

# Memorandum

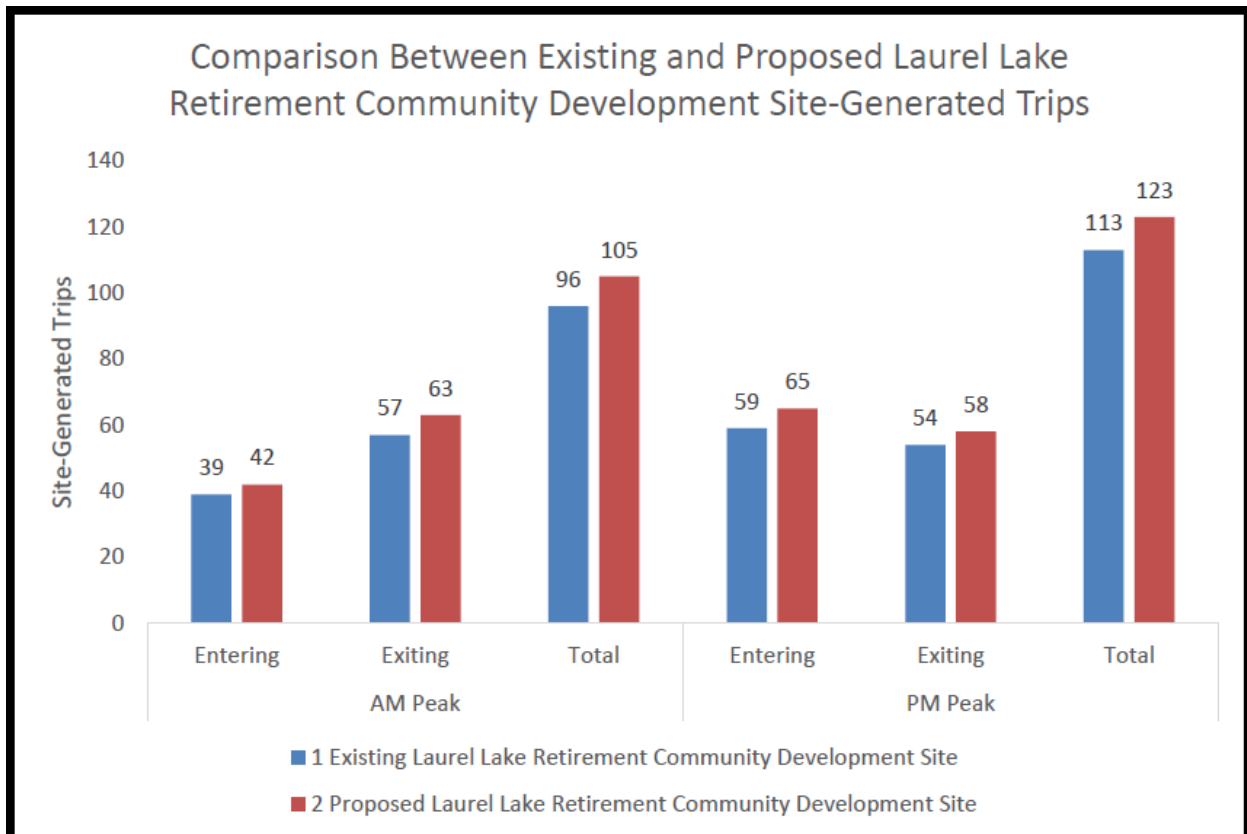
**To:** Eileen Nacht, AIA, LEED AP, EDAC  
RDL Architects

**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 11<sup>th</sup> 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 Laurel 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:  $ISD = 1.47 \times V_{major} \times tg$

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

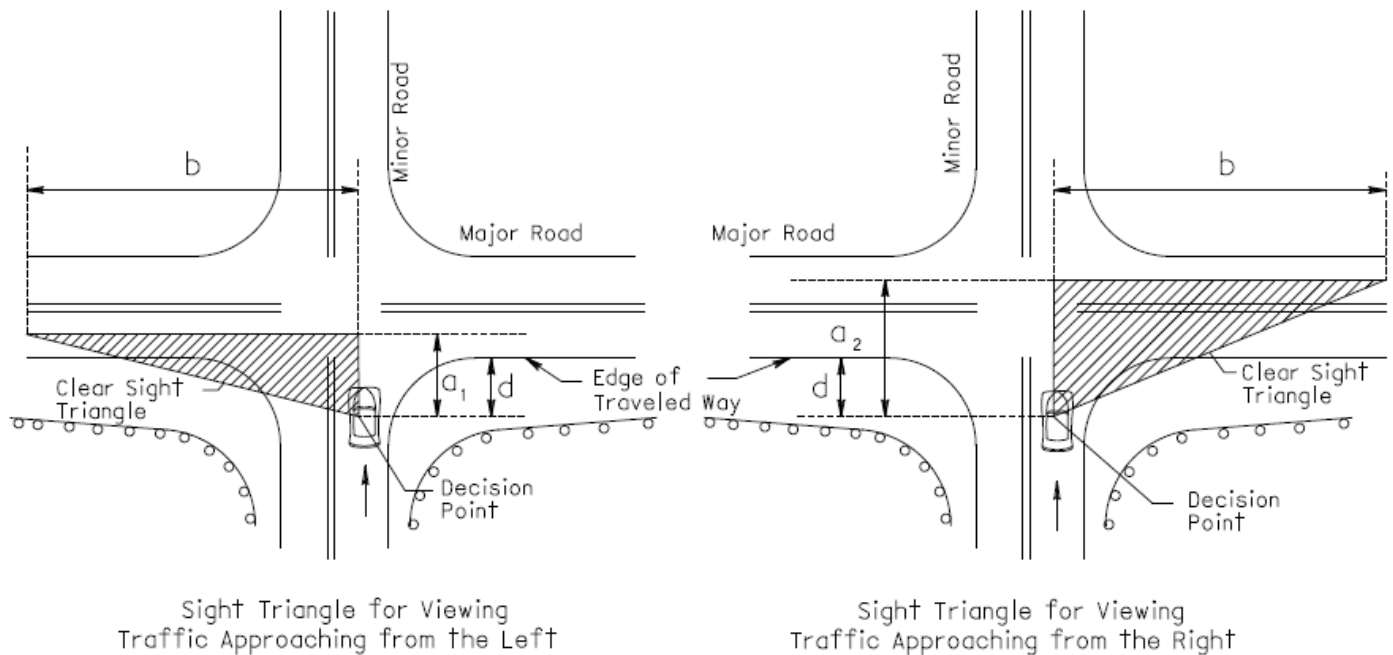


DIAGRAM A - SIGHT TRIANGLES

- $a_1$  = 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.

