bayerbecker.com
513-336-6600
mason | cincinnati | oxford | fort mitchell

Memorandum

Date: July 9, 2021

To: Mr. Bryan Williams, P.E., Director
Department of Transportation and Engineering
City of Cincinnati, Ohio

cc: Mr. Chad Munitz, Towne Properties
Mr. Mike Dooley, P.E., LEED AP, Bayer Becker
Mr. Fred Heekin, P.E., Bayer Becker

From: Wardell Wilcox, P.T.P., Bayer Becker

Subject: Pleasant Ridge Mixed-Use Development
Traffic Assessment Analysis

As discussed in our zoom meeting on Thursday, June 17, 2021, the purpose of this memorandum is to provide our finding for the initial traffic assessment of the proposed Pleasant Ridge Mixed-Use development. The proposed Pleasant Ridge Mixed-Use development is located in the southeast corner of the Montgomery Road (US 22) and Lester Road intersection. The land uses and densities of the proposed Pleasant Ridge Mixed-Use development are as follows:

- Multifamily Residential Housing – 83 Dwelling Units.
- Commercial Retail – 1,318 Square Feet.
- Fast Casual Restaurant – 3,162 Square Feet.

Access to the proposed Pleasant Ridge Mixed-Use development is anticipated on Montgomery Road (US 22), approximately 340 feet east of Lester Road (centerline to centerline) and on Lester Road, approximately 140 feet south of Montgomery Road (US 22) (centerline to centerline). As a reminder, the site plan for the proposed development is enclosed as Attachment A.

Existing traffic volumes at the critical intersection Montgomery Road (US 22) and Lester Road were determined based on historical data provided by the Cincinnati Department of Transportation and Engineering (DOTE). The existing AM and PM peak hour turning movement volumes were established based on the existing approaching and advancing traffic experience at the Montgomery Road (US 22) and Lester Road intersection. The existing AM and PM peak hour turning movement volumes for Montgomery Road (US 22) and Lester Road intersection, including supportive documents, are graphically provided as Attachment B.

The regional distribution of traffic during the weekday AM and PM peak hour periods were determined based on the existing traffic volumes entering and exiting the external stations of the project study area. The regional distribution percentages are shown graphically, along with the existing traffic data, in Attachment B and provided in Table 1.

Table 1
Regional Traffic Distribution

Pleasant Ridge Mixed-Used Development Orientation To/From	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
East on Montgomery Road (US 22)	50%	44%	45%	45%
West on Montgomery Road (US 22)	39%	46%	47%	38%
North on Lester Road	11%	10%	8%	17%
Total	100%	100%	100%	100%

The trips generated by the proposed Pleasant Ridge Mixed-Use development were estimated based on the trip rates provided by the Institute of Transportation Engineers (ITE), Trip Generation Manual, 10th Edition, as shown in Table 2.

Table 2
Trip Generation – Pleasant Ridge Mixed-Used Development

Land Use	ITE Code*	Size	Units	AM Peak Hour			PM Peak Hour		
				Enter	Exit	Total	Enter	Exit	Total
Multifamily Housing (Mid-Rise) 3 to 10 floors	221	79	DU's	7	20	27	21	14	35
Mid-Rise Residential w/1st – Floor Commercial – 3 to 10 Floors	231	4	DU's	0	1	1	1	0	1
Shopping Center	820	1.318	SF	94	58	152	11	11	22
Fast Casual Restaurant	930	3.162	SF	5	2	7	25	20	45
Total Generated Trips				106	81	187	58	45	103

* *Trip Generation Manual,* Institute of Transportation Engineers, 10th Edition.

The total trips generated by the proposed Pleasant Ridge Mixed-Use development were assigned to the adjacent road network based on the percentages contained in Table 1. It should be noted that the assignment of trips entering and exiting on Montgomery Road (US 22) were split 75%, to the 1st drive, and 25%, to the second drive, based on the inbound and outbound direction. The AM and PM peak hour site generated trip assignments are provided as Attachment C, along with ITE Land Use excerpts.

The site generated trips were combined with the existing traffic volumes to create the Opening Day Traffic Projections. The Opening Day Traffic Projections for the proposed Pleasant Ridge Mixed-Use development are provided as Attachment D.

An existing traffic and opening day traffic projection capacity analysis was completed at the Montgomery Road (US 22) and Lester Road intersection during the AM and PM peak hour periods. The results of the capacity analysis are provided in Table 3 and contained in Attachment E.

Table 3
Level of Service Capacity Results

		2021 Existing		Opening Day Traffic Projections	
		LOS (Sec. of Delay)			
		AM	PM	AM	PM
Montgomery Road (US 22) and Lester Road					
EB	T	A (9.8)	B (11.2)	A (9.9)	B (11.4)
	R	A (9.8)	B (11.2)	A (10.0)	B (11.4)
	Approach	**A (9.8)**	**B (11.2)**	**A (10.0)**	**B (11.4)**
WB	L	B (13.4)	C (27.0)	B (14.2)	C (30.4)
	T	A (10.0)	B (10.3)	B (10.0)	B (10.3)
	Approach	**B (10.5)**	**B (14.1)**	**B (10.7)**	**B (15.0)**
NB	LR	B (18.5)	B (18.4)	B (19.0)	B (18.6)
	Approach	**B (18.5)**	**B (18.4)**	**B (19.0)**	**B (18.6)**
Overall Intersection		**B (11.2)**	**B (13.1)**	**B (11.5)**	**B (13.6)**

Based on the level of service analysis completed and summarized in Table 3, the overall capacity analysis results for the Opening Day Traffic Projections are satisfactory. Please review the attached and feel free to contact me at 513-336-6600 with any questions.

ATTACHMENT A

bayer becker
www.bayerbecker.com
1404 Race Street, Suite 204
Cincinnati, OH 45202 - 513.834.6151

Basis of Bearing:
State Plane NAD83 (2011)
0 10 20 30
SCALE: 1" = 20'

m+a
1404 Race St, Suite 202
Cincinnati, Ohio 45202
p 513 407 8260
f 513 407 3086
www.ma-architects.com

MONTGOMERY ROAD

LESTER ROAD

PROP. UTILITY POLE PER DUKE ENERGY STANDARDS (SEE MEP PLANS)

EX. 8"INV.=775.6 (FIELD-VERIFY)

CONNECT TO EX. SAN. LATERAL w/PROP. CLEANOUT PER MSD STANDARDS (FIELD-VERIFY LOCATION & CONDITION w/CAMERA PRIOR TO CONSTRUCTION)

EX. 8"INV.=778.2 (FIELD-VERIFY)

CONNECT TO EX. SAN. LATERAL w/PROP. CLEANOUT PER MSD STANDARDS (FIELD-VERIFY LOCATION & CONDITION w/CAMERA PRIOR TO CONSTRUCTION)

CONNECT TO EX. 8" GAS MAIN PER DUKE ENERGY STANDARDS (WORK IN R/W BY DUKE ENERGY)

RELOCATE EX. UTILITY POLE FOR PROP. DRIVE APRON (COORDINATE w/DUKE ENERGY)

RELOCATE EX. FH FOR PROP. DRIVE APRON (COORDINATE w/GCWW)

EX. 8"INV.=771.8 (FIELD-VERIFY)

CONNECT TO EX. SAN. LATERAL w/PROP. CLEANOUT PER MSD STANDARDS (FIELD-VERIFY LOCATION & CONDITION w/CAMERA PRIOR TO CONSTRUCTION)

6"-6"S.L. (PVC SDR-35) @2.0% MIN.

SEE MEP PLANS FOR CONNECTION TO BUILDING SAN.

PROP. COMM SERVICE (COORDINATE w/CINCINNATI BELL)

6"-6"S.L. (PVC SDR-35) @2.0% MIN.

SEE MEP PLANS FOR CONNECTION TO BUILDING SAN.

PROP. GAS SERVICE (SEE MEP PLANS)

SEE MEP PLANS FOR GAS METER DETAILS

CONNECT TO EX. 24"W.M. PER GCWW STANDARDS (REMOVE & REPLACE EX. PAVEMENT PER DOTE STANDARDS)

6" FIRE BRANCH

FIELD-VERIFY LOCATION & DEPTH OF EX. 6"S.L. FOR BRANCH INSTALLATION

DUAL SERVICE METER PIT PER GCWW DETAIL 108-14B; 6" FIRE LINE 4" DOMESTIC LINE W/3" METER

PROP. PRIVATE FIRE HYDRANT

CONNECT TO EX. UTILITY POLE FOR PROP. ELECTRIC SERVICE PER DUKE ENERGY STANDARDS (SEE MEP PLANS)

4" DOMESTIC BRANCH

POST INDICATOR VALVE (PIV)

CHECK VALVE

FIRE DEPARTMENT CONNECTION (FDC)

SEE MEP PLANS FOR CONNECTION TO BUILDING ELEC.

2-4" SCH 40 CONDUITS FOR SECONDARY ELECTRIC SERVICE (SEE MEP PLANS)

8"-6"S.L. (PVC SDR-35) @2.0% MIN.

SEE MEP PLANS FOR CONNECTION TO BUILDING SAN.

4" DOMESTIC LINE
6" FIRE LINE

6" R.D.

12"STM

10' TYPE 'A' BUFFER YARD

PRIMARY ELECTRIC SERVICE PER DUKE ENERGY STANDARDS

PROP. CONTAINMENT STRUCTURE ("HOT BOX") FOR BACKFLOW PREVENTER ON DOMESTIC LINE (SUBMIT SHOP DRAWINGS FOR APPROVAL; PROVIDE POWER FROM BUILDING)

POTENTIAL GENERATOR LOCATION (COORDINATE w/MEP)

PROP. TRANSFORMER w/BOLLARDS PER DUKE ENERGY STANDARDS (SEE MEP PLANS)

3' PARKING SETBACK

UNDERGROUND DETENTION SYSTEM 6,500 CF (N). STORAGE; STORMTECH MC-4500 SYSTEM (OR EQUAL)

8"RCP

REMOVE & REPLACE EX. PAVEMENT & CURB PER DOTE STANDARDS FOR STORM CONNECTION

(VERIFY TIE-IN WITH MSD & SWU)

Justin A. Wiley
O.R. 13518, Page 1223
123-0091-0116
3012 Parkview

Robert E. Clark &
Pamela J. Clark
O.R. 13303, Page 1725
123-0091-0117
3018 Parkview

3029 Parkview, LLC
O.R. 13501, Page 1914
123-0091-0118
3029 Parkview

Lot 18 | Lot 17 | Lot 16 | Lot 15 | Lot 14 | Lot 13

6032 Montgomery Road LLC
O.R. 9355, Pg. 6270
Exhibit B
122-0004-0121
6032 Montgomery

Duke Energy Ohio, Inc
D.B. 3556, 558
122-0004-0124
6038 Montgomery

6032 Montgomery Road LLC
O.R. 9355, Pg. 6270
Exhibit A
122-0004-0014 & -0063 corp
6038 Montgomery

-0063

-0044

Plot time: Jan 08, 2021 - 3:42pm
Drawing name: J:\2019\19-0263\CVDWG\19-0263 CD.dwg - Layout Tab: Layout1

Pleasant Ridge Mixed Use

MONTGOMERY RD AND LESTER RD | CINCINNATI, OH 45213 |SCHEMATIC DESIGN 2

STATUS:

PRELIMINARY
NOT FOR CONSTRUCTION

REVISION:

PROJECT NUMBER:
2019.306

DRAWN BY:
BAYER BECKER

DATE:
8 JANUARY 2021

SHEET NAME:
SITE UTILITY PLAN

SHEET NUMBER:
C1.00

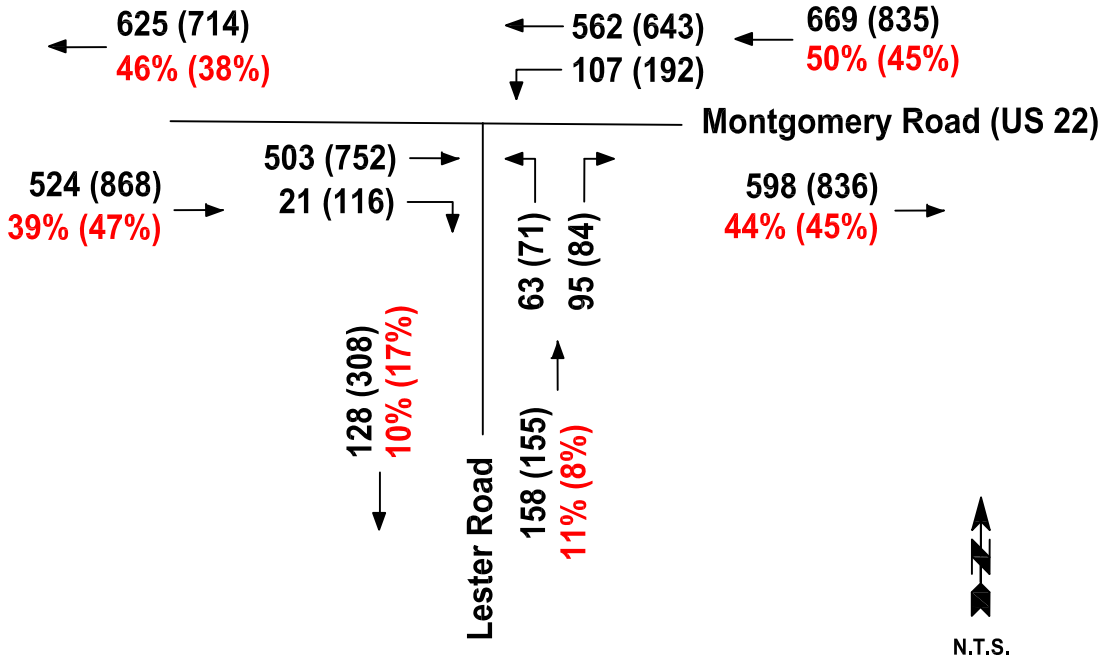
m+a architects

ATTACHMENT B

Existing Traffic and Percentage Validation

	AM Peak In		AM Peak Out	
To/From East on Montgomery Road (US 22)	669	50%	598	44%
To/From West on Montgomery Road (US 22)	524	39%	625	46%
To/From South on Lester Road	158	11%	128	10%
	1351	100%	1351	100%

	PM Peak In		PM Peak Out	
To/From East on Montgomery Road (US 22)	835	45%	836	45%
To/From West on Montgomery Road (US 22)	868	47%	714	38%
To/From South on Lester Road	155	8%	308	17%
	1858	100%	1858	100%



Attachment B

Pleasant Ridge Residential Development
City of Cincinnati, Hamilton County, Ohio

Existing Traffic and Percentage Distribution

xx/xx% - AM Peak Hour
(xx)/(xx%) - PM Peak Hour

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6900 Tylersville Road, Suite A
Mason, OH 45040 - 513.336.6600

Cypress Way to Langdon Farm Rd	35 MPH
Langdon Farm Rd to Lester Rd	30 MPH
Lester Rd to Woodmont Ave	25 MPH
Woodmont Ave to Grand Vista Ave	30 MPH
Grand Vista Ave to Coleridge Ave	35 MPH

CONTRACT DRAWING

PRINTS NOT BEARING THIS STAMP WERE MADE PRIOR TO ADVERTISING FOR BIDS AND ARE TO BE CONSIDERED OBSOLETE FOR CONTRACT PURPOSES.

Department of Transportation and Engineering

City of Cincinnati
City Hall
801 Plum Street
Cincinnati, Ohio 45202

Montgomery Rd Improvements

Traffic Counts

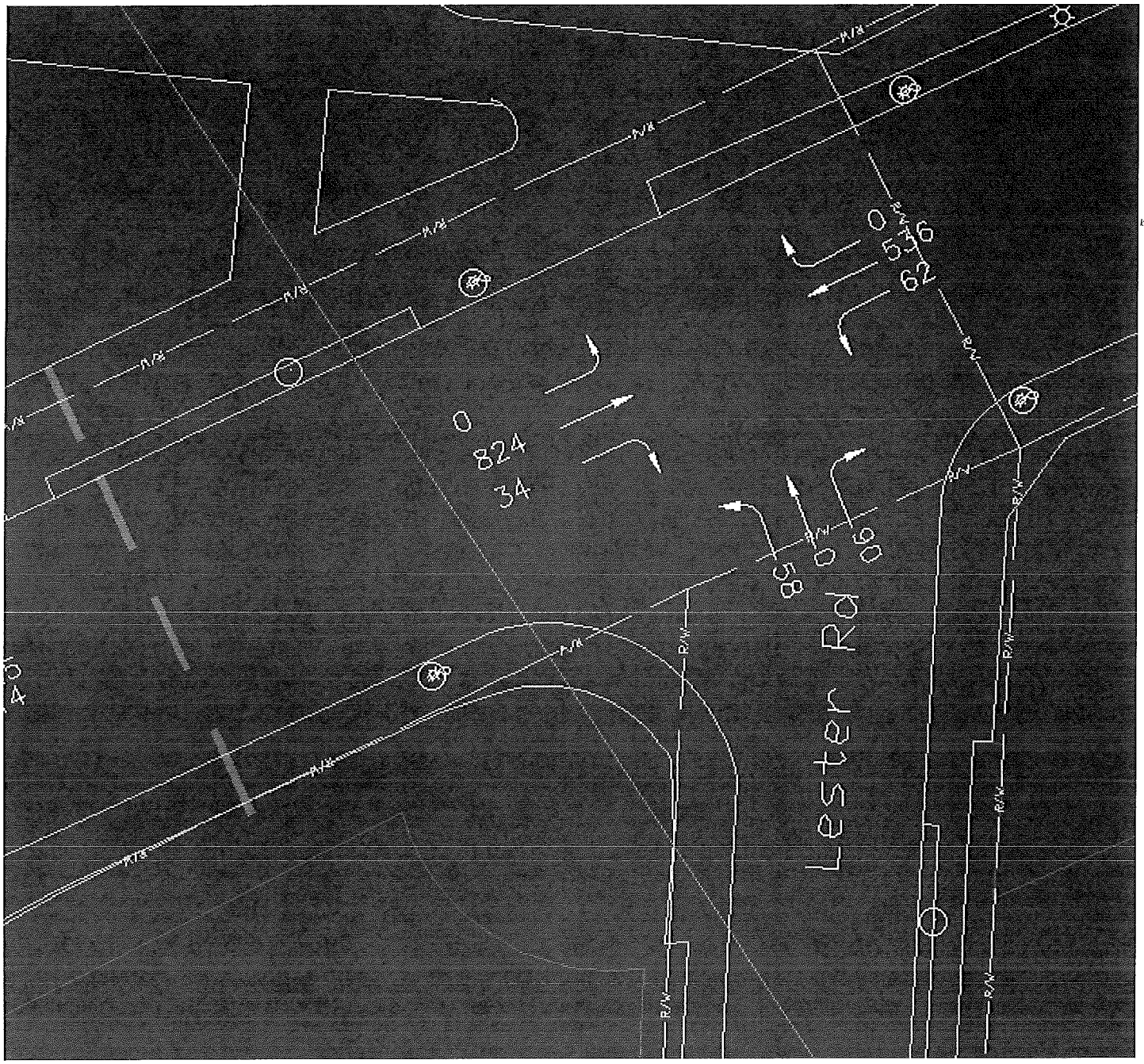
Revisions

No.				
	Date	Date	Date	Date
	Drawn by	Designed by	Checked by	Reviewed by

Consultant

Structure File Number

ACC No.



*USED FOR PERCENTAGE DISTRIBUTION ONLY

PM PEAK

MAINCOMERT ← 90% 10% →

90% → ← 10% 10% ↑

LEFTBACK

EB MAIN

96% →

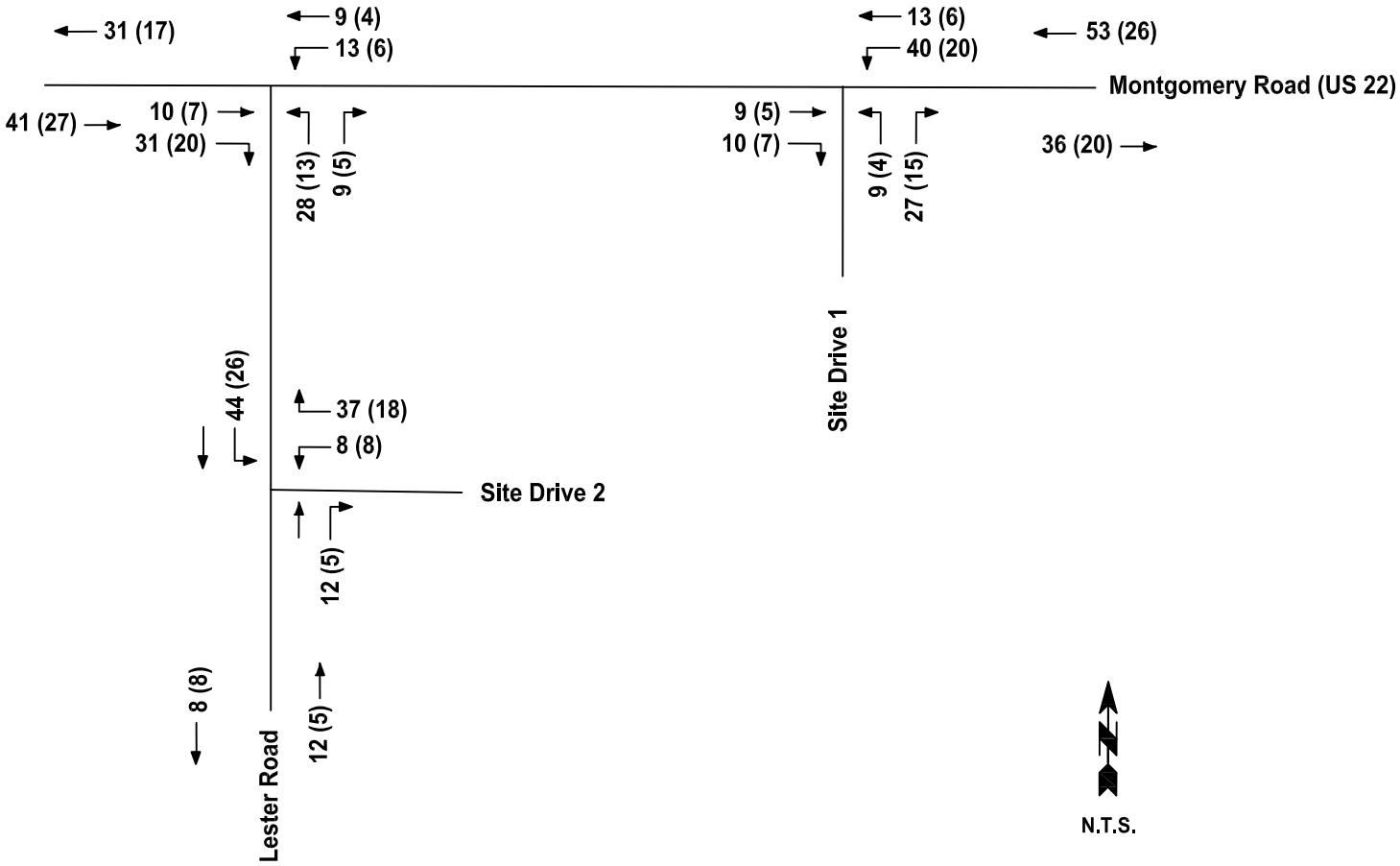
4% ↓

ATTACHMENT C

Site Generated Trip Validation

	AM Peak In	AM Peak Out
To/From East on Montgomery Road (US 22)	53	36
To/From West on Montgomery Road (US 22)	41	37
To/From South on Lester Road	12	8
	106	81

