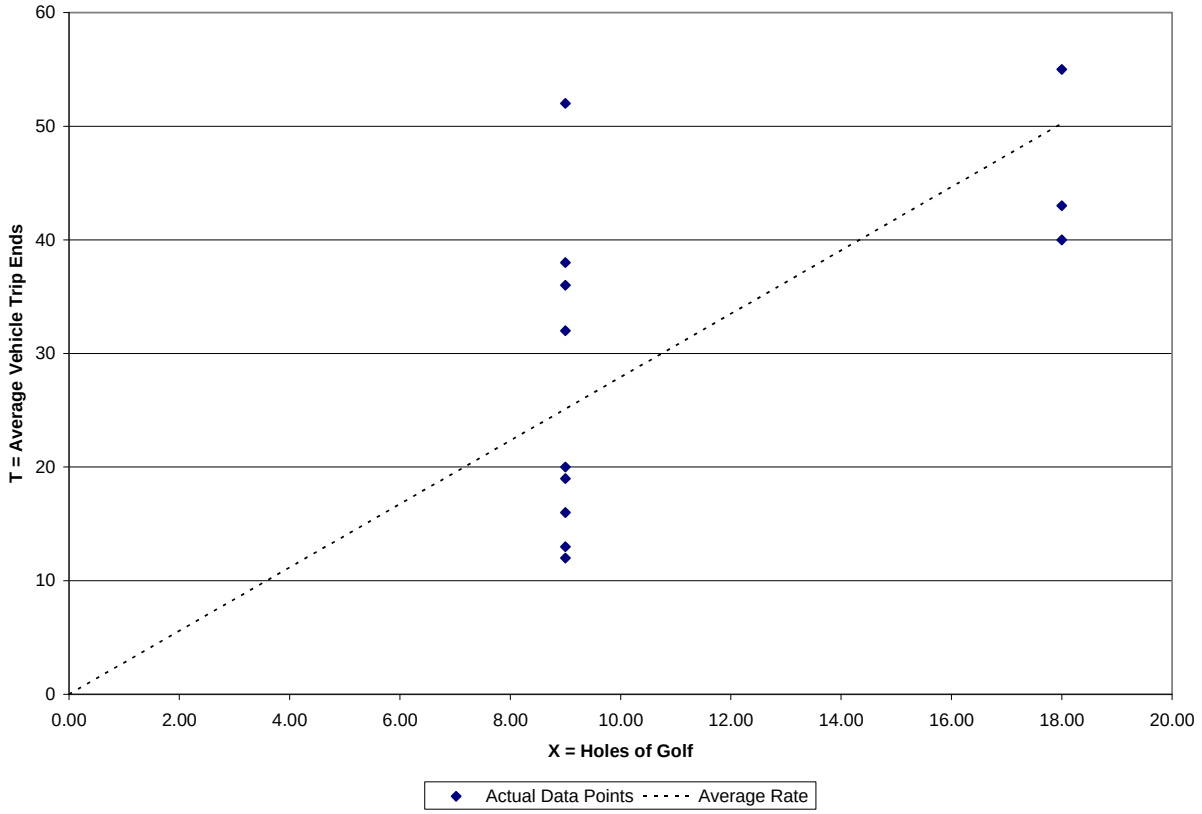
Average Vehicle Trip Ends vs: **Holes of Golf**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies 12
Average Number of Holes 11.25
Directional Distribution 52% entering; 48% exiting

Trip Generation per Holes of Golf

Average Rate	Range of Rates	Standard Deviation
2.79	1.33 – 5.78	1.21

Data Plot and Equation



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

Golf Course - Statewide
(430)

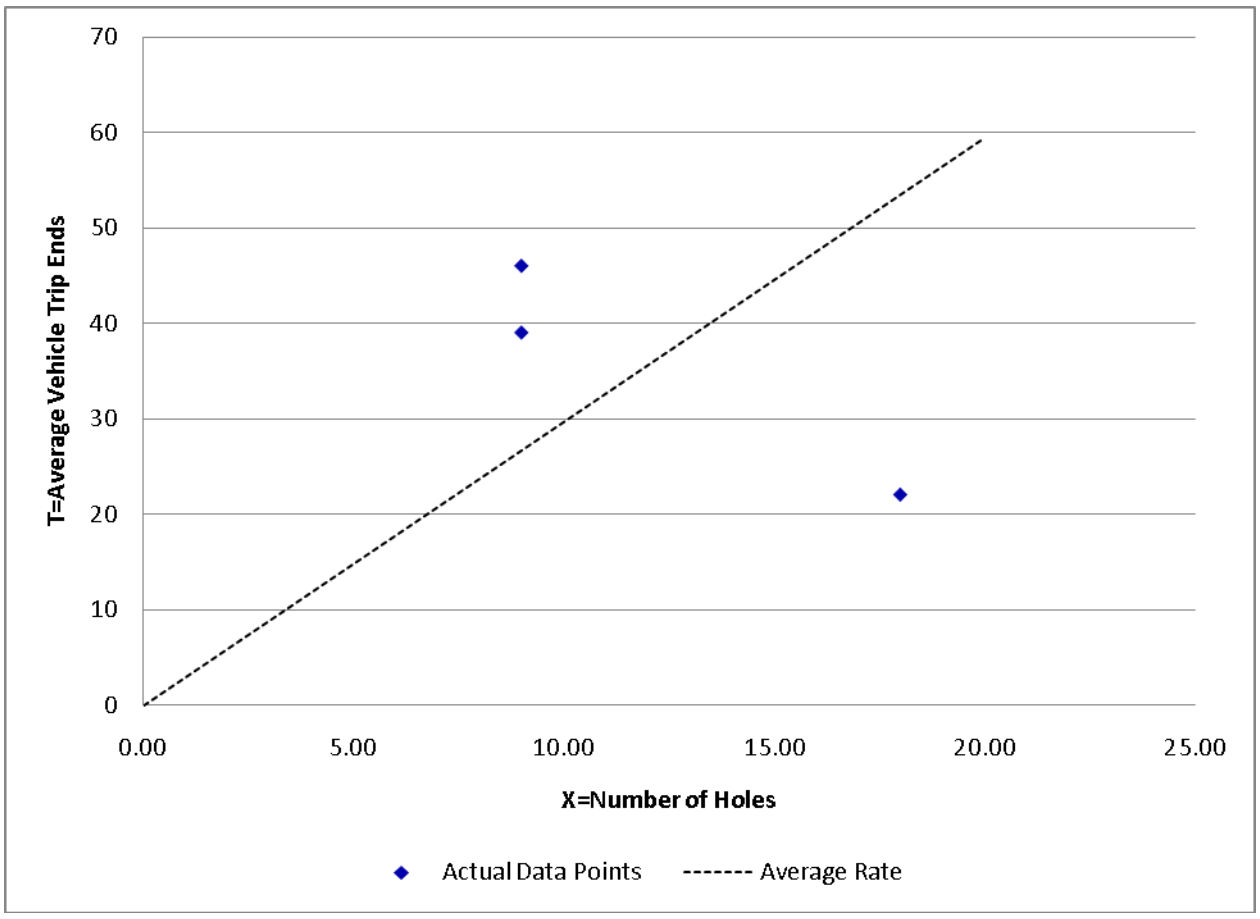
Average Vehicle Trip Ends vs: Holes
On a: Weekday
P.M. Peak Hour of Generator

Number of Studies 3
Average Number of Holes 12
Directional Distribution 61% entering; 39% exiting

Trip Generation per Holes

Average Rate	Range of Rates	Standard Deviation
2.97	1.22 – 5.11	2.24

Data Plot and Equation



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

Land Use: 820

Shopping Center[24]

[24] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1497

Shopping Center - Statewide
(820)

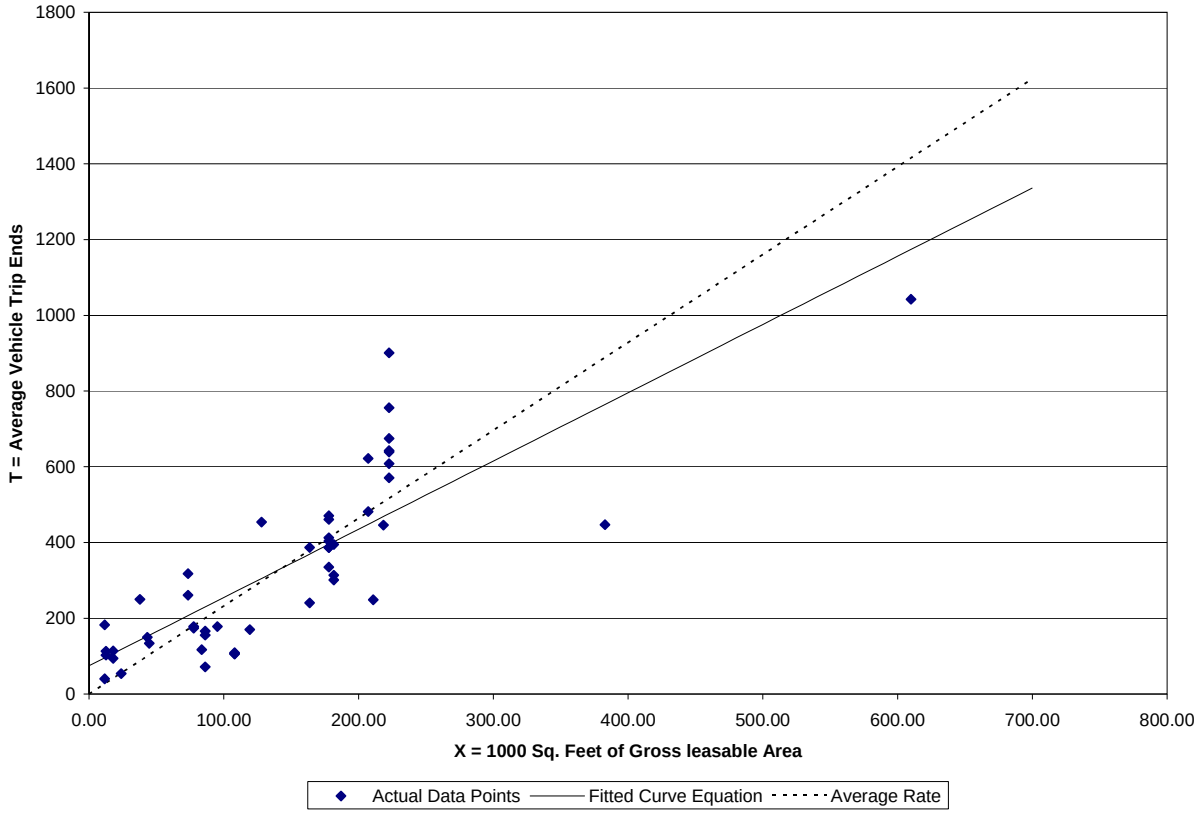
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Leasable Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies 49
Average 1000 Sq. Feet of GLA 144.06
Directional Distribution 58% entering; 42% exiting

Trip Generation per 1000 Sq. Feet of Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
2.32	0.84 – 15.78	1.12

Data Plot and Equation



Fitted Curve Equation: T = 1.80 X + 74.71 **R^2 = 0.68**

Shopping Center - Statewide
(820)

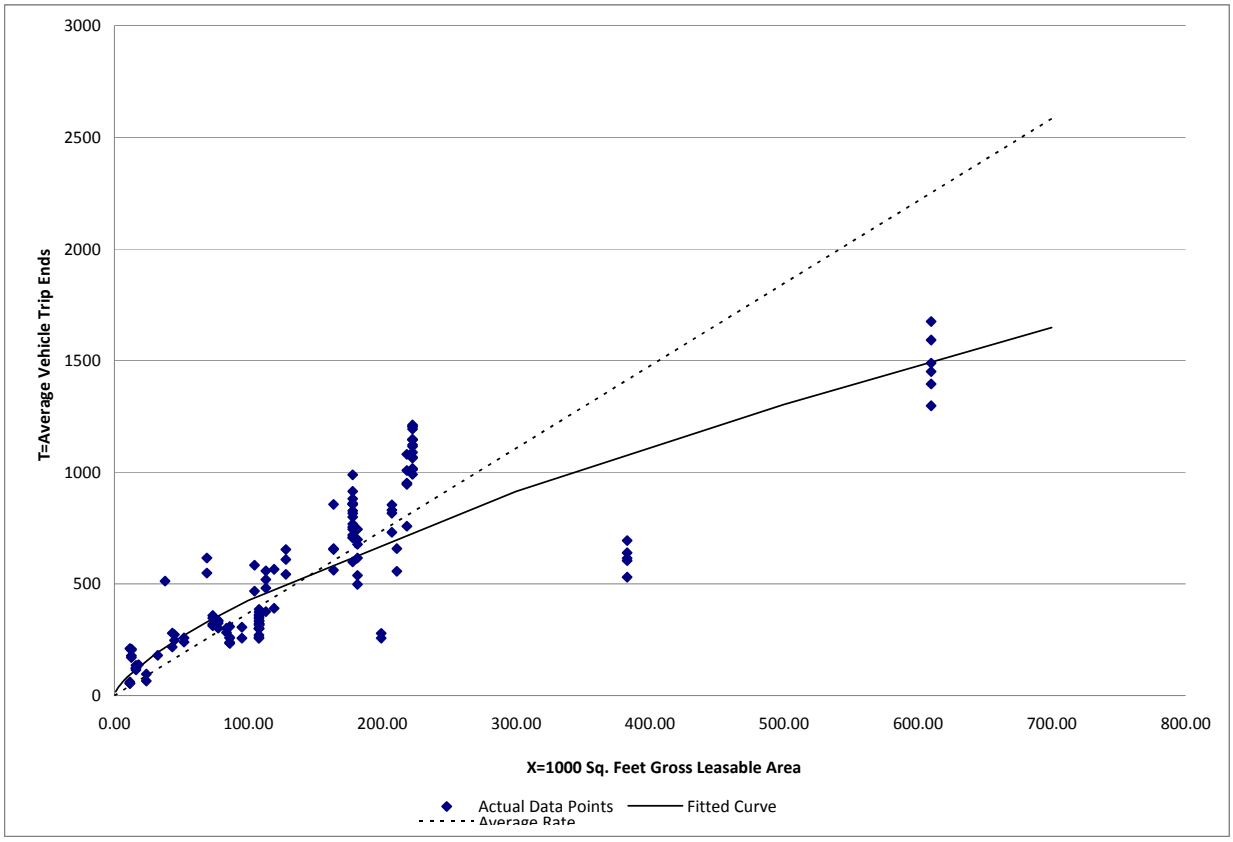
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Leasable Area
On a: Weekday
1 hour between 10:00 AM and 2:00 PM

Number of Studies	137
Average 1000 Sq. Feet of GLA	158.20
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
3.69	1.29 – 18.19	1.51

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.695 Ln(X) + 2.854 **R^2 = 0.76**

Shopping Center - Statewide
(820)

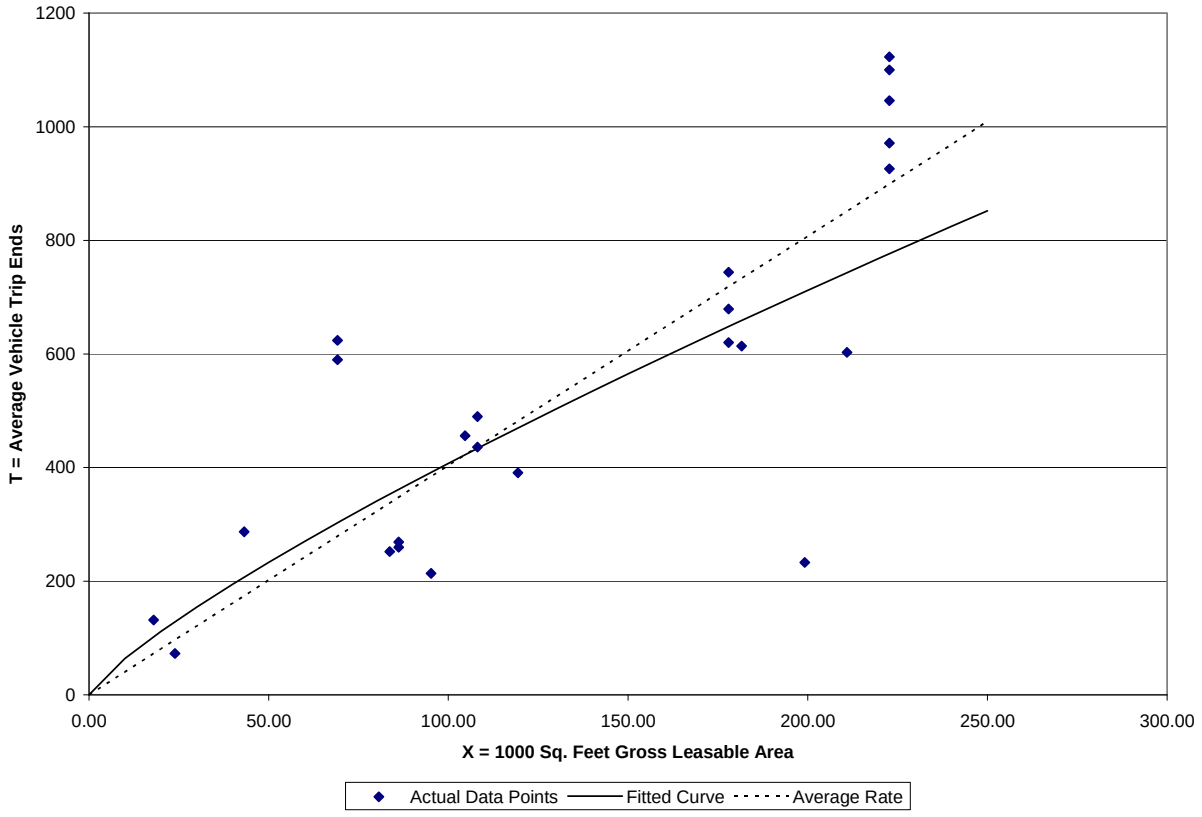
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Leasable Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Number of Studies	24
Average 1000 Sq. Feet of GLA	135.59
Directional Distribution	50% entering; 50% exiting

Trip Generation per 1000 Sq. Feet of Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
4.04	1.17 – 9.03	1.50

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.81 Ln(X) + 2.30 **R^2 = 0.65**

Land Use: 841

New Car Sales[25]

[25] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1519

New Car Sales - Statewide
(841)

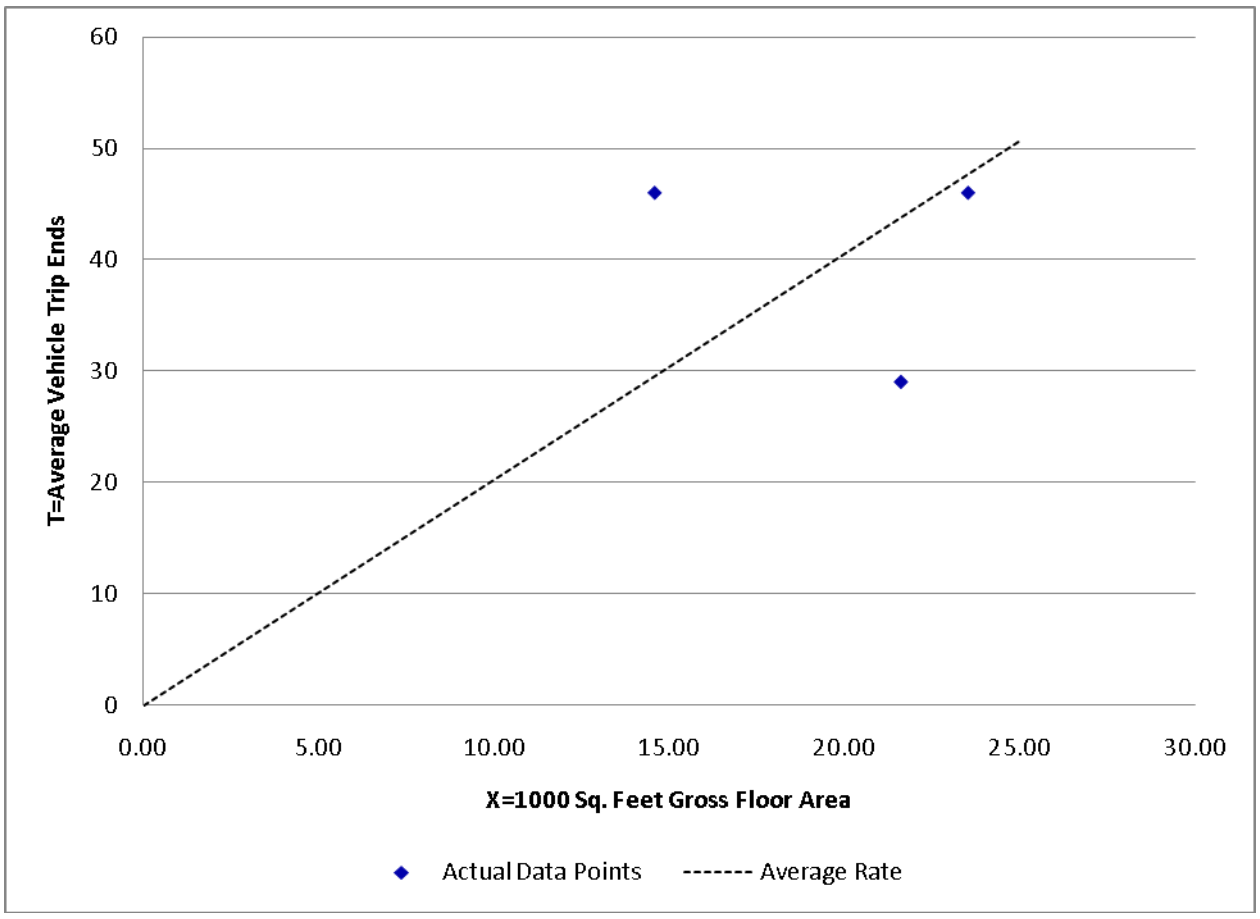
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies 3
Average 1000 Sq. Feet of GFA 19.9
Directional Distribution 55% entering; 45% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.03	1.34 – 3.15	0.86

