

APPENDIX M
TRIP GENERATION

BABCOCK MPD (PROJECT)



ITE RATES

Land Use: 310

Hotel

Description

Hotels are places of lodging that provide sleeping accommodations and supporting facilities such as restaurants, cocktail lounges, meeting and banquet rooms or convention facilities, limited recreational facilities (pool, fitness room), and/or other retail and service shops. Some of the sites included in this land use category are actually large motels providing the hotel facilities noted above. All suites hotel (Land Use 311), business hotel (Land Use 312), motel (Land Use 320) and resort hotel (Land Use 330) are related uses.

Additional Data

Studies of hotel employment density indicate that, on the average, a hotel will employ 0.9 employees per room.¹

Thirty studies provided information on occupancy rates at the time the studies were conducted. The average occupancy rate for these studies was approximately 83 percent.

The hotels surveyed were primarily located outside central business districts in suburban areas.

Some properties contained in this land use provide guest transportation services such as airport shuttles, limousine service, or golf course shuttle service, which may have an impact on the overall trip generation rates.

The sites were surveyed between the late 1960s and the 2000s throughout the United States.

For all lodging uses, it is important to collect data on occupied rooms as well as total rooms in order to accurately predict trip generation characteristics for the site.

Trip generation at a hotel may be related to the presence of supporting facilities such as convention facilities, restaurants, meeting/banquet space and retail facilities. Future data submissions should specify the presence of these amenities. Reporting the level of activity at the supporting facilities such as full, empty, partially active, number of people attending a meeting/banquet during observation may also be useful in further analysis of this land use.

Source Numbers

4, 5, 12, 13, 18, 55, 72, 170, 187, 254, 260, 262, 277, 280, 301, 306, 357, 422, 436, 507, 577, 728

¹ Buttke, Carl H. Unpublished studies of building employment densities, Portland, Oregon.

Hotel (310)

Average Vehicle Trip Ends vs: Occupied Rooms On a: Weekday

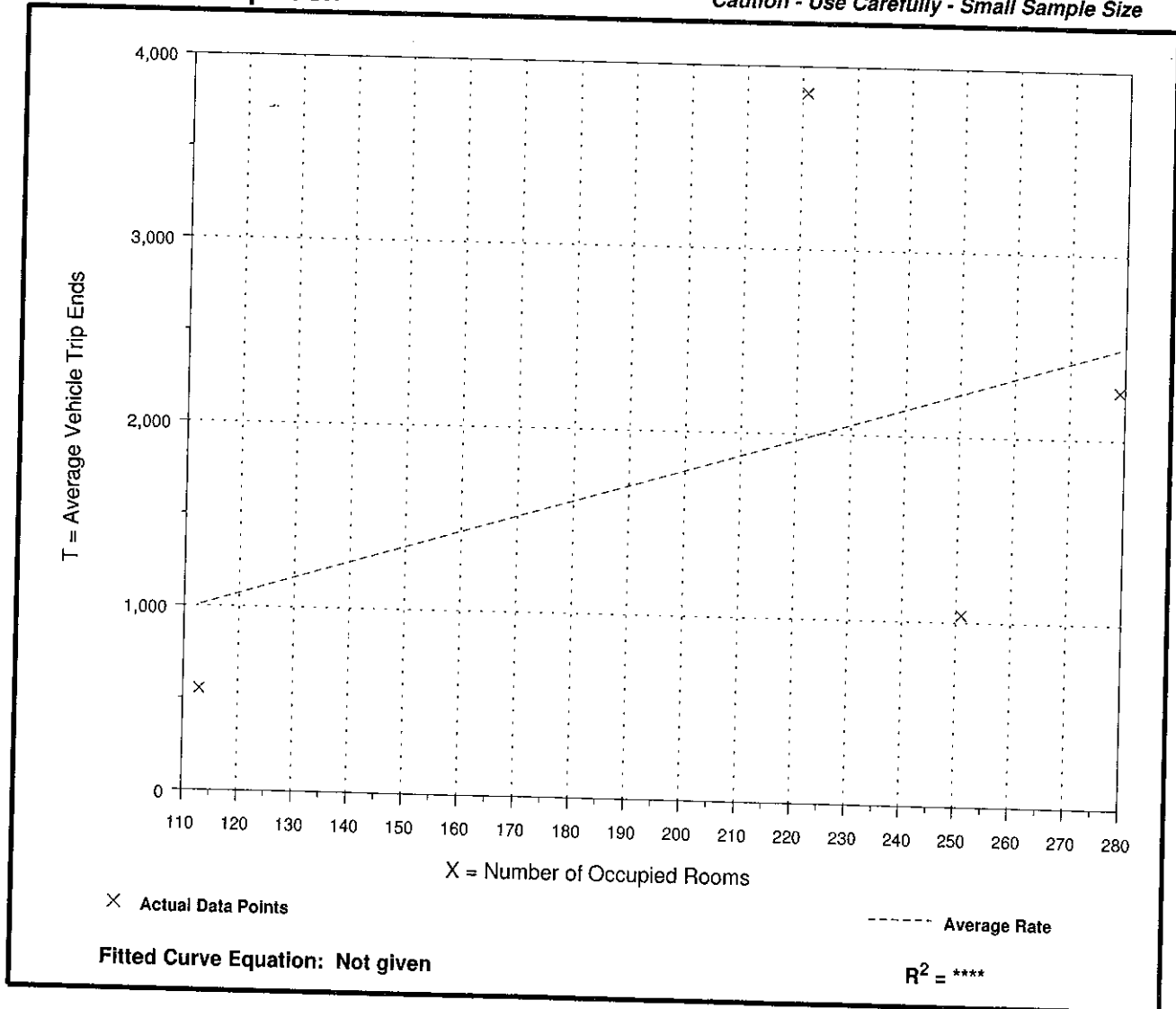
Number of Studies: 4
Average Number of Occupied Rooms: 216
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Occupied Room

Average Rate	Range of Rates	Standard Deviation
8.92	4.14 - 17.44	6.04

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Hotel (310)

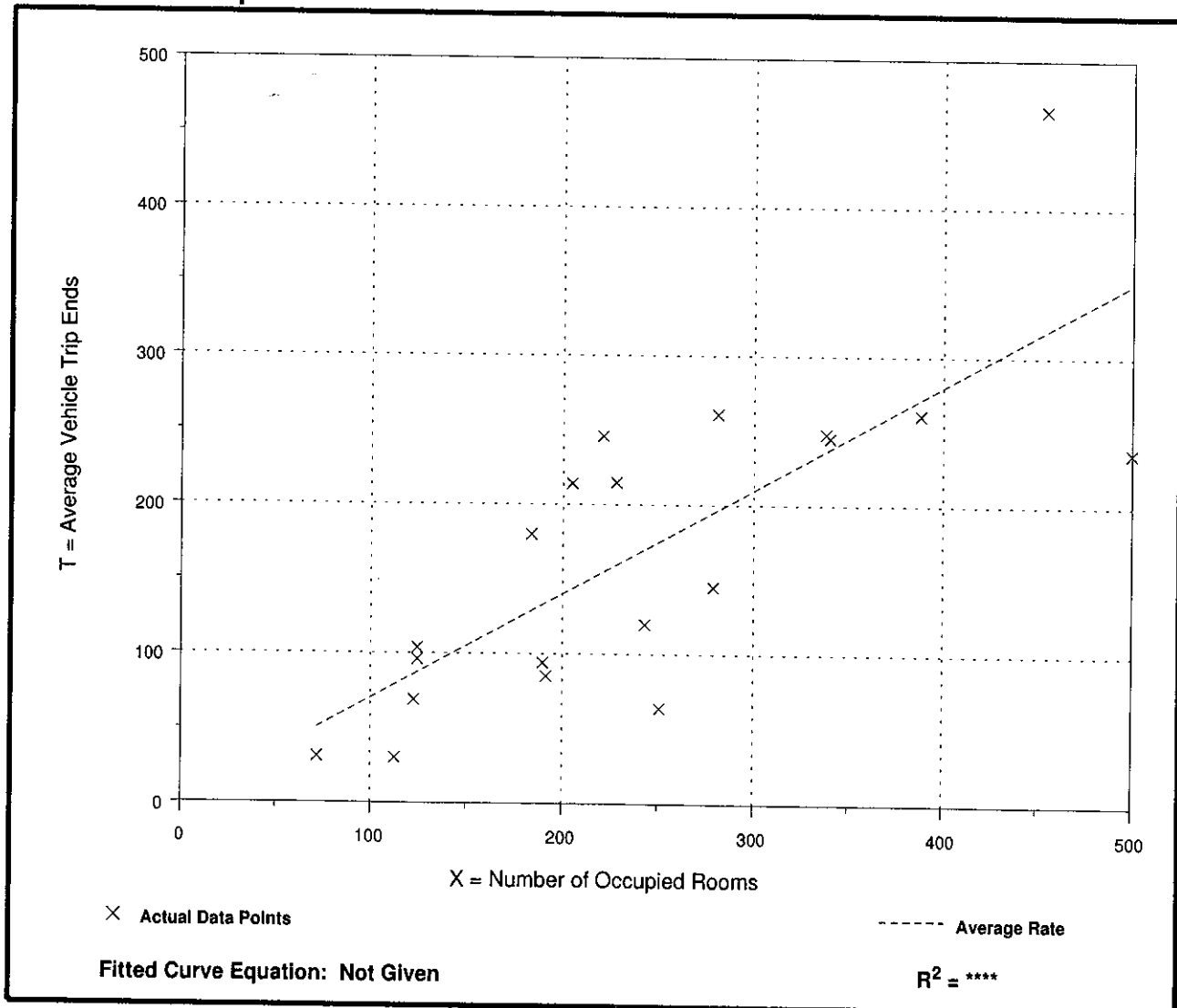
Average Vehicle Trip Ends vs: Occupied Rooms
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 20
 Average Number of Occupied Rooms: 243
 Directional Distribution: 49% entering, 51% exiting

Trip Generation per Occupied Room

Average Rate	Range of Rates	Standard Deviation
0.70	0.25 - 1.11	0.87

Data Plot and Equation



Land Use: 820

Shopping Center

Description

A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. Specialty retail center (Land Use 826) and factory outlet center (Land Use 823) are related uses.

Additional Data

Shopping centers, including neighborhood centers, community centers, regional centers and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs and recreational facilities (for example, ice skating rinks or indoor miniature golf courses). The centers ranged in size from 1,700 to 2.2 million square feet gross leasable area (GLA). The centers studied were located in suburban areas throughout the United States and, therefore, represent typical U.S. suburban conditions.

Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied included peripheral buildings, it can be assumed that some of the data show their effect.

The vehicle trips generated at a shopping center are based upon the total GLA of the center. In cases of smaller centers without an enclosed mall or peripheral buildings, the GLA could be the same as the gross floor area of the building.

Separate equations have been developed for shopping centers during the Christmas shopping season. Plots were included for the weekday peak hour of adjacent street traffic and the Saturday peak hour of the generator.

Information on approximate hourly, monthly and daily variation in shopping center traffic is shown in Tables 1–3. It should be noted, however, that the information contained in these tables is based on a limited sample size. Therefore, caution should be exercised when applying the data. Also, some information provided in the tables may conflict with the results obtained by applying the average rate or regression equations. When this occurs, it is suggested that the results from the average rate or regression equations be used, as they are based on a larger number of studies.

Table 1 Hourly Variation in Shopping Center Traffic						
Time	Average Weekday^a		Average Saturday^b		Average Sunday^c	
	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic
6 a.m.–7 a.m.	0.8	0.3	0.2	0.2	0.2	0.1
7 a.m.–8 a.m.	2.0	0.9	0.9	0.4	0.4	0.3
8 a.m.–9 a.m.	3.1	1.2	2.7	1.0	0.9	0.5
9 a.m.–10 a.m.	5.5	2.0	5.5	2.2	1.7	1.1
10 a.m.–11 a.m.	7.0	4.3	8.6	4.8	3.8	2.5
11 a.m.–12 p.m.	8.4	6.2	10.8	7.5	10.0	4.6
12 p.m.–1 p.m.	9.4	8.3	11.8	9.3	15.1	7.9
1 p.m.–2 p.m.	8.2	8.6	12.1	10.3	16.7	12.0
2 p.m.–3 p.m.	7.7	8.9	11.8	11.8	15.8	14.7
3 p.m.–4 p.m.	7.8	8.8	10.7	12.5	13.0	15.6
4 p.m.–5 p.m.	8.0	8.9	8.8	12.5	9.4	15.8
5 p.m.–6 p.m.	8.4	9.2	5.3	11.3	5.1	13.0
6 p.m.–7 p.m.	8.0	7.5	3.3	6.7	2.3	4.6
7 p.m.–8 p.m.	7.9	7.2	2.7	2.9	1.7	1.9
8 p.m.–9 p.m.	4.3	7.7	1.8	2.2	1.1	1.3
9 p.m.–10 p.m.	1.8	7.2	1.0	1.6	0.7	1.1
10 p.m.–6 a.m.	1.7	2.8	2.0	2.8	2.1	3.0

Sites ranged in size from 11,000 to 1,750,000 square feet gross leasable area

^a Source numbers – 13, 73, 88, 190, 217, 220, 225 and 376; based on ten studies

^b Source numbers – 13, 73, 88, 190, 220, 225 and 376; based on nine studies

^c Source numbers – 13, 73, 88, 190, 220 and 225; based on eight studies

Table 2 Daily Variation in Shopping Center Traffic Percentage of Average Weekday Volume (Monday through Friday)				
Day	Less than 100,000 Square Feet GLA	100,000 to 300,000 Square Feet GLA	More than 300,000 Square Feet GLA	Discount Center
Sunday	45.2	65.4	77.4	82.1
Monday	97.3	96.8	96.8	95.1
Tuesday	92.9	103.1	97.1	91.4
Wednesday	92.7	99.1	93.6	94.8
Thursday	98.2	85.3	97.1	99.5
Friday	118.9	108.7	115.4	119.2
Saturday	128.5	113.4	128.0	151.0
Sample Size	6	8	17	2

Source numbers: 88, 124

Table 3 Monthly Variation in Shopping Center Traffic Percentage of Average Month			
Month	Percentage	Month	Percentage
January	85.3	July	100.8
February	78.1	August	102.1
March	92.0	September	94.8
April	93.2	October	98.9
May	105.4	November	101.5
June	106.0	December	141.8

Sample size: 2

Average gross leasable area: 938,000 square feet

The sites were surveyed between the 1960s and the 2000s throughout the United States and Canada.

Specialized Land Use Data

Two studies provided data on outdoor shopping centers in Illinois and Alberta, Canada. The trip generation characteristics of these sites varied from the other stores in this land use; therefore, the information collected for these facilities is presented in the following tables and was excluded from the data plots.

<u>Independent Variable</u>	<u>Average Trip Generation Rate</u>	<u>Size of Independent Variable</u>	<u>Number of Studies</u>	<u>Directional Distribution</u>
1,000 Square Feet Gross Leasable Area				
Weekday	66.64	797	2	Not available
Weekday A.M. Peak Hour of Adjacent Street Traffic	3.27	797	2	Not available
Weekday P.M. Peak Hour of Adjacent Street Traffic	5.46	797	2	Not available

Sources: 446, 702

Source Numbers

1, 2, 3, 4, 5, 6, 13, 14, 18, 19, 22, 26, 40, 42, 48, 49, 54, 59, 60, 61, 64, 65, 72, 73, 75, 76, 77, 78, 79, 87, 89, 90, 98, 99, 100, 105, 110, 124, 156, 159, 172, 186, 193, 194, 195, 196, 197, 198, 199, 202, 204, 211, 213, 260, 263, 269, 295, 299, 300, 301, 304, 305, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 358, 365, 376, 385, 390, 400, 404, 414, 420, 423, 428, 437, 440, 442, 444, 446, 507, 562, 563, 580, 598, 629, 658, 702, 715, 728

Shopping Center (820)

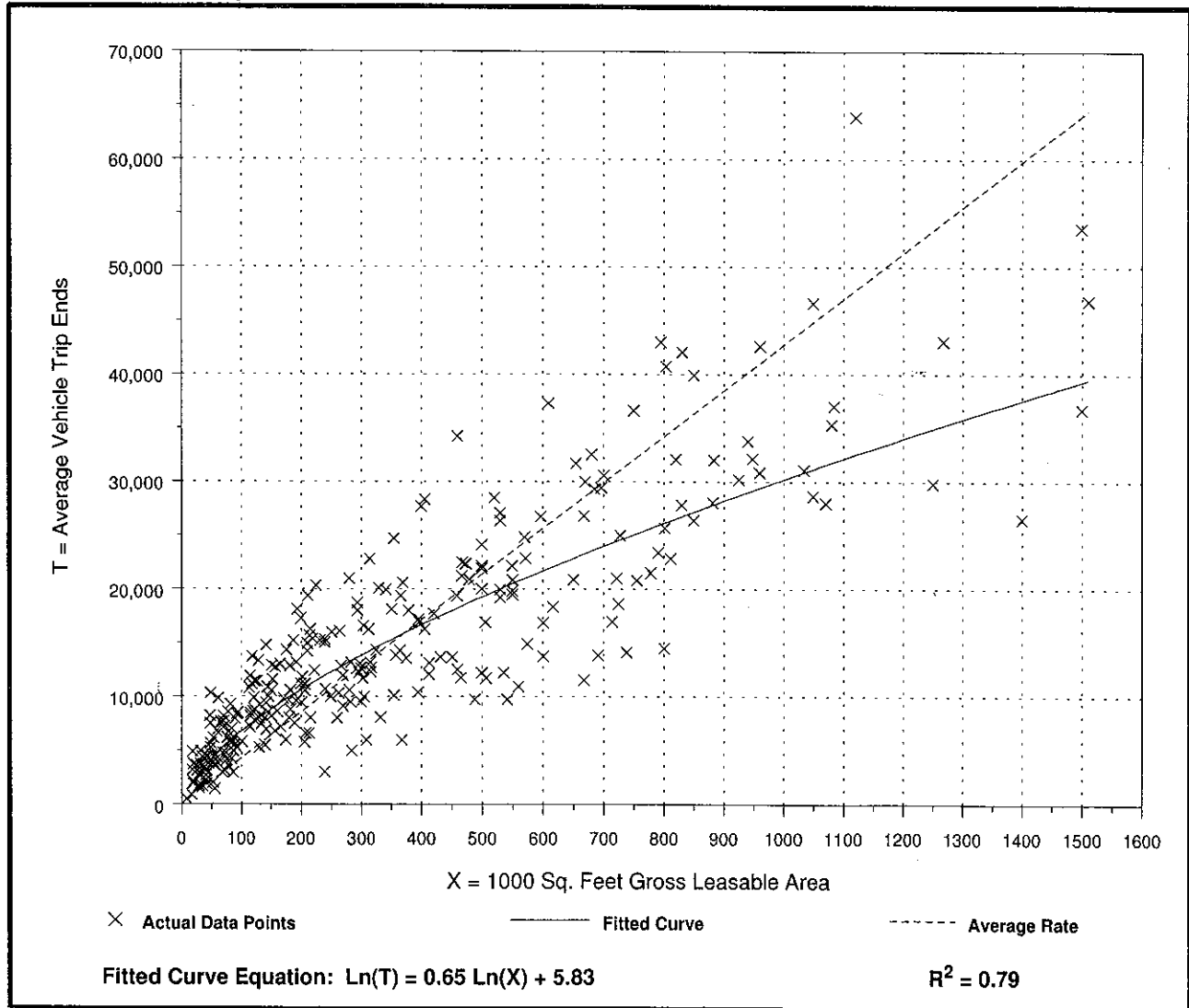
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: **Weekday**

Number of Studies: 302
Average 1000 Sq. Feet GLA: 331
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
42.70	12.50 - 270.89	21.25

Data Plot and Equation



Shopping Center (820)

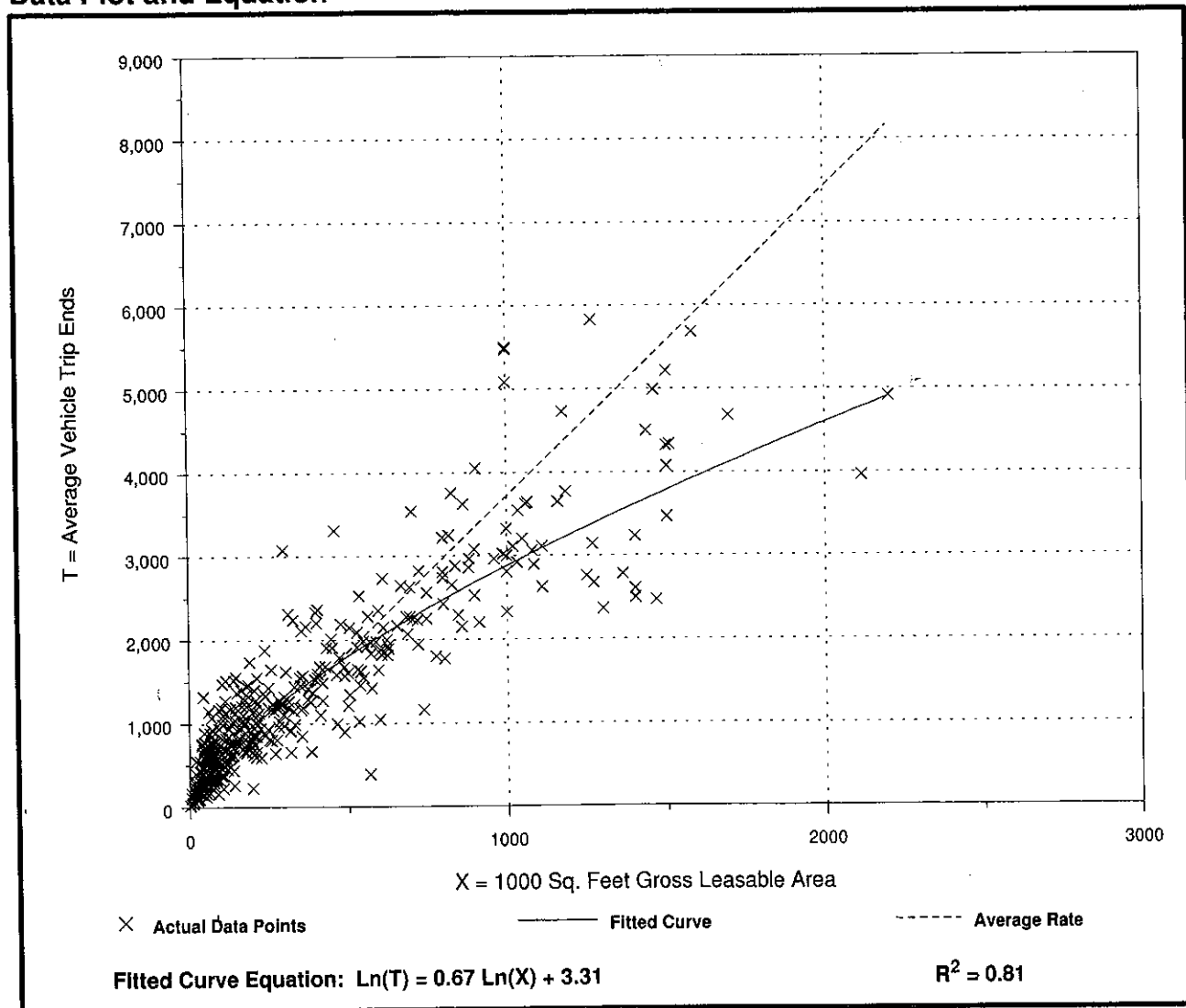
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 426
 Average 1000 Sq. Feet GLA: 376
 Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
3.71	0.68 - 29.27	2.74

Data Plot and Equation



Land Use: 710

General Office Building

Description

A general office building houses multiple tenants; it is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services, insurance companies, investment brokers and tenant services, such as a bank or savings and loan institution, a restaurant or cafeteria and service retail facilities. Corporate headquarters building (Land Use 714), single tenant office building (Land Use 715), office park (Land Use 750), research and development center (Land Use 760) and business park (Land Use 770) are related uses.