	PM Peak In	PM Peak Out
To/From East on Montgomery Road (US 22)	26	20
To/From West on Montgomery Road (US 22)	27	17
To/From South on Lester Road	5	8
	58	45



Attachment C

Pleasant Ridge Residential Development
City of Cincinnati, Hamilton County, Ohio

Site Generated Trips

xx - AM Peak Hour
(xx) - PM Peak Hour

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6900 Tylersville Road, Suite A
Mason, OH 45040 - 513.336.6600

Land Use: 221
Multifamily Housing (Mid-Rise)

Description

Mid-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have between three and 10 levels (floors). Multifamily housing (low-rise) (Land Use 220), multifamily housing (high-rise) (Land Use 222), off-campus student apartment (Land Use 225), and mid-rise residential with 1st-floor commercial (Land Use 231) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the mid-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the six sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.46 residents per occupied dwelling unit.

For the five sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 95.7 percent of the total dwelling units were occupied.

Time-of-day distribution data for this land use are presented in Appendix A. For the eight general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 4:45 and 5:45 p.m., respectively.

For the four dense multi-use urban sites with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:15 and 5:15 p.m., respectively. For the three center city core sites with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 6:45 and 7:45 a.m. and 5:00 and 6:00 p.m., respectively.

For the six sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.46 residents per occupied dwelling unit.

For the five sites for which data were provided for both occupied dwelling units and total dwelling units, an average of 95.7 percent of the units were occupied.

The average numbers of person trips per vehicle trip at the five center city core sites at which both person trip and vehicle trip data were collected were as follows:

- 1.84 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.94 during Weekday, AM Peak Hour of Generator
- 2.07 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.59 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 32 dense multi-use urban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.90 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.90 during Weekday, AM Peak Hour of Generator
- 2.00 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.08 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 13 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.56 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.88 during Weekday, AM Peak Hour of Generator
- 1.70 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.07 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), British Columbia (CAN), California, Delaware, District of Columbia, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, Ontario, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Virginia, and Wisconsin.

Source Numbers

168, 188, 204, 305, 306, 321, 357, 390, 436, 525, 530, 579, 638, 818, 857, 866, 901, 904, 910, 912, 918, 934, 936, 939, 944, 947, 948, 949, 959, 963, 964, 966, 967, 969, 970

Multifamily Housing (Mid-Rise)
(221)

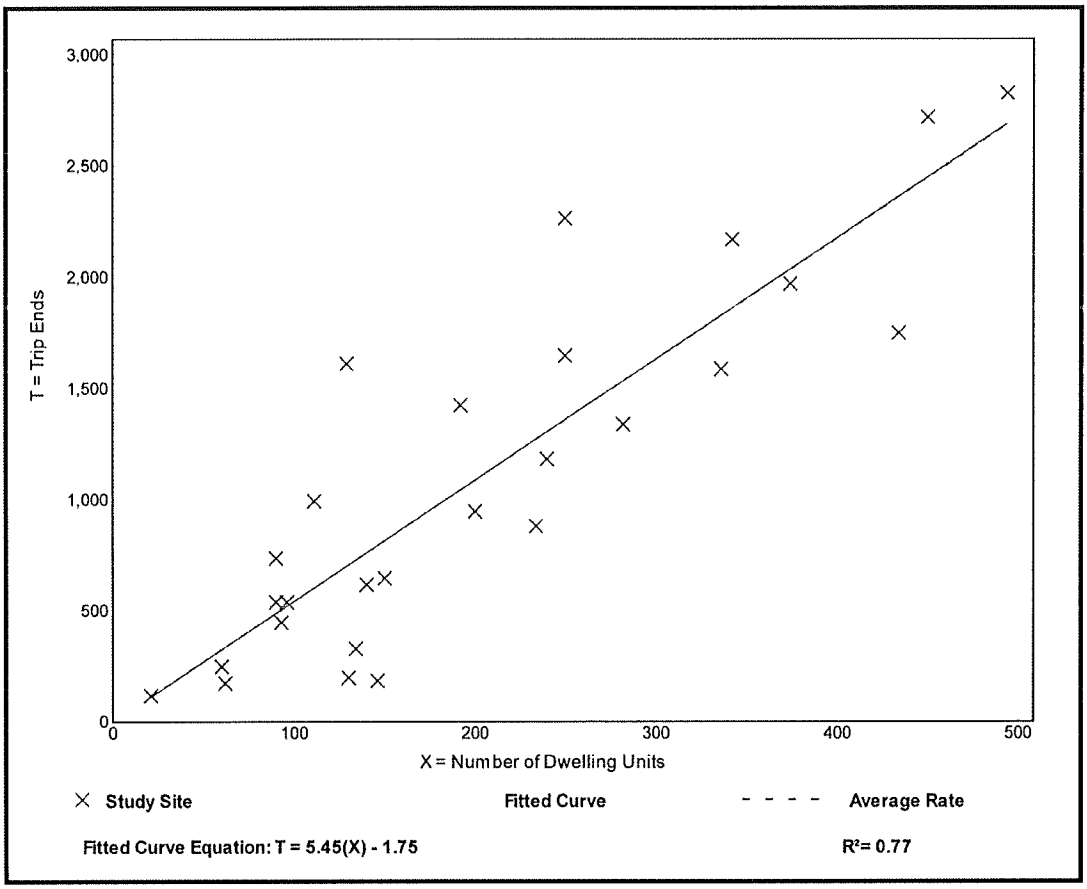
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 27
Avg. Num. of Dwelling Units: 205
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
5.44	1.27 - 12.50	2.03

Data Plot and Equation



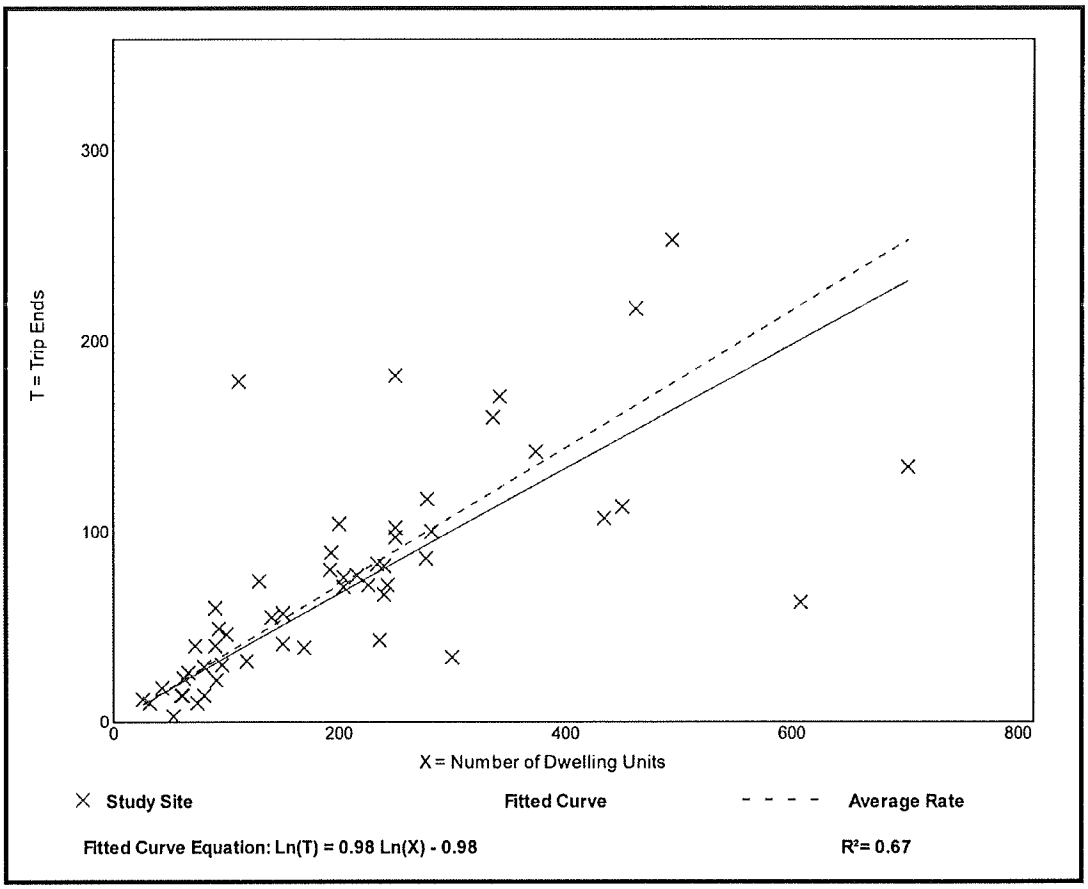
Multifamily Housing (Mid-Rise)
(221)

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: 53
Avg. Num. of Dwelling Units: 207
Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.36	0.06 - 1.61	0.19

