CT consultants
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Memorandum

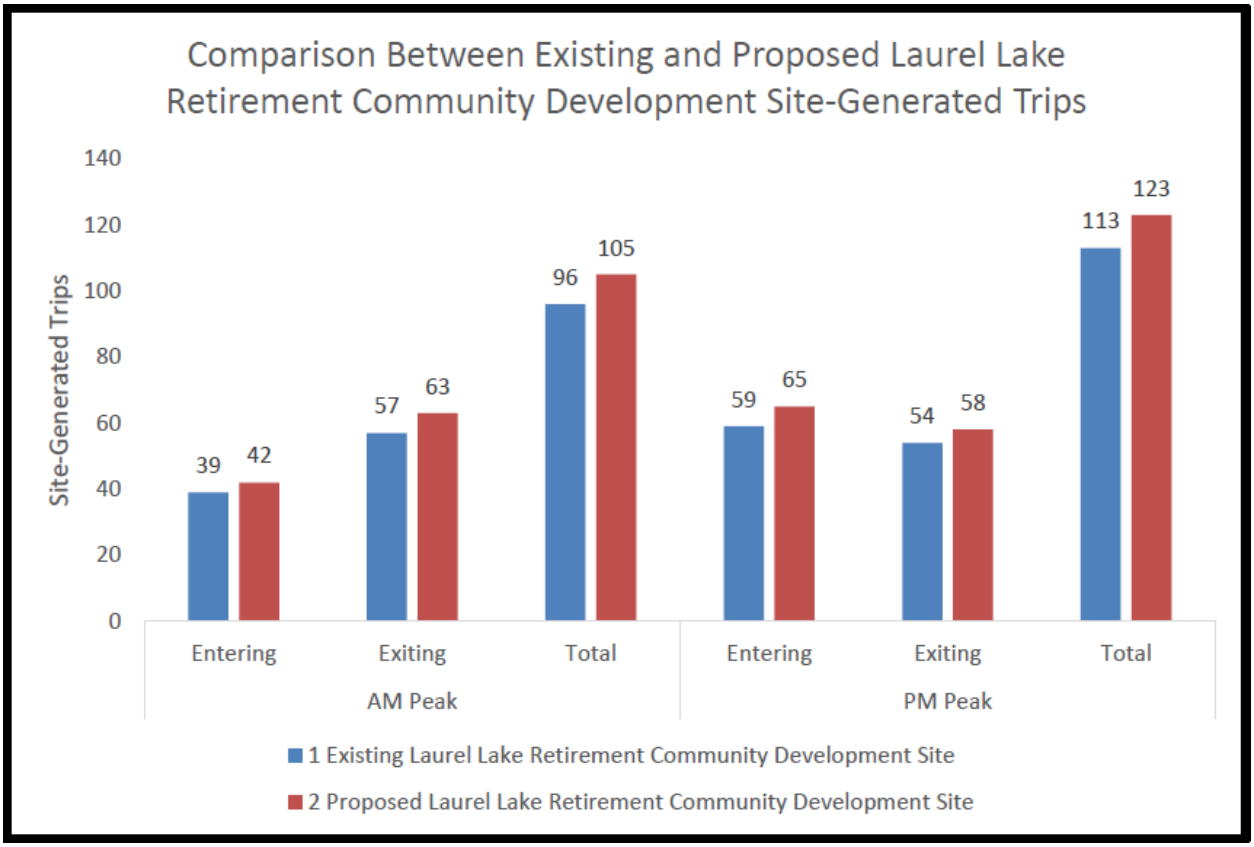
To: Eileen Nacht, AIA, LEED AP, EDAC
RDL Architects

From: Paul Ciupa, Senior Traffic Engineer
Lene Hill, PE, LEED AP

Subject: Laurel Lake Retirement Community
Trip Generation Study

Date: December 12, 2024

On May 24, 2024, CT Consultants prepared a Trip Generation Study for the Laurel Lake Retirement Community using the most recent Institute of Transportation Engineers Common Trip Generation Rates (AM/PM Peak Hour) (Trip Generation Manual, 11th Edition) Publishing Date**:** 9/20/2021. The chart from that Trip Generation Study shows that the number of trips that are generated are quite low, which is to be expected from a retirement community.



The trip-generation study shows that only a total of 9 trips and 10 trips are anticipated to increase with the addition of 7 duplexes at the existing Laurel Lake Retirement Community Development site. The AM Peak Hour total of the proposed site shows 42 entering and 63 exiting trips. This amount is split between the two intersections with Boston Mills Road over one hour in the AM Peak Hour. This is less than one vehicle entering the site per minute split between the two Boston Mills Road intersections and approximately one vehicle exiting per minute. The same is true for the PM Peak Hour where there is approximately one (1) vehicle entering and exiting per minute split between the two (2) Boston Mills Road intersections.

The principal issue to be considered for each home is the sight distance for the driver when exiting the driveway. The sight distance is crucial for driver safety and an especially important design element for intersections and driveways. The approximate centerline distance from the T-Intersection north of 59 Laurel Lake Drive is 105 feet while the approximate centerline distance from the T-Intersection south of 60 Laurel Lake Drive is 80 feet. These distances shall be used to determine the intersection sight distances for each of the proposed homes on Laurel Lake Drive.

The following is from the most recent edition of the **Federal Manual of Traffic Control Devices 11th Edition, December 2023**. This applies to all road/driveway intersections.

Section 2B.08 Right-of-Way Intersection Control Considerations

Guidance:

Before converting to a more restrictive form of right-of-way control at an unsignalized intersection, the following alternative treatments to address safety, operational, or other concerns should be among those to be considered:
Where yield or stop controlled, installing Yield Ahead or Stop Ahead signs on the appropriate approaches to the intersection.

- *Removing parking on one or more approaches*

  Since on street parking is not permitted on Laurel Lake Drive this will not be an issue.

- *Removing sight distance obstructions*

  Landscaping will not be permitted within fifteen feet of the homes and Laurel Lake Drive.

The following excerpts are from the **Ohio Department of Transportation Location and Design Manual - Volume 1, Published: July 19, 2024** which is used for roadway design.

201.3 Intersection Sight Distance (ISD)

Intersections generally have a higher potential for vehicular conflict than a continuous section of roadway due to the occurrence of numerous traffic movements. Providing adequate sight distance at the intersection can greatly reduce the likelihood of these conflicts.

The driver of a vehicle approaching an intersection should have an unobstructed view of the entire intersection and sufficient lengths along the intersecting highway to permit the driver to anticipate and avoid potential collisions. When entering or crossing a highway, motorists should be able to observe the traffic at a distance that will allow them to safely make the desired movement. The methods for determining sight distance needed by drivers approaching an intersection are based on the same principles as stopping sight distance, but incorporate modified assumptions based on observed driver behavior at intersections.

To enhance traffic operations, intersection sight distance should be provided at all intersections. **(As shown in the diagrams at the end of this report, the intersection sight distance is provided at the driveways for 59 Laurel Lake Drive and 60 Laural Lake Drive).**

If intersections sight distance cannot be provided due to environmental or right-of-way constraints, then as a minimum, the stopping sight distance for vehicles on the major road should be provided. By providing only stopping sight distance, this will require the major-road vehicle to stop or slow down to accommodate the maneuver of the minor-road vehicle. If the intersection sight distance cannot be attained, additional safety measures should be provided. These may include, but are not limited to, advance warning signs and flashers and/or reduced speed limit zones in the vicinity of the intersection.

201.3.1 Sight Triangles

Specified areas along intersection approach legs and across their included corners should be clear of obstructions that might block a driver's view of potentially conflicting vehicles. These unobstructed areas are known as sight triangles (see Figure 201-4). The

waiting vehicle is assumed to be located at a minimum of 14.4 ft. and preferably 17.8 ft. from the through road edge of traveled way. **(For driveway design, we have assumed the waiting vehicle is assumed to be 5 feet from the through road edge of traveled way.)** The position of the waiting vehicle is the vertex of the sight triangle on the minor road, otherwise referred to as the decision point. It represents the typical position of the minor-road driver's eye when a vehicle is stopped relatively close to the major road. The left edge of the moving vehicle on the through road is assumed to be a ½ lane width for vehicles approaching from the left, or 1 ½ lane widths for vehicles approaching from the right. The design speed of the through road is used to select the appropriate ISD length (see Figure 201-5). The dimension "b" in Figure 201-4 is the ISD length.

The provision of sight triangles allows the driver on the major road to see any vehicles stopped on the minor road approach and to be prepared to slow or stop, if necessary.

201.3.2.1 Left Turn from the Minor Road

The intersection sight distance along the major road is determined by the following formula:

English Units: ISD = 1.4 7x V major x tg

ISD = intersection sight distance (length of the leg of sight triangle along the major road) (ft)

V major = design speed of major road (mph) **(A speed of 15 mph was used for the calculation of the ISD).**

tg = time gap for minor road vehicle to enter the major road (sec.)

The design values for intersection sight distance for passenger cars are shown in Figure 201-5.

