HAYES ENGINEERING, INC.

Memorandum

To: Reading Community Planning and Development Commission
16 Lowell Street
Reading, Massachusetts

JOB #: REA-0387

From: William R. Bergeron, P.E.

Date: May 29, 2013

Subject: Traffic Information
Artis Senior Living of Reading
#1090-1100 Main Street, Reading, Ma. 01867

COMMONWEALTH OF MASSACHUSETTS
William R. Bergeron
CIVIL
No. 29484
REGISTERED PROFESSIONAL ENGINEER

William R. Bergeron P.E.
5/29/2013

INTRODUCTION

The purpose of this traffic information is to identify the potential traffic impacts of the proposed new Artis Senior Living facility at the existing Eric's Greenhouse site located at #1090 Main Street and an existing single family home located at #1100 Main Street located on the westerly sideline of Main Street (Route 28) approximately 500 feet northerly of Forest Street. The proposed new facility will replace all the existing structures on the two lots. The new building will consists of a 64 bed assisted living facility. It is anticipated that the two existing entrance and exit driveways servicing the greenhouse site will be adjusted for the proposed new use. The proposed new building is shown on the proposed Site Plan.

EXISTING CONDITIONS

Main Street (Route 28) is a public Massachusetts Highway Department controlled roadway, with two travel lanes in each direction. The roadway runs in a general north/south direction and is relatively level and straight. The posted speed limit is 40 MPH in each direction.

VEHICLE SPEEDS

Speed observations were conducted on Thursday, January 17, 2013, between 11:00 AM and 12:30 PM on a sunny, dry day, with temperatures in the mid 30s. There were no abnormal activities related to traffic in either direction during the observations. The observations made consisted of free-flowing vehicle speeds by traffic not encumbered by peak hour traffic and/or platooning effects that can occur.

The radar observations were taken in a concealed location at the existing site drive on Main Street to avoid the potential of adjusted normal driver speeds. One hundred readings were taken for each direction of travel. The results indicate the median speed for northbound traffic on Main Street was 38 MPH, with an 85th percentile speed of 45 MPH. The results for the southbound traffic on Main Street indicate a median speed of 41 MPH, with an 85th percentile speed of 45 MPH. (see attachment)

PROJECT-RELATED TRAFFIC

The proposed Aris Senior Living facility is a complex that provides residential settings that provide routine general protective oversight or assistance with activities necessary for independent living to mentally or physically limited persons. The facility will predominately care for Alzheimer's patients. Employees, visitors and delivery trucks make up most of the traffic to this type of facility. The peak hour of the traffic to and from the site is also typically does not coincide with the peak hour on the adjacent streets due to the shift times for the employees. The proposed replacement of the existing Nursery (Garden Center) and single family use to the 64 bed Aris Senior Living facility will result in a significant reduction in the traffic generation from the existing site. In order to estimate the existing and proposed traffic to be generated, the technical information available in "Trip Generation", by the Institute of Transportation Engineers, (ITE), 9th Edition, 2012; Land Use Code: 817 – Nursery (Garden Center) and Land Use Code: 210 –Single Family Detached Housing, was used for the existing site and Land Use Code: 254 Assisted Living was used for the proposed. The method and procedures of estimating the traffic generated by the new showroom using ITE data are shown in **TABLE I.**

TABLE I

ITE LAND USE CODE	AM (peak hour adjacent street)			PM (peak hour adjacent street)			ADT*
	IN	OUT	TOTAL	IN	OUT	TOTAL	
817 – Nursery (Garden Center)	10	9	19	26	27	53	533
210- Single Family Home	-	1	1	1	-	1	10
Total Existing	10	10	20	27	27	54	543
254- Assisted Living Total Proposed	8	4	12	9	10	19	175
Net Decrease	-2	-6	-8	-18	-17	-35	-368

*Average Daily Traffic

STOPPING SIGHT DISTANCE

Sight distance considerations are divided into two criteria: (1) Stopping Sight Distance (SSD) and (2) Intersection Sight Distance (ISD). Approach SSD is the distance required for an approaching vehicle to perceive and react accordingly to a driveway exiting vehicle or object.

Stopping sight distances used for design is the sum of two distances: (A) the distance a vehicle travels after the driver sees an object and begins breaking, and (B) the distance it travels during breaking, as calculated for wet level pavement. When the main roadway is either on an upgrade or downgrade, grade correction factors are applied. In this case, no adjustments were made for the Main Street roadway.

ISD is based upon a perception and reaction time, and time required to complete the desired exiting maneuver after the decision to do so have been made. Values for exiting ISD represent time required to turn left or right from a stop condition, to accelerate to the operating speed of the street without causing approaching vehicles to reduce speed by more than 70% of its initial/design speed, and, upon turning left, to clear the near half of the street without conflicting with vehicles approaching from the left having to reduce their speed by more than 70% of their initial/design speed. The ISD, therefore, is considered to enhance the operation of the major street traffic over and above the actual needs of the stopping sight distance that is needed for the safe operation of the intersection.

Approach SSD is far more important, as it represents the minimum distance required for safe stopping, while the exiting ISD criteria is based only upon acceptable speed reductions to the approaching traffic streams. As noted in ASSHTO, "If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions". Existing topographic mapping for the surrounding area, along with an in-field inspection on January 17, 2013, were used to identify the potential traffic safety problems that may be associated with the access driveways on Main Street. The available sight distances, as well as a review of the existing roadway conditions, were observed. The site visibility for the northbound and southbound approaches on Main Street is located at a straight section of Main Street with a relatively level section. The existing conditions will not be significantly changed with the minor driveway adjustments by the proposed new building construction.

The available stopping sight distances measured 14.5 feet back from the traveled way line are summarized in **TABLE II**. The Main Street southbound approach provides unobstructed sight distances of over 750 feet, and the northbound approach provides an unobstructed sight distance of over 550 feet. The results of the analysis indicate that all approach sight distances available exceed the recommended 85th percentile speeds observed by a significant amount.

TABLE II

Stopping Sight Distance
(Wet Pavement)

Location	Posted Speed *	85th Percentile Speed	Recommended SSD for Posted Speed	Recommended SSD for 85th Percentile Speed	Available Stopping Sight Distance
Main Street @ site drives					
Southbound approach	40 mph	45 mph	305 ft.	360 ft.	>750 ft.+
Northbound approach	40 mph	45 mph	305 ft.	360 ft.	>550 ft.+

* Posted speed limits.

