

# OCTOBER PARK

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TRAFFIC IMPACT STUDY

OCTOBER PARK  
RESIDENTIAL DEVELOPMENT

KNOX COUNTY, TN

CCI PROJECT NO. 01119-0001

PREPARED FOR:  
Vertex Development TN, LLC  
226 Castle Down Lane  
Knoxville, TN 37834

SUBMITTED BY  
Cannon & Cannon, Inc.  
8550 Kingston Pike  
Knoxville, TN 37919  
865.670.8555



OCTOBER 24

2018



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## EXECUTIVE SUMMARY

This report provides a summary of a traffic impact study that was performed for a proposed residential development to be located off Hatmaker Lane in west Knox County, just north of the Town of Farragut. The project site is located immediately north of Interstate 40/75 and the bordering Hatmaker Lane, and is typically accessed from the I-40/75 interchange with N. Campbell Station Road via N. Campbell Station Road to Fretz Road and then to Hatmaker Lane.

The current plans for this proposed residential development provide for a maximum of 66 single family lots and 30 condominiums at full build-out. The conceptual site plan for this project shows two access points onto Hatmaker Lane, one for the single family lots and one for the condos. The development entrances will be new three-leg intersections located on Hatmaker Lane, approximately 1850 and 2150 feet west of the Hatmaker Lane intersection with Fretz Road.

The purpose of this study was to provide a thorough evaluation of the traffic operational and safety impacts of the proposed development upon the adjacent portion of Hatmaker Lane, as well as the intersection of Fretz Road with N. Campbell Station Road. This evaluation was performed assuming full build-out of all units of the proposed development with existing and background growth conditions also evaluated for purposes of comparison.

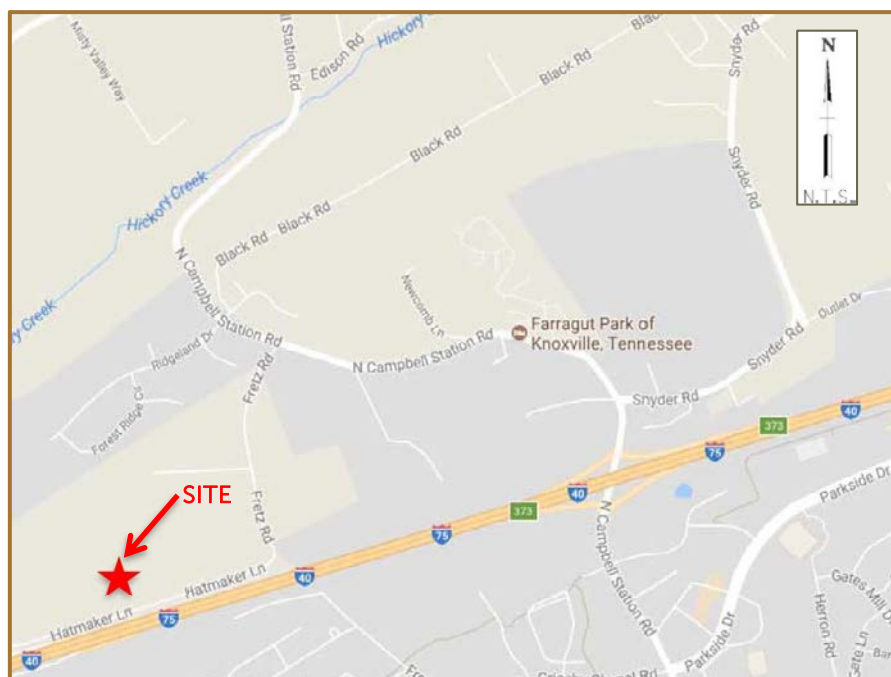
The primary conclusion of this study is that the traffic generated by the proposed development will result in some limited traffic operational impacts in the project area. Specifically, the increase in northbound left-turn traffic at the study intersection of N. Campbell Station Road and Fretz Road will in all likelihood create warranting conditions for construction of a northbound left-turn lane on N. Campbell Station Road. Regarding the timing of when the northbound left-turn lane would be expected to be warranted, analyses using trip generation data indicate that when 46 housing units are constructed and occupied, the left-turn lane warranting value of 50 left-turns would be satisfied.

The improvement recommendations that resulted from this study are summarized below:

1. Install a southbound Speed Limit 30 mph sign on Fretz Road, just south of Campbell Station Road. This is an existing need.
2. Further evaluate and install signs, markings and/or guardrail along the north side of Hatmaker Lane, beginning about 1200 feet west of Fretz Road, where a sizable edge-of-pavement drop off currently exists. This is an existing need.
3. Construct a northbound left-turn lane on N. Campbell Station Road at Fretz Road to be open no later than when the forty-sixth project housing unit is built and occupied. This lane should have a minimum turn lane storage length of 75 feet, plus bay and approach taper lengths consistent with T.D.O.T. standard procedures for a 35 mph design speed.
4. Widen any existing Fretz Road or Hatmaker Lane pavement between Woodhollow Lane and the proposed project site entrances to be a minimum of 18 feet. This will likely only involve a few hundred feet of pavement on Fretz Road that is currently in the 14-15 foot range. The existing pavement on Hatmaker Lane appears to currently be 18 feet in width as a minimum. This is an existing need.
5. Establish and maintain corner sight distance at the proposed site entrance intersections by eliminating any obstructing trees and brush, and also by ensuring that new site signage and landscaping is properly positioned to not impede lines of sight.

## INTRODUCTION & PURPOSE OF STUDY

This report provides a summary of a traffic impact study that was performed for a proposed residential development to be located off Hatmaker Lane in west Knox County, just north of the Town of Farragut. The project site is located immediately north of Interstate 40/75 and the bordering Hatmaker Lane, and is typically accessed from the I-40/75 interchange with N. Campbell Station Road via N. Campbell Station Road to Fretz Road and then to Hatmaker Lane. FIGURE 1 is a location map that identifies the project site in relation to the roadways in the vicinity of the proposed development.



**FIGURE 1**  
**LOCATION MAP**

The current plans for this proposed residential development provide for a maximum of 66 single family lots and 30 condominiums at full build-out. FIGURE 2 is a conceptual site plan showing the proposed site layout, which will have two access points onto Hatmaker Lane, one for the single family lots and one for the condos. The development entrances will be new three-leg intersections located on Hatmaker Lane, approximately 1850 and 2150 feet west of the Fretz Road to Hatmaker Lane curve.

The purpose of this study was to provide a thorough evaluation of the traffic operational and safety impacts of the proposed development upon the adjacent portion of Hatmaker Lane, as well as the intersection of Fretz Road with N. Campbell Station Road. This evaluation was performed assuming full build-out of all units of the proposed development with existing and background growth conditions also evaluated for purposes of comparison.





FIGURE 2  
CONCEPTUAL SITE PLAN

**EXISTING CONDITIONS**

**EXISTING ROADWAY CONDITIONS**

Hatmaker Lane and Fretz Road are classified as Local roadways and are maintained by Knox County, although the first three hundred feet or so of Fretz Road off of N. Campbell Station Road is maintained by the Town of Farragut. The roadway pavement varies in width, although the Brandywine at Turkey Creek development has widened Fretz Road from Campbell Station Road to its entrance to approximately 22 feet. Another development is underway that will continue this widening about two hundred feet further south. Continuing south, and up to the curve where Hatmaker Lane begins, the pavement narrows to a width in the range of 14 to 15 feet. The widened pavement is striped with a double solid yellow centerline delineating two traffic lanes of approximately 11 feet each. The posted speed limit on Fretz Road/Hatmaker Lane is 30 mph, although no southbound speed limit sign is located immediately south of N. Campbell Station Road, as would be typically placed.

Beginning about 1200 feet west of Fretz Road, on Hatmaker Lane, there is a sizeable edge of pavement drop-off for several hundred feet along the north side of the roadway. This is adjacent to ongoing grading for a new subdivision, and the drop-off is unmarked and unprotected by a guardrail.

N. Campbell Station Road is also a two lane roadway, and at the study intersection with Fretz Road, it is maintained by the Town of Farragut. It is classified as a Minor Arterial roadway, and the posted speed limit is 35 mph. There are no separate right or left turn lanes at the study intersection, but the roadway pavement of approximately 22 feet is striped with a double yellow solid centerline and white edgelines.

**EXISTING TRAFFIC DATA**

A traffic count station for collecting annual average daily traffic data (AADT) is located on N. Campbell Station Road, just south of Yarnell Road and approximately 0.9 miles north of the study intersection of N. Campbell Station Road. The most recent data from this station was provided by the Tennessee Department of Transportation with resulting AADTs shown in TABLE 1.

**TABLE 1: ANNUAL AVERAGE DAILY TRAFFIC COUNT SUMMARY**

| COUNT YEAR | TDOT COUNT STATION 0303<br>N. CAMPBELL STATION ROAD<br>SOUTH OF YARNELL ROAD |
|------------|--|
| 2016       | 5583   |
| 2015       | 4779   |
| 2014       | 4332   |
| 2013       | 4271   |
| 2012       | 4385   |
| 2011       | 4256   |
| 2010       | 3759   |
| 2009       | 4176   |



In order to collect more refined data for analyses and to establish a basis for trip distribution patterns, turning movement traffic counts were collected at the study intersection of N. Campbell Station Road and Fretz Road. These counts were conducted during the AM and PM peak traffic periods of a typical weekday, and the peak hours were found to be 7:30 to 8:30 AM and 4:45 to 5:45 PM. Raw data count summaries of this data are contained in APPENDIX A along with additional TDOT AADT data for count station 0303. In addition to helping establish trip distribution patterns, these turning movement counts were used to establish the existing traffic volumes for this study, as displayed in FIGURE 3, which provides both the 2017 raw counts and 2018 estimates established by applying an annual growth factor, which is discussed in detail in the BACKGROUND CONDITIONS section. The turning movement counts were also used to determine the peak hour factors for the counts as 0.92 for the AM peak and 0.93 for the PM peak.

### **EXISTING CAPACITY ANALYSES / LEVELS-OF-SERVICE**

Intersection capacity analyses employing the methods of the latest edition of the Highway Capacity Manual and companion software (HCS7) were used to evaluate the study intersection of N. Campbell Station Road and Fretz Road for the existing roadway, existing traffic control, and existing (2018) traffic conditions, as shown on FIGURE 3. The results indicate that the critical Fretz Road side street approach is currently operating at level-of-service (LOS) "B" during both the AM and PM peak traffic hours. These results are summarized in detail on the "HCS7 Two-Way Stop-Control Report" printouts contained in APPENDIX C. Also see APPENDIX C for a discussion of Intersection Capacity and Level of Service Concepts.