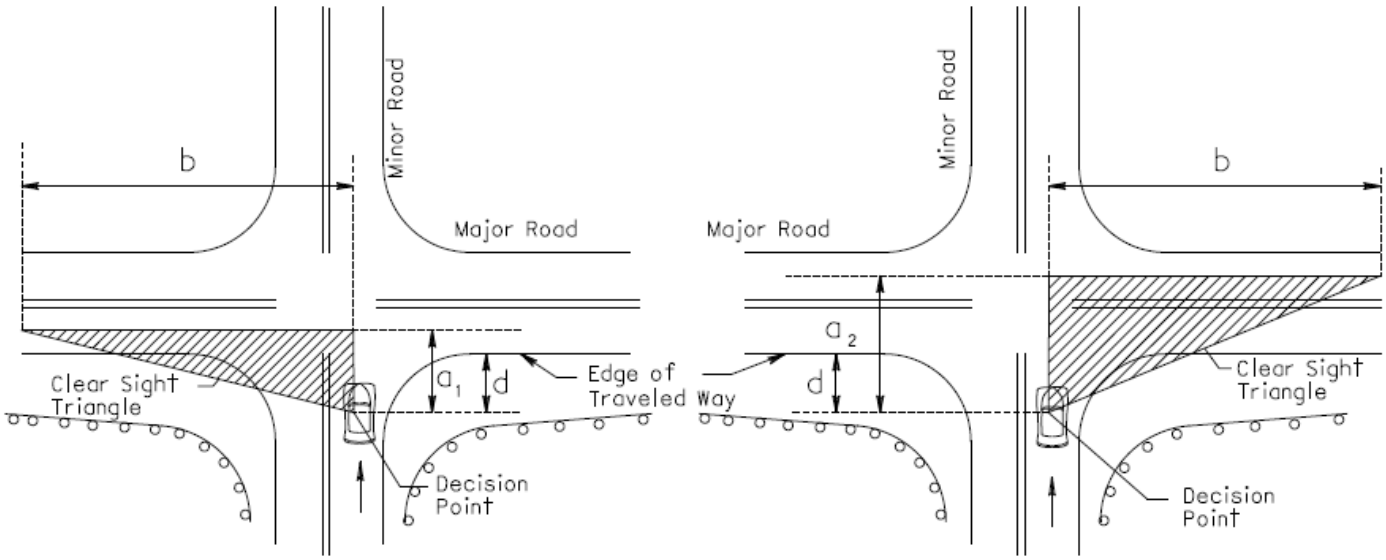
201.3.2.2 Right Turn from the Minor Road

The intersection sight distance for right turns is determined using the same methodology as that used for left turns, except that the time gaps differ. The time gap for right turns is decreased by 1.0 second. Also, the sight triangle for traffic approaching from the left should be used for right turns onto a major road. The design values for intersection sight distance for passenger cars are shown in Figure 201-5.

INTERSECTION SIGHT TRIANGLES

201-4

REFERENCE SECTION
201.3.1 & 201.3.3



Sight Triangle for Viewing Traffic Approaching from the Left

Sight Triangle for Viewing Traffic Approaching from the Right

DIAGRAM A - SIGHT TRIANGLES

a_1 = The distance, along the minor road, from the decision point to 1/2 the lane width of the approaching vehicle on the major road.

a_2 = The distance, along the minor road, from the decision point to 1 1/2 the lane width of the approaching vehicle on the major road.

b = Intersection Sight Distance

d = The distance from the edge of the traveled way of the major road to the decision point. The distance should be a minimum of 14.4′ and 17.8′ preferred.

INTERSECTION SIGHT DISTANCE

201-5

REFERENCE SECTION 201.3, 201.3.1, 201.3.2 & 201.3.3

(See Following Page for Additional Figures & Notes)

HEIGHT OF EYE 3.50′ HEIGHT OF OBJECT 3.50′

DESIGN SPEED (mph)	Passenger Cars Completing a Left Turn from a Stop (assuming a t_g of 7.5 sec.)		Passenger Cars Completing a Right Turn from a Stop or Crossing Maneuuver (assuming a t_g of 6.5 sec.)	
	ISD (ft.)	K-CREST VERT. CURVE	ISD (ft.)	K-CREST VERT. CURVE
15	170	10	145	8
20	225	18	195	14
25	280	28	240	21
30	335	40	290	30
35	390	54	335	40
40	445	71	385	53
45	500	89	430	66
50	555	110	480	82
55	610	133	530	100
60	665	158	575	118
65	720	185	625	140
70	775	214	670	160

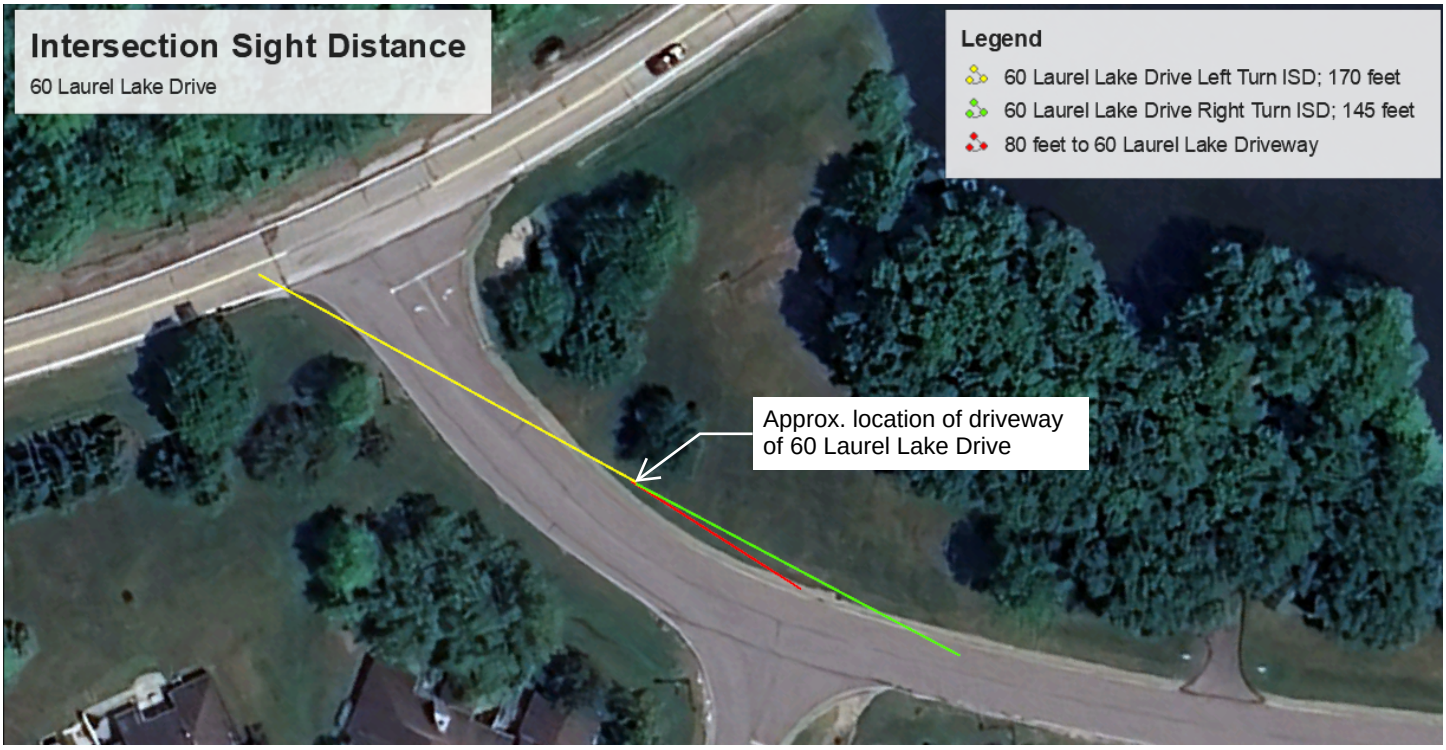
$$ISD = 1.47 \times V_{major} \times t_g$$

ISD = intersection sight distance (ft.)