CONCLUSIONS AND RECOMENDATIONS

The proposed new senior living facility to be located at #1090 and # 1010 Main will reduce the existing traffic from the site by a significant amount and will have little impact to the existing traffic conditions to and from the site and on Main Street. The adjusted entrance/exit driveways should have pavement markings added to delineate the entrance and exit lanes, as well as installing directional signs at both driveways to further enhance the operation of the driveways.

The site has been designed to provide for 36 on site parking spaces which is well beyond the number of spaces that will be needed. The new one way driveway provides full access for emergency vehicles to maneuver.

The study indicates that the required Stopping Sight Distance for the observed 85th percentile speeds is significantly exceeded by the available sight distances for both driveways under existing conditions. As noted in AASHTO, "If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions." The proximity of the site to the signalized Forest Street intersection with Main Street creates beneficial gaps in the Main Street traffic stream to assist with the turns into and out of the site.
Therefore, based upon the adjusted entrance and exit only access drives and the available sight distances, it is expected that little traffic impact will result on the adjacent roadways with the proposed reuse of this site.

SPEED SURVEY
PROJECT LOCATION: #1090 MAIN STREET, READING, MA.

PREPARED BY: WRB
JOB FILE #: REA-0387
DATE: 17-Jan-13

DAY OF WEEK: THURSDAY
TIME OF DAY: 11:00-12:30
WEATHER: 36 SUNNY DRY

VEHICLE TRAVEL DIRECTION: NORTHBOUND

SPEED MEASUREMENT NUMBER	SPEED* (m.p.h)	SPEED MEASUREMENT NUMBER	SPEED* (m.p.h)
1	41	51	42
2	36	52	36
3	33	53	43
4	39	54	42
5	41	55	33
6	40	56	32
7	37	57	32
8	37	58	35
9	38	59	41
10	42	60	37
11	44	61	33
12	38	62	45
13	38	63	40
14	34	64	40
15	42	65	39
16	36	66	41
17	44	67	38
18	31	68	42
19	41	69	41
20	37	70	32
21	38	71	44
22	38	72	37
23	40	73	42
24	36	74	33
25	45	75	35
26	38	76	43
27	45	77	36
28	49	78	41
29	32	79	35
30	32	80	36
31	45	81	38
32	45	82	38
33	37	83	36
34	37	84	36
35	35	85	33
36	42	86	37
37	37	87	43
38	43	88	35
39	50	89	37
40	37	90	44
41	37	91	35
42	38	92	37
43	38	93	41
44	41	94	42
45	40	95	41
46	48	96	46
47	37	97	40
48	36	98	47
49	38	99	40
50	39	100	36

85th PERCENTILE SPEED (m.p.h.): 45

ARITHMETIC MEAN SPEED (m.p.h.): 38.9

MEDIAN SPEED (m.p.h.): 38

VEHICLE TRAVEL DIRECTION: SOUTHBOUND

SPEED MEASUREMENT NUMBER	SPEED* (m.p.h)	SPEED MEASUREMENT NUMBER	SPEED* (m.p.h)
1	41	51	44
2	49	52	46
3	37	53	44
4	41	54	34
5	44	55	42
6	45	56	42
7	42	57	35
8	44	58	37
9	41	59	40
10	39	60	37
11	45	61	41
12	41	62	38
13	40	63	36
14	47	64	38
15	34	65	44
16	33	66	34
17	35	67	47
18	42	68	43
19	36	69	44
20	37	70	41
21	39	71	32
22	41	72	41
23	42	73	34
24	44	74	46
25	39	75	37
26	36	76	43
27	37	77	39
28	44	78	38
29	34	79	41
30	44	80	44
31	41	81	47
32	37	82	37
33	33	83	32
34	34	84	43
35	44	85	40
36	40	86	37
37	38	87	35
38	45	88	46
39	45	89	39
40	39	90	45
41	36	91	41
42	37	92	38
43	49	93	38
44	45	94	41
45	37	95	38
46	45	96	43
47	39	97	40
48	46	98	44
49	48	99	48
50	41	100	45

85th PERCENTILE SPEED (m.p.h.): 45

ARITHMETIC MEAN SPEED (m.p.h.): 40.5

MEDIAN SPEED (m.p.h.): 41

* SPEED MEASURED WITH HANDHELD RADAR

TRIP GENERATION MANUAL

9th Edition • Volume 3: Data

Trip Generation Rates, Plots and Equations

- Institutional (Land Uses 500–599)
- Medical (Land Uses 600–699)
- Office (Land Uses 700–799)
- Retail (Land Uses 800–899)
- Services (Land Uses 900–999)

Institute of Transportation Engineers

Land Use: 817
Nursery (Garden Center)

Description

A nursery or garden center is a free-standing building with an outside storage area for planting or landscape stock. The nurseries surveyed primarily serve the general public. Some have large greenhouses and offer landscaping services. Most have office, storage and shipping facilities. Nurseries are characterized by seasonal variations in trip characteristics. Nursery (Wholesale) (Land Use 818) is a related use.

Additional Data

Outside storage areas are not included in the overall gross floor area measurements. However, if storage areas are located within the principal outside faces of the exterior walls, they are included in the overall gross floor area of the building.

The sites were surveyed in the 1980s in California.

