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4-D-22-SU
TIL Version 2
3/28/2022

March 16, 2022
Revised March 28, 2022

Mr. John Anderson P.E.
SITE Inc.
10215 Technology Drive, Suite 304
Knoxville, Tennessee 37932

**RE: NORTSHORE TOWN CENTER TOWN CENTER SHOPS, TRAFFIC STUDY,
KNOXVILLE, TN.**

Dear Mr. Anderson:

This letter report is a summary of the anticipated trip generation for the proposed development of a strip retail site with a coffee shop within the Northshore Town Center located in southwest Knoxville adjacent to the Pellissippi Parkway (I-140) and Northshore Drive (SR 332) interchange. **Figure 1** illustrates this location. The proposed use is consistent with the uses assumed for the original Northshore Town Center traffic study approved March of 2011 and previous updates. The trip generation of the Northshore Town Center is updated in this letter to reflect the development of the proposed 8,173 square foot strip retail including a 2,000 square foot coffee shop with a drive-thru. The proposed site plan is illustrated in **Figure 2**. The trip generation included in this letter report builds upon an October 2020 transportation analysis for the Northshore Town Center that was completed for the Clingmans Dome residential land use revision. The proposed development of the retail strip is proposed within Zone D of the original 2011 traffic study (See **Figure 3** for the analysis zones). The trip generation for the Northshore Town Center was updated by applying trip generation rates published in the current 11th edition of **Trip Generation**, the recognized reference published by the Institute of Transportation Engineers (ITE).

The trip generation for the proposed strip retail is presented in **Table 1**. This trip generation is compared to the **Table 2** trip generation updated the October 2020 study prepared for the Clingmans Dome land use revision. The updated trip generation for the Northshore Town Center reflecting the changes for Zone D is presented in the **Table 3**.





Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 2

TABLE 1 Town Center Shops Trip Generation

| LAND USE | L.U.C | SIZE | DAILY TRAFFIC | AM PEAK | | | PM PEAK | | |
|-----------------------------------|-------|--------------|---------------|------------|-----------|------------|-----------|-----------|------------|
| | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| SHOPPING CENTER (<40K sqft) | 822 | 6,173 | 490 | 13 | 8 | 21 | 28 | 28 | 55 |
| COFFEE/DONUT SHOP (w. drive thru) | 937 | 2,000 | 1,067 | 88 | 84 | 172 | 39 | 39 | 78 |
| TOTAL | | 8,173 | 1,557 | 100 | 93 | 193 | 67 | 67 | 133 |
| <i>Pass-By Trips</i> | 50% | | 779 | 50 | 46 | 96 | 33 | 33 | 67 |
| <i>Primary Trips</i> | | | 779 | 50 | 46 | 96 | 33 | 33 | 67 |

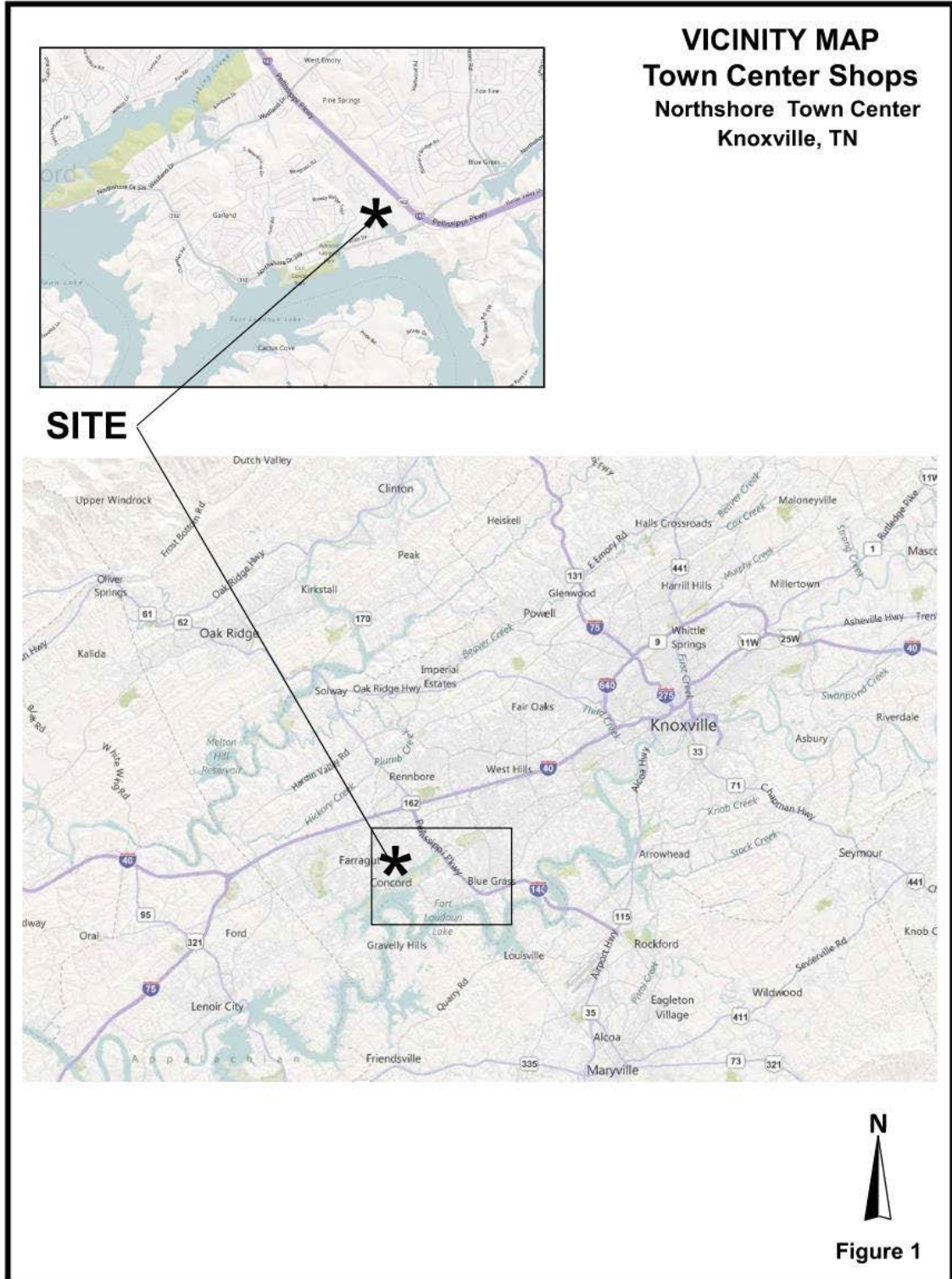
REFERENCE: Trip Generation 11th Edition, published by the Institute of Transportation Engineers.

The trip generation for this site is reduced 50-percent for pass-by trips assumed for the retail strip and with the drive-thru coffee shop. This reduction reflects a pass-by rate for the remaining proposed Zone D land uses of approximately 34-percent, an increase from 30-percent assumed for the previous and original traffic study. This increase from the previous pass-by rate reflects the included drive-thru coffee shop which would capture more traffic from the adjacent transportation network.

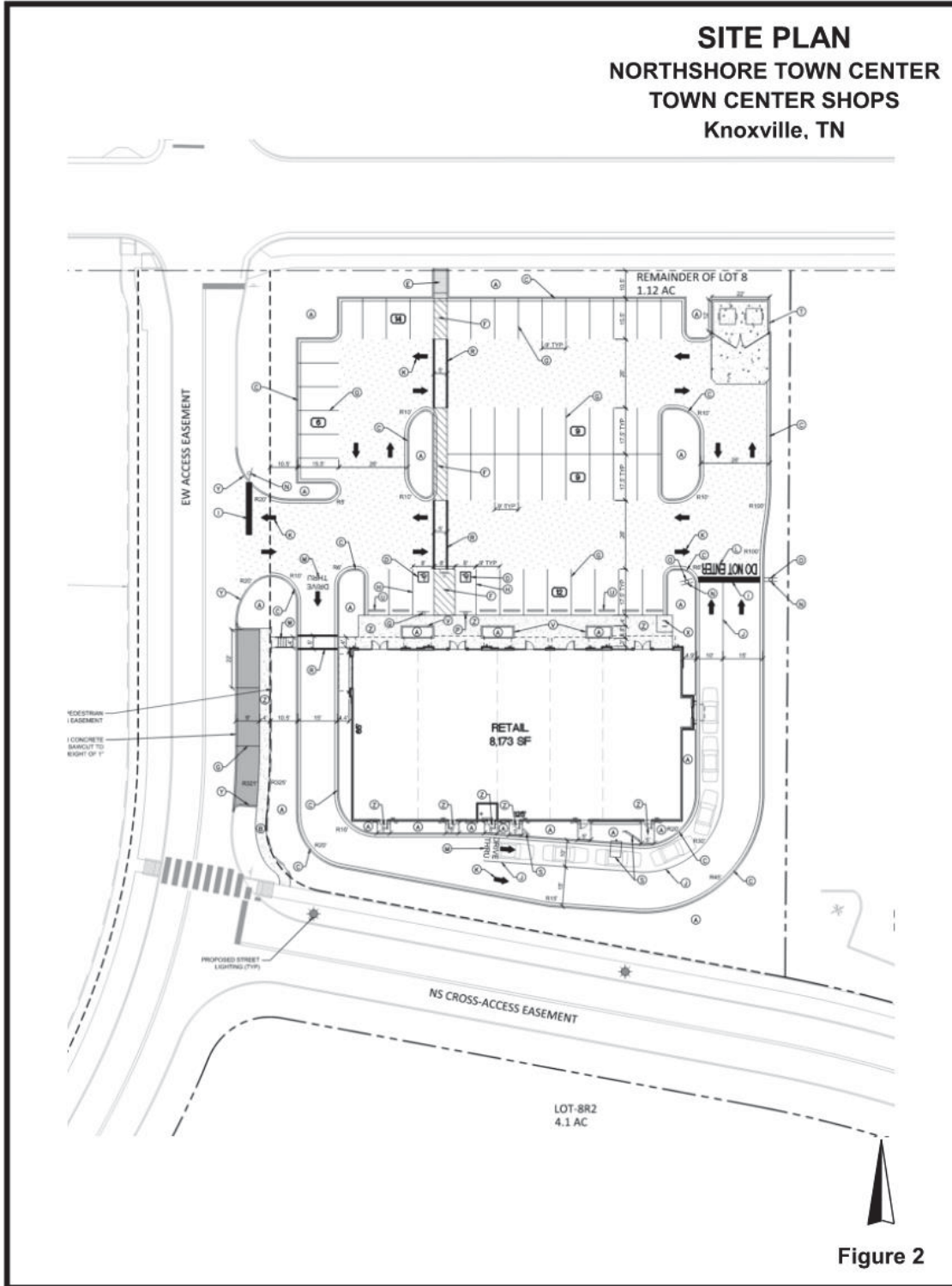
The increased pass-by rate applied is based on the much higher pass-by rates exhibited by the drive-thru coffee shop land uses. A fast-food restaurant use exhibits an average of 50-percent pass-by rates. Rather than a full retail land use previously studied in 2011, the proposed use with a coffee drive-thru would have a higher pass-by rate. The **Trip Generation Handbook, 3rd Edition** identifies pass-by rates for coffee drive-thru services exceeding 80-percent. **Trip Generation Handbook, 3rd Edition** identifies a pass-by rate of 34-percent for retail shopping centers (LUC 820), though smaller retail sites may exhibit higher pass-by rates. These pass-by rates from **Trip Generation Handbook, 3rd Edition** are attached. Applying a pass-by rate of 65-percent for the coffee shop use and a 30-percent for the retail use results in a pass-by rate of approximately 54-percent on the daily, 61-percent AM peak-hour, and 50-percent PM peak-hour trips. This study, therefore, applied a rate of 50-percent for the proposed Town Center Shops trip generation. This is a conservative reduction as an 80-percent pass-by rate for the coffee shop with drive-thru use could result in a pass-by rate of approximately 60-percent.



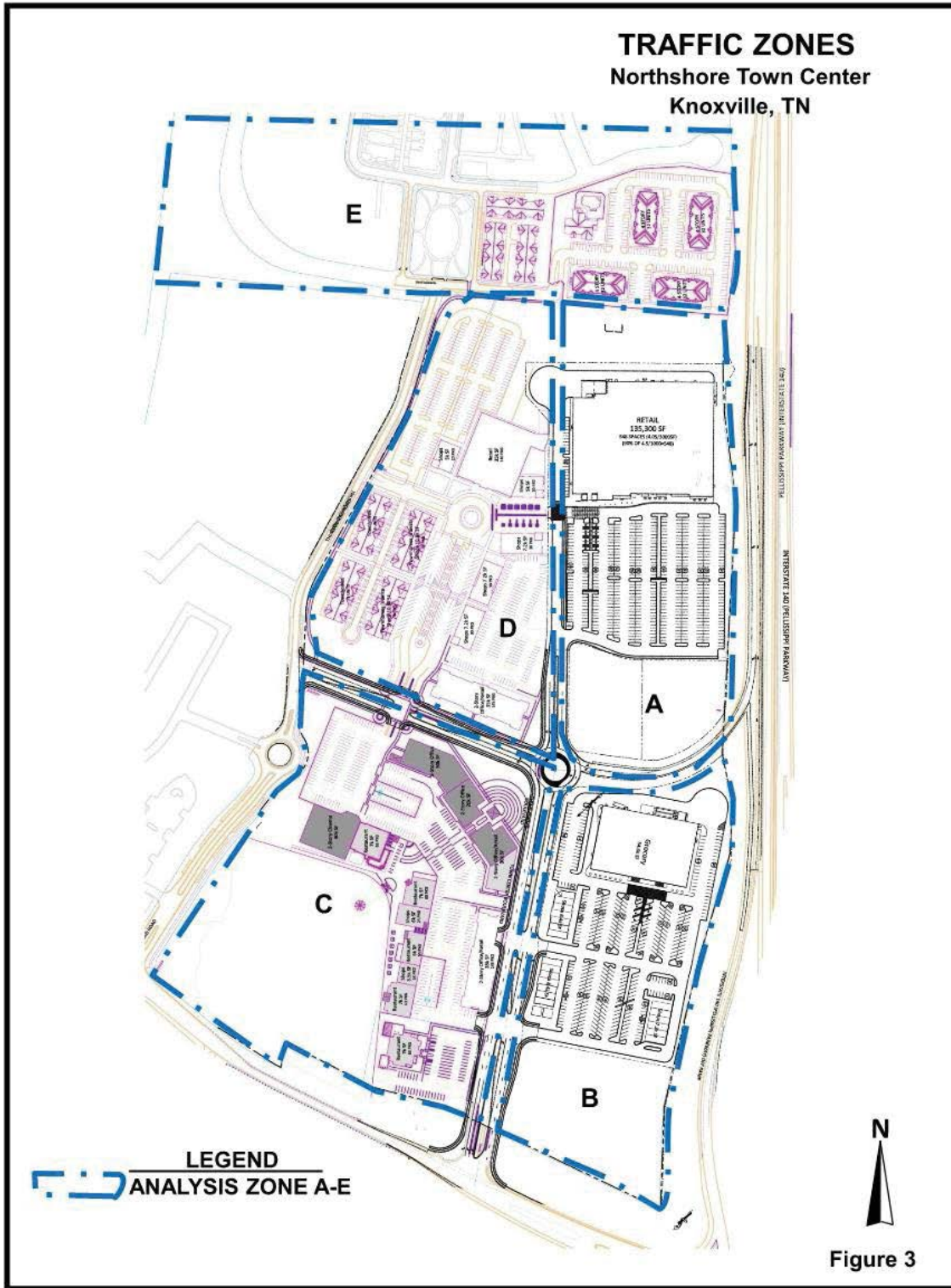
Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 3



Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 4



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 5





Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 6

TABLE 2
NORTHSHORE TOWN CENTER
Trip Generation-October 2020

| ZONE | LAND USE | L.U.C | SIZE | DAILY TRAFFIC | | | AM PEAK | | | PM PEAK | | |
|--------------------------------------|------------------------------------|-------|---------|---------------|------------|------------|------------------|------------|------------|--------------|------|-------|
| | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| A | DISCOUNT STORE | 815 | 135,320 | | | | EXISTING TRAFFIC | | | | | |
| | FASTFOOD REST. (w. drive thru) | 934 | 2,900 | | | | EXISTING TRAFFIC | | | | | |
| | DRIVE-IN BANK | 912 | 5,500 | 552 | 32 | 23 | 55 | 58 | 58 | 116 | | |
| | SUB-TOTAL | | 143,720 | 552 | 32 | 23 | 55 | 58 | 58 | 116 | | |
| | Internal Trips | 10% | | 55 | 3 | 2 | 5 | 6 | 6 | 12 | | |
| | Pass-By Trips | 30% | | 166 | 10 | 7 | 16 | 17 | 17 | 35 | | |
| | Primary Trips | | | 331 | 19 | 14 | 33 | 35 | 35 | 69 | | |
| B | SUPERMARKET | 850 | 54,000 | | | | ZONE BUILTOUT | | | | | |
| | SPECIAL RETAIL | 814 | 25,900 | | | | EXISTING TRAFFIC | | | | | |
| | FASTFOOD RESTAURANT | 934 | 4,992 | | | | EXISTING TRAFFIC | | | | | |
| | DRIVE-IN BANK | 912 | 4,500 | | | | EXISTING TRAFFIC | | | | | |
| C | OFFICE BLDG | 710 | 57,500 | | | | EXISTING TRAFFIC | | | | | |
| | SHOPPING CENTER (40-150K sqft) | 821 | 87,000 | 8,108 | 190 | 117 | 307 | 377 | 409 | 786 | | |
| | H.T. RESTAURANT | 932 | 14,000 | 1,501 | 74 | 60 | 134 | 77 | 49 | 127 | | |
| | MULTIPLEX THEATER | 445 | 8 | 1,760 | - | - | - | 55 | 57 | 112 | | |
| | SUB-TOTAL | | 158,500 | 11,369 | 264 | 177 | 441 | 510 | 515 | 1,025 | | |
| | Internal Trips | 10% | | 1,137 | 26 | 18 | 44 | 51 | 52 | 102 | | |
| Pass-By Trips | 25% | | 2,842 | 66 | 44 | 110 | 127 | 129 | 256 | | | |
| Primary Trips | | | 7,390 | 172 | 115 | 287 | 331 | 335 | 666 | | | |
| D | KNOX CO MULTI-FAMILY | | 24 | 265 | 3 | 11 | 14 | 14 | 12 | 26 | | |
| | SHOPPING CENTER (40-150K sqft) | 821 | 79,100 | 7,500 | 173 | 106 | 279 | 348 | 377 | 726 | | |
| | MEDICAL OFFICE | 720 | 24,000 | | | | EXISTING TRAFFIC | | | | | |
| | SUB-TOTAL | | 103,100 | 7,765 | 176 | 117 | 294 | 363 | 389 | 752 | | |
| | Internal Trips | 10% | | 776 | 18 | 12 | 29 | 36 | 39 | 75 | | |
| Pass-By Trips | 30% | | 2,329 | 53 | 35 | 88 | 109 | 117 | 226 | | | |
| Primary Trips | | | 4,659 | 106 | 70 | 176 | 218 | 233 | 451 | | | |
| E | SINGLE FAMILY | 210 | 193 | 1,904 | 35 | 106 | 141 | 120 | 71 | 191 | | |
| | Existing Single-Family Units | 210 | 88 | 924 | 17 | 50 | 67 | 57 | 33 | 90 | | |
| | Single Family Subdivision Buildout | | 105 | 980 | 18 | 56 | 74 | 63 | 38 | 101 | | |
| TOTAL TRIP GENERATION | | | | 20,665 | 490 | 373 | 863 | 993 | 1,000 | 1,993 | | |
| TOTAL PRIMARY TRIP GENERATION | | | | 13,360 | 315 | 255 | 569 | 647 | 641 | 1,288 | | |

REFERENCE: Trip Generation, 11th Edition, published by the Institute of Transportation Engineers.





Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 7

**TABLE 3
 NORTSHORE TOWN CENTER
 Trip Generation-March 2022**

| ZONE | LAND USE | L.U.C | SIZE | DAILY | | | AM PEAK | | PM PEAK | |
|--------------------------------------|------------------------------------|-------|---------|---------------|------------|------------|------------------|------------|------------|--------------|
| | | | | TRAFFIC | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| A | DISCOUNT STORE | 815 | 135,320 | | | | EXISTING TRAFFIC | | | |
| | FASTFOOD REST. (w. drive thru) | 934 | 2,900 | | | | EXISTING TRAFFIC | | | |
| | DRIVE-IN BANK | 912 | 5,500 | 552 | 32 | 23 | 55 | 58 | 58 | 116 |
| | SUB-TOTAL | | 143,720 | 552 | 32 | 23 | 55 | 58 | 58 | 116 |
| | Internal Trips | 10% | | 55 | 3 | 2 | 5 | 6 | 6 | 12 |
| | Pass-By Trips | 30% | | 166 | 10 | 7 | 16 | 17 | 17 | 35 |
| | Primary Trips | | | 331 | 19 | 14 | 33 | 35 | 35 | 69 |
| B | SUPERMARKET | 850 | 54,000 | | | | ZONE BUILTOUT | | | |
| | SPECIAL RETAIL | 814 | 25,900 | | | | EXISTING TRAFFIC | | | |
| | FASTFOOD RESTAURANT | 934 | 4,992 | | | | | | | |
| | DRIVE-IN BANK | 912 | 4,500 | | | | | | | |
| C | OFFICE BLDG | 710 | 57,500 | | | | EXISTING TRAFFIC | | | |
| | SHOPPING CENTER (40-150K sqft) | 821 | 87,000 | 8,108 | 190 | 117 | 307 | 377 | 409 | 786 |
| | H.T. RESTAURANT | 932 | 14,000 | 1,501 | 74 | 60 | 134 | 77 | 49 | 127 |
| | MULTIPLEX THEATER | 445 | 8 | 1,760 | - | - | - | 55 | 57 | 112 |
| | SUB-TOTAL | | 158,500 | 11,369 | 264 | 177 | 441 | 510 | 515 | 1,025 |
| | Internal Trips | 10% | | 1,137 | 26 | 18 | 44 | 51 | 52 | 102 |
| Pass-By Trips | 25% | | 2,842 | 66 | 44 | 110 | 127 | 129 | 256 | |
| | Primary Trips | | | 7,390 | 172 | 115 | 287 | 331 | 335 | 666 |
| D | KNOX CO MULTI-FAMILY | | 24 | 265 | 3 | 11 | 14 | 14 | 12 | 26 |
| | SHOPPING CENTER (40-150K sqft) | 821 | 51,173 | 5,351 | 112 | 69 | 181 | 245 | 266 | 511 |
| | COFFEE/DONUT SHOP (w. drive thru) | 937 | 2,000 | 1,067 | 88 | 84 | 172 | 39 | 39 | 78 |
| | MEDICAL OFFICE | 720 | 24,000 | | | | EXISTING TRAFFIC | | | |
| | SUB-TOTAL | | 77,173 | 6,683 | 203 | 164 | 367 | 299 | 317 | 615 |
| | Internal Trips | 10% | | 668 | 20 | 16 | 37 | 30 | 32 | 62 |
| Pass-By Trips | 34% | | 2,272 | 69 | 56 | 125 | 102 | 108 | 209 | |
| | Primary Trips | | | 3,742 | 114 | 92 | 205 | 167 | 177 | 345 |
| E | SINGLE FAMILY | 210 | 193 | 1,904 | 35 | 106 | 141 | 120 | 71 | 191 |
| | Existing Single-Family Units | 210 | 88 | 924 | 17 | 50 | 67 | 57 | 33 | 90 |
| | Single Family Subdivision Buildout | | 105 | 980 | 18 | 56 | 74 | 63 | 38 | 101 |
| TOTAL TRIP GENERATION | | | | 19,583 | 517 | 419 | 936 | 930 | 927 | 1,857 |
| TOTAL PRIMARY TRIP GENERATION | | | | 12,443 | 322 | 276 | 599 | 597 | 585 | 1,181 |

REFERENCE: Trip Generation, 11th Edition, published by the Institute of Transportation Engineers.



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 8

TABLE 4
Northshore Town Center
Trip Generation Comparison

| | DATE | DAILY TRAFFIC | AM PEAK | | | PM PEAK | | |
|----------------------------------|--------|---------------|------------|------------|------------|------------|------------|--------------|
| | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| NORTHSHORE TOWN CENTER | Oct-20 | 20,665 | 490 | 373 | 863 | 993 | 1,000 | 1,993 |
| Primary Trips | | 13,360 | 315 | 255 | 569 | 647 | 641 | 1,288 |
| NORTHSHORE TOWN CENTER | Mar-22 | 19,583 | 517 | 419 | 936 | 930 | 927 | 1,857 |
| Primary Trips | | 12,443 | 322 | 276 | 599 | 597 | 585 | 1,181 |
| Change in Trips Generated | | -1,082 | 26 | 47 | 73 | -64 | -72 | -136 |
| Change in Primary Trips | | -917 | 8 | 21 | 29 | -50 | -56 | -106 |

REFERENCE: Trip Generation 11th Edition, published by the Institute of Transportation Engineers.

The comparison of the Zone D trip generation is presented in **Table 5**.

TABLE 5
Zone D Trip Generation Comparison

| ZONE | LAND USE | L.U.C | SIZE | DAILY TRAFFIC | AM PEAK | | | PM PEAK | | |
|----------------------------------|-----------------------------------|-------|--------|---------------|-----------|-----------|-----------|------------|------------|-------------|
| | | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| D March 2022 | KNOX CO MULTI-FAMILY | | 24 | 265 | 3 | 11 | 14 | 14 | 12 | 26 |
| | SHOPPING CENTER (40-150K sqft) | 821 | 51,173 | 5,351 | 112 | 69 | 181 | 245 | 266 | 511 |
| | COFFEE/DONUT SHOP (w. drive thru) | 937 | 2,000 | 1,067 | 88 | 84 | 172 | 39 | 39 | 78 |
| | | | | 6,683 | 203 | 164 | 367 | 299 | 317 | 615 |
| D October 2020 | KNOX CO MULTI-FAMILY | | 24 | 265 | 3 | 11 | 14 | 14 | 12 | 26 |
| | SHOPPING CENTER | 821 | 79,100 | 7,500 | 173 | 106 | 279 | 348 | 377 | 726 |
| | | | | 7,765 | 176 | 117 | 294 | 363 | 389 | 752 |
| Trip Generation Reduction | | | | -1,082 | 26 | 47 | 73 | -64 | -72 | -136 |

REFERENCE: Trip Generation 11th Edition, published by the Institute of Transportation Engineers.

The comparison of the current updated trip generation with the trip generation of 2020 finds that the trip generation is increased during the AM peak hour due to the drive-thru coffee shop use but is a reduction during the PM peak hour and the daily trips generated. After some adjustment for the pass-by and internal trips, the increase in the new trips generated is a total of 29 additional trips during the AM peak hour and a total reduction of 106 trips during the PM peak hour. The daily generated trips for Zone D are reduced 917 trips. The PM peak hour is the critical peak hour for the Northshore Town Center. The increase during the AM peak hour would not affect any previous findings and/or recommendations of the original traffic study. The trip



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 9

generation of the proposed site accounts for approximately 3-percent of the daily and 2.5 percent of the PM peak hour of the original trip generation for the Northshore Town Center. The comparison of the trip generation reflected in Tables 2 and 3 compared the previous planned land uses with this proposed development relative **Trip Generation 11th Edition** and not a direct comparison of the previous trip generation as the previous generated trips were based on the 10th edition of Trip Generation. A further analysis was, however, conducted comparing the original trip generation from 2011 with the current 2022 trip generation reflecting both changes in various Northshore Town Center revised land uses and/or densities and the changes from the trip rates published in **Trip Generation 8th Edition**. **Table 6** below presents the differences that are reflected in this most current trip generation of the existing and proposed land uses based on **Trip Generation 11th Edition** with the trip generation of 2011, based on **Trip Generation 8th Edition**.

TABLE 6
NORTHSHORE TOWN CENTER
Trip Generation Comparison from 2011

| | DATE | DAILY TRAFFIC | AM PEAK | | | PM PEAK | | |
|-------------------------------------|--------|---------------|------------|------------|--------------|--------------|--------------|--------------|
| | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| NORTHSHORE TOWN CENTER ¹ | Jan-11 | 37,211 | 834 | 666 | 1,500 | 1,823 | 1,938 | 3,761 |
| Primary Trips | | 26,155 | 575 | 510 | 1,085 | 1,286 | 1,336 | 2,622 |
| NORTHSHORE TOWN CENTER ² | Mar-22 | 39,483 | 1,097 | 811 | 1,909 | 1,834 | 1,905 | 3,739 |
| Primary Trips | | 24,751 | 680 | 532 | 1,212 | 1,162 | 1,186 | 2,348 |
| Change in Trips Generated | | 2,272 | 263 | 145 | 409 | 11 | -33 | -22 |
| Change in Primary Trips | | -1,404 | 105 | 22 | 127 | -124 | -150 | -274 |

REFERENCE: 1.) Trip Generation 8th Edition, published by the Institute of Transportation Engineers.
 2.) Trip Generation 11th Edition, published by the Institute of Transportation Engineers.

The primary trips generated difference from 2011 indicates, as previously identified, an increase during the AM peak hour but a reduction in the daily and PM peak hour. The detailed trip generation tables for both the current and the 2011 land uses, densities, and trip rates are attached. This comparison reflects all the changes in the Northshore Town Center and not just the current proposed Town Center Shops. The more significant changes have included a couple of fast food restaurants which are higher trip generators but also exhibit higher pass-by rates.

The study of this proposed site, in addition to the analysis of its trip generation, did analyze the roundabout intersection of Town Center Boulevard and Boardwalk Boulevard and proposed site access from two planned access easements, one to Boardwalk Boulevard and another to the adjacent Target store access street. The following **Figures 4-9** illustrate the current traffic control, 2022 traffic turning movements, trip distribution and assignment for AM and PM peak hours, based on the current distribution to and from the north approach of the Town Center Boulevard roundabout, and projected traffic with the proposed shops.



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 10

Analyses of the proposed site access determined that levels of service (LOS) A would be provided with the proposed development. **Table 7** presents the analyses conducted for this study.

TABLE 7
Capacity and Level of Service

| INTERSECTION | TRAFFIC CONTROL | PEAK PERIOD | V/C | DELAY | LOS |
|-------------------------------------|-----------------|-------------|----------------------|-------|-----|
| Town Center Blvd & Boardwalk Blvd | ROUNDAABOUT | AM | 0.220 _{max} | 4.8 | A |
| | | PM | 0.285 _{max} | 4.8 | A |
| Boardwalk Blvd & NS Access Easement | STOP SB | AM | 0.025 | 9.5 | A |
| | | PM | 0.006 | 9.6 | A |
| Boardwalk Blvd & EW Access Easement | STOP | AM | 0.102 | 8.7 | A |
| | | PM | 0.083 | 8.8 | A |

Note: Average vehicle delay estimated in seconds.

The trips generated by the proposed site as identified in Table 1 and the analysis of the site accesses, the traffic impact to the public street system is minimal and would be reduced during the PM peak hour.



Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 11

GEOMETRY AND TRAFFIC CONTROL

Northshore Town Center
Town Center Shops
Knoxville, TN

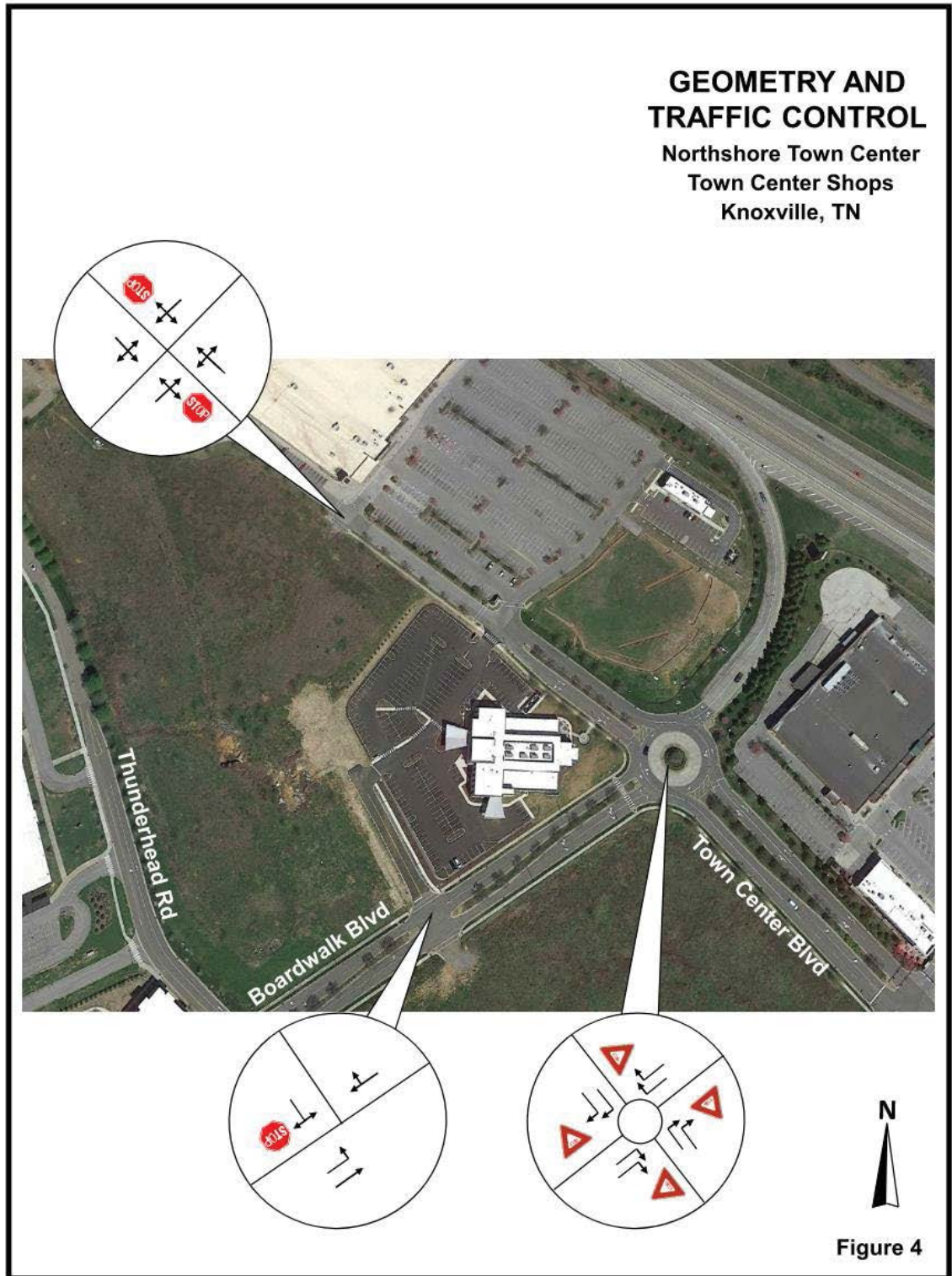


Figure 4



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 12

**2022 EXISTING
 TRAFFIC**
 Northshore Town Center
 Town Center Shops
 Knoxville, TN

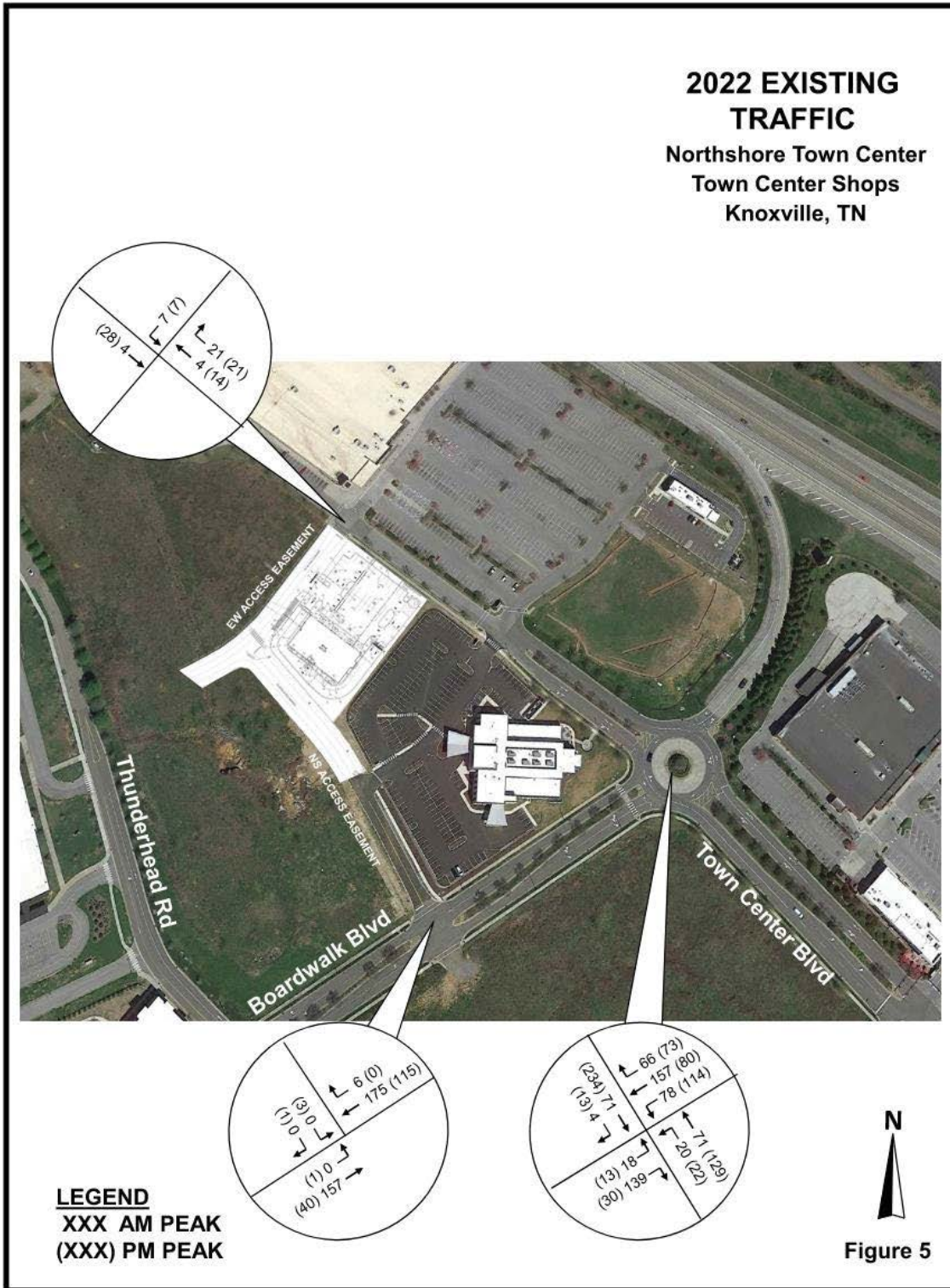
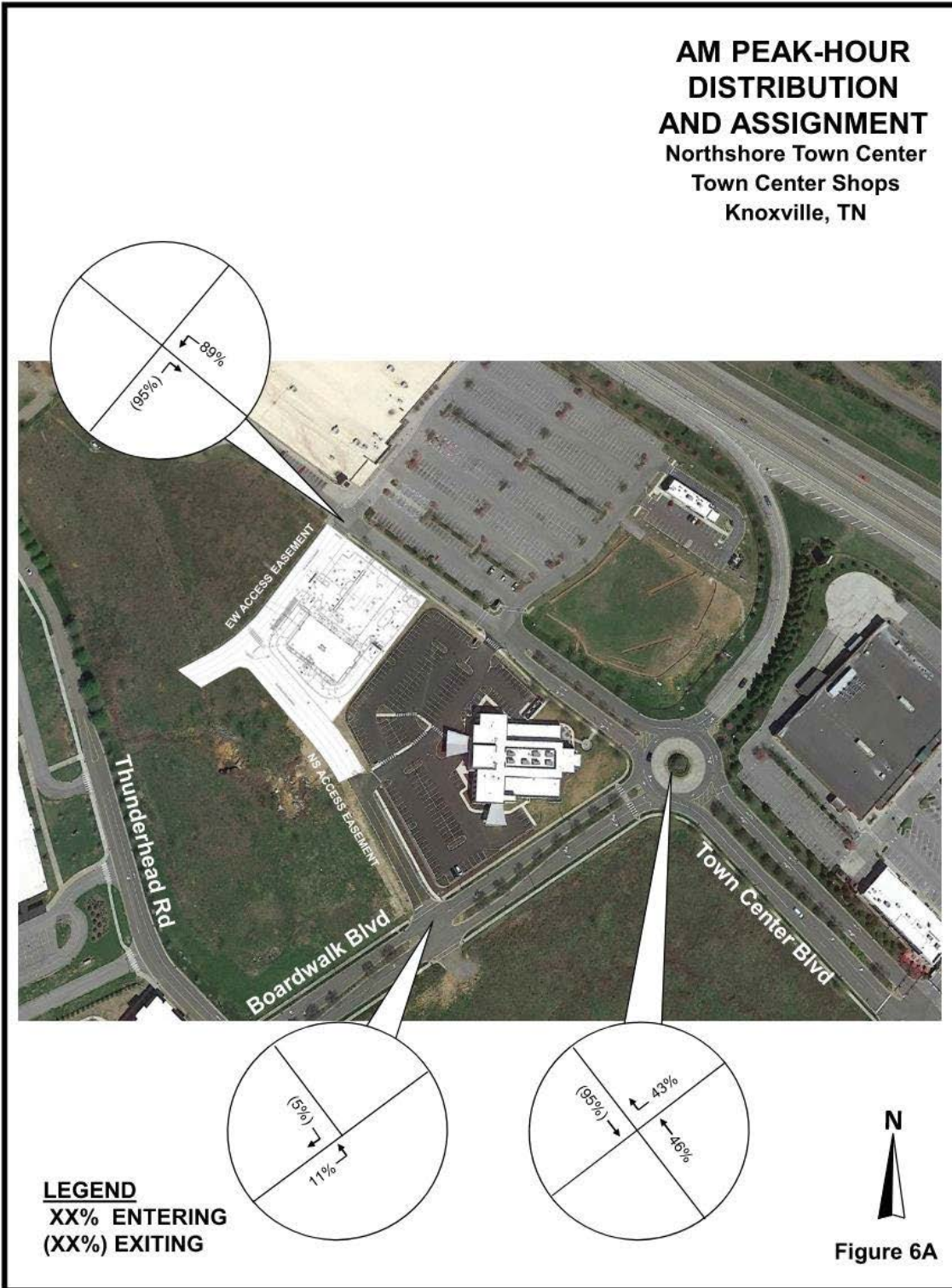