If information is known about individual buildings, it is suggested that the general office building category be used rather than office parks when estimating trip generation for one or more office buildings in a single development. The office park category is more general and should be used when a breakdown of individual or different uses is not known. If the general office building category is used and if additional buildings, such as banks, restaurants, or retail stores, are included in the development, the development should be treated as a multiuse project. On the other hand, if the office park category is used, internal trips are already reflected in the data and do not need to be considered.

When the buildings are interrelated (defined by shared parking facilities or the ability to easily walk between buildings) or house one tenant, it is suggested that the total area or employment of all the buildings be used for calculating the trip generation. When the individual buildings are isolated and not related to one another, it is suggested that trip generation be calculated for each building separately and then summed.

Additional Data

Average weekday transit trip ends—

Transit service was either nonexistent or negligible at the majority of the sites surveyed in this land use. Users may wish to modify trip generation rates presented in this land use to reflect the presence of public transit, carpools and other transportation demand management (TDM) strategies. Information has not been analyzed to document the impacts of TDM measures on the total trip generation of a site. See the *ITE Trip Generation Handbook*, Second Edition for additional information on this topic.

The average building occupancy varied considerably within the studies for which occupancy data were provided. For buildings with occupancy rates reported, the average occupied gross leasable area was 88 percent.

Some of the regression curves plotted for this land use may produce illogical trip-end estimates for small office buildings. When the proposed site size is significantly smaller than the average-sized facility published in this report, caution should be used when applying these statistics. For more information, please refer to Chapter 3, "Guidelines for Estimating Trip Generation," of the *ITE Trip Generation Handbook*, Second Edition.

General Office Building (710)

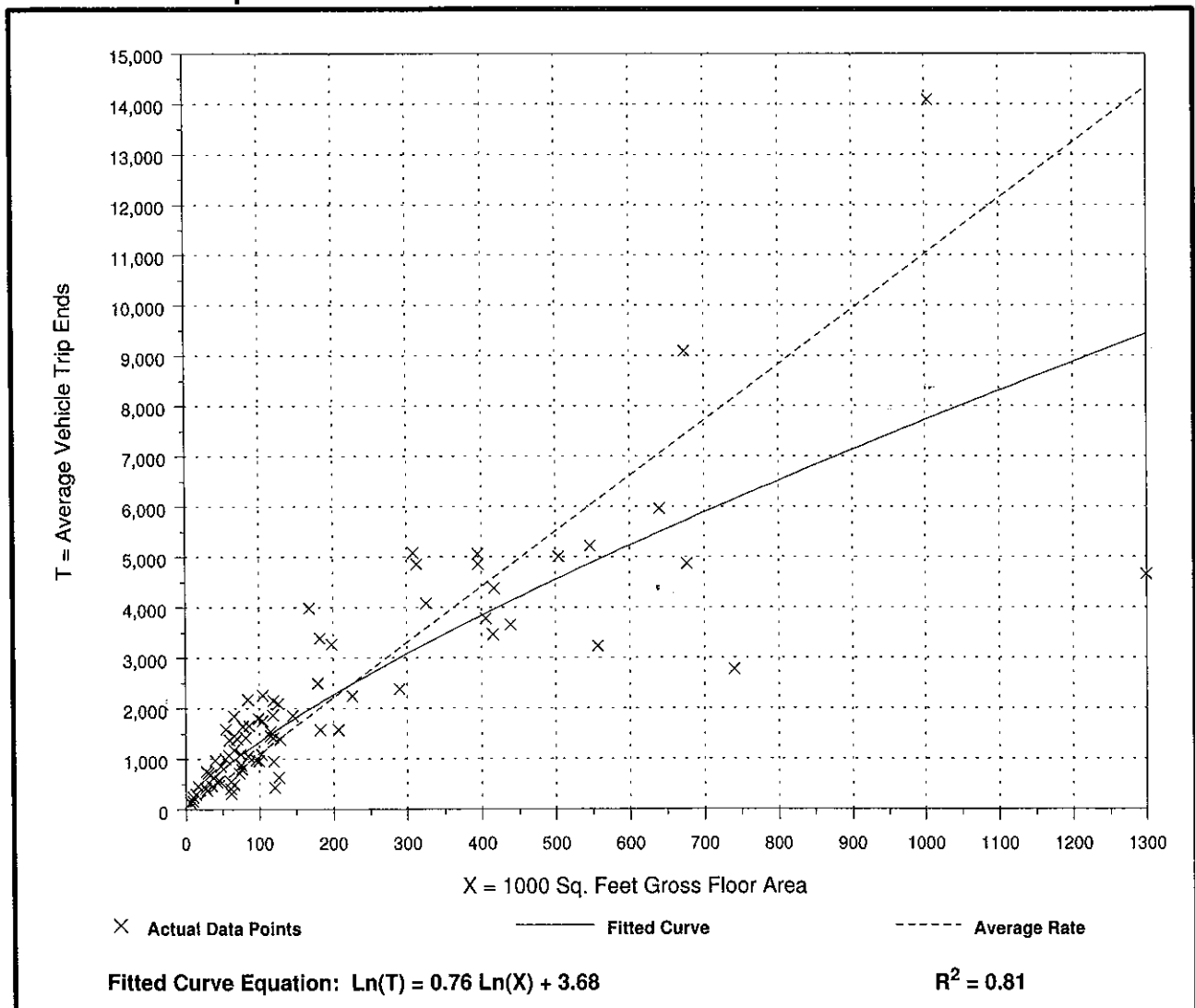
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

Number of Studies: 79
Average 1000 Sq. Feet GFA: 197
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
11.03	3.58 - 28.80	6.15

Data Plot and Equation



General Office Building (710)

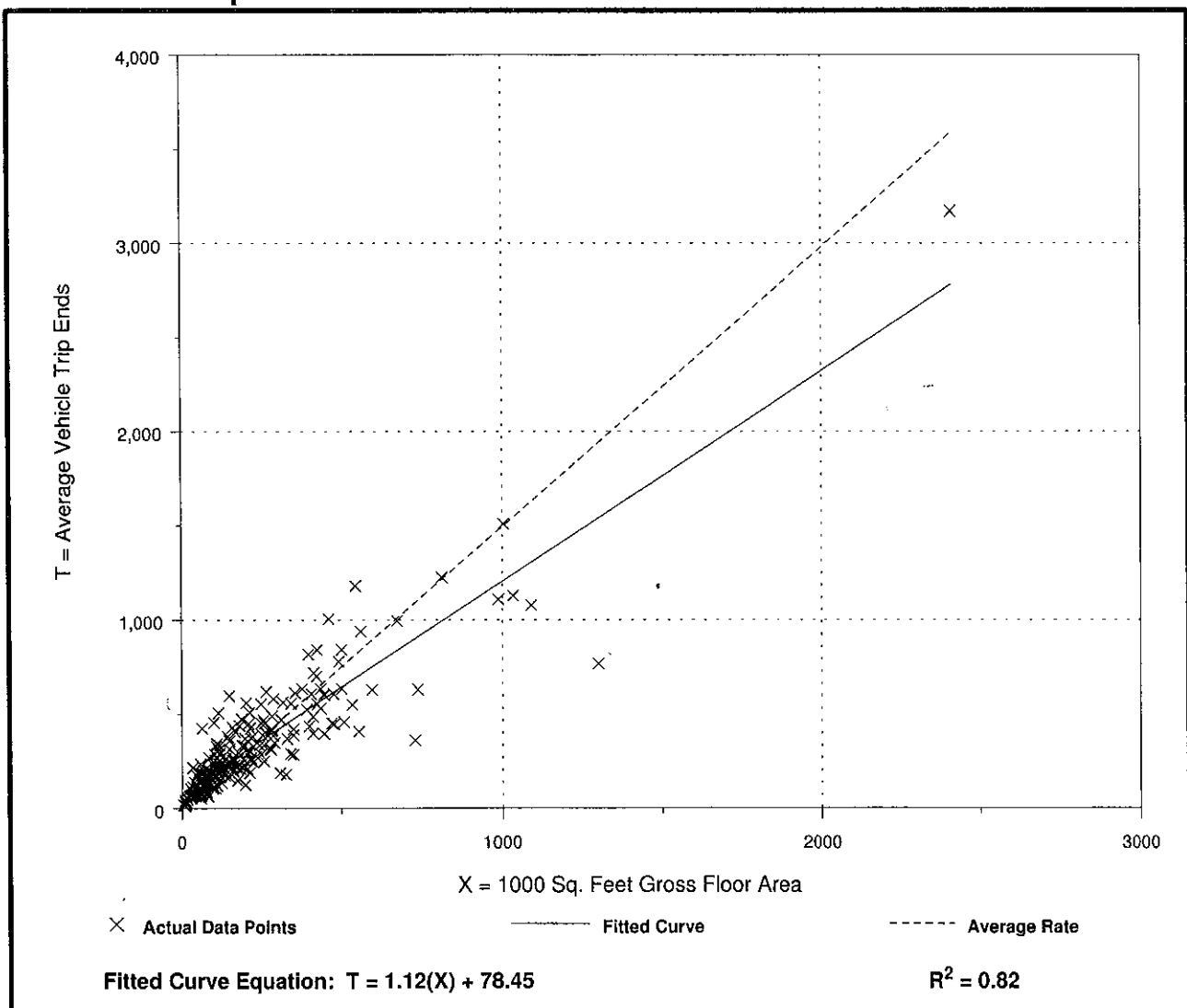
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
P.M. Peak Hour

Number of Studies: 236
 Average 1000 Sq. Feet GFA: 215
 Directional Distribution: 17% entering, 83% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.49	0.49 - 6.39	1.37

Data Plot and Equation



Land Use: 720

Medical-Dental Office Building

Description

A medical-dental office building is a facility that provides diagnoses and outpatient care on a routine basis but is unable to provide prolonged in-house medical and surgical care. One or more private physicians or dentists generally operate this type of facility. Clinic (Land Use 630) is a related use.

Additional Data

The average vehicle occupancy for the six studies for which information was submitted was approximately 1.37 persons per automobile. The vehicle occupancy rates ranged from 1.32 to 1.44 persons per automobile.

The sites were surveyed between the 1980s and the 2000s throughout the United States.

Source Numbers

8, 19, 98, 104, 109, 120, 157, 184, 209, 211, 253, 287, 294, 295, 304, 357, 384, 404, 407, 423, 444, 509, 601, 715

Medical-Dental Office Building (720)

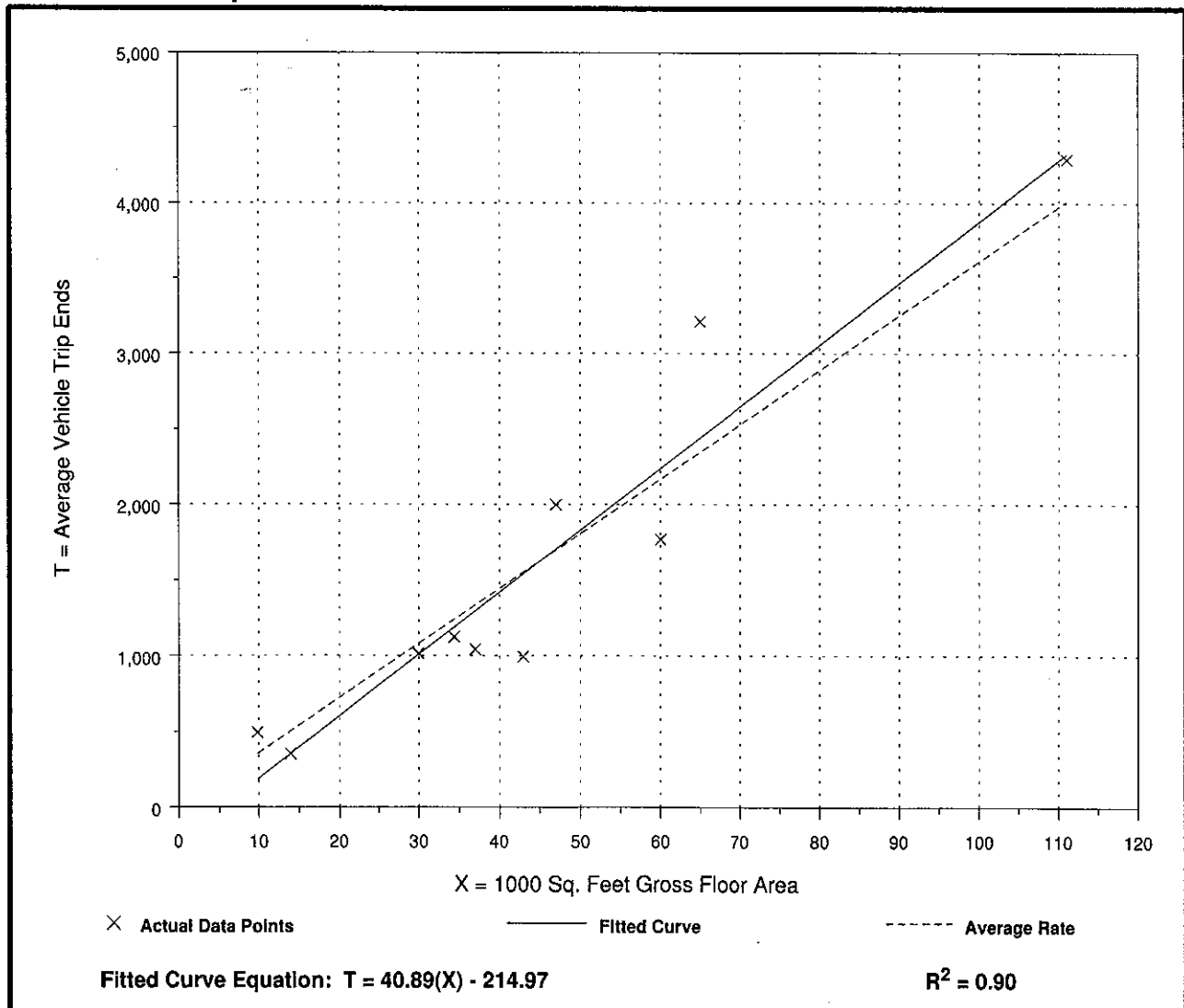
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

Number of Studies: 10
Average 1000 Sq. Feet GFA: 45
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
36.13	23.16 - 50.51	10.18

Data Plot and Equation



Medical-Dental Office Building (720)

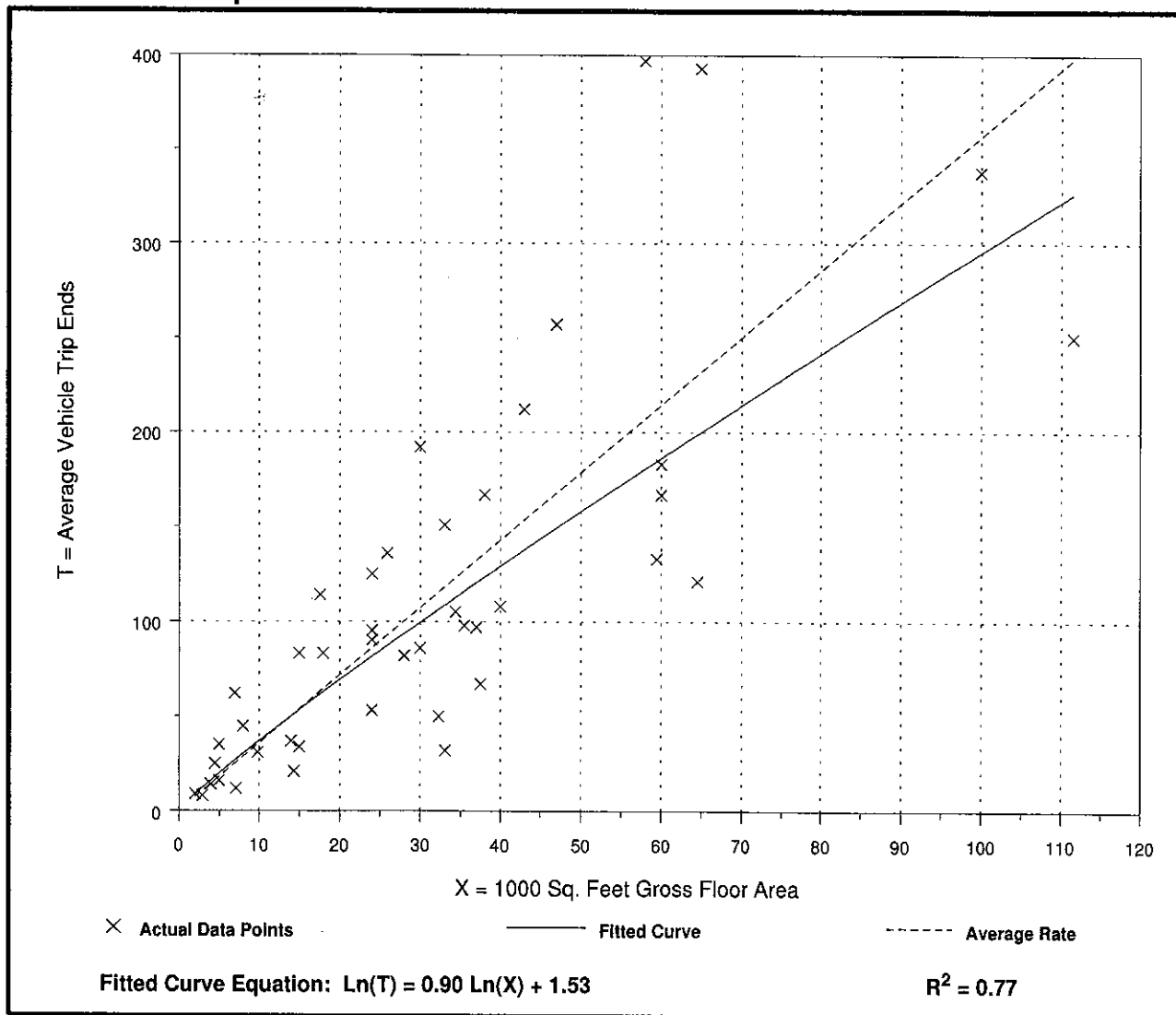
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 43
Average 1000 Sq. Feet GFA: 31
Directional Distribution: 28% entering, 72% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
3.57	0.97 - 8.86	2.47

Data Plot and Equation



Land Use: 210

Single-Family Detached Housing

Description

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

Additional Data

The number of vehicles and residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it was usually readily available, easy to project and had a high correlation with average weekday vehicle trip ends.

This land use included data from a wide variety of units with different sizes, price ranges, locations and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Single-family detached units had the highest trip generation rate per dwelling unit of all residential uses because they were the largest units in size and had more residents and more vehicles per unit than other residential land uses; they were generally located farther away from shopping centers, employment areas and other trip attractors than other residential land uses; and they generally had fewer alternative modes of transportation available because they were typically not as concentrated as other residential land uses.