Source Numbers

205, 240

Nursery (Garden Center)
(817)

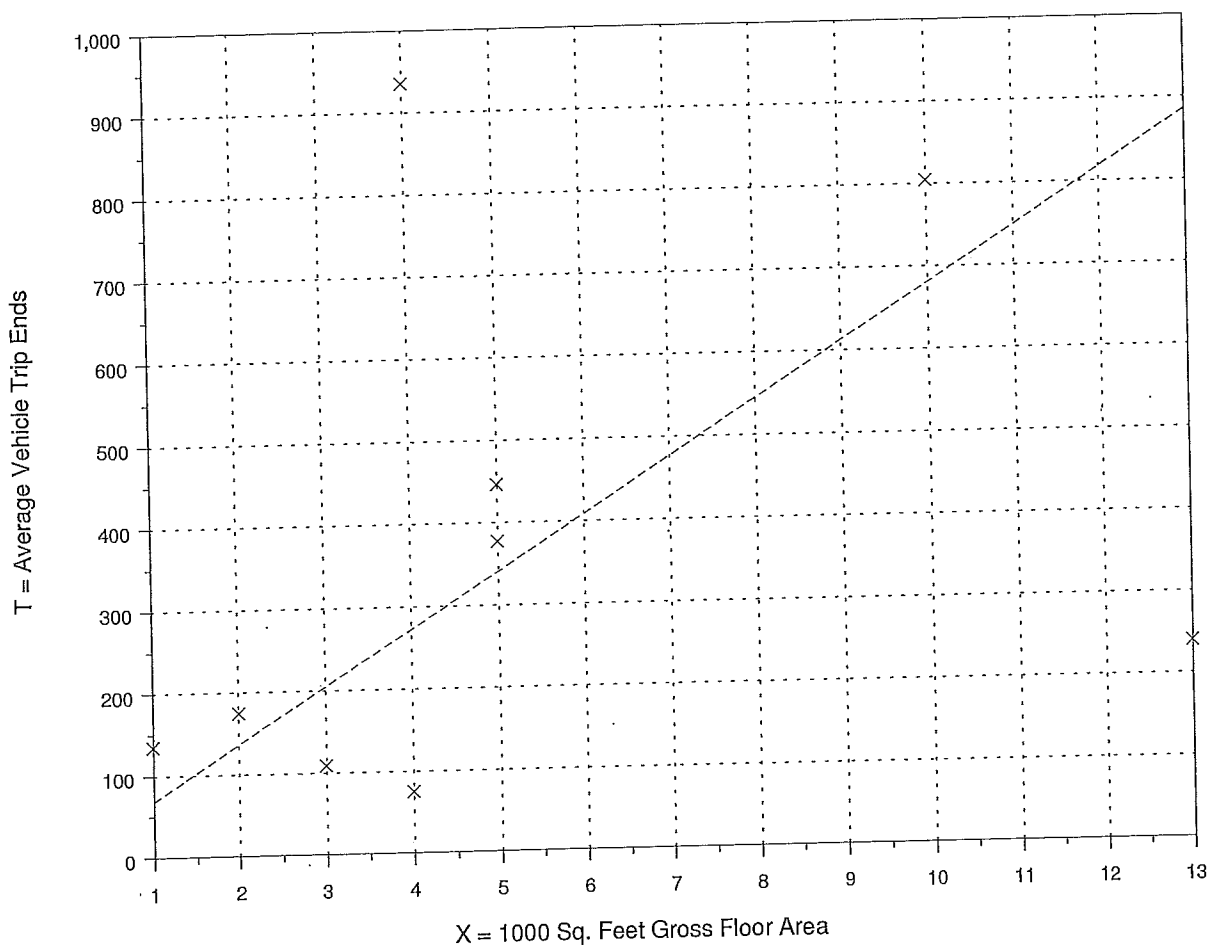
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday

Number of Studies: 10
Average 1000 Sq. Feet GFA: 5
Directional Distribution: 50% entering, 50% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
68.10	18.46 - 233.75	58.80

Data Plot and Equation



× Actual Data Points

------ Average Rate

Fitted Curve Equation: Not given

R^2 = ****

Nursery (Garden Center)
(817)

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

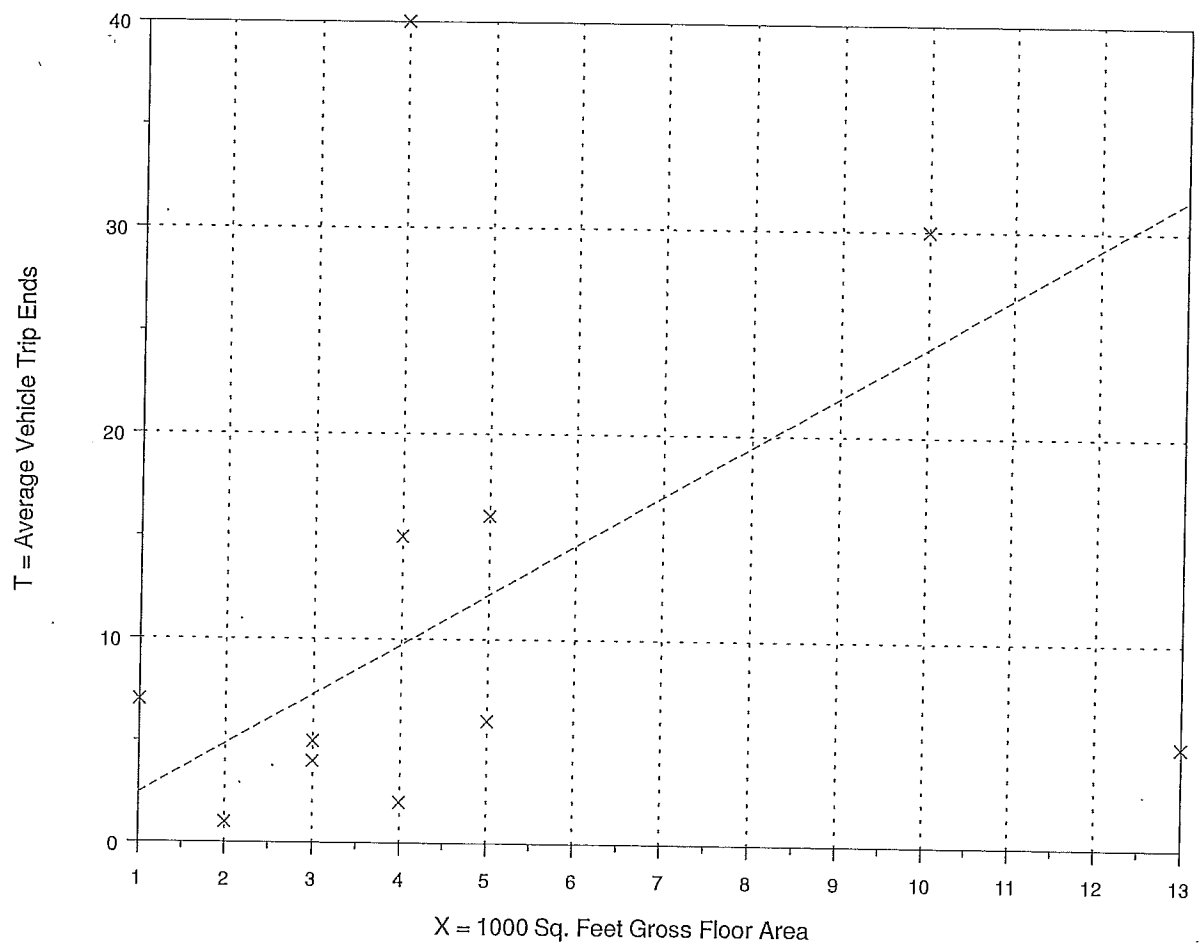
Number of Studies: 11
Average 1000 Sq. Feet GFA: 5
Directional Distribution: Not available