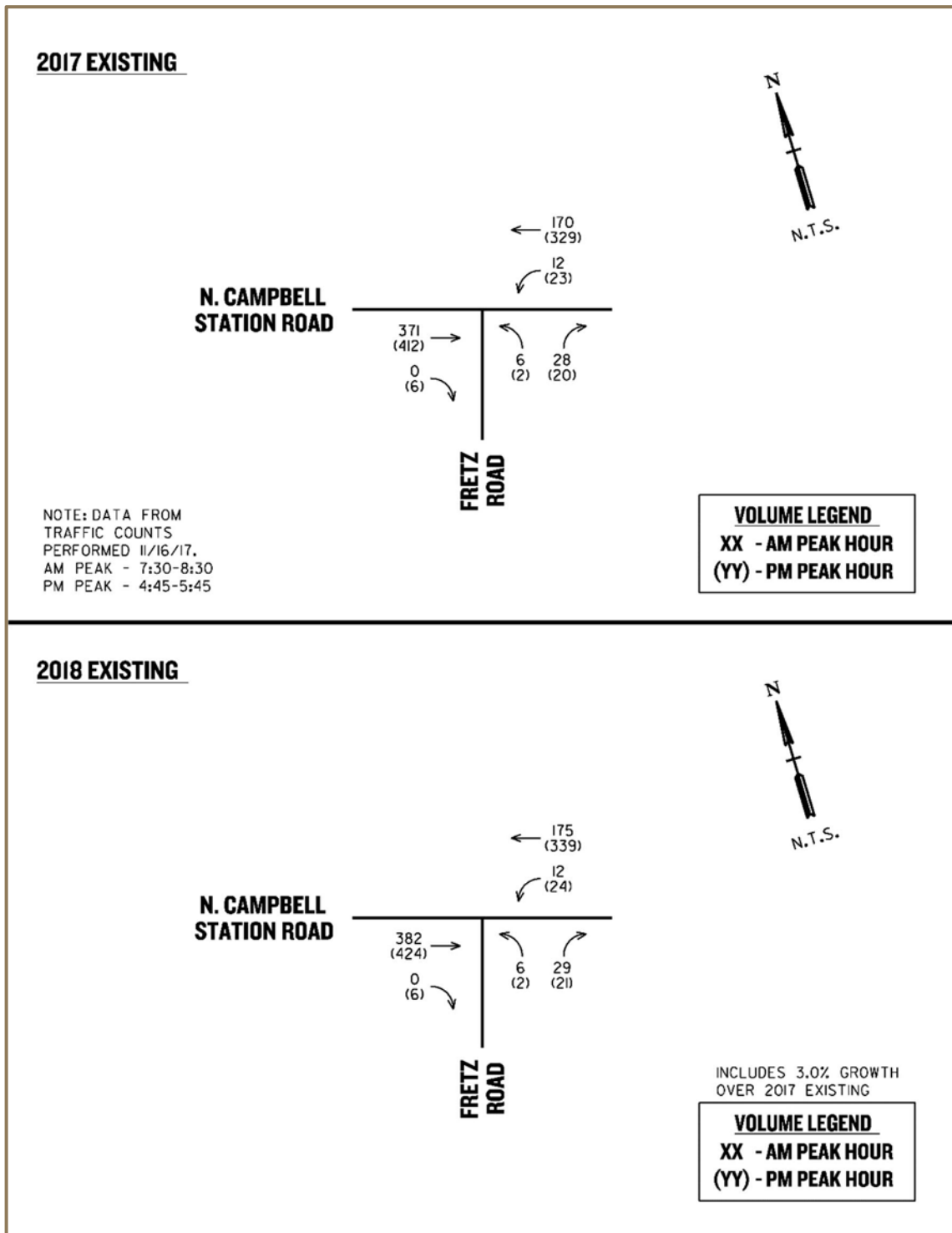


FIGURE 3  
EXISTING TRAFFIC VOLUMES

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## BACKGROUND CONDITIONS

### BACKGROUND TRAFFIC GROWTH

The anticipated time for full build-out of the proposed October Park residential project is estimated as three years. Therefore, year 2021 was established as the appropriate design/analysis year for this study. In order to determine traffic volumes resulting solely from background traffic growth to year 2021, it was necessary to establish an annual growth rate for existing traffic. The ADT values given previously in TABLE 1, along with engineering judgment, were used to arrive at a rate of 3.0 percent per year for this development. FIGURE 4 contains the background traffic volumes that would result from this 3.0 percent annual growth rate to year 2021.

### BACKGROUND CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual and companion software (HCS7) were used to evaluate the study intersection of N. Campbell Station Road and Fretz Road for the existing roadway, existing traffic control, and background (2021) traffic conditions, as shown on FIGURE 4. The results indicate that the critical Fretz Road side street approach will be expected to continue to operate at level-of-service (LOS) "B" during both the AM and PM peak traffic hours. These results are summarized in detail on the "HCS7 Two-Way Stop-Control Report" printouts contained in APPENDIX C. Also see APPENDIX C for a discussion of Intersection Capacity and Level-of-Service Concepts.



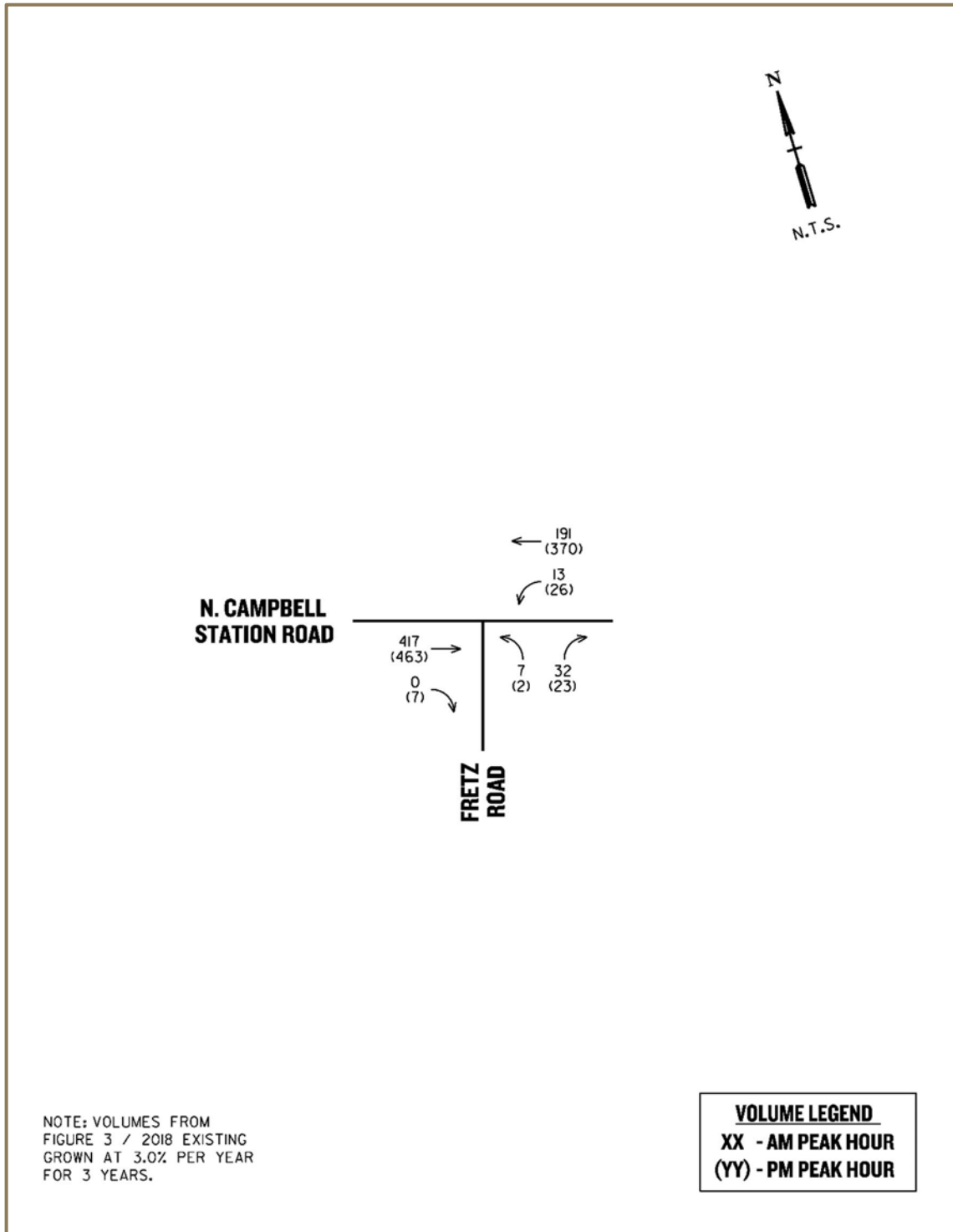


FIGURE 4  
 2021 BACKGROUND TRAFFIC VOLUMES

## FUTURE CONDITIONS

### TRIP GENERATION

In order to estimate the expected traffic volumes to be generated by full build-out of the proposed development, the data and procedures of *Trip Generation, Tenth Edition* (Institute of Transportation Engineers, 2017) were utilized. The generated traffic volumes were determined based on the total weekday morning and evening peak hour of adjacent street traffic trip generation rates for single-family detached housing (Land Use Code 210). Utilizing the anticipated maximum number of units upon full build-out of 96, the newly generated trips were estimated. TABLE 2 summarizes the number and directional split of these anticipated entering and exiting trips from the proposed development.

**TABLE 2: TRIP GENERATION SUMMARY**

| LAND USE                       | ITE CODE | SIZE      | WEEKDAY (TRIPS/DAY) | AM PEAK HOUR (TRIPS/HR) | PM PEAK HOUR (TRIPS/HR) |
|--------------------------------|----------|-----------|---------------------|-------------------------|-------------------------|
| Single-Family Detached Housing | 210      | 96 units* | 501                 | 18                      | 62                      |
| Entering Trips                 |          |           | 501                 | 55                      | 36                      |
| <b>TOTAL</b>                   | -        | -         | 501                 | 18                      | 62                      |
| Entering Trips                 | -        | -         | 501                 | 55                      | 36                      |

\*Units include 66 single family homes and 30 small building condos. Small building condos do not have a suitable ITE trip generation code, so these units were totaled together with the single-family units.

### TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 5 provides a summary of the trip distribution patterns developed for the study intersection, which were derived from the existing traffic counts. In addition, FIGURE 6 provides the generated traffic volumes as assigned to the local roadway network in accordance with these distribution patterns. FIGURE 7 shows the combined year 2021 volumes reflecting the existing traffic, the background traffic growth, and the newly generated traffic from the proposed October Park residential development. These are the volumes used in the analysis of full build-out conditions.

### FUTURE CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual and companion software (HCS7) were used to evaluate the study intersection of N. Campbell Station Road and Fretz Road for the existing roadway, existing traffic control, and combined (2021) traffic conditions, as shown on FIGURE 7. The results indicate that the critical Fretz Road side street approach will be expected to continue to operate at level-of-service (LOS) "B" during both the AM and PM peak traffic hours. Evaluations were also made assuming the addition of a northbound left-turn lane, with similar level-of-service results. These results are summarized in detail on the "HCS7 Two-Way Stop-Control Report" printouts contained in APPENDIX C. Also see APPENDIX C for a discussion of Intersection Capacity and Level of Service Concepts.

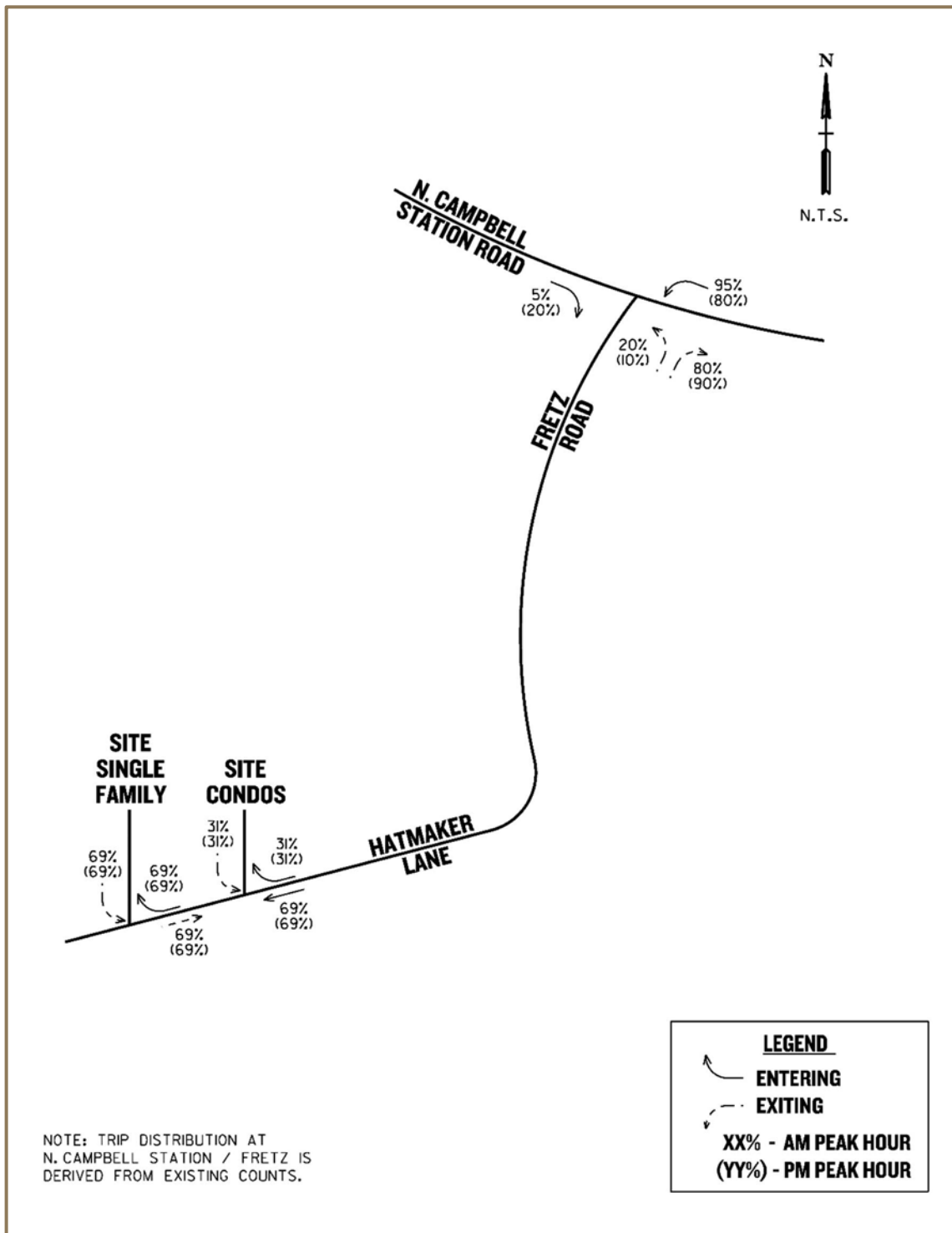


FIGURE 5  
TRIP DISTRIBUTION PATTERNS (%)