Data Plot and Equation



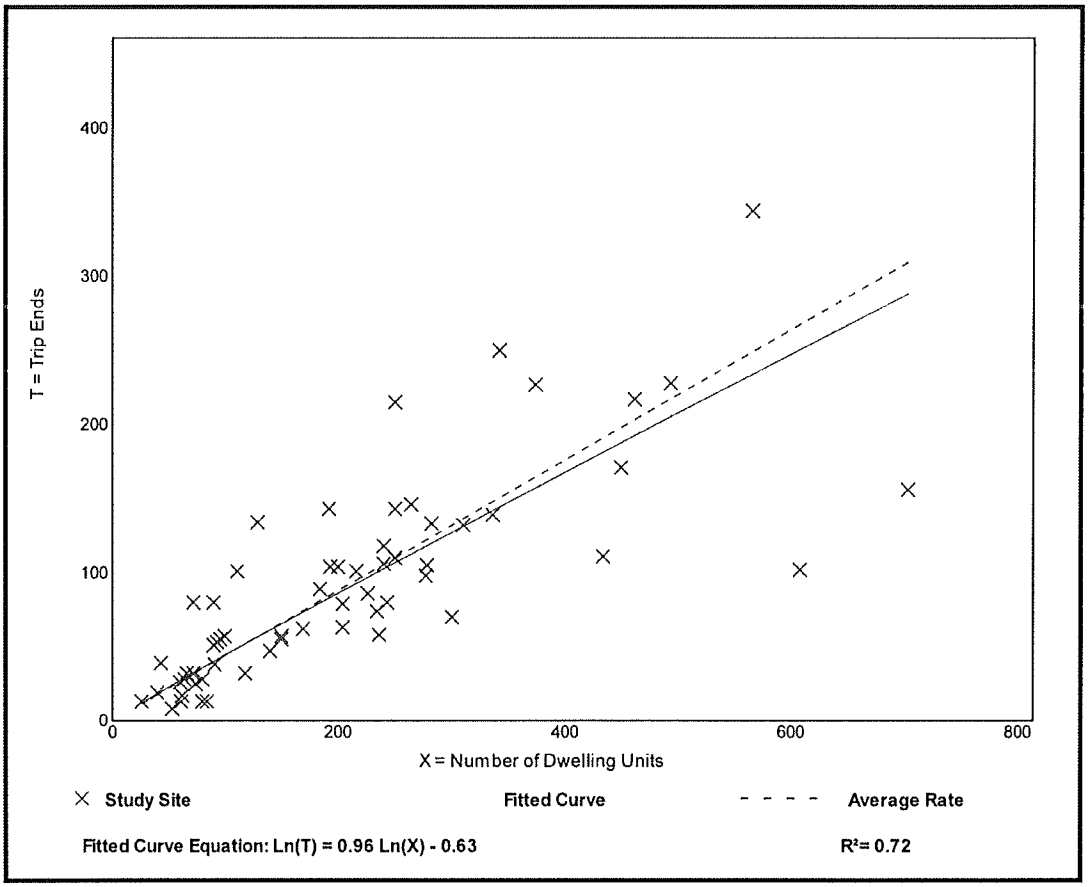
Multifamily Housing (Mid-Rise)
(221)

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: 60
Avg. Num. of Dwelling Units: 208
Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.11	0.19

Data Plot and Equation



Land Use: 231
Mid-Rise Residential with 1st-Floor Commercial

Description

Mid-rise residential with 1st-floor commercial are mixed-use multifamily housing buildings that have between three and 10 levels (floors) and include retail space on the first level. These facilities are typically found in dense multi-use urban and center city core settings. Multifamily housing (mid-rise) (Land Use 221) and high-rise residential with 1st-floor commercial (Land Use 232) are related land uses.

Additional Data

The sites included in this land use category include both a residential and retail component. A multi-variable regression analysis based on-site characteristics reflecting both components produced the following fitted curve equations:

Dense Multi-Use Urban Sites

Weekday, AM Peak Hour of Generator
Vehicle Trips = [1.64 x (Retail GFA (000))] + [0.14 x (Occupied Units)] + 3.9 {R^2 = 0.58}

Weekday, AM Peak Hour of Adjacent Street Traffic
Vehicle Trips = [2.65 x (Retail GFA (000))] + [0.03 x (Occupied Units)] + 5.2 {R^2 = 0.75}
Person Trips = [6.67 x (Retail GFA (000))] + [0.29 x (Occupied Units)] + 21.9 {R^2 = 0.65}

Weekday, PM Peak Hour of Generator
Vehicle Trips = [3.43 x (Retail GFA (000))] + [0.10 x (Occupied Units)] – 8.2 {R^2 = 0.77}
Person Trips = [8.98 x (Retail GFA (000))] + [0.67 x (Occupied Units)] + 60.5 {R^2 = 0.58}

Center City Core Sites

Weekday, AM Peak Hour of Generator
Vehicle Trips = [0.97 x (Retail GFA (000))] + [0.25 x (Occupied Units)] + 9.1 {R^2 = 0.83}
Person Trips = [1.32 x (Retail GFA (000))] + [1.11 x (Occupied Units)] + 51.0 {R^2 = 0.76}

Weekday, AM Peak Hour of Adjacent Street Traffic
Vehicle Trips = [1.26 x (Retail GFA (000))] + [0.16 x (Occupied Units)] + 18.6 {R^2 = 0.94}
Person Trips = [2.42 x (Retail GFA (000))] + [0.73 x (Occupied Units)] + 111.5 {R^2 = 0.84}

Weekday, PM Peak Hour of Generator
Vehicle Trips = [1.51 x (Retail GFA (000))] + [0.16 x (Occupied Units)] + 2.0 {R^2 = 0.87}
Person Trips = [8.01 x (Retail GFA (000))] + [0.87 x (Occupied Units)] + 68.0 {R^2 = 0.78}

Weekday, PM Peak Hour of Adjacent Street Traffic
Vehicle Trips = [3.46 x (Retail GFA (000))] + [0.31 x (Occupied Units)] – 27.8 {R^2 = 0.99}
Person Trips = [2.87 x (Retail GFA (000))] + [1.14 x (Occupied Units)] + 83.8 {R^2 = 0.98}

Time-of-day distribution data for this land use are presented in Appendix A. For the one general urban/suburban site with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:30 and 8:30 a.m. and 5:30 and 6:30 p.m., respectively.

The average numbers of person trips per vehicle trip at the 15 center city core sites at which both person trip and vehicle trip data were collected were as follows:

- 3.90 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 3.85 during Weekday, AM Peak Hour of Generator
- 5.76 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 6.33 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 33 dense multi-use urban sites at which both person trip and vehicle trip data were collected were as follows:

- 3.36 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 3.45 during Weekday, AM Peak Hour of Generator
- 3.48 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 4.36 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 2010s in Alberta (CAN), District of Columbia, Oregon, and Utah.

Source Numbers

855, 901, 949, 950, 951, 970

Mid-Rise Residential with 1st-Floor Commercial
(231)

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

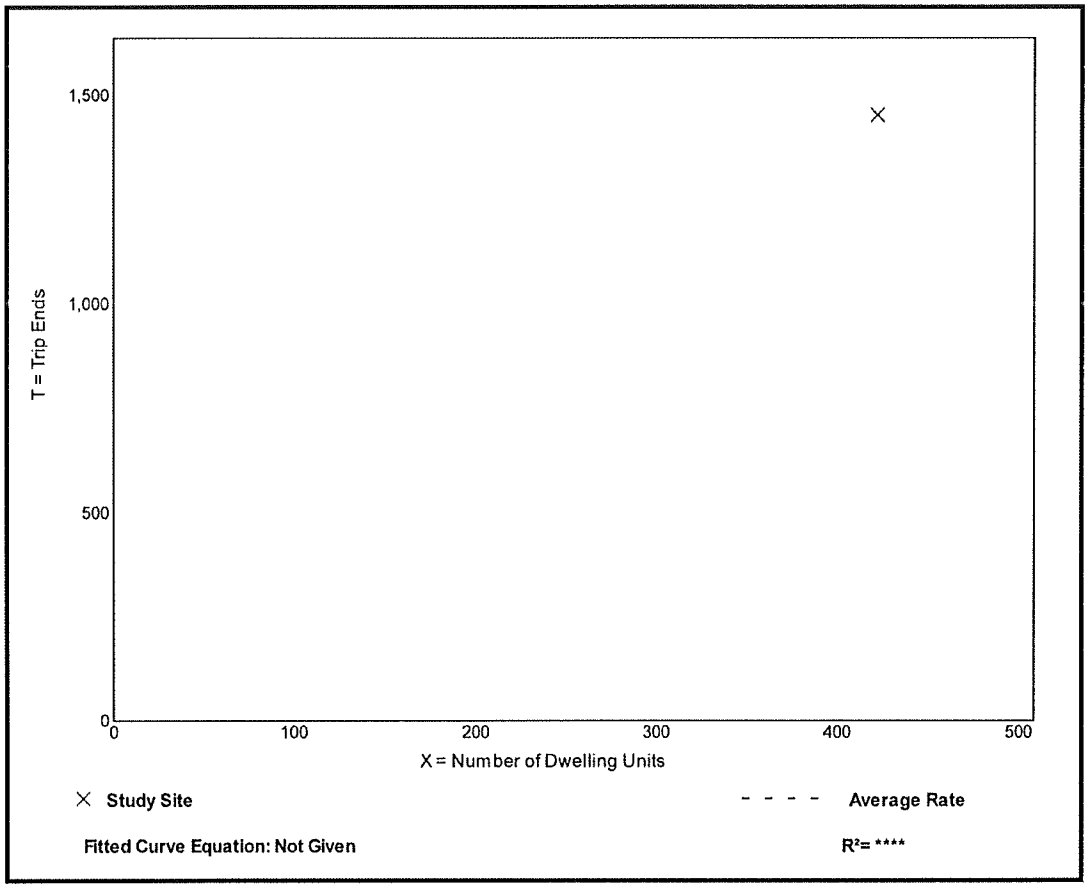
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
Avg. Num. of Dwelling Units: 422
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
3.44	3.44 - 3.44	*

Data Plot and Equation

Caution – Small Sample Size



Mid-Rise Residential with 1st-Floor Commercial
(231)

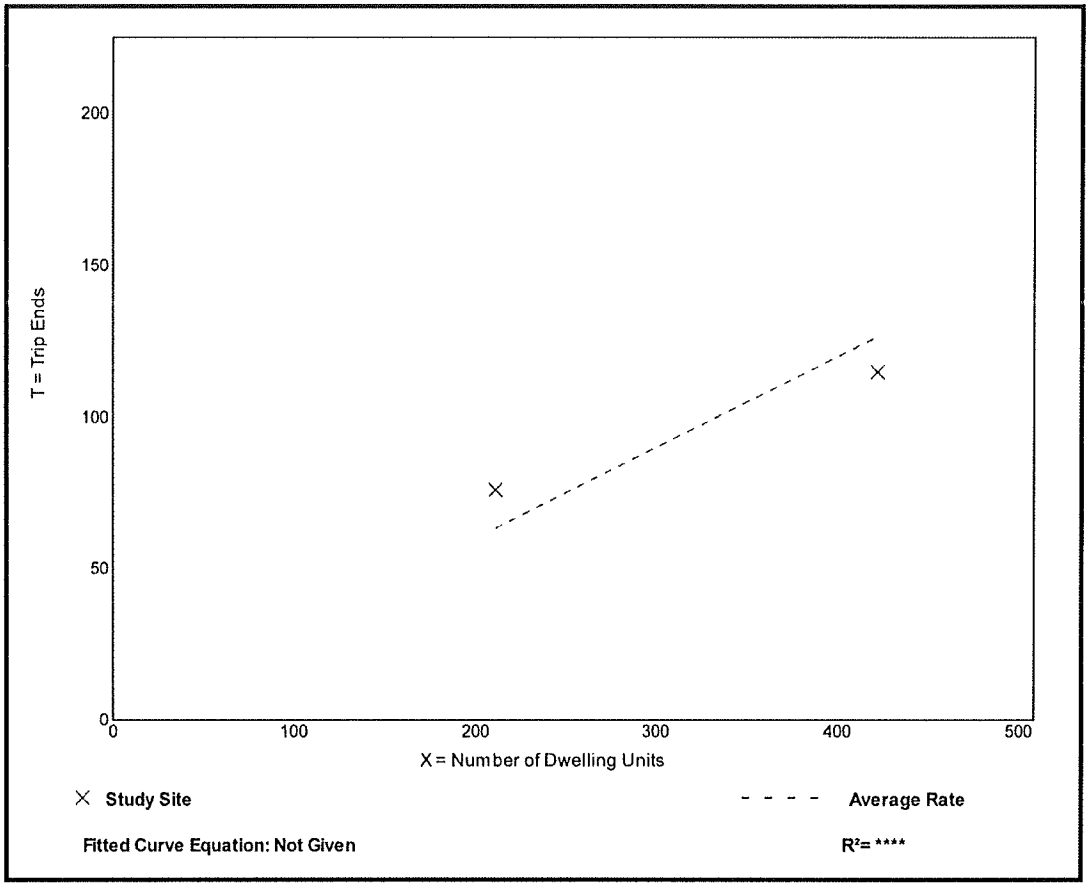
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 2
Avg. Num. of Dwelling Units: 317
Directional Distribution: 28% entering, 72% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.30	0.27 - 0.36	*