Data Plot and Equation



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

New Car Sales - Statewide
(841)

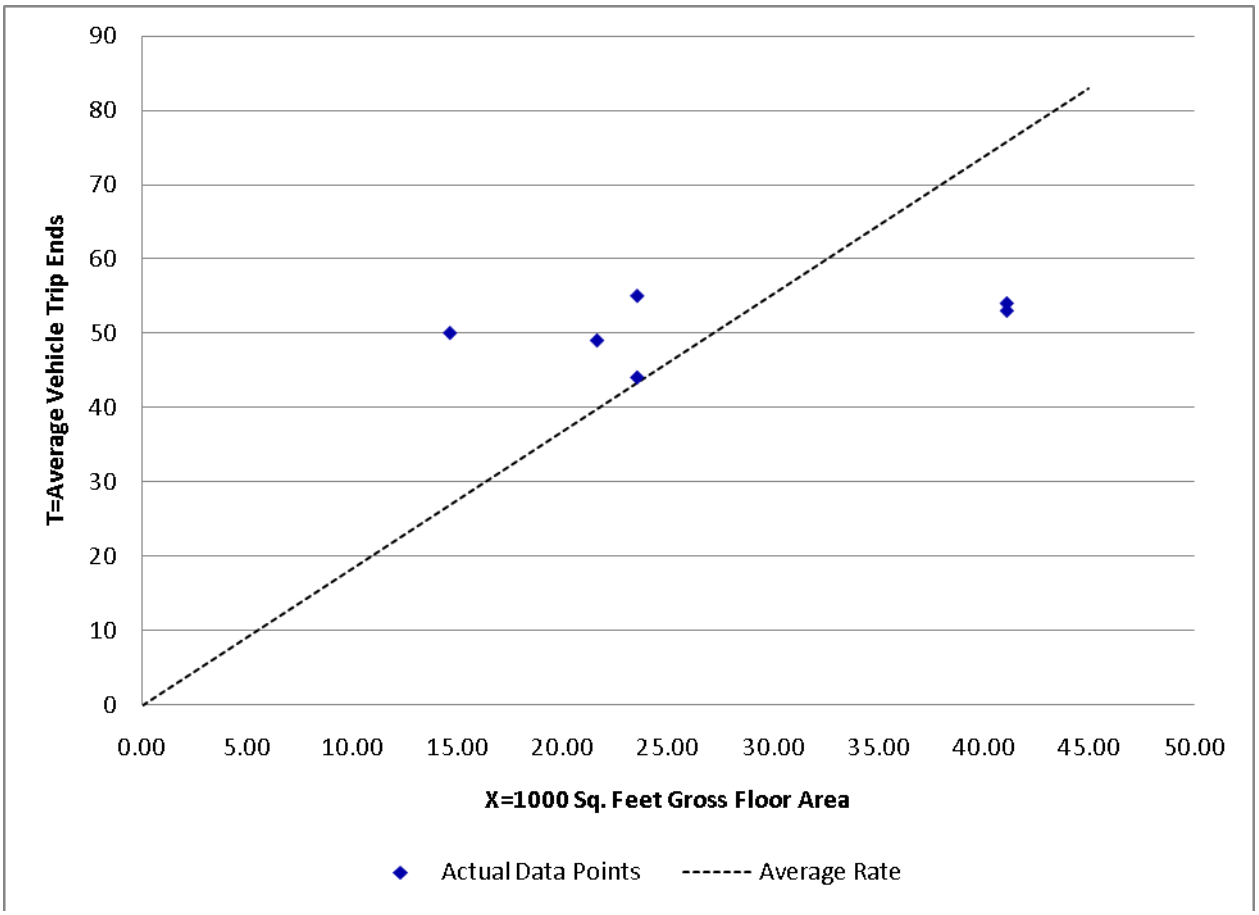
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies	6
Average 1000 Sq. Feet of GFA	27.57
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.84	1.29 – 3.42	0.72

Data Plot and Equation



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

Land Use: 850

Supermarket[26]

[26] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1572

Supermarket - Statewide
(850)

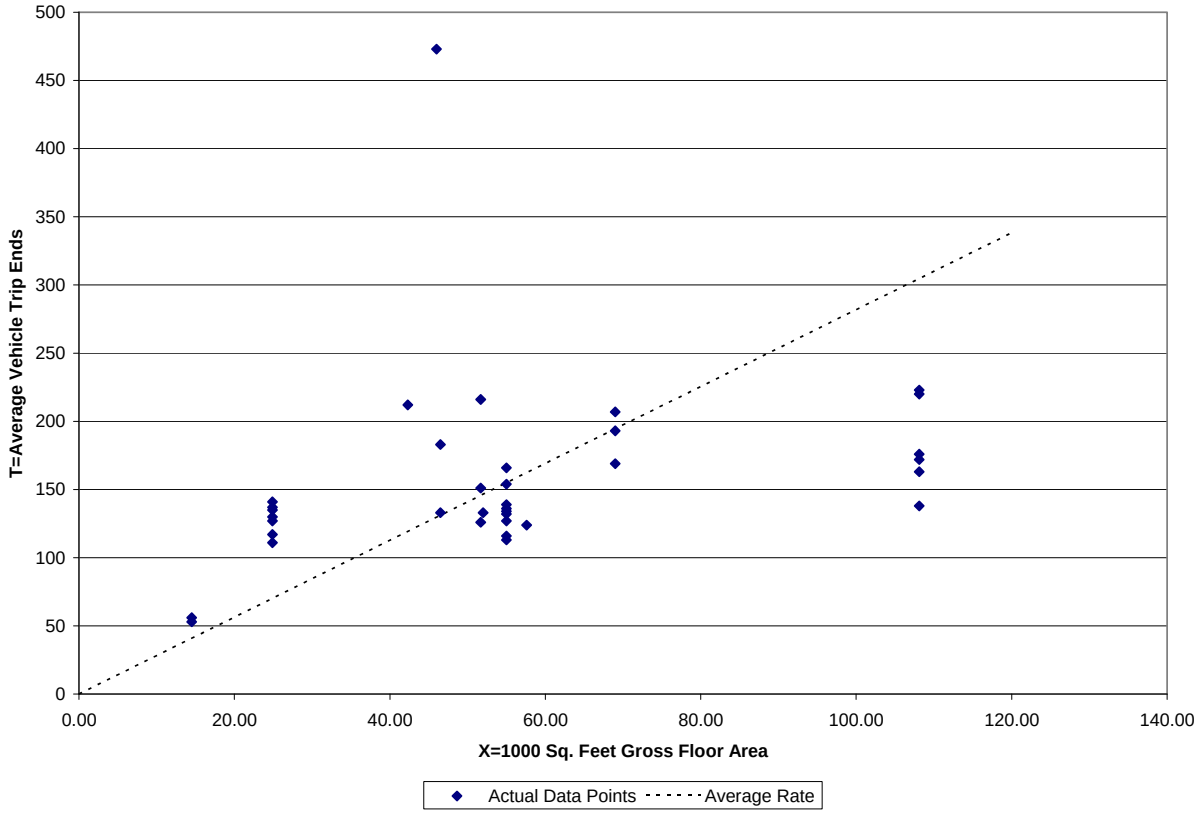
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies 36
Average 1000 Sq. Feet GFA 55.55
Directional Distribution 56% entering; 44% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.82	1.28 – 10.28	1.60

Data Plot and Equation



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

Supermarket – Chittenden County
(850)

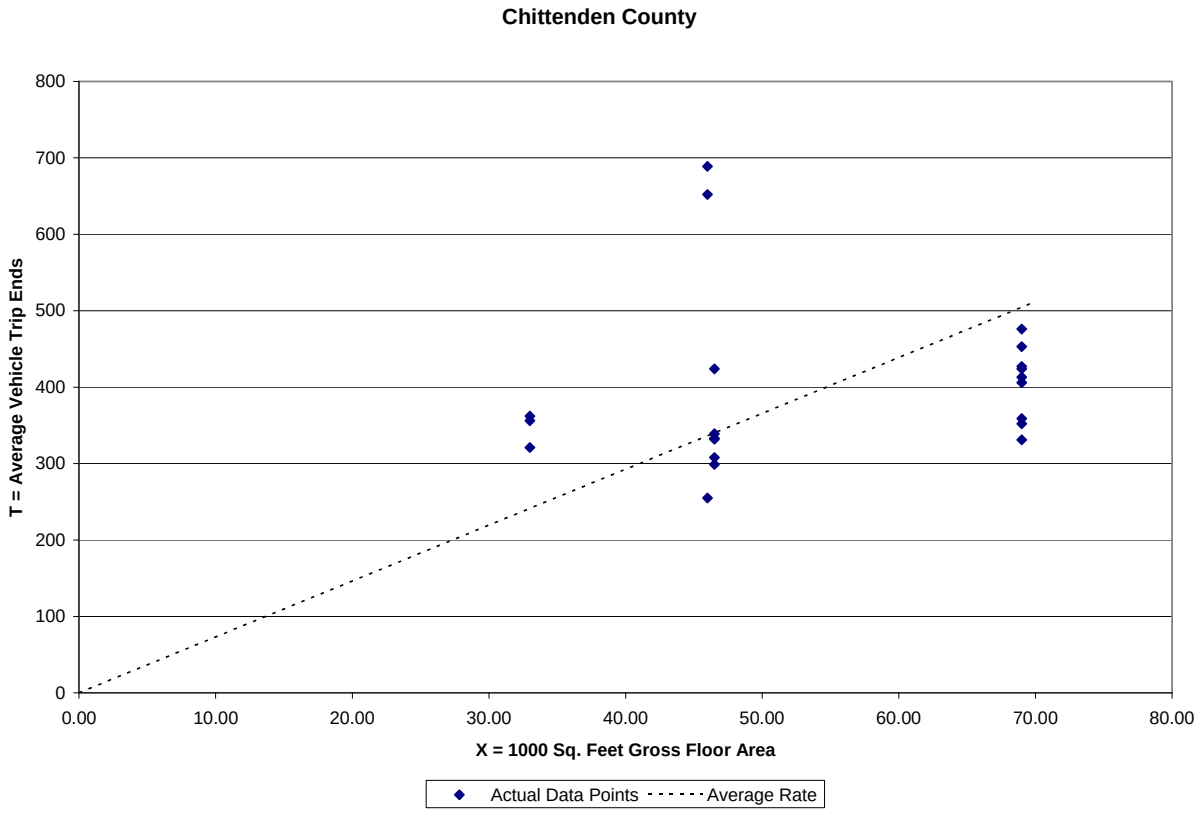
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 1 p.m.

Number of Studies	21
Average 1000 Sq. Feet GFA	54.1
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
7.31	4.80 – 14.98	2.69

Data Plot and Equation



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

Supermarket – Other than Chittenden County
(850)

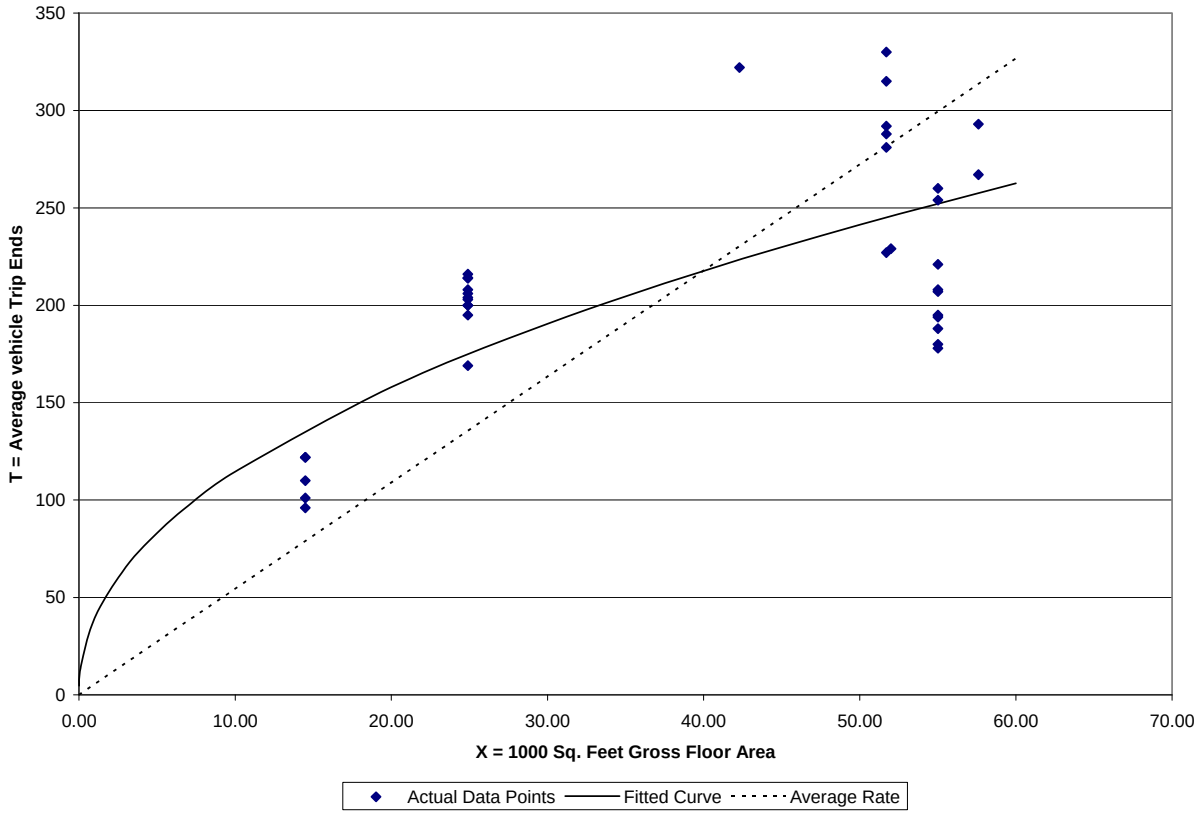
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number Studies	36
Average 1000 Sq. Feet GFA	39.3
Directional Distribution	50% entering; 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
5.44	3.24 – 8.67	1.81

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.463 Ln(X) + 3.675 **R^2 = 0.557**

Supermarket – Chittenden County
(850)

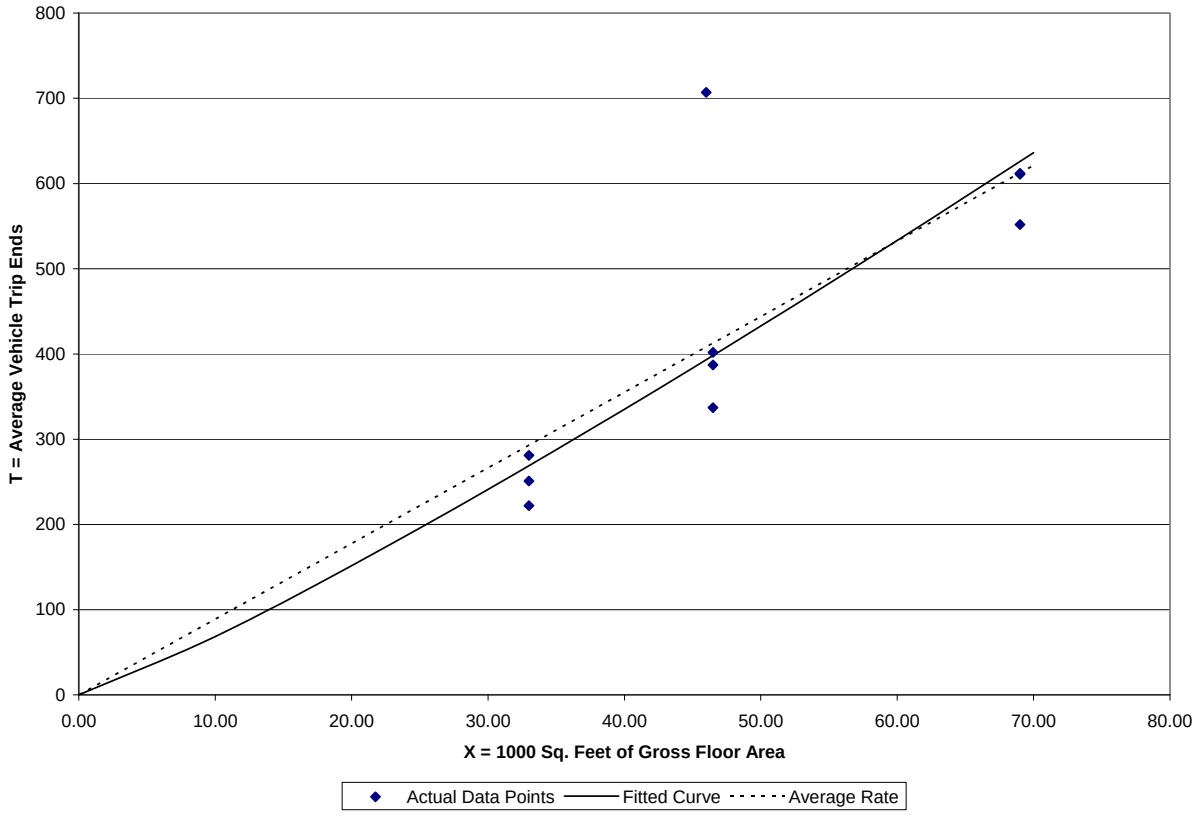
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Number of Studies	10
Average 1000 Sq. Feet GFA	49.1
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
8.87	6.73 – 15.37	2.31

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 1.145 Ln(X) + 1.591 **R^2 = 0.713**

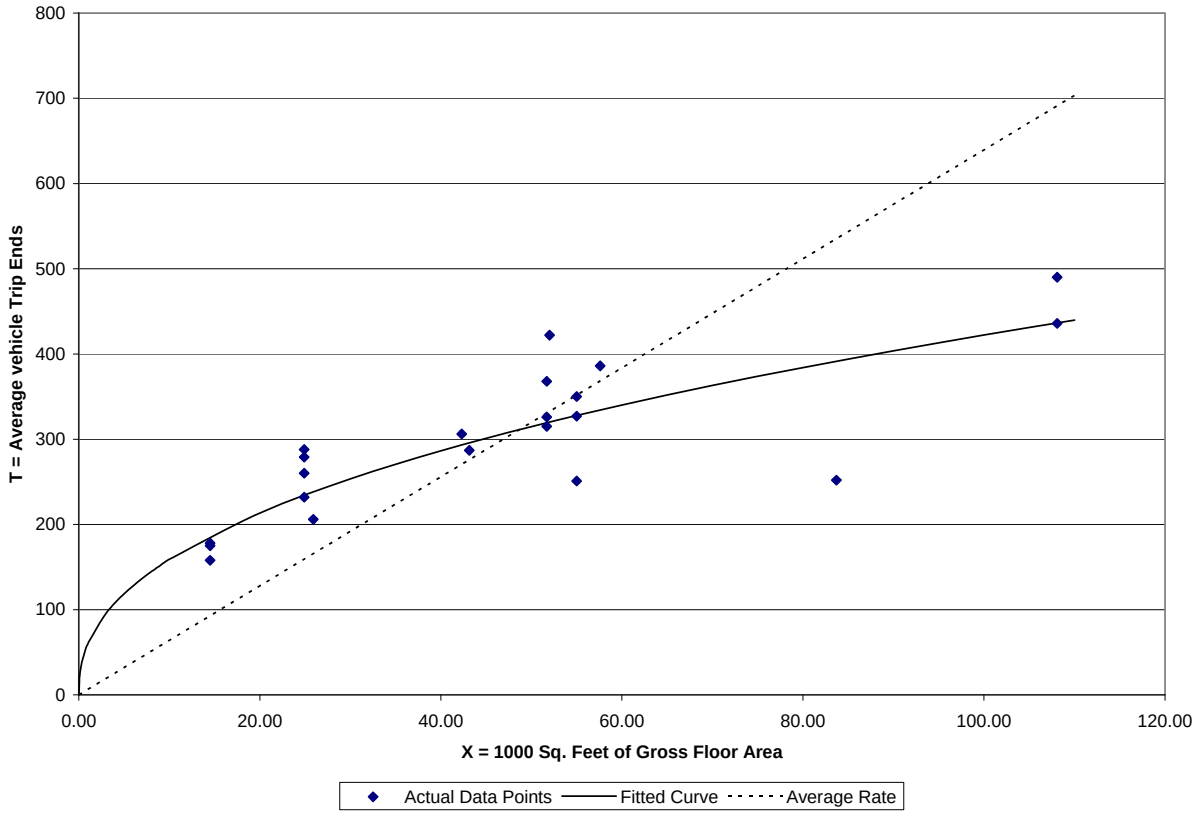
Supermarket – Other than Chittenden County
(850)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic
	One Hour Between 4 and 6 p.m.
Number of Studies	21
Average 1000 Sq. Feet GFA	46.9
Directional Distribution	50% entering; 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
6.39	3.01 – 12.28	2.45