|                                    |                                                                        |
|------------------------------------|------------------------------------------------------------------------|
| <b>INTERSECTION SIGHT DISTANCE</b> | <b>201-5</b>                                                           |
|                                    | <b>REFERENCE SECTION<br/>201.3, 201.3.1,<br/>201.3.2 &amp; 201.3.3</b> |

(See Following Page for Additional Figures &amp; Notes)

HEIGHT OF EYE 3.50'

HEIGHT OF OBJECT 3.50'

| DESIGN<br>SPEED<br>(mph) | Passenger Cars<br>Completing a Left<br>Turn from a Stop<br>(assuming a $t_g$ of 7.5 sec.) |                           | Passenger Cars<br>Completing a Right<br>Turn from a Stop or<br>Crossing Maneuver<br>(assuming a $t_g$ of 6.5 sec.) |                           |
|--------------------------|-------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------|
|                          | ISD<br>(ft.)                                                                              | K-CREST<br>VERT.<br>CURVE | ISD<br>(ft.)                                                                                                       | K-CREST<br>VERT.<br>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                       |

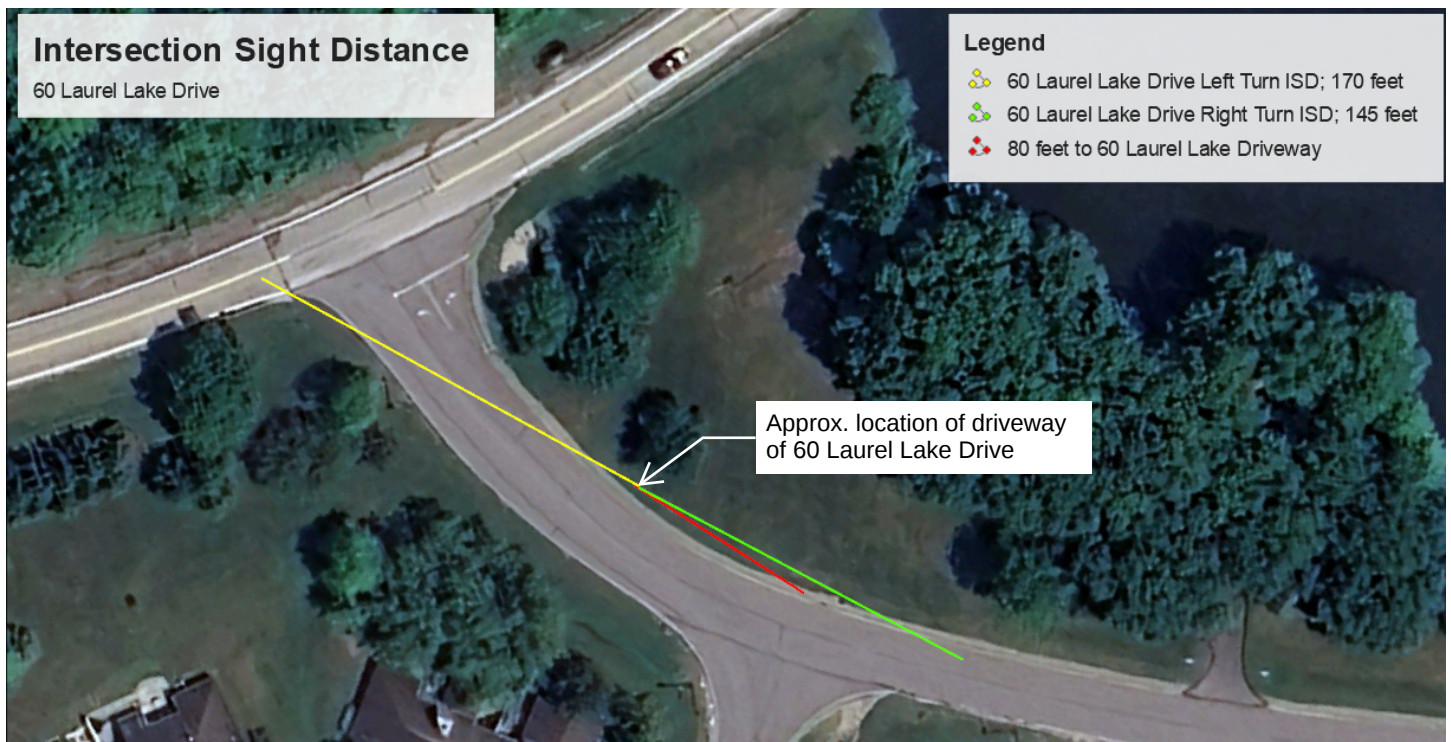
$$ISD = 1.47 \times V_{\text{major}} \times t_g$$

ISD = intersection sight distance (ft.)

$V_{\text{major}}$  = 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)*

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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), 11<sup>th</sup> 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)

May 24, 2024

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- 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