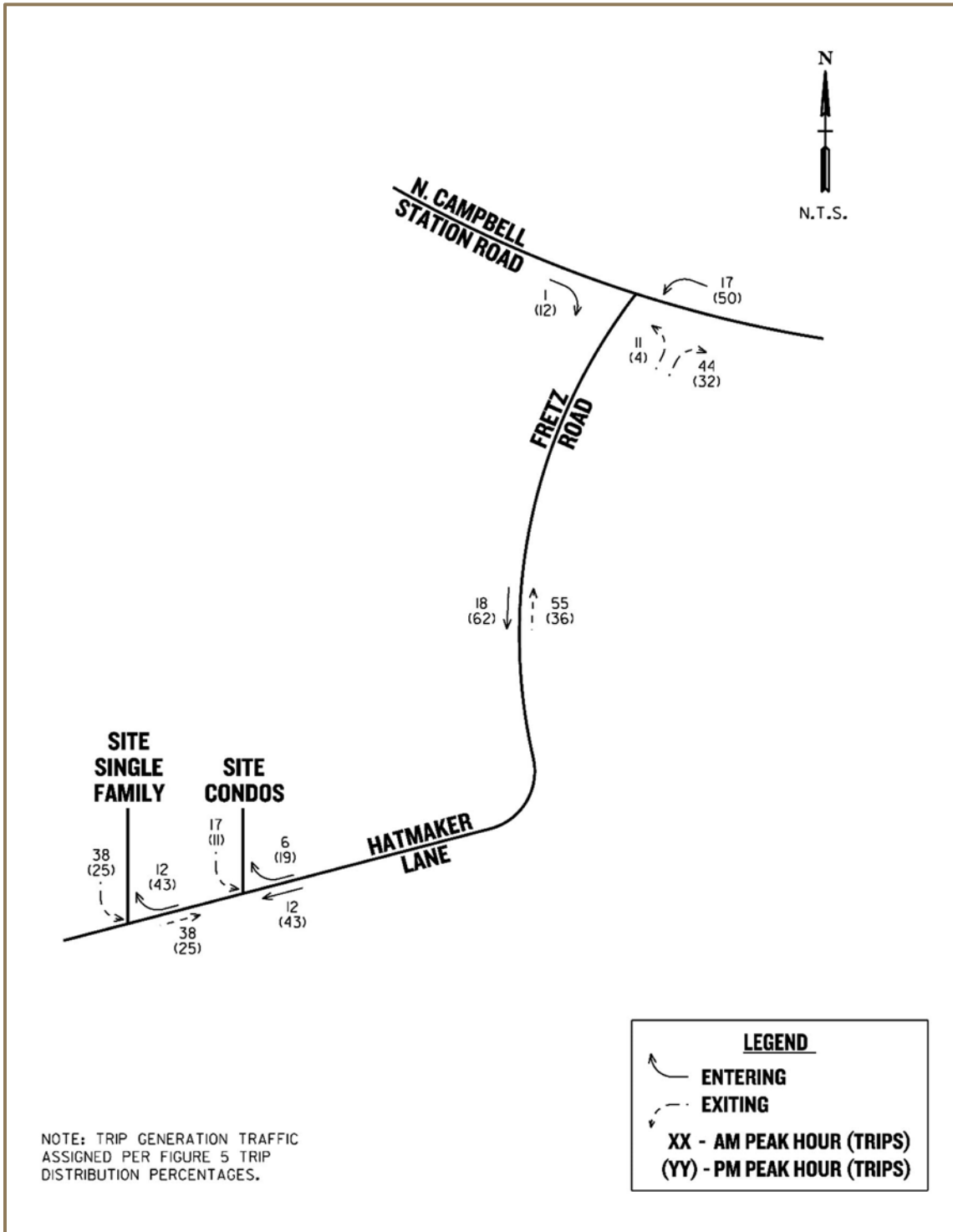


FIGURE 6  
TRIP ASSIGNMENT

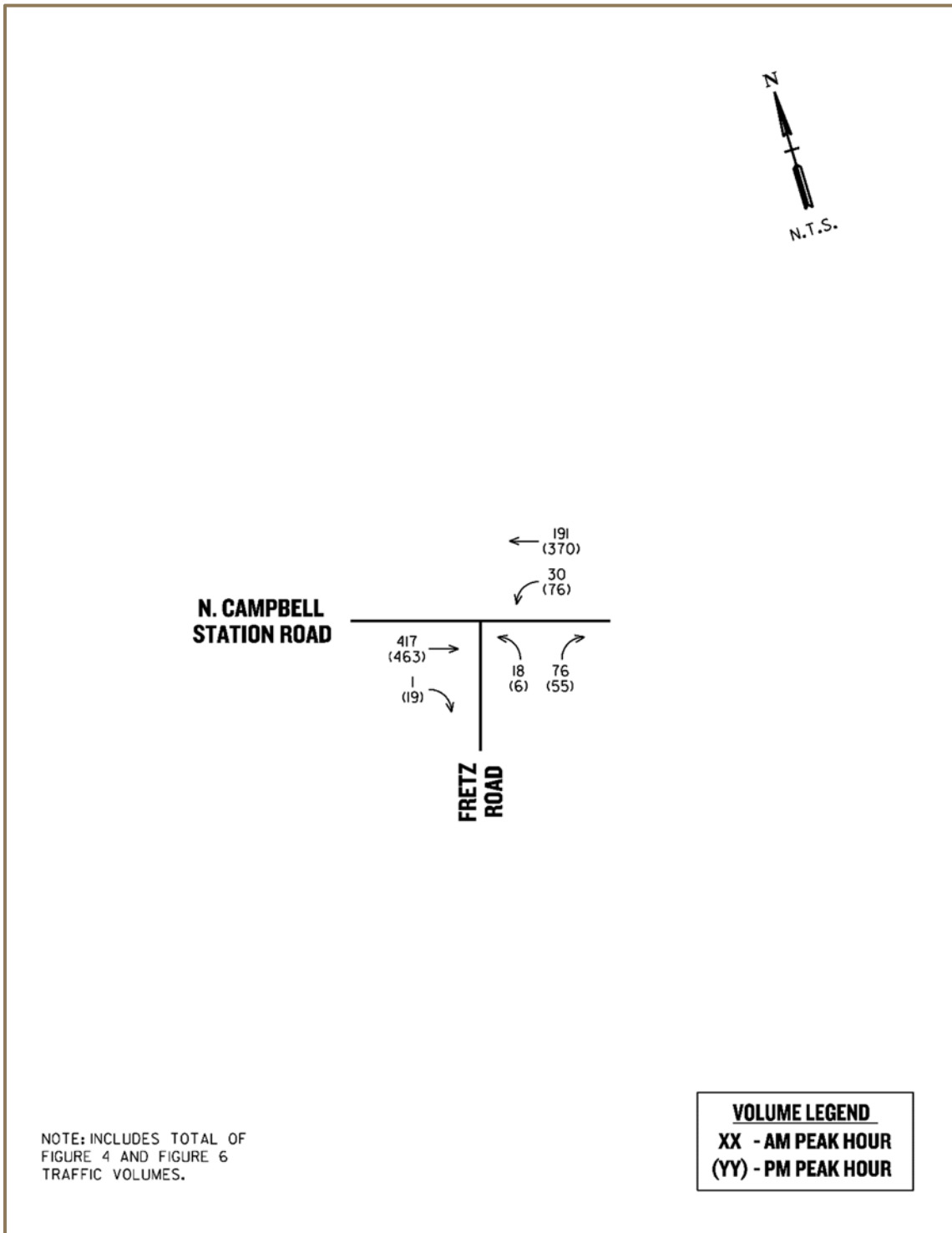


FIGURE 7  
2021 COMBINED TRAFFIC VOLUMES

## EVALUATIONS

### INTERSECTION CAPACITY ANALYSES

As discussed in the preceding sections of this report, capacity analyses employing the methods of the Highway Capacity Manual and companion software (HCS7) were conducted for the study intersection of N. Campbell Station Road and Fretz Road. These analyses were performed for existing, background, and combined traffic conditions using existing geometry and existing traffic control. In addition, the intersection was also evaluated with the addition of a northbound left-turn lane on N. Campbell Station Road for the combined 2021 traffic conditions. A summary of the capacity analyses results is shown in TABLE 3.

**TABLE 3: CAPACITY ANALYSES SUMMARY**

| EVALUATION CONDITION                    | LEVEL-OF-SERVICE (AVG. DELAY IN SECONDS)*   |   |
|---|---|---|
|   | FRETZ ROAD APPROACH<br>(LEFT & RIGHT TURNS) | N. CAMPBELL STA. ROAD<br>NORTHBOUND APPROACH<br>(LEFT ONLY / LEFT & THRU) |
| Existing (2018) – AM                    | B (12.0)                                    | A (8.2) / A (0.6)   |
| Existing (2018) – PM                    | B (12.3)                                    | A (8.4) / A (0.8)   |
| Background (2021) – AM                  | B (12.6)                                    | A (8.3) / A (0.6)   |
| Background (2021) – PM                  | B (12.9)                                    | A (8.5) / A (0.8)   |
| Combined w/ Existing Lanes (2021) – AM  | B (14.1)                                    | A (8.4) / A (1.4)   |
| Combined w/ Existing Lanes (2021) – PM  | B (14.5)                                    | A (8.8) / A (2.2)   |
| Combined w/ added NBLT Lane (2021) – AM | B (14.1)                                    | A (8.4) / A (1.1)   |
| Combined w/ added NBLT Lane (2021) – PM | B (14.5)                                    | A (8.8) / A (1.5)   |

\* Side Street Stop Control – Level-of-Service and Average Vehicular Delay (seconds) for side street movements and main street left-turn and through movements utilizing HCM methodology.

As shown in TABLE 3, all levels-of-service are expected to remain the same in all evaluated conditions. The addition of a northbound left-turn lane will improve the average delay on the northbound approach to a small degree.

### SIGHT DISTANCE ASSESSMENT

The proposed project development entrances on Hatmaker Lane were evaluated for corner sight distance. Based on the posted 30 mph speed limit, the required minimum sight distance in accordance with Knox County regulations would be 300 feet. Field reviews indicate that this requirement will be relatively easy to meet at these intersections, as the only sight distance impeding features are trees and brush located on the Hatmaker Lane ROW or site property, along the north side of the road. With appropriate cutting of these features, sight distances well in excess of the required 300 feet are attainable.



## **TURN LANE ASSESSMENT**

Turn lane warrant analyses were conducted for the study intersection of N. Campbell Station Road and Fretz Road under proposed combined development conditions. These analyses employed Tables 4A and 4B from the Knox County Access Control and Driveway Design Policy, which are based on turn lane warrants developed by Harmelink. The results are that a northbound left-turn lane on N. Campbell Station Road is expected to be warranted during the PM peak traffic hour. A southbound right-turn lane on N. Campbell Station Road was also evaluated and found to not be warranted. Regarding the timing of when the northbound left-turn lane would be expected to be warranted, analyses using trip generation data indicate that when 46 housing units are constructed and occupied, the left-turn lane warranting value of 50 left-turns would be satisfied. Copies of Knox County Tables 4A and 4B are located in APPENDIX C for review, as well as a sheet documenting how the 46 unit threshold was determined.

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## CONCLUSIONS & RECOMMENDATIONS

The primary conclusion of this study is that the traffic generated by the proposed development will result in some limited traffic operational impacts in the project area. Specifically, the increase in northbound left-turn traffic at the study intersection of N. Campbell Station Road and Fretz Road will in all likelihood create warranting conditions for construction of a northbound left-turn lane on N. Campbell Station Road. Regarding the timing of when the northbound left-turn lane would be expected to be warranted, analyses using trip generation data indicate that when 46 housing units are constructed and occupied, the left-turn lane warranting value of 50 left-turns would be satisfied.