The peak hour of the generator typically coincided with the peak hour of the adjacent street traffic.

The sites were surveyed between the late 1960s and the 2000s throughout the United States and Canada.

Source Numbers

1, 4, 5, 6, 7, 8, 11, 12, 13, 14, 16, 19, 20, 21, 26, 34, 35, 36, 38, 40, 71, 72, 84, 91, 98, 100, 105, 108, 110, 114, 117, 119, 157, 167, 177, 187, 192, 207, 211, 246, 275, 283, 293, 300, 319, 320, 357, 384, 435, 550, 552, 579, 598, 601, 603, 611, 614, 637, 711, 735

Single-Family Detached Housing (210)

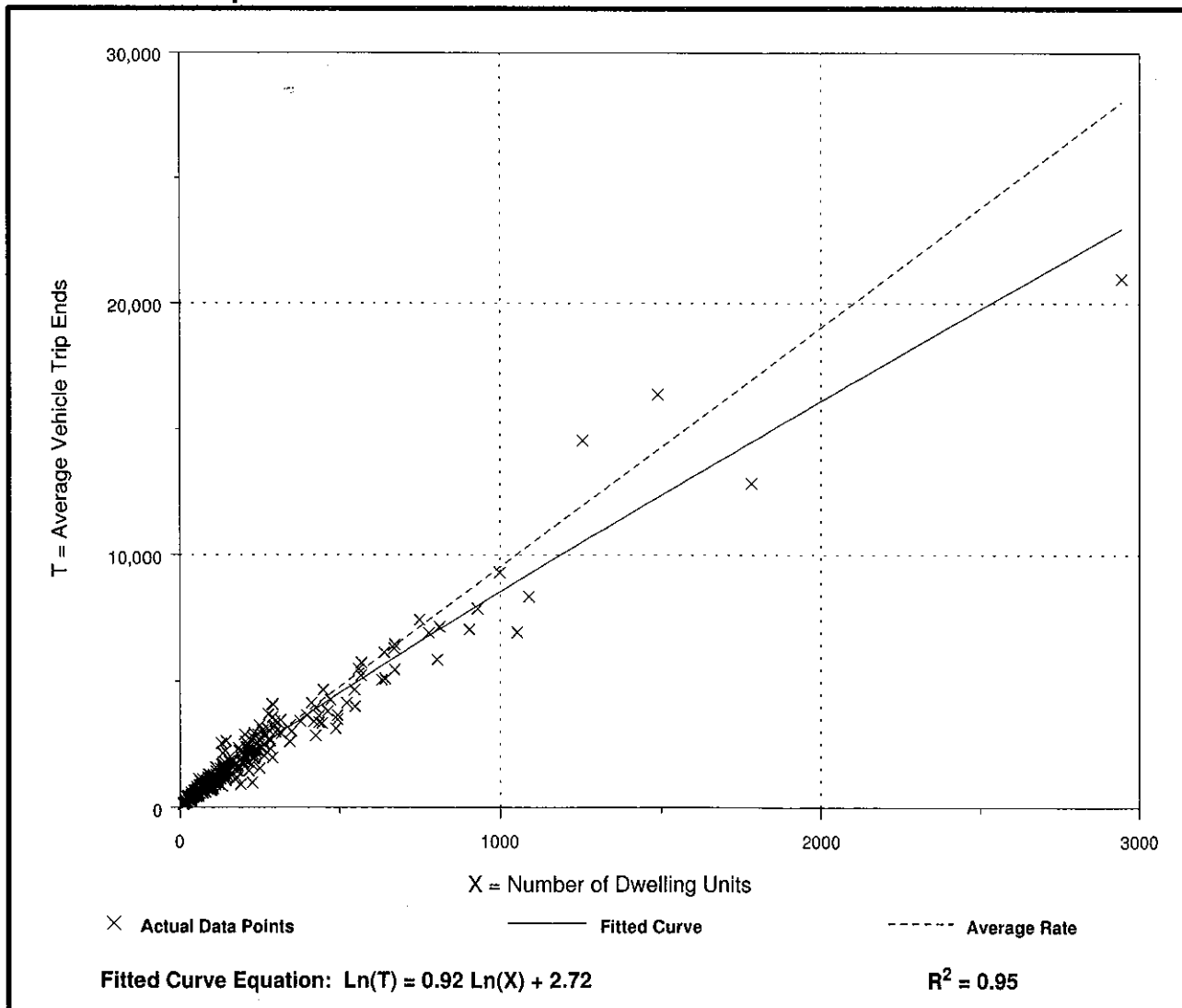
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 355
Avg. Number of Dwelling Units: 198
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.52	4.31 - 21.85	3.70

Data Plot and Equation



Single-Family Detached Housing (210)

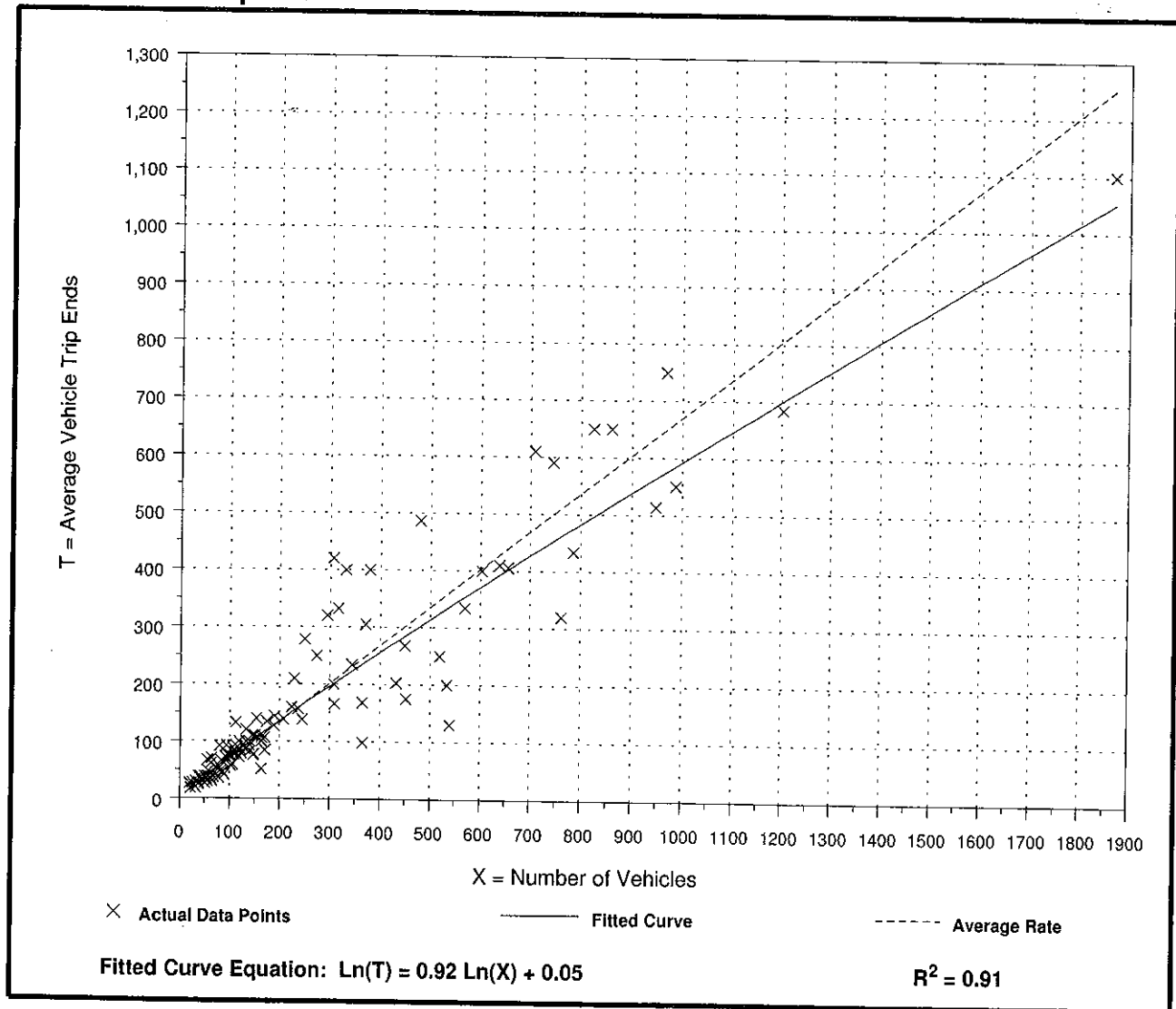
Average Vehicle Trip Ends vs: Vehicles
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 110
Average Number of Vehicles: 260
Directional Distribution: 66% entering, 34% exiting

Trip Generation per Vehicle

Average Rate	Range of Rates	Standard Deviation
0.67	0.24 - 1.37	0.84

Data Plot and Equation



Land Use: 230

Residential Condominium/Townhouse

Description

Residential condominiums/townhouses are defined as ownership units that have at least one other owned unit within the same building structure. **Both condominiums and townhouses are included in this land use.** The studies in this land use did not identify whether the condominiums/townhouses were low-rise or high-rise. Low-rise residential condominium/townhouse (Land Use 231), high-rise residential condominium/townhouse (Land Use 232) and luxury condominium/townhouse (Land Use 233) are related uses.

Additional Data

The number of vehicles and the number of residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it is usually readily available, easy to project and had a high correlation with average weekday vehicle trip ends.

The peak hour of the generator typically coincided with the peak hour of the adjacent street traffic.

The sites were surveyed between the mid-1970s and the 2000s throughout the United States and Canada.

Source Numbers

4, 92, 94, 95, 97, 100, 105, 106, 114, 168, 186, 204, 237, 253, 293, 319, 320, 321, 390, 412, 418, 561, 562, 583, 638

Residential Condominium/Townhouse (230)

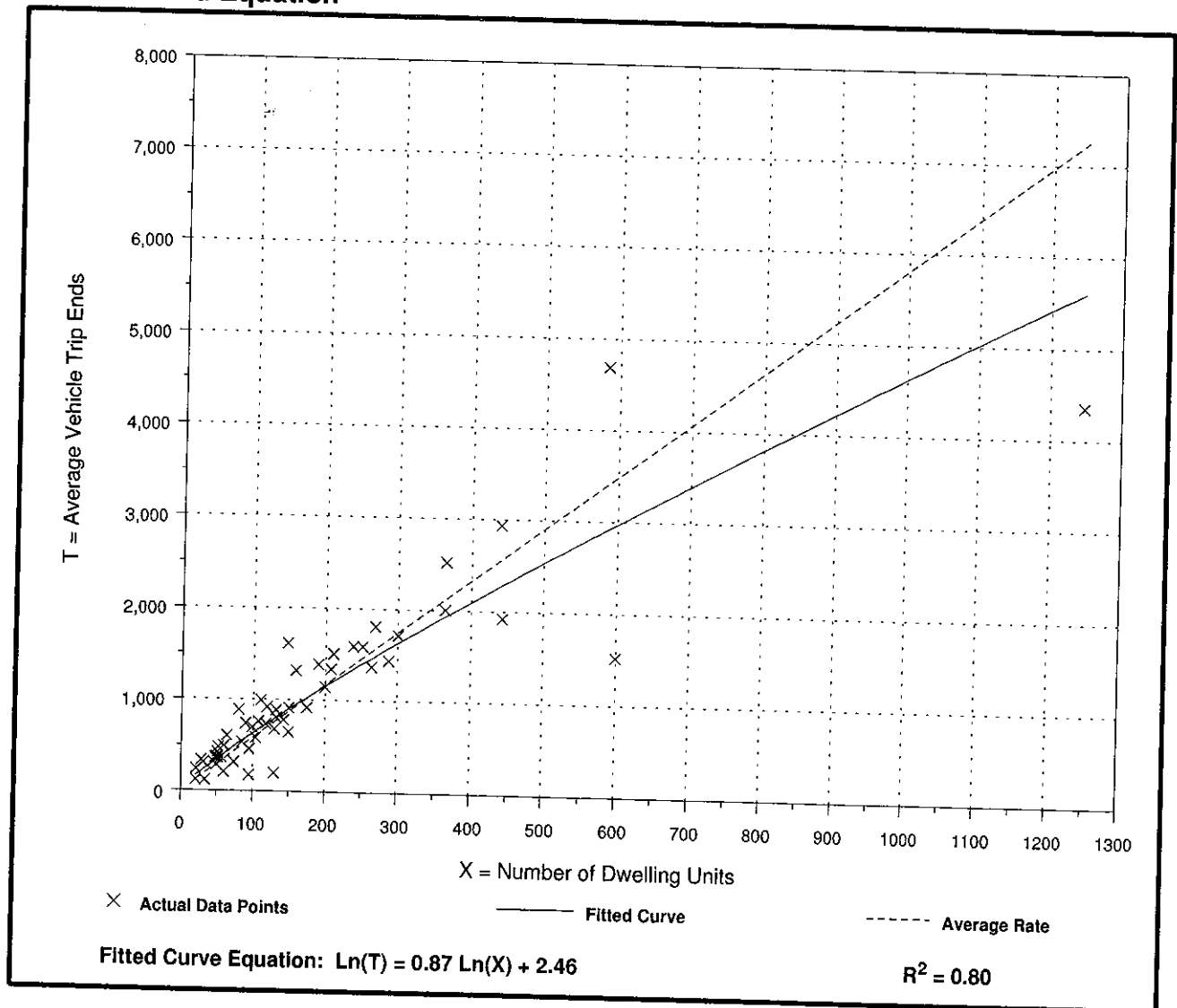
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 56
Avg. Number of Dwelling Units: 179
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
5.81	1.53 - 11.79	3.11

Data Plot and Equation



Residential Condominium/Townhouse (230)

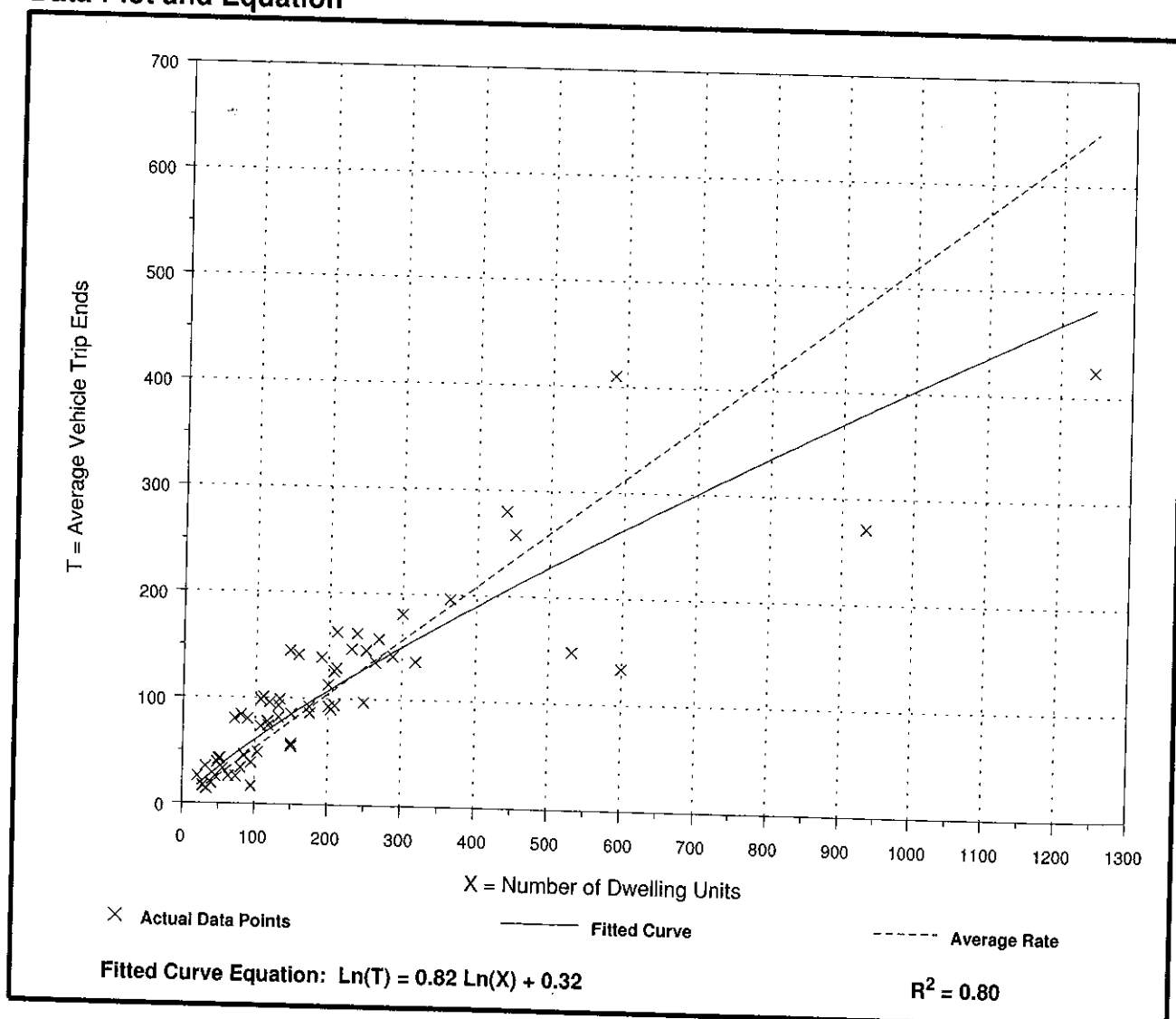
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 62
Avg. Number of Dwelling Units: 205
Directional Distribution: 67% entering, 33% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.52	0.18 - 1.24	0.75

Data Plot and Equation



Land Use: 411

City Park

Description

City parks are owned and operated by a city. The city parks surveyed vary widely as to location, type and number of facilities, including boating or swimming facilities, ball fields, soccer fields, camp-sites and picnic facilities. Seasonal use of the individual sites differs widely as a result of the varying facilities and local conditions, such as weather. For example, some of the sites are used primarily for boating or swimming; others are used for softball games. Soccer complex (Land Use 488) is a related use.

Additional Data

The percentage of the park area that is used most intensively varies considerably within the studies contained in this land use; therefore, caution should be used when using acres as an independent variable.

The sites were surveyed in the 1970s and the 2000s, primarily in California and Arizona.