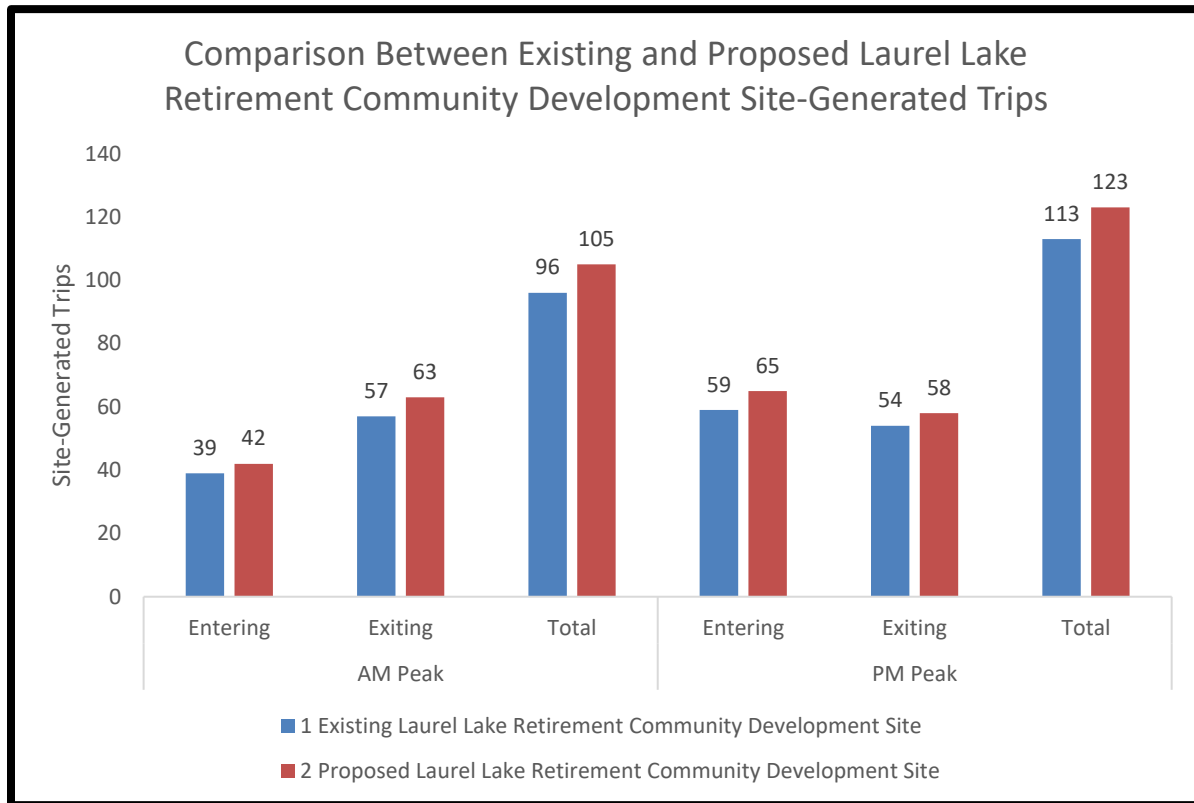
| S.N.                                                                  | Development Description                                                                                                                                    | ITE Land Use                         | ITE Land Use Code | Independent 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   |

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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.

May 24, 2024

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## Appendix



Laurel Lake Retirement Community  
200 Laurel Lake Drive, Hudson OH 44236  
330-650-2100 / [www.laurellake.org](http://www.laurellake.org)

- Residences & Neighborhoods
- Roads
- Walks
- Grass & Woodlands
- Wetland Habitat