The improvement recommendations that resulted from this study are summarized below:

1. Install a southbound Speed Limit 30 mph sign on Fretz Road, just south of Campbell Station Road. This is an existing need.
2. Further evaluate and install signs, markings or guardrail along the northside of Hatmaker Lane, beginning about 1200 feet west of Fretz Road, where a sizable edge-of-pavement drop off currently exists. This is an existing need.
3. Construct a northbound left-turn lane on N. Campbell Station Road at Fretz Road to be open no later than when the forty-sixth project housing unit is built and occupied. This lane should have a minimum turn lane storage length of 75 feet, plus bay and approach taper lengths consistent with T.D.O.T. standard procedures for a 35 mph design speed.
4. Widen any existing Fretz Road or Hatmaker Lane pavement between Woodhollow Lane and the proposed project site entrances to be a minimum of 18 feet. This will likely only involve a few hundred feet of pavement on Fretz Road that is currently in the 14-15 foot range. The existing pavement on Hatmaker Lane appears to currently be 18 feet in width as a minimum. This is an existing need.
5. Establish and maintain corner sight distance at the proposed site entrance intersections by eliminating any obstructing trees and brush, and also by ensuring that new site signage and landscaping is properly positioned to not impede lines of sight.

**APPENDIX**

**APPENDIX A – TRAFFIC DATA**

**APPENDIX B – TRIP GENERATION**

**APPENDIX C – ANALYSES**

**APPENDIX A – TRAFFIC DATA**



## Traffic History

| Station # | County | Location            | Route # |
|-----------|--------|---------------------|---------|
| 000303    | Knox   | NEAR LOUDON CO LINE | 01277   |

*Campbell Station Road  
South of Yarnell Road*

| Record | Year | AADT |
|--------|------|------|
| 1      | 2016 | 5583 |
| 2      | 2015 | 4779 |
| 3      | 2014 | 4332 |
| 4      | 2013 | 4271 |
| 5      | 2012 | 4385 |
| 6      | 2011 | 4256 |
| 7      | 2010 | 3759 |
| 8      | 2009 | 4176 |
| 9      | 2008 | 3860 |
| 10     | 2007 | 3436 |
| 11     | 2006 | 3169 |
| 12     | 2005 | 2978 |
| 13     | 2004 | 2623 |
| 14     | 2003 | 2907 |
| 15     | 2002 | 3067 |
| 16     | 2001 | 2367 |
| 17     | 2000 | 3378 |
| 18     | 1999 | 1940 |
| 19     | 1998 | 2103 |
| 20     | 1997 | 2599 |
| 21     | 1996 | 2550 |
| 22     | 1995 | 2048 |
| 23     | 1994 | 1742 |
| 24     | 1993 | 2819 |
| 25     | 1992 | 1721 |
| 26     | 1991 | 1694 |



Cannon & Cannon, Inc.  
 Consulting Engineers - Field Surveyors  
 8550 Kingston Pike  
 Knoxville, TN 37919

CCI Project Name: Fretz Subdivision TIS  
 CCI Project Number: 545-0011  
 Intersection: Camp Sta at Fretz  
 Counted By: CCI

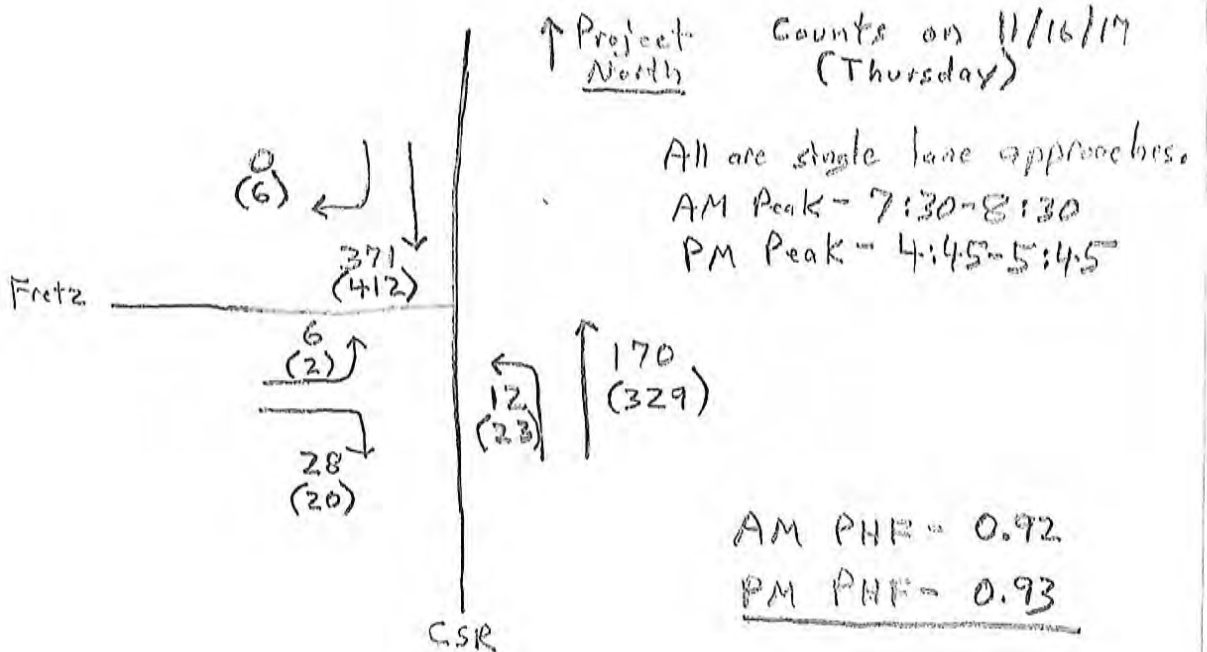
File Name : Campbell Station\_Fretz\_11-16-17  
 Site Code : 00000001  
 Start Date : 11/16/2017  
 Page No : 1

Groups Printed- Unshifted

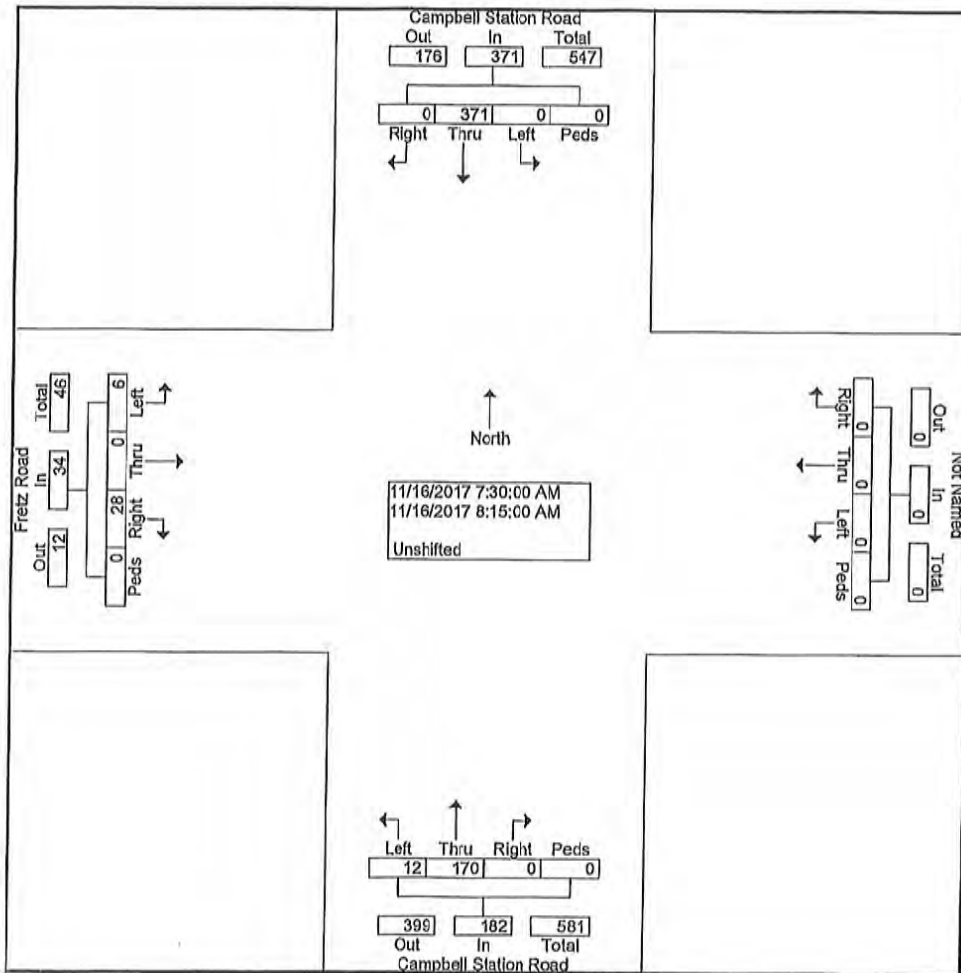
| Start Time | Campbell Station Road Southbound |      |       |      |            | Westbound |      |       |      |            | Campbell Station Road Northbound |      |       |      |            | Fretz Road Eastbound |      |       |      |            | Int. Total |
|------------|----------------------------------|------|-------|------|------------|-----------|------|-------|------|------------|----------------------------------|------|-------|------|------------|----------------------|------|-------|------|------------|------------|
|            | Left                             | Thru | Right | Peds | App. Total | Left      | Thru | Right | Peds | App. Total | Left                             | Thru | Right | Peds | App. Total | Left                 | Thru | Right | Peds | App. Total |            |
| Factor     | 1.0                              | 1.0  | 1.0   | 1.0  |            | 1.0       | 1.0  | 1.0   | 1.0  |            | 1.0                              | 1.0  | 1.0   | 1.0  |            | 1.0                  | 1.0  | 1.0   | 1.0  |            |            |
| 07:30 AM   | 0                                | 93   | 0     | 0    | 93         | 0         | 0    | 0     | 0    | 0          | 4                                | 43   | 0     | 0    | 47         | 3                    | 0    | 8     | 0    | 11         | 151        |
| 07:45 AM   | 0                                | 97   | 0     | 0    | 97         | 0         | 0    | 0     | 0    | 0          | 5                                | 46   | 0     | 0    | 51         | 1                    | 0    | 6     | 0    | 7          | 155        |
| Total      | 0                                | 190  | 0     | 0    | 190        | 0         | 0    | 0     | 0    | 0          | 9                                | 89   | 0     | 0    | 98         | 4                    | 0    | 14    | 0    | 18         | 306        |
| 08:00 AM   | 0                                | 110  | 0     | 0    | 110        | 0         | 0    | 0     | 0    | 0          | 2                                | 43   | 0     | 0    | 45         | 0                    | 0    | 5     | 0    | 5          | 160        |
| 08:15 AM   | 0                                | 71   | 0     | 0    | 71         | 0         | 0    | 0     | 0    | 0          | 1                                | 38   | 0     | 0    | 39         | 2                    | 0    | 9     | 0    | 11         | 121        |
| 08:30 AM   | 0                                | 71   | 1     | 0    | 72         | 0         | 0    | 0     | 0    | 0          | 3                                | 45   | 0     | 0    | 48         | 1                    | 0    | 5     | 0    | 6          | 126        |
| 08:45 AM   | 0                                | 57   | 0     | 0    | 57         | 0         | 0    | 0     | 0    | 0          | 4                                | 54   | 0     | 0    | 58         | 1                    | 0    | 4     | 0    | 5          | 120        |
| Total      | 0                                | 309  | 1     | 0    | 310        | 0         | 0    | 0     | 0    | 0          | 10                               | 180  | 0     | 0    | 190        | 4                    | 0    | 23    | 0    | 27         | 527        |