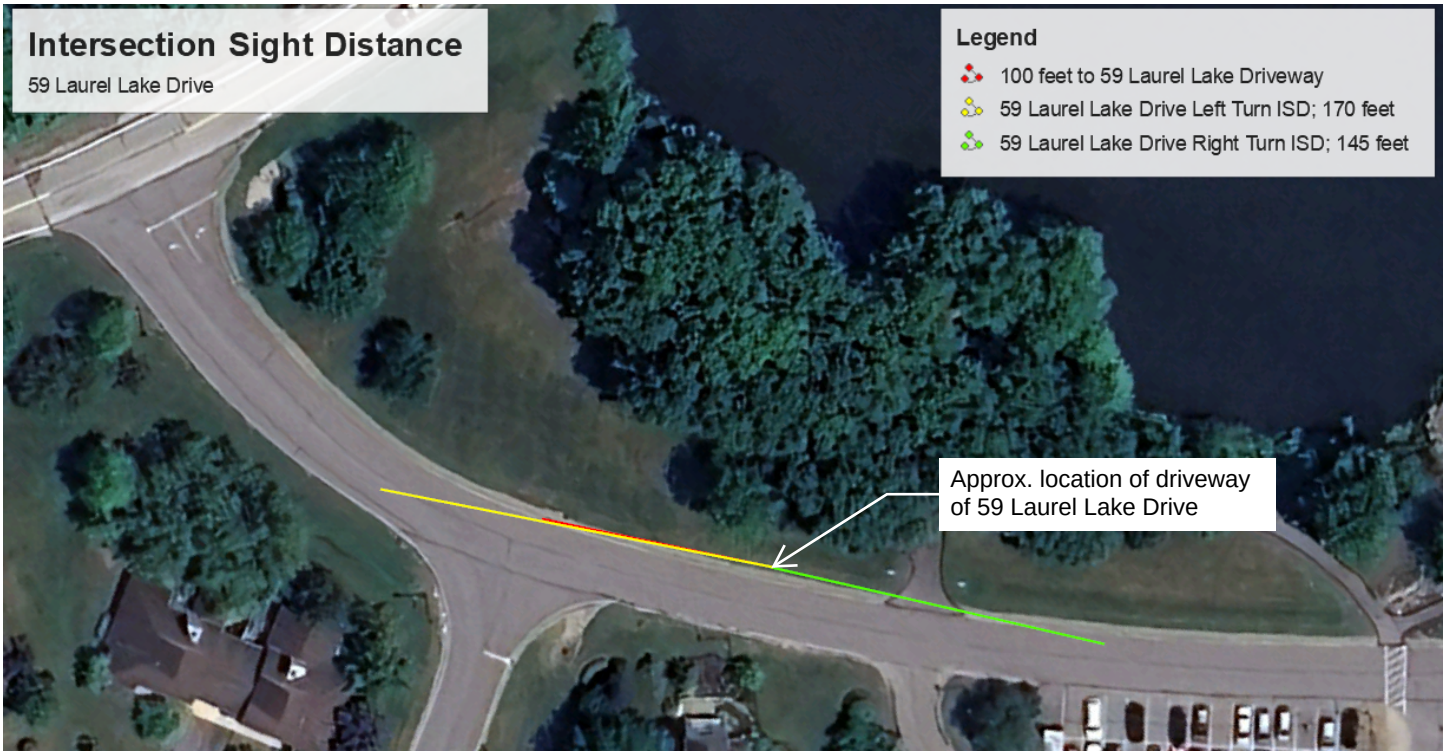
V_{major} = design speed of major road (mph)

t_g = time gap for minor road vehicle to enter the major road (sec.)

Figure 201-5 of the **Ohio Department of Transportation Location and Design Manual - Volume 1** shows that an ISD = intersection sight distance (feet) of 170 feet is required for a vehicle making a left turn out of the driveway and an ISD = intersection sight distance (feet) of 145 feet for a vehicle making a right turn. The road elevation is negligible for these calculations.



The Left Turn and Right Turn Intersection Sight Distance requirements for 60 Laurel Lake Drive meet the standards as set forth in the **Ohio Department of Transportation Location and Design Manual - Volume 1, Published: July 19, 2024.**



The Left Turn and Right Turn Intersection Sight Distance requirements for 59 Laurel Lake Drive meet the standards as set forth in the **Ohio Department of Transportation Location and Design Manual - Volume 1, Published: July 19, 2024**

Memorandum

To: Eileen Nacht, AIA, LEED AP, EDAC (Senior Living Director, RDL Architects)

From: Lene Hill, PE, LEED AP (Senior Project Engineer, CT Consultants, Inc.);
Jay Korros, PE, PTOE (Senior Traffic Engineer, CT Consultants, Inc.);
Doug Gerda, (Civil Co-op, CT Consultants, Inc.)

Subject: Laurel Lake Retirement Community Trip Generation Study

Date: August 10, 2022 *(Revised May 24, 2024)*

This memorandum summarizes the revised trip generation study performed for the existing Laurel Lake Retirement Community located in the City of Hudson, Ohio.

Project Description:

Laurel Lake Retirement Community currently provides various combinations of senior adult housing (both-single-family and multi-family), congregate care, assisted living, and nursing home. The community also provides special services such as medical, dining, recreational, communal transportation, and some limited, supporting retail facilities. The community is planning to add 7 duplexes with two units. The existing site map and proposed preliminary site plan of the community are attached to this memo.

Trip Generation:

Trip generation estimates were prepared for the existing and proposed Laurel Lake Retirement Community development using the Institute of Transportation Engineers (ITE), 11th Edition, as shown in Table 1 and Table 2, respectively.

The ITE Trip Generation Manual includes several types of senior or retirement homes as listed below:

- Senior Adult Housing – Single-Family (ITE Land Use Code: 251)
- Senior Adult Housing – Multifamily (ITE Land Use Code: 252)
- Assisted Living (ITE Land Use Code: 254)

- Nursing Home (ITE Land Use Code: 620)
- Continuing Care Retirement Community (ITE Land Use Code: 255)

Continuing Care retirement communities (CCRC) are land uses that provides multiple elements of senior adult living. Housing options may include various combinations of senior adult housing (both single-family and multifamily), congregate care, assisted living, and nursing home. To be conservative as shown in Table 1, rather than using all-inclusive CCRC trip generation estimates, combination of several land use trip generation estimates was selected to compare the trips generated by existing and proposed development site. Figure 1 shows the comparison between the trips generated by the existing and proposed development site.

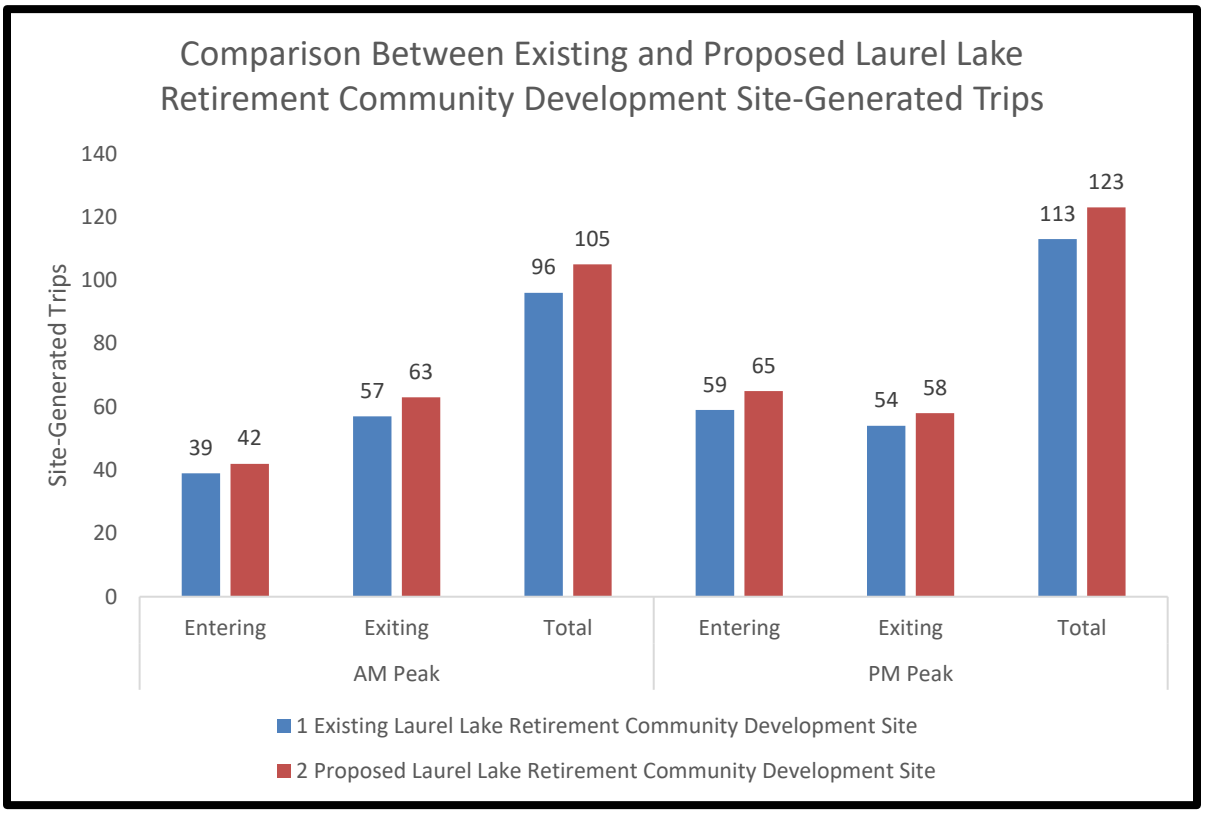
Table 1: Existing Laurel Lake Retirement Community Site Trip Generation Summary