FROM PEAK HOUR INFORMATION
52% entering, 48% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.43	0.38 - 10.00	2.92

Data Plot and Equation



× Actual Data Points

------ Average Rate

Fitted Curve Equation: Not given

R^2 = ****

Nursery (Garden Center)
(817)

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.

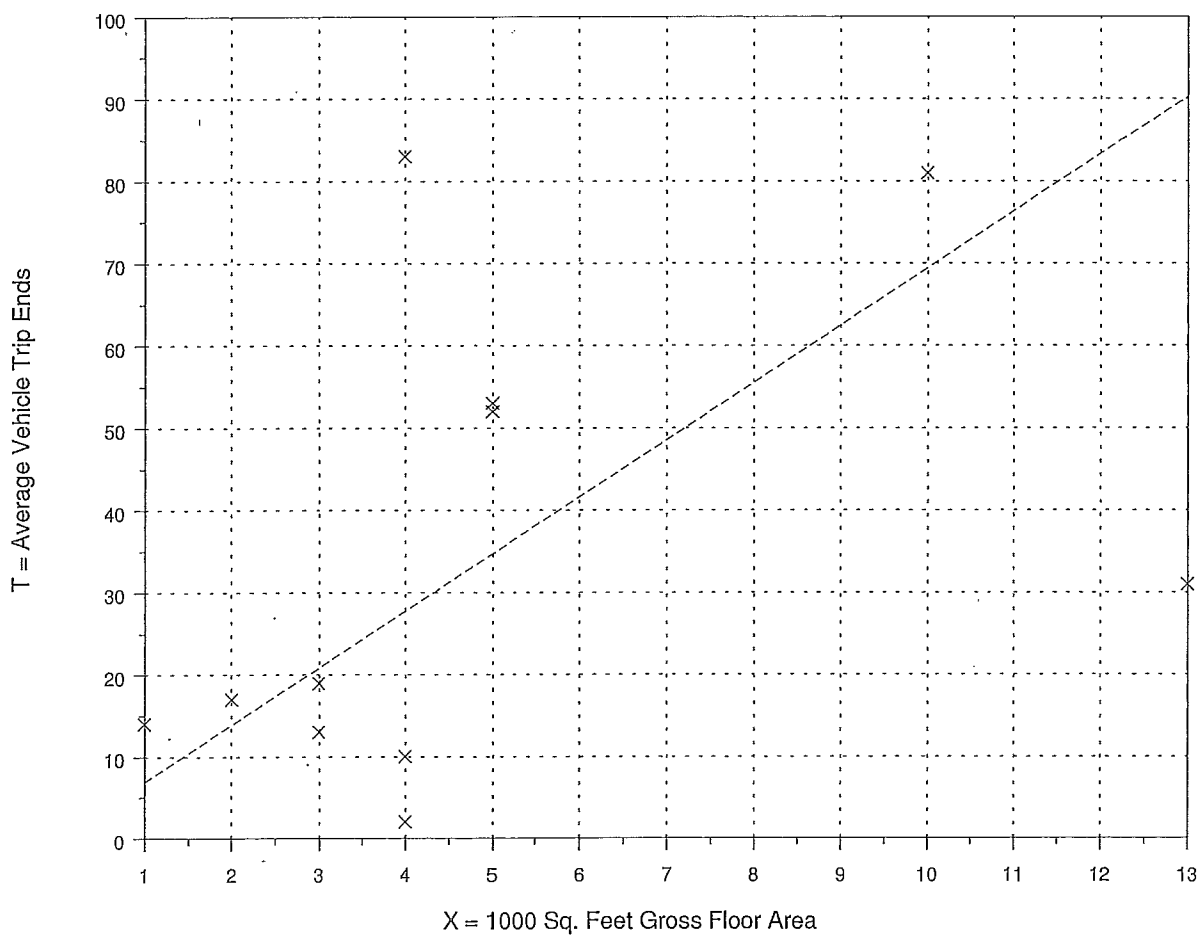
Number of Studies: 11
Average 1000 Sq. Feet GFA: 5
Directional Distribution: Not available 49% entering, 51% exiting

From Peak Hour Information

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
6.94	0.50 - 20.75	5.80

Data Plot and Equation



× Actual Data Points

------ Average Rate

Fitted Curve Equation: Not given

R^2 = ****

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)