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.424 Ln(X) + 4.093 **R^2 = 0.711**

Land Use: 853

Convenience Market with Gasoline Pumps[27]

[27] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1598

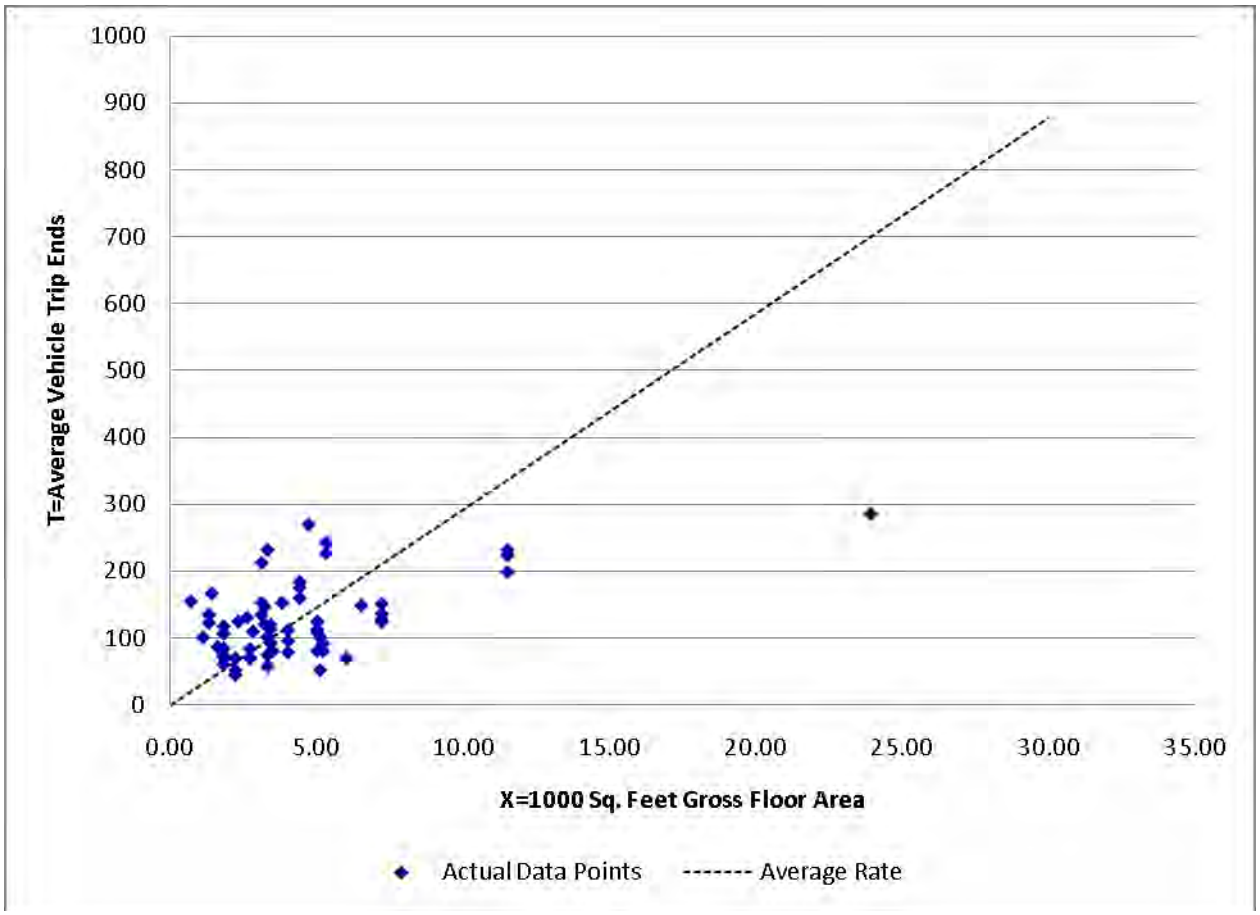
Convenience Market with Gasoline Pumps - Statewide
(853)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Number of Studies	63
Average 1000 Sq. Feet of GFA	4.30
Directional Distribution	50% entering; 50% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
29.25	10.20 – 227.94	20.32

Data Plot and Equation



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

Convenience Market with Gasoline Pumps - Statewide
(853)

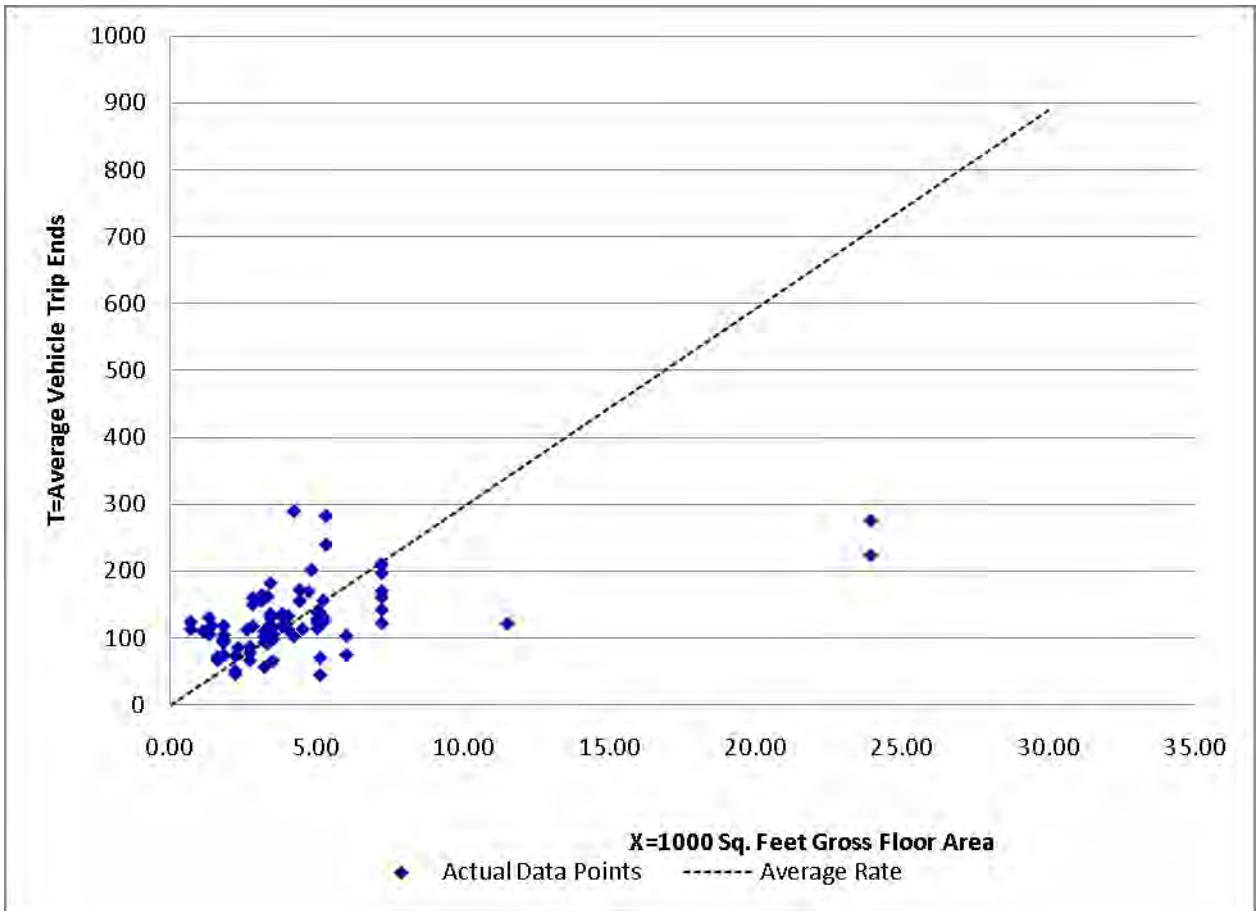
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies	87
Average 1000 Sq. Feet of GFA	4.26
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
29.62	8.63 – 182.35	17.98

Data Plot and Equation



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

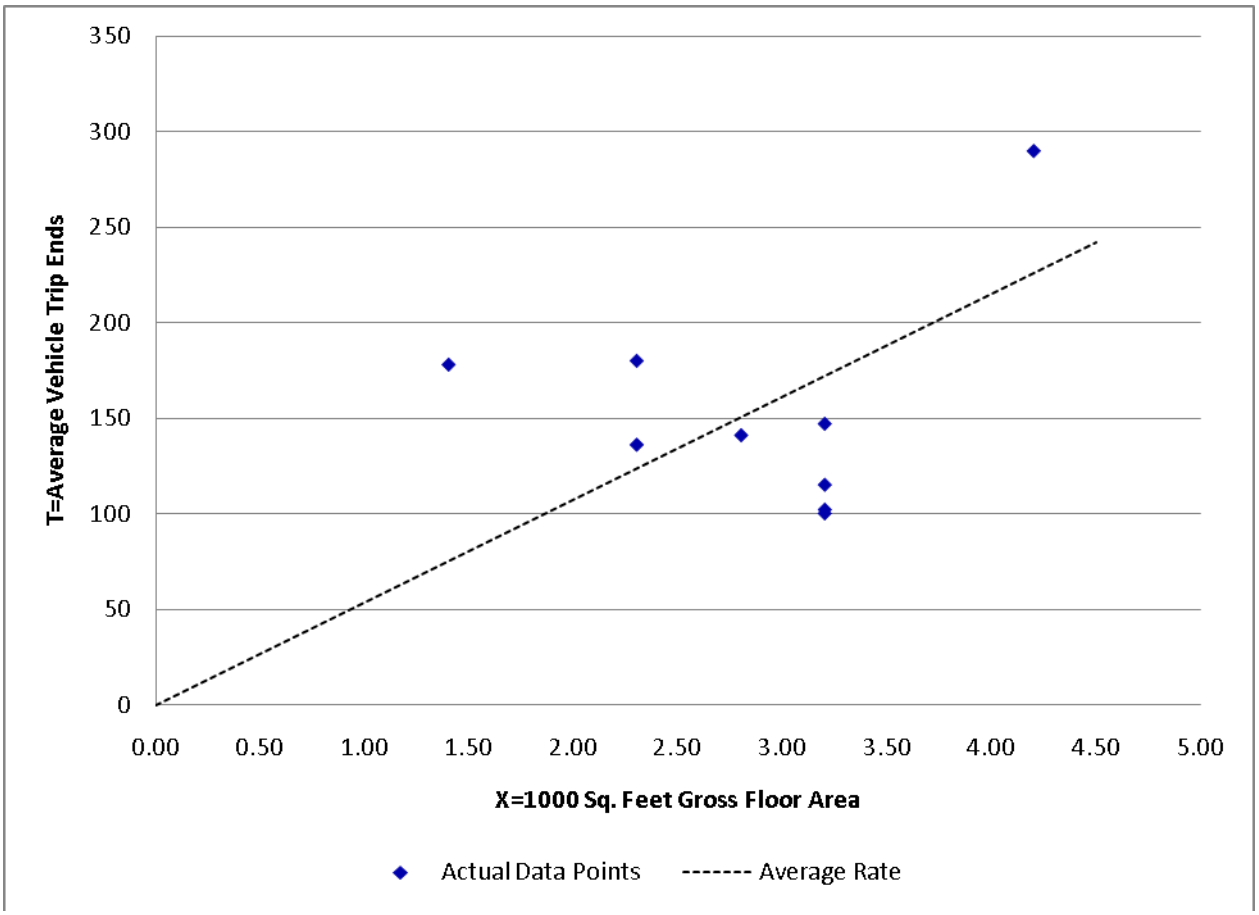
Convenience Market with Gasoline Pumps – Chittenden County (853)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic
	One Hour Between 4 and 6 p.m.
Number of Studies	9
Average 1000 Sq. Feet GFA	2.87
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
53.84	31.25 – 127.14	25.14

Data Plot and Equation



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

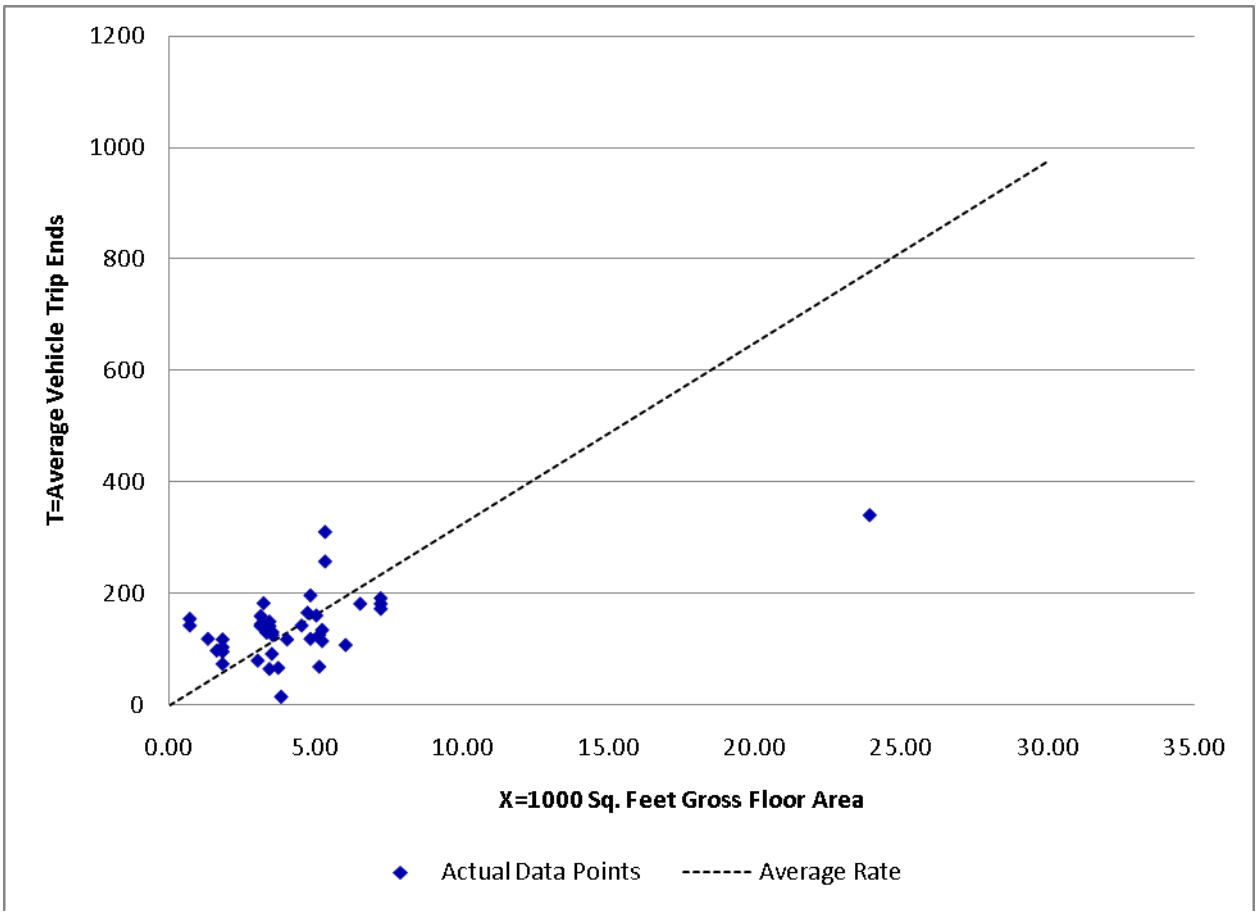
Convenience Market with Gasoline Pumps – Other than Chittenden County (853)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Number of Studies	42
Average 1000 Sq. Feet GFA	4.33
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
32.47	3.95 – 227.94	22.32

Data Plot and Equation



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

Land Use: 862

Home Improvement Superstore[28]

[28] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008, Volume 3 of 3, p. 1654

Home Improvement Superstore - Statewide
(862)

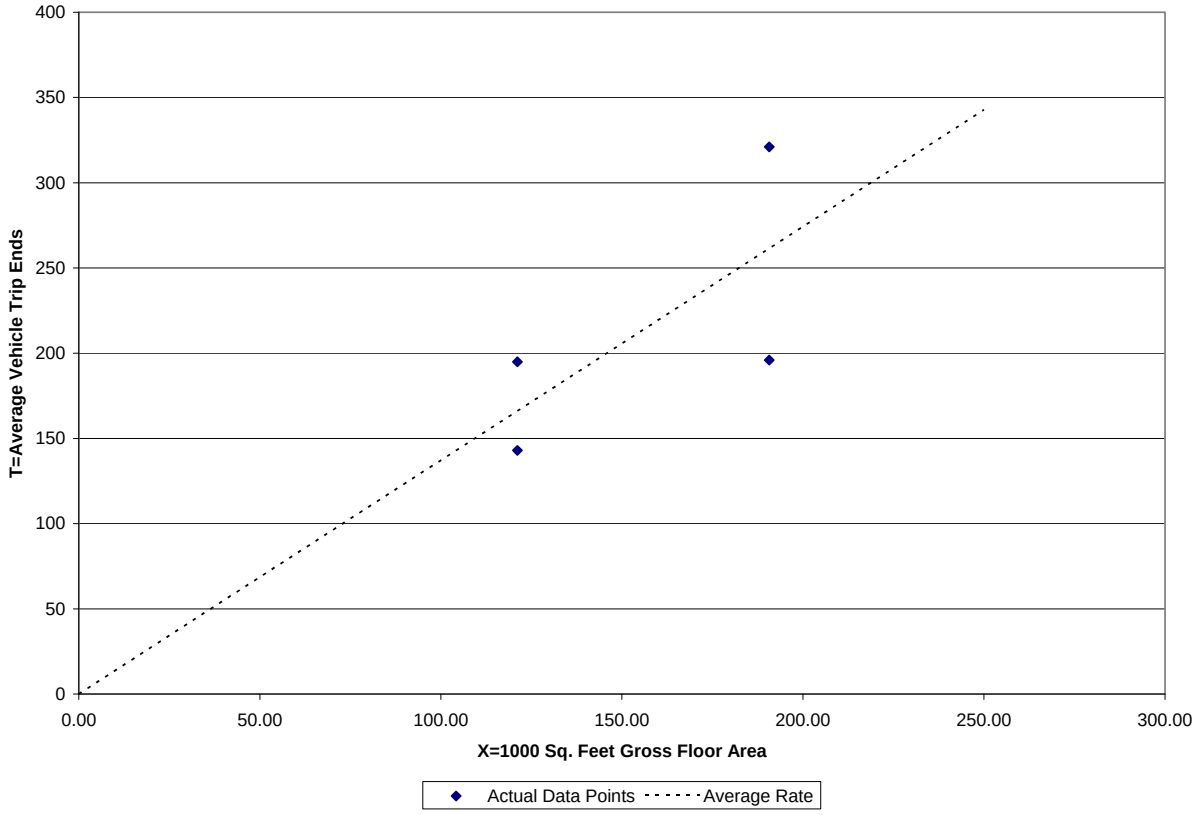
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies	4
Average 1000 Sq. Feet of GFA	155.90
Directional Distribution	56% entering; 44% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.37	1.03– 1.68	0.34

Data Plot and Equation



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

Home Improvement Superstore - Statewide
(862)

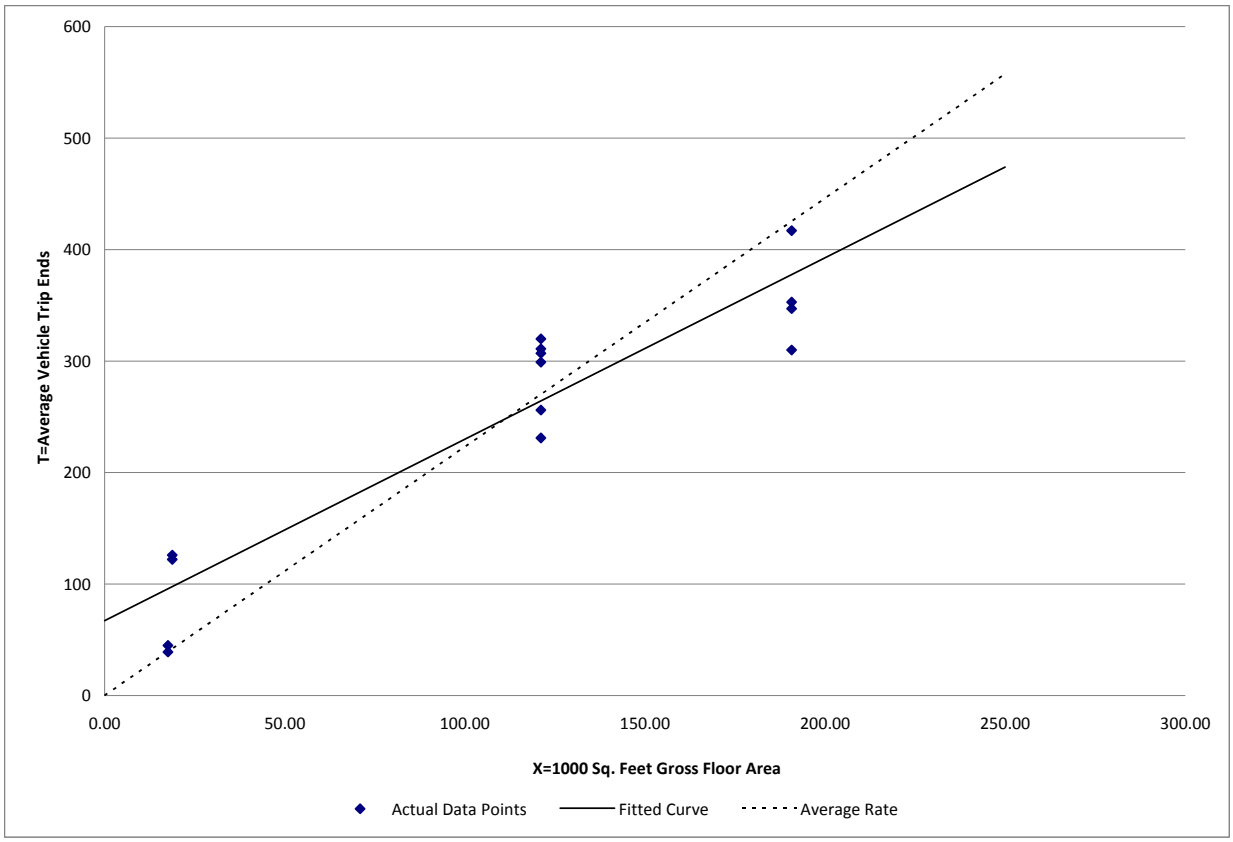
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic
One Hour Between 11 a.m. and 2 p.m.