## 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

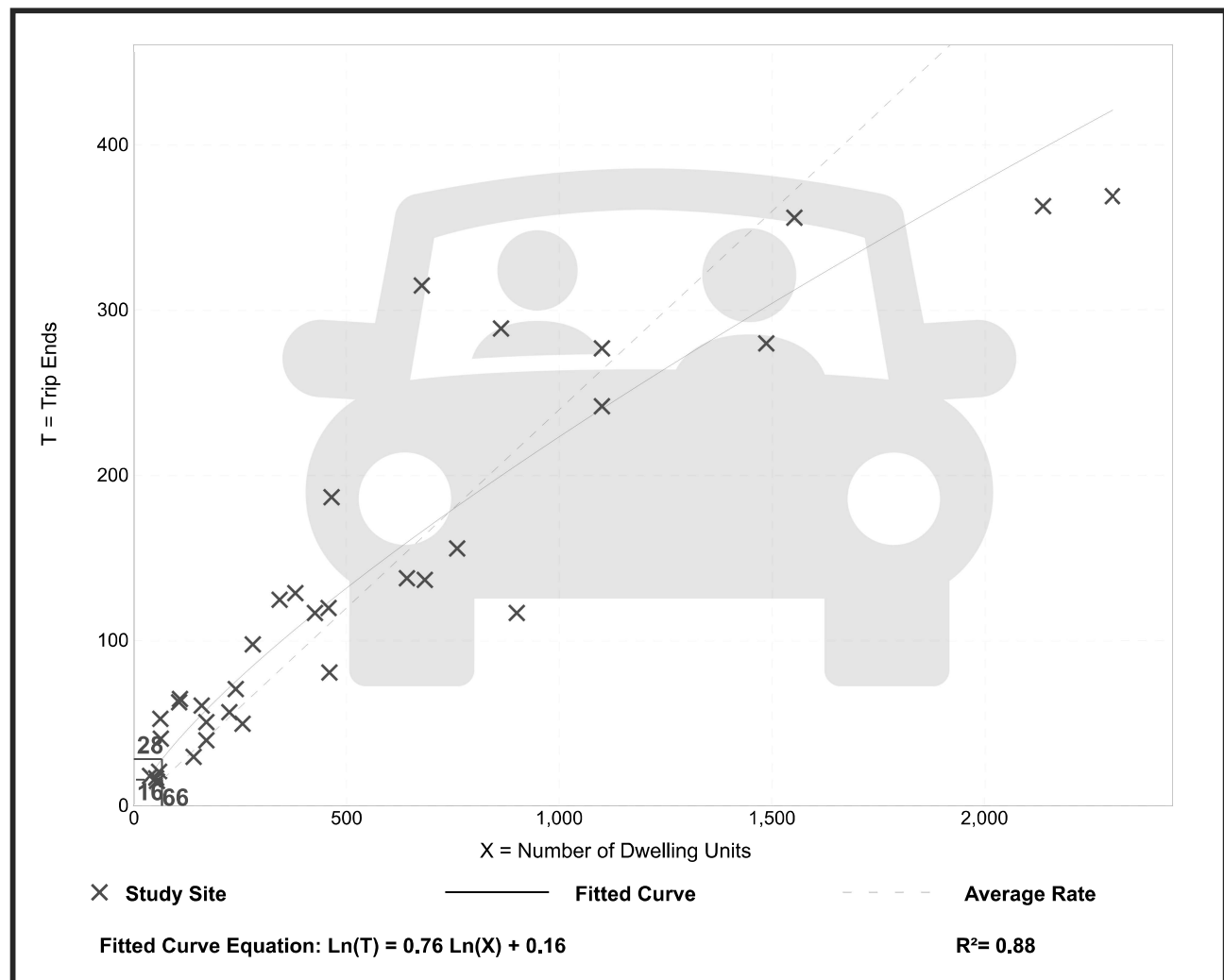
Avg. Num. of Dwelling Units: 557

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



## 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

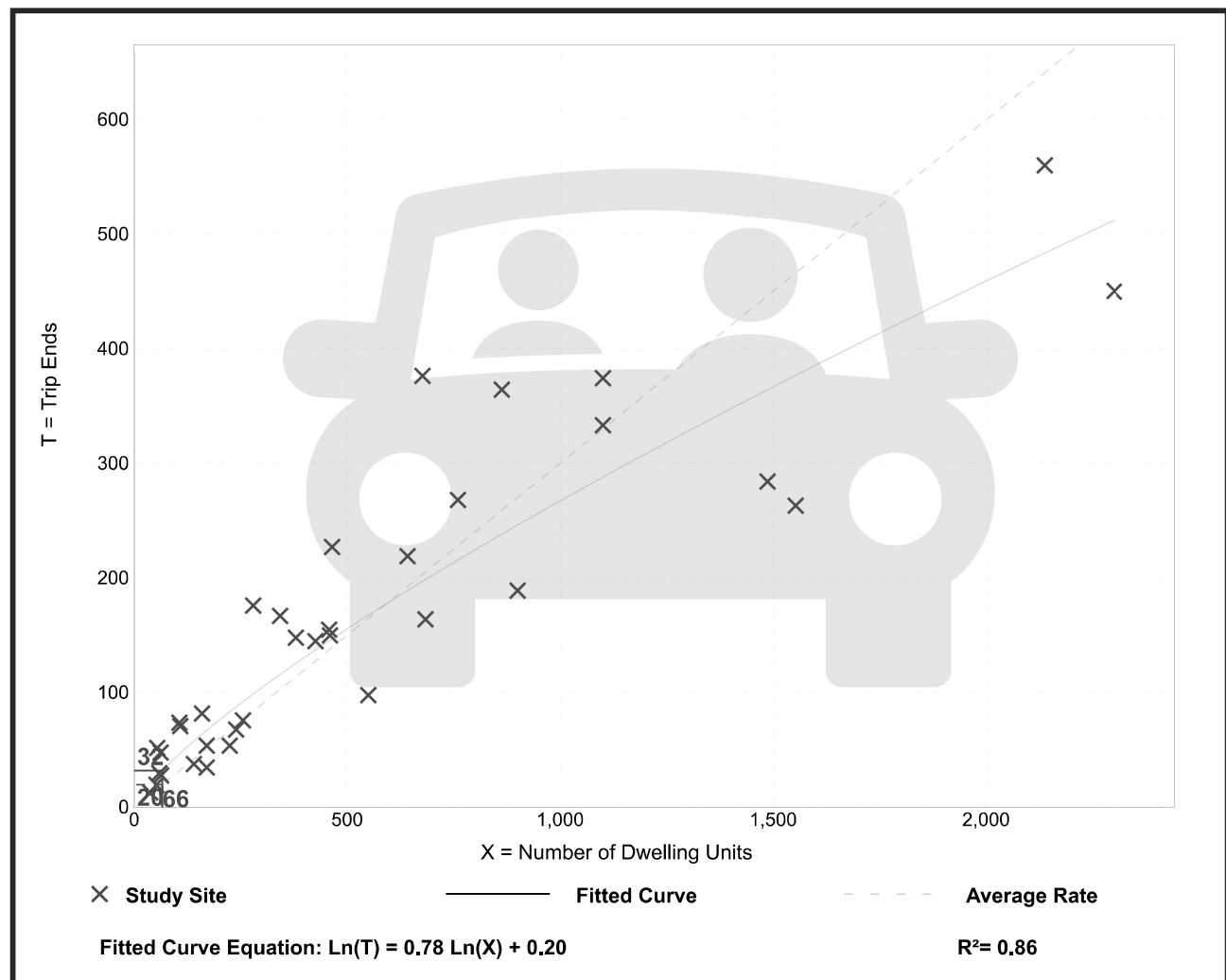
Avg. Num. of Dwelling Units: 556