S.N.	Development Description	ITE Land Use	ITE Land Use Code	Independent Variable	AM Peak			PM Peak		
					Entering	Exiting	Total	Entering	Exiting	Total
1	Independent Living - 66 villas (semi-attached homes with attached 1 or 2-car garages)	Senior Adult Housing - Single Family	251	66 DU	9	19	28	19	13	32
2	Independent Living – 224 apartments located in two 3-story apartment buildings, Eastwood and Westwood	Senior Adult Housing - Multi-Family	252	224 DU	15	30	45	31	25	56
3	Greenwood Assisted Living – 56 apartments (studios, 1-bedrooms, 2-bedrooms) located in Greenwood 3-story building, Greenwood Suites, and Greenwood Studios	Assisted Living	254	56 Beds	6	4	10	5	8	13
4	Crown Center 24-hour Skilled Nursing & Rehabilitation - 75 bed licensed skilled nursing facility	Nursing Home	620	75 Beds	9	4	13	4	8	12
Total (Combination of Trip Generation from Above-Listed Developments)					39	57	96	59	54	113
5	Laurel Lake Retirement Community (Includes all the Above-Listed Developments)	Continuing Care Retirement Community	255	421 DU	49	27	76	43	67	110

Table 2: Proposed Laurel Lake Retirement Community Site Trip Generation Summary

S.N.	Development Description	ITE Land Use	ITE Land Use Code	Independent Variable	AM Peak			PM Peak		
					Entering	Exiting	Total	Entering	Exiting	Total
1	Independent Living - 66 villas (semi-attached homes with attached 1 or 2-car garages)	Senior Adult Housing - Single Family	251	66 DU	9	19	28	19	13	32
2	Independent Living – 224 apartments located in two 3-story apartment buildings, Eastwood and Westwood	Senior Adult Housing - Multi-Family	252	224 DU	15	30	45	31	25	56
3	Greenwood Assisted Living – 56 apartments (studios, 1-bedrooms, 2-bedrooms) located in Greenwood 3-story building, Greenwood Suites, and Greenwood Studios	Assisted Living	254	56 Beds	6	4	10	5	8	13
4	Crown Center 24-hour Skilled Nursing & Rehabilitation - 75 bed licensed skilled nursing facility	Nursing Home	620	75 Beds	9	4	13	4	8	12
5	Independent Living - 7 duplexes with two units each - Total of 14 new units.	Senior Adult Housing - Single Family	251	14 DU	3	6	9	6	4	10
Total (Combination of Trip Generation from Above-Listed Developments)					42	63	105	65	58	123

Figure 1: Trip Generation Comparison Between and Existing and Proposed Laurel Lake Retirement Community Development Site-Generated Trips



Findings:

The trip-generation study shows that only a total of 9 trips and 10 trips are anticipated to increase with the addition of 7 duplexes at the existing Laurel Lake Retirement Community Development site.

If any of the information in the memo is not consistent with what we discussed or any information is missing, please let us know and the memo will be updated accordingly.

Appendix

Laurel Lake Retirement Community
200 Laurel Lake Drive, Hudson OH 44236
330-650-2100 / www.laurellake.org

Residences & Neighborhoods
Roads
Walks
Grass & Woodlands
Wetland Habitat

BOSTON MILLS ROAD (60' R.O.W.)
LAUREL LAKE
LAUREL LAKE DRIVE
BARLOW PAVILLION
OUTLOOK POINT
ROSE ARBOR
FOX HILL GAZEBO
VILLAS
WESTWOOD
EASTWOOD
TOWN CENTER
SALON
FITNESS CENTER
AQUATIC CENTER
THERAPY CENTER
PAT'S PATIO
GREENWOOD PATIO
GREENWOOD
CARPORTS
WALLACE GAZEBO
WALT'S POND
WORKSHOP & GARAGE SALE
MAINTENANCE GARAGE
COMMUNITY GARDEN
LOOP ROAD
SERENITY CHAPEL
SUTCLIFFE TRANQUILITY COURTYARD
CROWN CENTER
PRACTICE GOLF COURSE
THE BELVEDERE AT RIDER LAKE PAVILION
RIDER LAKE

1ST FLOOR

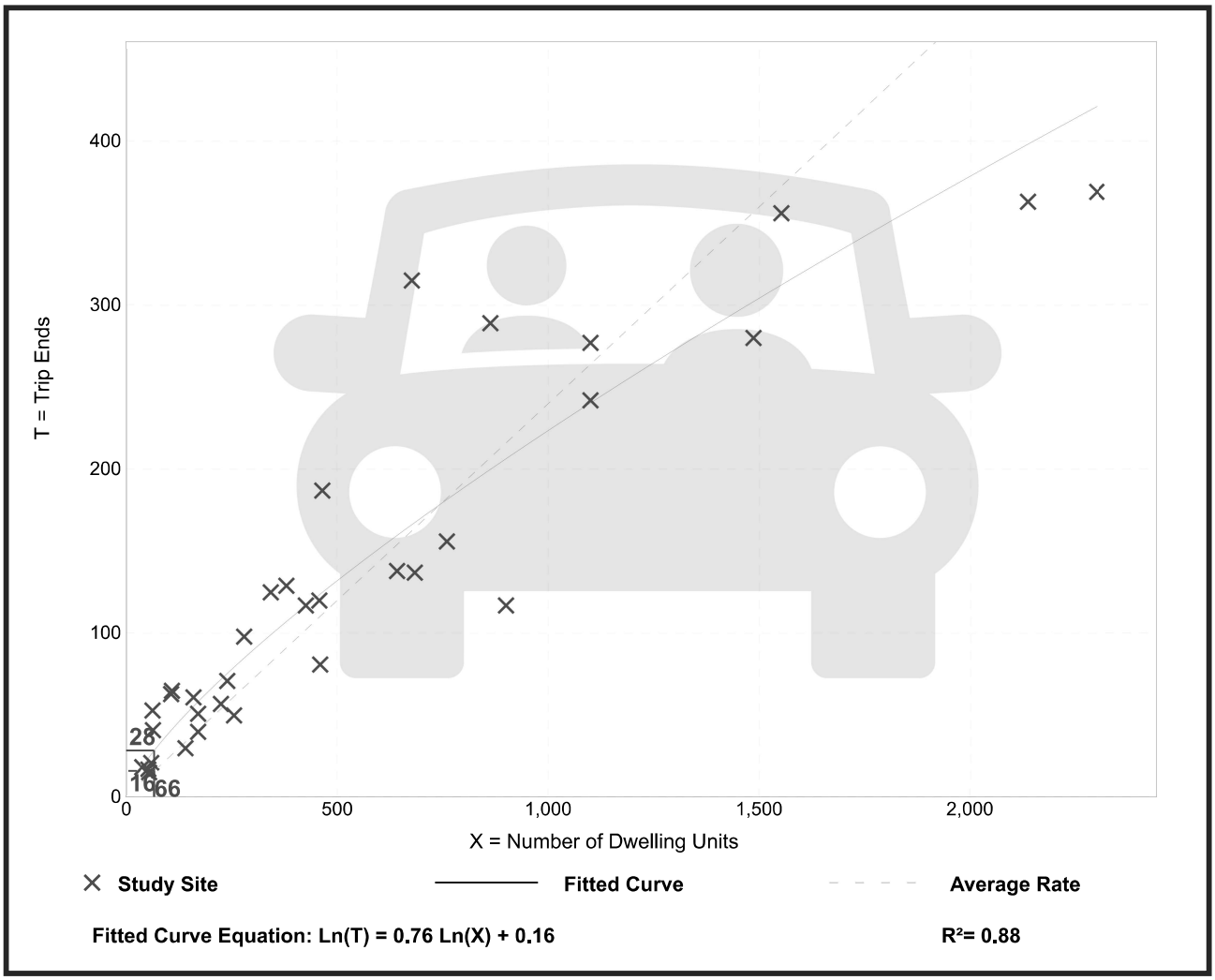
Senior Adult Housing - Single-Family
(251)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	34
Avg. Num. of Dwelling Units:	557
Directional Distribution:	33% entering, 67% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.24	0.13 - 0.84	0.10