Figure 5



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 13

**AM PEAK-HOUR
 DISTRIBUTION
 AND ASSIGNMENT**
 Northshore Town Center
 Town Center Shops
 Knoxville, TN



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 14

**AM PASS-BY
 DISTRIBUTION
 AND ASSIGNMENT**
 Northshore Town Center
 Town Center Shops
 Knoxville, TN

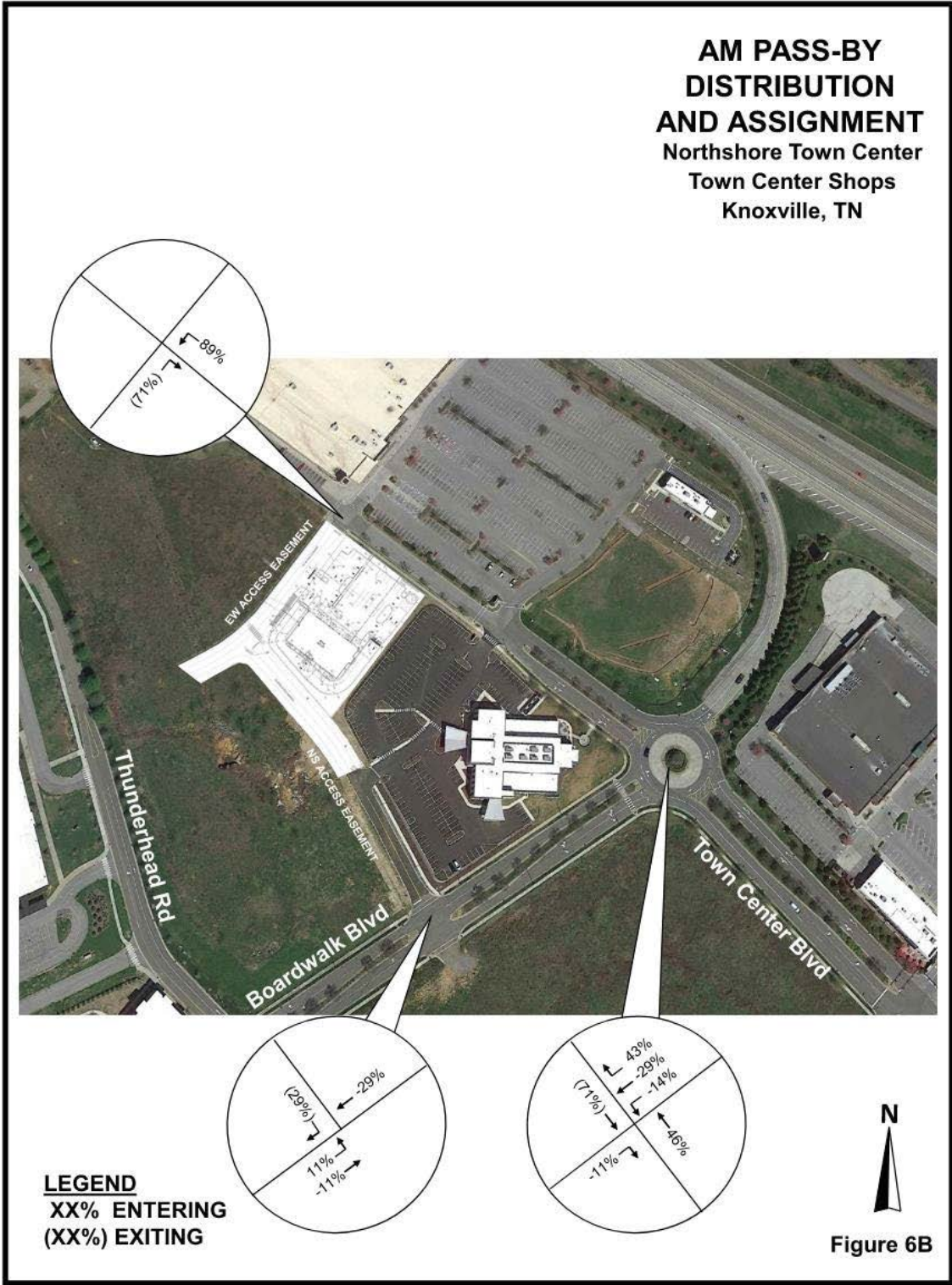


Figure 6B



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 15

**PM PEAK-HOUR
 DISTRIBUTION
 AND ASSIGNMENT**
 Northshore Town Center
 Town Center Shops
 Knoxville, TN

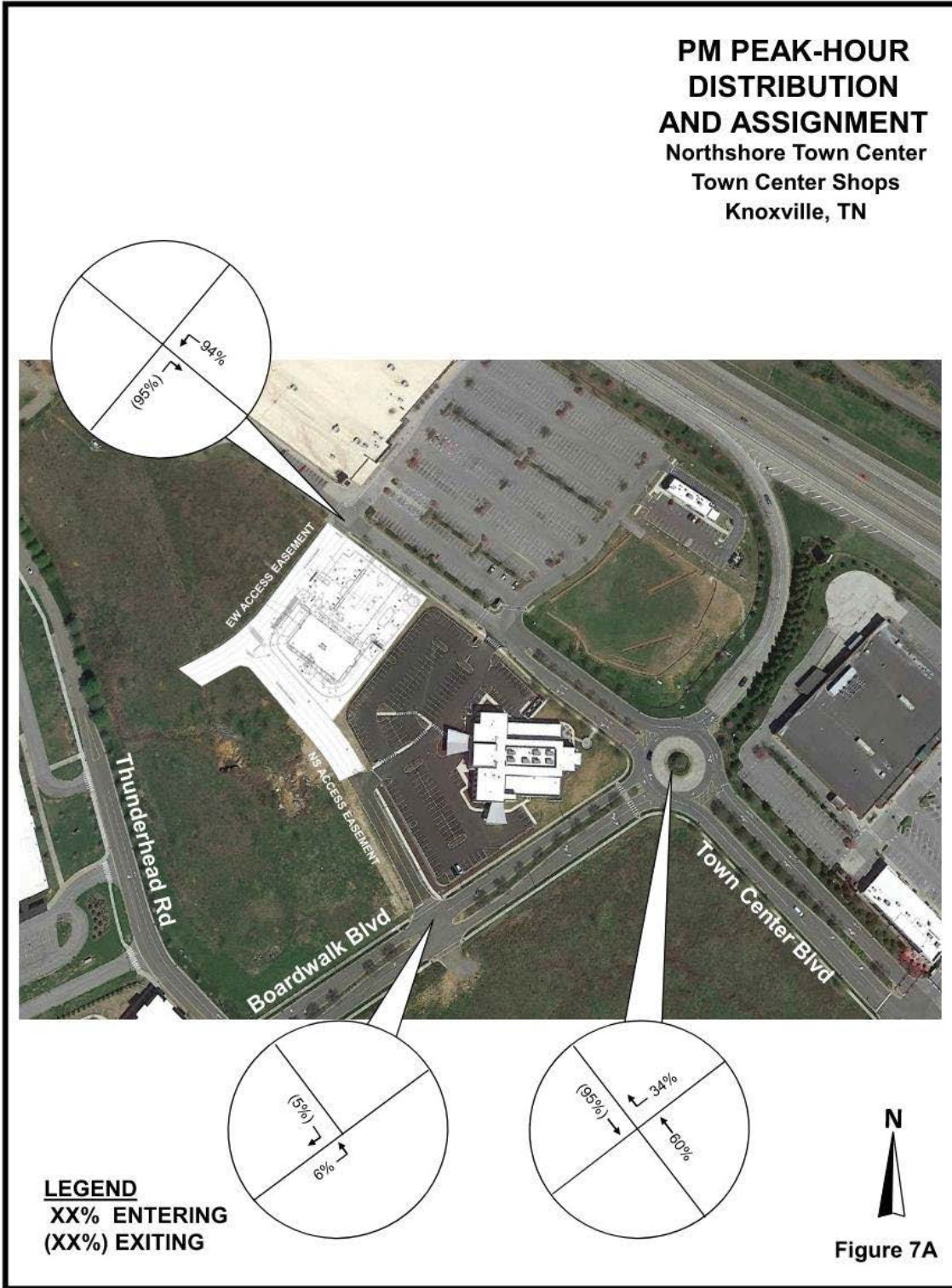
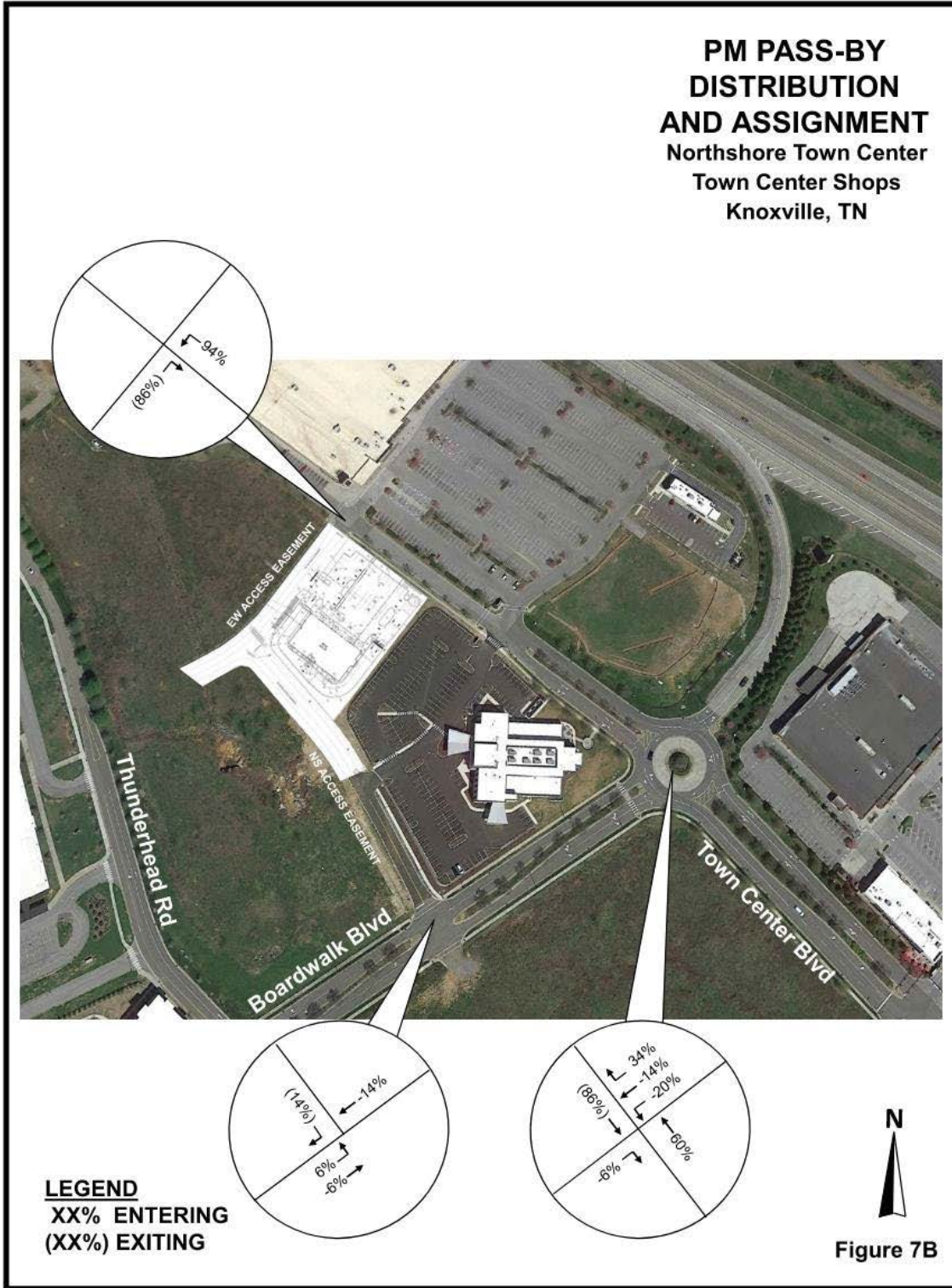


Figure 7A



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 16

**PM PASS-BY
 DISTRIBUTION
 AND ASSIGNMENT**
 Northshore Town Center
 Town Center Shops
 Knoxville, TN



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 17

PROJECT TRIPS
 Northshore Town Center
 Town Center Shops
 Knoxville, TN

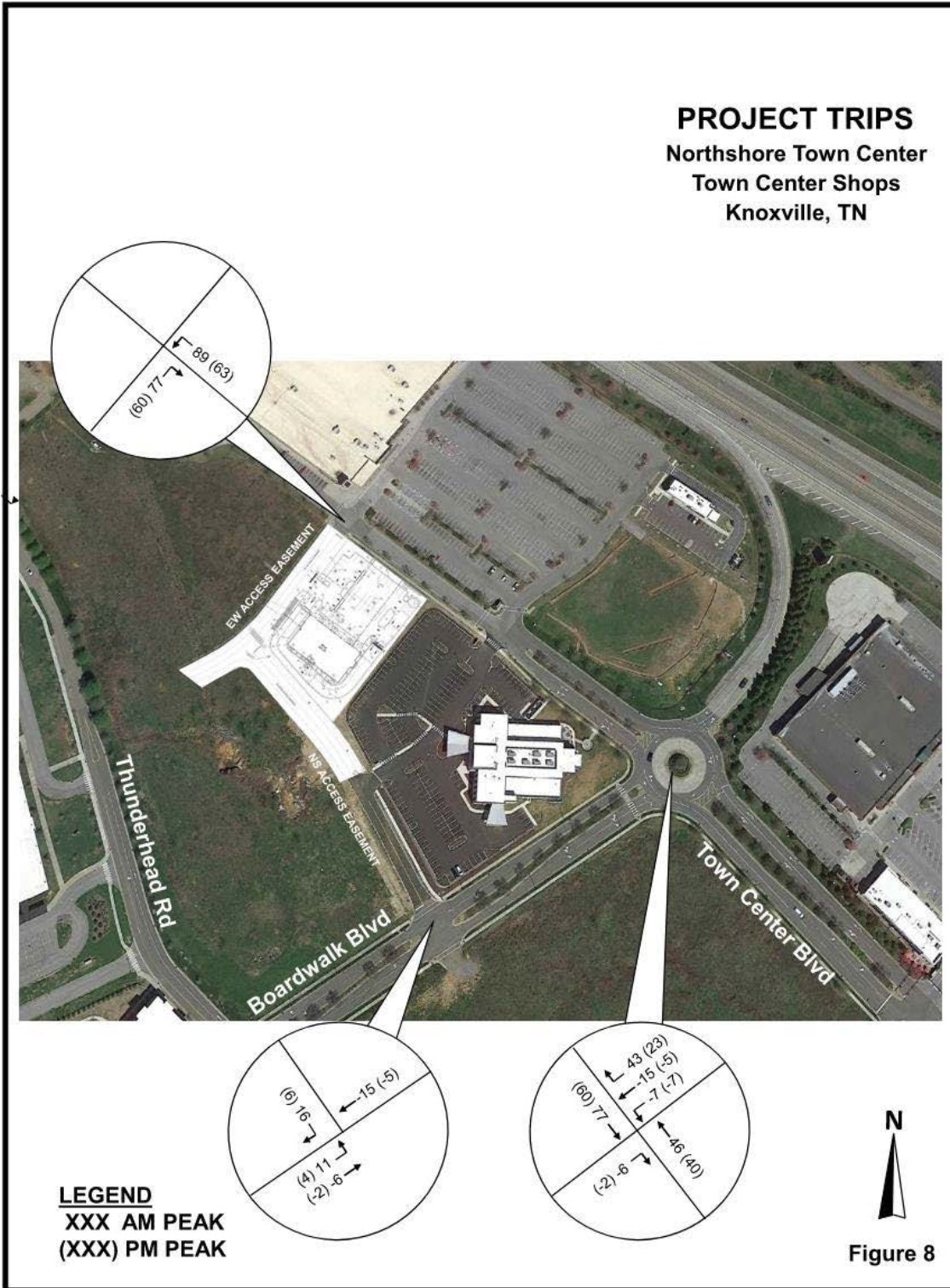
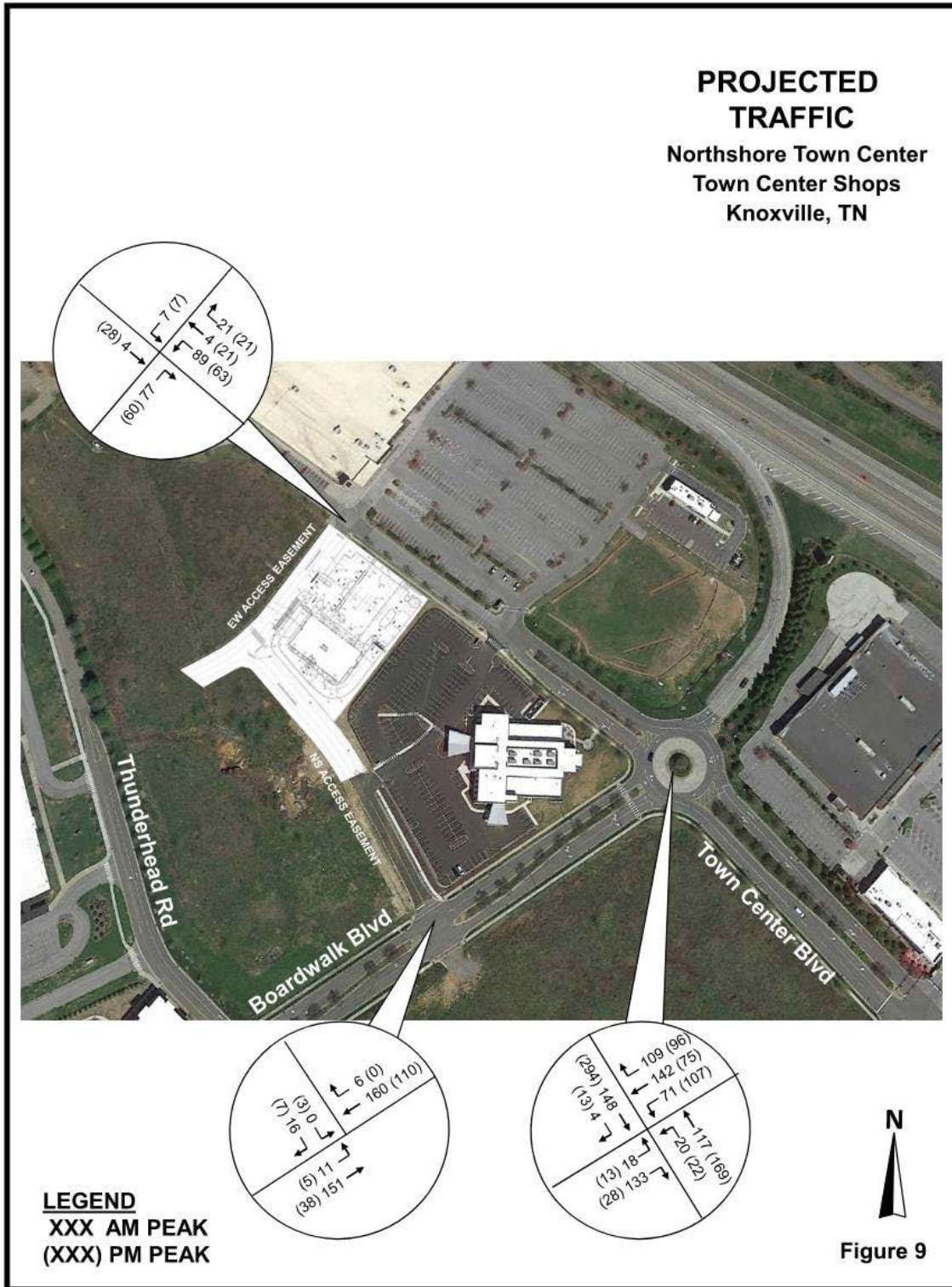