Number of Studies 14
Average 1000 Sq. Feet of GFA 111.59
Directional Distribution 51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.23	1.63 – 6.70	0.81

Data Plot and Equation



Fitted Curve Equation: T = 1.627 X + 67.2 **R^2 = 0.868**

Home Improvement Superstore - Statewide
(862)

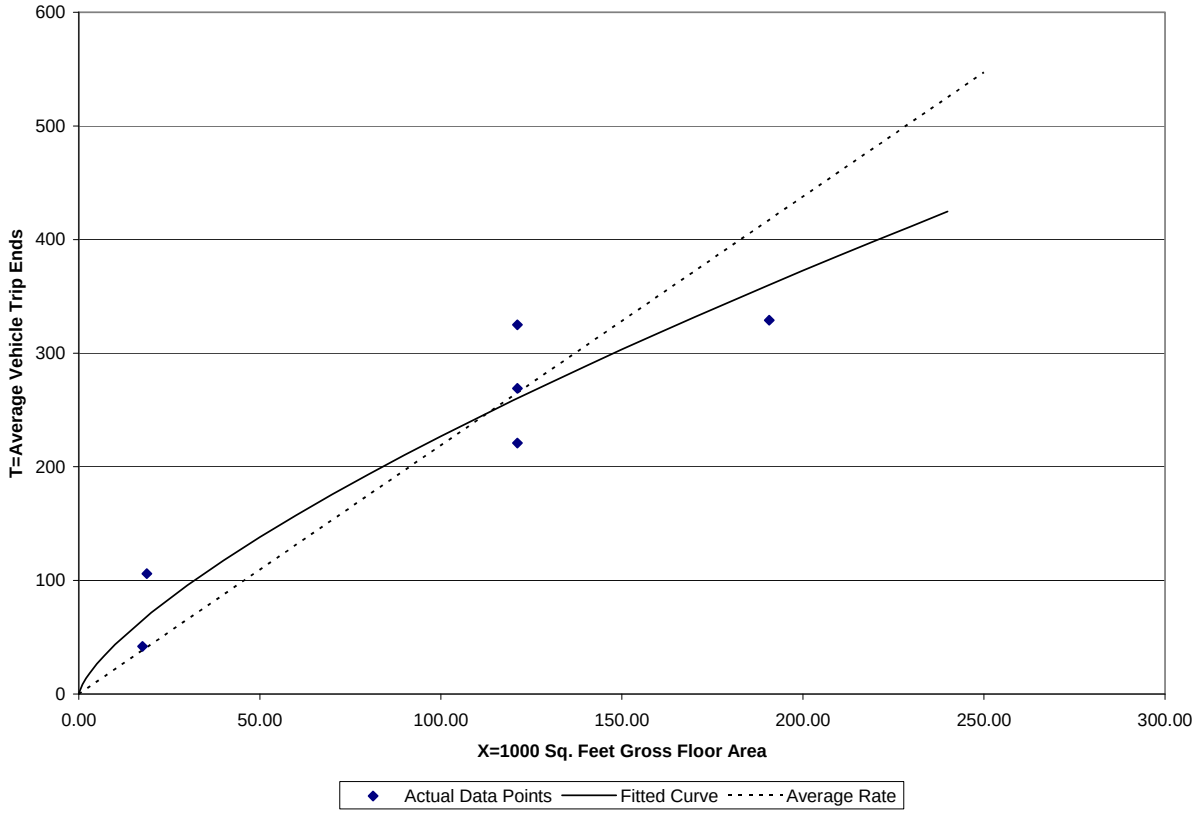
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday,
P.M. Peak Hour of Generator

Number of Studies 6
Average 1000 Sq. Feet of GFA 98.40
Directional Distribution 49% entering; 51% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.19	1.73 – 5.64	0.83

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.72 Ln(X) + 2.13 **R^2 = 0.858**

Land Use: 880

Pharmacy/Drugstore without Drive-Through Window[29]

[29] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008, Volume 3 of 3, p. 1707

Pharmacy/Drugstore without Drive-Through Window - Statewide (880)

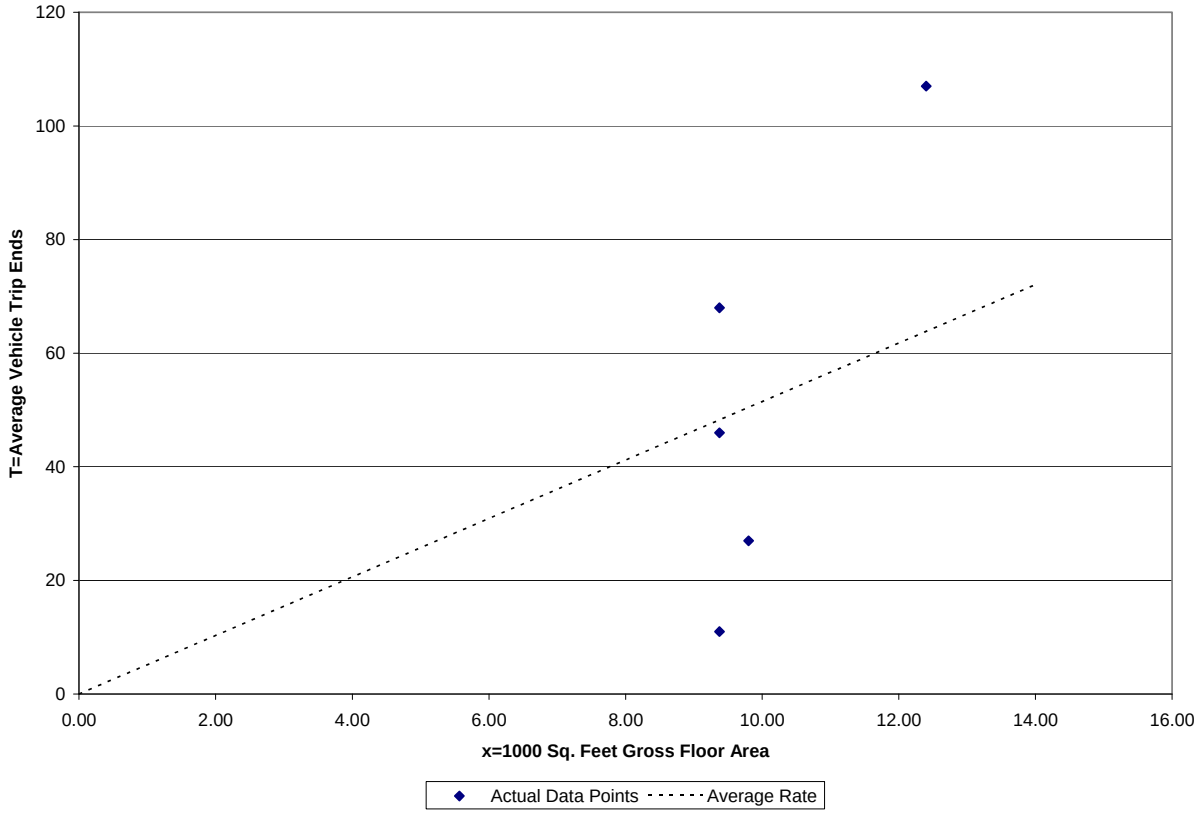
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies 5
Average 1000 Sq. Feet of GFA 10.07
Directional Distribution 55% entering; 45% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
5.15	1.17 – 8.63	3.14

Data Plot and Equation



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

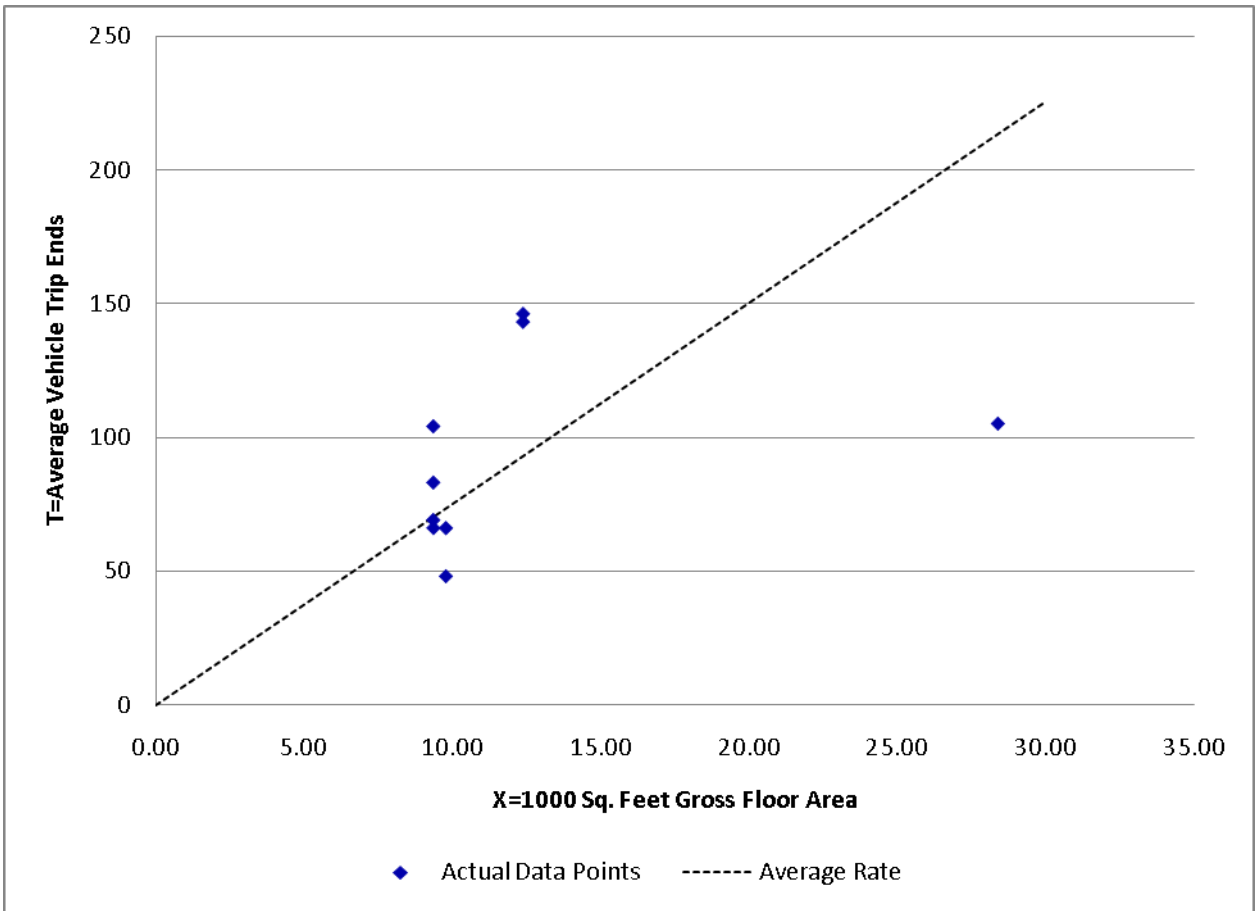
Pharmacy/Drugstore without Drive-Through Window - Statewide (880)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic
	One Hour Between 11 a.m. and 2 p.m.
Number of Studies	9
Average 1000 Sq. Feet of GFA	12.26
Directional Distribution	49% entering; 51% exiting

Trip Generation

Average Rate	Range of Rates	Standard Deviation
7.52	3.70 – 11.77	3.32

Data Plot and Equation



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

Pharmacy/Drugstore without Drive-Through Window - Statewide (880)

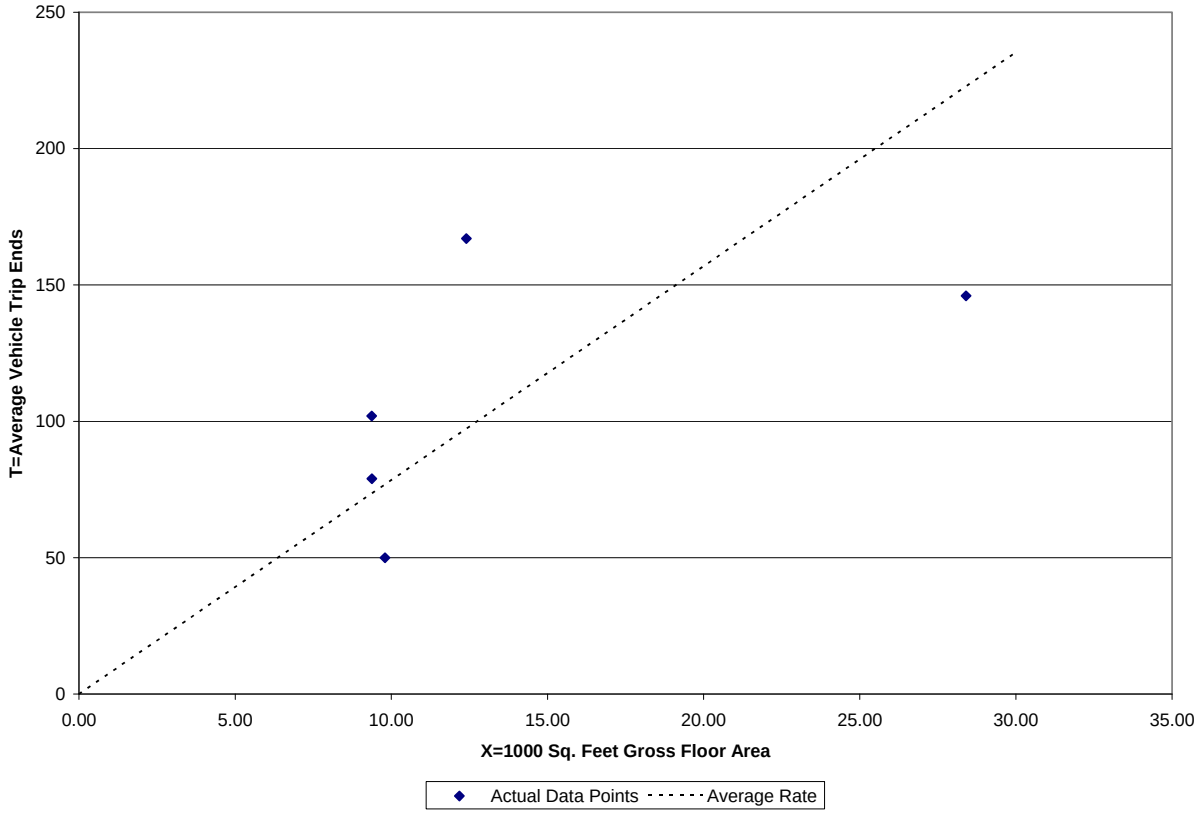
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
P.M. Peak Hour of Generator

Number of Studies 5
Average 1000 Sq. Feet of GFA 13.87
Directional Distribution 51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
7.84	5.10 – 13.47	3.85

Data Plot and Equation



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

Land Use: 881

Pharmacy/Drugstore with Drive-Through Window[30]

[30] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1714

Pharmacy/Drugstore with Drive-Through Window - Statewide
(881)

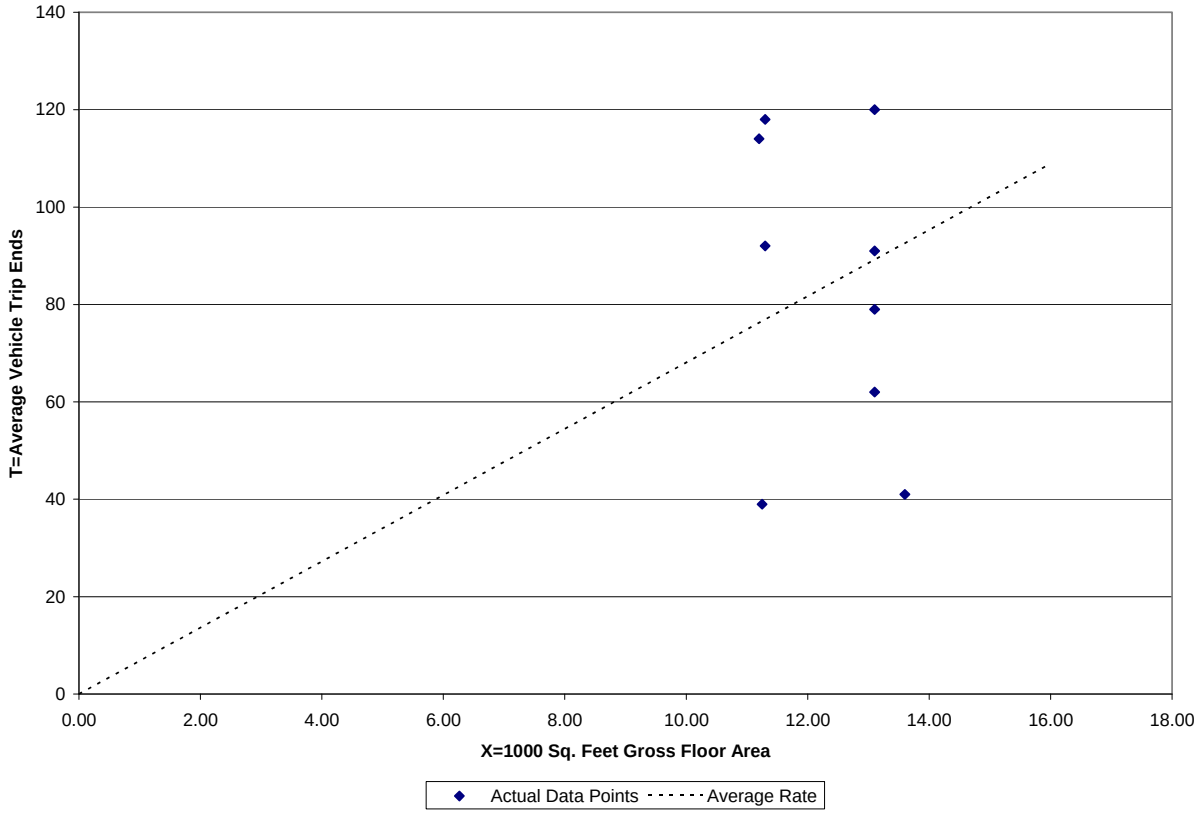
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies 9
Average 1000 Sq. Feet of GFA 12.34
Directional Distribution 56% entering; 44% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
6.81	3.01 – 10.44	2.77