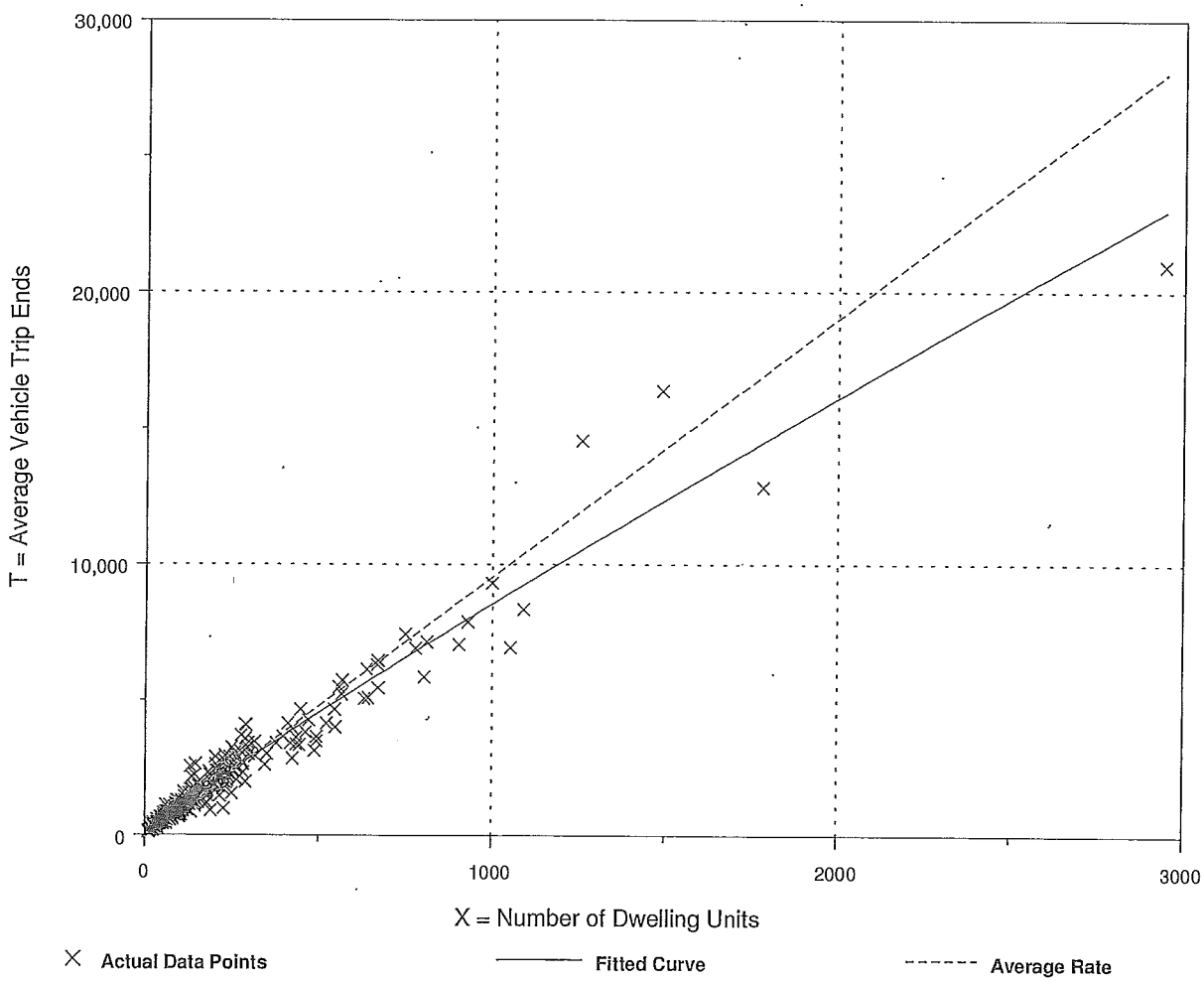
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.72 $R^2 = 0.95$

Single-Family Detached Housing
(210)

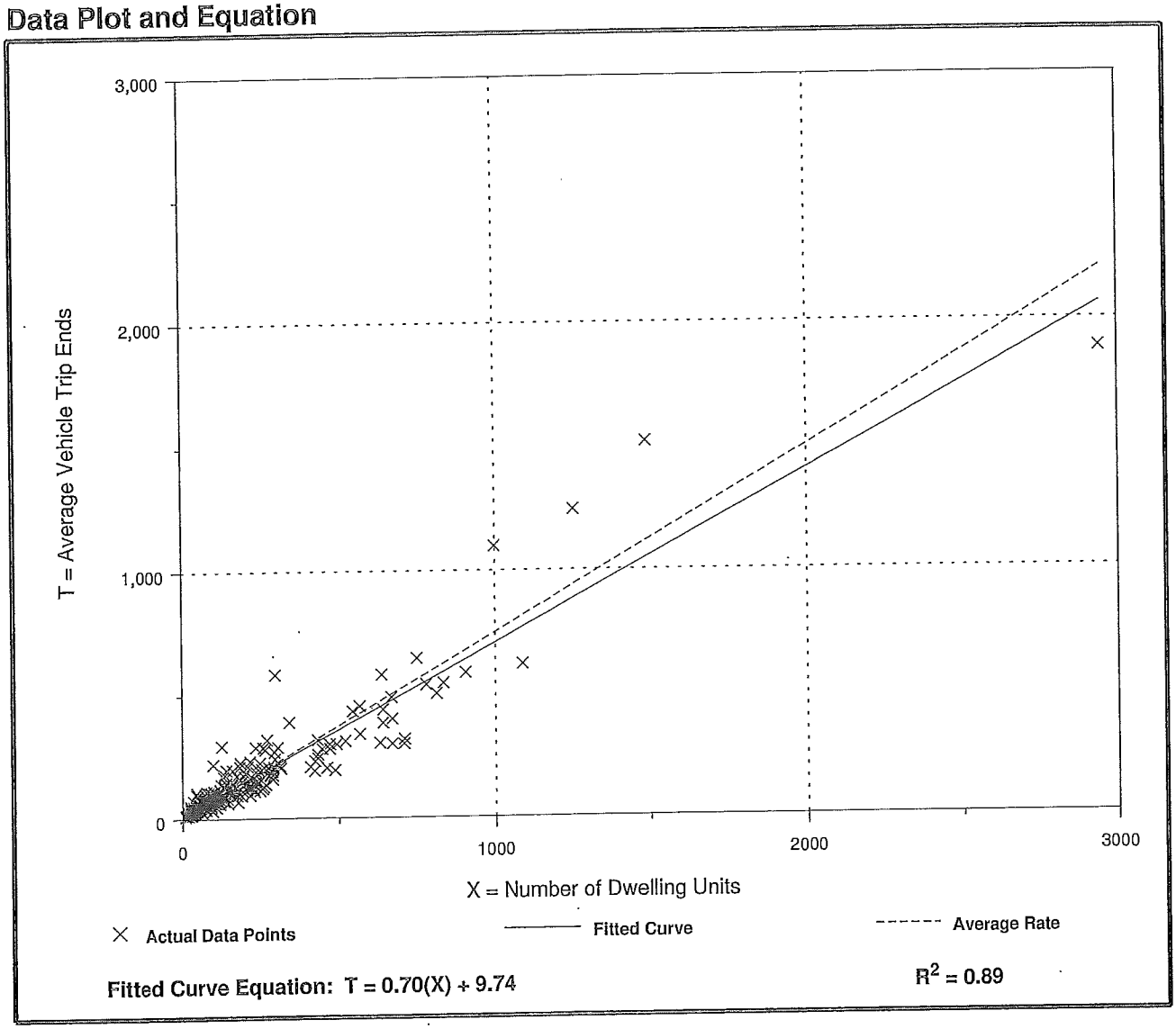
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