Figure 8



Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 18

**PROJECTED
TRAFFIC**
Northshore Town Center
Town Center Shops
Knoxville, TN



Mr. John Anderson P.E.
 SITE Inc.
 March 16, 2022
 Revised March 28, 2022
 Page 19

Drive-thru queuing was analyzed to determine if the available storage of 11 vehicles (275-feet) is adequate for the proposed operation. Using a simple queuing model with a single-service window was used to evaluate the coffee service drive thru.

L_q is the average vehicle queue length:

$$E[L_q] = \frac{r^2}{1 - r}$$

Drive-thru coffee service is recognized as less than 60 second per vehicle Queuing were therefore modeled from 30-60 seconds. **Table 7** presents the model results for these various service rates.

Table 7
Service Window Queues

| SERVICE RATE | | ARRIVAL RATE λ | RATIO r | AVERAGE QUEUE $E[L_q]$ | % OF ENTERING TRIPS |
|--------------|--------|---------------------------|--------------|---------------------------|---------------------|
| | μ | | | | |
| seconds | veh/hr | | | | |
| 60 | 60 | 52 | 0.867 | 6 | 59% |
| | | 55 | 0.917 | 10 | 63% |
| 55 | 65.5 | 57 | 0.871 | 6 | 65% |
| | | 60 | 0.917 | 10 | 68% |
| 50 | 72 | 63 | 0.875 | 6 | 72% |
| | | 66 | 0.917 | 10 | 75% |
| 45 | 80 | 70 | 0.875 | 6 | 80% |
| | | 73 | 0.913 | 10 | 83% |
| 40 | 90 | 78 | 0.867 | 6 | 89% |
| | | 83 | 0.922 | 11 | 94% |
| 35 | 102.9 | 88 | 0.856 | 5 | 100% |
| 30 | 120 | 88 | 0.733 | 2 | 100% |

The available storage is more than sufficient to store more than half of the entering trips. With the greater service rate of 60 vehicles/hour, the available widow queue storage can accommodate 63-percent of the entering trips during the AM peak hour. A widow time of 45 seconds, providing a service rate of 80 vehicles/hour, would accommodate as much as 83-percent of the entering trips. The available storage should accommodate the traffic generated by the coffee shop as it is estimated that 60-80% of the AM peak-hour entering trips would utilize the drive thru and the average window service times should range between 45-60 seconds.



Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 20

The access easement of the Target access is from an existing cross access stub. There is not any adverse geometry restricting lines of sight from the EW access easement to Target access street. The Target access street is a low functioning access street with both low volume and speeds. The speeds should be less than 30mph, thereby a minimum stopping sight-distance less than 200 feet, which is more than available. With the traffic from the access easement to the Target access street being a right-turn movement, the conflict is also very minimal. The lines of sight are unlimited to either direction. **Figures 10 and 11** are images of the lines of sight available.



Figure 10 Line of Sight LEFT From EW Access Easement



Figure 11 Line of Sight RIGHT From EW Access Easement

Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 21

The proposed development's impact to the Thunderhead Road intersection with Northshore Drive (S.R. 332) will be minimal. The trip generation is not greater than 2.5 percent of the original total trip generation of the Northshore Town Center PM peak hour traffic. Primary trips of the proposed site are an estimated 50 vehicles during the AM peak hour; any trips traveling through this intersection should be less than 15 vehicles during this peak, and less would enter using the left-turn lane from Northshore Drive to Thunderhead Road thereby having negligible impact on the eastbound left-turn queue. With access for this site provided from the Target access street, much of the traffic from Northshore Drive should enter using Town Center Boulevard and not Thunderhead Road.

In addition, the recently completed Northshore Drive Corridor Study did not determine the need for improving current eastbound left-turn lane from Northshore Drive to Thunderhead Road. A review of the final report found that the eastbound left-turn queues appeared managed, and existing and future 95th percentile queues did not exceed the available storage. With the minimal impact of this proposed development, the current conditions as analyzed by the Northshore Drive Corridor Study, will not change.

The existing 2021 traffic, including much of the Northshore Town Center traffic, for the Northshore Drive and Thunderhead Road intersection is lower than the projected 2016 background traffic in the 2011 Northshore Town Center traffic study. The critical AM peak of the eastbound left-turn and the southbound left-turn movements are significantly less. These reduced traffic volumes and buildout of the assumed 2016 background conditions including the development of the Knox County elementary school, the traffic impacts are much reduced than the projected background and site related projected traffic conditions than originally identified. During the critical AM peak hour, the eastbound left-turn demand is 75 vehicles and the southbound left-turn movement is 220 vehicles lower than the original background traffic conditions and these movements currently include some traffic generated by the Northshore Town Center. The impact from both the background and Northshore Town Center is, therefore, much less than originally estimated. The recommended geometric improvement for the eastbound left-turn lane and southbound left-turn lane can be modified which would be predicated with buildout of Zone C and Zone E residential development. A second left-turn movement from Thunderhead Road is probably not required as the demand is much reduced.

The construction of a northbound right-turn lane from Thunderhead Road to Boardwalk Boulevard is another previous 2011 recommendation that remains which need would probably be predicated on buildout of Zone C of the Northshore Town Center. A recommended southbound left-turn lane from Thunderhead Road to Boardwalk Boulevard should have been constructed in conjunction with the Knox County elementary school. This left-turn lane is precluded as the school constructed a left-turn lane to the school where this lane should have been provided.

The proposed development and its access is found to have minimal if any impact to the adjacent streets. Levels of service for the site accesses are A with acceptable lines of sight. Queue





Mr. John Anderson P.E.
SITE Inc.
March 16, 2022
Revised March 28, 2022
Page 22

storage for the proposed coffee drive thru should be more than adequate for management of approximately 85-percent of the entering trips to the coffee shop during the AM peak hour. This development should not have any adverse impact to the current Thunderhead Road intersection with Northshore Drive (S.R. 332).

Should you have any questions, please call me.

Sincerely,
CDM Smith Inc.



John F. Gould, P.E.
Senior Transportation Engineer

Enclosures: March 2022 Northshore Town Center Cumulative Trip Generation
WSA 2011 TIA 2011 Table 4 Trip Generation
Site Trip Generation
Trip Generation Handbook, 3rd Edition Pass-By Reference Pages
Pass-By Rate Estimation Calculation
WSA 2011 TIA 2016 Background Traffic Figure 6B
Synchro HCM Reports
2022 Turning Movement Count

Project No. 271397



NORTHSHORE TOWN CENTER

Trip Generation

March 2022

| ZONE | LAND USE | L.U.C | SIZE | DAILY TRAFFIC | | | AM PEAK | | | PM PEAK | | |
|--------------------------------------|------------------------------------|-------|---------|---------------|------------|------------|--------------|--------------|--------------|--------------|------|-------|
| | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| A | DISCOUNT STORE | 815 | 135,320 | 6,829 | 91 | 39 | 129 | 308 | 308 | 615 | | |
| | FASTFOOD REST. (w. drive thru) | 934 | 2,900 | 1,356 | 66 | 63 | 129 | 50 | 46 | 96 | | |
| | DRIVE-IN BANK ³ | 912 | 5,500 | 552 | 32 | 23 | 55 | 58 | 58 | 116 | | |
| | SUB-TOTAL | | 143,720 | 8,736 | 188 | 125 | 313 | 415 | 412 | 827 | | |
| | Internal Trips | 10% | | 874 | 19 | 13 | 31 | 42 | 41 | 83 | | |
| | Pass-By Trips | 30% | | 2,621 | 56 | 38 | 94 | 125 | 123 | 248 | | |
| | Primary Trips | | 5,242 | 113 | 75 | 188 | 249 | 247 | 496 | | | |
| B | SUPERMARKET | 850 | 54,000 | 5,042 | 91 | 63 | 154 | 235 | 235 | 469 | | |
| | SHOPPING CENTER (<40K sqft) | 822 | 25,900 | 1,323 | 32 | 22 | 54 | 77 | 77 | 153 | | |
| | FASTFOOD RESTAURANT | 934 | 4,992 | 2,334 | 114 | 109 | 223 | 86 | 79 | 165 | | |
| | DRIVE-IN BANK | 912 | 4,500 | 452 | 26 | 19 | 45 | 47 | 47 | 95 | | |
| | SUB-TOTAL | | 89,392 | 9,150 | 263 | 213 | 476 | 444 | 438 | 882 | | |
| | Internal Trips | 10% | | 915 | 26 | 21 | 48 | 44 | 44 | 88 | | |
| | Pass-By Trips | 30% | 2,745 | 79 | 64 | 143 | 133 | 131 | 264 | | | |
| | Primary Trips | | 5,490 | 158 | 128 | 286 | 266 | 263 | 529 | | | |
| C | OFFICE BLDG | 710 | 57,500 | 717 | 92 | 12 | 104 | 18 | 87 | 105 | | |
| | SHOPPING CENTER (40-150K sqft) | 821 | 87,000 | 8,108 | 190 | 117 | 307 | 377 | 409 | 786 | | |
| | H.T. RESTAURANT | 932 | 14,000 | 1,501 | 74 | 60 | 134 | 77 | 49 | 127 | | |
| | MULTIPLEX THEATER | 445 | 8 | 1,760 | - | - | - | 55 | 57 | 112 | | |
| | SUB-TOTAL | | 158,500 | 12,086 | 356 | 189 | 545 | 527 | 602 | 1,130 | | |
| | Internal Trips | 10% | | 1,209 | 36 | 19 | 55 | 53 | 60 | 113 | | |
| | Pass-By Trips | 25% | 3,022 | 89 | 47 | 136 | 132 | 151 | 282 | | | |
| | Primary Trips | | 7,856 | 231 | 123 | 354 | 343 | 391 | 734 | | | |
| D | KNOX CO MULTI-FAMILY | | 24 | 265 | 3 | 11 | 14 | 14 | 12 | 26 | | |
| | SHOPPING CENTER (40-150K sqft) | 821 | 51,173 | 5,351 | 112 | 69 | 181 | 245 | 266 | 511 | | |
| | COFFEE/DONUT SHOP (w. drive thru) | 937 | 2,000 | 1,067 | 88 | 84 | 172 | 39 | 39 | 78 | | |
| | MEDICAL OFFICE | 720 | 24,000 | 923 | 53 | 14 | 67 | 28 | 66 | 95 | | |
| | SUB-TOTAL | | 77,173 | 7,606 | 255 | 178 | 433 | 327 | 383 | 710 | | |
| | Internal Trips | 10% | | 761 | 26 | 18 | 43 | 33 | 38 | 71 | | |
| | Pass-By Trips | 34% | 2,586 | 87 | 61 | 147 | 111 | 130 | 241 | | | |
| | Primary Trips | | 4,259 | 143 | 100 | 243 | 183 | 214 | 398 | | | |
| E | SINGLE FAMILY | 210 | 193 | 1,904 | 35 | 106 | 141 | 120 | 71 | 191 | | |
| | Existing Single-Family Units | 210 | 88 | 924 | 17 | 50 | 67 | 57 | 33 | 90 | | |
| | Single Family Subdivision Buildout | | 105 | 980 | 18 | 56 | 74 | 63 | 38 | 101 | | |
| TOTAL TRIP GENERATION | | | | 39,483 | 1,097 | 811 | 1,909 | 1,834 | 1,905 | 3,739 | | |
| TOTAL PRIMARY TRIP GENERATION | | | | 24,751 | 680 | 532 | 1,212 | 1,162 | 1,186 | 2,348 | | |

REFERENCE: Trip Generation, 11th Edition, published by the Institute of Transportation Engineers.

Generated trips reflected in the existing traffic volumes.

Zone D revised trip generation.