Data Plot and Equation



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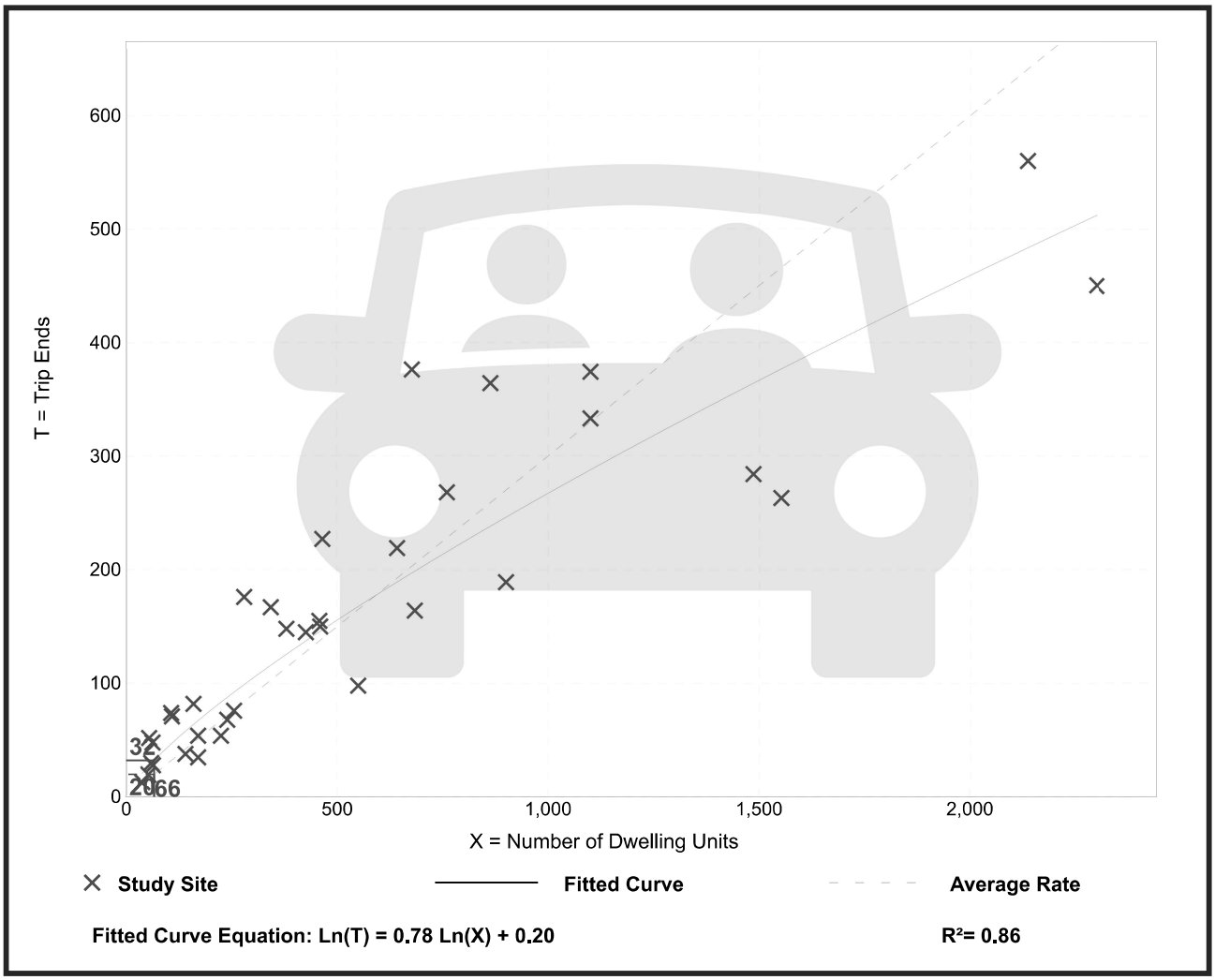
Senior Adult Housing - Single-Family
(251)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 35
Avg. Num. of Dwelling Units: 556
Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.30	0.17 - 0.95	0.12

Data Plot and Equation



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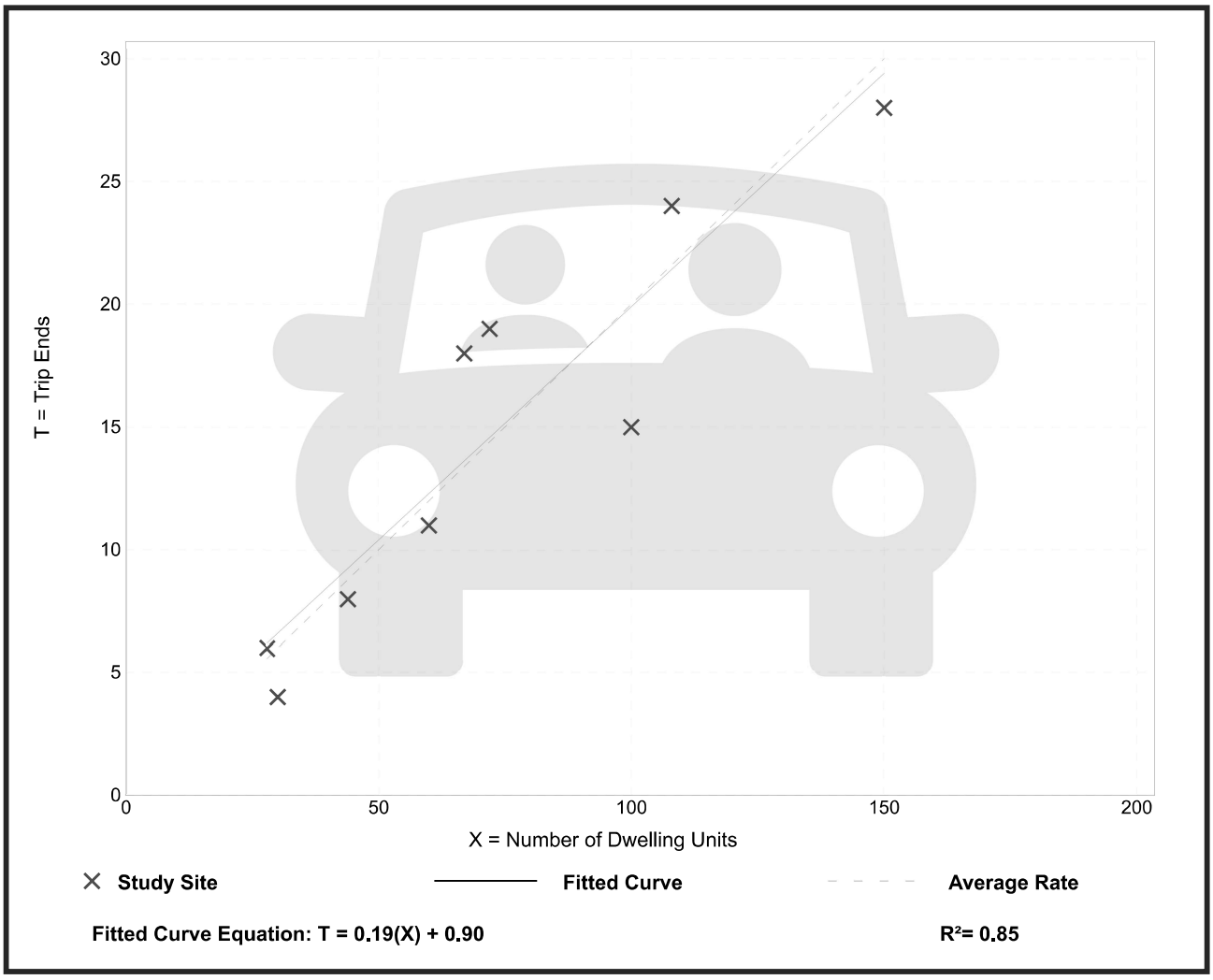
Senior Adult Housing - Multifamily
(252)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	9
Avg. Num. of Dwelling Units:	73
Directional Distribution:	34% entering, 66% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.20	0.13 - 0.27	0.04