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



## 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

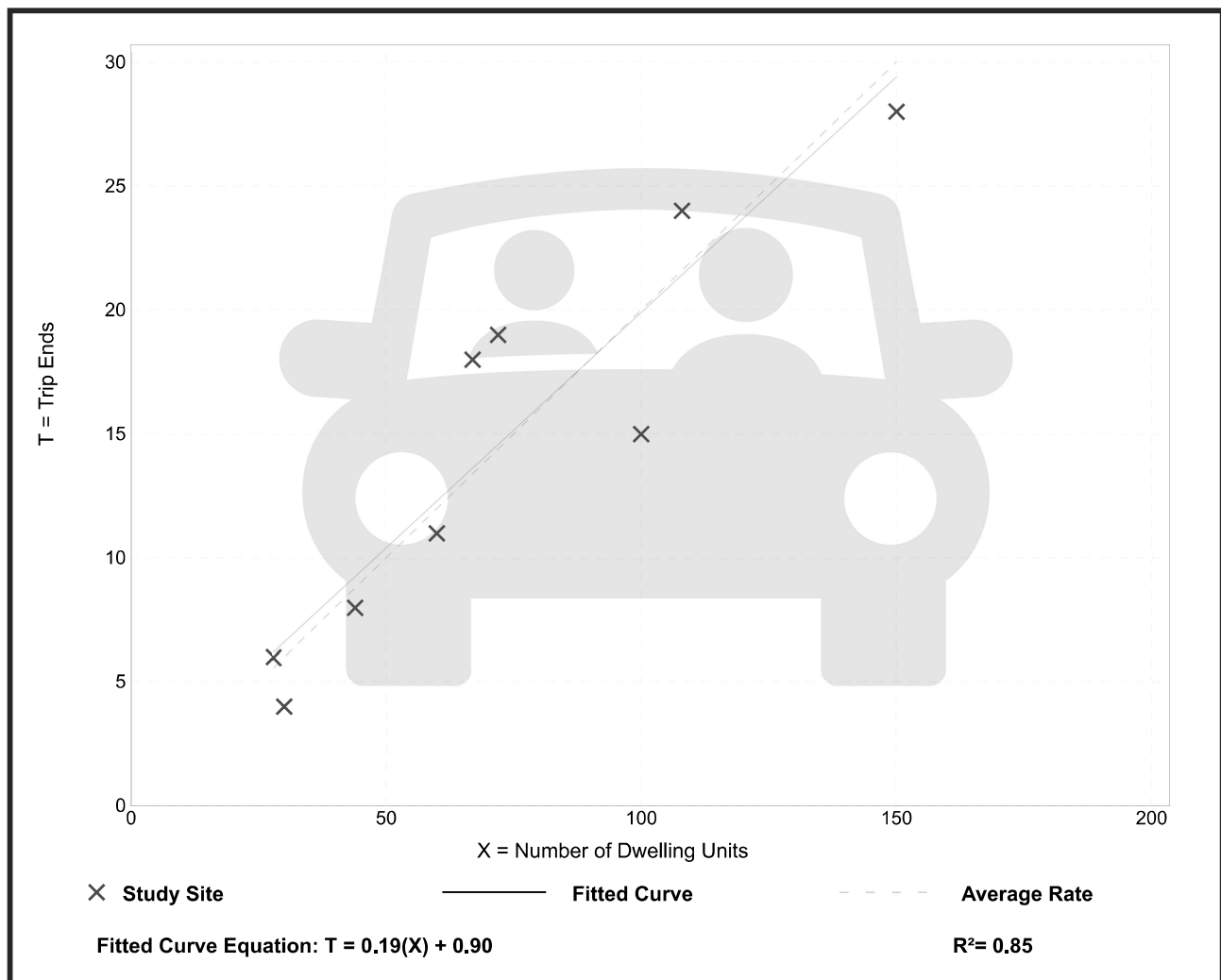
Avg. Num. of Dwelling Units: 73

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



## 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

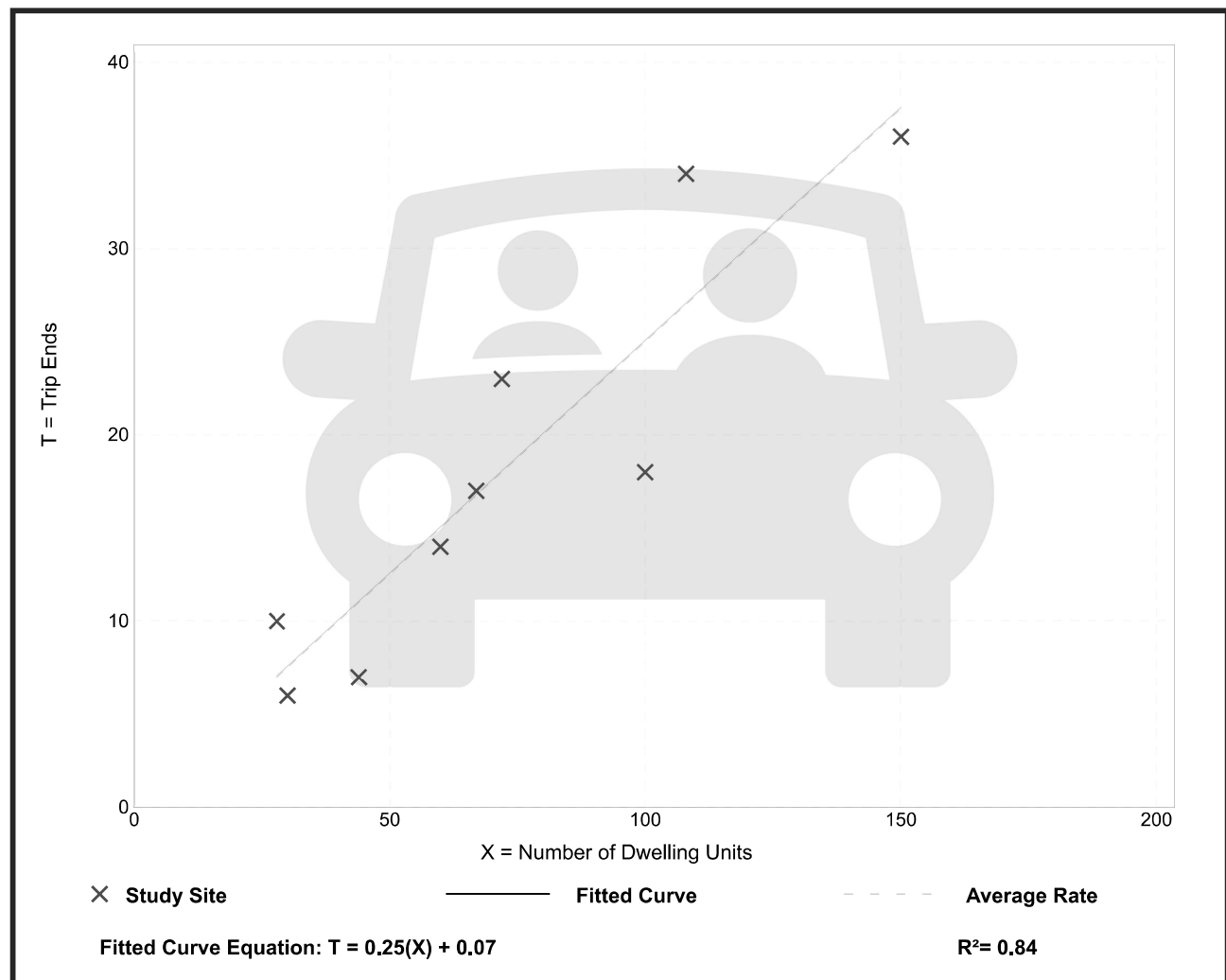