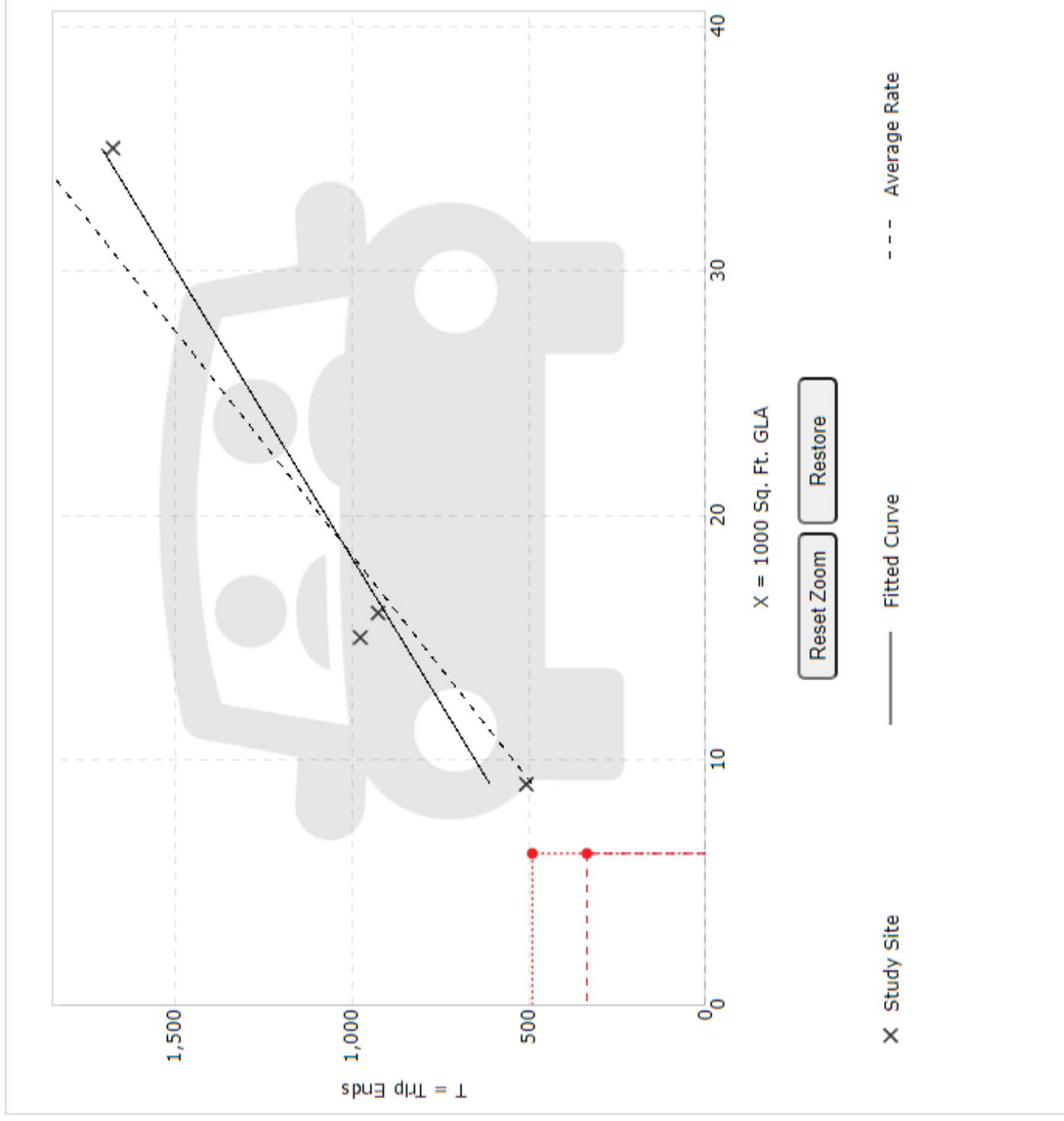
**TABLE 4
TRIP GENERATION**

| ZONE | LAND USE | L.U.C | SIZE | DAILY | AM PEAK | | TOTAL | PM PEAK | | TOTAL |
|------|--------------------------------------|-------|---------|---------------|------------|------------|--------------|--------------|--------------|--------------|
| | | | | TRAFFIC | ENTER | EXIT | | ENTER | EXIT | |
| A | DISCOUNT STORE | 815 | 135,320 | 8,347 | 98 | 46 | 143 | 338 | 338 | 677 |
| | H.T. RESTAURANT | 932 | 6,500 | 826 | 39 | 36 | 75 | 43 | 30 | 72 |
| | DRIVE-IN BANK | 912 | 4,500 | 667 | 31 | 24 | 56 | 58 | 58 | 116 |
| | SUB-TOTAL | | 146,320 | 9,840 | 168 | 106 | 274 | 439 | 426 | 865 |
| | Internal Trips | 10% | | 984 | 17 | 11 | 27 | 44 | 43 | 87 |
| | Pass-By Trips | 20% | | 1,968 | 34 | 21 | 55 | 88 | 85 | 173 |
| | Primary Trips | | | 6,888 | 117 | 74 | 192 | 307 | 298 | 606 |
| B | SUPERMARKET | 850 | 54,000 | 5,007 | 118 | 76 | 194 | 302 | 290 | 592 |
| | SPECIAL RETAIL | 814 | 25,900 | 1,146 | 16 | 10 | 27 | 37 | 47 | 84 |
| | SERVICE STA w CONV. MARKET | 945 | 1,000 | 1,271 | 40 | 39 | 79 | 49 | 49 | 97 |
| | DRIVE-IN BANK | 912 | 4,500 | 667 | 31 | 24 | 56 | 58 | 58 | 116 |
| | SUB-TOTAL | | 85,400 | 8,090 | 206 | 149 | 355 | 445 | 443 | 889 |
| | Internal Trips | 10% | | 809 | 21 | 15 | 36 | 45 | 44 | 89 |
| | Pass-By Trips | 20% | | 1,618 | 41 | 30 | 71 | 89 | 89 | 178 |
| | Primary Trips | | | 5,663 | 144 | 105 | 249 | 312 | 310 | 622 |
| C | OFFICE BLDG. | 710 | 57,500 | 871 | 106 | 14 | 120 | 24 | 119 | 143 |
| | SHOPPING CENTER | 820 | 87,000 | 6,203 | 87 | 55 | 142 | 278 | 301 | 579 |
| | H.T. RESTAURANT | 932 | 14,000 | 1,780 | 84 | 77 | 161 | 92 | 64 | 156 |
| | MULTIPLEX THEATER | 445 | 8 | - | - | - | - | 49 | 60 | 109 |
| | SUB-TOTAL | | 158,500 | 8,855 | 276 | 147 | 424 | 444 | 544 | 988 |
| | Internal Trips | 10% | | 885 | 28 | 15 | 42 | 44 | 54 | 99 |
| | Pass-By Trips | 25% | | 2,214 | 69 | 37 | 106 | 111 | 136 | 247 |
| | Primary Trips | | | 5,756 | 180 | 96 | 275 | 288 | 354 | 642 |
| D | KNOX CO MULTI-FAMILY | 225 | 24 | 265 | 3 | 11 | 14 | 14 | 12 | 26 |
| | SHOPPING CENTER | 820 | 79,100 | 5,831 | 82 | 52 | 134 | 261 | 283 | 544 |
| | OFFICE BLDG. | 710 | 17,500 | 349 | 41 | 6 | 47 | 17 | 82 | 98 |
| | SUB-TOTAL | | 96,600 | 6,444 | 126 | 69 | 195 | 292 | 376 | 668 |
| | Internal Trips | 10% | | 644 | 13 | 7 | 19 | 29 | 38 | 67 |
| | Pass-By Trips | 30% | | 1,933 | 38 | 21 | 58 | 88 | 113 | 200 |
| | Primary Trips | | | 3,867 | 76 | 41 | 117 | 175 | 226 | 401 |
| E | SINGLE FAMILY | 210 | 120 | 1,230 | 23 | 70 | 94 | 78 | 46 | 124 |
| | KNOX CO MULTI-FAMILY | 225 | 325 | 2,753 | 35 | 124 | 159 | 125 | 102 | 227 |
| | SUB-TOTAL | | 445 | 3,983 | 58 | 194 | 252 | 203 | 148 | 351 |
| | Internal Trips | | | - | - | - | - | - | - | - |
| | Pass-By Trips | | | - | - | - | - | - | - | - |
| | Primary Trips | | | 3,983 | 58 | 194 | 252 | 203 | 148 | 351 |
| | TOTAL TRIP GENERATION | | | 37,211 | 834 | 666 | 1,500 | 1,823 | 1,938 | 3,761 |
| | TOTAL PRIMARY TRIP GENERATION | | | 26,155 | 575 | 510 | 1,085 | 1,286 | 1,336 | 2,622 |

REFERENCE: Trip Generation, 8th Edition, published by the Institute of Transportation Engineers.

Data Plot and Equation

Caution – Small Sample Size



DATA STATISTICS

Land Use:

Strip Retail Plaza (<40k) (822) [Click for Description and Data Plots](#)

Independent Variable:

1000 Sq. Ft. GLA

Time Period:

Weekday

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

4

Avg. 1000 Sq. Ft. GLA:

19

Average Rate:

54.45

Range of Rates:

47.86 - 65.07

Standard Deviation:

7.81

Fitted Curve Equation:

$T = 42.20(X) + 229.68$

R²:

0.96

Directional Distribution:

50% entering, 50% exiting

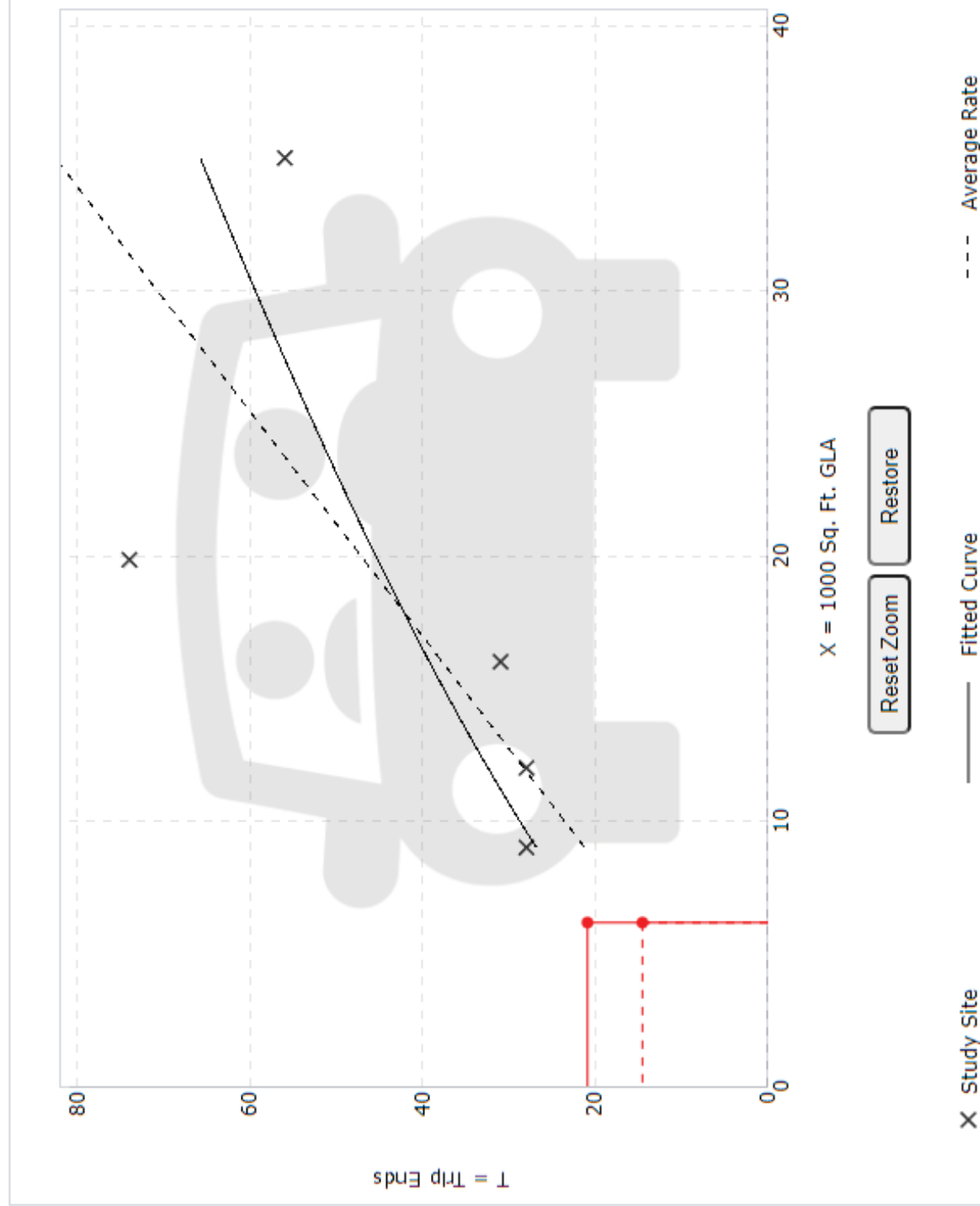
Calculated Trip Ends:

Average Rate: 336 (Total), 168 (Entry), 168 (Exit)

Fitted Curve: 490 (Total), 245 (Entry), 245 (Exit)

Data Plot and Equation

Caution – Small Sample Size



DATA STATISTICS

Land Use:

Strip Retail Plaza (<40k) (822) [Click for Description and Data Plots](#)

Independent Variable:

1000 Sq. Ft. GLA

Time Period:

Weekday

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

5

Avg. 1000 Sq. Ft. GLA:

18

Average Rate:

2.36

Range of Rates:

1.60 - 3.73

Standard Deviation:

0.94

Fitted Curve Equation:

$\ln(T) = 0.66 \ln(X) + 1.84$

R²:

0.57

Directional Distribution:

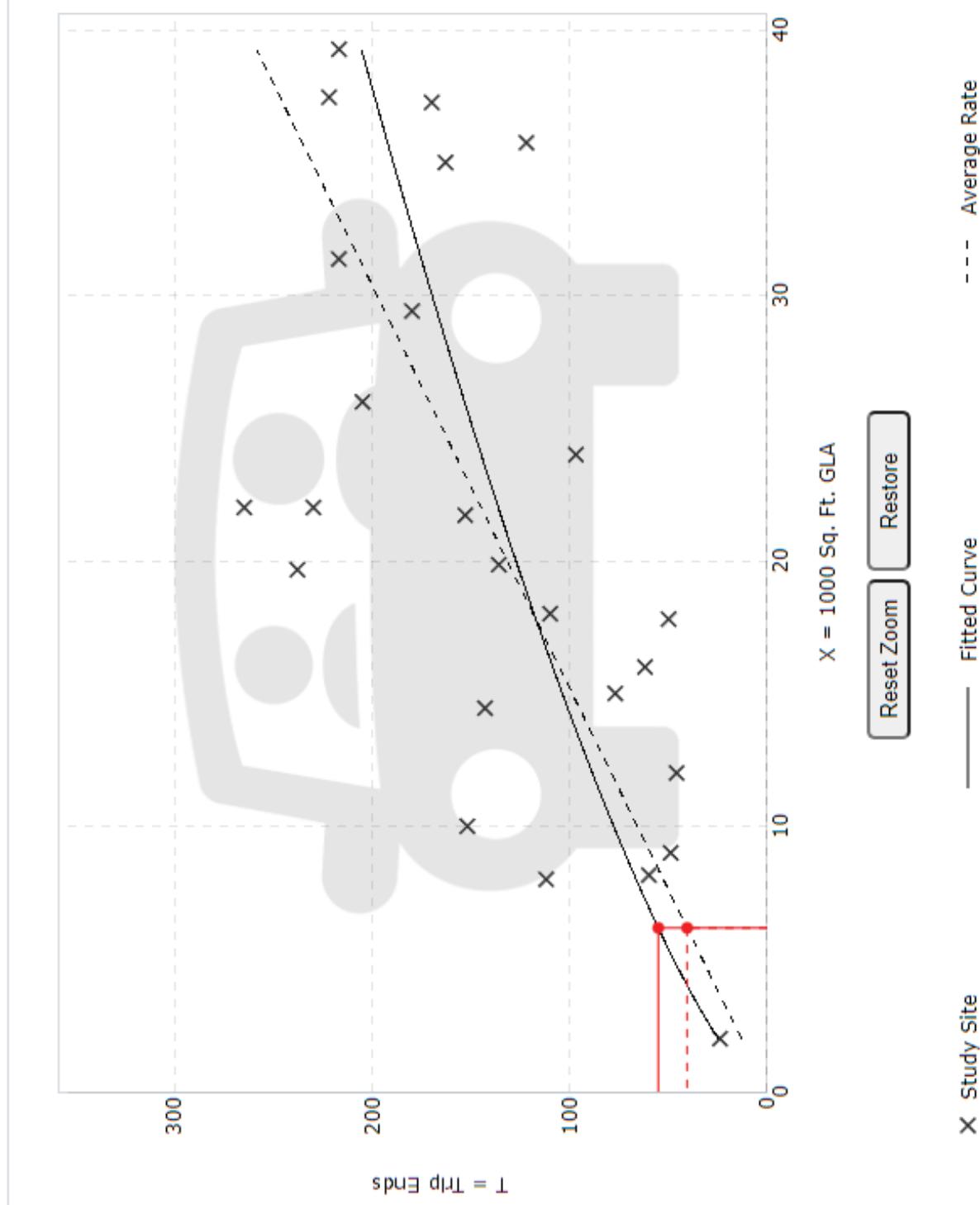
60% entering, 40% exiting

Calculated Trip Ends:

Average Rate: 15 (Total), 9 (Entry), 6 (Exit)

Fitted Curve: 21 (Total), 13 (Entry), 8 (Exit)

Data Plot and Equation



DATA STATISTICS

Land Use:

Strip Retail Plaza (<40k) (822) [Click for Description and Data Plots](#)

Independent Variable:

1000 Sq. Ft. GLA

Time Period:

Weekday

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

25

Avg. 1000 Sq. Ft. GLA:

21

Average Rate:

6.59

Range of Rates:

2.81 - 15.20

Standard Deviation:

2.94

Fitted Curve Equation:

$\ln(T) = 0.71 \ln(X) + 2.72$

R²:

0.56

Directional Distribution:

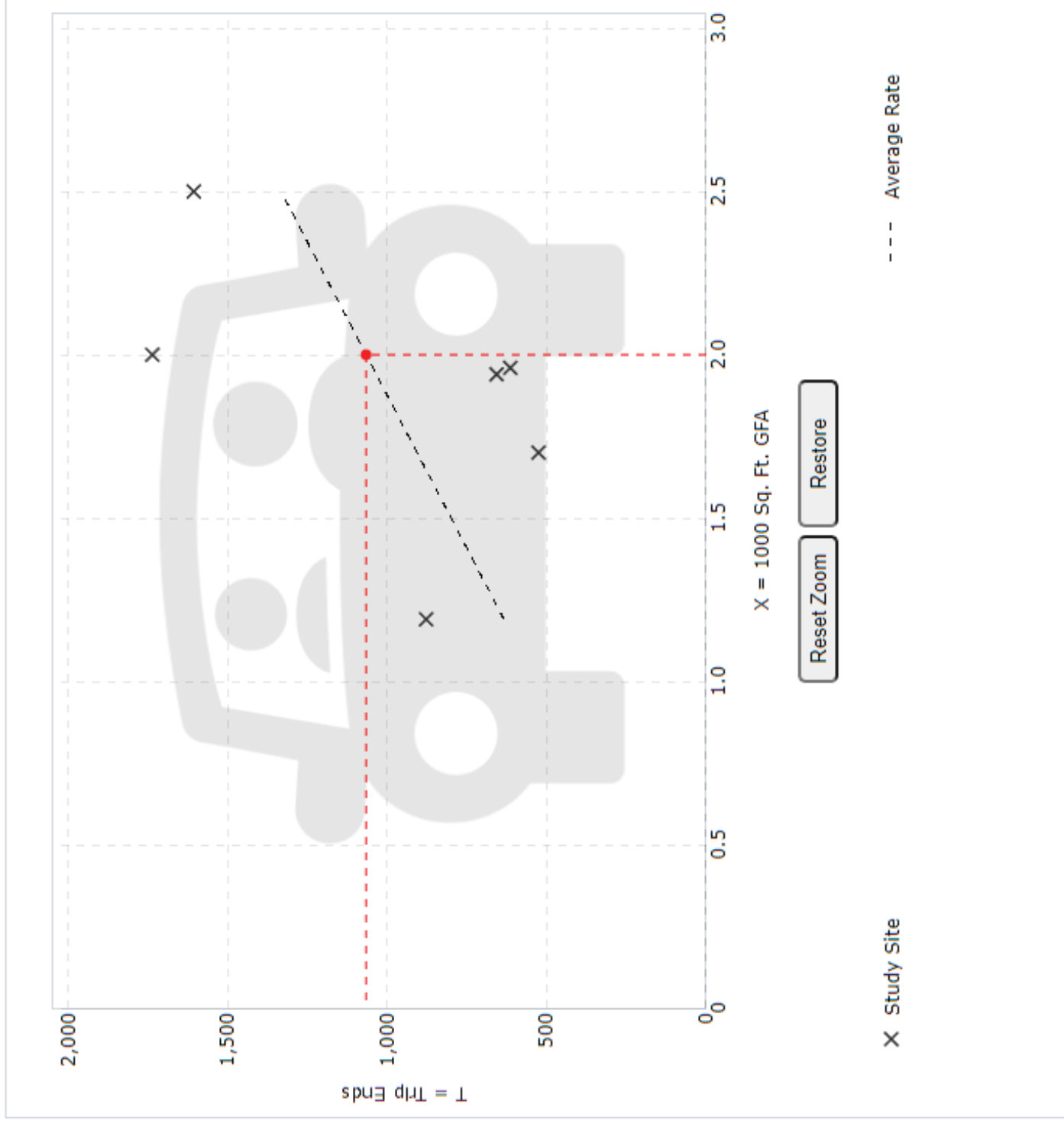
50% entering, 50% exiting

Calculated Trip Ends:

Average Rate: 41 (Total), 20 (Entry), 21 (Exit)

Fitted Curve: 55 (Total), 27 (Entry), 28 (Exit)

Data Plot and Equation



DATA STATISTICS

Land Use:

Coffee/Donut Shop with Drive-Through Window
(937) [Click for Description and Data Plots](#)

Independent Variable:

1000 Sq. Ft. GFA

Time Period:

Weekday

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

6

Avg. 1000 Sq. Ft. GFA:

2

Average Rate:

533.57

Range of Rates:

309.41 - 869.00

Standard Deviation:

243.65

Fitted Curve Equation:

Not Given

R²:

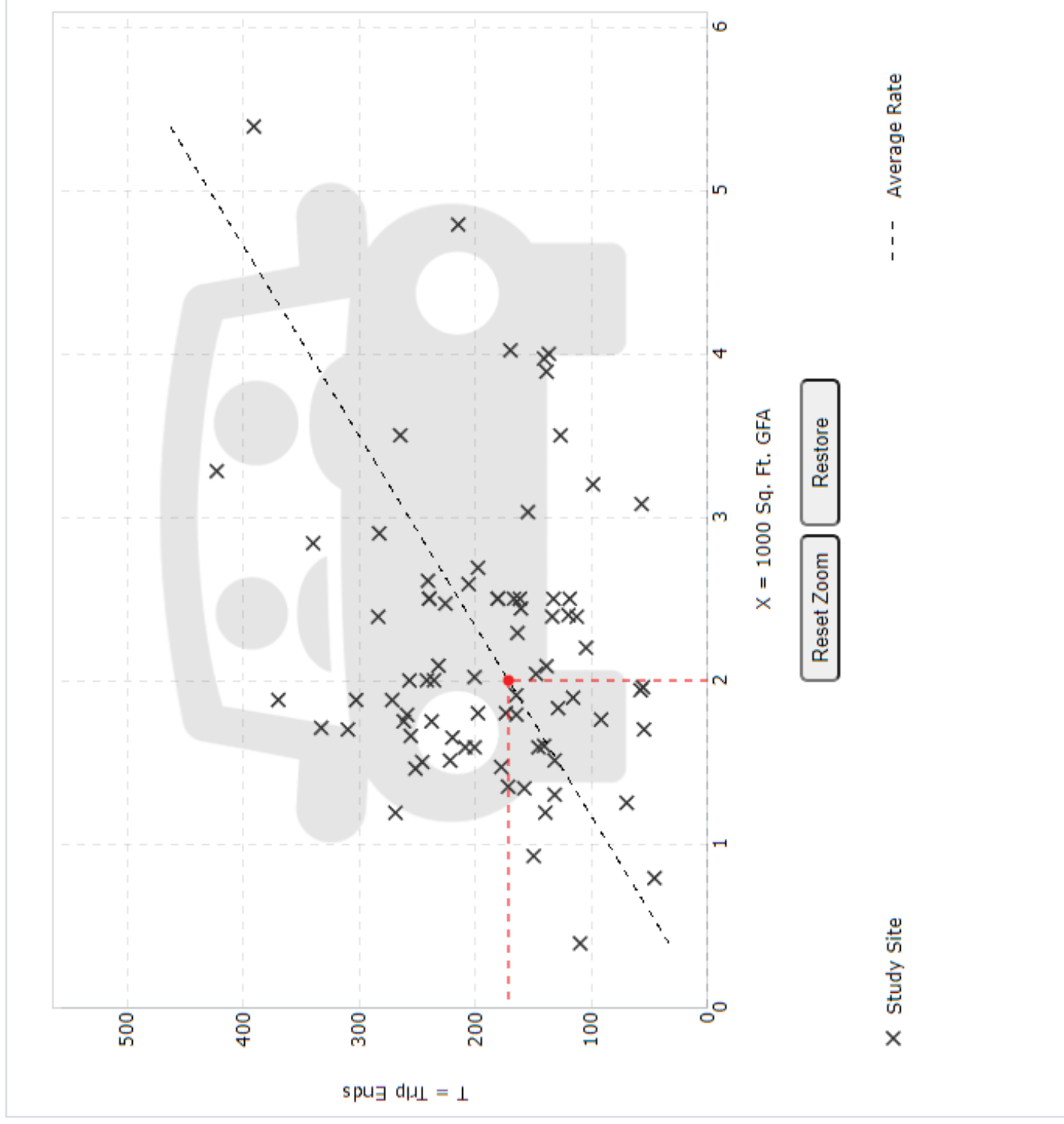
Directional Distribution:

50% entering, 50% exiting

Calculated Trip Ends:

Average Rate: 1067 (Total), 533 (Entry), 534 (Exit)

Data Plot and Equation



DATA STATISTICS

Land Use:

Coffee/Donut Shop with Drive-Through Window
(937) [Click for Description and Data Plots](#)

Independent Variable:

1000 Sq. Ft. GFA

Time Period:

Weekday

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

78

Avg. 1000 Sq. Ft. GFA:

2

Average Rate:

85.88

Range of Rates:

18.51 - 282.05

Standard Deviation:

44.92

Fitted Curve Equation:

Not Given

R²:

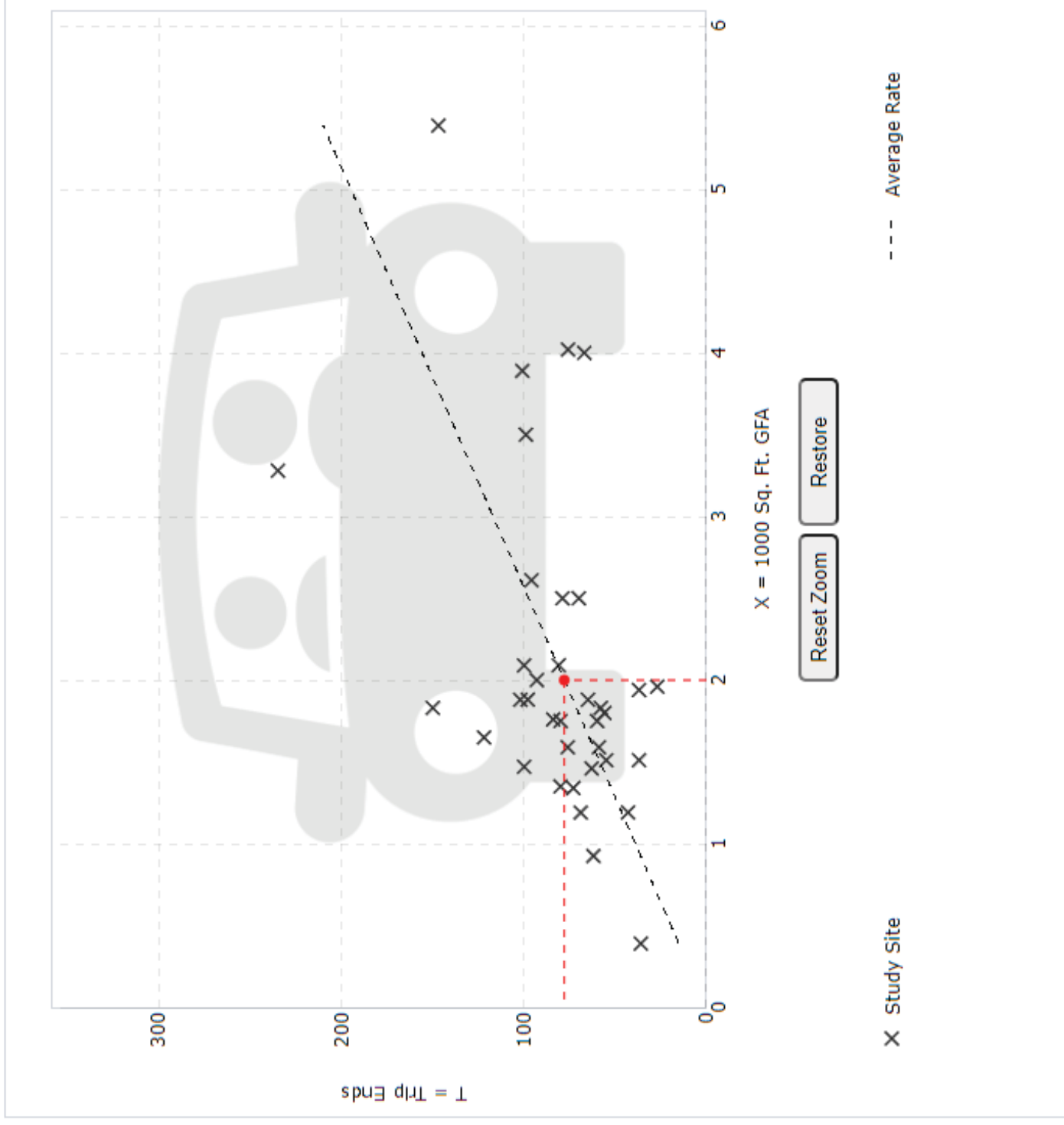
Directional Distribution:

51% entering, 49% exiting

Calculated Trip Ends:

Average Rate: 172 (Total), 88 (Entry), 84 (Exit)

Data Plot and Equation



DATA STATISTICS

Land Use:

Coffee/Donut Shop with Drive-Through Window (937) [Click for Description and Data Plots](#)

Independent Variable:

1000 Sq. Ft. GFA

Time Period:

Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

36

Avg. 1000 Sq. Ft. GFA:

2

Average Rate:

38.99

Range of Rates:

13.78 - 92.31

Standard Deviation:

17.79

Fitted Curve Equation:

Not Given

R²:

Directional Distribution:

50% entering, 50% exiting

Calculated Trip Ends:

Average Rate: 78 (Total), 39 (Entry), 39 (Exit)

Table F.9 (Cont'd) Pass-By and Non-Pass-By Trips Weekday, PM Peak Period Land Use Code 820—Shopping Center

| SIZE (1,000 SQ. FT. GLA) | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS-BY TRIP (%) | NON-PASS-BY TRIP (%) | | | ADJ. STREET PEAK HOUR VOLUME | AVERAGE 24-HOUR TRAFFIC | SOURCE |
|--------------------------------|-------------------------|------------------------|----------------------|----------------|---------------------|----------------------|----------|-------|------------------------------------|-------------------------------|--------------------------------|
| | | | | | | PRIMARY | DIVERTED | TOTAL | | | |
| 921 | Albany, NY | July & Aug. 1985 | 196 | 4:00–6:00 p.m. | 23 | 42 | 35 | 77 | — | 60,950 | Raymond Keyes Assoc. |
| 108 | Overland Park, KS | July 1988 | 111 | 4:30–5:30 p.m. | 26 | 61 | 13 | 74 | — | 34,000 | — |
| 118 | Overland Park, KS | Aug. 1988 | 123 | 4:30–5:30 p.m. | 25 | 55 | 20 | 75 | — | — | — |
| 256 | Greece, NY | June 1988 | 120 | 4:00–6:00 p.m. | 38 | 62 | — | 62 | — | 23,410 | Sear Brown |
| 160 | Greece, NY | June 1988 | 78 | 4:00–6:00 p.m. | 29 | 71 | — | 71 | — | 57,306 | Sear Brown |
| 550 | Greece, NY | June 1988 | 117 | 4:00–6:00 p.m. | 48 | 52 | — | 52 | — | 40,763 | Sear Brown |
| 51 | Boca Raton, FL | Dec. 1987 | 110 | 4:00–6:00 p.m. | 33 | 34 | 33 | 67 | — | 42,225 | Kimley-Horn and Assoc. Inc. |
| 1,090 | Ross Twp, PA | July 1988 | 411 | 2:00–8:00 p.m. | 34 | 56 | 10 | 66 | — | 51,500 | Wilbur Smith and Assoc. |
| 97 | Upper Dublin Twp, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 41 | — | — | 59 | — | 34,000 | McMahon Associates |
| 118 | Tredyffrin Twp, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 24 | — | — | 76 | — | 10,000 | Booz Allen & Hamilton |
| 122 | Lawnside, NJ | Winter 1988/89 | — | 4:00–6:00 p.m. | 37 | — | — | 63 | — | 20,000 | Pennoni Associates |
| 126 | Boca Raton, FL | Winter 1988/89 | — | 4:00–6:00 p.m. | 43 | — | — | 57 | — | 40,000 | McMahon Associates |
| 150 | Willow Grove, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 39 | — | — | 61 | — | 26,000 | Booz Allen & Hamilton |
| 153 | Broward Cnty., FL | Winter 1988/89 | — | 4:00–6:00 p.m. | 50 | — | — | 50 | — | 85,000 | McMahon Associates |
| 153 | Arden, DE | Winter 1988/89 | — | 4:00–6:00 p.m. | 30 | — | — | 70 | — | 26,000 | Orth-Rodgers & Assoc. Inc. |
| 154 | Doylestown, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 32 | — | — | 68 | — | 29,000 | Orth-Rodgers & Assoc. Inc. |
| 164 | Middletown Twp, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 33 | — | — | 67 | — | 25,000 | Booz Allen & Hamilton |
| 166 | Haddon Twp, NJ | Winter 1988/89 | — | 4:00–6:00 p.m. | 20 | — | — | 80 | — | 6,000 | Pennoni Associates |
| 205 | Broward Cnty., FL | Winter 1988/89 | — | 4:00–6:00 p.m. | 55 | — | — | 45 | — | 62,000 | McMahon Associates |

Table F.9 (Cont'd) Pass-By and Non-Pass-By Trips Weekday, PM Peak Period Land Use Code 820—Shopping Center

| SIZE (1,000 SQ. FT. GLA) | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS-BY TRIP (%) | NON-PASS-BY TRIP (%) | | | ADJ. STREET PEAK HOUR VOLUME | AVERAGE 24-HOUR TRAFFIC | SOURCE |
|-----------------------------|-----------------------|------------------------|----------------------|----------------|---------------------|----------------------|----------|-------|------------------------------------|-------------------------------|-------------------------------|
| | | | | | | PRIMARY | DIVERTED | TOTAL | | | |
| 237 | W. Windsor Twp, NJ | Winter 1988/89 | — | 4:00–6:00 p.m. | 48 | — | — | 52 | — | 46,000 | Booz Allen & Hamilton |
| 242 | Willow Grove, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 37 | — | — | 63 | — | 26,000 | McMahon Associates |
| 297 | Whitehall, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 33 | — | — | 67 | — | 26,000 | Orth-Rodgers & Assoc. Inc. |
| 360 | Broward Cnty., FL | Winter 1988/89 | — | 4:00–6:00 p.m. | 44 | — | — | 56 | — | 73,000 | McMahon Associates |
| 370 | Pittsburgh, PA | Winter 1988/89 | — | 4:00–6:00 p.m. | 19 | — | — | 81 | — | 33,000 | Wilbur Smith |
| 150 | Portland, OR | — | 519 | 4:00–6:00 p.m. | 68 | 6 | 26 | 32 | — | 25,000 | Kittelson and Associates |
| 150 | Portland, OR | — | 655 | 4:00–6:00 p.m. | 65 | 7 | 28 | 35 | — | 30,000 | Kittelson and Associates |
| 760 | Calgary, Alberta | Oct.-Dec. 1987 | 15,436 | 4:00–6:00 p.m. | 20 | 39 | 41 | 80 | — | — | City of Calgary DOT |
| 178 | Bordentown, NJ | Apr. 1989 | 154 | 2:00–6:00 p.m. | 35 | — | — | 65 | — | 37,980 | Raymond Keyes Assoc. |
| 144 | Manalapan, NJ | July 1990 | 176 | 3:30–6:15 p.m. | 32 | 44 | 24 | 68 | — | 69,347 | Raymond Keyes Assoc. |
| 549 | Natick, MA | Feb. 1989 | — | 4:45–5:45 p.m. | 33 | 26 | 41 | 67 | — | 48,782 | Raymond Keyes Assoc. |

Average Pass-By Trip Percentage: 34

“—” means no data were provided

**Table F.31 Pass-By and Non-Pass-By Trips Weekday, AM Peak Period
Land Use Code 934—Fast-Food Restaurant with Drive-Through Window**

| SEATS | SIZE (1,000 SQ. FT. GFA) | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS-BY TRIP (%) | NON-PASS-BY TRIPS (%) | | | ADJ. STREET PEAK HOUR VOLUME | SOURCE |
|-------|--------------------------------|------------------------|---------------------------|----------------------|----------------|---------------------|-----------------------|----------|-------|------------------------------------|--------------------------------|
| | | | | | | | PRIMARY | DIVERTED | TOTAL | | |
| — | <5 | Chicago suburbs, IL | 1987 | 84 | 7:00–9:00 a.m. | 44 | — | — | 56 | — | Kenig, O'Hara, Humes, Flock |
| 88 | 1.4 | Louisville area, KY | 1993 | — | 7:00–9:00 a.m. | 62 | 22 | 16 | 38 | 1,407 | Barton-Aschman Assoc. |
| 100 | 3.6 | Louisville, KY | 1993 | — | 7:00–9:00 a.m. | 32 | 47 | 21 | 68 | 437 | Barton-Aschman Assoc. |
| 87 | 4.2 | New Albany, IN | 1993 | — | 7:00–9:00 a.m. | 46 | 23 | 31 | 54 | 1,049 | Barton-Aschman Assoc. |
| 150 | 3.0 | Louisville area, KY | 1993 | — | 7:00–9:00 a.m. | 43 | 14 | 43 | 57 | 2,903 | Barton-Aschman Assoc. |
| — | 3.3 | varies | 1996 | — | 6:00–9:00 a.m. | 68 | — | — | 32 | — | Oracle Engineering |

Average Pass-By Trip Percentage: 49

“—” means no data were provided

**Table F.32 Pass-By and Non-Pass-By Trips Weekday, PM Peak Period
Land Use Code 934—Fast-Food Restaurant with Drive-Through Window**

| SEATS | SIZE (1,000 SQ. FT. GFA) | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS- BY TRIP (%) | NON-PASS-BY TRIPS (%) | | | ADJ. STREET PEAK HOUR VOLUME | SOURCE |
|-------|--------------------------------------|--------------------------|---------------------------|----------------------|----------------|----------------------------|-----------------------|----------|-------|--|--------------------------------|
| | | | | | | | PRIMARY | DIVERTED | TOTAL | | |
| — | ~2.6 | Minn-St. Paul, MN | 1987 | 50 | 3:00–7:00 p.m. | 25 | 27 | 48 | 75 | — | — |
| — | <5.0 | Chicago suburbs, IL | 1987 | 80 | 3:00–6:00 p.m. | 38 | — | — | 62 | — | Kenig, O'Hara, Humes, Flock |
| — | <5.0 | Chicago suburbs, IL | 1987 | 100 | 3:00–6:00 p.m. | 55 | — | — | 45 | — | Kenig, O'Hara, Humes, Flock |
| — | <5.0 | Chicago suburbs, IL | 1987 | 159 | 3:00–6:00 p.m. | 56 | — | — | 44 | — | Kenig, O'Hara, Humes, Flock |
| — | <5.0 | Chicago suburbs, IL | 1987 | 225 | 3:00–6:00 p.m. | 48 | — | — | 52 | — | Kenig, O'Hara, Humes, Flock |
| — | <5.0 | Chicago suburbs, IL | 1987 | 88 | 3:00–6:00 p.m. | 35 | — | — | 65 | — | Kenig, O'Hara, Humes, Flock |
| — | <5.0 | Chicago suburbs, IL | 1987 | 84 | 3:00–6:00 p.m. | 44 | — | — | 56 | — | Kenig, O'Hara, Humes, Flock |
| 88 | 1.3 | Louisville area, KY | 1993 | — | 4:00–6:00 p.m. | 68 | 22 | 10 | 32 | 2,055 | Barton- Aschman Assoc. |
| 120 | 1.9 | Louisville area, KY | 1993 | 33 | 4:00–6:00 p.m. | 67 | 24 | 9 | 33 | 2,447 | Barton- Aschman Assoc. |
| 87 | 4.2 | New Albany, IN | 1993 | — | 4:00–6:00 p.m. | 56 | 25 | 19 | 44 | 1,632 | Barton- Aschman Assoc. |
| 150 | 3.0 | Louisville area, KY | 1993 | — | 4:00–6:00 p.m. | 31 | 31 | 38 | 69 | 4,250 | Barton- Aschman Assoc. |
| — | 3.1 | Kissimmee, FL | 1995 | 28 | 2:00–6:00 p.m. | 71 | — | — | 29 | — | TPD Inc. |
| — | 3.1 | Apopka, FL | 1996 | 29 | 2:00–6:00 p.m. | 38 | — | — | 62 | — | TPD Inc. |
| — | 2.8 | Winter Springs, FL | 1995 | 47 | 2:00–6:00 p.m. | 66 | — | — | 34 | — | TPD Inc. |
| — | 4.3 | Longwood, FL | 1994 | 304 | 2:00–6:00 p.m. | 62 | — | — | 38 | — | TPD Inc. |
| — | 3.2 | Altamonte Springs, FL | 1996 | 202 | 2:00–6:00 p.m. | 40 | 39 | 21 | 60 | — | TPD Inc. |
| — | 2.9 | Winter Park, FL | 1996 | 271 | 2:00–6:00 p.m. | 41 | 41 | 18 | 59 | — | TPD Inc. |
| — | 3.3* | several | 1996 | varies | 4:00–6:00 p.m. | 62 | — | — | 38 | — | Oracle Engineering |

*Average of several combined studies.