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)

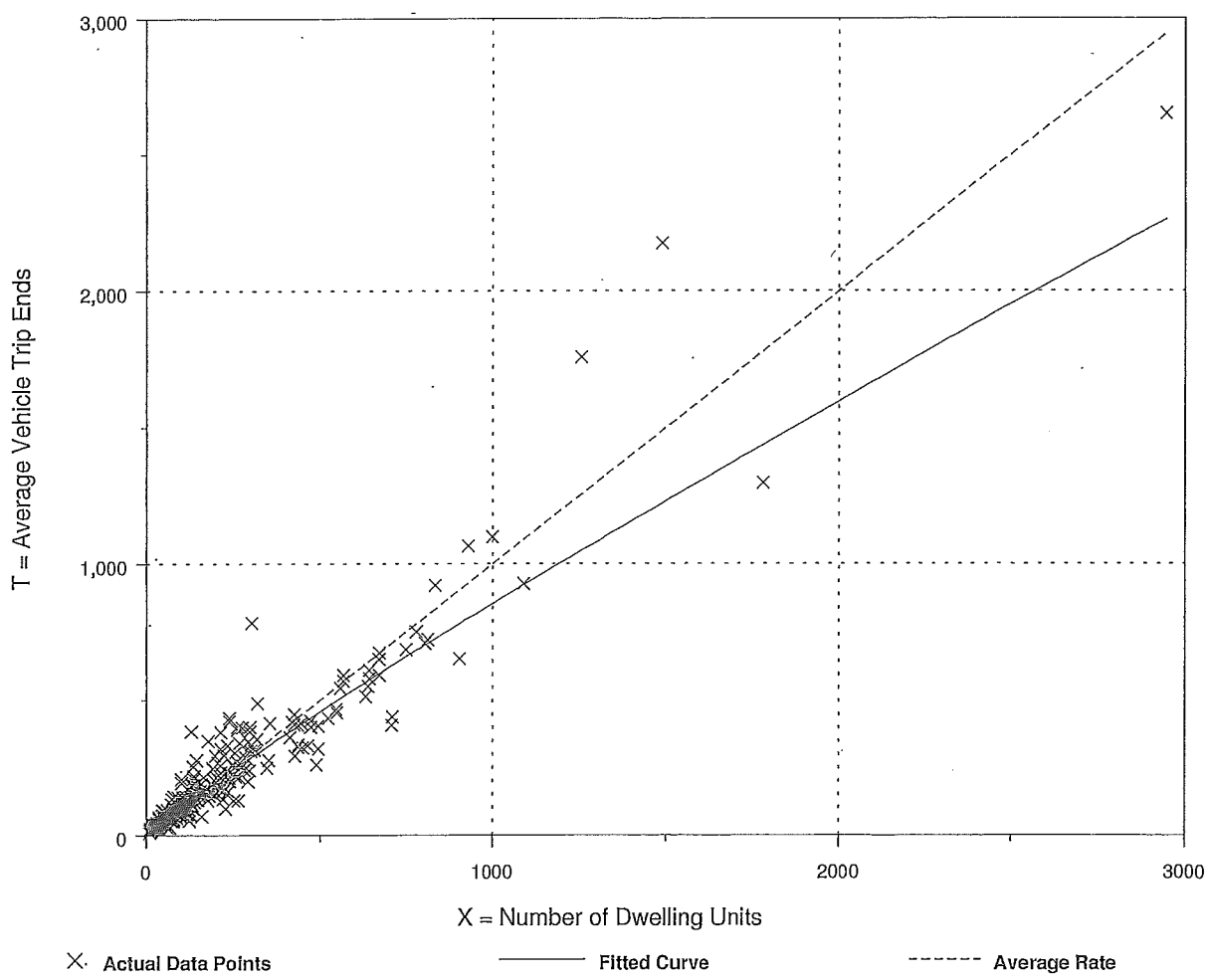
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

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



Fitted Curve Equation: Ln(T) = 0.90 Ln(X) + 0.51 $R^2 = 0.91$

Land Use: 254
Assisted Living

Description

Assisted living complexes are residential settings that provide either routine general protective oversight or assistance with activities necessary for independent living to mentally or physically limited persons. They commonly have separate living quarters for residents, and services include dining, housekeeping, social and physical activities, medication administration and transportation. Alzheimer's and ALS care are commonly offered by these facilities, though the living quarters for these patients may be located separately from the other residents. Assisted care commonly bridges the gap between independent living and nursing homes. In some areas of the country, assisted living residences may be called personal care, residential care, or domiciliary care. Staff may be available at an assisted care facility 24 hours a day, but skilled medical care—which is limited in nature—is not required. Continuing care retirement community (Land Use 255) and nursing home (Land Use 620) are related uses.

Additional Data

The rooms in these facilities may be private or shared accommodations, consisting of either a single room or a small apartment-style unit with a kitchenette and living space.

One study reported that according to national and local data, less than 5 percent of the residents owned cars, which were rarely driven. Employees, visitors and delivery trucks make most of the trips to these facilities.

Truck traffic was captured for some studies in this land use and is presented in the following table. Although truck traffic was very low overall, most trips occurred during the mid-day period on a weekday.

The peak hour of the generator did not coincide with the peak hour of the adjacent street traffic for several sites included in this land use, primarily because of the shifts of the employees. For the data collected at those sites, shifts typically began at 7:00 a.m., 3:00 p.m. and 11:00 p.m. For all sites, the A.M. peak hour of the generator typically ranged from 6:00 a.m. to 9:00 a.m., while the P.M. peak hour of the generator typically ranged from 3:00 p.m. and 5:00 p.m.