Data Plot and Equation



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

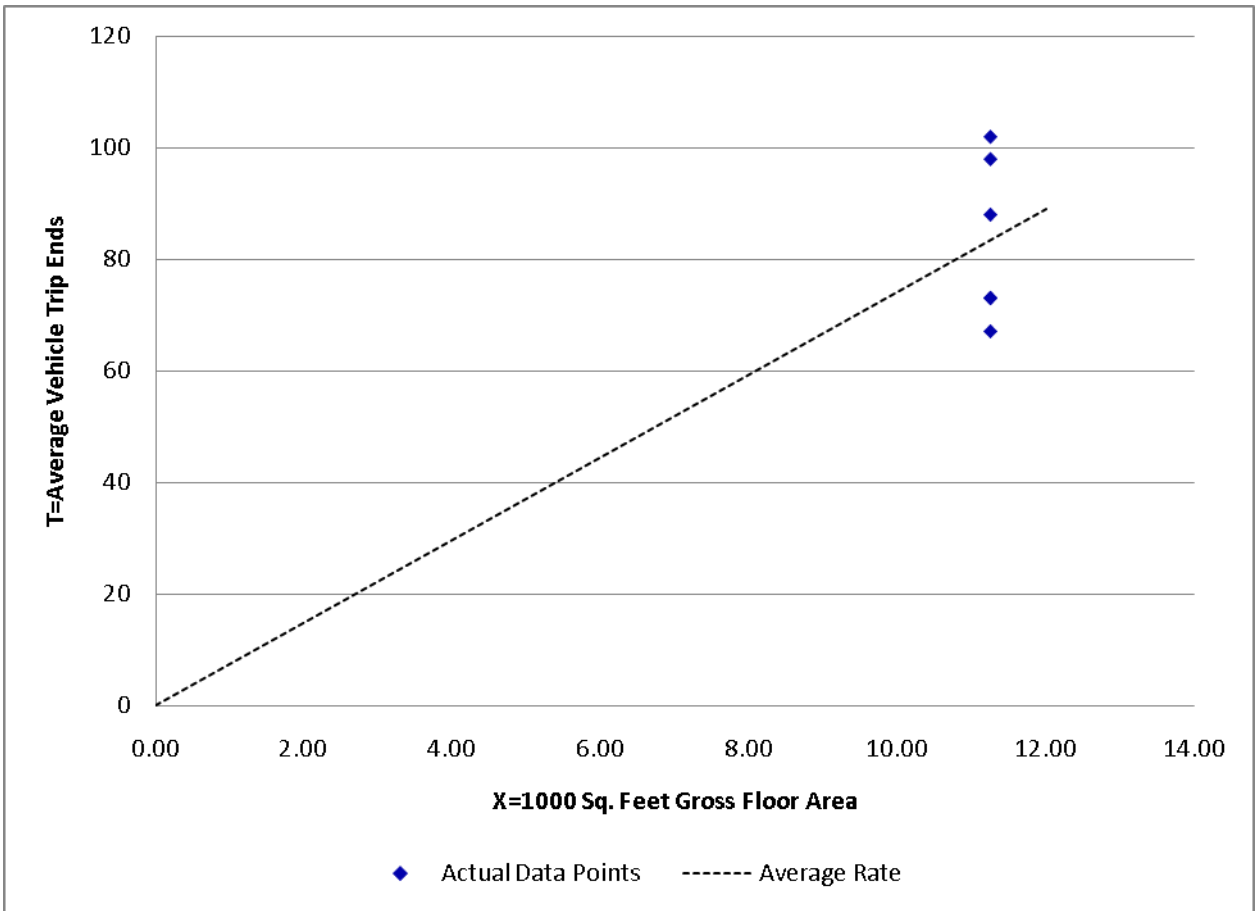
Pharmacy/Drugstore with Drive-Through Window – Chittenden County (881)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic
	One Hour Between 11 a.m. and 2 p.m.
Number of Studies	6
Average 1000 Sq. Feet GFA	11.25
Directional Distribution	48% entering; 52% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
7.42	5.96 – 9.07	1.30

Data Plot and Equation



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

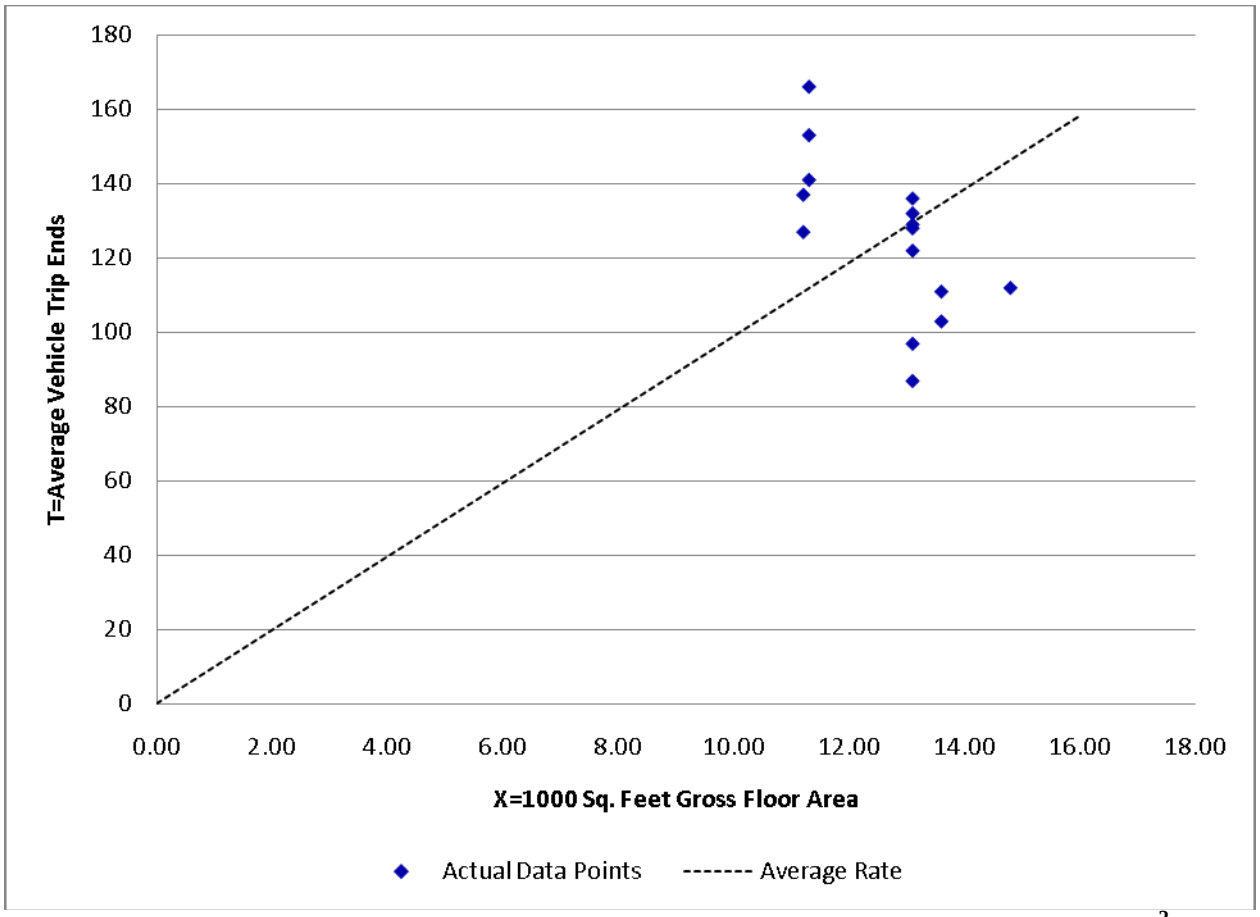
Pharmacy/Drugstore with Drive-Through Window – Other than Chittenden County
(881)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic
	One Hour Between 11 a.m. and 2 p.m.
Number Studies	15
Average 1000 Sq. Feet GFA	12.67
Directional Distribution	53% entering; 47% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
9.90	6.64 – 14.69	2.37

Data Plot and Equation



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

Pharmacy/Drugstore with Drive-Through Window - Statewide
(881)

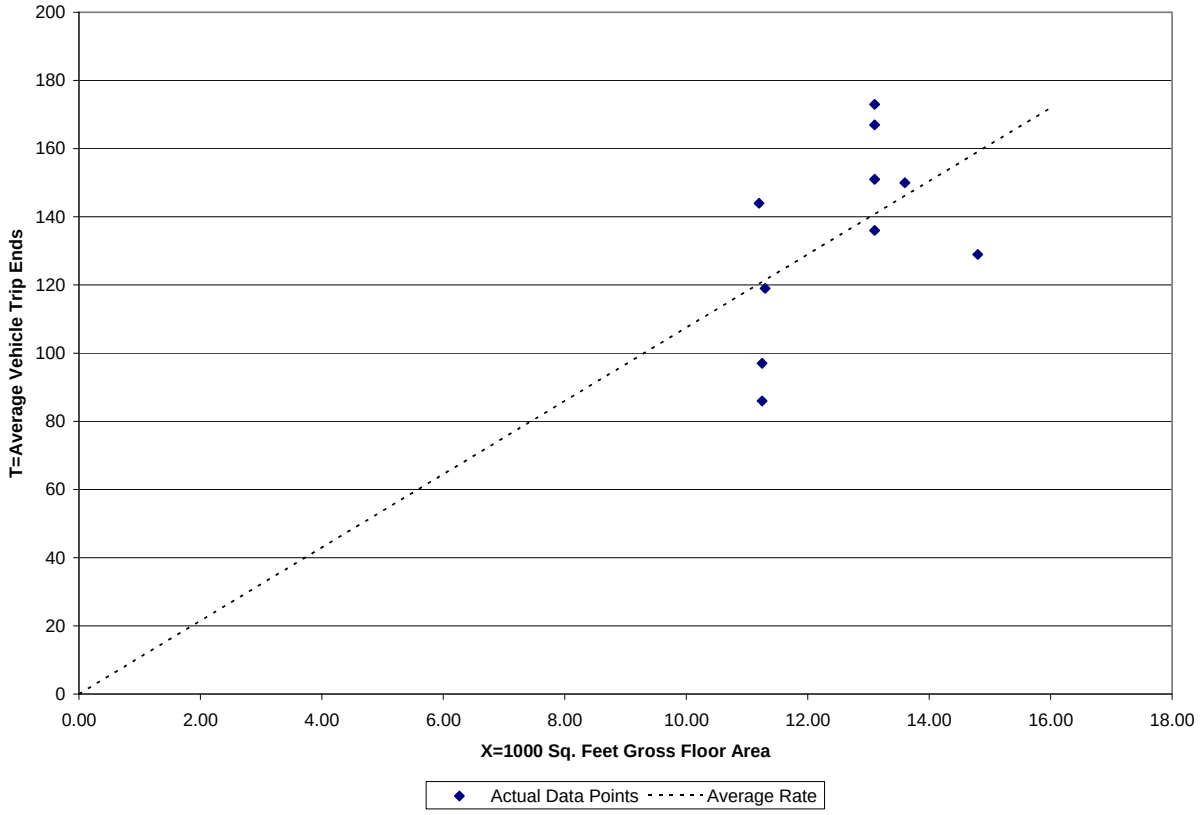
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday,
P.M. Peak Hour of Generator

Number of Studies 10
Average 1000 Sq. Feet of GFA 12.58
Directional Distribution 51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
10.75	7.64 – 13.21	1.91

Data Plot and Equation



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

Land Use: 912

Drive-in Bank[31]

[31] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1746

Drive-in Bank – Chittenden County
(912)

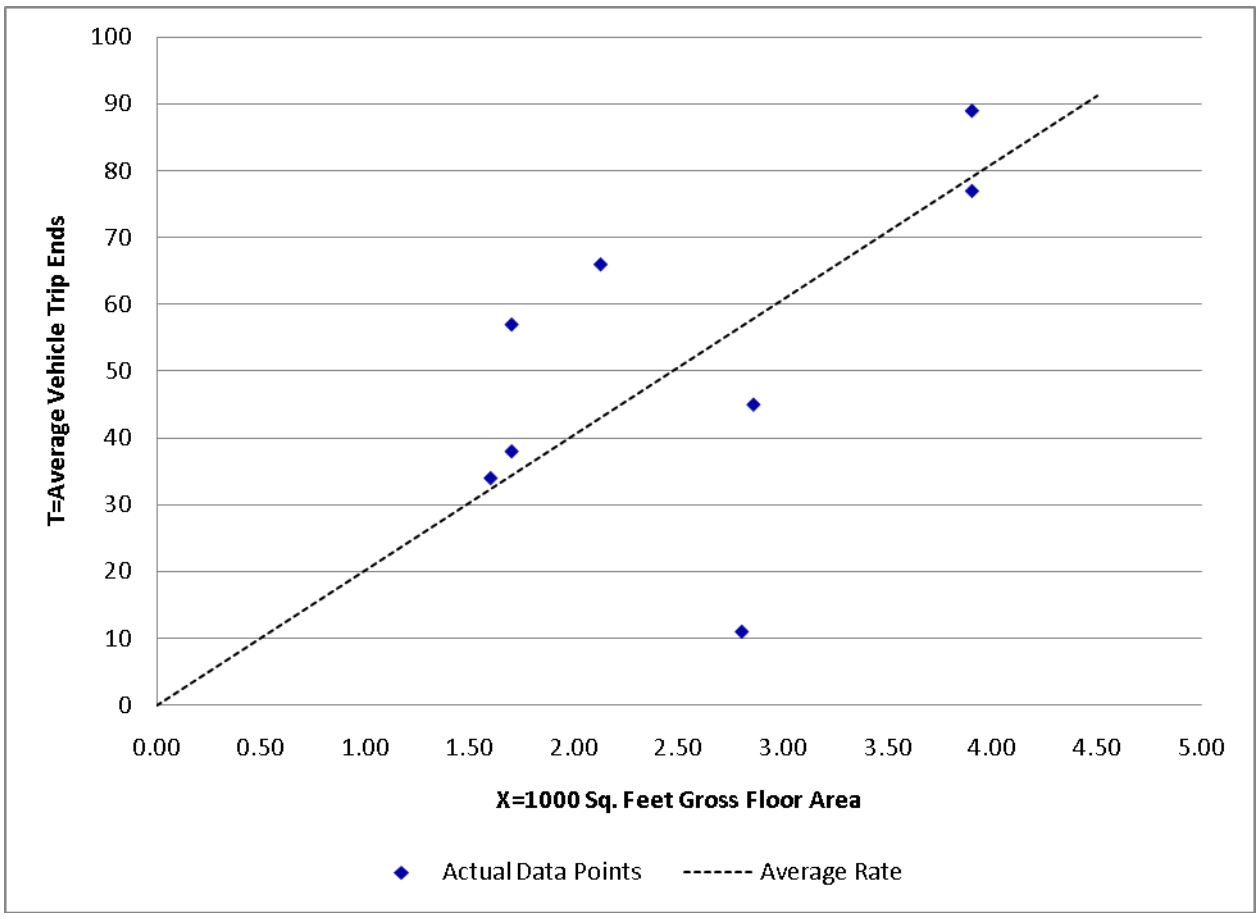
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies	8
Average 1000 Sq. Feet of GFA	2.57
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
20.26	3.93 – 33.53	8.85

Data Plot and Equation



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

Drive-in Bank – Other than Chittenden County
(912)

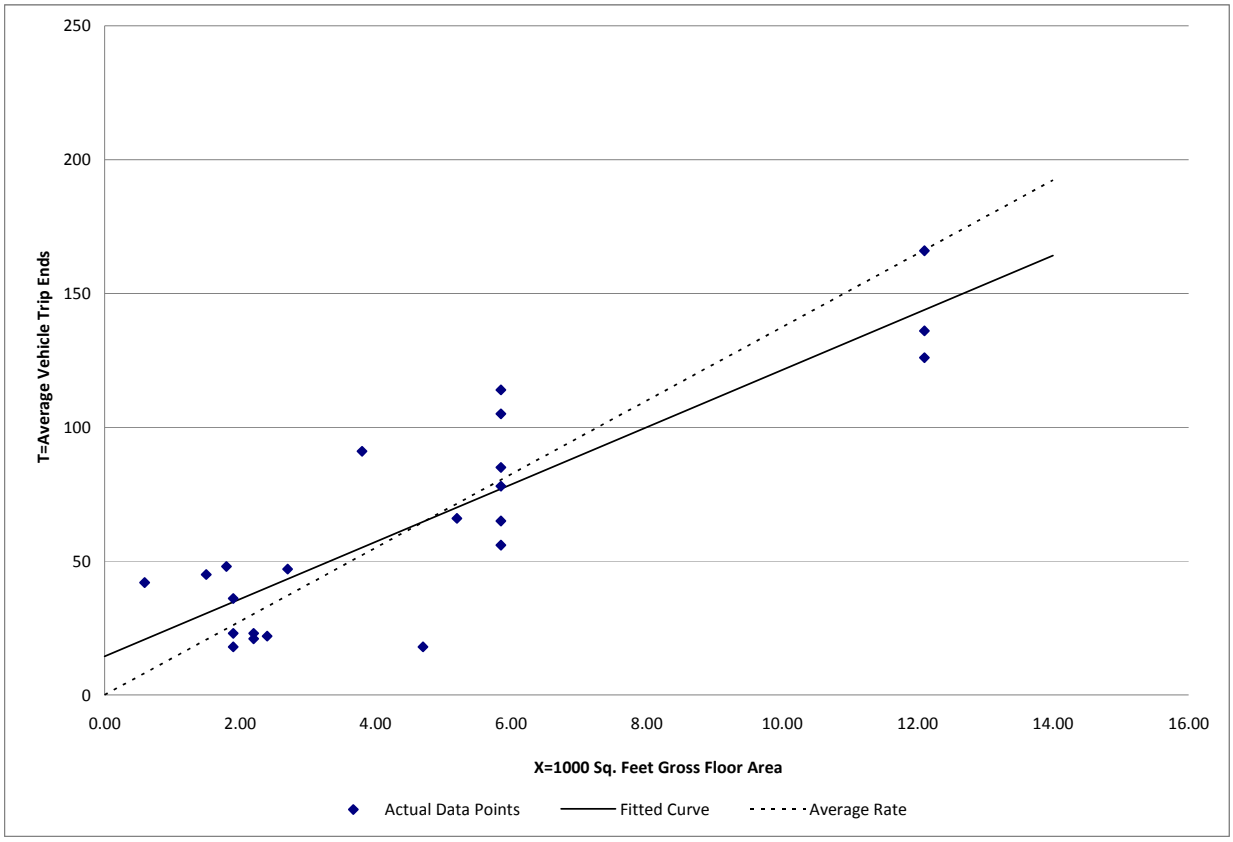
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies	22
Average 1000 Sq. Feet of GFA	4.74
Directional Distribution	54% entering; 46% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
13.73	3.83 – 71.19	6.74

Data Plot and Equation



Fitted Curve Equation: T = 10.702 X + 14.362 **R^2 = 0.758**

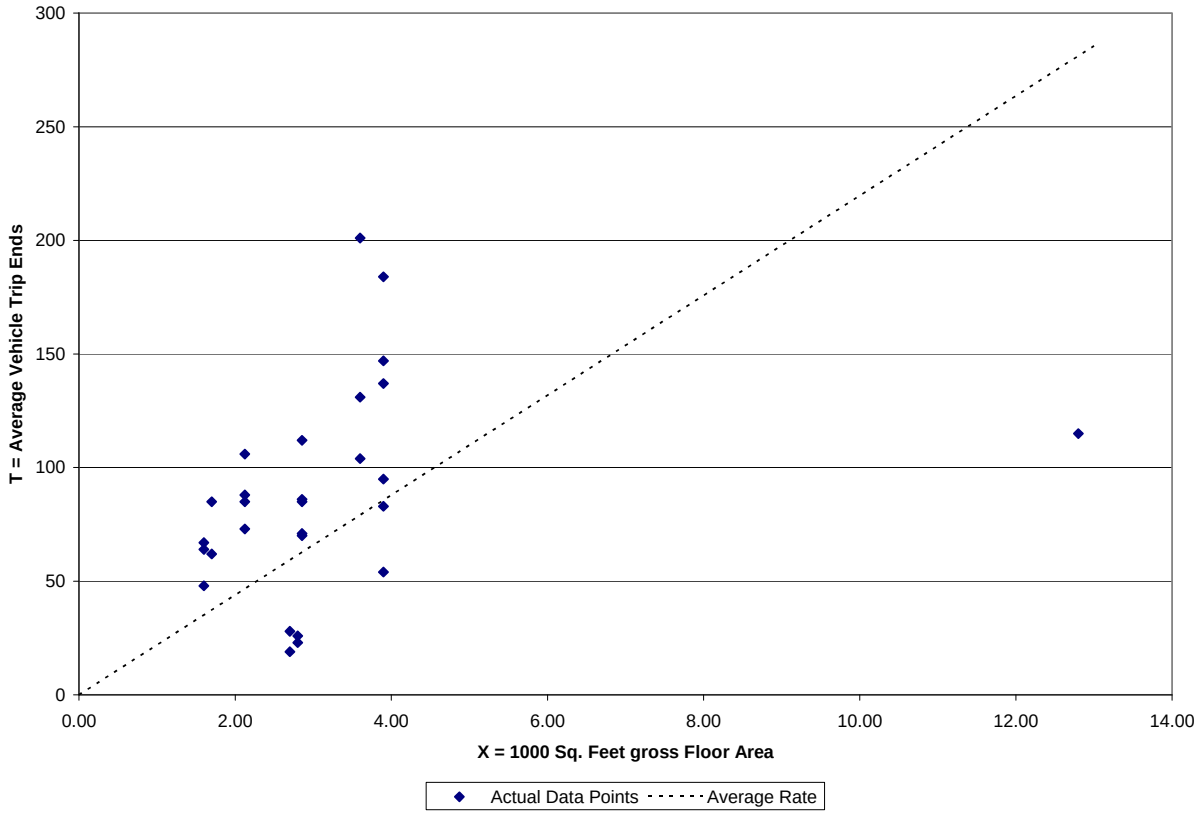
Drive-in Bank – Chittenden County
(912)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Midday Peak Hour of Generator
	One hour between 11 am and 2 pm
Number of Studies	28
Average 1000 Sq. Feet of GFA	3.18
Directional Distribution	50% entering; 50% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
27.52	7.04 – 55.83	14.79