Data Plot and Equation

Caution – Small Sample Size



Mid-Rise Residential with 1st-Floor Commercial
(231)

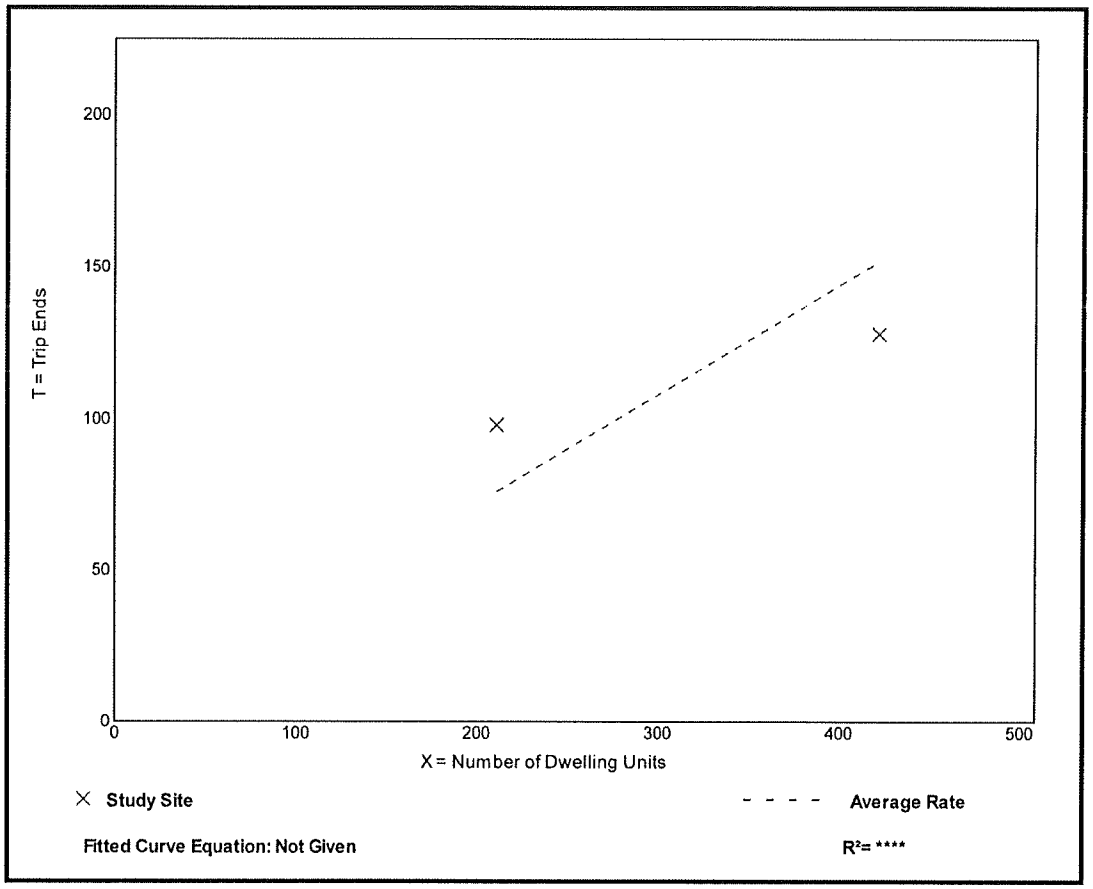
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 2
Avg. Num. of Dwelling Units: 317
Directional Distribution: 70% entering, 30% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.36	0.30 - 0.46	*

Data Plot and Equation

Caution – Small Sample Size



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. Factory outlet center (Land Use 823) is a related use.

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).

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.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:15 and 1:15 p.m., respectively.

The average numbers of person trips per vehicle trip at the 27 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.31 during Weekday, AM Peak Hour of Generator
- 1.43 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 1.46 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), British Columbia (CAN), California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

Source Numbers

105, 110, 154, 156, 159, 186, 190, 198, 199, 202, 204, 211, 213, 239, 251, 259, 260, 269, 294, 295, 299, 300, 301, 304, 305, 307, 308, 309, 310, 311, 314, 315, 316, 317, 319, 358, 365, 376, 385, 390, 400, 404, 414, 420, 423, 428, 437, 440, 442, 444, 446, 507, 562, 580, 598, 629, 658, 702, 715, 728, 868, 870, 871, 880, 899, 908, 912, 915, 926, 936, 944, 946, 960, 961, 962, 973, 974, 978

Shopping Center
(820)

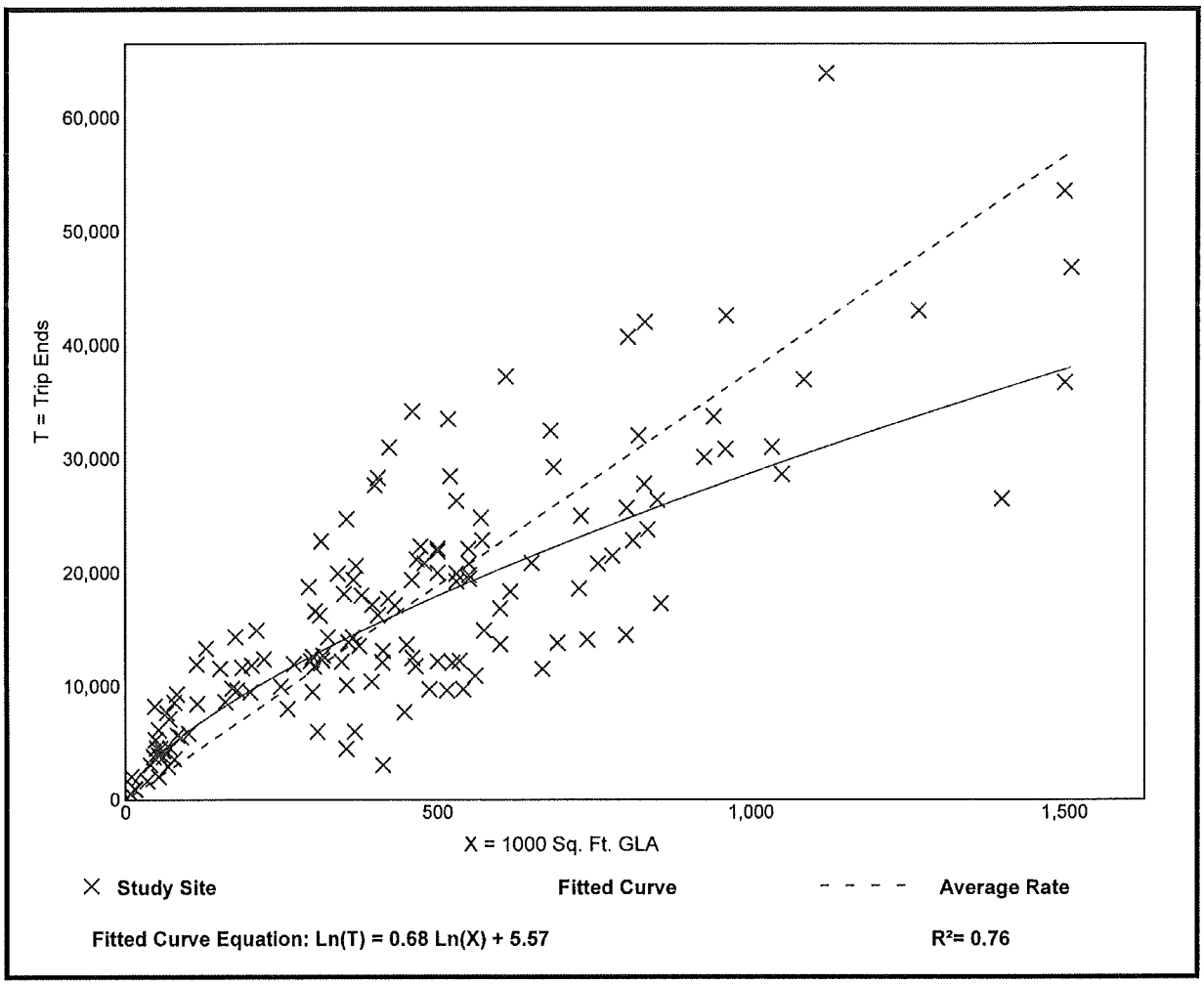
Vehicle Trip Ends vs: **1000 Sq. Ft. GLA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 147
1000 Sq. Ft. GLA: 453
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
37.75	7.42 - 207.98	16.41

Data Plot and Equation



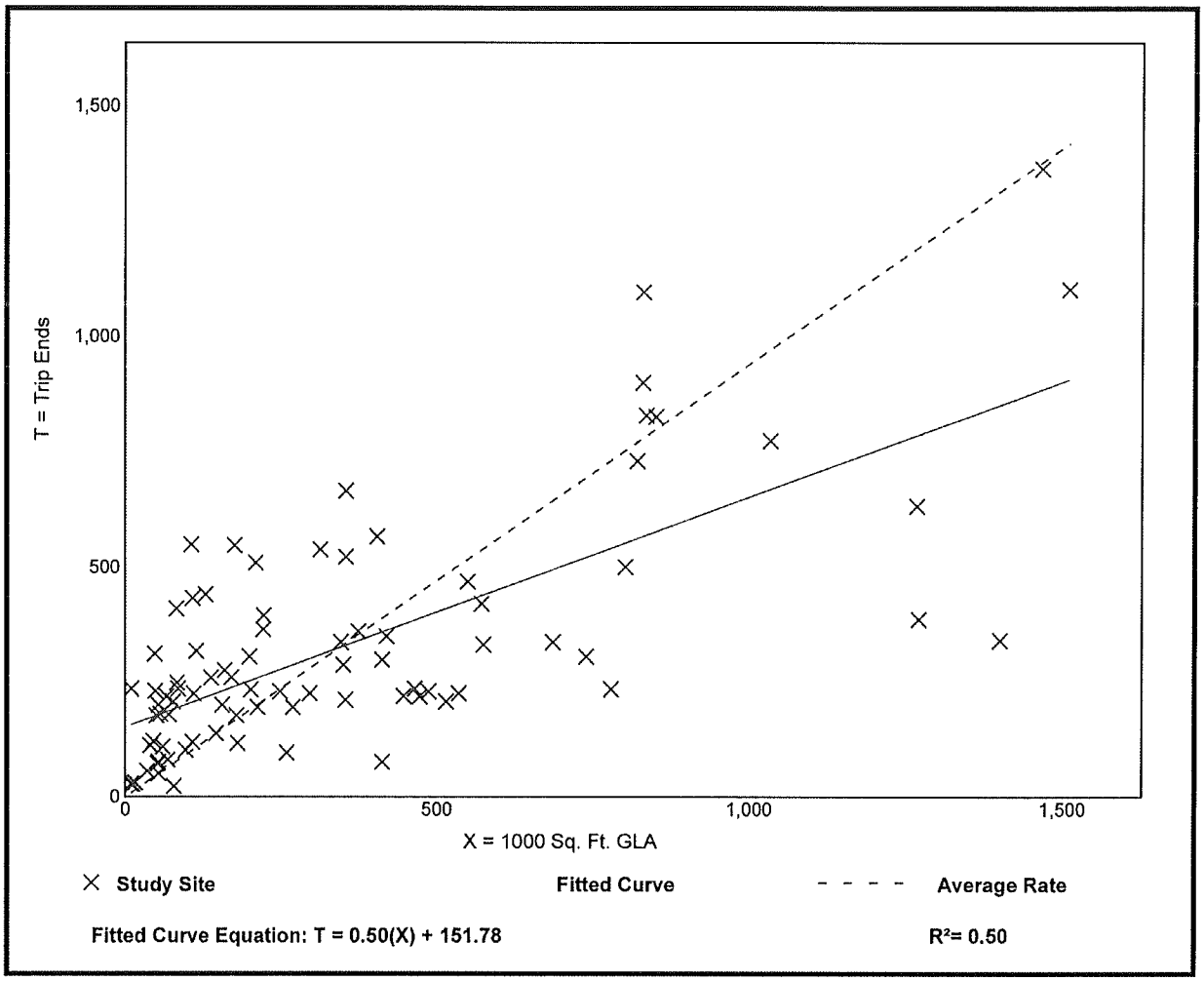
Shopping Center
(820)