Source Numbers

13, 18, 214, 709

Land Use: 411 City Park

Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

<u>Independent Variable</u>	<u>Trip Generation Rate</u>	<u>Size of Independent Variable</u>	<u>Number of Studies</u>	<u>Directional Distribution</u>
Acres				
Weekday A.M. Peak Hour of Adjacent Street Traffic	4.50	4	1	56% entering, 44% exiting
Weekday P.M. Peak Hour of Adjacent Street Traffic	3.50	4	1	57% entering, 43% exiting
Weekday A.M. Peak Hour of Generator	4.50	4	1	50% entering, 50% exiting
Weekday P.M. Peak Hour of Generator	4.50	4	1	61% entering, 39% exiting
Saturday	22.75	4	1	50% entering, 50% exiting
Saturday Peak Hour of Generator	4.50	4	1	50% entering, 50% exiting
Sunday Peak Hour of Generator	5.00	4	1	50% entering, 50% exiting

City Park (411)

Average Vehicle Trip Ends vs: Acres
On a: Weekday

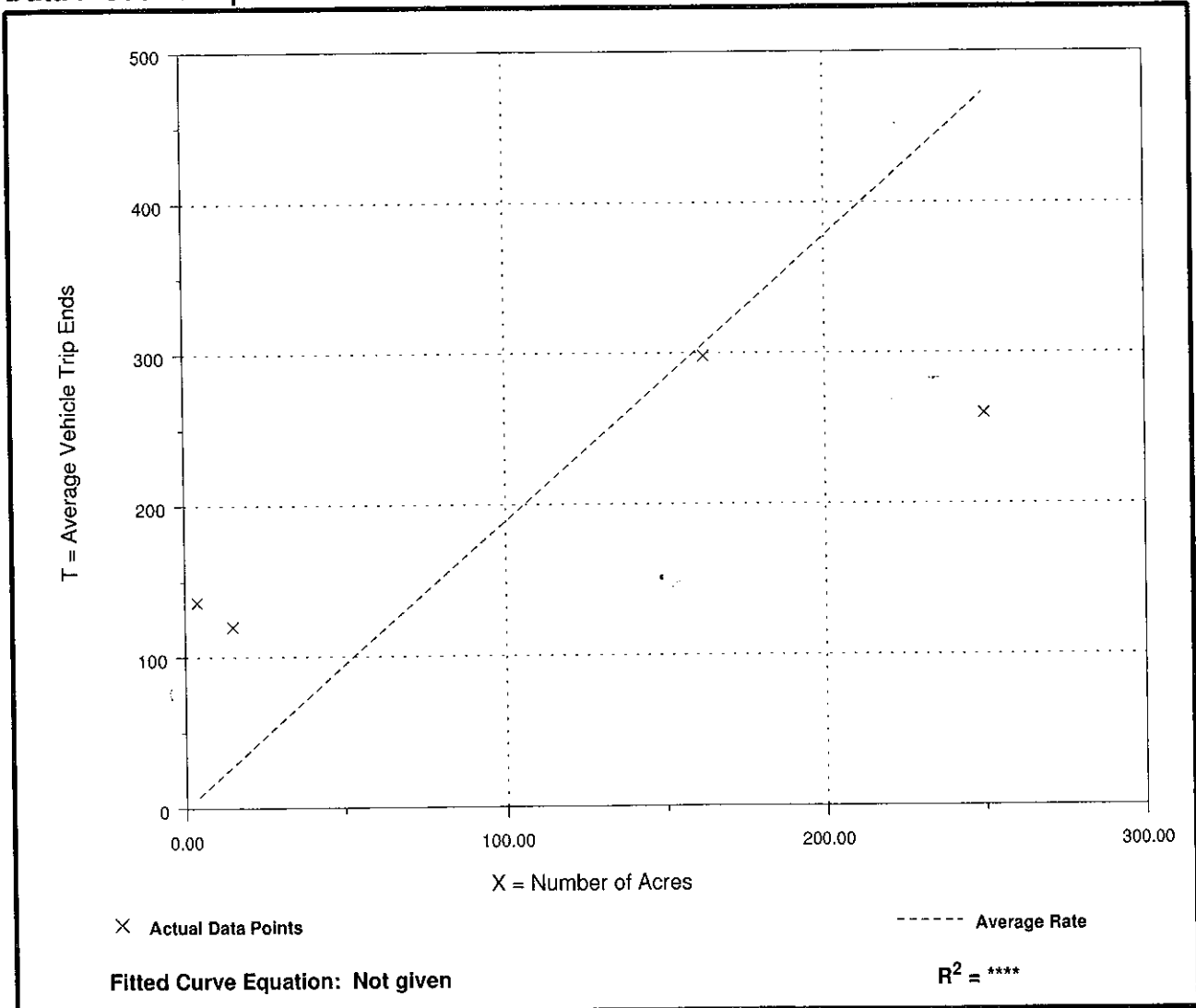
Number of Studies: 4
Average Number of Acres: 108
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Acre

Average Rate	Range of Rates	Standard Deviation
1.89	1.04 - 34.00	3.62

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



ITE/NCHRP ICR

**Table 6.1 Unconstrained Internal Person Trip Capture Rates
for Trip Origins within a Mixed-Use Development**

		WEEKDAY	
		AM Peak Hour	PM Peak Hour
From OFFICE	To Retail	28%	20%
	To Restaurant	63%	4%
	To Cinema/Entertainment	0%	0%
	To Residential	1%	2%
	To Hotel	0%	0%
From RETAIL	To Office	29%	2%
	To Restaurant	13%	29%
	To Cinema/Entertainment	0%	4%
	To Residential	14%	26%
	To Hotel	0%	5%
From RESTAURANT	To Office	31%	3%
	To Retail	14%	41%
	To Cinema/Entertainment	0%	8%
	To Residential	4%	18%
	To Hotel	3%	7%
From CINEMA/ENTERTAINMENT	To Office	0%	2%
	To Retail	0%	21%
	To Restaurant	0%	31%
	To Residential	0%	8%
	To Hotel	0%	2%
From RESIDENTIAL	To Office	2%	4%
	To Retail	1%	42%
	To Restaurant	20%	21%
	To Cinema/Entertainment	0%	0%
	To Hotel	0%	3%
From HOTEL	To Office	75%	0%
	To Retail	14%	16%
	To Restaurant	9%	68%
	To Cinema/Entertainment	0%	0%
	To Residential	0%	2%

Source: Bochner, B., K. Hooper, B. Sperry, and R. Dunphy. NCHRP Report 684: *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*. Washington, DC: Transportation Research Board, Tables 99 and 100, 2011.

**Table 6.2 Unconstrained Internal Person Trip Capture Rates
for Trip Destinations within a Mixed-Use Development**

		Weekday	
		AM Peak Hour	PM Peak Hour
To OFFICE	From Retail	4%	31%
	From Restaurant	14%	30%
	From Cinema/Entertainment	0%	6%
	From Residential	3%	57%
	From Hotel	3%	0%
To RETAIL	From Office	32%	8%
	From Restaurant	8%	50%
	From Cinema/Entertainment	0%	4%
	From Residential	17%	10%
	From Hotel	4%	2%
To RESTAURANT	From Office	23%	2%
	From Retail	50%	29%
	From Cinema/Entertainment	0%	3%
	From Residential	20%	14%
	From Hotel	6%	5%
To CINEMA/ENTERTAINMENT	From Office	0%	1%
	From Retail	0%	26%
	From Restaurant	0%	32%
	From Residential	0%	0%
	From Hotel	0%	0%
To RESIDENTIAL	From Office	0%	4%
	From Retail	2%	46%
	From Restaurant	5%	16%
	From Cinema/Entertainment	0%	4%
	From Hotel	0%	0%
To HOTEL	From Office	0%	0%
	From Retail	0%	17%
	From Restaurant	4%	71%
	From Cinema/Entertainment	0%	1%
	From Residential	0%	12%

Source: Bochner, B., K. Hooper, B. Sperry, and R. Dunphy. NCHRP Report 684: *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*. Washington, DC: Transportation Research Board, Tables 101 and 102, 2011.

BRC DRI (CHARLOTTE COUNTY, BACKGROUND TRAFFIC)



ITE RATES

Land Use: 210

Single-Family Detached Housing

Description

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

Additional Data

The number of vehicles and residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it was usually readily available, easy to project and had a high correlation with average weekday vehicle trip ends.

This land use included data from a wide variety of units with different sizes, price ranges, locations and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Single-family detached units had the highest trip generation rate per dwelling unit of all residential uses because they were the largest units in size and had more residents and more vehicles per unit than other residential land uses; they were generally located farther away from shopping centers, employment areas and other trip attractors than other residential land uses; and they generally had fewer alternative modes of transportation available because they were typically not as concentrated as other residential land uses.

The peak hour of the generator typically coincided with the peak hour of the adjacent street traffic.

The sites were surveyed between the late 1960s and the 2000s throughout the United States and Canada.

Source Numbers

1, 4, 5, 6, 7, 8, 11, 12, 13, 14, 16, 19, 20, 21, 26, 34, 35, 36, 38, 40, 71, 72, 84, 91, 98, 100, 105, 108, 110, 114, 117, 119, 157, 167, 177, 187, 192, 207, 211, 246, 275, 283, 293, 300, 319, 320, 357, 384, 435, 550, 552, 579, 598, 601, 603, 611, 614, 637, 711, 735

Single-Family Detached Housing (210)

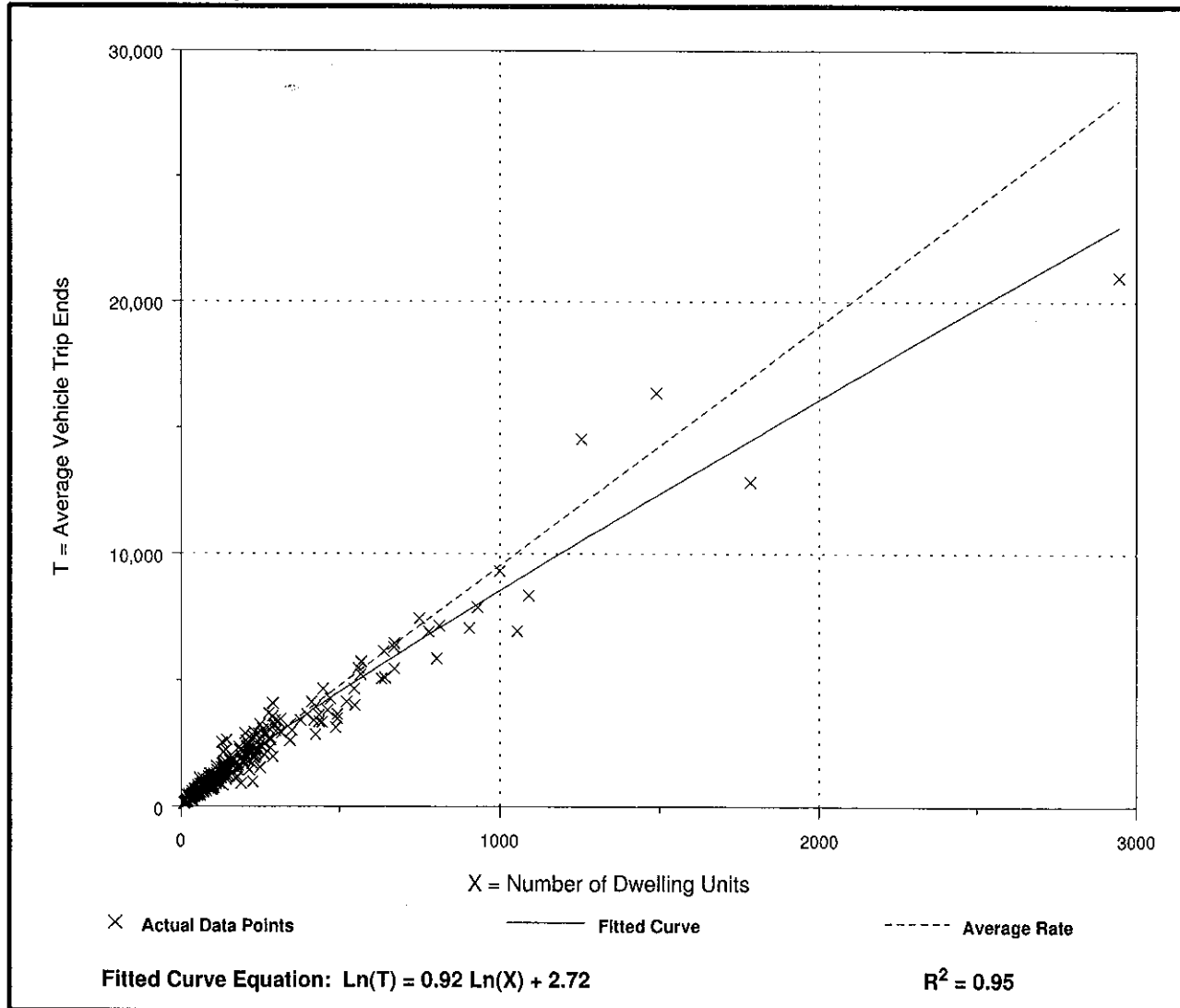
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 355
Avg. Number of Dwelling Units: 198
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.52	4.31 - 21.85	3.70

Data Plot and Equation



Single-Family Detached Housing (210)

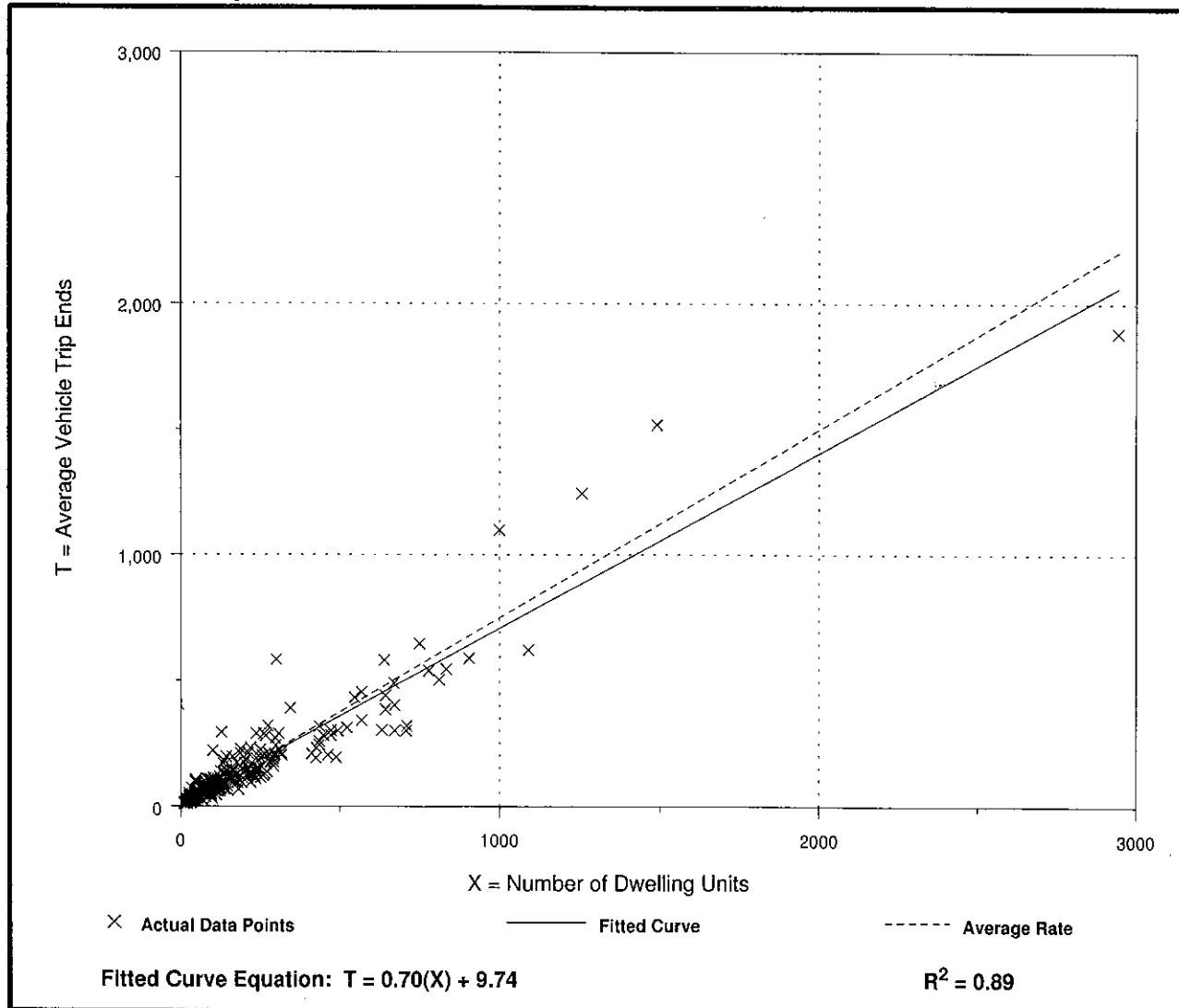
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 292
 Avg. Number of Dwelling Units: 194
 Directional Distribution: 25% entering, 75% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.75	0.33 - 2.27	0.90

Data Plot and Equation



Single-Family Detached Housing (210)

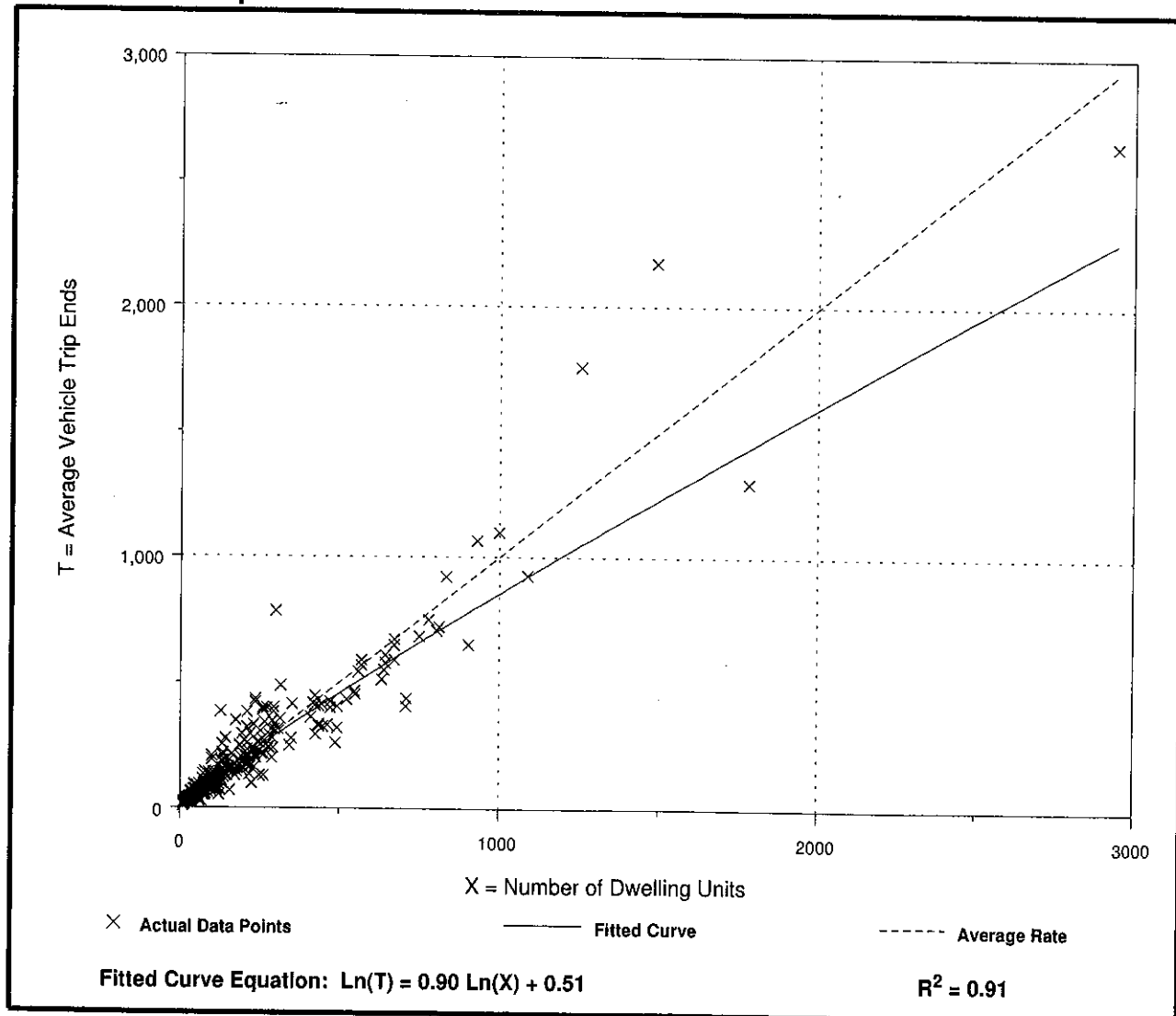
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 321
Avg. Number of Dwelling Units: 207
Directional Distribution: 63% entering, 37% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
1.00	0.42 - 2.98	1.05

Data Plot and Equation



Land Use: 230

Residential Condominium/Townhouse

Description

Residential condominiums/townhouses are defined as ownership units that have at least one other owned unit within the same building structure. **Both condominiums and townhouses are included in this land use.** The studies in this land use did not identify whether the condominiums/townhouses were low-rise or high-rise. Low-rise residential condominium/townhouse (Land Use 231), high-rise residential condominium/townhouse (Land Use 232) and luxury condominium/townhouse (Land Use 233) are related uses.

Additional Data

The number of vehicles and the number of residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it is usually readily available, easy to project and had a high correlation with average weekday vehicle trip ends.

The peak hour of the generator typically coincided with the peak hour of the adjacent street traffic.

The sites were surveyed between the mid-1970s and the 2000s throughout the United States and Canada.