Data Plot and Equation



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

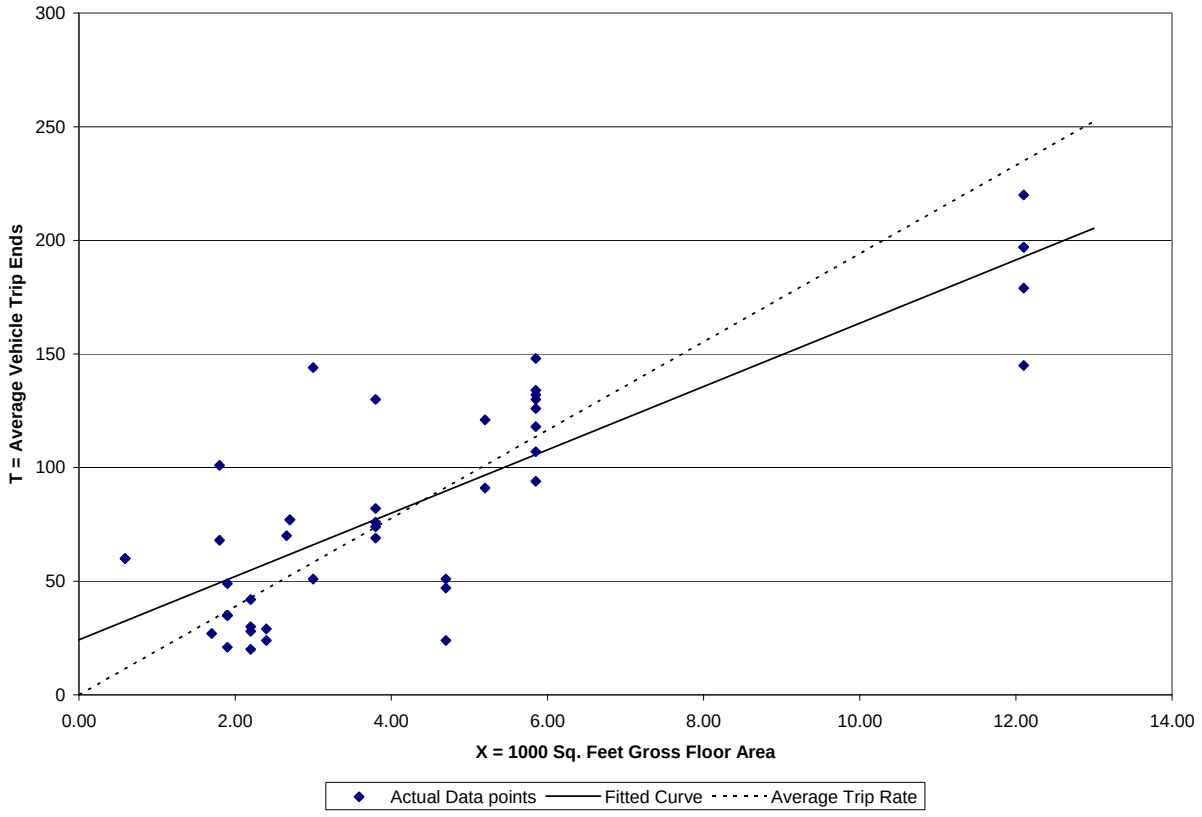
Drive-in Bank – Other than Chittenden County
(912)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Midday Peak Hour of Generator
	One hour between 11 am and 2 pm
Number of Studies	44
Average 1000 Sq. Feet of GFA	4.42
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
19.41	5.11 – 101.69	10.16

Data Plot and Equation



Fitted Curve Equation: T = 13.931 X + 24.235 **R^2 = 0.696**

Drive-in Bank - Statewide
(912)

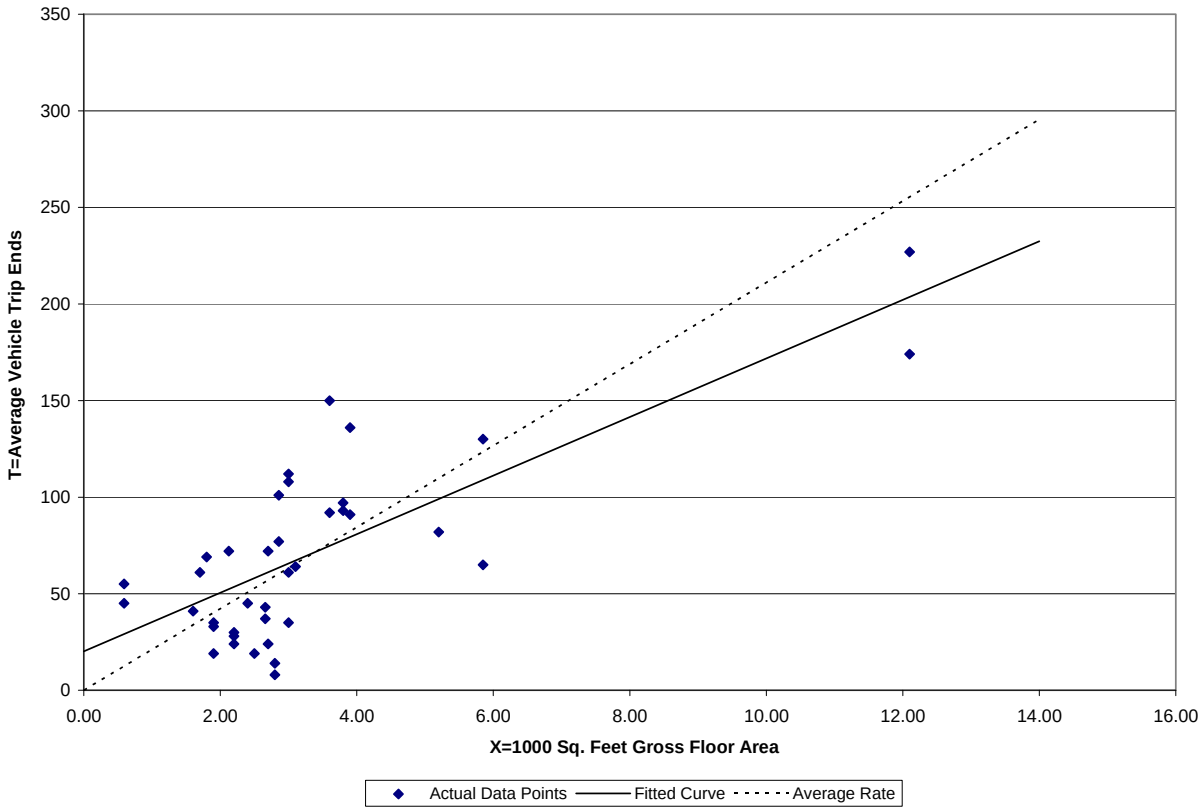
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
P.M. Peak Hour of Generator

Number of Studies	37
Average 1000 Sq. Feet of GFA	3.33
Directional Distribution	49% entering; 51% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
21.11	2.86 – 93.22	11.47

Data Plot and Equation



Fitted Curve Equation: T = 15.171 X + 20.126 **R^2 = 0.577**

Land Use: 932

High Turnover (Sit-Down) Restaurant[32]

[32] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1794

High-Turnover (Sit-Down) Restaurant – Chittenden County (932)

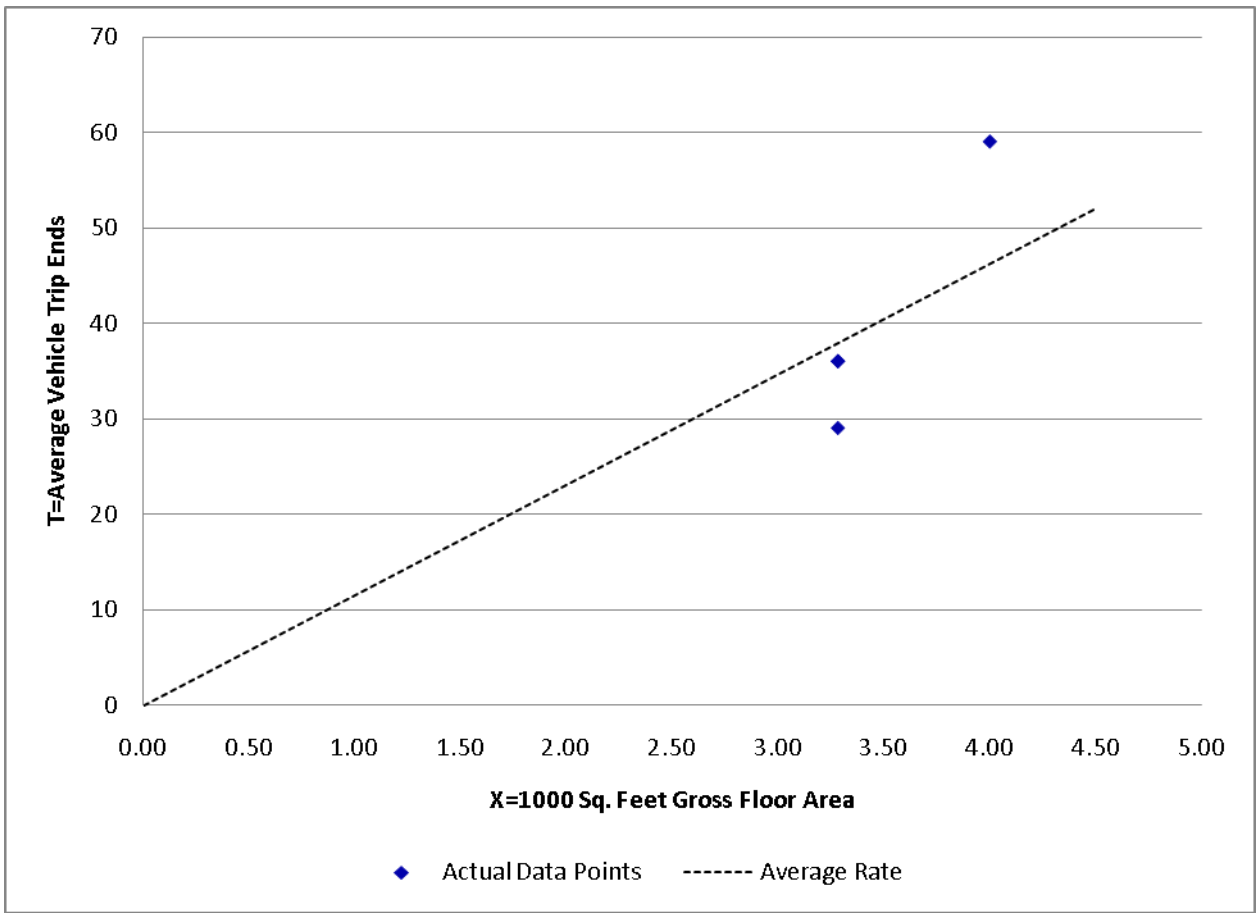
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies	4
Average 1000 Sq. Feet of GFA	3.46
Directional Distribution	54% entering; 46% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
11.56	8.84 – 14.75	2.55

Data Plot and Equation



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

High-Turnover (Sit-Down) Restaurant – Other than Chittenden County (932)

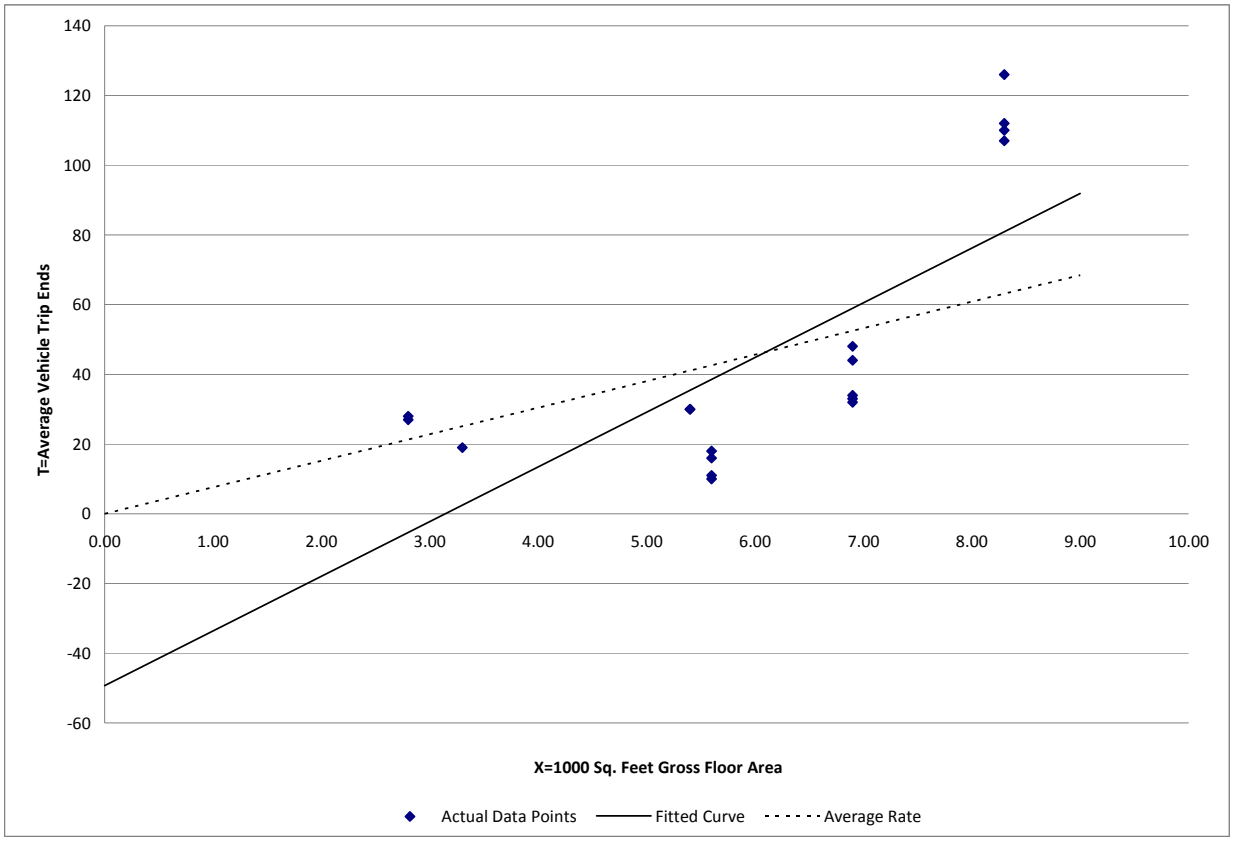
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies 18
Average 1000 Sq. Feet of GFA 6.10
Directional Distribution 56% entering; 44% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
7.60	1.79 – 15.18	4.54

Data Plot and Equation



Fitted Curve Equation: T = 15.687 X – 49.301 **R^2 = 0.537**

High-Turnover (Sit-Down) Restaurant - Statewide
(932)

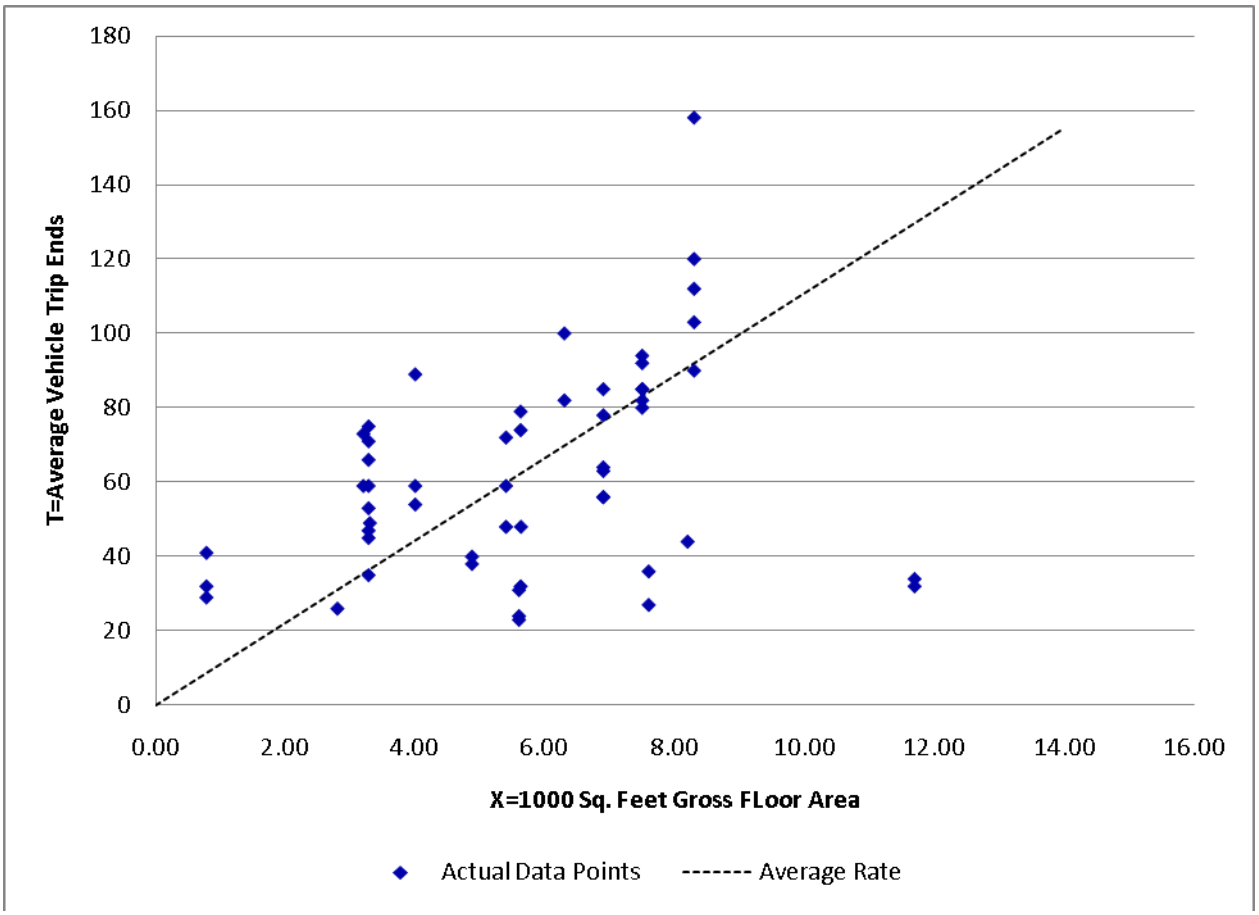
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Midday Peak Hour of Generator
One hour between 11 am and 2 pm

Number of Studies	54
Average 1000 Sq. Feet of GFA	5.66
Directional Distribution	54% entering; 46% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
11.09	2.74 – 52.56	5.78