Data Plot and Equation



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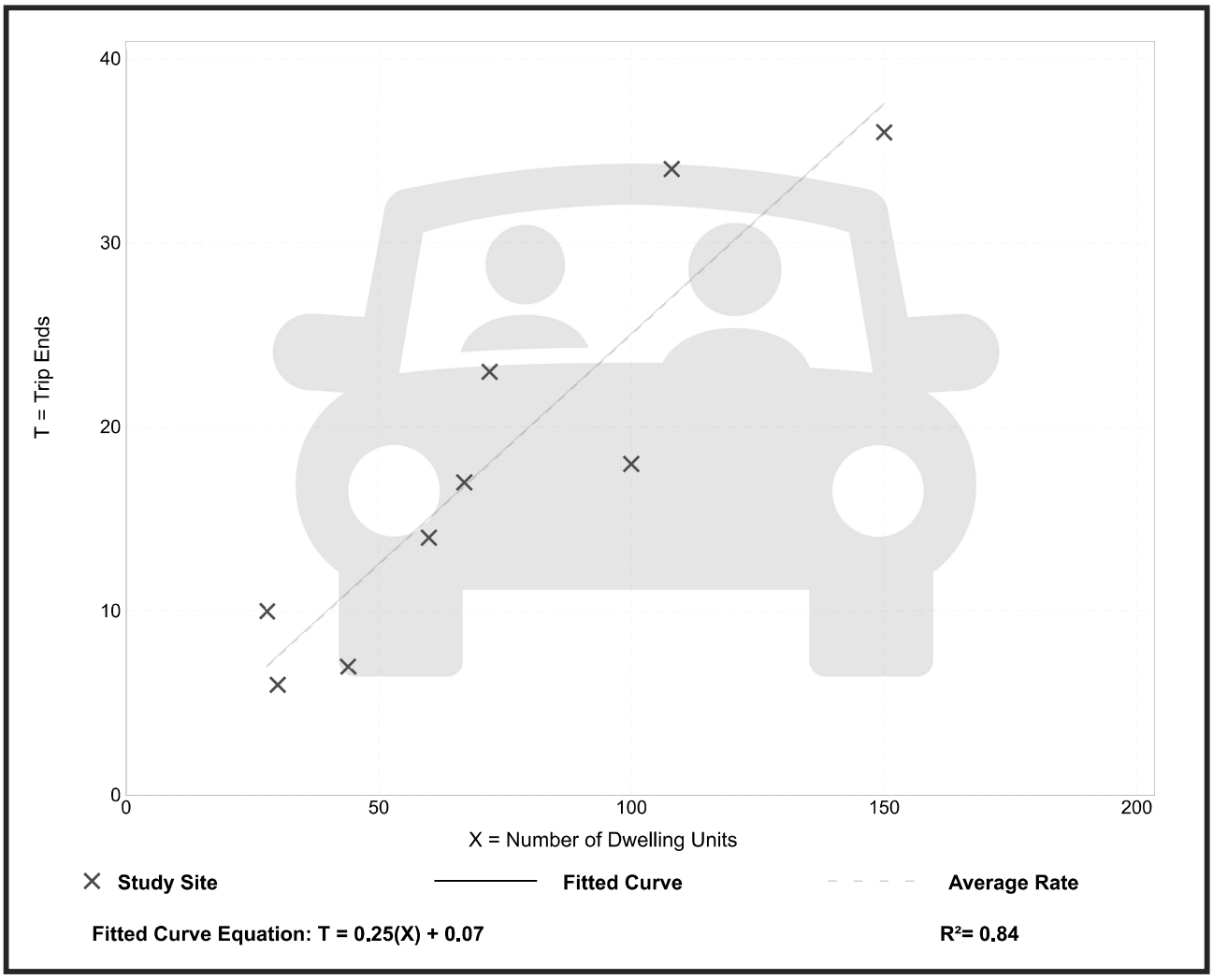
Senior Adult Housing - Multifamily
(252)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	9
Avg. Num. of Dwelling Units:	73
Directional Distribution:	56% entering, 44% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.25	0.16 - 0.36	0.06

Data Plot and Equation



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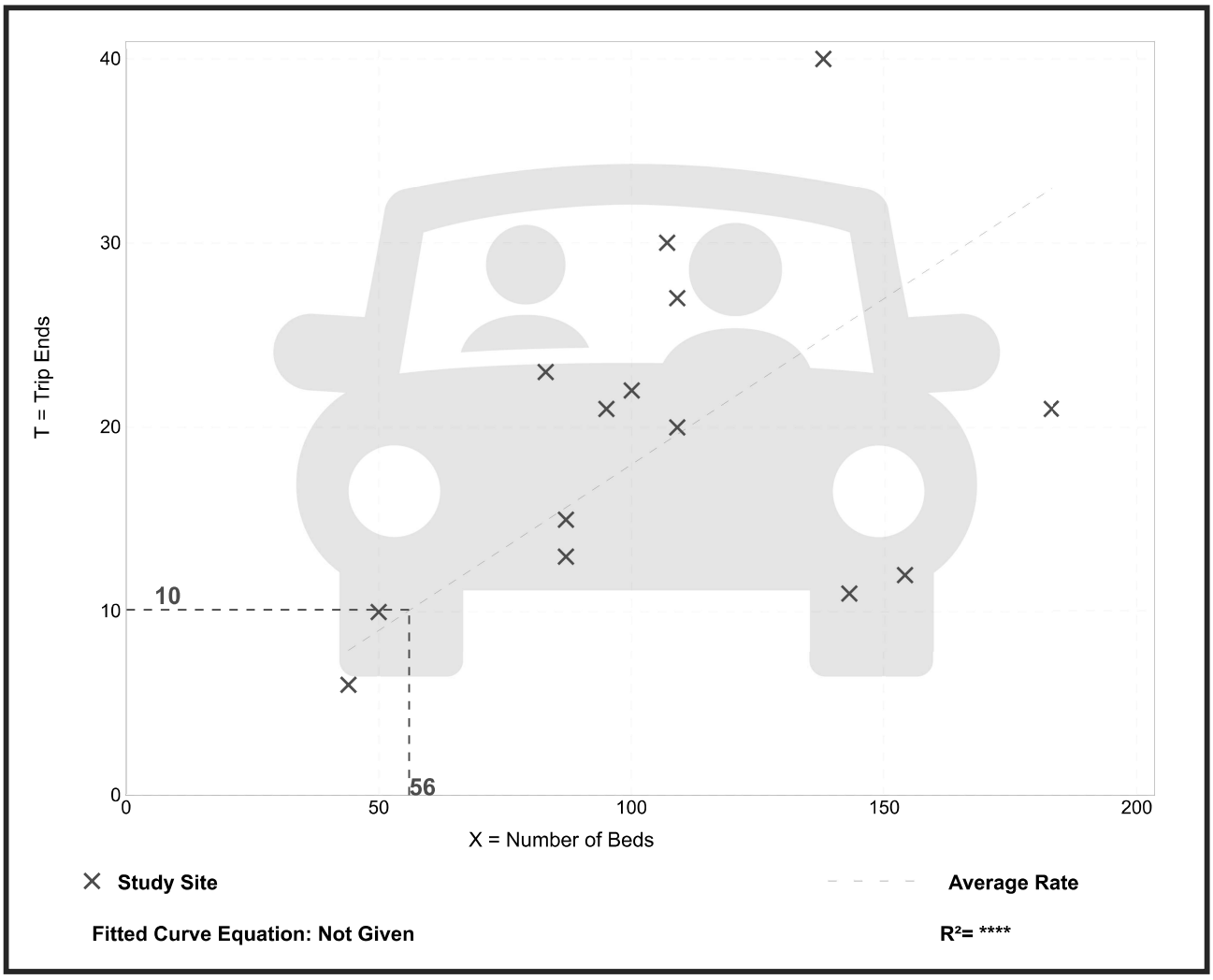
Assisted Living
(254)

Vehicle Trip Ends vs:	**Beds**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	14
Avg. Num. of Beds:	106
Directional Distribution:	60% entering, 40% exiting

Vehicle Trip Generation per Bed

Average Rate	Range of Rates	Standard Deviation
0.18	0.08 - 0.29	0.08

Data Plot and Equation



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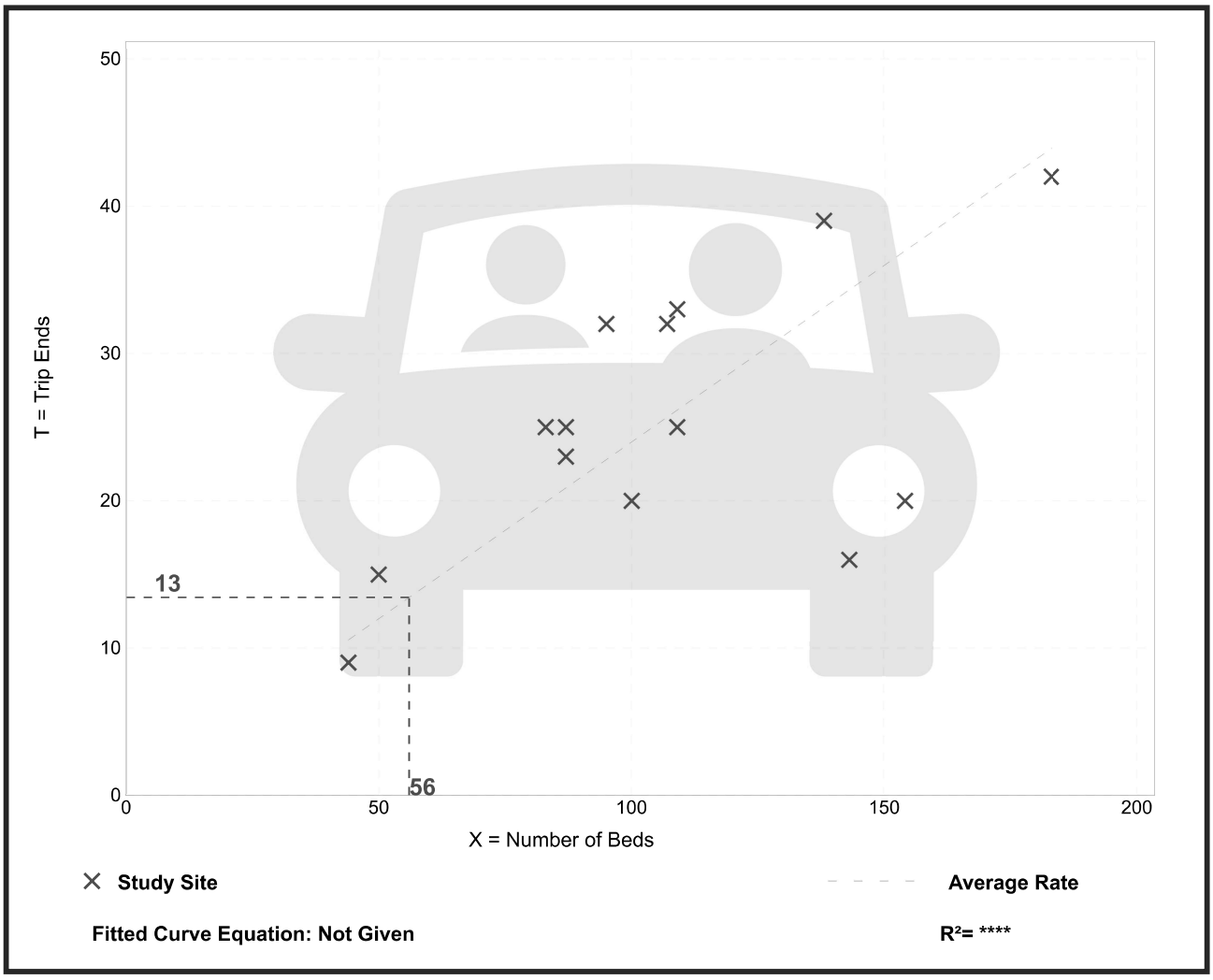
Assisted Living
(254)