Source Numbers

4, 92, 94, 95, 97, 100, 105, 106, 114, 168, 186, 204, 237, 253, 293, 319, 320, 321, 390, 412, 418, 561, 562, 583, 638

Residential Condominium/Townhouse (230)

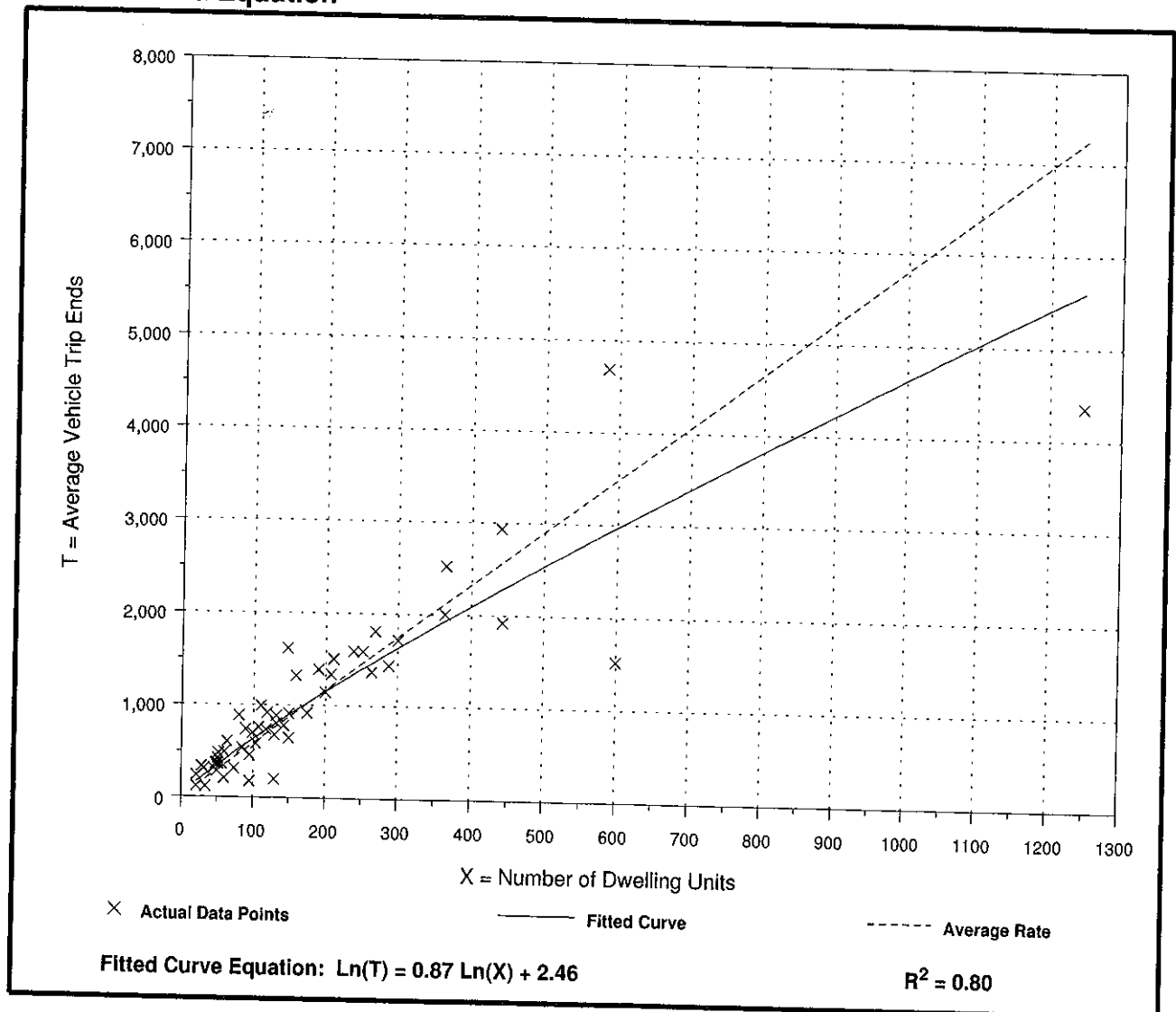
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 56
Avg. Number of Dwelling Units: 179
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
5.81	1.53 - 11.79	3.11

Data Plot and Equation



Residential Condominium/Townhouse (230)

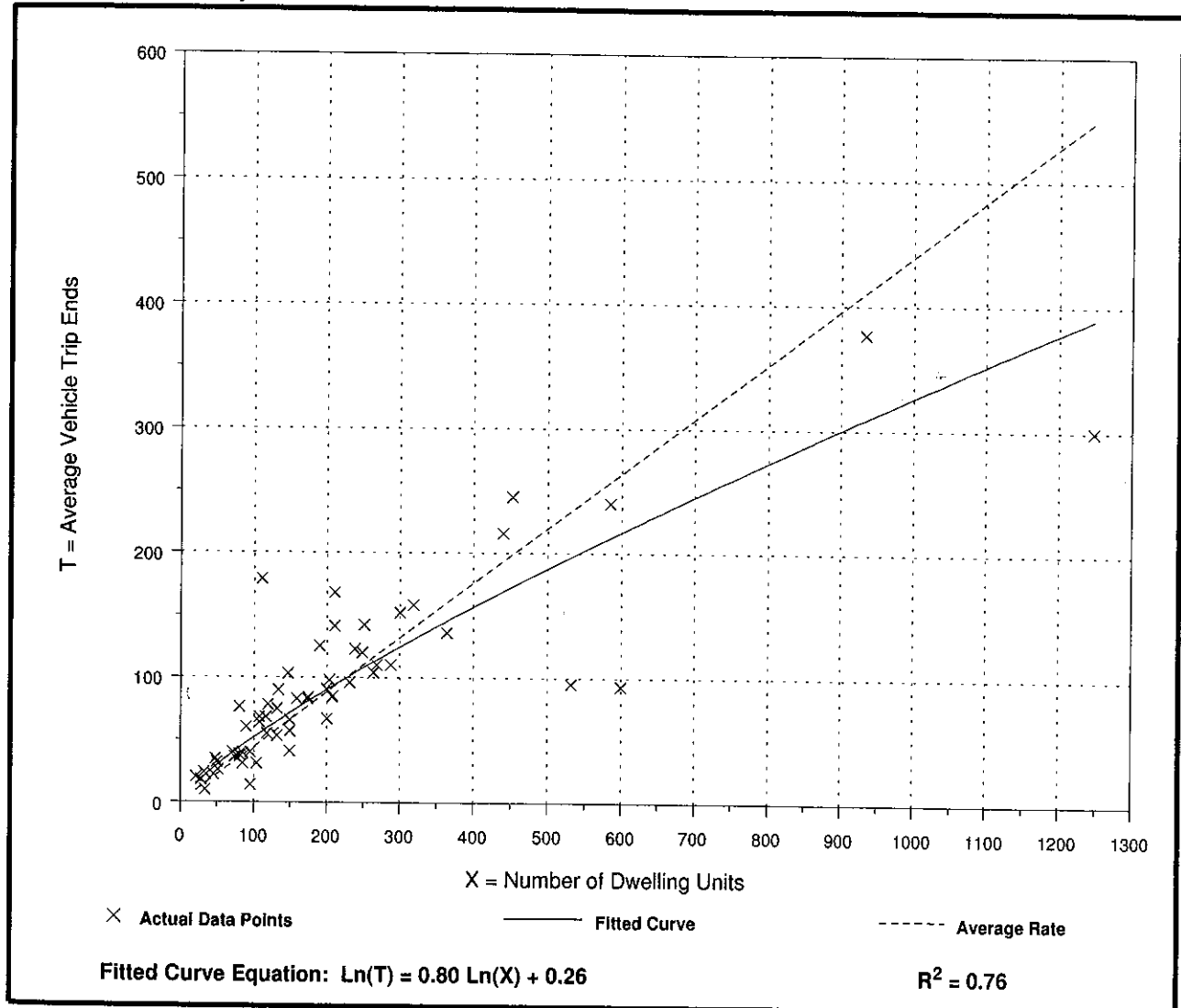
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 59
Avg. Number of Dwelling Units: 213
Directional Distribution: 17% entering, 83% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.61	0.69

Data Plot and Equation



Residential Condominium/Townhouse (230)

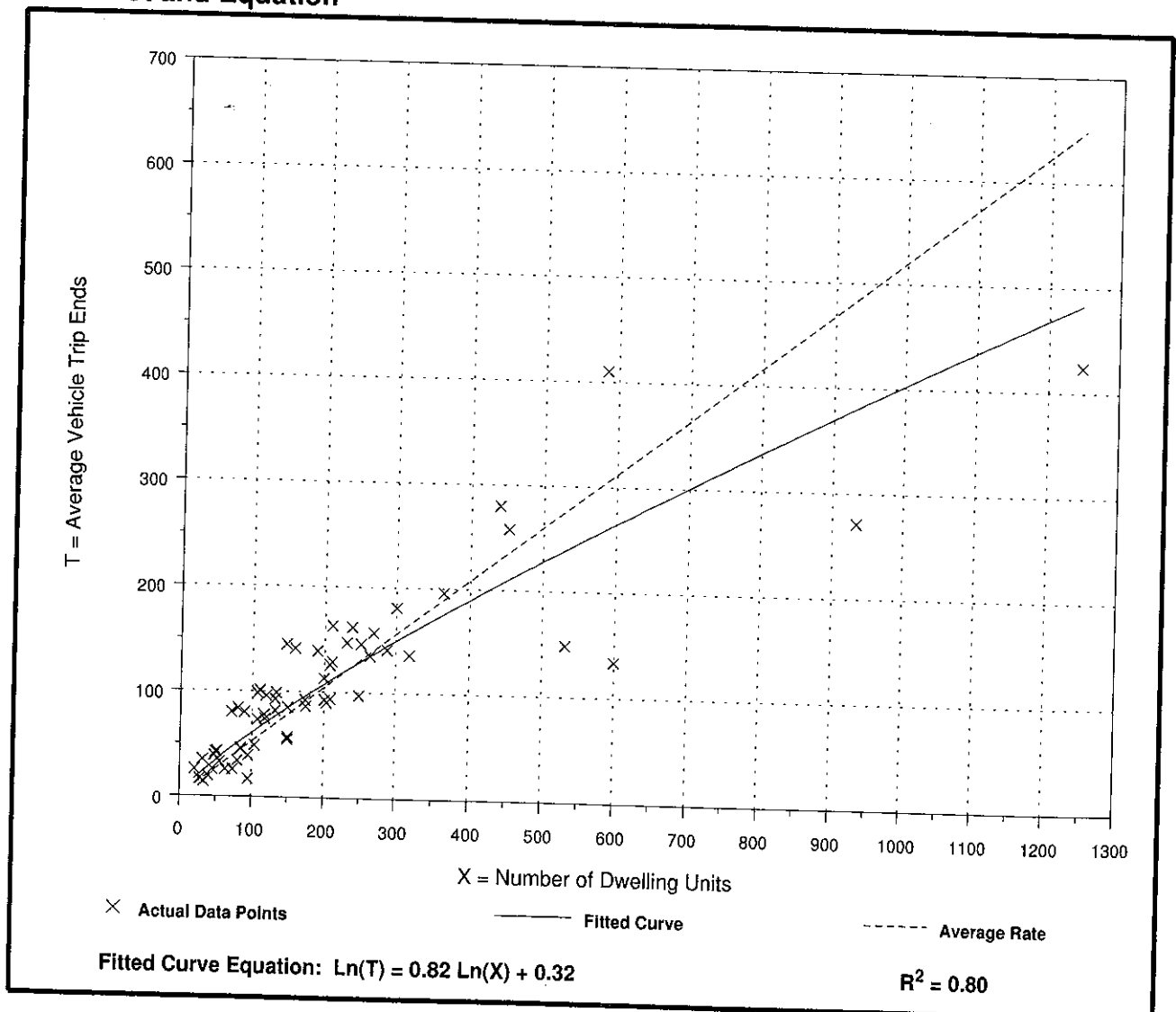
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 62
Avg. Number of Dwelling Units: 205
Directional Distribution: 67% entering, 33% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.52	0.18 - 1.24	0.75

Data Plot and Equation



Land Use: 820

Shopping Center

Description

A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. Specialty retail center (Land Use 826) and factory outlet center (Land Use 823) are related uses.

Additional Data

Shopping centers, including neighborhood centers, community centers, regional centers and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs and recreational facilities (for example, ice skating rinks or indoor miniature golf courses). The centers ranged in size from 1,700 to 2.2 million square feet gross leasable area (GLA). The centers studied were located in suburban areas throughout the United States and, therefore, represent typical U.S. suburban conditions.

Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied included peripheral buildings, it can be assumed that some of the data show their effect.

The vehicle trips generated at a shopping center are based upon the total GLA of the center. In cases of smaller centers without an enclosed mall or peripheral buildings, the GLA could be the same as the gross floor area of the building.

Separate equations have been developed for shopping centers during the Christmas shopping season. Plots were included for the weekday peak hour of adjacent street traffic and the Saturday peak hour of the generator.

Information on approximate hourly, monthly and daily variation in shopping center traffic is shown in Tables 1–3. It should be noted, however, that the information contained in these tables is based on a limited sample size. Therefore, caution should be exercised when applying the data. Also, some information provided in the tables may conflict with the results obtained by applying the average rate or regression equations. When this occurs, it is suggested that the results from the average rate or regression equations be used, as they are based on a larger number of studies.

Table 1 Hourly Variation in Shopping Center Traffic						
Time	Average Weekday^a		Average Saturday^b		Average Sunday^c	
	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic
6 a.m.–7 a.m.	0.8	0.3	0.2	0.2	0.2	0.1
7 a.m.–8 a.m.	2.0	0.9	0.9	0.4	0.4	0.3
8 a.m.–9 a.m.	3.1	1.2	2.7	1.0	0.9	0.5
9 a.m.–10 a.m.	5.5	2.0	5.5	2.2	1.7	1.1
10 a.m.–11 a.m.	7.0	4.3	8.6	4.8	3.8	2.5
11 a.m.–12 p.m.	8.4	6.2	10.8	7.5	10.0	4.6
12 p.m.–1 p.m.	9.4	8.3	11.8	9.3	15.1	7.9
1 p.m.–2 p.m.	8.2	8.6	12.1	10.3	16.7	12.0
2 p.m.–3 p.m.	7.7	8.9	11.8	11.8	15.8	14.7
3 p.m.–4 p.m.	7.8	8.8	10.7	12.5	13.0	15.6
4 p.m.–5 p.m.	8.0	8.9	8.8	12.5	9.4	15.8
5 p.m.–6 p.m.	8.4	9.2	5.3	11.3	5.1	13.0
6 p.m.–7 p.m.	8.0	7.5	3.3	6.7	2.3	4.6
7 p.m.–8 p.m.	7.9	7.2	2.7	2.9	1.7	1.9
8 p.m.–9 p.m.	4.3	7.7	1.8	2.2	1.1	1.3
9 p.m.–10 p.m.	1.8	7.2	1.0	1.6	0.7	1.1
10 p.m.–6 a.m.	1.7	2.8	2.0	2.8	2.1	3.0

Sites ranged in size from 11,000 to 1,750,000 square feet gross leasable area

^a Source numbers – 13, 73, 88, 190, 217, 220, 225 and 376; based on ten studies

^b Source numbers – 13, 73, 88, 190, 220, 225 and 376; based on nine studies

^c Source numbers – 13, 73, 88, 190, 220 and 225; based on eight studies

Table 2 Daily Variation in Shopping Center Traffic Percentage of Average Weekday Volume (Monday through Friday)				
Day	Less than 100,000 Square Feet GLA	100,000 to 300,000 Square Feet GLA	More than 300,000 Square Feet GLA	Discount Center
Sunday	45.2	65.4	77.4	82.1
Monday	97.3	96.8	96.8	95.1
Tuesday	92.9	103.1	97.1	91.4
Wednesday	92.7	99.1	93.6	94.8
Thursday	98.2	85.3	97.1	99.5
Friday	118.9	108.7	115.4	119.2
Saturday	128.5	113.4	128.0	151.0
Sample Size	6	8	17	2

Source numbers: 88, 124

Table 3 Monthly Variation in Shopping Center Traffic Percentage of Average Month			
Month	Percentage	Month	Percentage
January	85.3	July	100.8
February	78.1	August	102.1
March	92.0	September	94.8
April	93.2	October	98.9
May	105.4	November	101.5
June	106.0	December	141.8

Sample size: 2

Average gross leasable area: 938,000 square feet

The sites were surveyed between the 1960s and the 2000s throughout the United States and Canada.

Specialized Land Use Data

Two studies provided data on outdoor shopping centers in Illinois and Alberta, Canada. The trip generation characteristics of these sites varied from the other stores in this land use; therefore, the information collected for these facilities is presented in the following tables and was excluded from the data plots.

<u>Independent Variable</u>	<u>Average Trip Generation Rate</u>	<u>Size of Independent Variable</u>	<u>Number of Studies</u>	<u>Directional Distribution</u>
1,000 Square Feet Gross Leasable Area				
Weekday	66.64	797	2	Not available
Weekday A.M. Peak Hour of Adjacent Street Traffic	3.27	797	2	Not available
Weekday P.M. Peak Hour of Adjacent Street Traffic	5.46	797	2	Not available

Sources: 446, 702

Source Numbers

1, 2, 3, 4, 5, 6, 13, 14, 18, 19, 22, 26, 40, 42, 48, 49, 54, 59, 60, 61, 64, 65, 72, 73, 75, 76, 77, 78, 79, 87, 89, 90, 98, 99, 100, 105, 110, 124, 156, 159, 172, 186, 193, 194, 195, 196, 197, 198, 199, 202, 204, 211, 213, 260, 263, 269, 295, 299, 300, 301, 304, 305, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 358, 365, 376, 385, 390, 400, 404, 414, 420, 423, 428, 437, 440, 442, 444, 446, 507, 562, 563, 580, 598, 629, 658, 702, 715, 728

Shopping Center (820)

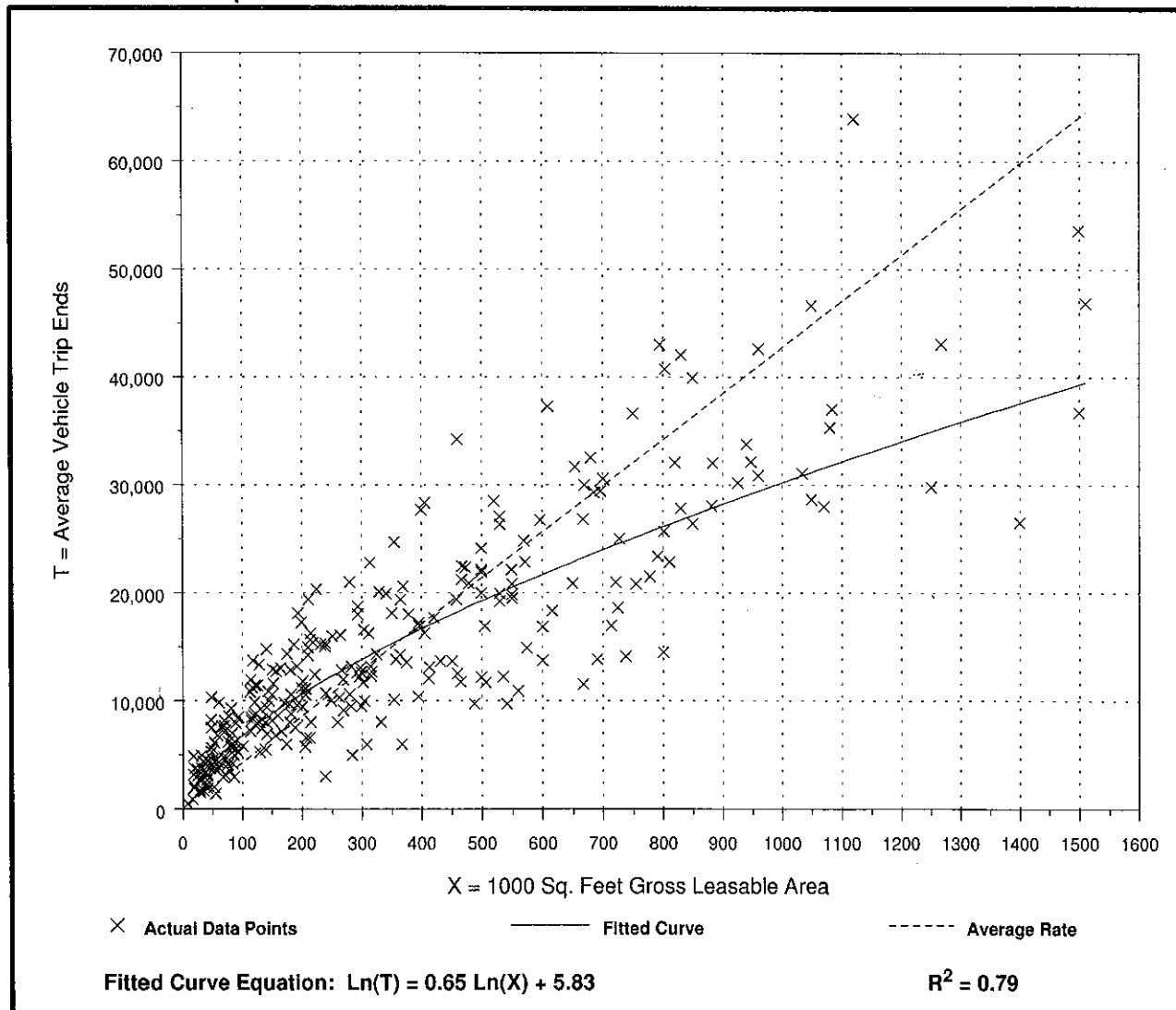
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday

Number of Studies: 302
Average 1000 Sq. Feet GLA: 331
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
42.70	12.50 - 270.89	21.25

Data Plot and Equation



Shopping Center (820)