Data Plot and Equation



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

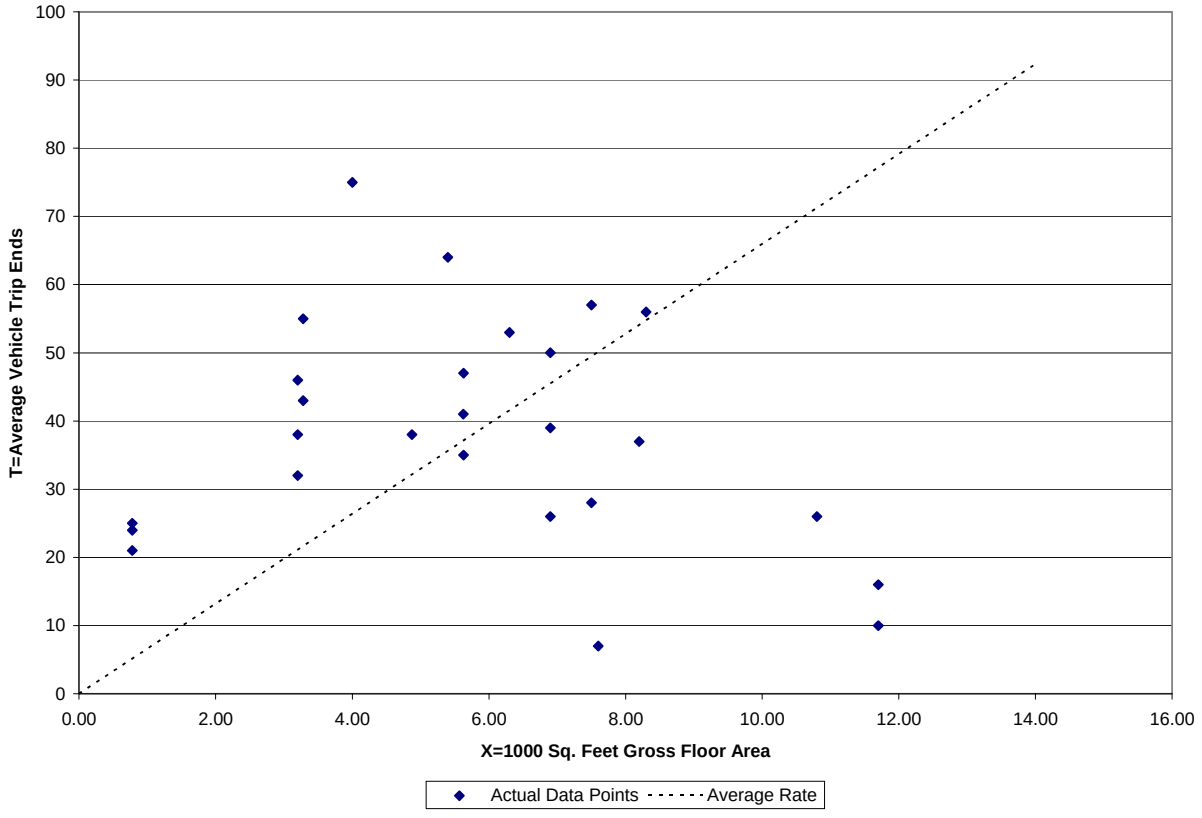
High-Turnover (Sit Down) Restaurant - Statewide
(932)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Number of Studies	26
Average 1000 Sq. Feet of GFA	5.77
Directional Distribution	60% entering; 40% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
6.60	0.85 – 32.05	5.41

Data Plot and Equation



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

Land Use: 933

Fast-Food Restaurant without Drive-Through Window[33]

[33] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008, Volume 3 of 3, p. 1813

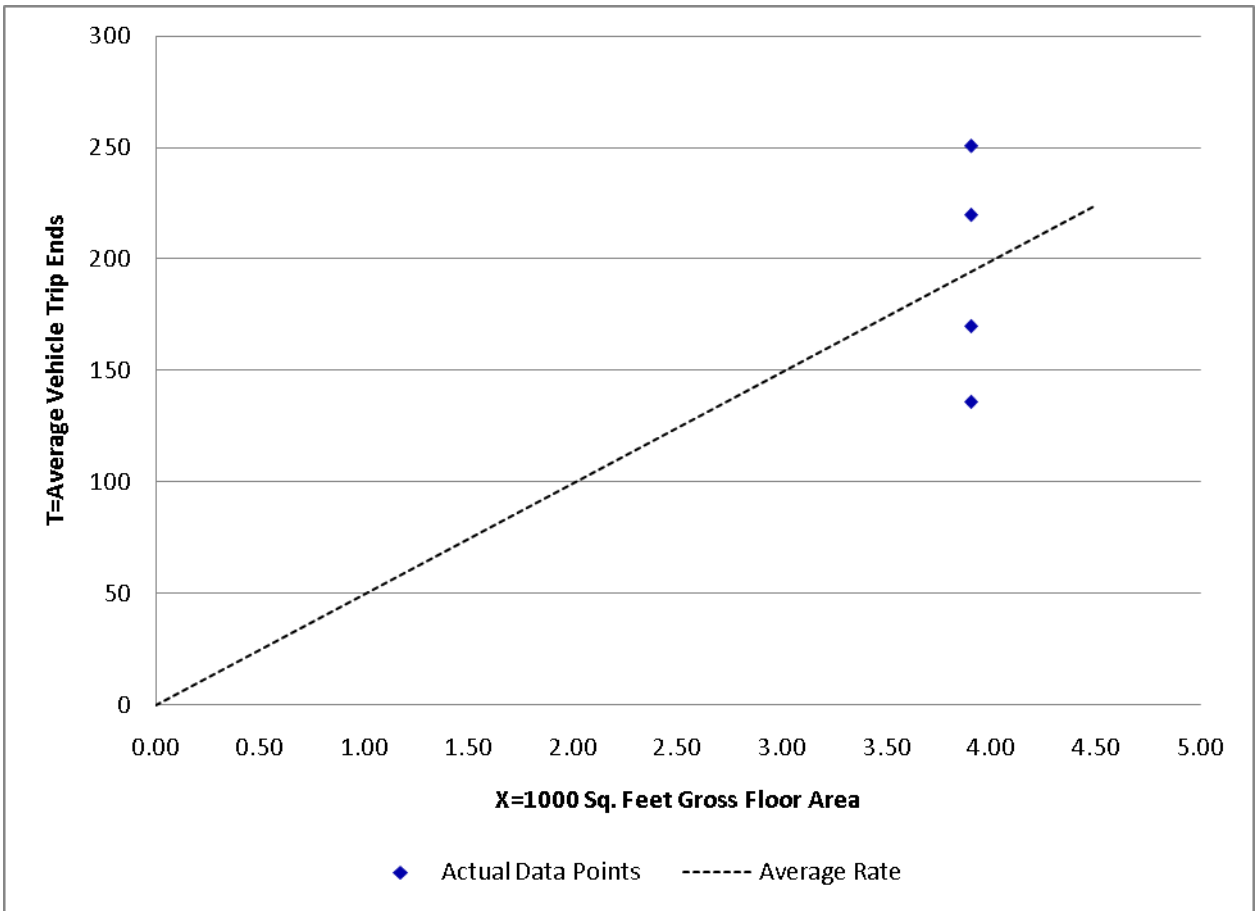
Fast-Food Restaurant without Drive-Through Window – Chittenden County (933)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Midday Peak Hour of Generator
	One hour between 11 am and 2 pm
Number of Studies	4
Average 1000 Sq. Feet of GFA	3.90
Directional Distribution	55% entering; 45% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
49.81	34.87 – 64.36	13.13

Data Plot and Equation



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

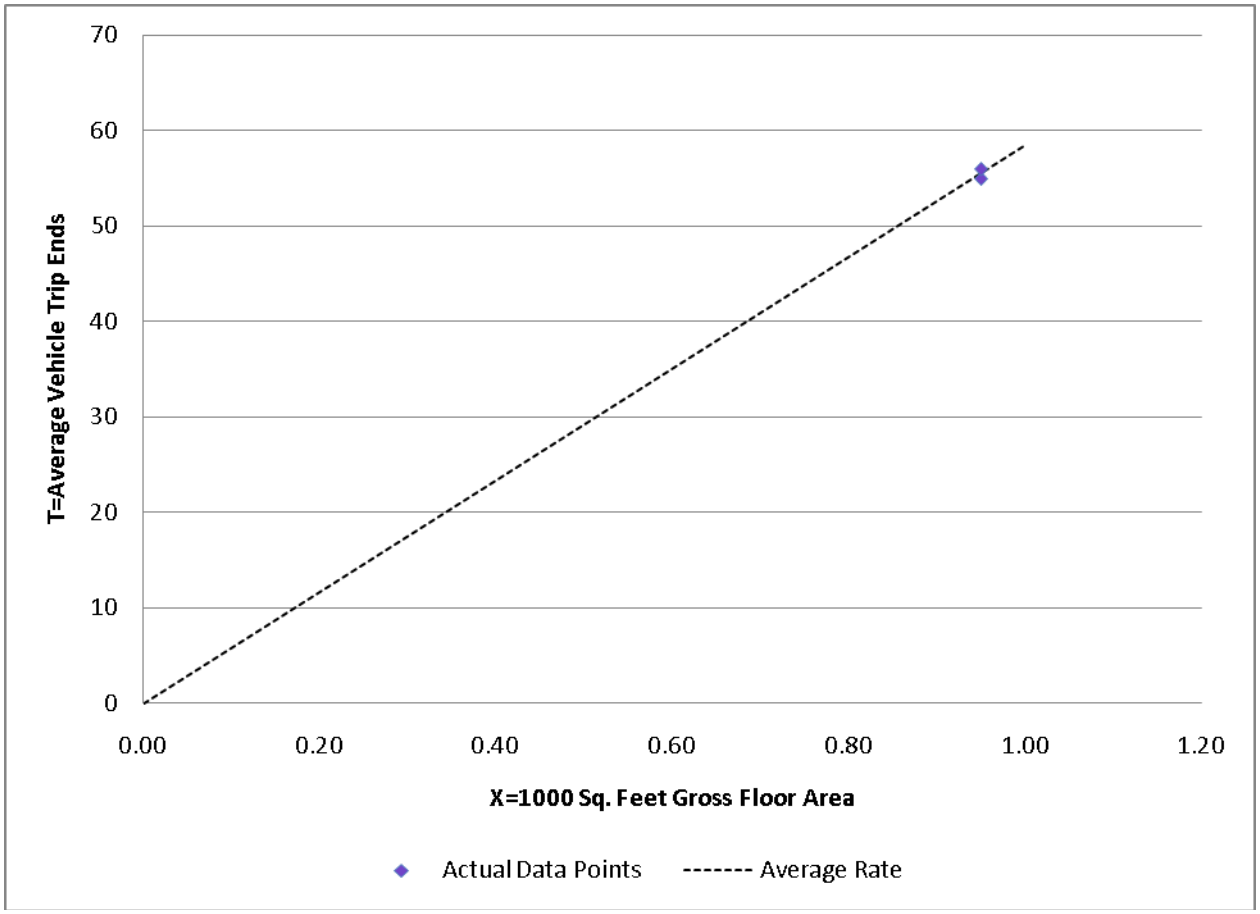
Fast-Food Restaurant without Drive-Through Window—Other than Chittenden County
(933)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday** **Midday Peak Hour of Generator** **One hour between 11 am and 2 pm**
Number of Studies	2
Average 1000 Sq. Feet of GFA	0.95
Directional Distribution	56% entering; 44% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
58.42	57.89 – 58.95	0.74

Data Plot and Equation



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

Land Use: 934

Fast-Food Restaurant with Drive-Through Window[34]

[34] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1820

Fast-Food Restaurant with Drive-Through Window – Chittenden County (934)

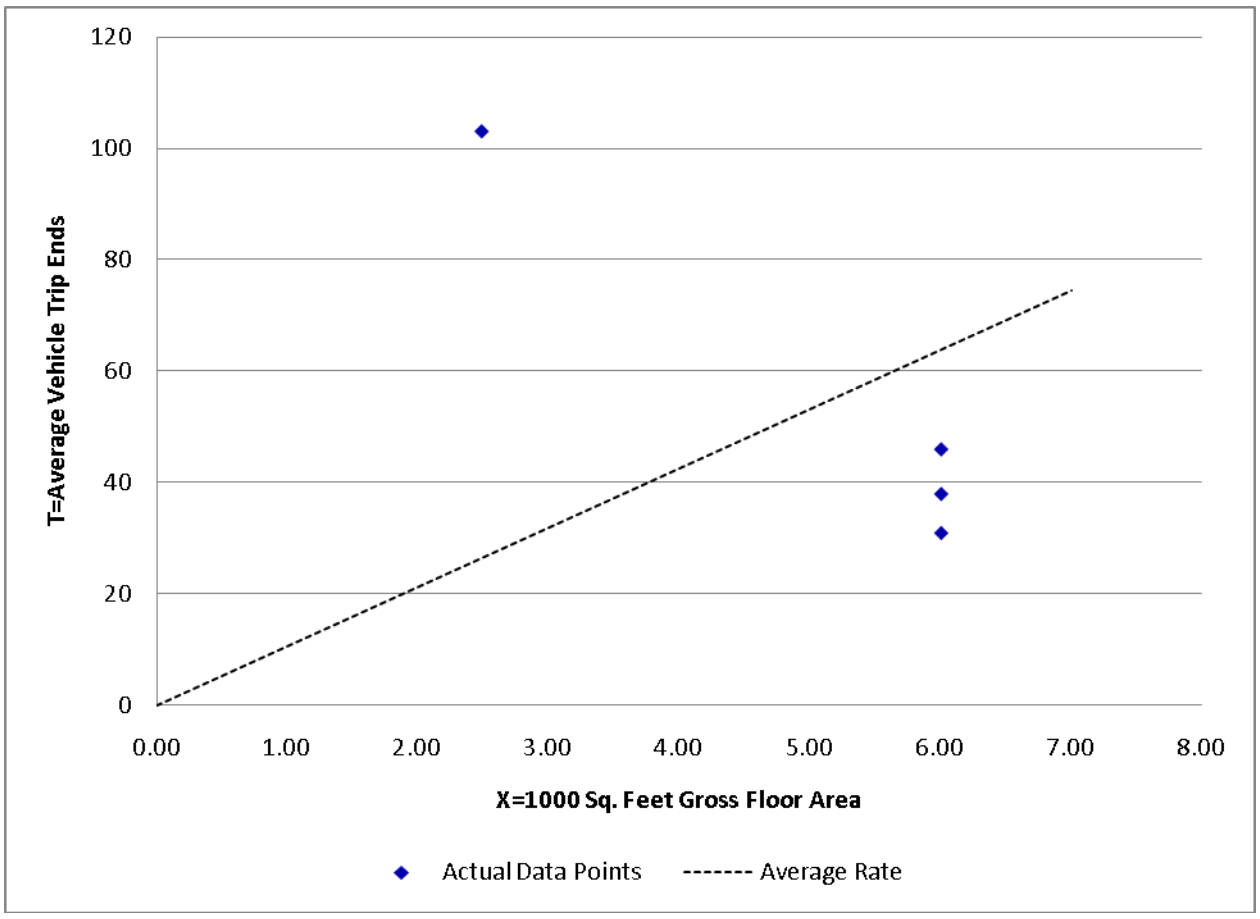
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies	4
Average 1000 Sq. Feet of GFA	5.12
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
10.64	5.17 – 41.43	13.46

Data Plot and Equation



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

Fast-Food Restaurant with Drive-Through Window – Other than Chittenden County
(934)

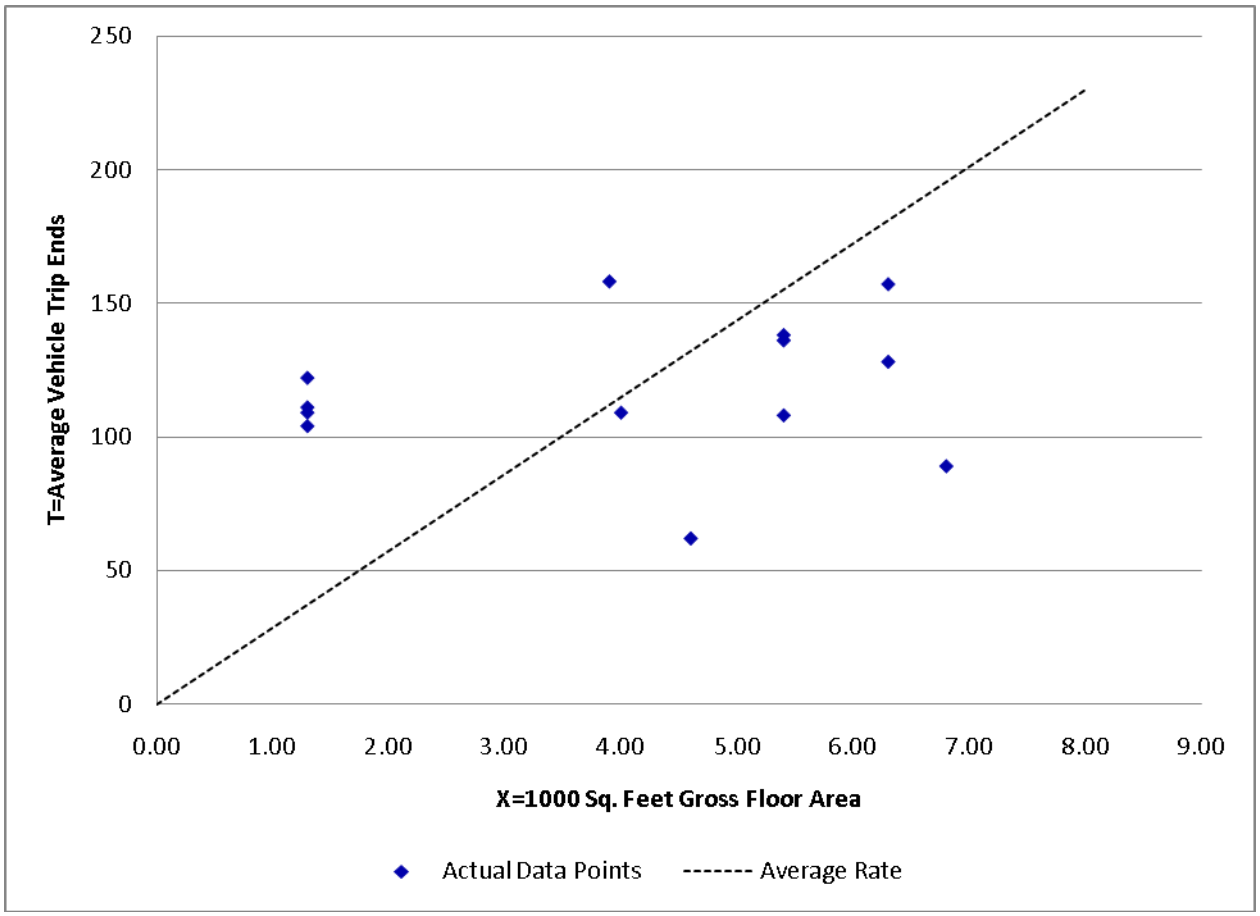
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
A.M. Peak Hour of Generator

Number of Studies	13
Average 1000 Sq. Feet of GFA	4.10
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
28.72	13.09 – 93.85	21.08

Data Plot and Equation



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

Fast-Food Restaurant with Drive-Through Window - Statewide (934)

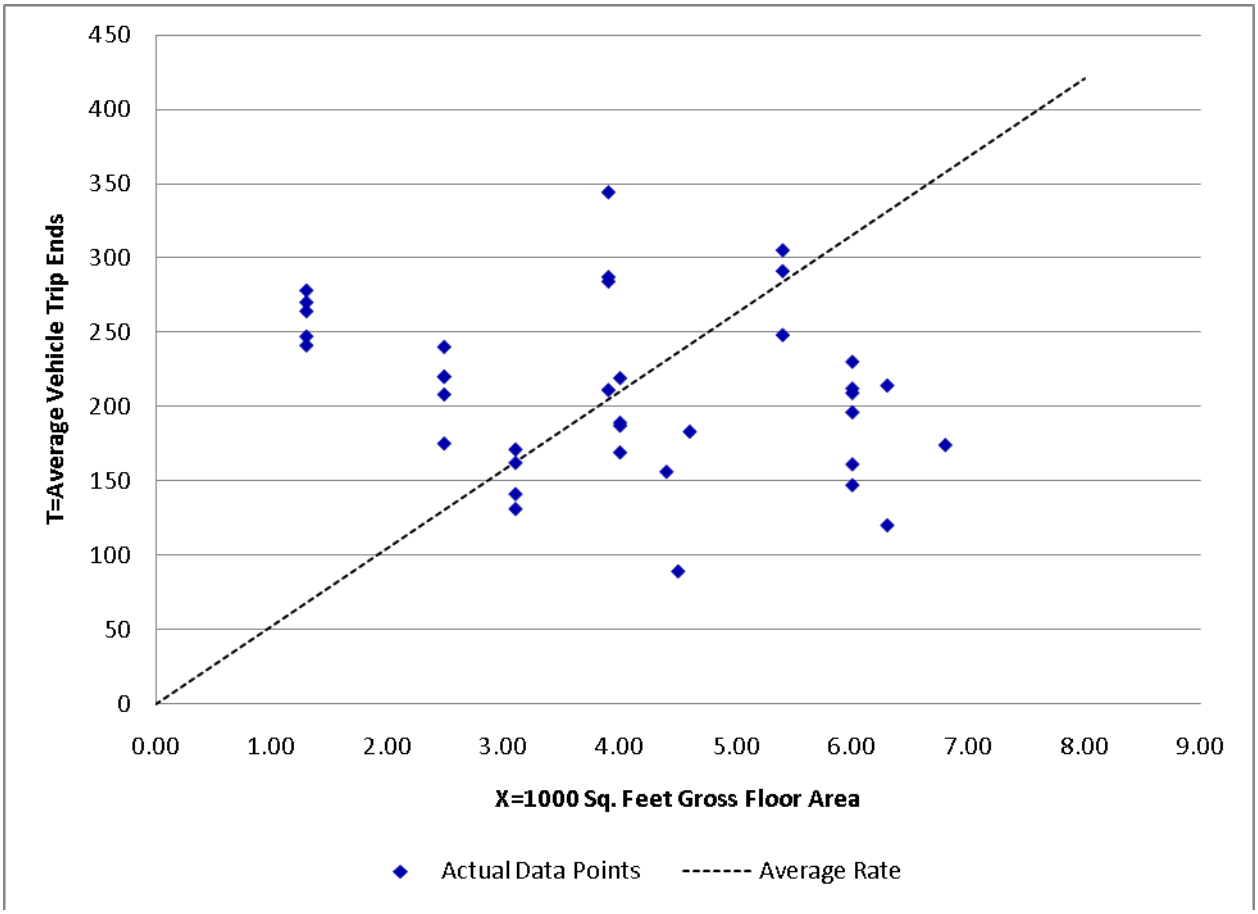
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Midday Peak Hour of Generator
One hour between 11 am and 2 pm