Average Pass-By Trip Percentage: 50

“—” means no data were provided

**Table F.33 Pass-By and Non-Pass-By Trips Weekday
Land Use Code 938—Coffee/Donut Shop with Drive-Through Window
and No Indoor Seating (Coffee/Esspresso Stand)**

| SIZE (1,000 SQ. FT. GFA) | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS-BY TRIP (%) | NON-PASS-BY TRIPS (%) | | | SOURCE |
|-----------------------------------|---------------|---------------------------|----------------------|---------------------|---------------------|-----------------------|----------|-------|-----------------------------|
| | | | | | | PRIMARY | DIVERTED | TOTAL | |
| 0.1 | Vancouver, WA | Nov. 1997 | 69 | 6:00 a.m.–6:00 p.m. | 83 | — | — | 17 | Kittelson & Associates Inc. |

“—” means no data were provided

**Table F.34 Pass-By and Non-Pass-By Trips Weekday
Land Use Code 938—Coffee/Donut Shop with Drive-Through Window
and No Indoor Seating (Coffee/Esspresso Stand)**

| EMPLOYEES | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS-BY TRIP (%) | NON-PASS-BY TRIPS (%) | | | SOURCE |
|-----------|---------------|---------------------------|----------------------|---------------------|---------------------|-----------------------|----------|-------|-----------------------------|
| | | | | | | PRIMARY | DIVERTED | TOTAL | |
| 1 | Vancouver, WA | Nov. 1997 | 70 | 6:00 a.m.–6:00 p.m. | 83 | — | — | 17 | Kittelson & Associates Inc. |
| 1 | Woodburn, OR | Feb. 1998 | 109 | 6:00 a.m.–6:00 p.m. | 95 | — | — | 5 | Kittelson & Associates Inc. |
| 1 | Vancouver, WA | Feb. 1998 | 83 | 6:00 a.m.–1:00 p.m. | 89 | — | — | 11 | Kittelson & Associates Inc. |

Average Pass-By Trip Percentage: 89

“—” means no data were provided

**Table F.35 Pass-By and Non-Pass-By Trips Weekday, AM Peak Period
Land Use Code 944—Gasoline/Service Station**

| SIZE (1,000 SQ. FT. GFA) | VEHICLE FUELING POSITIONS | LOCATION | WEEKDAY SURVEY DATE | NO. OF INTERVIEWS | TIME PERIOD | PASS-BY TRIP (%) | NON-PASS-BY TRIPS (%) | | | ADJ. STREET PEAK HOUR VOLUME | SOURCE |
|-----------------------------------|---------------------------------|------------------|---------------------------|----------------------|----------------|---------------------|-----------------------|----------|-------|--|--------|
| | | | | | | | PRIMARY | DIVERTED | TOTAL | | |
| 2.3 | 6 | Gaithersburg, MD | 1992 | 37 | 7:00–9:00 a.m. | 32 | 41 | 27 | 68 | 2,080 | RBA |
| 2.1 | 6 | Bethesda, MD | 1992 | 26 | 7:00–9:00 a.m. | 58 | 23 | 19 | 42 | 2,080 | RBA |
| 1.7 | 6 | Wheaton, MD | 1992 | 21 | 7:00–9:00 a.m. | 67 | 14 | 19 | 33 | 900 | RBA |
| 2.0 | 8 | Gaithersburg, MD | 1992 | 46 | 7:00–9:00 a.m. | 87 | 13 | 0 | 13 | 2,235 | RBA |
| 1.2 | 6 | Damascus, MD | 1992 | 21 | 7:00–9:00 a.m. | 43 | 28 | 29 | 57 | 870 | RBA |
| 0.3 | 12 | Wheaton, MD | 1992 | 36 | 7:00–9:00 a.m. | 61 | 8 | 31 | 39 | 3,480 | RBA |

Average Pass-By Trip Percentage: 58

“—” means no data were provided

TRIP GENERATION

25-Mar-22

| | | | AVERAGE | | | | | | |
|---------------------------|-------|-------|---------|---------|------|-------|---------|------|-------|
| LAND USE | L.U.C | SIZE | DAILY | AM PEAK | | | PM PEAK | | |
| | | | TRAFFIC | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| ICE CREAM SHOP (w. drive) | 937 | 2,000 | 1,067 | 88 | 84 | 172 | 39 | 39 | 78 |
| HOPPING CENTER (<40 ft) | 822 | 6,173 | 336 | 9 | 6 | 15 | 20 | 20 | 41 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 1,403 | 96 | 90 | 186 | 59 | 59 | 119 |

| | | | REGRESSION | | | | | | |
|---------------------------|-------|-------|------------|---------|------|-------|---------|------|-------|
| LAND USE | L.U.C | SIZE | DAILY | AM PEAK | | | PM PEAK | | |
| | | | TRAFFIC | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL |
| ICE CREAM SHOP (w. drive) | 937 | 2,000 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| HOPPING CENTER (<40 ft) | 822 | 6,173 | 490 | 13 | 8 | 21 | 28 | 28 | 55 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 490 | 13 | 8 | 21 | 28 | 28 | 55 |

| | | | SATURDAY | | | | SUNDAY | | | |
|---------------------------|-------|-------|----------|-------|------|-------|---------|-------|------|-------|
| LAND USE | L.U.C | SIZE | DAILY | PEAK | | | DAILY | PEAK | | |
| | | | TRAFFIC | ENTER | EXIT | TOTAL | TRAFFIC | ENTER | EXIT | TOTAL |
| ICE CREAM SHOP (w. drive) | 937 | 2,000 | N/A | 88 | 88 | 176 | N/A | N/A | N/A | N/A |
| HOPPING CENTER (<40 ft) | 822 | 6,173 | N/A | 21 | 20 | 40 | N/A | N/A | N/A | N/A |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 0 | 109 | 108 | 216 | 0 | 0 | 0 | 0 |

TRIP GENERATION

25-Mar-22

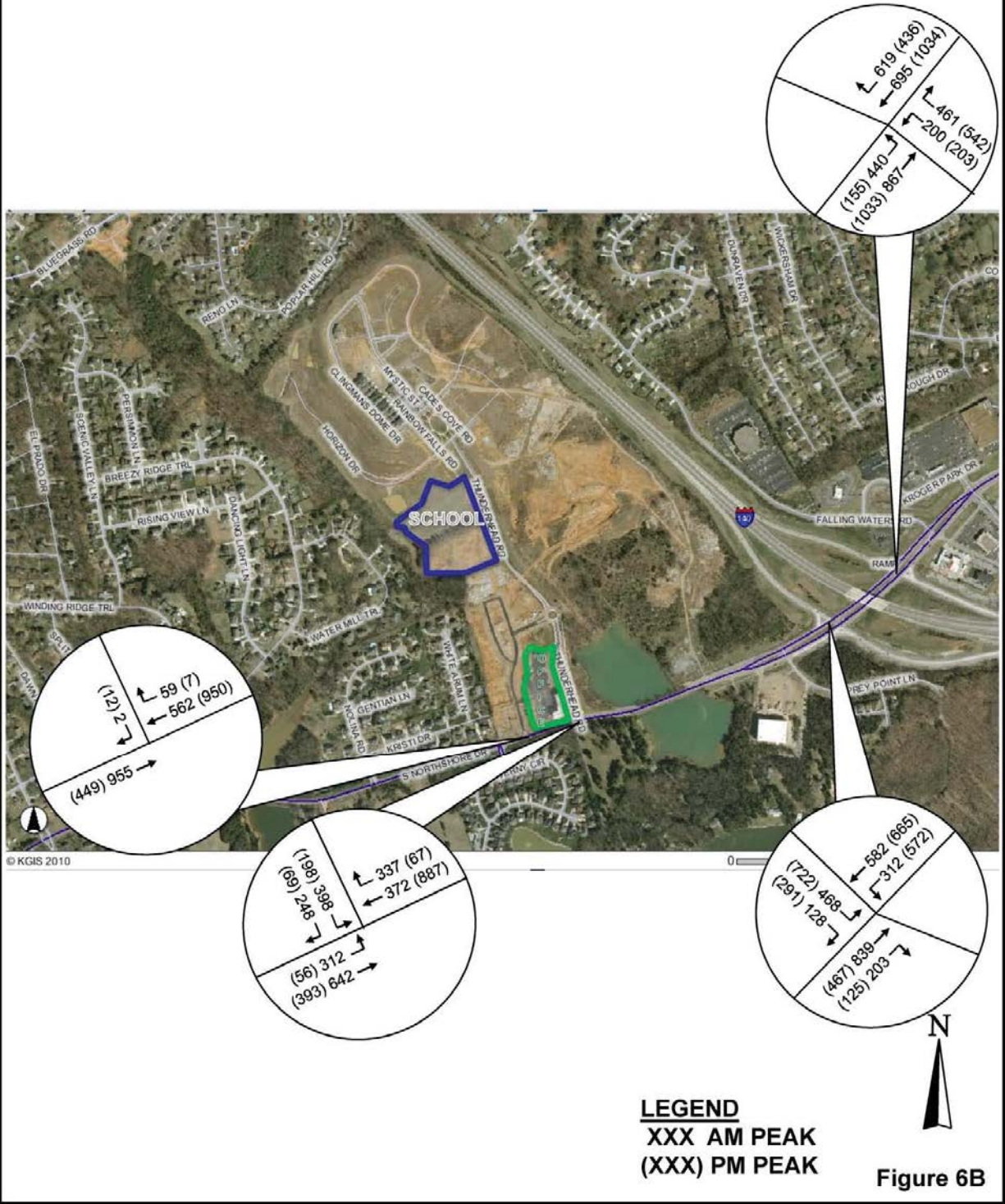
| | | | TRIP GENERATION | | | | | | | PASS-BY RATE |
|------------------------|-------|-------|-----------------|---------|------|---------|-------|------|-------|--------------|
| LAND USE | L.U.C | SIZE | DAILY TRAFFIC | AM PEAK | | PM PEAK | | | | |
| | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL | |
| EE/DONUT SHOP (w. driv | 937 | 2,000 | 1,067 | 88 | 84 | 172 | 39 | 39 | 78 | 65% |
| HOPPING CENTER (<40 | 822 | 6,173 | 490 | 13 | 8 | 21 | 28 | 28 | 55 | 30% |
| | | | 1,557 | 100 | 93 | 193 | 67 | 67 | 133 | |

| | | | ADJUSTED TRIP GENERATION | | | | | | | PASS-BY RATE |
|------------------------|-------|-------|--------------------------|---------|------|---------|-------|------|-------|--------------|
| LAND USE | L.U.C | SIZE | DAILY TRAFFIC | AM PEAK | | PM PEAK | | | | |
| | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL | |
| EE/DONUT SHOP (w. driv | 937 | 2,000 | 373 | 31 | 29 | 60 | 14 | 14 | 27 | 54% |
| HOPPING CENTER (<40 | 822 | 6,173 | 343 | 9 | 6 | 15 | 19 | 19 | 39 | |
| | | | 717 | 39 | 35 | 75 | 33 | 33 | 66 | |

| | | | PASS-BY TRIP GENERATION | | | | | | | PASS-BY RATE |
|------------------------|-------|-------|-------------------------|---------|------|---------|-------|------|-------|--------------|
| LAND USE | L.U.C | SIZE | DAILY TRAFFIC | AM PEAK | | PM PEAK | | | | |
| | | | | ENTER | EXIT | TOTAL | ENTER | EXIT | TOTAL | |
| EE/DONUT SHOP (w. driv | 937 | 2,000 | 694 | 57 | 55 | 112 | 25 | 25 | 51 | |
| HOPPING CENTER (<40 | 822 | 6,173 | 147 | 4 | 3 | 6 | 8 | 8 | 17 | |
| | | | 841 | 61 | 57 | 118 | 34 | 34 | 67 | |

2016 BACKGROUND TRAFFIC

Northshore Town Center Knoxville, TN



HCM 6th Roundabout

2: Town Center Blvd/Target Drive & Boardwalk Blvd/I-140 off-ramp

03/16/2022

| Intersection | | | | | | | | |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 4.8 | | | | | | | |
| Intersection LOS | A | | | | | | | |
| Approach | EB | | WB | | SE | | NW | |
| Entry Lanes | 2 | | 2 | | 2 | | 2 | |
| Conflicting Circle Lanes | 1 | | 1 | | 1 | | 1 | |
| Adj Approach Flow, veh/h | 260 | | 384 | | 234 | | 163 | |
| Demand Flow Rate, veh/h | 266 | | 392 | | 239 | | 166 | |
| Vehicles Circulating, veh/h | 320 | | 198 | | 283 | | 32 | |
| Vehicles Exiting, veh/h | 202 | | 0 | | 307 | | 554 | |
| Ped Vol Crossing Leg, #/h | 0 | | 0 | | 0 | | 0 | |
| Ped Cap Adj | 1.000 | | 1.000 | | 1.000 | | 1.000 | |
| Approach Delay, s/veh | 5.3 | | 4.7 | | 5.3 | | 3.6 | |
| Approach LOS | A | | A | | A | | A | |
| Lane | Left | Right | Left | Right | Left | Right | Left | Right |
| Designated Moves | L | TR | LT | R | LT | R | LT | LT |
| Assumed Moves | L | TR | LT | R | LT | R | LT | LT |
| RT Channelized | | | | | | | | |
| Lane Util | 0.120 | 0.880 | 0.661 | 0.339 | 0.975 | 0.025 | 1.000 | |
| Follow-Up Headway, s | 2.535 | 2.535 | 2.535 | 2.535 | 2.535 | 2.535 | 2.535 | |
| Critical Headway, s | 4.544 | 4.544 | 4.544 | 4.544 | 4.544 | 4.544 | 4.544 | |
| Entry Flow, veh/h | 32 | 234 | 259 | 133 | 233 | 6 | 166 | |
| Cap Entry Lane, veh/h | 1061 | 1061 | 1186 | 1186 | 1098 | 1098 | 1379 | |
| Entry HV Adj Factor | 0.969 | 0.979 | 0.979 | 0.977 | 0.980 | 1.000 | 0.983 | |
| Flow Entry, veh/h | 31 | 229 | 254 | 130 | 228 | 6 | 163 | |
| Cap Entry, veh/h | 1028 | 1039 | 1161 | 1159 | 1076 | 1098 | 1356 | |
| V/C Ratio | 0.030 | 0.220 | 0.218 | 0.112 | 0.212 | 0.005 | 0.120 | |
| Control Delay, s/veh | 3.8 | 5.5 | 5.1 | 4.1 | 5.3 | 3.3 | 3.6 | |
| LOS | A | A | A | A | A | A | A | |
| 95th %tile Queue, veh | 0 | 1 | 1 | 0 | 1 | 0 | 0 | |

HCM 6th TWSC
6: NS Access Easement & Boardwalk Blvd

03/16/2022

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.7 | | | | | | | | | | | |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | | ↕ | | | ↕ | |
| Traffic Vol, veh/h | 11 | 151 | 0 | 0 | 160 | 6 | 0 | 0 | 0 | 1 | 0 | 16 |
| Future Vol, veh/h | 11 | 151 | 0 | 0 | 160 | 6 | 0 | 0 | 0 | 1 | 0 | 16 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 100 | - | - | 100 | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 60 | 60 | 60 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 18 | 252 | 0 | 0 | 188 | 7 | 0 | 0 | 0 | 1 | 0 | 19 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|----------------------|--------|---|---|--------|---|---|--------|-------|-------|--------|-------|-------|
| Conflicting Flow All | 195 | 0 | 0 | 252 | 0 | 0 | 489 | 483 | 252 | 480 | 480 | 192 |
| Stage 1 | - | - | - | - | - | - | 288 | 288 | - | 192 | 192 | - |
| Stage 2 | - | - | - | - | - | - | 201 | 195 | - | 288 | 288 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1378 | - | - | 1313 | - | - | 489 | 483 | 787 | 496 | 485 | 850 |
| Stage 1 | - | - | - | - | - | - | 720 | 674 | - | 810 | 742 | - |
| Stage 2 | - | - | - | - | - | - | 801 | 739 | - | 720 | 674 | - |
| Platoon blocked, % | - | - | - | - | - | - | - | - | - | - | - | - |
| Mov Cap-1 Maneuver | 1378 | - | - | 1313 | - | - | 473 | 477 | 787 | 491 | 479 | 850 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 473 | 477 | - | 491 | 479 | - |
| Stage 1 | - | - | - | - | - | - | 711 | 665 | - | 799 | 742 | - |
| Stage 2 | - | - | - | - | - | - | 783 | 739 | - | 711 | 665 | - |

| Approach | EB | WB | NB | SB |
|----------------------|-----|----|----|-----|
| HCM Control Delay, s | 0.5 | 0 | 0 | 9.5 |
| HCM LOS | | | A | A |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|-----------------------|-------|-------|-----|-----|------|-----|-----|-------|
| Capacity (veh/h) | - | 1378 | - | - | 1313 | - | - | 815 |
| HCM Lane V/C Ratio | - | 0.013 | - | - | - | - | - | 0.025 |
| HCM Control Delay (s) | 0 | 7.6 | - | - | 0 | - | - | 9.5 |
| HCM Lane LOS | A | A | - | - | A | - | - | A |
| HCM 95th %tile Q(veh) | - | 0 | - | - | 0 | - | - | 0.1 |

HCM 6th TWSC
 9: E/W Access Easement/Target & Target Drive

03/16/2022

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 7 | | | | | | | | | | | |
| Movement | SEL | SET | SER | NWL | NWT | NWR | NEL | NET | NER | SWL | SWT | SWR |
| Lane Configurations | | ↕ | | | ↕ | | | ↕ | | | ↕ | |
| Traffic Vol, veh/h | 0 | 4 | 0 | 89 | 4 | 21 | 0 | 0 | 77 | 7 | 0 | 0 |
| Future Vol, veh/h | 0 | 4 | 0 | 89 | 4 | 21 | 0 | 0 | 77 | 7 | 0 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 6 | 0 | 127 | 6 | 30 | 0 | 0 | 110 | 10 | 0 | 0 |

| Major/Minor | Major1 | | Major2 | | | Minor1 | | Minor2 | | | | |
|----------------------|--------|---|--------|-------|---|--------|-------|--------|-------|-------|-------|-------|
| Conflicting Flow All | 36 | 0 | 0 | 6 | 0 | 0 | 281 | 296 | 6 | 336 | 281 | 21 |
| Stage 1 | - | - | - | - | - | - | 6 | 6 | - | 275 | 275 | - |
| Stage 2 | - | - | - | - | - | - | 275 | 290 | - | 61 | 6 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1575 | - | - | 1615 | - | - | 671 | 616 | 1077 | 618 | 627 | 1056 |
| Stage 1 | - | - | - | - | - | - | 1016 | 891 | - | 731 | 683 | - |
| Stage 2 | - | - | - | - | - | - | 731 | 672 | - | 950 | 891 | - |
| Platoon blocked, % | - | - | - | - | - | - | - | - | - | - | - | - |
| Mov Cap-1 Maneuver | 1575 | - | - | 1615 | - | - | 629 | 566 | 1077 | 520 | 576 | 1056 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 629 | 566 | - | 520 | 576 | - |
| Stage 1 | - | - | - | - | - | - | 1016 | 891 | - | 731 | 628 | - |
| Stage 2 | - | - | - | - | - | - | 672 | 618 | - | 853 | 891 | - |

| Approach | SE | NW | NE | SW |
|----------------------|----|-----|-----|------|
| HCM Control Delay, s | 0 | 5.8 | 8.7 | 12.1 |
| HCM LOS | | | A | B |

| Minor Lane/Major Mvmt | NELn1 | NWL | NWT | NWR | SEL | SET | SERSWLn1 |
|-----------------------|-------|-------|-----|-----|------|-----|----------|
| Capacity (veh/h) | 1077 | 1615 | - | - | 1575 | - | 520 |
| HCM Lane V/C Ratio | 0.102 | 0.079 | - | - | - | - | 0.019 |
| HCM Control Delay (s) | 8.7 | 7.4 | 0 | - | 0 | - | 12.1 |
| HCM Lane LOS | A | A | A | - | A | - | B |
| HCM 95th %tile Q(veh) | 0.3 | 0.3 | - | - | 0 | - | 0.1 |

HCM 6th Roundabout
 2: Town Center Blvd/Target Drive & Boardwalk Blvd/I-140 off-ramp