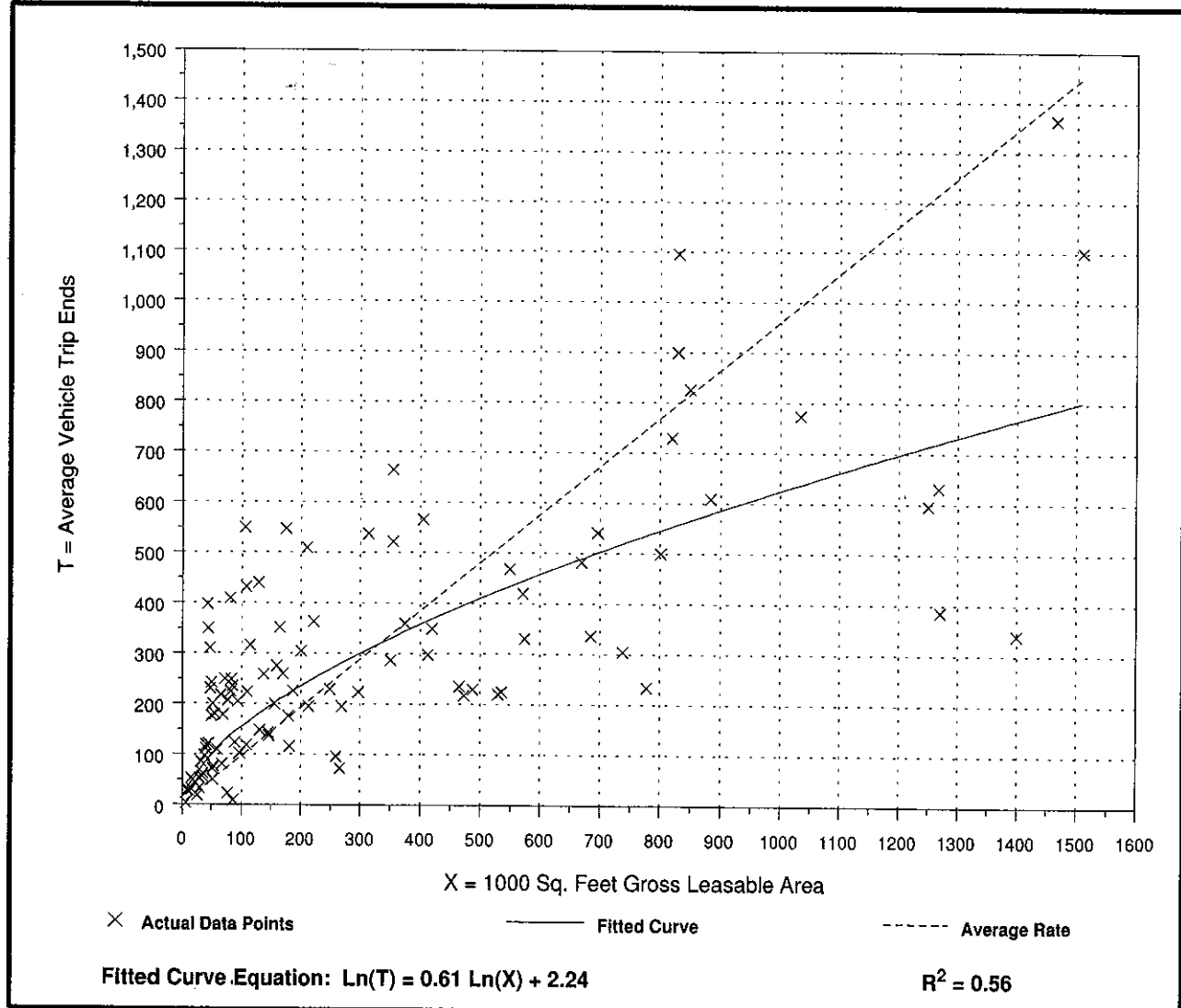
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 104
 Average 1000 Sq. Feet GLA: 310
 Directional Distribution: 62% entering, 38% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
0.96	0.10 - 9.05	1.31

Data Plot and Equation



Shopping Center (820)

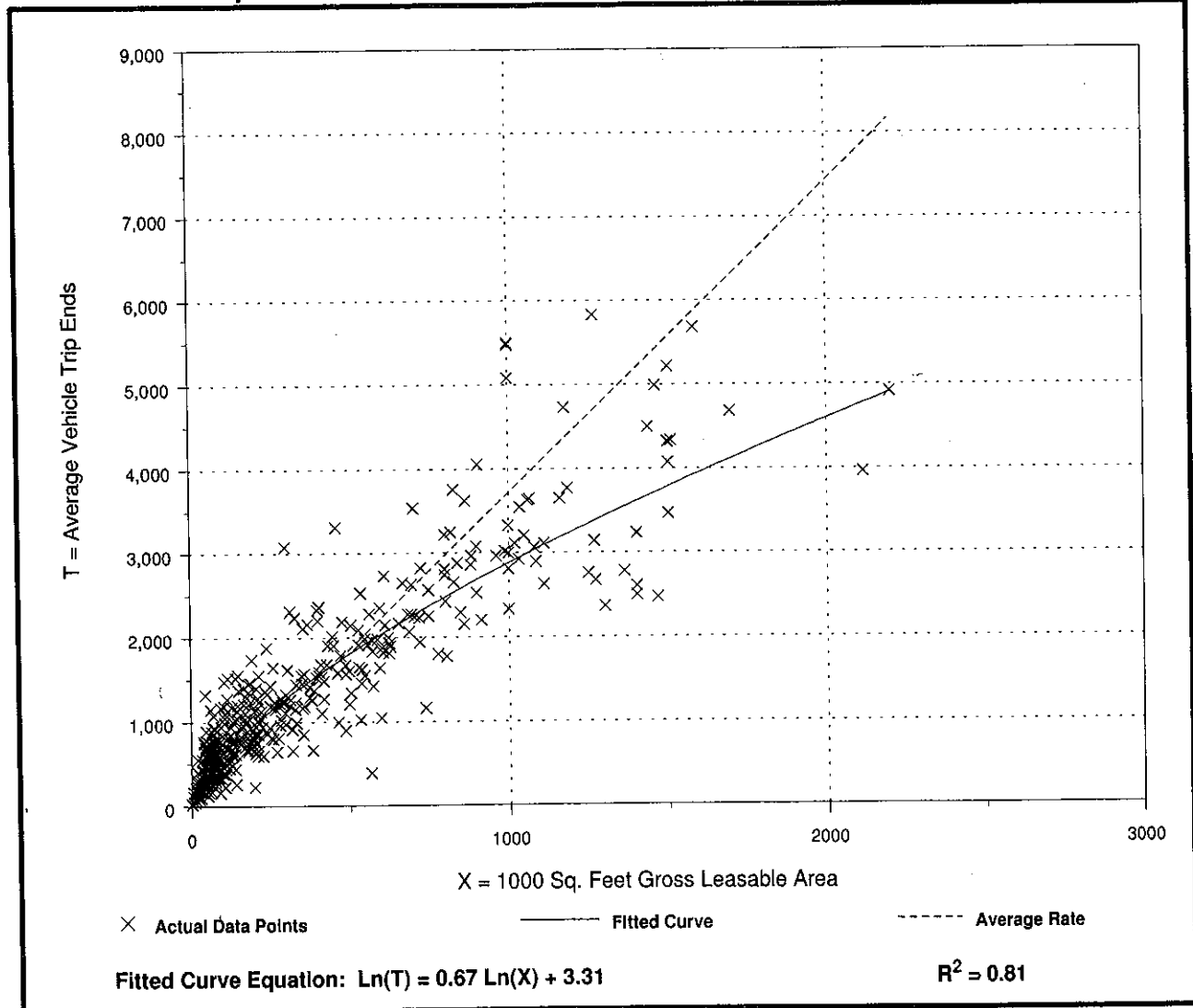
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 426
 Average 1000 Sq. Feet GLA: 376
 Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
3.71	0.68 - 29.27	2.74

Data Plot and Equation



Land Use: 710

General Office Building

Description

A general office building houses multiple tenants; it is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services, insurance companies, investment brokers and tenant services, such as a bank or savings and loan institution, a restaurant or cafeteria and service retail facilities. Corporate headquarters building (Land Use 714), single tenant office building (Land Use 715), office park (Land Use 750), research and development center (Land Use 760) and business park (Land Use 770) are related uses.

If information is known about individual buildings, it is suggested that the general office building category be used rather than office parks when estimating trip generation for one or more office buildings in a single development. The office park category is more general and should be used when a breakdown of individual or different uses is not known. If the general office building category is used and if additional buildings, such as banks, restaurants, or retail stores, are included in the development, the development should be treated as a multiuse project. On the other hand, if the office park category is used, internal trips are already reflected in the data and do not need to be considered.

When the buildings are interrelated (defined by shared parking facilities or the ability to easily walk between buildings) or house one tenant, it is suggested that the total area or employment of all the buildings be used for calculating the trip generation. When the individual buildings are isolated and not related to one another, it is suggested that trip generation be calculated for each building separately and then summed.

Additional Data

Average weekday transit trip ends—

Transit service was either nonexistent or negligible at the majority of the sites surveyed in this land use. Users may wish to modify trip generation rates presented in this land use to reflect the presence of public transit, carpools and other transportation demand management (TDM) strategies. Information has not been analyzed to document the impacts of TDM measures on the total trip generation of a site. See the *ITE Trip Generation Handbook*, Second Edition for additional information on this topic.

The average building occupancy varied considerably within the studies for which occupancy data were provided. For buildings with occupancy rates reported, the average occupied gross leasable area was 88 percent.

Some of the regression curves plotted for this land use may produce illogical trip-end estimates for small office buildings. When the proposed site size is significantly smaller than the average-sized facility published in this report, caution should be used when applying these statistics. For more information, please refer to Chapter 3, "Guidelines for Estimating Trip Generation," of the *ITE Trip Generation Handbook*, Second Edition.

In some regions, peaking may occur earlier or later and may last somewhat longer than the traditional 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. peak period time frames.

The sites were surveyed between the 1960s and the 2000s throughout the United States.

Trip Characteristics

The trip generation for the A.M. and P.M. peak hours of the generator typically coincided with the peak hours of the adjacent street traffic; therefore, only one A.M. peak hour and one P.M. peak hour, which represent both the peak hour of the generator and the peak hour of the adjacent street traffic, are shown for general office buildings.

Source Numbers

2, 5, 20, 21, 51, 53, 54, 72, 88, 89, 92, 95, 98, 100, 159, 161, 172, 175, 178, 183, 184, 185, 189, 193, 207, 212, 217, 247, 253, 257, 260, 262, 279, 295, 297, 298, 300, 301, 302, 303, 304, 321, 322, 323, 324, 327, 404, 407, 408, 418, 419, 423, 562, 734

General Office Building (710)

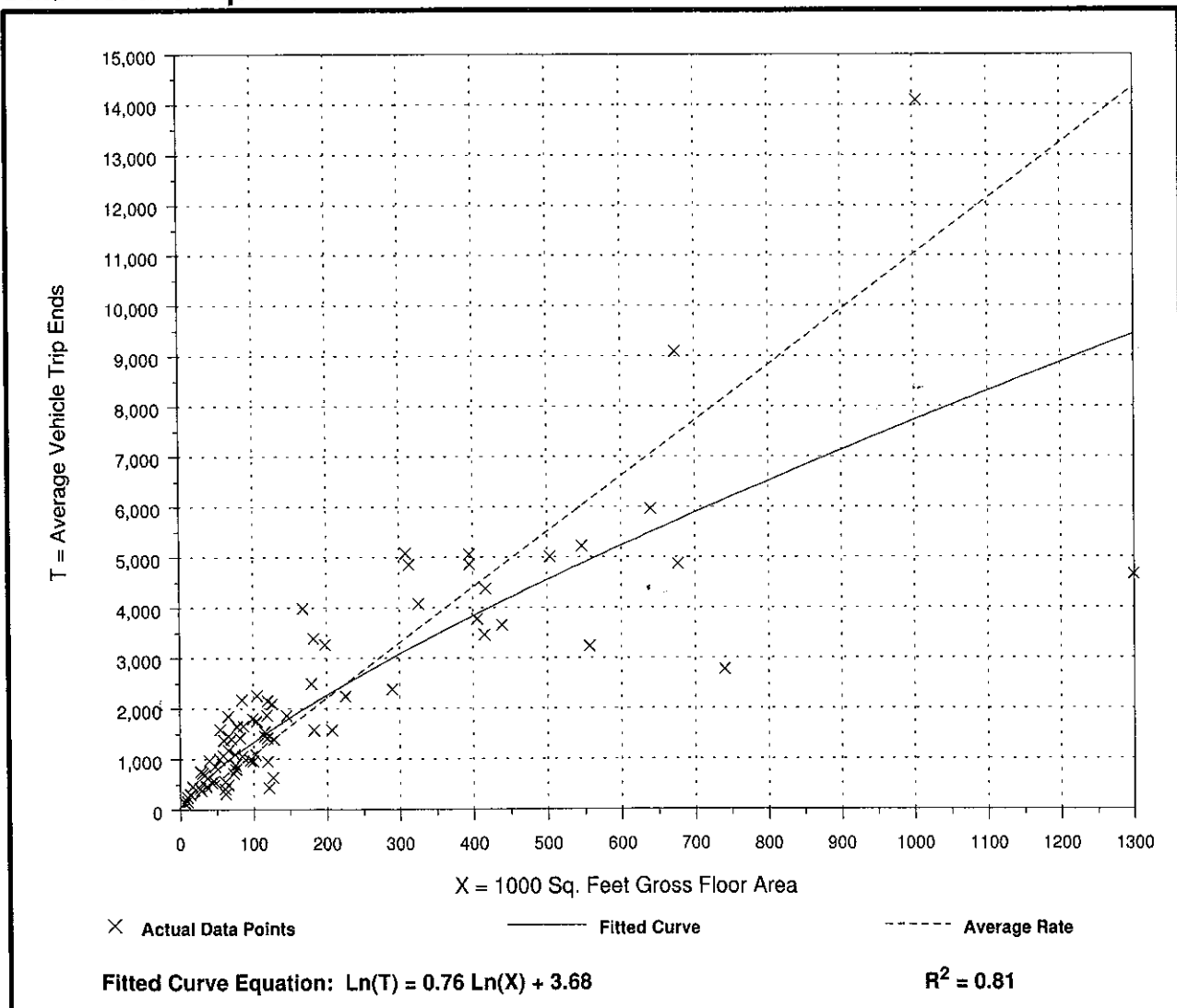
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

Number of Studies: 79
Average 1000 Sq. Feet GFA: 197
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
11.03	3.58 - 28.80	6.15

Data Plot and Equation



General Office Building (710)

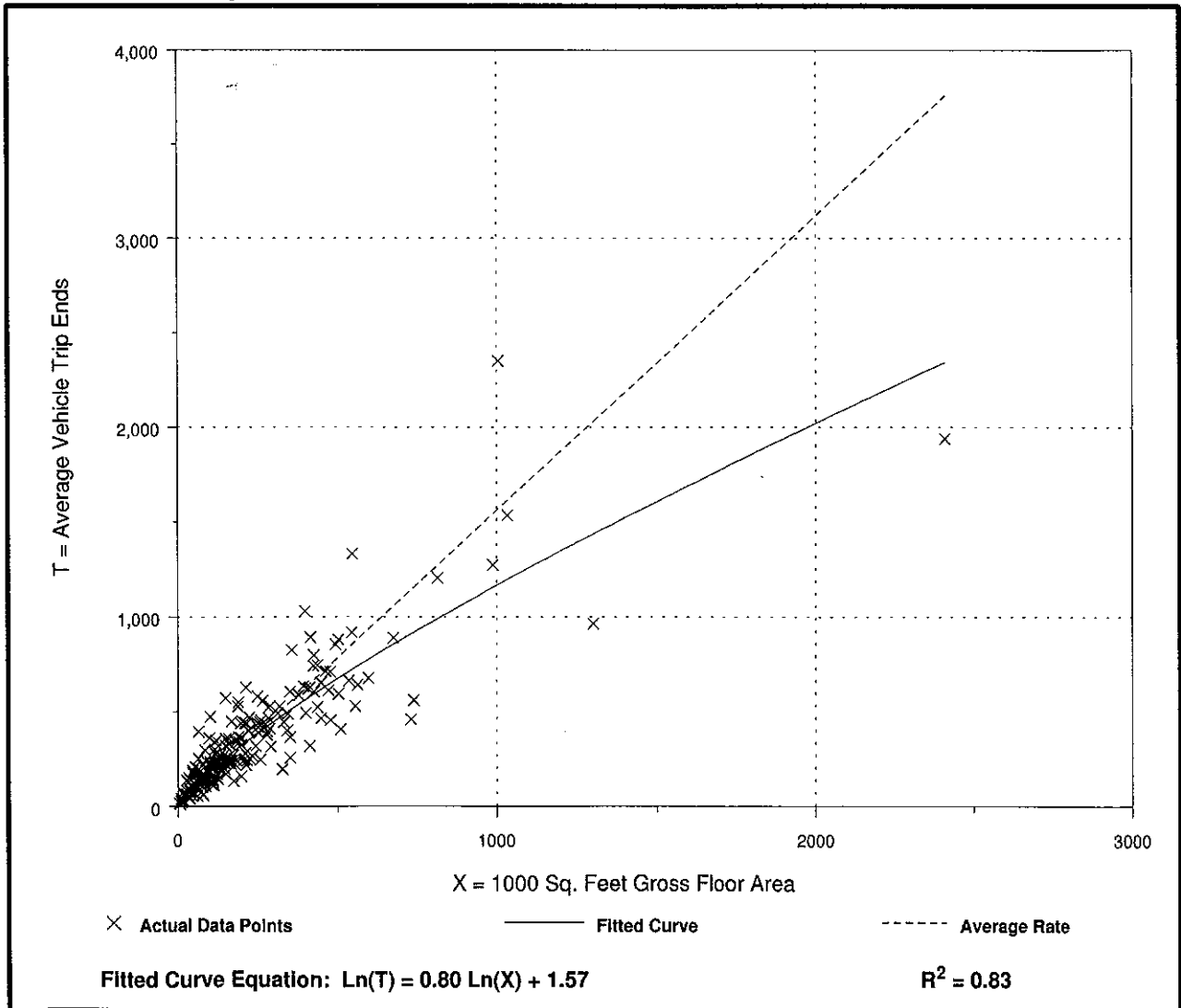
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
A.M. Peak Hour

Number of Studies: 218
 Average 1000 Sq. Feet GFA: 222
 Directional Distribution: 88% entering, 12% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.56	0.60 - 5.98	1.40

Data Plot and Equation



General Office Building (710)

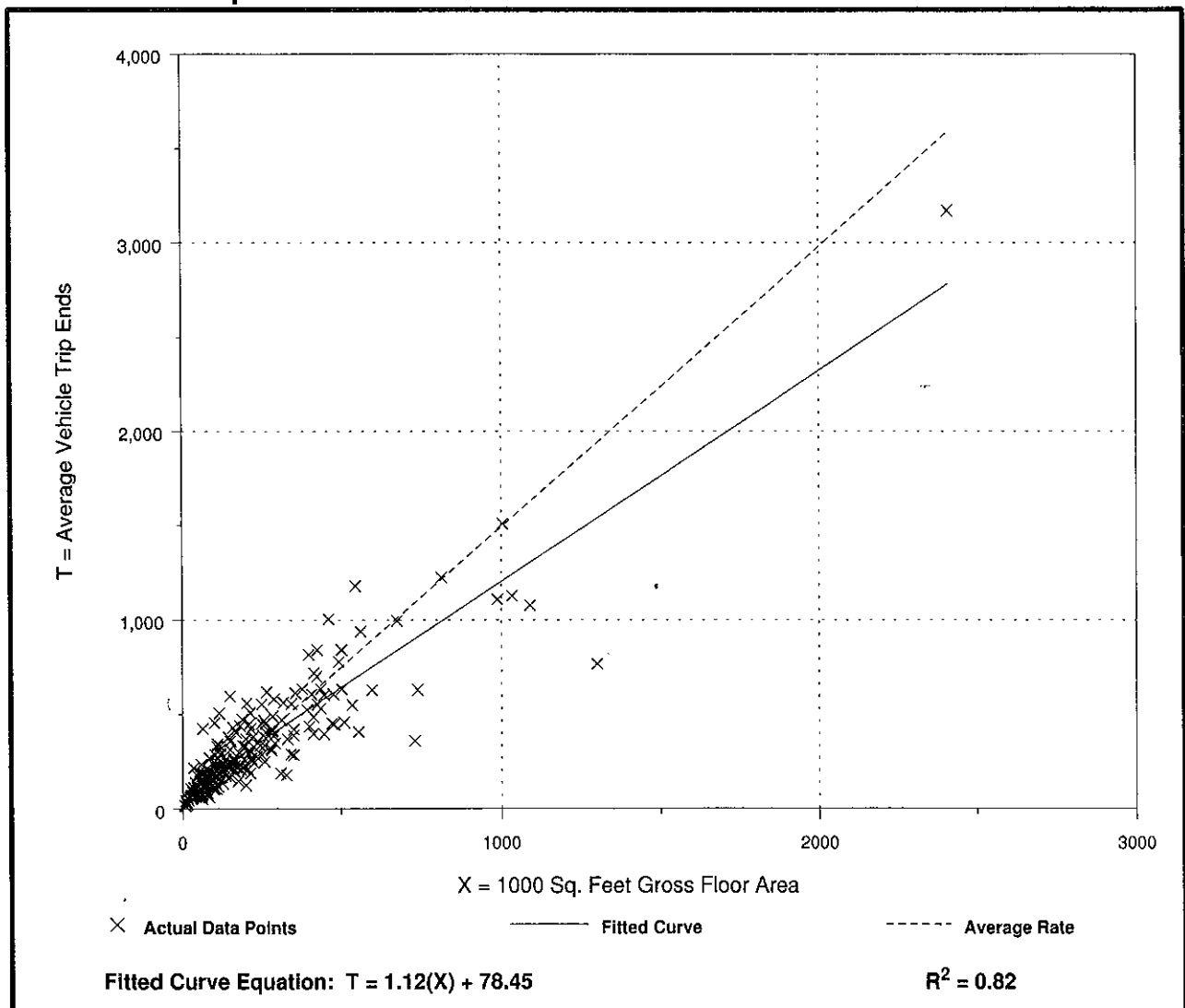
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
P.M. Peak Hour

Number of Studies: 236
Average 1000 Sq. Feet GFA: 215
Directional Distribution: 17% entering, 83% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.49	0.49 - 6.39	1.37

Data Plot and Equation



Land Use: 730

Government Office Building

Description

A government office building is an individual building containing either the entire function or simply one agency of a city, county, state, federal, or other governmental unit. This type of building differs from a government office complex (Land Use 733) in that it is not a group of buildings that are interconnected by pedestrian walkways.

Additional Data

Peak hours of the generator—

The weekday A.M. peak hour typically coincided with the peak hour of the adjacent street traffic.

The weekday P.M. peak hour was between 1:00 p.m. and 2:00 p.m.

The sites were surveyed in 1970 and 2002 in California and Oregon, respectively. Two of the sites were city halls.