Vehicle Trip Ends vs: **Beds**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 14
Avg. Num. of Beds: 106
Directional Distribution: 39% entering, 61% exiting

Vehicle Trip Generation per Bed

Average Rate	Range of Rates	Standard Deviation
0.24	0.11 - 0.34	0.07

Data Plot and Equation



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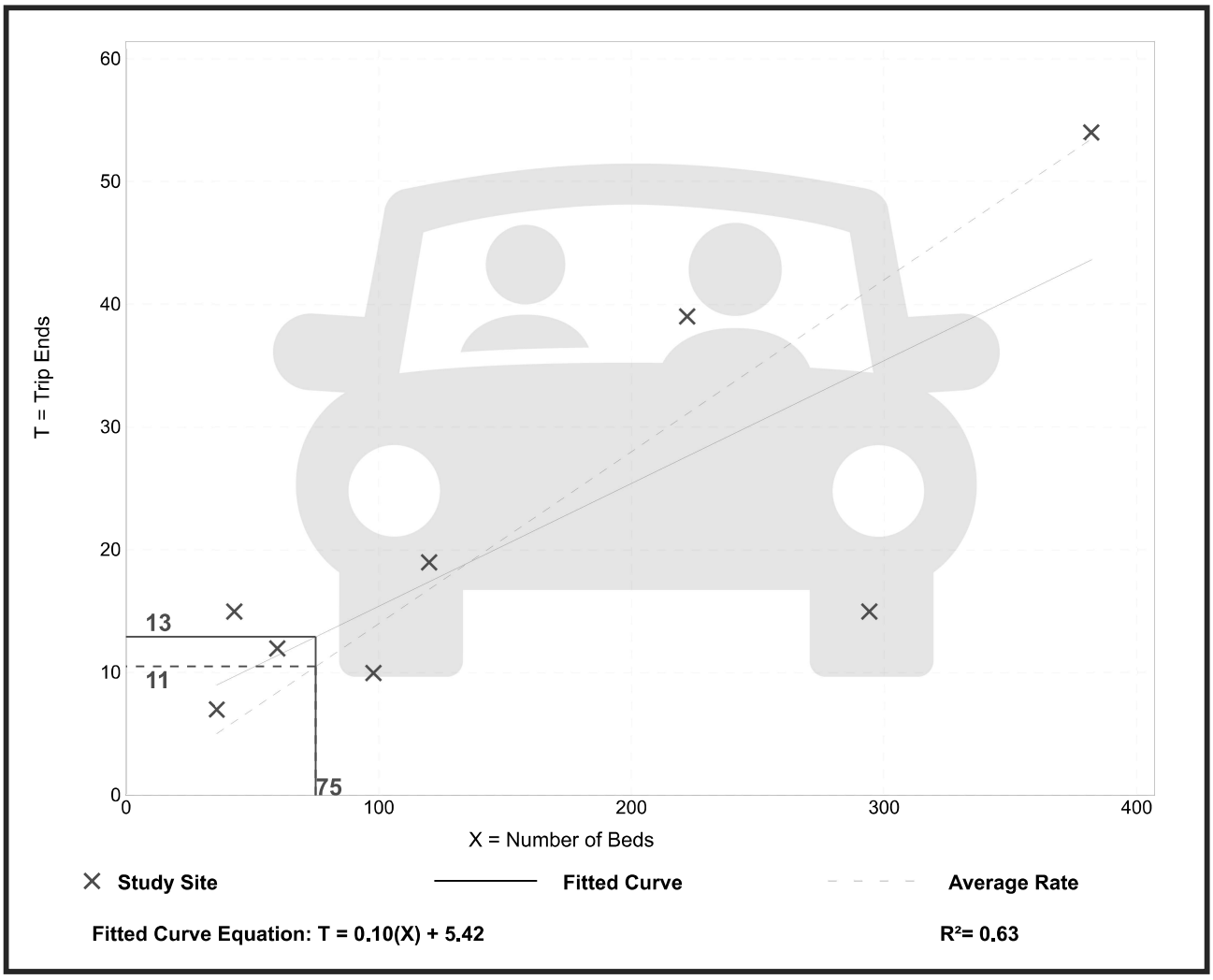
Nursing Home
(620)

Vehicle Trip Ends vs: **Beds**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 8
Avg. Num. of Beds: 157
Directional Distribution: 72% entering, 28% exiting

Vehicle Trip Generation per Bed

Average Rate	Range of Rates	Standard Deviation
0.14	0.05 - 0.35	0.07

Data Plot and Equation



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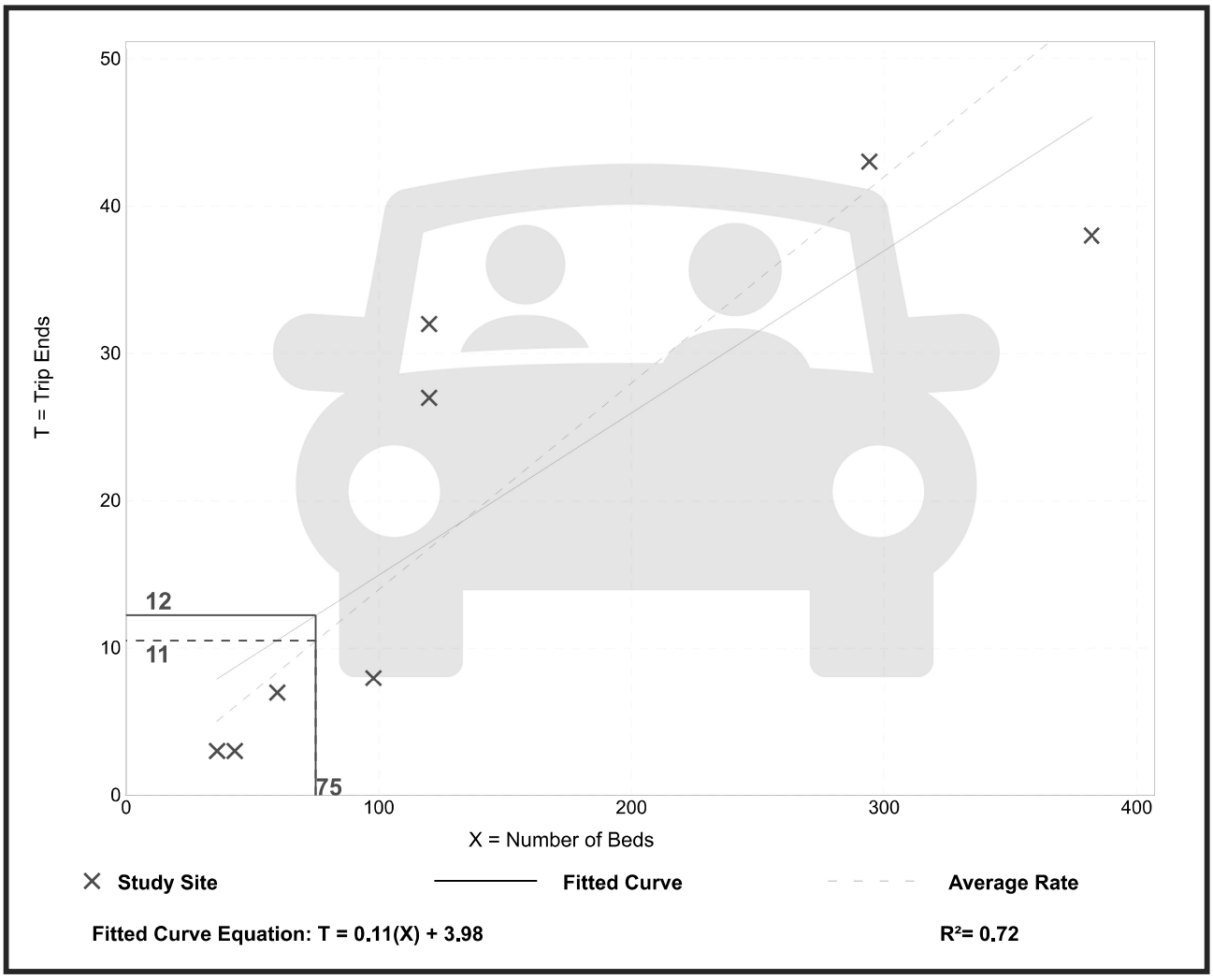
Nursing Home
(620)