03/16/2022

| Intersection | | | | | | | | |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Intersection Delay, s/veh | 4.8 | | | | | | | |
| Intersection LOS | A | | | | | | | |
| Approach | EB | | WB | | SE | | NW | |
| Entry Lanes | 2 | | 2 | | 2 | | 2 | |
| Conflicting Circle Lanes | 1 | | 1 | | 1 | | 1 | |
| Adj Approach Flow, veh/h | 69 | | 323 | | 334 | | 208 | |
| Demand Flow Rate, veh/h | 70 | | 329 | | 340 | | 212 | |
| Vehicles Circulating, veh/h | 452 | | 234 | | 239 | | 22 | |
| Vehicles Exiting, veh/h | 127 | | 0 | | 324 | | 500 | |
| Ped Vol Crossing Leg, #/h | 0 | | 0 | | 0 | | 0 | |
| Ped Cap Adj | 1.000 | | 1.000 | | 1.000 | | 1.000 | |
| Approach Delay, s/veh | 4.3 | | 4.6 | | 5.8 | | 3.9 | |
| Approach LOS | A | | A | | A | | A | |
| Lane | Left | Right | Left | Right | Left | Right | Left | Right |
| Designated Moves | L | TR | LT | R | LT | R | LT | R |
| Assumed Moves | L | TR | LT | R | LT | R | LT | R |
| RT Channelized | | | | | | | | |
| Lane Util | 0.314 | 0.686 | 0.653 | 0.347 | 0.959 | 0.041 | 1.000 | |
| Follow-Up Headway, s | 2.535 | 2.535 | 2.535 | 2.535 | 2.535 | 2.535 | 2.535 | |
| Critical Headway, s | 4.544 | 4.544 | 4.544 | 4.544 | 4.544 | 4.544 | 4.544 | |
| Entry Flow, veh/h | 22 | 48 | 215 | 114 | 326 | 14 | 212 | |
| Cap Entry Lane, veh/h | 941 | 941 | 1148 | 1148 | 1142 | 1142 | 1392 | |
| Entry HV Adj Factor | 1.000 | 0.979 | 0.983 | 0.982 | 0.980 | 1.000 | 0.983 | |
| Flow Entry, veh/h | 22 | 47 | 211 | 112 | 320 | 14 | 208 | |
| Cap Entry, veh/h | 941 | 922 | 1128 | 1128 | 1120 | 1142 | 1368 | |
| V/C Ratio | 0.023 | 0.051 | 0.187 | 0.099 | 0.285 | 0.012 | 0.152 | |
| Control Delay, s/veh | 4.0 | 4.4 | 4.9 | 4.0 | 5.9 | 3.3 | 3.9 | |
| LOS | A | A | A | A | A | A | A | |
| 95th %tile Queue, veh | 0 | 0 | 1 | 0 | 1 | 0 | 1 | |

HCM 6th TWSC
6: NS Access Easement & Boardwalk Blvd

03/16/2022

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 0.5 | | | | | | | | | | | |
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | | ↕ | | | ↕ | |
| Traffic Vol, veh/h | 5 | 38 | 0 | 0 | 110 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| Future Vol, veh/h | 5 | 38 | 0 | 0 | 110 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 100 | - | - | 100 | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 60 | 60 | 60 | 86 | 86 | 86 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 8 | 63 | 0 | 0 | 128 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|----------------------|--------|---|---|--------|---|---|--------|-------|-------|--------|-------|-------|
| Conflicting Flow All | 128 | 0 | 0 | 63 | 0 | 0 | 208 | 207 | 63 | 207 | 207 | 128 |
| Stage 1 | - | - | - | - | - | - | 79 | 79 | - | 128 | 128 | - |
| Stage 2 | - | - | - | - | - | - | 129 | 128 | - | 79 | 79 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1458 | - | - | 1540 | - | - | 749 | 690 | 1002 | 751 | 690 | 922 |
| Stage 1 | - | - | - | - | - | - | 930 | 829 | - | 876 | 790 | - |
| Stage 2 | - | - | - | - | - | - | 875 | 790 | - | 930 | 829 | - |
| Platoon blocked, % | - | - | - | - | - | - | - | - | - | - | - | - |
| Mov Cap-1 Maneuver | 1458 | - | - | 1540 | - | - | 745 | 687 | 1002 | 748 | 687 | 922 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 745 | 687 | - | 748 | 687 | - |
| Stage 1 | - | - | - | - | - | - | 925 | 825 | - | 872 | 790 | - |
| Stage 2 | - | - | - | - | - | - | 874 | 790 | - | 925 | 825 | - |

| Approach | EB | WB | NB | SB |
|----------------------|-----|----|----|-----|
| HCM Control Delay, s | 0.9 | 0 | 0 | 9.6 |
| HCM LOS | | | A | A |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|-----------------------|-------|-------|-----|-----|------|-----|-----|-------|
| Capacity (veh/h) | - | 1458 | - | - | 1540 | - | - | 785 |
| HCM Lane V/C Ratio | - | 0.006 | - | - | - | - | - | 0.006 |
| HCM Control Delay (s) | 0 | 7.5 | - | - | 0 | - | - | 9.6 |
| HCM Lane LOS | A | A | - | - | A | - | - | A |
| HCM 95th %tile Q(veh) | - | 0 | - | - | 0 | - | - | 0 |

HCM 6th TWSC
 9: E/W Access Easement/Target & Target Drive

03/16/2022

| Intersection | | | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Int Delay, s/veh | 5.4 | | | | | | | | | | | |
| Movement | SEL | SET | SER | NWL | NWT | NWR | NEL | NET | NER | SWL | SWT | SWR |
| Lane Configurations | | ↕ | | | ↕ | | | ↕ | | | ↕ | |
| Traffic Vol, veh/h | 0 | 28 | 0 | 63 | 21 | 21 | 0 | 0 | 60 | 7 | 0 | 0 |
| Future Vol, veh/h | 0 | 28 | 0 | 63 | 21 | 21 | 0 | 0 | 60 | 7 | 0 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 0 | 40 | 0 | 90 | 30 | 30 | 0 | 0 | 86 | 10 | 0 | 0 |

| Major/Minor | Major1 | | Major2 | | | Minor1 | | Minor2 | | | | |
|----------------------|--------|---|--------|-------|---|--------|-------|--------|-------|-------|-------|-------|
| Conflicting Flow All | 60 | 0 | 0 | 40 | 0 | 0 | 265 | 280 | 40 | 308 | 265 | 45 |
| Stage 1 | - | - | - | - | - | - | 40 | 40 | - | 225 | 225 | - |
| Stage 2 | - | - | - | - | - | - | 225 | 240 | - | 83 | 40 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1544 | - | - | 1570 | - | - | 688 | 628 | 1031 | 644 | 640 | 1025 |
| Stage 1 | - | - | - | - | - | - | 975 | 862 | - | 778 | 718 | - |
| Stage 2 | - | - | - | - | - | - | 778 | 707 | - | 925 | 862 | - |
| Platoon blocked, % | - | - | - | - | - | - | - | - | - | - | - | - |
| Mov Cap-1 Maneuver | 1544 | - | - | 1570 | - | - | 656 | 590 | 1031 | 564 | 602 | 1025 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 656 | 590 | - | 564 | 602 | - |
| Stage 1 | - | - | - | - | - | - | 975 | 862 | - | 778 | 675 | - |
| Stage 2 | - | - | - | - | - | - | 731 | 665 | - | 848 | 862 | - |

| Approach | SE | NW | NE | SW |
|----------------------|----|-----|-----|------|
| HCM Control Delay, s | 0 | 4.5 | 8.8 | 11.5 |
| HCM LOS | | | A | B |

| Minor Lane/Major Mvmt | NELn1 | NWL | NWT | NWR | SEL | SET | SERSWLn1 |
|-----------------------|-------|-------|-----|-----|------|-----|----------|
| Capacity (veh/h) | 1031 | 1570 | - | - | 1544 | - | 564 |
| HCM Lane V/C Ratio | 0.083 | 0.057 | - | - | - | - | 0.018 |
| HCM Control Delay (s) | 8.8 | 7.4 | 0 | - | 0 | - | 11.5 |
| HCM Lane LOS | A | A | A | - | A | - | B |
| HCM 95th %tile Q(veh) | 0.3 | 0.2 | - | - | 0 | - | 0.1 |

National Data & Surveying Services Intersection Turning Movement Count

Location: Town Center Blvd & Boardwalk Blvd
City: Knoxville
Control: 4-Way Yield

Project ID: 22-190011-001
Date: 3/8/2022

Data - Total

| NS/EW Streets: | Town Center Blvd | | | | | | Boardwalk Blvd | | | | | | Boardwalk Blvd | | | | | | | | | |
|-------------------------|---------------------|--------|------------|-------|-------|--------|----------------|--------|-----------|--------|-------|--------|----------------|--------|-------|-------|----|--|----|--|-------|--|
| | NORTHBOUND | | SOUTHBOUND | | SU | | EASTBOUND | | WESTBOUND | | EU | | WL | | WT | | WR | | WU | | TOTAL | |
| | NL | NT | NR | NU | SL | ST | SR | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL | | | | | TOTAL | |
| 7:00 AM | 5 | 7 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 13 | 0 | 4 | 35 | 3 | 0 | 69 | | | | | | |
| 7:15 AM | 11 | 16 | 0 | 0 | 0 | 10 | 1 | 5 | 0 | 41 | 0 | 16 | 66 | 8 | 0 | 174 | | | | | | |
| 7:30 AM | 6 | 20 | 0 | 0 | 0 | 14 | 1 | 9 | 0 | 59 | 0 | 11 | 61 | 14 | 0 | 195 | | | | | | |
| 7:45 AM | | 21 | 0 | 0 | 0 | 20 | 0 | 4 | 0 | 31 | 0 | 29 | 17 | 24 | 0 | 146 | | | | | | |
| 8:00 AM | 3 | 14 | 0 | 0 | 0 | 27 | 2 | 0 | 0 | 8 | 0 | 22 | 13 | 20 | 0 | 109 | | | | | | |
| 8:15 AM | 6 | 12 | 0 | 0 | 0 | 15 | 1 | 4 | 0 | 11 | 0 | 15 | 10 | 19 | 0 | 93 | | | | | | |
| 8:30 AM | 3 | 12 | 0 | 0 | 0 | 23 | 1 | 1 | 0 | 8 | 0 | 11 | 15 | 19 | 0 | 93 | | | | | | |
| 8:45 AM | 1 | 15 | 0 | 0 | 0 | 25 | 0 | 1 | 0 | 4 | 0 | 15 | 16 | 16 | 0 | 93 | | | | | | |
| TOTAL VOLUMES : | 35 | 117 | 0 | 0 | 0 | 134 | 7 | 25 | 0 | 175 | 0 | 123 | 233 | 123 | 0 | 972 | | | | | | |
| APPROACH % s : | 23.03% | 76.97% | 0.00% | 0.00% | 0.00% | 95.04% | 4.96% | 12.50% | 0.00% | 87.50% | 0.00% | 25.68% | 48.64% | 25.68% | 0.00% | | | | | | | |
| PEAK HR : | 07:15 AM - 08:15 AM | | | | | | | | | | | | | | | | | | | | | |
| PEAK HR VOL : | 20 | 71 | 0 | 0 | 0 | 71 | 4 | 18 | 0 | 139 | 0 | 78 | 157 | 66 | 0 | 624 | | | | | | |
| PEAK HR FACTOR : | 0.455 | 0.845 | 0.000 | 0.000 | 0.000 | 0.657 | 0.500 | 0.500 | 0.000 | 0.589 | 0.000 | 0.672 | 0.595 | 0.688 | 0.000 | 0.800 | | | | | | |
| | 0.843 | | | | | | | | | | | | | | | | | | | | | |

| NS/EW Streets: | Town Center Blvd | | | | | | Boardwalk Blvd | | | | | | Boardwalk Blvd | | | | | | | | | |
|-------------------------|---------------------|--------|------------|-------|-------|--------|----------------|--------|-----------|--------|-------|--------|----------------|--------|-------|-------|----|--|----|--|-------|--|
| | NORTHBOUND | | SOUTHBOUND | | SU | | EASTBOUND | | WESTBOUND | | EU | | WL | | WT | | WR | | WU | | TOTAL | |
| | NL | NT | NR | NU | SL | ST | SR | EL | ET | ER | EU | WL | WT | WR | WU | TOTAL | | | | | TOTAL | |
| 3:00 PM | 10 | 26 | 0 | 0 | 0 | 48 | 5 | 6 | 0 | 34 | 0 | 21 | 14 | 22 | 0 | 186 | | | | | | |
| 3:15 PM | 4 | 21 | 0 | 0 | 0 | 59 | 3 | 2 | 0 | 25 | 0 | 26 | 13 | 20 | 0 | 173 | | | | | | |
| 3:30 PM | 3 | 25 | 0 | 0 | 0 | 54 | 3 | 7 | 0 | 21 | 0 | 33 | 15 | 21 | 0 | 182 | | | | | | |
| 3:45 PM | 6 | 34 | 0 | 0 | 0 | 48 | 7 | 2 | 0 | 11 | 0 | 34 | 16 | 27 | 0 | 185 | | | | | | |
| 4:00 PM | 5 | 17 | 0 | 0 | 0 | 66 | 2 | 8 | 0 | 14 | 0 | 26 | 16 | 21 | 0 | 175 | | | | | | |
| 4:15 PM | 4 | 29 | 0 | 0 | 0 | 62 | 6 | 4 | 0 | 8 | 0 | 36 | 14 | 20 | 0 | 183 | | | | | | |
| 4:30 PM | 6 | 34 | 0 | 0 | 0 | 61 | 5 | 3 | 0 | 15 | 0 | 21 | 16 | 15 | 0 | 176 | | | | | | |
| 4:45 PM | 6 | 30 | 0 | 0 | 0 | 62 | 1 | 6 | 0 | 3 | 0 | 35 | 14 | 13 | 0 | 170 | | | | | | |
| 5:00 PM | 9 | 32 | 0 | 0 | 0 | 47 | 4 | 0 | 0 | 6 | 0 | 31 | 28 | 19 | 0 | 176 | | | | | | |
| 5:15 PM | 1 | 33 | 0 | 0 | 0 | 64 | 3 | 4 | 0 | 6 | 0 | 27 | 22 | 26 | 0 | 186 | | | | | | |
| 5:30 PM | 3 | 29 | 0 | 0 | 0 | 43 | 6 | 1 | 0 | 7 | 0 | 27 | 22 | 15 | 0 | 153 | | | | | | |
| 5:45 PM | 5 | 32 | 0 | 0 | 0 | 54 | 1 | 3 | 0 | 13 | 0 | 28 | 18 | 17 | 0 | 171 | | | | | | |
| TOTAL VOLUMES : | 62 | 342 | 0 | 0 | 0 | 668 | 46 | 46 | 0 | 163 | 0 | 345 | 208 | 236 | 0 | 2116 | | | | | | |
| APPROACH % s : | 15.35% | 84.65% | 0.00% | 0.00% | 0.00% | 93.56% | 6.44% | 22.01% | 0.00% | 77.99% | 0.00% | 43.73% | 26.36% | 29.91% | 0.00% | | | | | | | |
| PEAK HR : | 03:00 PM - 04:00 PM | | | | | | | | | | | | | | | | | | | | | |
| PEAK HR VOL : | 23 | 106 | 0 | 0 | 0 | 209 | 18 | 17 | 0 | 91 | 0 | 114 | 58 | 90 | 0 | 726 | | | | | | |
| PEAK HR FACTOR : | 0.575 | 0.779 | 0.000 | 0.000 | 0.000 | 0.886 | 0.643 | 0.607 | 0.000 | 0.669 | 0.000 | 0.838 | 0.906 | 0.833 | 0.000 | 0.976 | | | | | | |
| | 0.806 | | | | | | | | | | | | | | | | | | | | | |

| NS/EW Streets: | Town Center Blvd | | Boardwalk Blvd | | Boardwalk Blvd | |
|--------------------------|------------------|------|----------------|------|----------------|-------|
| | NL | NT | WL | WT | WR | TOTAL |
| 4:30 PM - 5:30 PM | 22 | 129 | 0 | 13 | 30 | 708 |
| | 0 | 0 | 234 | 0 | 80 | 73 |
| | 0 | 0 | 0 | 0 | 0 | 0 |
| | 151 | 247 | 43 | 0 | 267 | 708 |
| | 0.92 | 0.92 | 0.60 | 0.86 | 0.86 | |



1100 Marion St., Suite 300
Knoxville, Tennessee 37921
tel: 865. 963.4300
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March 28, 2022

Mike Conger, P.E.
Knoxville-Knox County Planning
400 Main Street, Suite 403
Knoxville, TN 37902

RE: TOWN CENTER SHOPS TRAFFIC IMPACT LETTER (TIL) COMMENT RESPONSE

Dear Mr. Conger:

Please find enclosed attached the revised traffic impact study prepared for the above referenced site with responses to the TIS Review comments received November 12th. The following comments received related to the TIL are addressed as indicated in red.

1. The study does not compare/validate the running total of expected trip generation as was requested. Please tabulate and include the trip generation for the “existing” uses in the bottom line tally and compare those with the 2011 report to the current expected amount based on the latest information and actual uses. Existing uses can be denoted as such in the table and noted that actual trip generation may not match exactly with the ITE calculated amount.

The Attachments of the TIL includes a comprehensive 2022 trip generation update with the proposed Town Center Shops and reflecting ITE trip generation rates from Trip Generation, 11th Edition and the Trip generation of the original 2011 trip generation. A summary of a comparison of total trips generated are provided in Table 6 (page 9) of the revised TIL.

2. Pass-by rates should be verified with Knox Planning/City staff if not using previously regionally-accepted percentages. Please provide additional justification for the application of a 50% pass-by rate for the entire development since the typical maximum allowed pass-by rate for a shopping center use is 30%.

*A paragraph was added to the TIL, page 2, detailing the approach of determining the pass-by rate of 50-percent used in adjusting for primary trips for the Town Center Shops. The trip generation in the Attachments shows the means for this calculation. The retail shops reflected a pass-by rate of 30% but the coffee shop with drive-thru reflected a pass-by rate of 65%. Drive-thru coffee establishments can exhibit pass-by rates in excess of 80%. Also attached are the recognized pass-by rates published in the ITE reference **Trip Generation Handbook, 3rd Edition** for the study documentation.*

3. Please document the status of all recommendations from the 2011 Northshore Town Center TIS and which ones remain uncompleted and this development’s impact and





Mike Conger, P.E.
Knoxville-Knox County Planning
March 28, 2022
Page 2

potential triggering of such. In terms of the critical intersection of Thunderhead Rd at Northshore Dr where remaining improvements are called for, a 2021 TMC is being attached with this letter that was conducted as part of the Northshore Corridor Study that was referenced in your report. Please compare these volumes with the amounts shown to warrant additional improvements in the 2011 TIS such as the eastbound left turn lane storage and separate southbound left turn lane to further demonstrate that this development will not trigger these improvements beyond the narrative included in the current version of this TIL.

The TIL further expanded the discussion of the left-turn movements for the Northshore Drive and Thunderhead Road intersection (Page 21). The existing 2021 traffic, including much of the Northshore Town Center traffic, for the Northshore Drive and Thunderhead Road intersection is lower than the projected 2016 background traffic in the 2011 Northshore Town Center traffic study. The critical AM peak of the eastbound left-turn and the southbound left-turn movements are significantly less. These reduced traffic volumes and buildout of the assumed 2016 background conditions including the development of the Knox County elementary school, the traffic impacts are much reduced than the projected background and site related projected traffic conditions than originally identified. During the critical AM peak hour, the eastbound left-turn demand is 75 vehicles and the southbound left-turn movement is 220 vehicles lower than the original background traffic conditions and these movements currently include some traffic generated by the Northshore Town Center. The impact from both the background and Northshore Town Center is, therefore, much less than originally estimated.

4. Please revise the summary of the TIL to clarify that the original 2011 Northshore Town Center TIS is the basis for identifying improvements needed at the intersection of Thunderhead Rd at Northshore Dr and not the recent Northshore Drive Corridor Study.

Revised

5. Please revise the ITE land use code that was referenced as 820 to 822, which is the new designation for shopping center < 40,000 square feet in the 11th Edition of the ITE Trip Generation Manual.

Revised



Mike Conger, P.E.
Knoxville-Knox County Planning
March 28, 2022
Page 3

If you have any questions regarding this study, please call me.

Sincerely,

CDM SMITH INC.

A handwritten signature in blue ink that reads "John F. Gould". The signature is written in a cursive style with a large, looped "J" and "G".

John F Gould, P.E.
Senior Transportation Engineer

pc: John Anderson, SITE Inc