\*\*\* BREAK \*\*\*

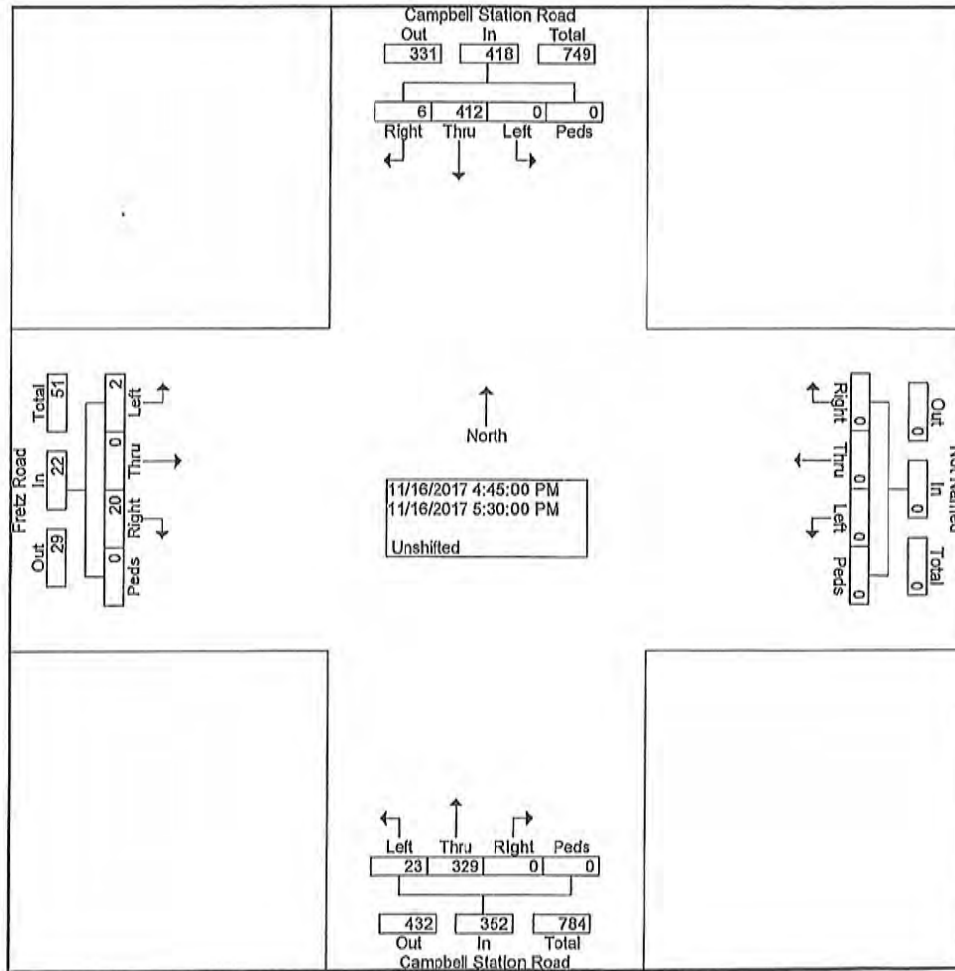
|             |     |      |     |     |      |     |     |     |     |     |     |      |     |     |      |      |     |      |     |     |      |
|-------------|-----|------|-----|-----|------|-----|-----|-----|-----|-----|-----|------|-----|-----|------|------|-----|------|-----|-----|------|
| 04:30 PM    | 0   | 120  | 0   | 0   | 120  | 0   | 0   | 0   | 0   | 0   | 6   | 69   | 0   | 0   | 75   | 0    | 0   | 5    | 0   | 5   | 200  |
| 04:45 PM    | 0   | 113  | 1   | 0   | 114  | 0   | 0   | 0   | 0   | 0   | 3   | 76   | 0   | 0   | 79   | 0    | 0   | 2    | 0   | 2   | 195  |
| Total       | 0   | 233  | 1   | 0   | 234  | 0   | 0   | 0   | 0   | 0   | 9   | 145  | 0   | 0   | 154  | 0    | 0   | 7    | 0   | 7   | 395  |
| 05:00 PM    | 0   | 98   | 0   | 0   | 98   | 0   | 0   | 0   | 0   | 0   | 6   | 71   | 0   | 0   | 77   | 1    | 0   | 3    | 0   | 4   | 179  |
| 05:15 PM    | 0   | 90   | 4   | 0   | 94   | 0   | 0   | 0   | 0   | 0   | 6   | 96   | 0   | 0   | 102  | 1    | 0   | 8    | 0   | 9   | 205  |
| 05:30 PM    | 0   | 111  | 1   | 0   | 112  | 0   | 0   | 0   | 0   | 0   | 8   | 86   | 0   | 0   | 94   | 0    | 0   | 7    | 0   | 7   | 213  |
| 05:45 PM    | 0   | 76   | 2   | 0   | 78   | 0   | 0   | 0   | 0   | 0   | 11  | 69   | 0   | 0   | 80   | 0    | 0   | 5    | 0   | 5   | 163  |
| Total       | 0   | 375  | 7   | 0   | 382  | 0   | 0   | 0   | 0   | 0   | 31  | 322  | 0   | 0   | 353  | 2    | 0   | 23   | 0   | 25  | 760  |
| Grand Total | 0   | 1107 | 9   | 0   | 1116 | 0   | 0   | 0   | 0   | 0   | 59  | 736  | 0   | 0   | 795  | 10   | 0   | 67   | 0   | 77  | 1988 |
| Apprch %    | 0.0 | 99.2 | 0.8 | 0.0 |      | 0.0 | 0.0 | 0.0 | 0.0 |     | 7.4 | 92.6 | 0.0 | 0.0 |      | 13.0 | 0.0 | 87.0 | 0.0 |     |      |
| Total %     | 0.0 | 55.7 | 0.5 | 0.0 | 56.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 37.0 | 0.0 | 0.0 | 40.0 | 0.5  | 0.0 | 3.4  | 0.0 | 3.9 |      |



| Start Time  | Campbell Station Road Southbound |       |       |      |            | Westbound  |      |       |      |            | Campbell Station Road Northbound |      |       |      |            | Fretz Road Eastbound |      |       |      |            | Int. Total |
|---|----------------------------------|-------|-------|------|------------|------------|------|-------|------|------------|----------------------------------|------|-------|------|------------|----------------------|------|-------|------|------------|------------|
|   | Left                             | Thru  | Right | Peds | App. Total | Left       | Thru | Right | Peds | App. Total | Left                             | Thru | Right | Peds | App. Total | Left                 | Thru | Right | Peds | App. Total |            |
| Peak Hour From 07:30 AM to 08:45 AM - Peak 1 of 1 |                                  |       |       |      |            |            |      |       |      |            |                                  |      |       |      |            |                      |      |       |      |            |            |
| Intersection                                      | 07:30 AM                         |       |       |      |            |            |      |       |      |            |                                  |      |       |      |            |                      |      |       |      |            |            |
| Volume  | 0                                | 371   | 0     | 0    | 371        | 0          | 0    | 0     | 0    | 0          | 12                               | 170  | 0     | 0    | 182        | 6                    | 0    | 28    | 0    | 34         | 587        |
| Percent   | 0.0                              | 100.0 | 0.0   | 0.0  |            | 0.0        | 0.0  | 0.0   | 0.0  |            | 6.6                              | 93.4 | 0.0   | 0.0  |            | 17.6                 | 0.0  | 82.4  | 0.0  |            |            |
| 08:00 Volume                                      | 0                                | 110   | 0     | 0    | 110        | 0          | 0    | 0     | 0    | 0          | 2                                | 43   | 0     | 0    | 45         | 0                    | 0    | 5     | 0    | 5          | 160        |
| Peak Factor                                       | 0.917                            |       |       |      |            |            |      |       |      |            |                                  |      |       |      |            |                      |      |       |      |            |            |
| High Int. Volume                                  | 08:00 AM                         |       |       |      |            | 7:15:00 AM |      |       |      |            | 07:45 AM                         |      |       |      |            | 07:30 AM             |      |       |      |            |            |
| Peak Factor                                       | 0.84                             |       |       |      |            |            |      |       |      |            | 0.89                             |      |       |      |            | 0.77                 |      |       |      |            |            |
| Factor  | 3                                |       |       |      |            |            |      |       |      |            | 2                                |      |       |      |            | 3                    |      |       |      |            |            |



| Start Time  | Campbell Station Road Southbound |      |       |      |            | Westbound |      |       |      |            | Campbell Station Road Northbound |      |       |      |            | Fretz Road Eastbound |      |       |      |            | Int. Total |
|---|----------------------------------|------|-------|------|------------|-----------|------|-------|------|------------|----------------------------------|------|-------|------|------------|----------------------|------|-------|------|------------|------------|
|   | Left                             | Thru | Right | Peds | App. Total | Left      | Thru | Right | Peds | App. Total | Left                             | Thru | Right | Peds | App. Total | Left                 | Thru | Right | Peds | App. Total |            |
| Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1 |                                  |      |       |      |            |           |      |       |      |            |                                  |      |       |      |            |                      |      |       |      |            |            |
| Intersection                                      | 04:45 PM                         |      |       |      |            |           |      |       |      |            |                                  |      |       |      |            |                      |      |       |      |            |            |
| Volume  | 0                                | 412  | 6     | 0    | 418        | 0         | 0    | 0     | 0    | 0          | 23                               | 329  | 0     | 0    | 352        | 2                    | 0    | 20    | 0    | 22         | 792        |
| Percent   | 0.0                              | 98.6 | 1.4   | 0.0  |            | 0.0       | 0.0  | 0.0   | 0.0  |            | 6.5                              | 93.5 | 0.0   | 0.0  |            | 9.1                  | 0.0  | 90.9  | 0.0  |            |            |
| 05:30 Volume                                      | 0                                | 111  | 1     | 0    | 112        | 0         | 0    | 0     | 0    | 0          | 8                                | 86   | 0     | 0    | 94         | 0                    | 0    | 7     | 0    | 7          | 213        |
| Peak Factor                                       | 0.930                            |      |       |      |            |           |      |       |      |            |                                  |      |       |      |            |                      |      |       |      |            |            |
| High Int. Volume                                  | 04:45 PM                         |      |       |      |            | 05:15 PM  |      |       |      |            | 05:15 PM                         |      |       |      |            |                      |      |       |      |            |            |
| Peak Factor                                       | 0                                | 113  | 1     | 0    | 114        | 0         | 0    | 0     | 0    | 0          | 6                                | 96   | 0     | 0    | 102        | 1                    | 0    | 8     | 0    | 9          | 0.917      |
|   |                                  |      |       |      |            |           |      |       |      |            | 0.863                            |      |       |      |            | 0.611                |      |       |      |            |            |



**APPENDIX B – TRIP GENERATION**

# Land Use: 210

## Single-Family Detached Housing

### Description

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

### Additional Data

The number of vehicles and residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it was usually readily available, easy to project, and had a high correlation with average weekday vehicle trip ends.

This land use included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Single-family detached units had the highest trip generation rate per dwelling unit of all residential uses because they were the largest units in size and had more residents and more vehicles per unit than other residential land uses; they were generally located farther away from shopping centers, employment areas, and other trip attractors than other residential land uses; and they generally had fewer alternative modes of transportation available because they were typically not as concentrated as other residential land uses.

Time-of-day distribution data for this land use are presented in Appendix A. For the six general urban/suburban sites with 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 4:00 and 5:00 p.m., respectively. For the two sites with Saturday data, the overall highest vehicle volume was counted between 3:00 and 4:00 p.m. For the one site with Sunday data, the overall highest vehicle volume was counted between 10:15 and 11:15 a.m.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in California, Connecticut, Delaware, Illinois, Indiana, Maryland, Minnesota, Montana, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Vermont, and Virginia.

### Source Numbers

100, 105, 114, 126, 157, 167, 177, 197, 207, 211, 217, 267, 275, 293, 300, 319, 320, 356, 357, 367, 384, 387, 407, 435, 522, 550, 552, 579, 598, 601, 603, 614, 637, 711, 716, 720, 728, 735, 868, 903, 925, 936



## Single-Family Detached Housing (210)

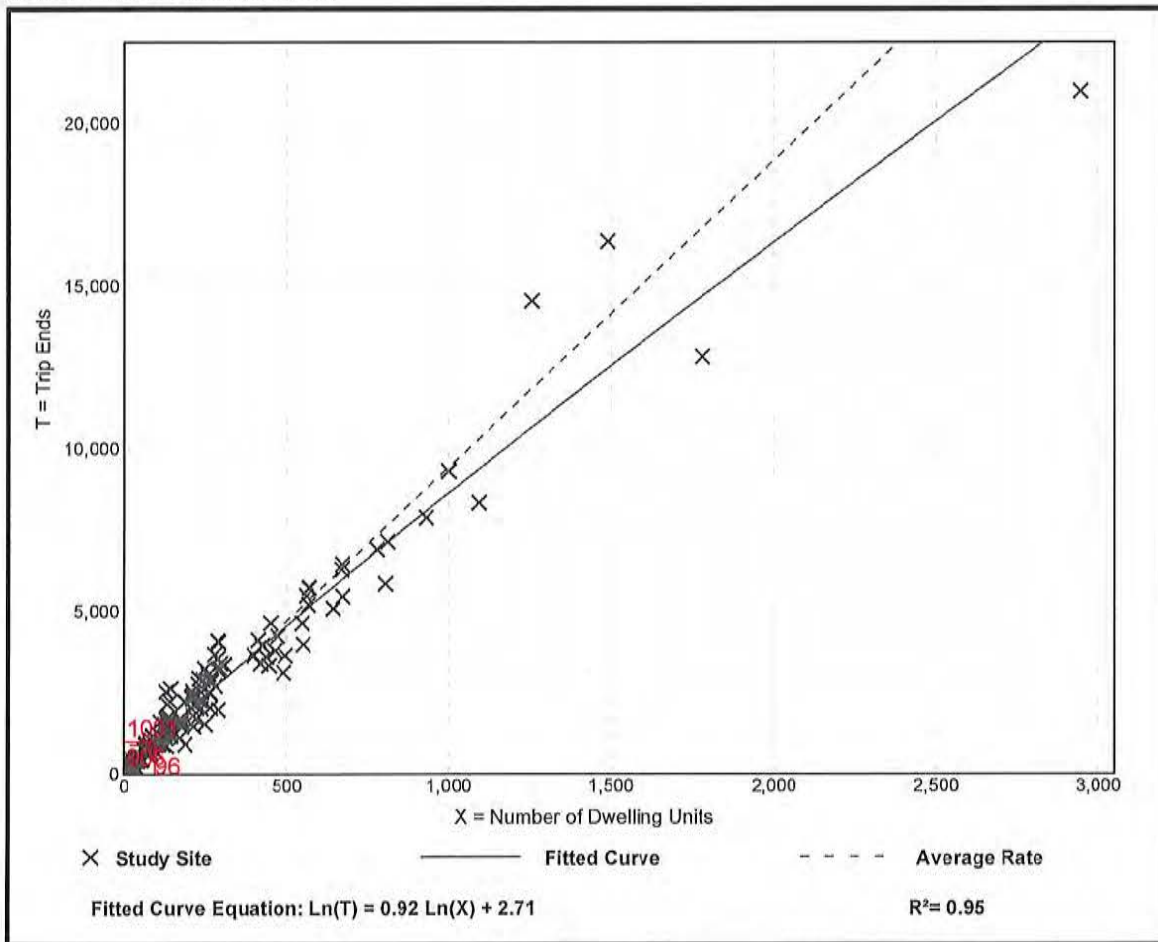
Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Setting/Location: General Urban/Suburban  
Number of Studies: 159  
Avg. Num. of Dwelling Units: 264  
Directional Distribution: 50% entering, 50% exiting