Avg. Num. of Dwelling Units: 73

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



# 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

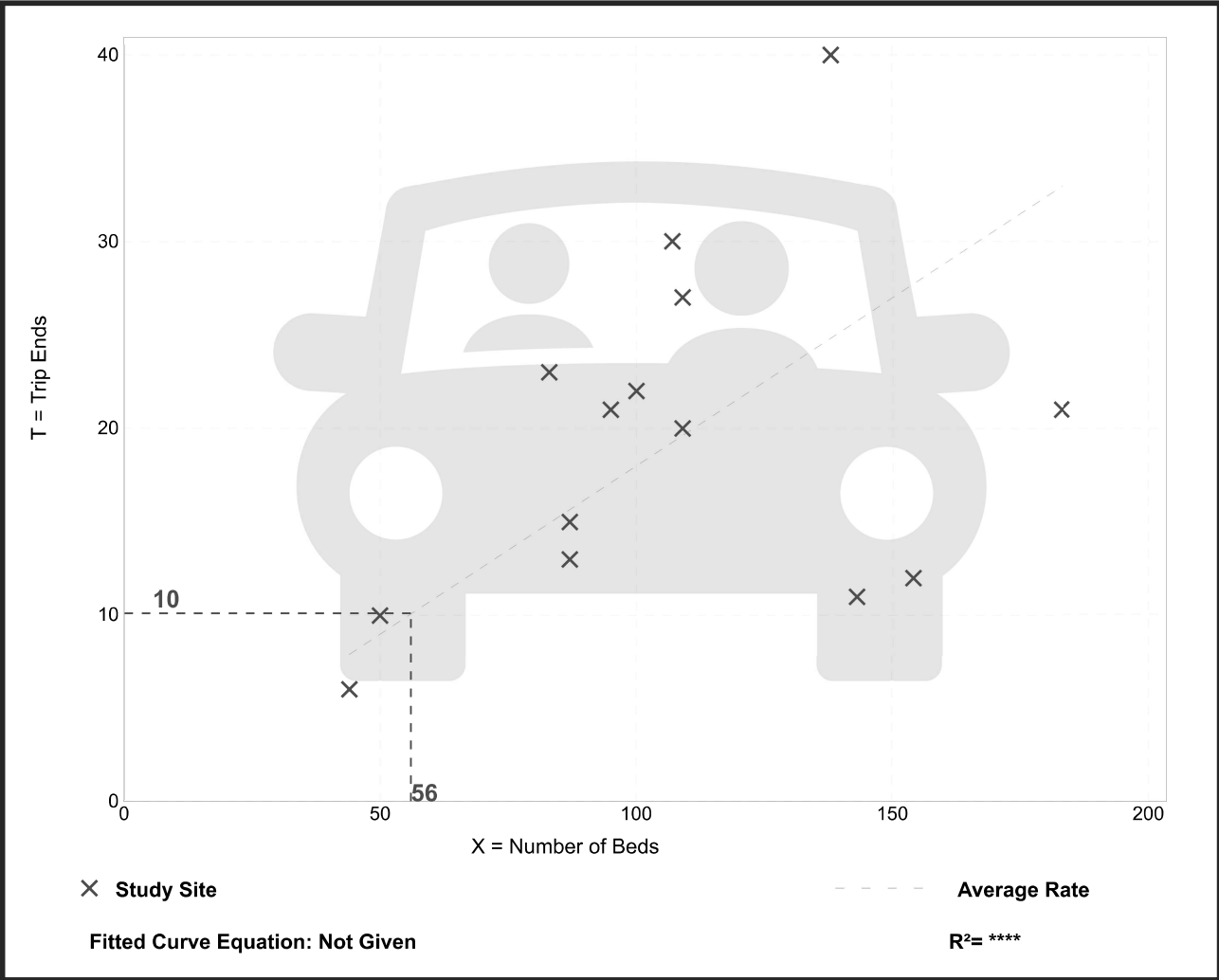
Avg. Num. of Beds: 106

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



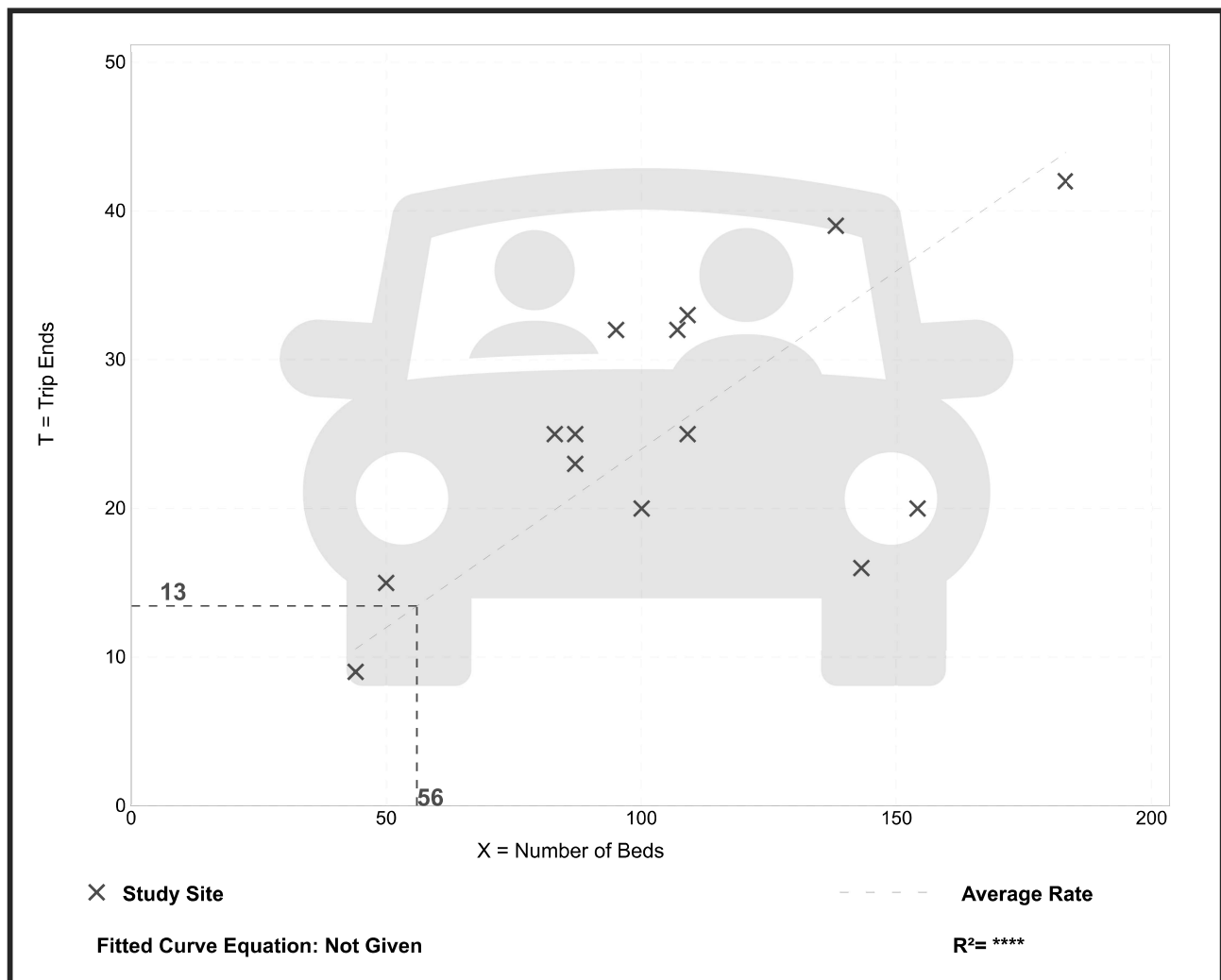
## Assisted Living (254)