Assisted Living
(254)

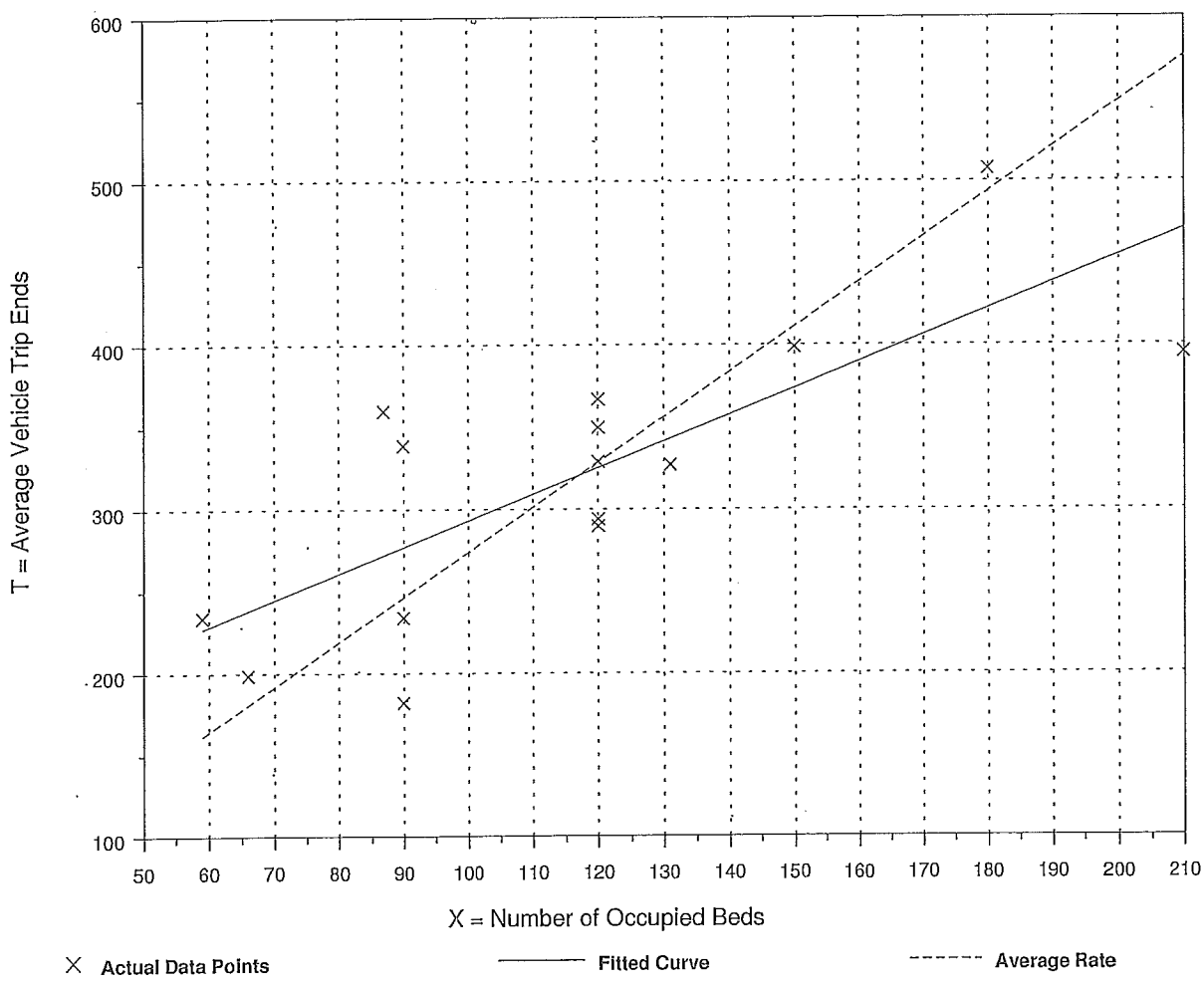
Average Vehicle Trip Ends vs: Occupied Beds
On a: Weekday

Number of Studies: 15
Average Number of Occupied Beds: 117
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Occupied Bed

Average Rate	Range of Rates	Standard Deviation
2.74	1.88 - 4.14	1.75

Data Plot and Equation



Fitted Curve Equation: T = 1.61(X) + 132.16

R^2 = 0.58

Assisted Living
(254)

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

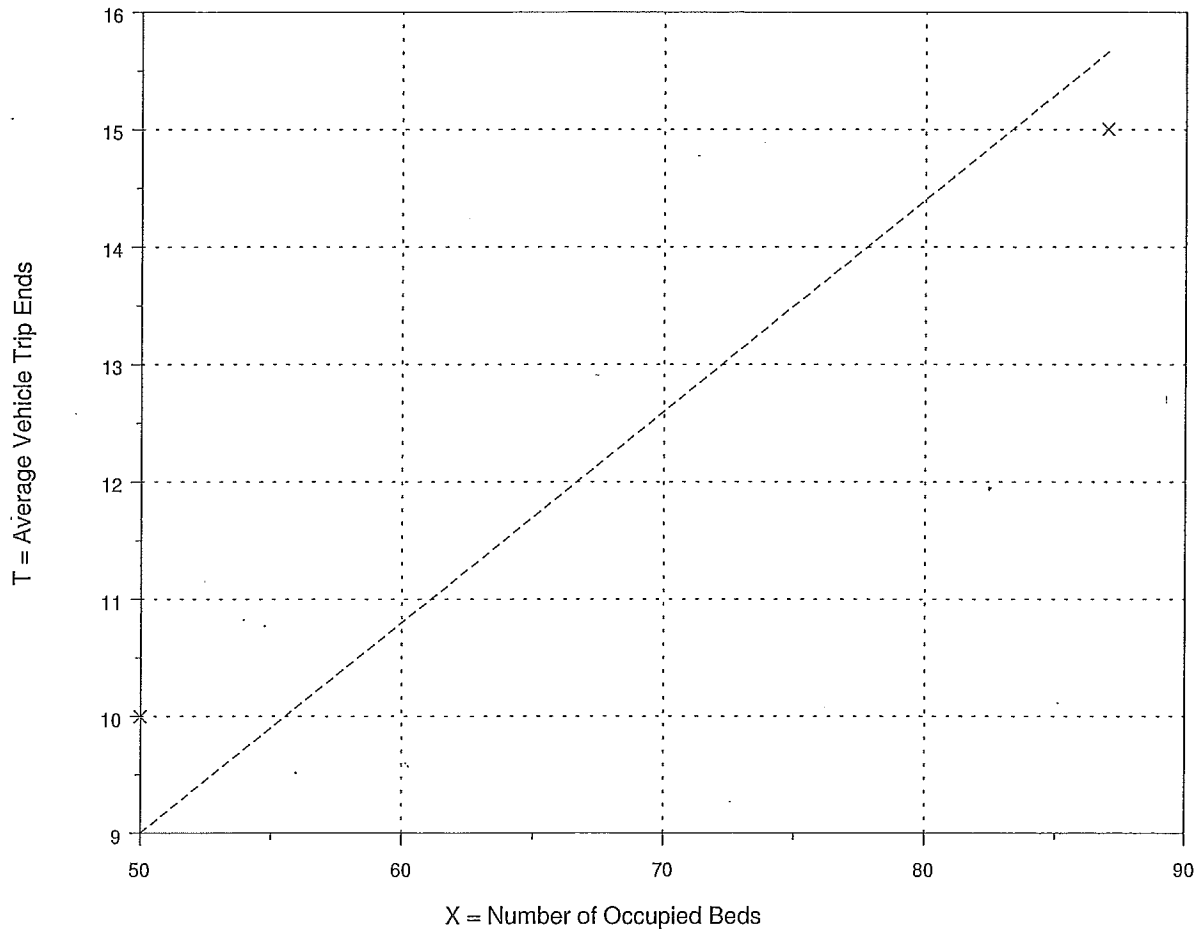
Number of Studies: 2
Average Number of Occupied Beds: 69
Directional Distribution: 68% entering, 32% exiting