### Vehicle Trip Generation per Dwelling Unit

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 9.44         | 4.81 - 19.39   | 2.10               |

### Data Plot and Equation



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

Trips = 1001 for 96 units

## Single-Family Detached Housing (210)

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

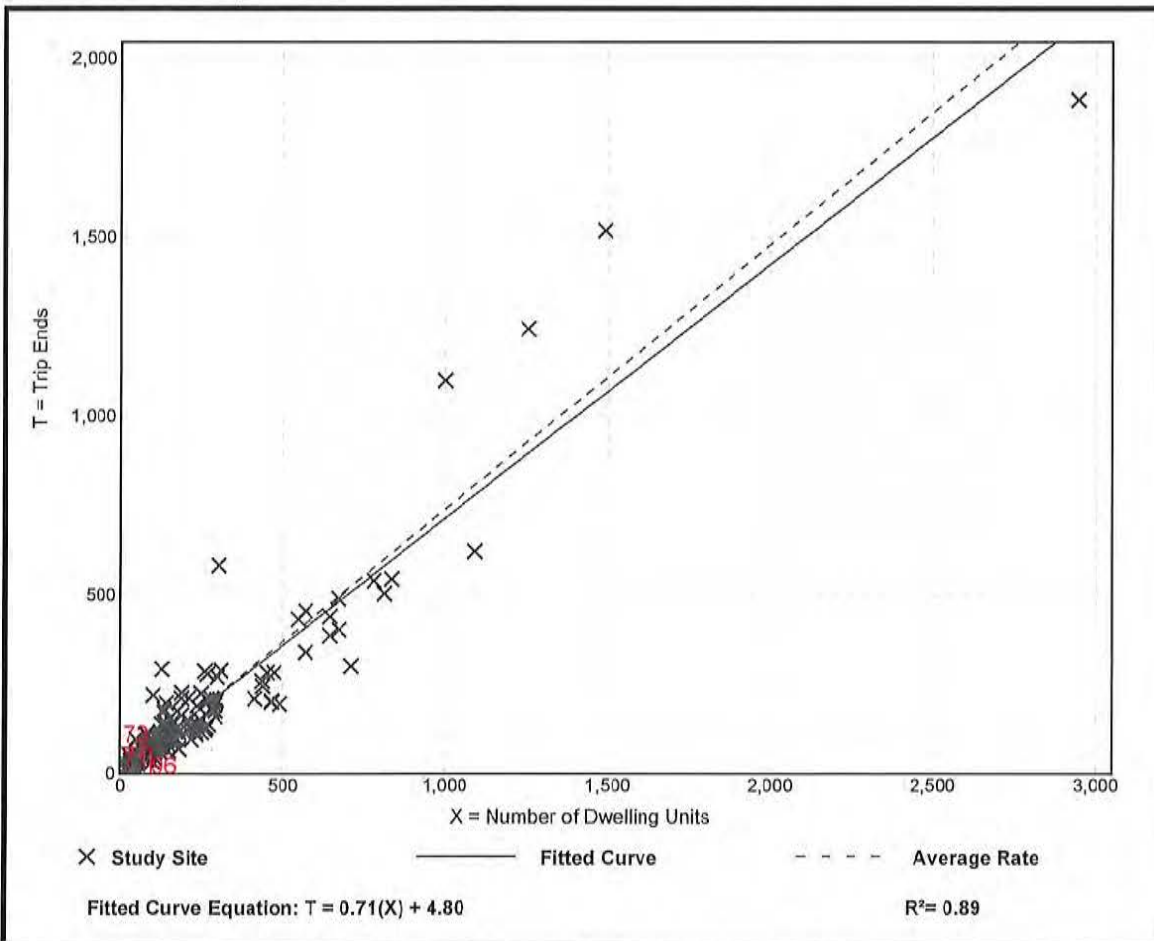
**Setting/Location: General Urban/Suburban**

Number of Studies: 173  
 Avg. Num. of Dwelling Units: 219  
 Directional Distribution: 25% entering, 75% exiting

### Vehicle Trip Generation per Dwelling Unit

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.74         | 0.33 - 2.27    | 0.27               |

### Data Plot and Equation



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

Trips = 73 for 96 units

## Single-Family Detached Housing (210)

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

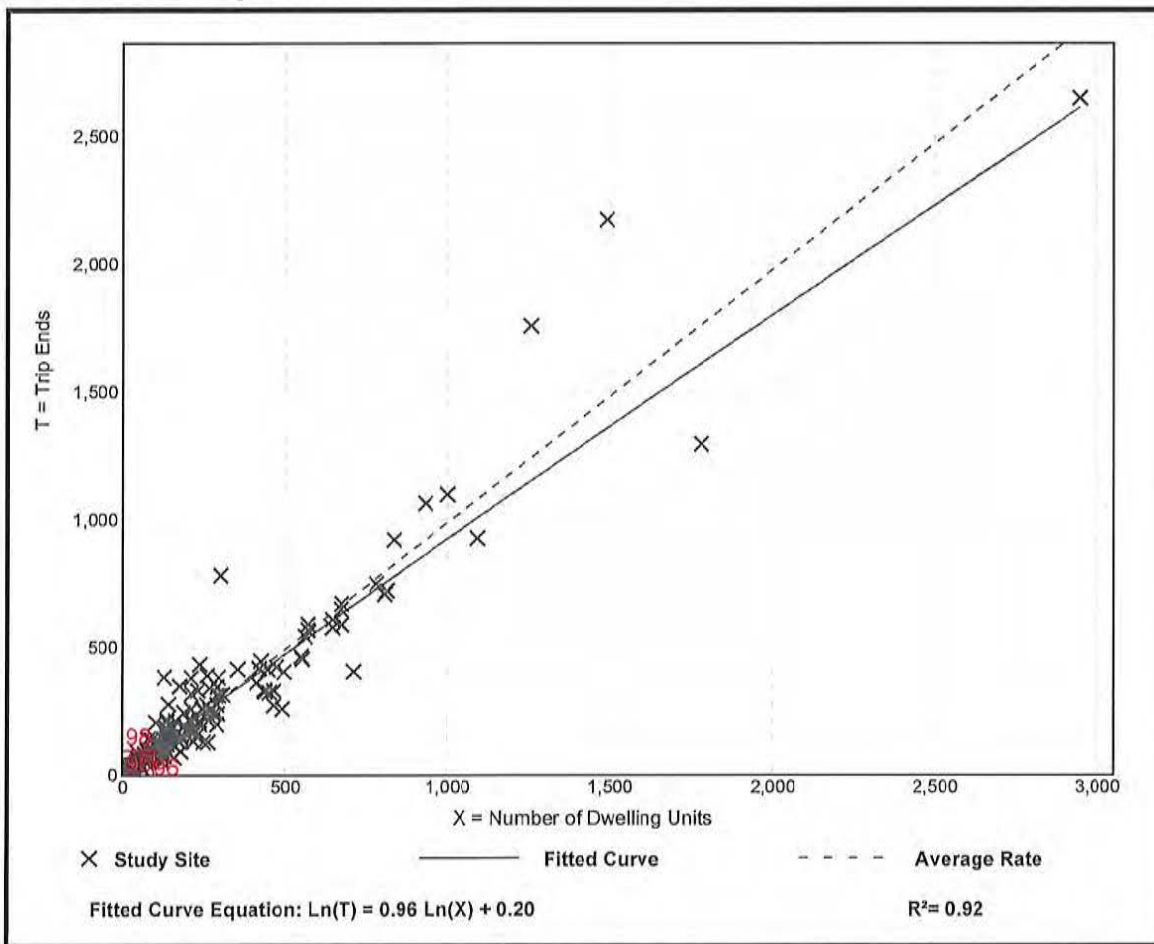
**Setting/Location: General Urban/Suburban**

Number of Studies: 190  
 Avg. Num. of Dwelling Units: 242  
 Directional Distribution: 63% entering, 37% exiting

### Vehicle Trip Generation per Dwelling Unit

| Average Rate | Range of Rates | Standard Deviation |
|--------------|----------------|--------------------|
| 0.99         | 0.44 - 2.98    | 0.31               |

### Data Plot and Equation



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

Trips = 98 for 96 units

**APPENDIX C - ANALYSES**



## CAPACITY AND LEVEL-OF-SERVICE CONCEPTS

In a general sense, a roadway is similar to a pipeline or other material carrying conduit in that it has a certain capacity for the amount of material (vehicles) that it can efficiently carry. As the number of vehicles in a given time period gradually increases, the quality of traffic flow gradually decreases. On roadway sections this results in increasing turbulence in the traffic stream, and at intersections it results in increasing stops and delay. As the volumes begin to approach the capacity of the facility, these problems rapidly magnify, with resulting serious levels of congestion, stops, delay, excess fuel consumption, pollutant emissions, etc.

The Transportation Research Board has published the Year 2010 Highway Capacity Manual (HCM2010), which establishes theoretical techniques to quantify the capacity conditions on all types of roadways, intersections, ramps, pedestrian facilities, etc. A basic concept that is applicable to most of these techniques is the idea of level of service (LOS). This concept establishes a rating system that quantifies the quality of traffic flow, as perceived by motorists and/or passengers. The general system is similar to a school grade scale, and is outlined as follows:

| Level of Service (LOS) | General Quality of Traffic Flow | Description of Corresponding Conditions   |
|------------------------|---------------------------------|---|
| A                      | Excellent                       | Roadways – Free flow, high maneuverability<br>Intersections – Very few stops, very low delay  |
| B                      | Very Good                       | Roadways – Free flow, slightly lower maneuverability<br>Intersections – Minor stops, low delay  |
| C                      | Good                            | Roadways – Stable flow, restricted maneuverability<br>Intersections – Significant stops, significant delay  |
| D                      | Fair                            | Roadways – Marginally stable flow, congestion seriously restricts maneuverability<br>Intersections – High stops, long but tolerable delay   |
| E                      | Poor                            | Roadways – Unstable flow*, lower operating speeds, congestion severely restricts maneuverability<br>Intersections – All vehicles stop, very long queues and very long intolerable delay     |
| F                      | Very Poor                       | Roadways – Forced flow, stoppages may be lengthy, congestion severely restricts maneuverability<br>Intersections – All vehicles stop, extensive queues and extremely long intolerable delay |

\*Unstable flow is such that minor fluctuations or disruptions can result in rapid degradation to LOS F.