**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



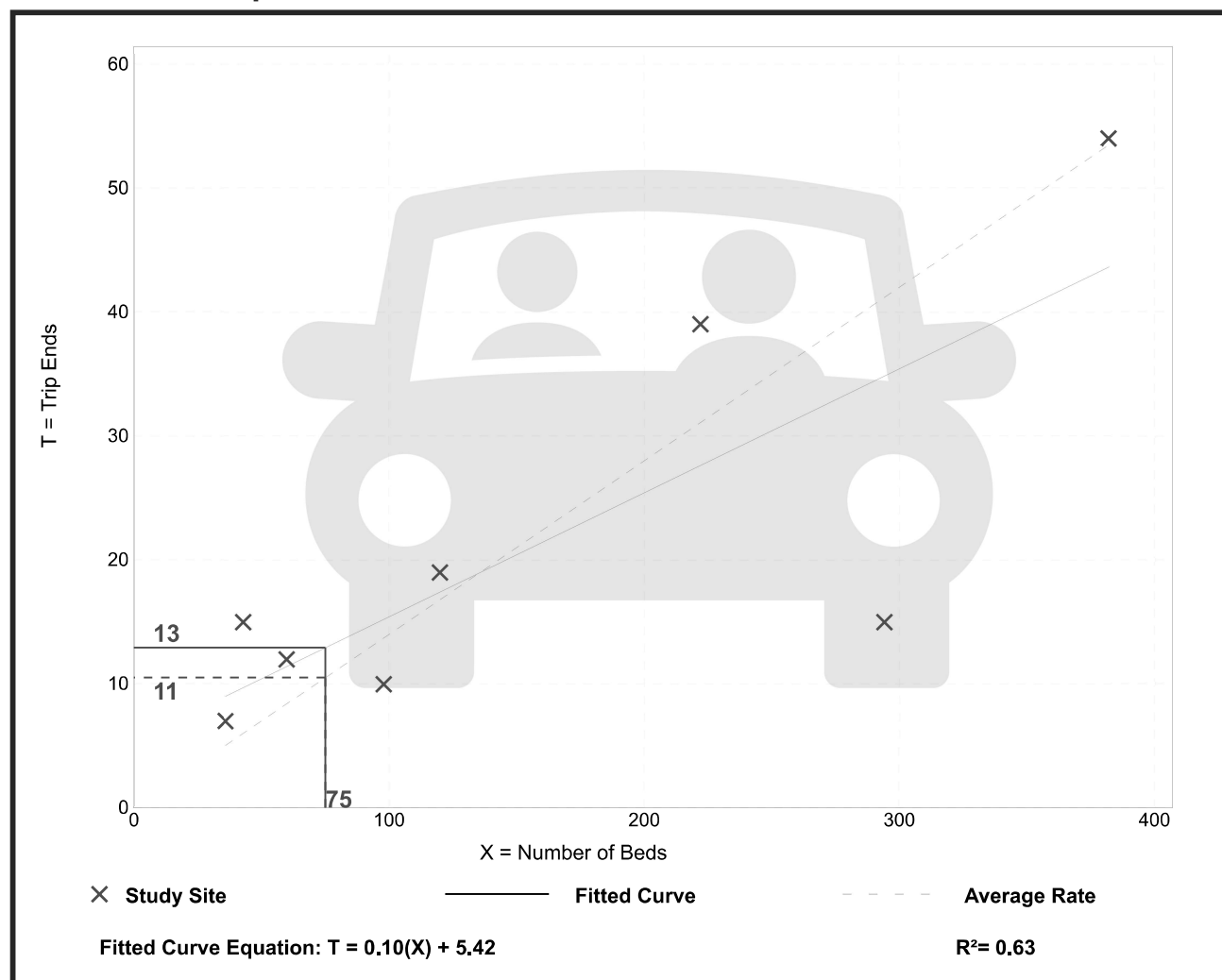
## Nursing Home (620)