Vehicle Trip Ends vs: **1000 Sq. Ft. GLA**
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: 84
1000 Sq. Ft. GLA: 351
Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
0.94	0.18 - 23.74	0.87

Data Plot and Equation



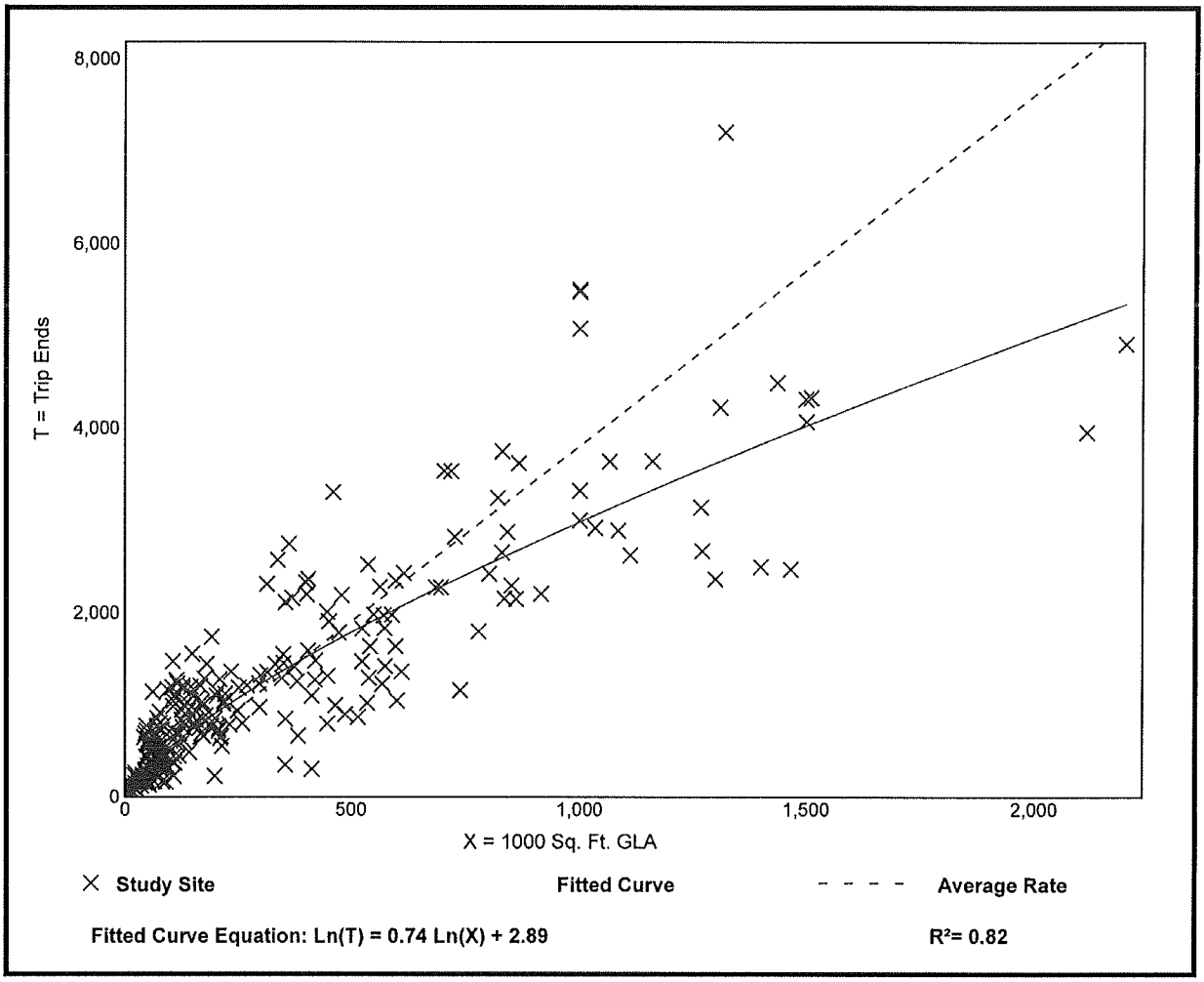
Shopping Center
(820)

Vehicle Trip Ends vs: **1000 Sq. Ft. GLA**
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: 261
1000 Sq. Ft. GLA: 327
Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
3.81	0.74 - 18.69	2.04

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.74 Ln(X) + 2.89

R^2= 0.82

Land Use: 930
Fast Casual Restaurant

Description

A fast casual restaurant is a sit down restaurant with no wait staff or table service. Customers typically order off a menu board, pay for food before the food is prepared and seat themselves. The menu generally contains higher quality made to order food items with fewer frozen or processed ingredients than fast food restaurants. Quality restaurant (Land Use 931), high-turnover (sit-down) restaurant (Land Use 932), fast-food restaurant without drive-through window (Land Use 933), fast-food restaurant with drive-through window (Land Use 934), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

Additional Data

Time-of-day distribution data for this land use for a weekday and Saturday are presented in Appendix A. For the one general urban/suburban site with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:30 a.m. and 12:30 p.m. and 12:00 and 1:00 p.m., respectively.

The sites were surveyed in the 2010s in Minnesota, South Carolina, Washington, and Wisconsin.

Source Numbers

861, 869, 939, 959, 962

Fast Casual Restaurant
(930)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

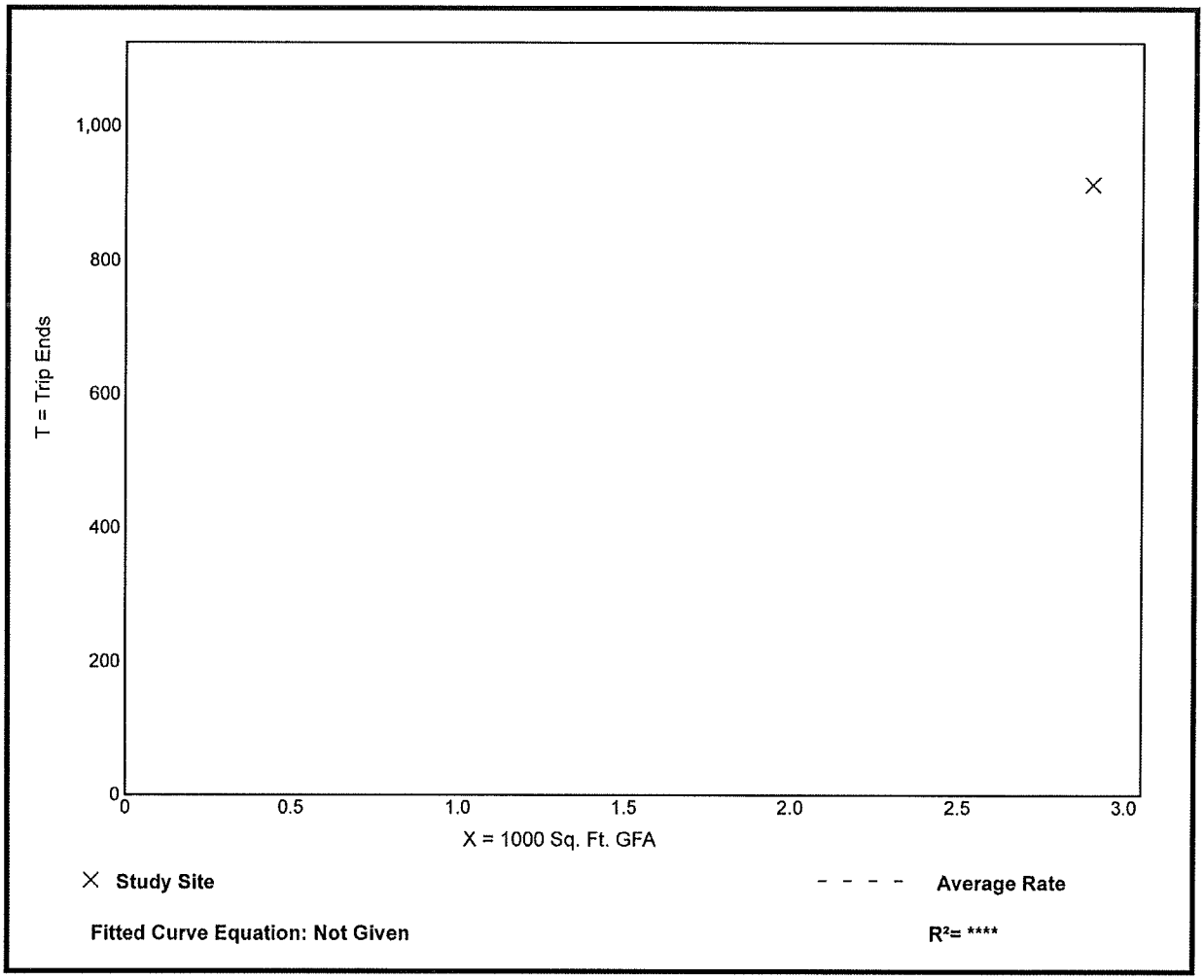
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
1000 Sq. Ft. GFA: 3
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
315.17	315.17 - 315.17	*

Data Plot and Equation

Caution – Small Sample Size



Fast Casual Restaurant
(930)