Trip Generation per Occupied Bed

Average Rate	Range of Rates	Standard Deviation
0.18	0.17 - 0.20	*

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



× **Actual Data Points**

------ **Average Rate**

Fitted Curve Equation: Not given

R^2 = ****

Assisted Living
(254)

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

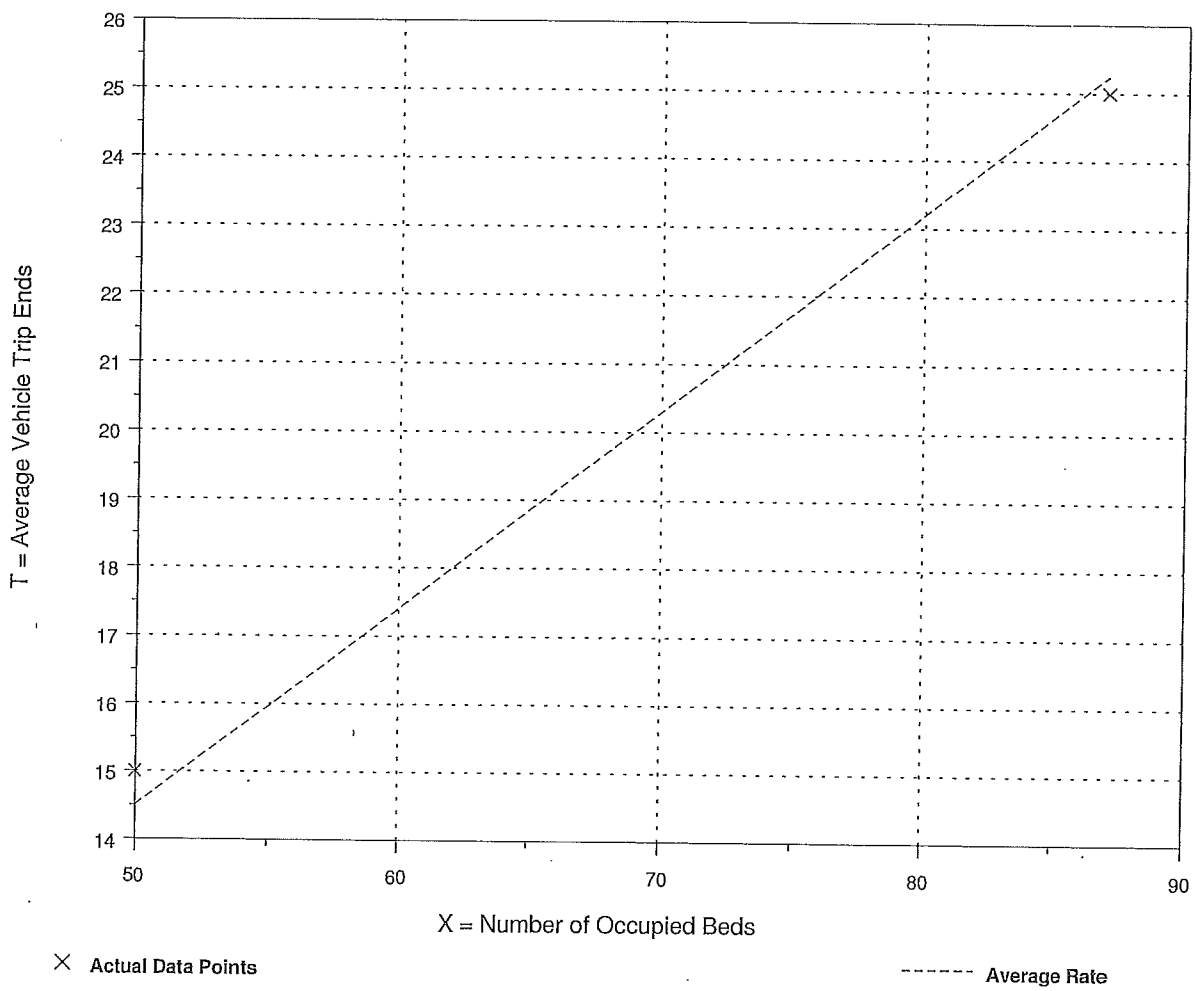
Number of Studies: 2
Average Number of Occupied Beds: 69
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Occupied Bed

Average Rate	Range of Rates	Standard Deviation
0.29	0.29 - 0.30	*

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****