Source Numbers

11, 579

Land Use: 730

Government Office Building

Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

<u>Independent Variable</u>	<u>Average Trip Generation Rate</u>	<u>Size of Independent Variable</u>	<u>Number of Studies</u>	<u>Directional Distribution</u>
Employees				
Weekday	11.95	102	1	50% entering, 50% exiting
Weekday A.M. Peak Hour of Adjacent Street Traffic	1.02	102	1	84% entering, 16% exiting
Weekday A.M. Peak Hour of Generator	1.02	102	1	84% entering, 16% exiting
Weekday P.M. Peak Hour of Generator	1.91	102	1	74% entering, 26% exiting

1,000 Square Feet Gross Floor Area				
Weekday	68.93	18	1	50% entering, 50% exiting
Weekday A.M. Peak Hour of Adjacent Street Traffic	5.88	18	1	84% entering, 16% exiting
Weekday A.M. Peak Hour of Generator	5.88	18	1	84% entering, 16% exiting
Weekday P.M. Peak Hour of Generator	11.03	18	1	74% entering, 26% exiting

Government Office Building (730)

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.

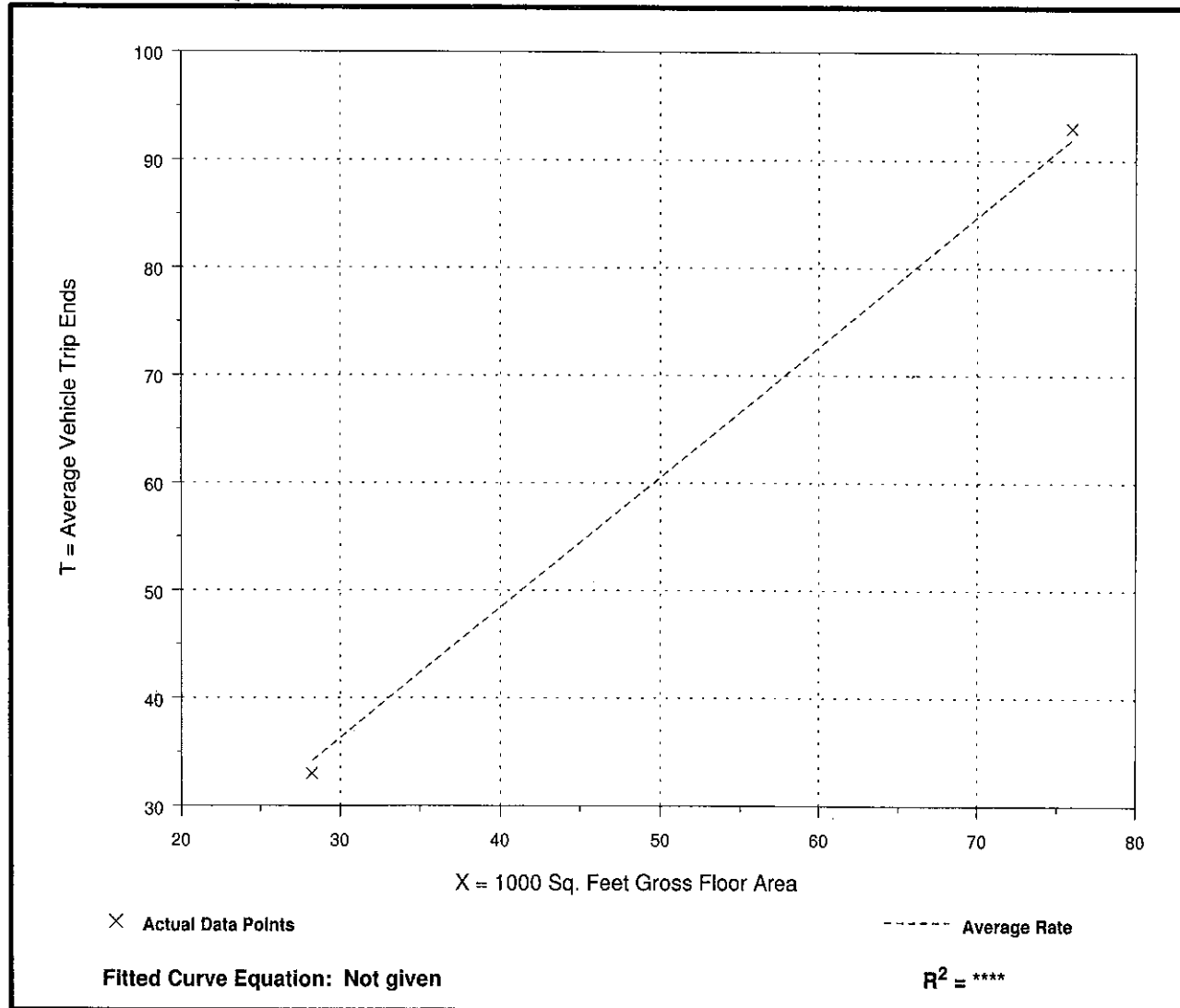
Number of Studies: 2
Average 1000 Sq. Feet GFA: 52
Directional Distribution: 31% entering, 69% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.21	1.17 - 1.22	*

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Land Use: 411

City Park

Description

City parks are owned and operated by a city. The city parks surveyed vary widely as to location, type and number of facilities, including boating or swimming facilities, ball fields, soccer fields, camp-sites and picnic facilities. Seasonal use of the individual sites differs widely as a result of the varying facilities and local conditions, such as weather. For example, some of the sites are used primarily for boating or swimming; others are used for softball games. Soccer complex (Land Use 488) is a related use.

Additional Data

The percentage of the park area that is used most intensively varies considerably within the studies contained in this land use; therefore, caution should be used when using acres as an independent variable.

The sites were surveyed in the 1970s and the 2000s, primarily in California and Arizona.

Source Numbers

13, 18, 214, 709

Land Use: 411 City Park

Independent Variables with One Observation

The following trip generation data are for independent variables with only one observation. This information is shown in this table only; there are no related plots for these data.

Users are cautioned to use data with care because of the small sample size.

<u>Independent Variable</u>	<u>Trip Generation Rate</u>	<u>Size of Independent Variable</u>	<u>Number of Studies</u>	<u>Directional Distribution</u>
Acres				
Weekday A.M. Peak Hour of Adjacent Street Traffic	4.50	4	1	56% entering, 44% exiting
Weekday P.M. Peak Hour of Adjacent Street Traffic	3.50	4	1	57% entering, 43% exiting
Weekday A.M. Peak Hour of Generator	4.50	4	1	50% entering, 50% exiting
Weekday P.M. Peak Hour of Generator	4.50	4	1	61% entering, 39% exiting
Saturday	22.75	4	1	50% entering, 50% exiting
Saturday Peak Hour of Generator	4.50	4	1	50% entering, 50% exiting
Sunday Peak Hour of Generator	5.00	4	1	50% entering, 50% exiting

City Park (411)

Average Vehicle Trip Ends vs: Acres On a: Weekday

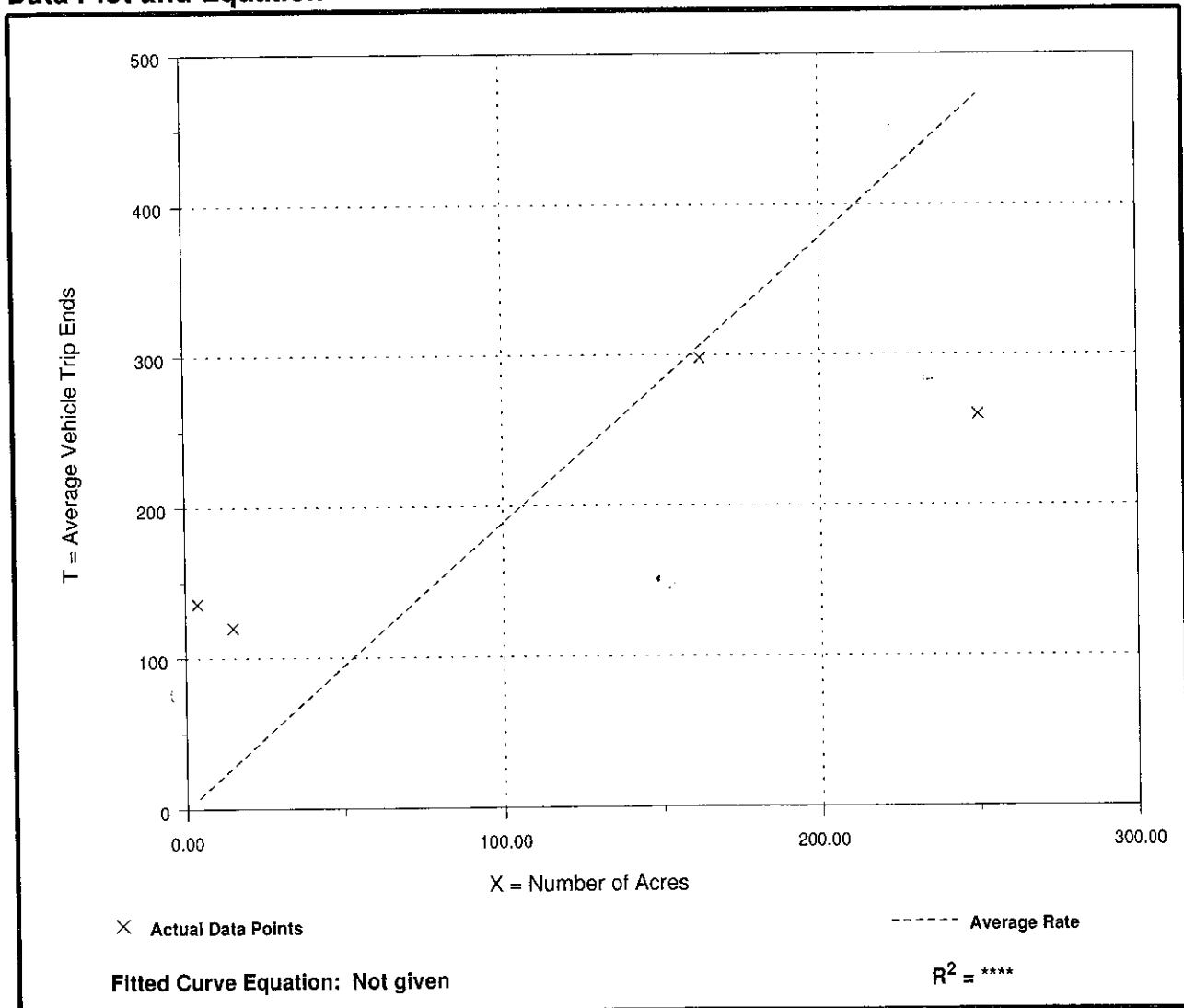
Number of Studies: 4
Average Number of Acres: 108
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Acre

Average Rate	Range of Rates	Standard Deviation
1.89	1.04 - 34.00	3.62

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Land Use: 520

Elementary School

Description

Elementary schools typically serve students attending kindergarten through the fifth or sixth grade. Elementary schools are usually centrally located in residential communities in order to facilitate student access and have no student drivers. This land use consists of schools where bus service is usually provided to students living beyond a specified distance from the school. Both public and private elementary schools are included in this land use. Middle school/junior high school (Land Use 522), high school (Land Use 530), private school (K-8) (Land Use 534) and private school (K-12) (Land Use 536) are related uses.

Additional Data

Average weekday transit trip ends—

Elementary school students generally used school buses more than regular transit and were dropped off and picked up more than high school students, who were apt to walk longer distances, ride bicycles, or, in some cases, drive to school. The percentage of students at the sites who were transported to school via bus varied considerably. Some sites experienced higher than average trip rates because many students did not utilize the available school bus service. Due to the varied transit and school bus usage at these sites, it is desirable that future studies report additional detail on the percentage of students who were bused to school and the percentage that were dropped off and picked up.

The elementary schools surveyed exhibited significant variations in terms of facilities provided. Because the ratio of floor space to student population varied widely among the schools surveyed, the number of students may be a more reliable independent variable on which to establish trip generation rates.

Peak hours of the generator—

The weekday A.M. peak hour of the generator typically coincided with the peak hour of the adjacent street traffic; therefore, only one A.M. peak hour, which represents both the peak hour of the generator and the peak hour of the adjacent street traffic, is displayed. The weekday P.M. peak hour varied between 2:00 p.m. and 4:00 p.m.

The sites were surveyed between the mid-1970s and the 2000s throughout the United States and Canada.

Many of the studies included in this land use did not indicate if the sites surveyed were public, private, or charter schools. To assist in the future analysis of this land use, it is important that this information be collected and included in trip generation data submissions.

Source Numbers

7, 32, 86, 186, 383, 390, 395, 444, 533, 536, 572, 579, 583, 609, 611, 612, 613, 632, 707

Elementary School (520)

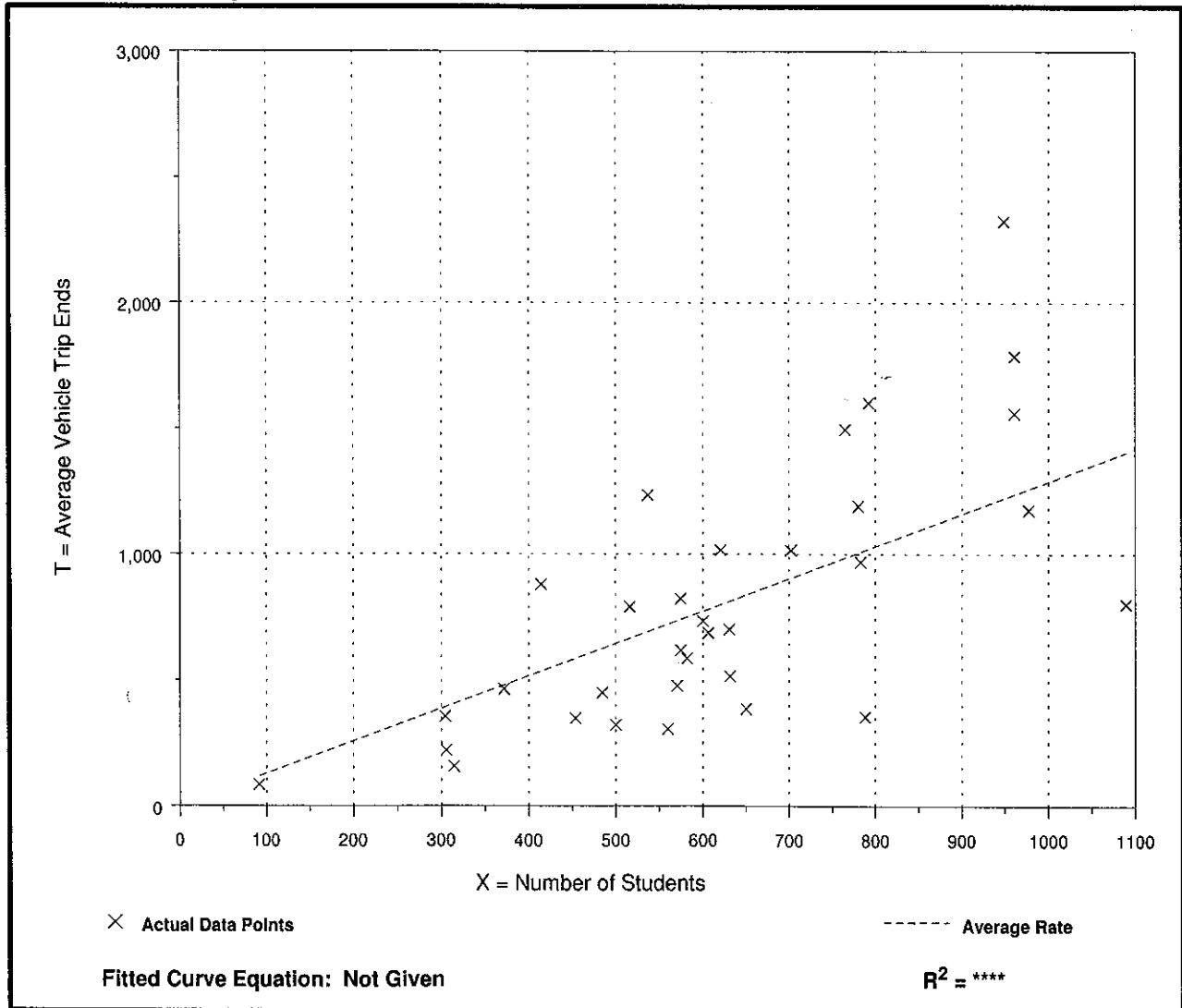
Average Vehicle Trip Ends vs: Students On a: Weekday

Number of Studies: 33
Average Number of Students: 620
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
1.29	0.45 - 2.45	1.26

Data Plot and Equation



Elementary School (520)

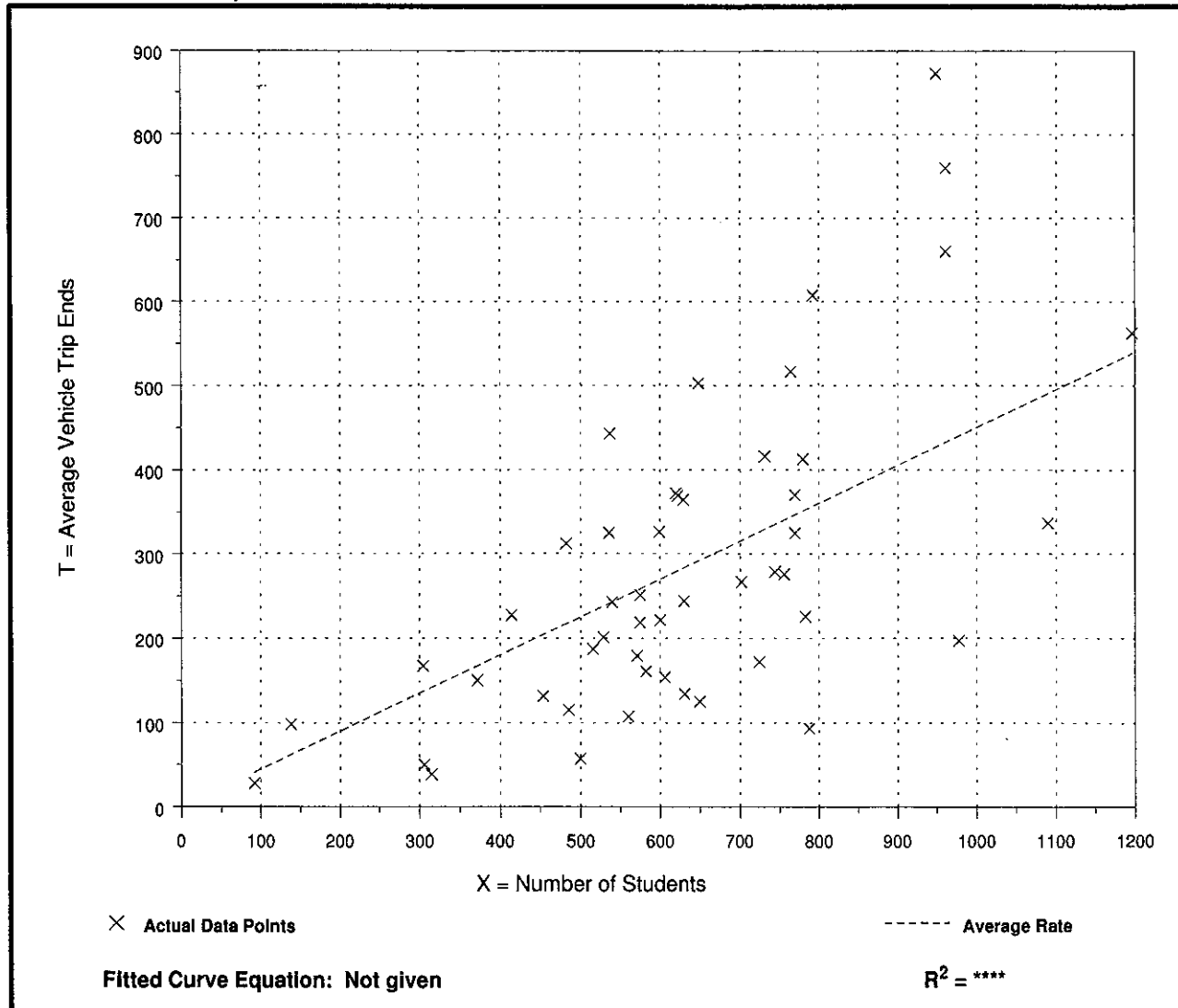
Average Vehicle Trip Ends vs: Students
On a: Weekday,
A.M. Peak Hour

Number of Studies: 49
 Average Number of Students: 630
 Directional Distribution: 55% entering, 45% exiting

Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.45	0.11 - 0.92	0.70

Data Plot and Equation



Elementary School (520)