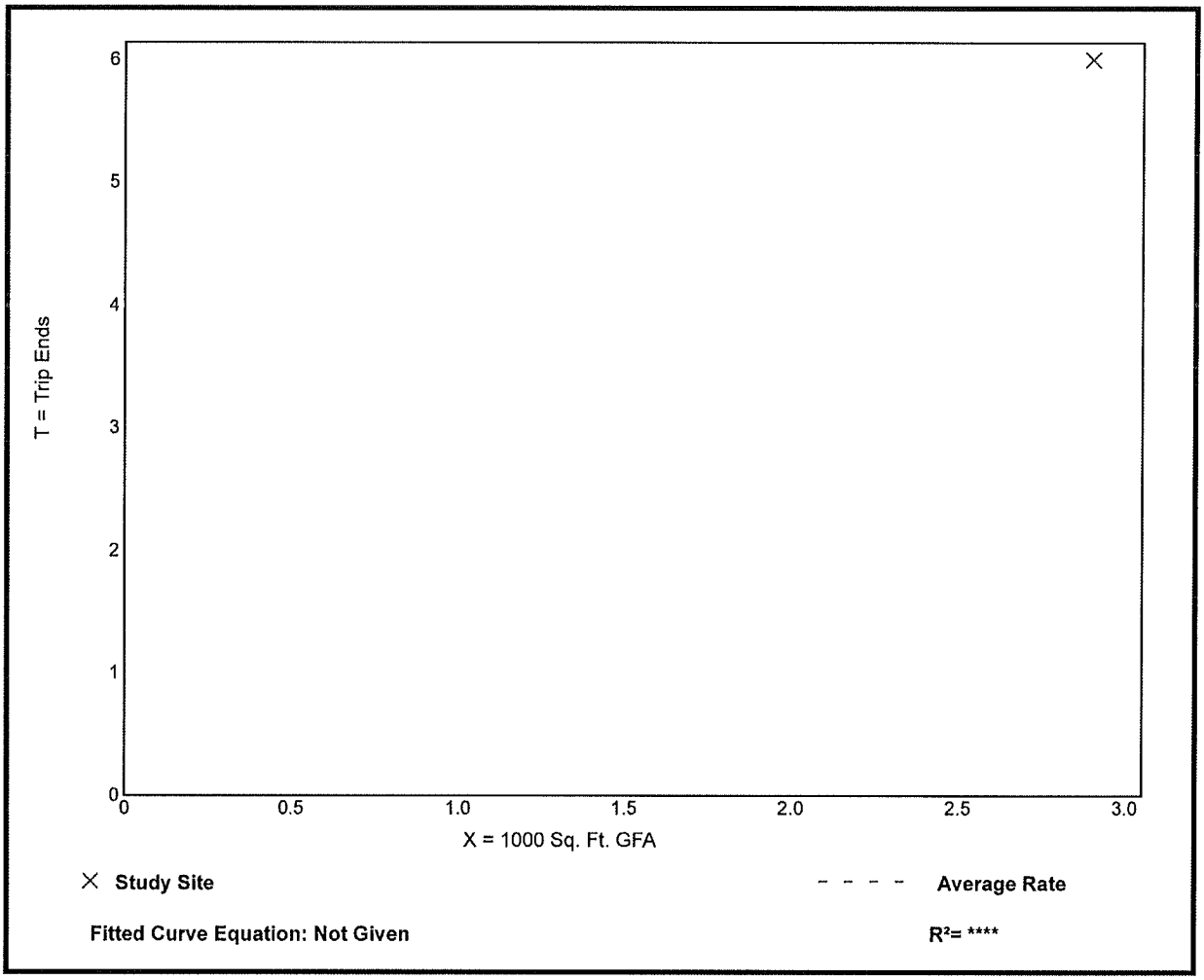
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
1000 Sq. Ft. GFA: 3
Directional Distribution: 67% entering, 33% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.07	2.07 - 2.07	*

Data Plot and Equation

Caution – Small Sample Size



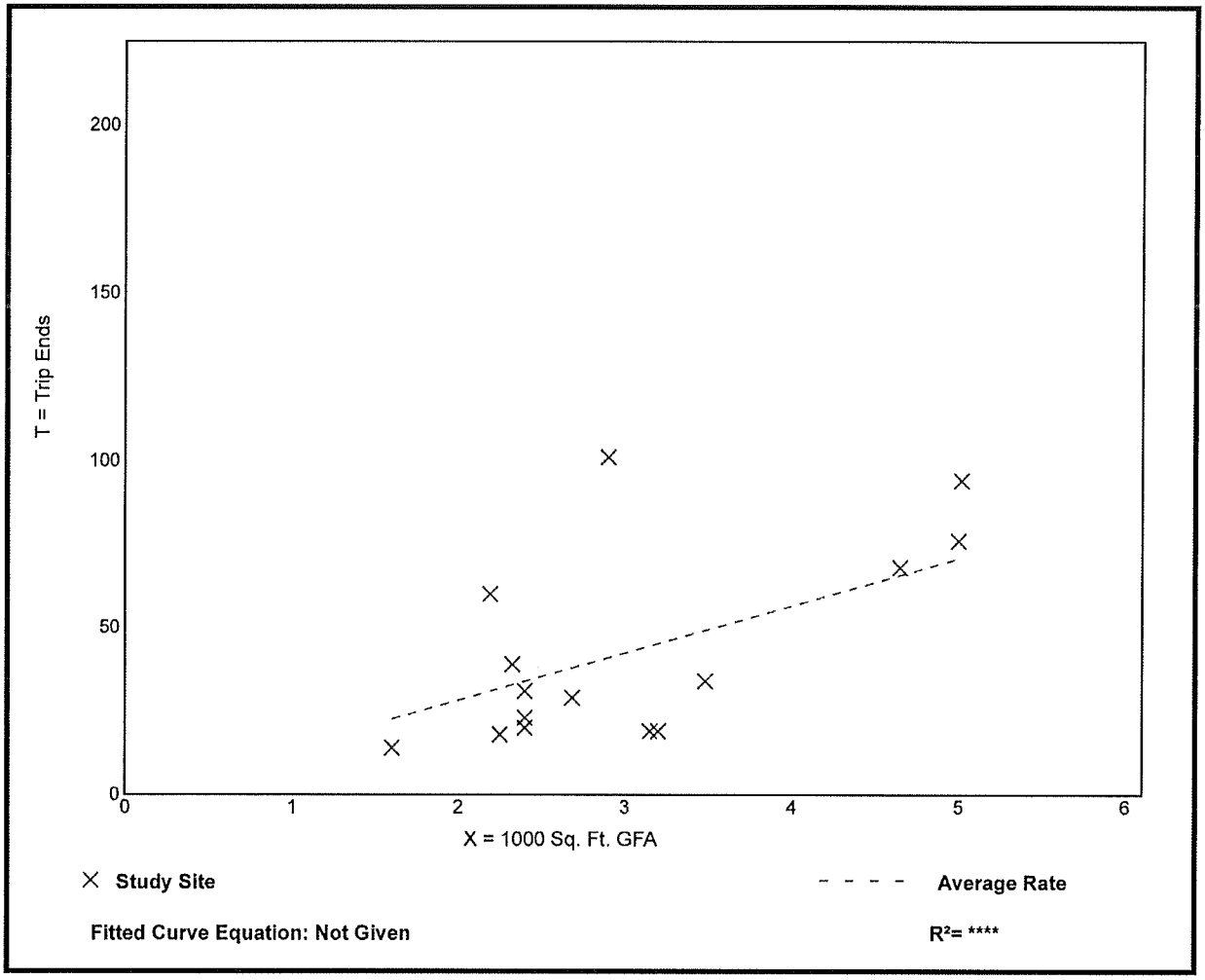
Fast Casual Restaurant
(930)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
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
1000 Sq. Ft. GFA:	3
Directional Distribution:	55% entering, 45% exiting

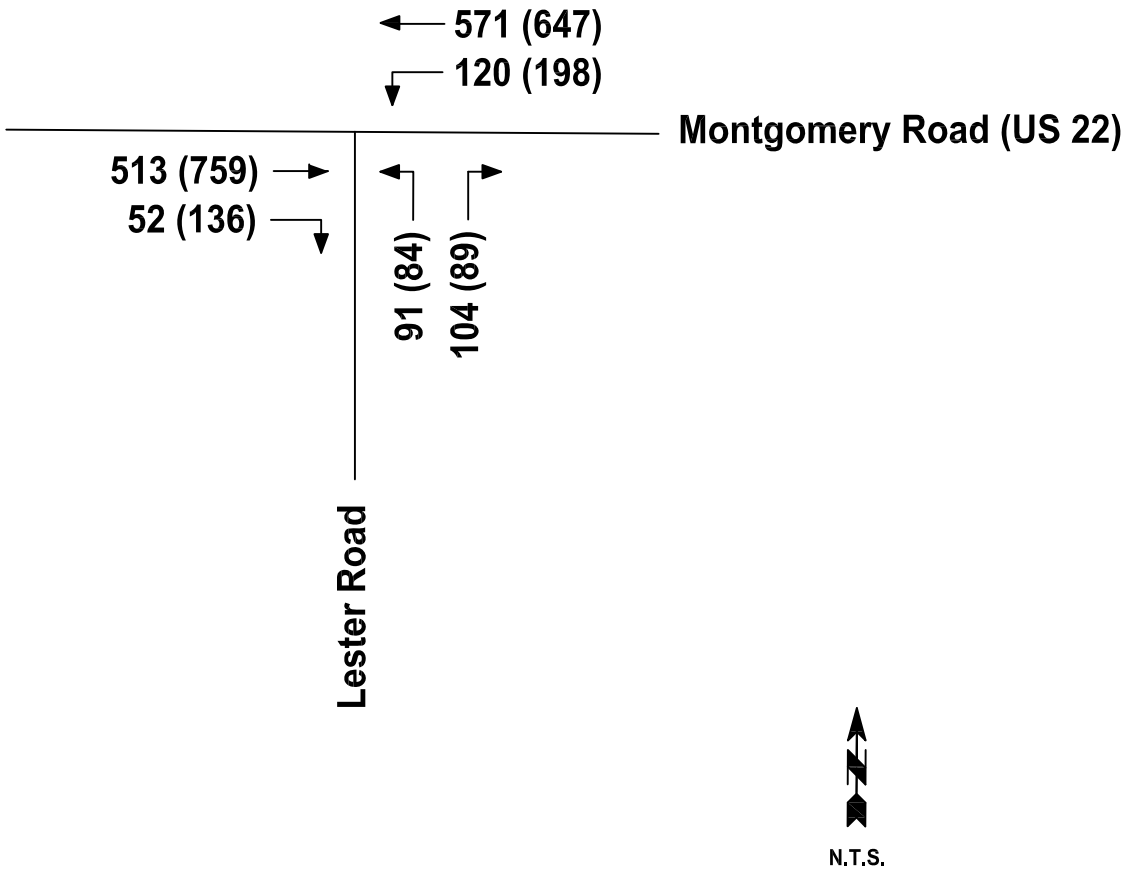
Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
14.13	5.94 - 34.83	7.72

Data Plot and Equation



ATTACHMENT D



Attachment D

Pleasant Ridge Residential Development
City of Cincinnati, Hamilton County, Ohio

Opening Day Traffic Projections

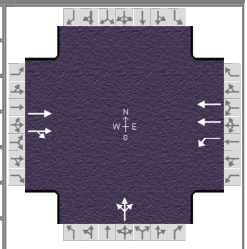
xx - AM Peak Hour
(xx) - PM Peak Hour

bayer becker
www.bayerbecker.com
6900 Tylersville Road, Suite A
Mason, OH 45040 - 513.336.6600