**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



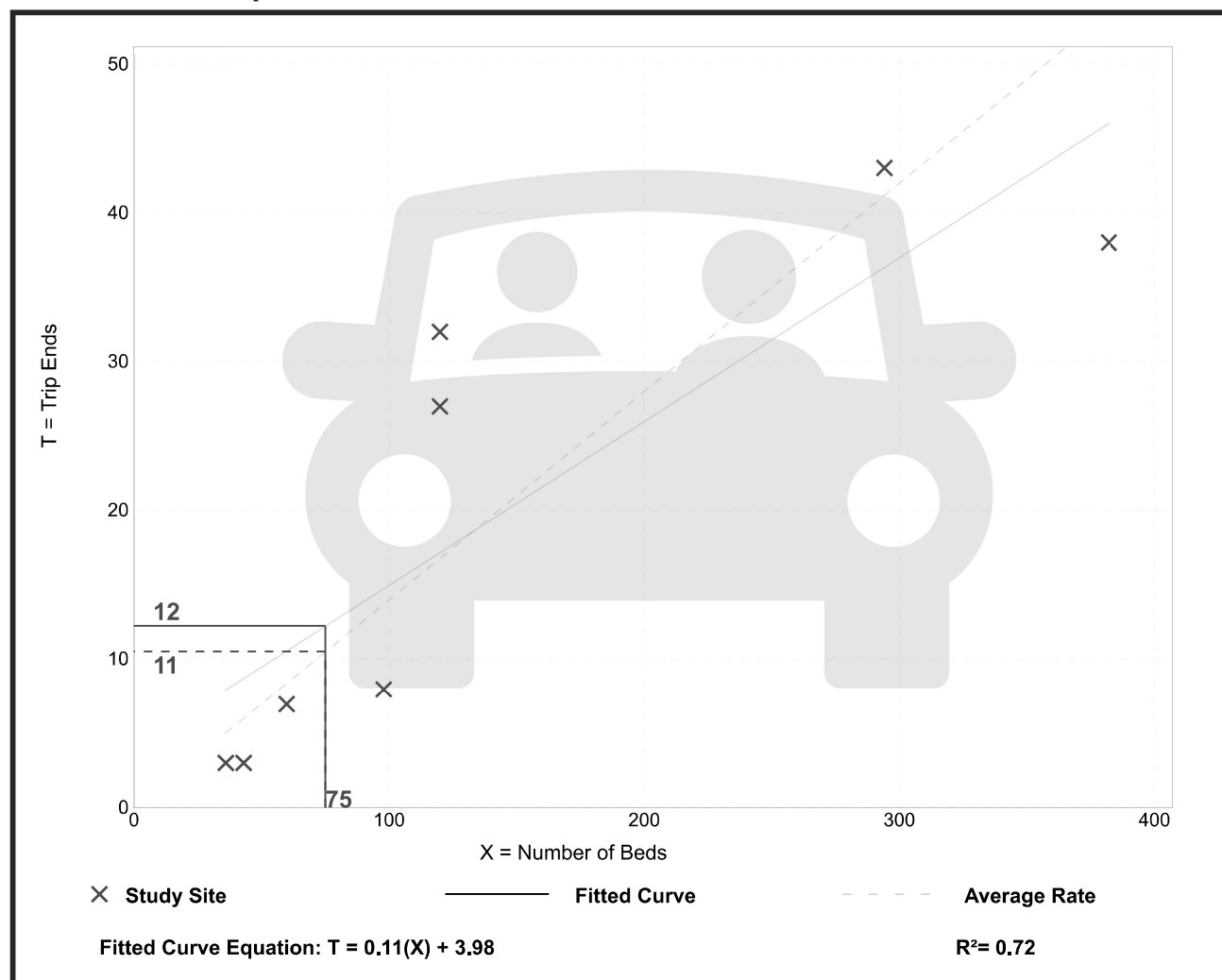
## Nursing Home (620)

**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



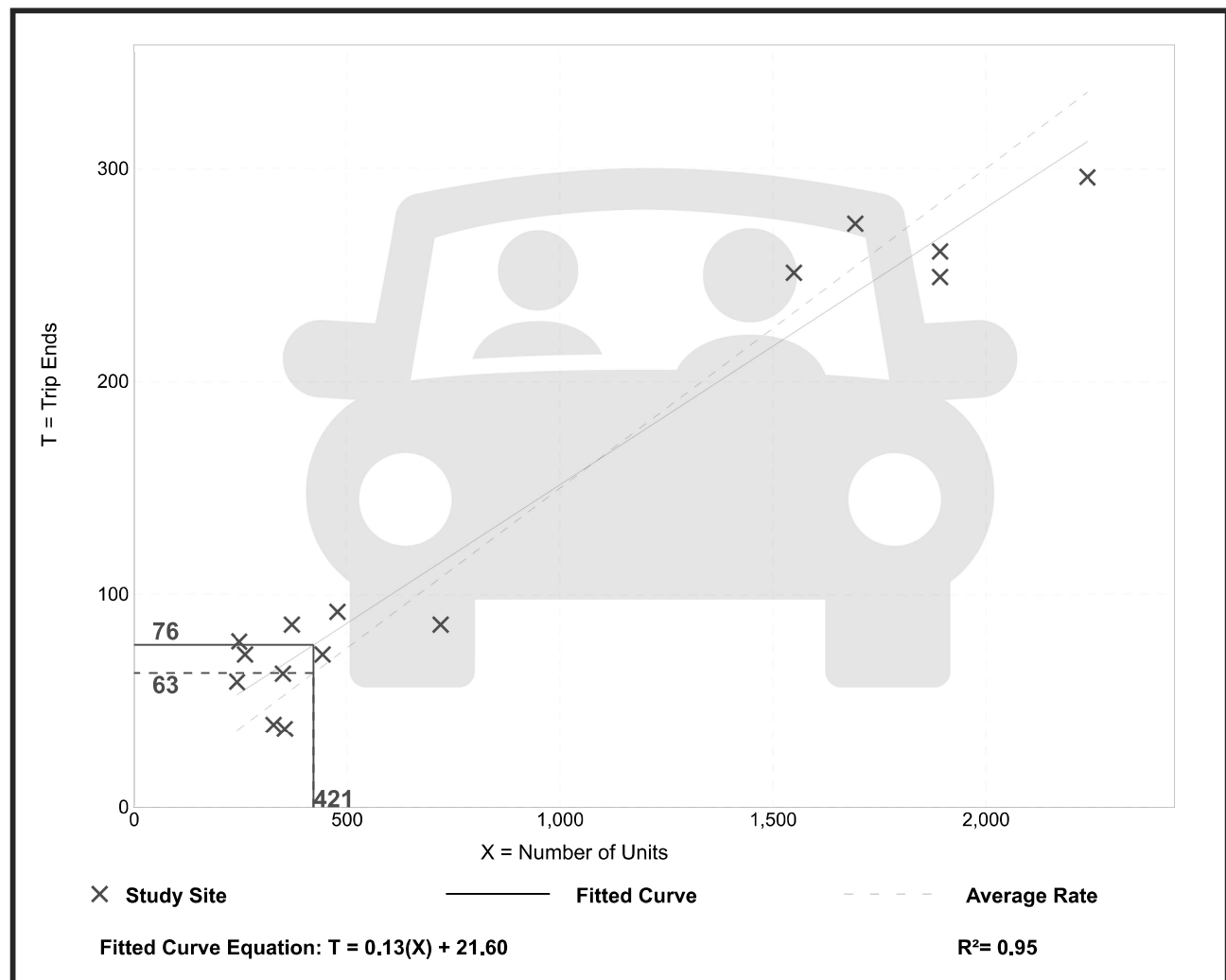
## Continuing Care Retirement Community (255)

**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



## 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