LOS CRITERIA: SIGNALIZED & UNSIGNALIZED INTERSECTIONS

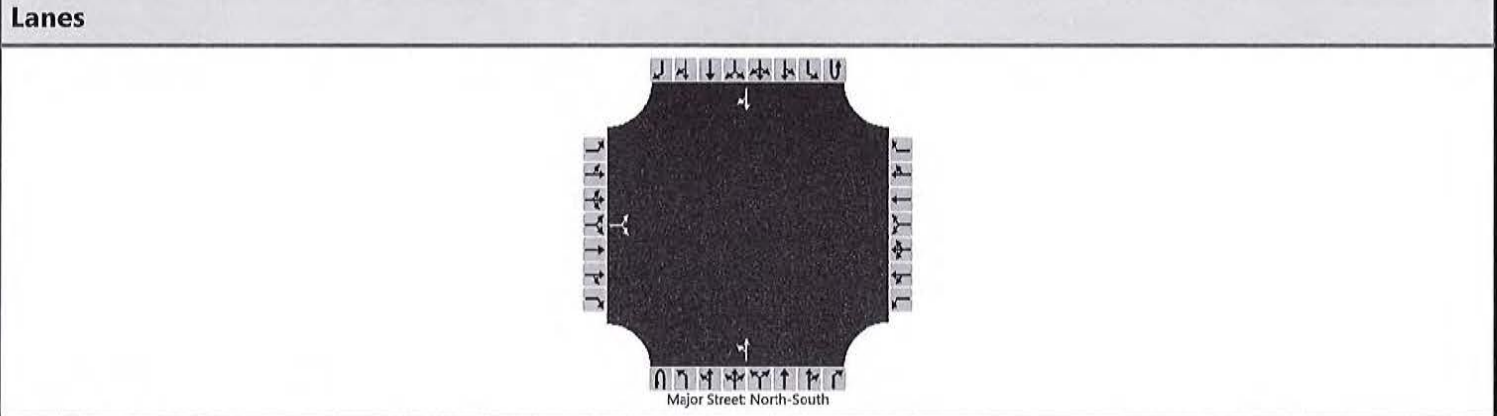
| LOS | CONTROL DELAY (S/VEH) |              |             |
|-----|-----------------------|--------------|-------------|
|     | SIGNALIZED            | UNSIGNALIZED | ROUNDBABOUT |
| A   | ≤10                   | ≤10          | ≤10         |
| B   | >10-20                | >10-15       | >10-15      |
| C   | >20-35                | >15-25       | >15-25      |
| D   | >35-55                | >25-35       | >25-35      |
| E   | >55-80                | >35-50       | >35-50      |
| F   | >80                   | >50          | >50         |

Another measure of intersection capacity that is often used in the evaluation of intersection operations is the volume to capacity (V/C) ratio. This ratio is defined as “the ratio of flow rate to capacity”, and is a good measure of how much of an intersection’s available capacity has been used up by the analysis volumes. Conversely, it also provides an indication of the reserve capacity available for future growth in traffic volumes.

The Intersection Capacity Utilization (ICU) is another measure that expresses a value similar to the V/C ratio. Specifically, the ICU method “sums the amount of the time required to serve all movements at saturation for a given cycle length and divides by that reference cycle length.” The ICU is considered a more accurate measure of volume to capacity conditions for a signalized intersection, primarily because it accounts for the effects of the signal timing on intersection capacity.

# HCS7 Two-Way Stop-Control Report

| General Information      |                          |  |  | Site Information           |                       |  |  |
|--------------------------|--------------------------|--|--|----------------------------|-----------------------|--|--|
| Analyst                  | ALC                      |  |  | Intersection               | CSR @ Fretz Rd.       |  |  |
| Agency/Co.               | CCI                      |  |  | Jurisdiction               | Town of Farragut      |  |  |
| Date Performed           | 10/22/2018               |  |  | East/West Street           | Fretz Road            |  |  |
| Analysis Year            | 2018                     |  |  | North/South Street         | Campbell Station Road |  |  |
| Time Analyzed            | AM Peak Existing         |  |  | Peak Hour Factor           | 0.92                  |  |  |
| Intersection Orientation | North-South              |  |  | Analysis Time Period (hrs) | 0.25                  |  |  |
| Project Description      | October Park Subdivision |  |  |                            |                       |  |  |



**Vehicle Volumes and Adjustments**

| Approach                   | Eastbound |    |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |
|----------------------------|-----------|----|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|
|                            | U         | L  | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |
| Movement                   |           |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Priority                   |           | 10 | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |
| Number of Lanes            |           | 0  | 1  | 0  |           | 0 | 0 | 0 | 0          | 0  | 1   | 0 | 0          | 0 | 1   | 0  |
| Configuration              |           |    | LR |    |           |   |   |   |            | LT |     |   |            |   |     | TR |
| Volume (veh/h)             |           | 6  |    | 29 |           |   |   |   |            | 12 | 175 |   |            |   | 382 | 0  |
| Percent Heavy Vehicles (%) |           | 3  |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |
| Proportion Time Blocked    |           |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Percent Grade (%)          |           | 4  |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Right Turn Channelized     |           |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Median Type   Storage      | Undivided |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |

**Critical and Follow-up Headways**

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |

**Delay, Queue Length, and Level of Service**

|   |      |  |      |  |  |  |  |  |     |      |  |  |  |  |  |  |
|---|------|--|------|--|--|--|--|--|-----|------|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |      |  | 38   |  |  |  |  |  |     | 13   |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |      |  | 550  |  |  |  |  |  |     | 1137 |  |  |  |  |  |  |
| v/c Ratio                               |      |  | 0.07 |  |  |  |  |  |     | 0.01 |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |      |  | 0.2  |  |  |  |  |  |     | 0.0  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |      |  | 12.0 |  |  |  |  |  |     | 8.2  |  |  |  |  |  |  |
| Level of Service (LOS)                  |      |  | B    |  |  |  |  |  |     | A    |  |  |  |  |  |  |
| Approach Delay (s/veh)                  | 12.0 |  |      |  |  |  |  |  | 0.6 |      |  |  |  |  |  |  |
| Approach LOS                            | B    |  |      |  |  |  |  |  |     |      |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

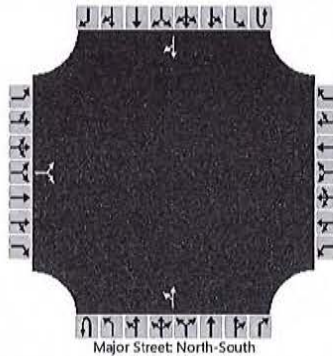
## General Information

|                          |                          |
|--------------------------|--------------------------|
| Analyst                  | ALC                      |
| Agency/Co.               | CCI                      |
| Date Performed           | 11/22/2018               |
| Analysis Year            | 2018                     |
| Time Analyzed            | PM Peak Existing         |
| Intersection Orientation | North-South              |
| Project Description      | October Park Subdivision |

## Site Information

|                            |                       |
|----------------------------|-----------------------|
| Intersection               | CSR @ Fretz Rd.       |
| Jurisdiction               | Town of Farragut      |
| East/West Street           | Fretz Road            |
| North/South Street         | Campbell Station Road |
| Peak Hour Factor           | 0.93                  |
| Analysis Time Period (hrs) | 0.25                  |

## Lanes



## Vehicle Volumes and Adjustments

| Approach                   | Eastbound |    |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |
|----------------------------|-----------|----|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|
|                            | U         | L  | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |
| Movement                   |           |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Priority                   |           | 10 | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |
| Number of Lanes            |           | 0  | 1  | 0  |           | 0 | 0 | 0 | 0          | 0  | 1   | 0 | 0          | 0 | 1   | 0  |
| Configuration              |           |    | LR |    |           |   |   |   |            | LT |     |   |            |   |     | TR |
| Volume (veh/h)             |           | 2  |    | 21 |           |   |   |   |            | 24 | 339 |   |            |   | 424 | 6  |
| Percent Heavy Vehicles (%) |           | 3  |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |
| Proportion Time Blocked    |           |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Percent Grade (%)          |           | 4  |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Right Turn Channelized     |           |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |
| Median Type   Storage      | Undivided |    |    |    |           |   |   |   |            |    |     |   |            |   |     |    |

## Critical and Follow-up Headways

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |

## Delay, Queue Length, and Level of Service

|   |      |  |      |  |  |  |  |  |     |      |  |  |  |  |  |  |
|---|------|--|------|--|--|--|--|--|-----|------|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |      |  | 25   |  |  |  |  |  |     | 26   |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |      |  | 515  |  |  |  |  |  |     | 1092 |  |  |  |  |  |  |
| v/c Ratio                               |      |  | 0.05 |  |  |  |  |  |     | 0.02 |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |      |  | 0.2  |  |  |  |  |  |     | 0.1  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |      |  | 12.3 |  |  |  |  |  |     | 8.4  |  |  |  |  |  |  |
| Level of Service (LOS)                  |      |  | B    |  |  |  |  |  |     | A    |  |  |  |  |  |  |
| Approach Delay (s/veh)                  | 12.3 |  |      |  |  |  |  |  | 0.8 |      |  |  |  |  |  |  |
| Approach LOS                            | B    |  |      |  |  |  |  |  |     |      |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

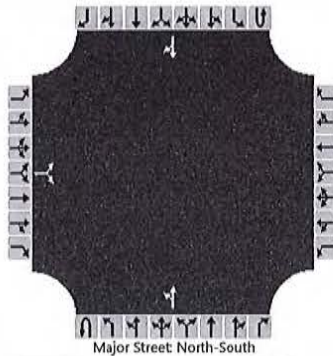
## General Information

|                          |                          |
|--------------------------|--------------------------|
| Analyst                  | ALC                      |
| Agency/Co.               | CCI                      |
| Date Performed           | 10/22/2018               |
| Analysis Year            | 2021                     |
| Time Analyzed            | AM Peak Background       |
| Intersection Orientation | North-South              |
| Project Description      | October Park Subdivision |

## Site Information

|                            |                       |
|----------------------------|-----------------------|
| Intersection               | CSR @ Fretz Rd.       |
| Jurisdiction               | Town of Farragut      |
| East/West Street           | Fretz Road            |
| North/South Street         | Campbell Station Road |
| Peak Hour Factor           | 0.92                  |
| Analysis Time Period (hrs) | 0.25                  |

## Lanes



## Vehicle Volumes and Adjustments

| Approach                   | Eastbound |           |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |  |
|----------------------------|-----------|-----------|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|--|
|                            | U         | L         | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |  |
| Movement                   |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Priority                   |           | 10        | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |  |
| Number of Lanes            |           | 0         | 1  | 0  |           | 0 | 0 | 0 | 0          | 0  | 1   | 0 | 0          | 0 | 1   | 0  |  |
| Configuration              |           |           | LR |    |           |   |   |   |            | LT |     |   |            |   |     | TR |  |
| Volume (veh/h)             |           | 7         |    | 32 |           |   |   |   |            | 13 | 191 |   |            |   | 417 | 0  |  |
| Percent Heavy Vehicles (%) |           | 3         |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |  |
| Proportion Time Blocked    |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Percent Grade (%)          |           | 4         |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Right Turn Channelized     |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Median Type   Storage      |           | Undivided |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |

## Critical and Follow-up Headways

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |  |

## Delay, Queue Length, and Level of Service

|   |  |      |      |  |  |  |  |  |  |      |  |  |  |  |  |  |  |
|---|--|------|------|--|--|--|--|--|--|------|--|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |  |      | 42   |  |  |  |  |  |  | 14   |  |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |  |      | 514  |  |  |  |  |  |  | 1101 |  |  |  |  |  |  |  |
| v/c Ratio                               |  |      | 0.08 |  |  |  |  |  |  | 0.01 |  |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |  |      | 0.3  |  |  |  |  |  |  | 0.0  |  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |  |      | 12.6 |  |  |  |  |  |  | 8.3  |  |  |  |  |  |  |  |
| Level of Service (LOS)                  |  |      | B    |  |  |  |  |  |  | A    |  |  |  |  |  |  |  |
| Approach Delay (s/veh)                  |  | 12.6 |      |  |  |  |  |  |  | 0.6  |  |  |  |  |  |  |  |
| Approach LOS                            |  | B    |      |  |  |  |  |  |  |      |  |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

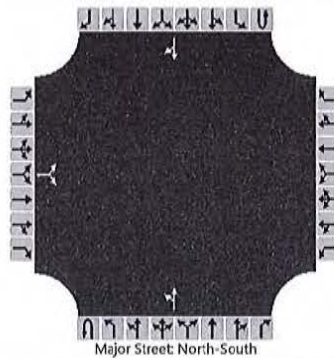
## General Information

|                          |                          |
|--------------------------|--------------------------|
| Analyst                  | ALC                      |
| Agency/Co.               | CCI                      |
| Date Performed           | 11/22/2018               |
| Analysis Year            | 2021                     |
| Time Analyzed            | PM Peak Background       |
| Intersection Orientation | North-South              |
| Project Description      | October Park Subdivision |

## Site Information

|                            |                       |
|----------------------------|-----------------------|
| Intersection               | CSR @ Fretz Rd.       |
| Jurisdiction               | Town of Farragut      |
| East/West Street           | Fretz Road            |
| North/South Street         | Campbell Station Road |
| Peak Hour Factor           | 0.93                  |
| Analysis Time Period (hrs) | 0.25                  |