ATTACHMENT E

HCS7 Signalized Intersection Results Summary

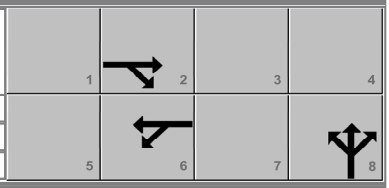
General Information				Intersection Information	
Agency	Bayer Becker			Duration, h	0.250
Analyst	WLW	Analysis Date	6/23/2021	Area Type	Other
Jurisdiction	City of Cincinnati	Time Period	AM Peak	PHF	0.92
Urban Street	Montgomery Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Montgomery Road and…	File Name	19-0263 Montgomery and Lester-EX AM.xus		
Project Description	Existing Conditions				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		503	21	107	562		63	0	95			

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	36.0	22.0	0.0	0.0	0.0	0.0	
Yellow	3.2	3.3	0.0	0.0	0.0	0.0	
Red	2.8	2.7	0.0	0.0	0.0	0.0	



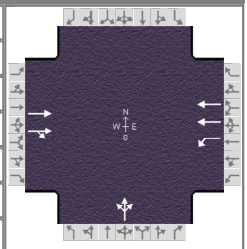
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		12.0		
Phase Duration, s		42.0		42.0		28.0		
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		
Max Allow Headway (*MAH*), s		3.2		3.2		3.3		
Queue Clearance Time (g_s), s		8.1		14.4		24.0		
Green Extension Time (g_e), s		3.2		3.1		0.0		
Phase Call Probability		1.00		1.00		1.00		
Max Out Probability		0.00		0.01		1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		286	283	116	611			172				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1900	1873	856	1809			1684				
Queue Service Time (g_s), s		6.0	6.1	6.3	6.9			5.5				
Cycle Queue Clearance Time (g_c), s		6.0	6.1	12.4	6.9			5.5				
Green Ratio (*g/C*)		0.51	0.51	0.51	0.51			0.31				
Capacity (*c*), veh/h		977	963	469	1860			529				
Volume-to-Capacity Ratio (*X*)		0.293	0.294	0.248	0.328			0.324				
Back of Queue (*Q*), ft/ln (95 th percentile)		96.7	95.6	49.2	105.1			88.7				
Back of Queue (*Q*), veh/ln (95 th percentile)		3.9	3.8	2.0	4.2			3.5				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00			0.00				
Uniform Delay (d_1), s/veh		9.7	9.7	13.3	9.9			18.3				
Incremental Delay (d_2), s/veh		0.1	0.1	0.1	0.0			0.1				
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0				
Control Delay (*d*), s/veh		9.8	9.8	13.4	10.0			18.5				
Level of Service (LOS)		A	A	B	A			B				
Approach Delay, s/veh / LOS	9.8	A		10.5	B		18.5	B		0.0		
Intersection Delay, s/veh / LOS	11.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.66	B	1.37	A	2.31	B	2.14	B
Bicycle LOS Score / LOS	0.96	A	1.09	A	0.77	A		

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Bayer Becker			Duration, h	0.250
Analyst	WLW	Analysis Date	6/23/2021	Area Type	Other
Jurisdiction	City of Cincinnati	Time Period	PM Peak	PHF	0.92
Urban Street	Montgomery Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Montgomery Road and…	File Name	19-0263 Montgomery and Lester-EX PM.xus		
Project Description	Existing Conditions				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		752	116	192	643		71	0	84			

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	36.0	22.0	0.0	0.0	0.0	0.0						
Yellow	3.2	3.3	0.0	0.0	0.0	0.0						
Red	2.8	2.7	0.0	0.0	0.0	0.0	5	6	7	8		

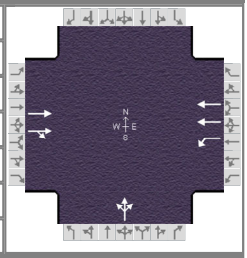
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		12.0		
Phase Duration, s		42.0		42.0		28.0		
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		
Max Allow Headway (*MAH*), s		3.4		3.4		3.3		
Queue Clearance Time (g_s), s		13.6		37.7		24.0		
Green Extension Time (g_e), s		5.8		0.0		0.0		
Phase Call Probability		1.00		1.00		1.00		
Max Out Probability		0.09		1.00		1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		483	460	209	699			168				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1900	1811	604	1809			1696				
Queue Service Time (g_s), s		11.5	11.6	24.1	8.1			5.3				
Cycle Queue Clearance Time (g_c), s		11.5	11.6	35.7	8.1			5.3				
Green Ratio (*g/C*)		0.51	0.51	0.51	0.51			0.31				
Capacity (*c*), veh/h		977	931	313	1860			533				
Volume-to-Capacity Ratio (*X*)		0.494	0.494	0.666	0.376			0.316				
Back of Queue (*Q*), ft/ln (95 th percentile)		185.9	177.3	153.8	123.7			86.8				
Back of Queue (*Q*), veh/ln (95 th percentile)		7.4	7.1	6.2	4.9			3.5				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00			0.00				
Uniform Delay (d_1), s/veh		11.1	11.1	22.7	10.2			18.3				
Incremental Delay (d_2), s/veh		0.1	0.2	4.3	0.0			0.1				
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0				
Control Delay (*d*), s/veh		11.2	11.2	27.0	10.3			18.4				
Level of Service (LOS)		B	B	C	B			B				
Approach Delay, s/veh / LOS	11.2	B		14.1	B		18.4	B		0.0		
Intersection Delay, s/veh / LOS	13.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.66	B	1.37	A	2.31	B	2.14	B
Bicycle LOS Score / LOS	1.27	A	1.24	A	0.77	A		

HCS7 Signalized Intersection Results Summary

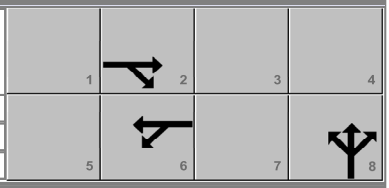
General Information				Intersection Information	
Agency	Bayer Becker			Duration, h	0.250
Analyst	WLW	Analysis Date	6/23/2021	Area Type	Other
Jurisdiction	City of Cincinnati	Time Period	AM Peak	PHF	0.92
Urban Street	Montgomery Road	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Montgomery Road and…	File Name	19-0263 Montgomery and Lester-Build AM.xus		
Project Description	Opening Day Traffic Projections				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		513	52	120	571		91	0	104			

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	36.0	22.0	0.0	0.0	0.0	0.0	
Yellow	3.2	3.3	0.0	0.0	0.0	0.0	
Red	2.8	2.7	0.0	0.0	0.0	0.0	



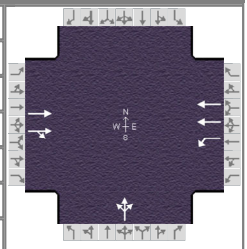
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		12.0		
Phase Duration, s		42.0		42.0		28.0		
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		
Max Allow Headway (*MAH*), s		3.2		3.2		3.3		
Queue Clearance Time (g_s), s		8.7		16.4		8.8		
Green Extension Time (g_e), s		3.4		3.3		0.3		
Phase Call Probability		1.00		1.00		1.00		
Max Out Probability		0.00		0.02		0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		311	303	130	621			212				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1900	1838	821	1809			1697				
Queue Service Time (g_s), s		6.7	6.7	7.7	7.0			6.8				
Cycle Queue Clearance Time (g_c), s		6.7	6.7	14.4	7.0			6.8				
Green Ratio (*g/C*)		0.51	0.51	0.51	0.51			0.31				
Capacity (*c*), veh/h		977	945	446	1860			533				
Volume-to-Capacity Ratio (*X*)		0.319	0.320	0.292	0.334			0.397				
Back of Queue (*Q*), ft/ln (95 th percentile)		106.7	103.8	58	107.1			112.5				
Back of Queue (*Q*), veh/ln (95 th percentile)		4.3	4.2	2.3	4.3			4.5				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00			0.00				
Uniform Delay (d_1), s/veh		9.9	9.9	14.1	10.0			18.8				
Incremental Delay (d_2), s/veh		0.1	0.1	0.1	0.0			0.2				
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0				
Control Delay (*d*), s/veh		9.9	10.0	14.2	10.0			19.0				
Level of Service (LOS)		A	A	B	B			B				
Approach Delay, s/veh / LOS	10.0	A		10.7	B		19.0	B		0.0		
Intersection Delay, s/veh / LOS	11.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.66	B	1.37	A	2.31	B	2.14	B
Bicycle LOS Score / LOS	0.99	A	1.11	A	0.84	A		

HCS7 Signalized Intersection Results Summary

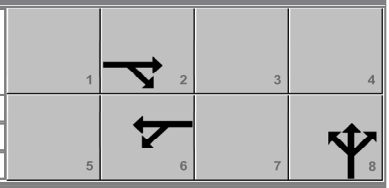
General Information				Intersection Information	
Agency	Bayer Becker			Duration, h	0.250
Analyst	WLW	Analysis Date	6/23/2021	Area Type	Other
Jurisdiction	City of Cincinnati	Time Period	PM Peak	PHF	0.92
Urban Street	Montgomery Road	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Montgomery Road and…	File Name	19-0263 Montgomery and Lester-Build PM.xus		
Project Description	Opening Day Traffic Projections				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		759	136	198	647		84	0	89			

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	36.0	22.0	0.0	0.0	0.0	0.0	
Yellow	3.2	3.3	0.0	0.0	0.0	0.0	
Red	2.8	2.7	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		12.0		
Phase Duration, s		42.0		42.0		28.0		
Change Period, ($Y+R_c$), s		6.0		6.0		6.0		
Max Allow Headway (*MAH*), s		3.5		3.5		3.2		
Queue Clearance Time (g_s), s		14.1		38.0		8.0		
Green Extension Time (g_e), s		6.0		0.0		0.3		
Phase Call Probability		1.00		1.00		1.00		
Max Out Probability		0.10		1.00		0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3	8	18			
Adjusted Flow Rate (*v*), veh/h		500	473	215	703			188				
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1900	1799	587	1809			1701				
Queue Service Time (g_s), s		12.0	12.1	23.9	8.2			6.0				
Cycle Queue Clearance Time (g_c), s		12.0	12.1	36.0	8.2			6.0				
Green Ratio (*g/C*)		0.51	0.51	0.51	0.51			0.31				
Capacity (*c*), veh/h		977	925	303	1860			535				
Volume-to-Capacity Ratio (*X*)		0.511	0.511	0.710	0.378			0.352				
Back of Queue (*Q*), ft/ln (95 th percentile)		194	185.1	173	124.9			98.1				
Back of Queue (*Q*), veh/ln (95 th percentile)		7.8	7.4	6.9	5.0			3.9				
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00			0.00				
Uniform Delay (d_1), s/veh		11.2	11.2	23.9	10.2			18.5				
Incremental Delay (d_2), s/veh		0.2	0.2	6.5	0.0			0.1				
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0			0.0				
Control Delay (*d*), s/veh		11.4	11.4	30.4	10.3			18.6				
Level of Service (LOS)		B	B	C	B			B				
Approach Delay, s/veh / LOS	11.4	B		15.0	B		18.6	B		0.0		
Intersection Delay, s/veh / LOS	13.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.66	B	1.37	A	2.31	B	2.14	B
Bicycle LOS Score / LOS	1.29	A	1.25	A	0.80	A		