Vehicle Trip Ends vs: **Beds**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 8
Avg. Num. of Beds: 144
Directional Distribution: 33% entering, 67% exiting

Vehicle Trip Generation per Bed

Average Rate	Range of Rates	Standard Deviation
0.14	0.07 - 0.27	0.06

Data Plot and Equation



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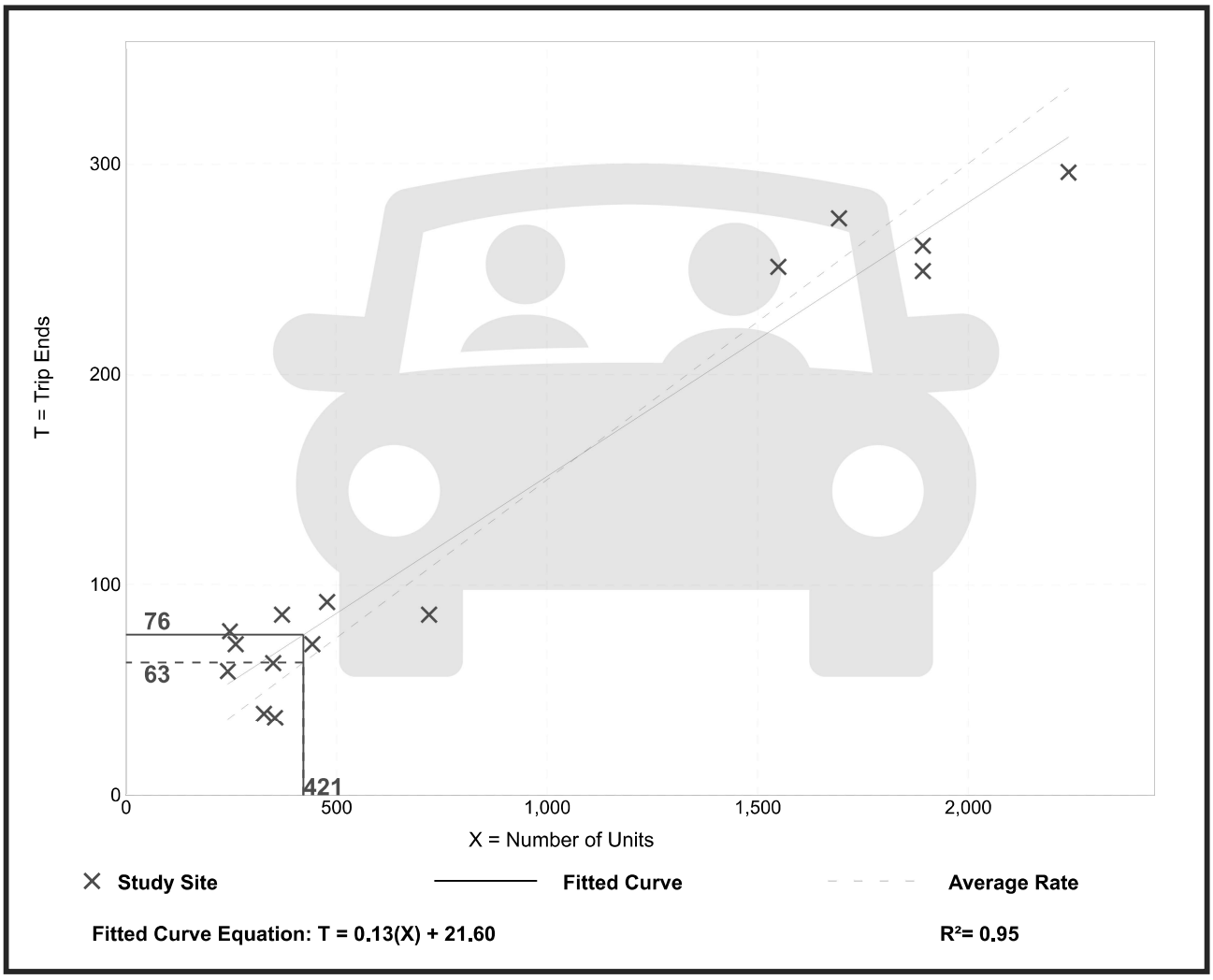
Continuing Care Retirement Community
(255)

Vehicle Trip Ends vs: **Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 15
Avg. Num. of Units: 871
Directional Distribution: 65% entering, 35% exiting

Vehicle Trip Generation per Unit

Average Rate	Range of Rates	Standard Deviation
0.15	0.10 - 0.32	0.04

Data Plot and Equation



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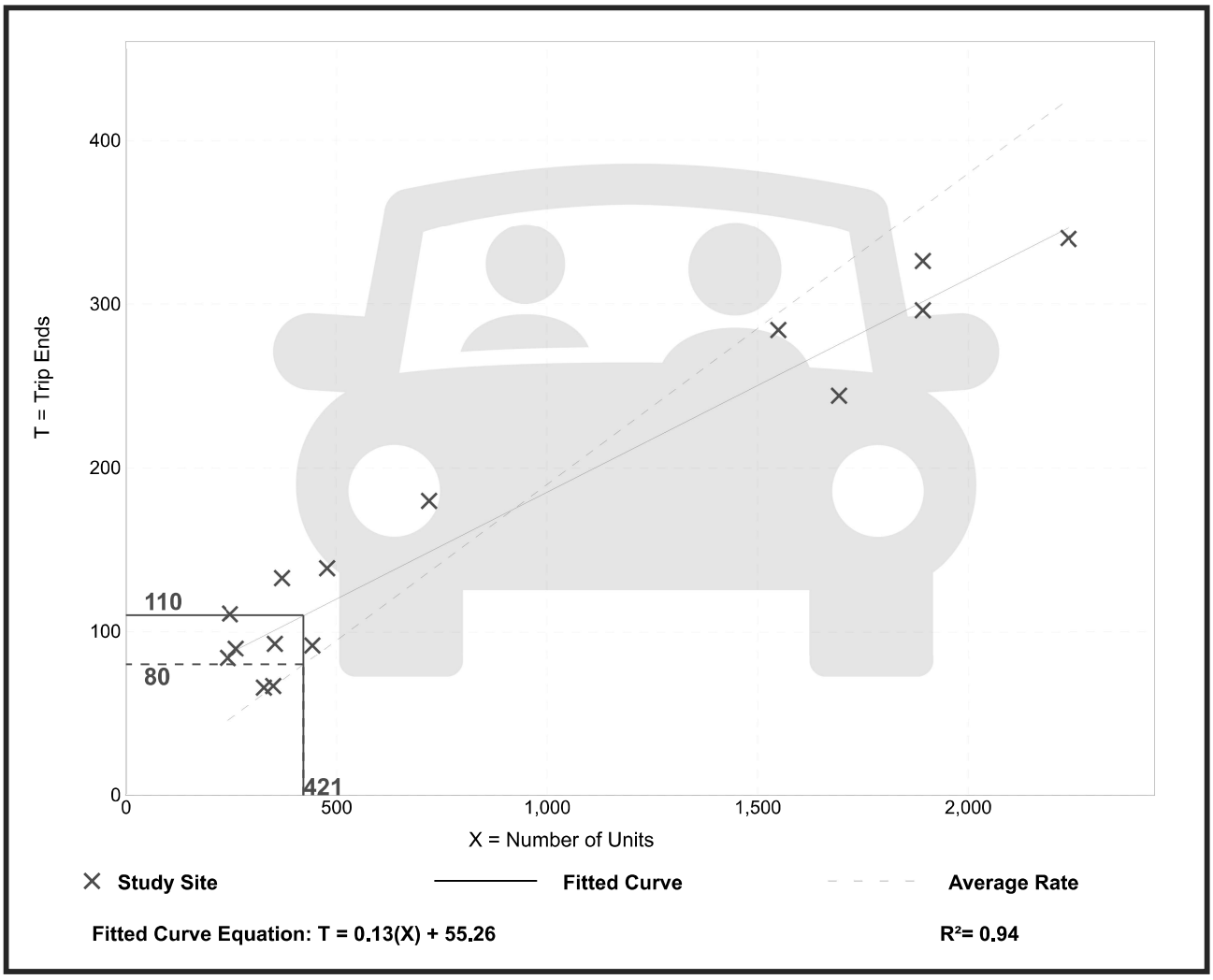
Continuing Care Retirement Community
(255)

Vehicle Trip Ends vs: **Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 15
Avg. Num. of Units: 871
Directional Distribution: 39% entering, 61% exiting

Vehicle Trip Generation per Unit

Average Rate	Range of Rates	Standard Deviation
0.19	0.14 - 0.45	0.07

Data Plot and Equation



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