Number of Studies	37
Average 1000 Sq. Feet of GFA	4.00
Directional Distribution	51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
52.64	19.05 – 213.85	37.66

Data Plot and Equation



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

Fast-Food Restaurant with Drive-Through Window - Statewide (934)

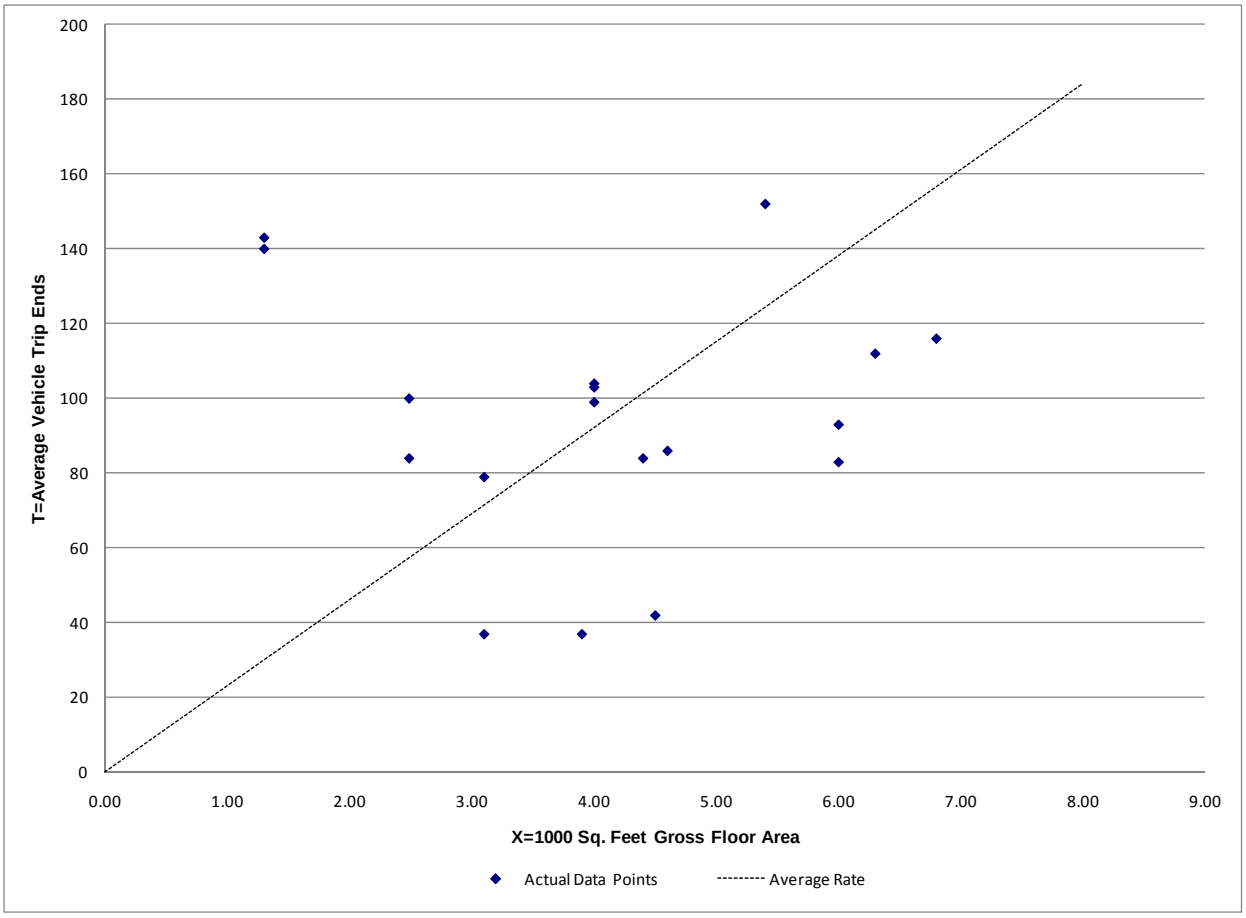
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies	18
Average 1000 Sq. Feet of GFA	4.09
Directional Distribution	49% entering; 51% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
22.99	9.33 – 110.00	18.56

Data Plot and Equation



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

Land Use: 936

Coffee/Donut Shop without Drive-Through Window[35]

[35] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2008, Volume 3 of 3, p. 1843

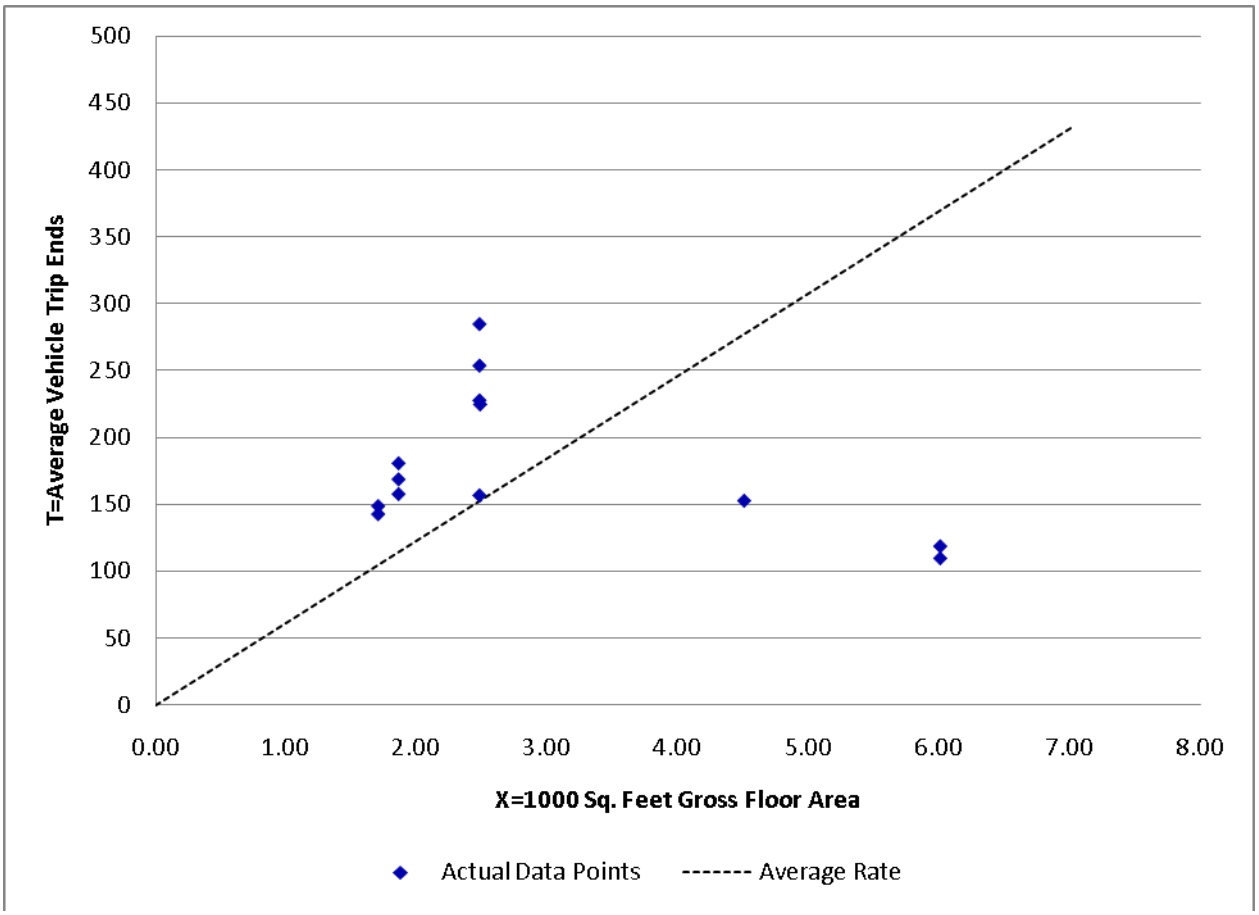
Coffee/Donut Shop without Drive-Through Window – Chittenden County (936)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Number of Studies	13
Average 1000 Sq. Feet of GFA	2.91
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
61.59	18.33 – 115.15	37.42

Data Plot and Equation



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

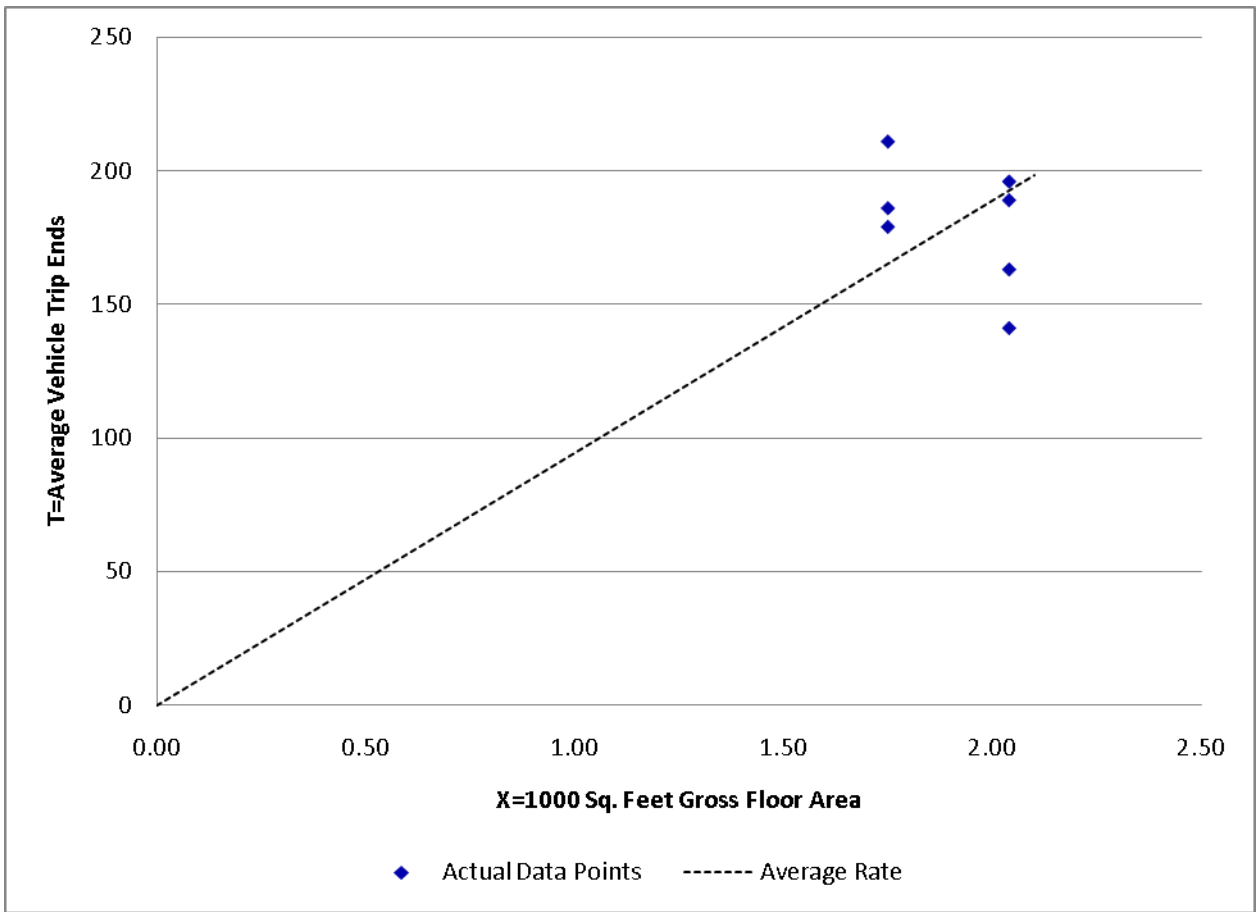
Coffee/Donut Shop without Drive-Through Window – Other than Chittenden County
(936)

Average Vehicle Trip Ends vs:	**1000 Sq. Feet of Gross Floor Area**
On a:	**Weekday** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Number of Studies	7
Average 1000 Sq. Feet of GFA	1.92
Directional Distribution	52% entering; 48% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
94.33	69.12 – 120.57	16.95

Data Plot and Equation



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

Land Use: 937

Coffee/Donut Shop with Drive-Through Window[36]

[36] For a description of this Land Use, refer to Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008, Volume 3 of 3, p. 1850

Coffee/Donut Shop with Drive-Through Window - Statewide
(937)

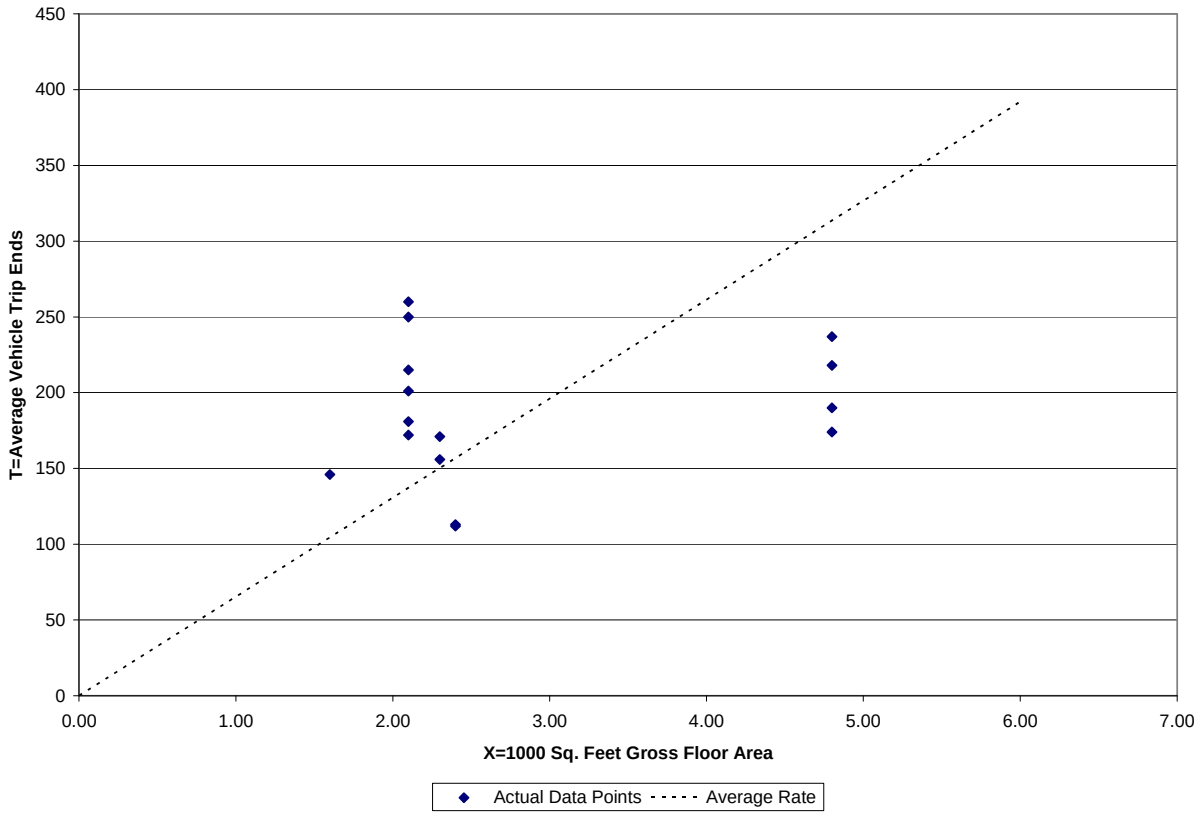
Average Vehicle Trip Ends vs: **1000 Sq. Feet of Gross Floor Area**
On a: **Weekday**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies 15
Average 1000 Sq. Feet of GFA 2.85
Directional Distribution 51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
65.33	36.25-123.81	28.85

Data Plot and Equation



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

Coffee/Donut Shop with Drive-Through Window - Statewide (937)

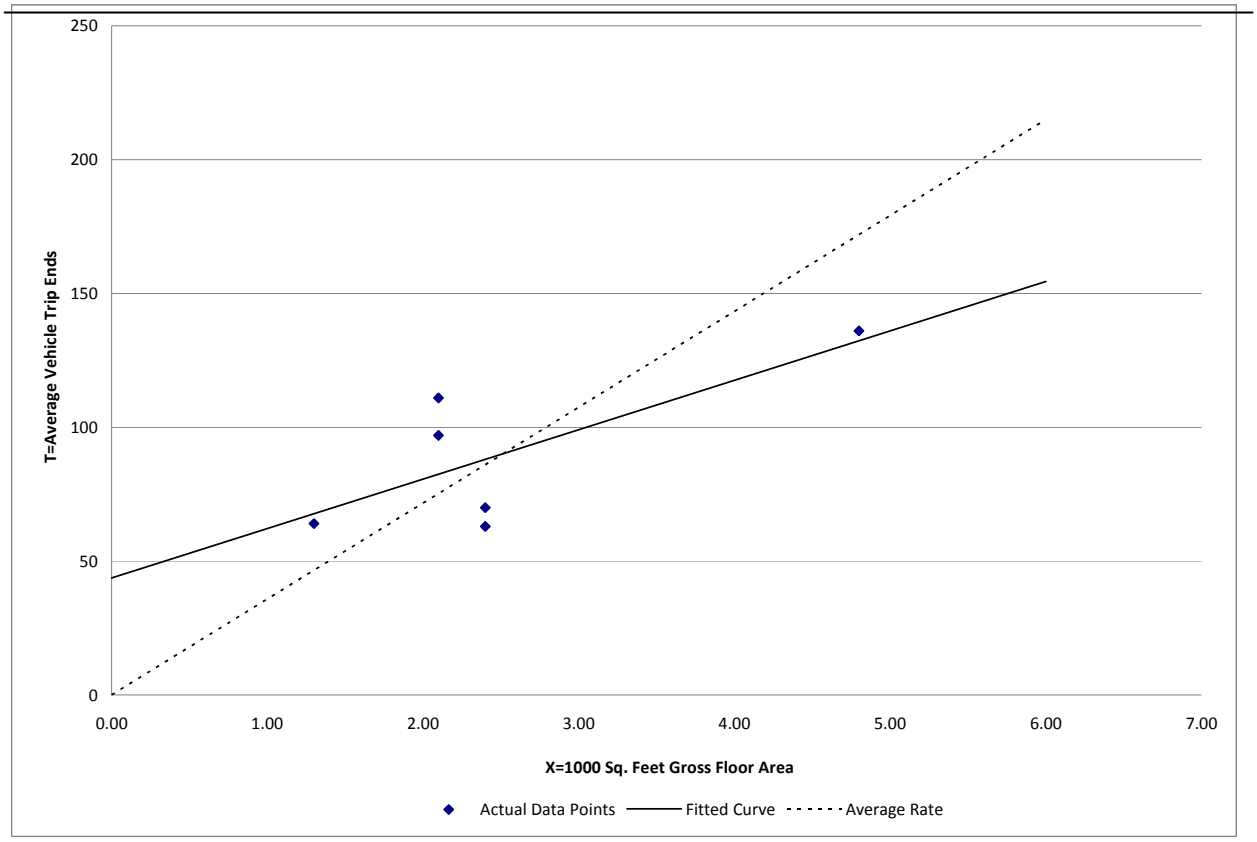
Average Vehicle Trip Ends vs: 1000 Sq. Feet of Gross Floor Area
On a: Weekday
A.M. Peak Hour of Generator

Number of Studies 6
Average 1000 Sq. Feet of GFA 2.52
Directional Distribution 51% entering; 49% exiting

Trip Generation per 1000 Sq. Feet of Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
35.83	26.25 – 52.86	11.72

Data Plot and Equation



Fitted Curve Equation: T = 18.46 X + 43.708 **R^2 = 0.546**