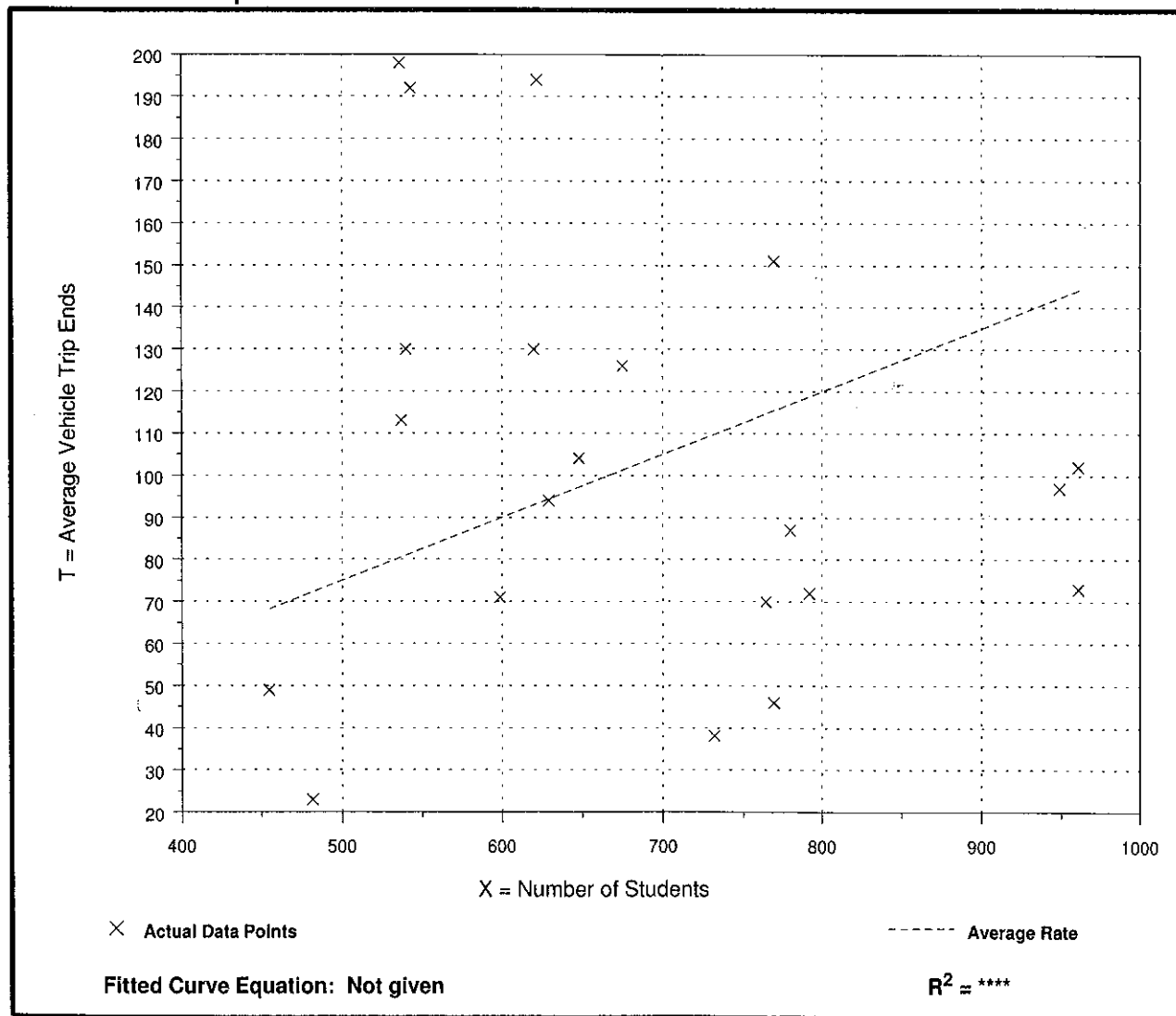
Average Vehicle Trip Ends vs: Students
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 21
 Average Number of Students: 684
 Directional Distribution: 49% entering, 51% exiting

Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.15	0.05 - 0.37	0.40

Data Plot and Equation



Land Use: 430

Golf Course

Description

Golf courses include 9-, 18-, 27- and 36-hole municipal courses. Some sites may also have driving ranges and clubhouses with a pro shop, restaurant, lounge and banquet facilities. Miniature golf course (Land Use 431), golf driving range (Land Use 432) and multipurpose recreational facility (Land Use 435) are related uses.

Additional Data

Most of the facilities were located in suburban areas; a few were in scenic, rural areas.

Information on approximate hourly variation in golf course traffic is shown in table below. It should be noted, however, that the information contained in this table is based on a limited sample size. Therefore, caution should be exercised when applying the data. Also, some information provided in the tables may conflict with the results obtained by applying the average rate or regression equations. When this occurs, it is suggested that the results from the average rate or regression equations be used, as they are based on a larger number of studies.

Land Use: 430 Golf Course

Hourly Variation in Golf Course Traffic						
Time	Average Weekday		Average Saturday		Average Sunday	
	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic	Percent of 24-Hour Entering Traffic	Percent of 24-Hour Exiting Traffic
6 a.m.–7 a.m.	4.8	0.5	6.8	0.8	5.4	0.6
7 a.m.–8 a.m.	6.3	1.3	7.7	1.6	7.0	0.8
8 a.m.–9 a.m.	7.4	2.2	8.0	2.6	7.3	2.4
9 a.m.–10 a.m.	9.5	3.6	8.9	5.6	8.0	3.5
10 a.m.–11 a.m.	8.3	4.9	8.4	6.3	7.7	7.4
11 a.m.–12 p.m.	8.7	6.8	7.5	6.1	8.5	8.2
12 p.m.–1 p.m.	10.2	8.8	6.4	7.6	9.1	7.9
1 p.m.–2 p.m.	8.2	9.4	7.5	7.9	8.8	8.3
2 p.m.–3 p.m.	6.5	9.5	6.8	8.7	7.4	9.2
3 p.m.–4 p.m.	7.1	10.1	6.8	9.0	7.7	9.5
4 p.m.–5 p.m.	7.2	8.9	8.1	8.2	6.0	9.9
5 p.m.–6 p.m.	5.7	9.1	4.4	12.2	4.8	9.4
6 p.m.–7 p.m.	4.0	9.3	5.1	7.6	3.7	7.5
7 p.m.–8 p.m.	2.9	7.6	1.8	5.9	2.1	8.0
8 p.m.–9 p.m.	1.2	5.6	1.0	4.4	0.9	4.2
9 p.m.–10 p.m.	0.3	1.5	0.2	1.3	0.2	1.1
10 p.m.–6 a.m.	1.7	0.9	4.6	4.2	5.4	2.2

Table based on data from three study sites; two sites had 18 holes and one site had 36 holes

Source numbers—18 and 89

The sites were surveyed between the late 1960s and the 2000s throughout the United States.

Source Numbers

7, 11, 12, 13, 18, 98, 102, 214, 378, 407, 440, 629, 729

Golf Course (430)

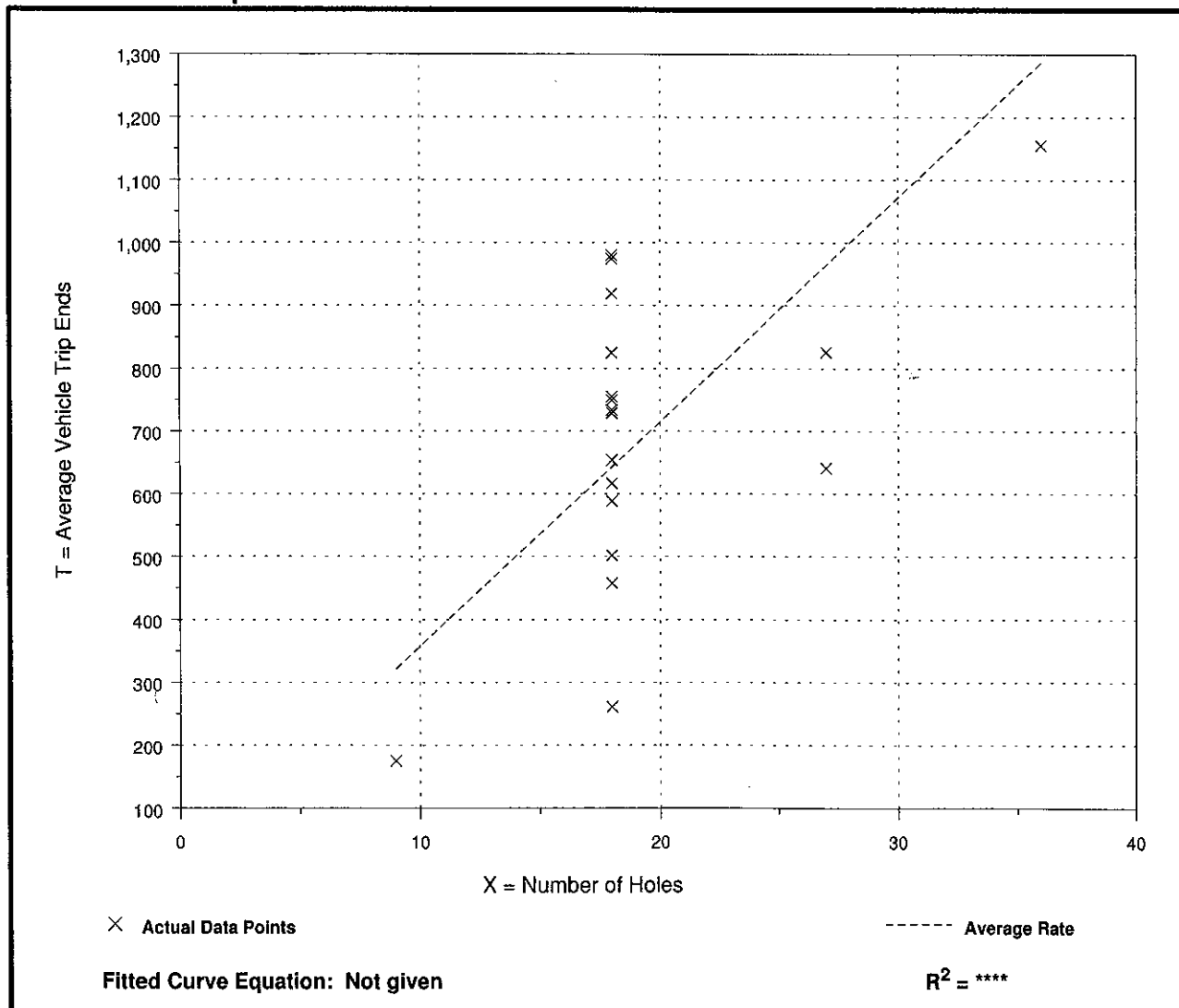
Average Vehicle Trip Ends vs: Holes On a: Weekday

Number of Studies: 18
Average Number of Holes: 20
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Hole

Average Rate	Range of Rates	Standard Deviation
35.74	14.50 - 54.44	12.12

Data Plot and Equation



Golf Course (430)

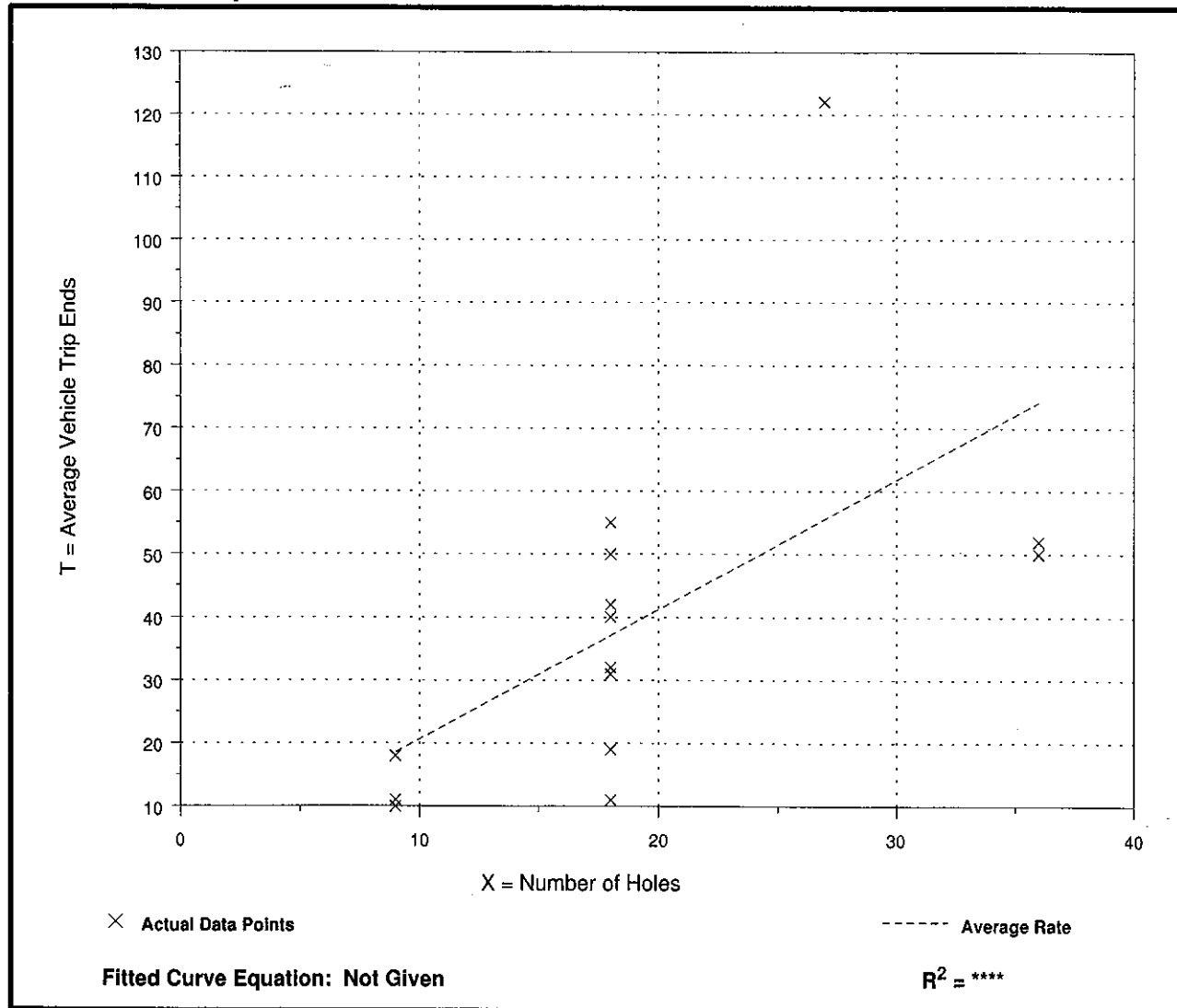
Average Vehicle Trip Ends vs: Holes
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 15
 Average Number of Holes: 19
 Directional Distribution: 79% entering, 21% exiting

Trip Generation per Hole

Average Rate	Range of Rates	Standard Deviation
2.06	0.61 - 4.52	1.74

Data Plot and Equation



Golf Course (430)

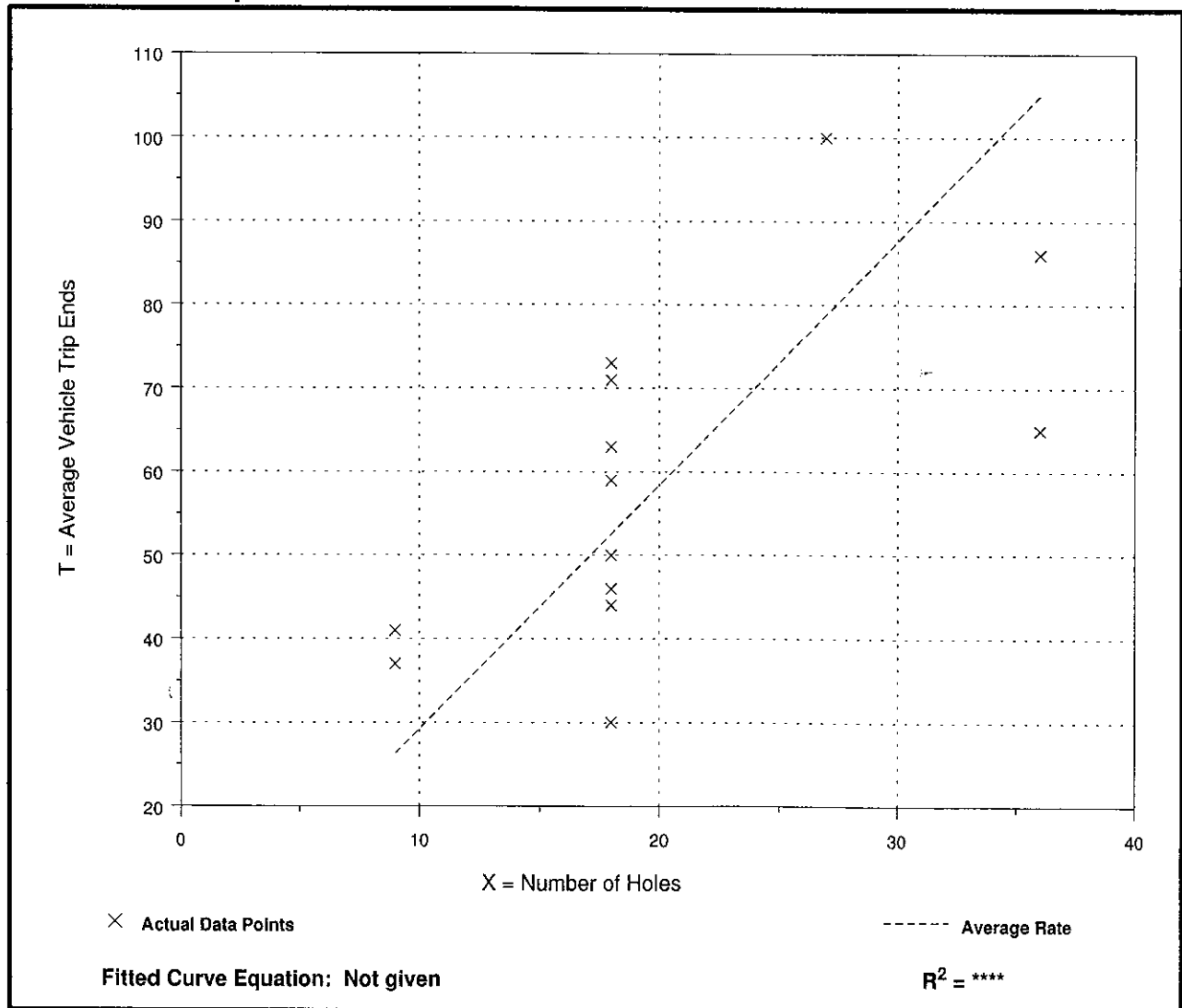
Average Vehicle Trip Ends vs: Holes
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 14
 Average Number of Holes: 20
 Directional Distribution: 51% entering, 49% exiting

Trip Generation per Hole

Average Rate	Range of Rates	Standard Deviation
2.92	1.67 - 4.56	1.86

Data Plot and Equation



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**Table 6.1 Unconstrained Internal Person Trip Capture Rates
for Trip Origins within a Mixed-Use Development**

		WEEKDAY	
		AM Peak Hour	PM Peak Hour
From OFFICE	To Retail	28%	20%
	To Restaurant	63%	4%
	To Cinema/Entertainment	0%	0%
	To Residential	1%	2%
	To Hotel	0%	0%
From RETAIL	To Office	29%	2%
	To Restaurant	13%	29%
	To Cinema/Entertainment	0%	4%
	To Residential	14%	26%
	To Hotel	0%	5%
From RESTAURANT	To Office	31%	3%
	To Retail	14%	41%
	To Cinema/Entertainment	0%	8%
	To Residential	4%	18%
	To Hotel	3%	7%
From CINEMA/ENTERTAINMENT	To Office	0%	2%
	To Retail	0%	21%
	To Restaurant	0%	31%
	To Residential	0%	8%
	To Hotel	0%	2%
From RESIDENTIAL	To Office	2%	4%
	To Retail	1%	42%
	To Restaurant	20%	21%
	To Cinema/Entertainment	0%	0%
	To Hotel	0%	3%
From HOTEL	To Office	75%	0%
	To Retail	14%	16%
	To Restaurant	9%	68%
	To Cinema/Entertainment	0%	0%
	To Residential	0%	2%

Source: Bochner, B., K. Hooper, B. Sperry, and R. Dunphy. NCHRP Report 684: *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*. Washington, DC: Transportation Research Board, Tables 99 and 100, 2011.

**Table 6.2 Unconstrained Internal Person Trip Capture Rates
for Trip Destinations within a Mixed-Use Development**

		Weekday	
		AM Peak Hour	PM Peak Hour
To OFFICE	From Retail	4%	31%
	From Restaurant	14%	30%
	From Cinema/Entertainment	0%	6%
	From Residential	3%	57%
	From Hotel	3%	0%
To RETAIL	From Office	32%	8%
	From Restaurant	8%	50%
	From Cinema/Entertainment	0%	4%
	From Residential	17%	10%
	From Hotel	4%	2%
To RESTAURANT	From Office	23%	2%
	From Retail	50%	29%
	From Cinema/Entertainment	0%	3%
	From Residential	20%	14%
	From Hotel	6%	5%
To CINEMA/ENTERTAINMENT	From Office	0%	1%
	From Retail	0%	26%
	From Restaurant	0%	32%
	From Residential	0%	0%
	From Hotel	0%	0%
To RESIDENTIAL	From Office	0%	4%
	From Retail	2%	46%
	From Restaurant	5%	16%
	From Cinema/Entertainment	0%	4%
	From Hotel	0%	0%
To HOTEL	From Office	0%	0%
	From Retail	0%	17%
	From Restaurant	4%	71%
	From Cinema/Entertainment	0%	1%
	From Residential	0%	12%

Source: Bochner, B., K. Hooper, B. Sperry, and R. Dunphy. NCHRP Report 684: *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*. Washington, DC: Transportation Research Board, Tables 101 and 102, 2011.