## Lanes



## Vehicle Volumes and Adjustments

| Approach                   | Eastbound |           |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |  |
|----------------------------|-----------|-----------|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|--|
|                            | U         | L         | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |  |
| Movement                   |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Priority                   |           | 10        | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |  |
| Number of Lanes            |           | 0         | 1  | 0  |           | 0 | 0 | 0 |            | 0  | 1   | 0 |            | 0 | 1   | 0  |  |
| Configuration              |           |           | LR |    |           |   |   |   |            | LT |     |   |            |   |     | TR |  |
| Volume (veh/h)             |           | 2         |    | 23 |           |   |   |   |            | 26 | 370 |   |            |   | 463 | 7  |  |
| Percent Heavy Vehicles (%) |           | 3         |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |  |
| Proportion Time Blocked    |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Percent Grade (%)          |           | 4         |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Right Turn Channelized     |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Median Type   Storage      |           | Undivided |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |

## Critical and Follow-up Headways

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |

## Delay, Queue Length, and Level of Service

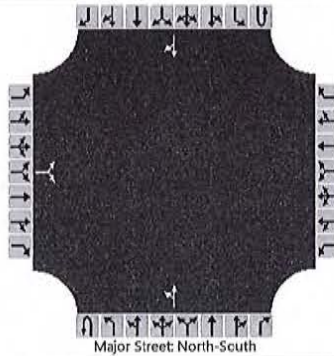
|   |  |      |      |  |  |  |  |  |  |      |     |  |  |  |  |  |  |  |
|---|--|------|------|--|--|--|--|--|--|------|-----|--|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |  |      | 27   |  |  |  |  |  |  | 28   |     |  |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |  |      | 483  |  |  |  |  |  |  | 1053 |     |  |  |  |  |  |  |  |
| v/c Ratio                               |  |      | 0.06 |  |  |  |  |  |  | 0.03 |     |  |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |  |      | 0.2  |  |  |  |  |  |  | 0.1  |     |  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |  |      | 12.9 |  |  |  |  |  |  | 8.5  |     |  |  |  |  |  |  |  |
| Level of Service (LOS)                  |  |      | B    |  |  |  |  |  |  | A    |     |  |  |  |  |  |  |  |
| Approach Delay (s/veh)                  |  | 12.9 |      |  |  |  |  |  |  |      | 0.8 |  |  |  |  |  |  |  |
| Approach LOS                            |  | B    |      |  |  |  |  |  |  |      |     |  |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

| General Information      |                          |  |  | Site Information           |                       |  |  |
|--------------------------|--------------------------|--|--|----------------------------|-----------------------|--|--|
| Analyst                  | ALC                      |  |  | Intersection               | CSR @ Fretz Rd.       |  |  |
| Agency/Co.               | CCI                      |  |  | Jurisdiction               | Town of Farragut      |  |  |
| Date Performed           | 10/22/2018               |  |  | East/West Street           | Fretz Road            |  |  |
| Analysis Year            | 2021                     |  |  | North/South Street         | Campbell Station Road |  |  |
| Time Analyzed            | AM Peak Combined         |  |  | Peak Hour Factor           | 0.92                  |  |  |
| Intersection Orientation | North-South              |  |  | Analysis Time Period (hrs) | 0.25                  |  |  |
| Project Description      | October Park Subdivision |  |  |                            |                       |  |  |

## Lanes



## Vehicle Volumes and Adjustments

| Approach                   | Eastbound |           |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |  |
|----------------------------|-----------|-----------|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|--|
|                            | U         | L         | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |  |
| Movement                   |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Priority                   |           | 10        | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |  |
| Number of Lanes            |           | 0         | 1  | 0  |           | 0 | 0 | 0 | 0          | 0  | 1   | 0 | 0          | 0 | 1   | 0  |  |
| Configuration              |           |           | LR |    |           |   |   |   |            | LT |     |   |            |   |     | TR |  |
| Volume (veh/h)             |           | 18        |    | 76 |           |   |   |   |            | 30 | 191 |   |            |   | 417 | 1  |  |
| Percent Heavy Vehicles (%) |           | 3         |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |  |
| Proportion Time Blocked    |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Percent Grade (%)          |           | 4         |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Right Turn Channelized     |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Median Type   Storage      |           | Undivided |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |

## Critical and Follow-up Headways

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |

## Delay, Queue Length, and Level of Service

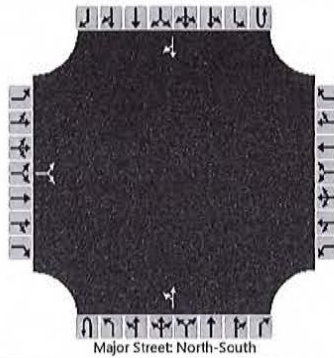
|   |  |      |      |  |  |  |  |  |  |      |  |  |  |  |  |  |
|---|--|------|------|--|--|--|--|--|--|------|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |  |      | 102  |  |  |  |  |  |  | 33   |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |  |      | 499  |  |  |  |  |  |  | 1100 |  |  |  |  |  |  |
| v/c Ratio                               |  |      | 0.20 |  |  |  |  |  |  | 0.03 |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |  |      | 0.8  |  |  |  |  |  |  | 0.1  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |  |      | 14.1 |  |  |  |  |  |  | 8.4  |  |  |  |  |  |  |
| Level of Service (LOS)                  |  |      | B    |  |  |  |  |  |  | A    |  |  |  |  |  |  |
| Approach Delay (s/veh)                  |  | 14.1 |      |  |  |  |  |  |  | 1.4  |  |  |  |  |  |  |
| Approach LOS                            |  | B    |      |  |  |  |  |  |  | A    |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

| General Information      |                          |  |  | Site Information           |                       |  |  |
|--------------------------|--------------------------|--|--|----------------------------|-----------------------|--|--|
| Analyst                  | ALC                      |  |  | Intersection               | CSR @ Fretz Rd.       |  |  |
| Agency/Co.               | CCI                      |  |  | Jurisdiction               | Town of Farragut      |  |  |
| Date Performed           | 11/22/2018               |  |  | East/West Street           | Fretz Road            |  |  |
| Analysis Year            | 2021                     |  |  | North/South Street         | Campbell Station Road |  |  |
| Time Analyzed            | PM Peak Combined         |  |  | Peak Hour Factor           | 0.93                  |  |  |
| Intersection Orientation | North-South              |  |  | Analysis Time Period (hrs) | 0.25                  |  |  |
| Project Description      | October Park Subdivision |  |  |                            |                       |  |  |

## Lanes



## Vehicle Volumes and Adjustments

| Approach                   | Eastbound |           |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |  |
|----------------------------|-----------|-----------|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|--|
|                            | U         | L         | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |  |
| Movement                   |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Priority                   |           | 10        | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |  |
| Number of Lanes            |           | 0         | 1  | 0  |           | 0 | 0 | 0 | 0          | 0  | 1   | 0 | 0          | 0 | 1   | 0  |  |
| Configuration              |           |           | LR |    |           |   |   |   |            | LT |     |   |            |   |     | TR |  |
| Volume (veh/h)             |           | 6         |    | 55 |           |   |   |   |            | 76 | 370 |   |            |   | 463 | 19 |  |
| Percent Heavy Vehicles (%) |           | 3         |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |  |
| Proportion Time Blocked    |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Percent Grade (%)          |           | 4         |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Right Turn Channelized     |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Median Type   Storage      |           | Undivided |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |

## Critical and Follow-up Headways

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |

## Delay, Queue Length, and Level of Service

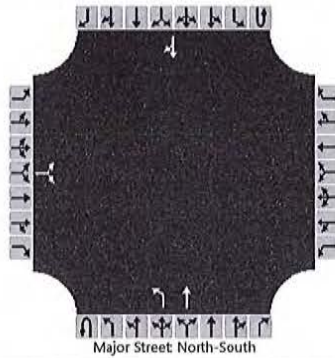
|   |  |      |      |  |  |  |  |  |  |      |     |  |  |  |  |  |  |  |
|---|--|------|------|--|--|--|--|--|--|------|-----|--|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |  |      | 66   |  |  |  |  |  |  | 82   |     |  |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |  |      | 444  |  |  |  |  |  |  | 1041 |     |  |  |  |  |  |  |  |
| v/c Ratio                               |  |      | 0.15 |  |  |  |  |  |  | 0.08 |     |  |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |  |      | 0.5  |  |  |  |  |  |  | 0.3  |     |  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |  |      | 14.5 |  |  |  |  |  |  | 8.8  |     |  |  |  |  |  |  |  |
| Level of Service (LOS)                  |  |      | B    |  |  |  |  |  |  | A    |     |  |  |  |  |  |  |  |
| Approach Delay (s/veh)                  |  | 14.5 |      |  |  |  |  |  |  |      | 2.2 |  |  |  |  |  |  |  |
| Approach LOS                            |  | B    |      |  |  |  |  |  |  |      |     |  |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

| General Information      |                                       |  |  | Site Information           |                       |  |  |
|--------------------------|---------------------------------------|--|--|----------------------------|-----------------------|--|--|
| Analyst                  | ALC                                   |  |  | Intersection               | CSR @ Fretz Rd.       |  |  |
| Agency/Co.               | CCI                                   |  |  | Jurisdiction               | Town of Farragut      |  |  |
| Date Performed           | 10/22/2018                            |  |  | East/West Street           | Fretz Road            |  |  |
| Analysis Year            | 2021                                  |  |  | North/South Street         | Campbell Station Road |  |  |
| Time Analyzed            | AM Peak Combined                      |  |  | Peak Hour Factor           | 0.92                  |  |  |
| Intersection Orientation | North-South                           |  |  | Analysis Time Period (hrs) | 0.25                  |  |  |
| Project Description      | October Park Subdivision w/ NBLT lane |  |  |                            |                       |  |  |

## Lanes



## Vehicle Volumes and Adjustments

| Approach                   | Eastbound |           |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |  |
|----------------------------|-----------|-----------|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|--|
|                            | U         | L         | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |  |
| Movement                   |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Priority                   |           | 10        | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |  |
| Number of Lanes            |           | 0         | 1  | 0  |           | 0 | 0 | 0 | 0          | 1  | 1   | 0 | 0          | 0 | 1   | 0  |  |
| Configuration              |           |           | LR |    |           |   |   |   |            | L  | T   |   |            |   |     | TR |  |
| Volume (veh/h)             |           | 18        |    | 76 |           |   |   |   |            | 30 | 191 |   |            |   | 417 | 1  |  |
| Percent Heavy Vehicles (%) |           | 3         |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |  |
| Proportion Time Blocked    |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Percent Grade (%)          |           | 4         |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Right Turn Channelized     |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Median Type   Storage      |           | Undivided |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |

## Critical and Follow-up Headways

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |  |

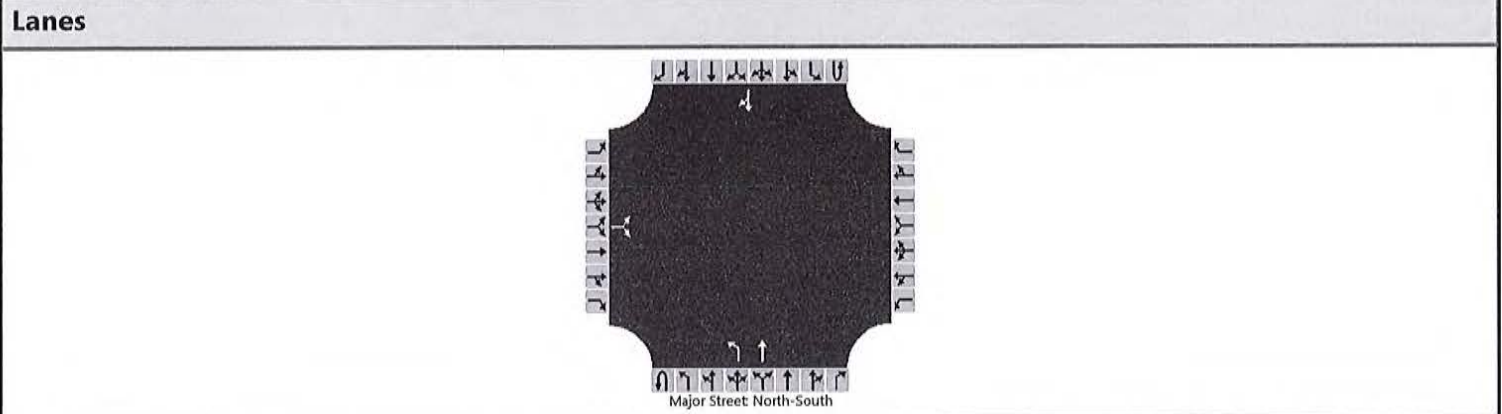
## Delay, Queue Length, and Level of Service

|   |  |      |      |  |  |  |  |  |  |      |  |  |  |  |  |  |  |
|---|--|------|------|--|--|--|--|--|--|------|--|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |  |      | 102  |  |  |  |  |  |  | 33   |  |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |  |      | 499  |  |  |  |  |  |  | 1100 |  |  |  |  |  |  |  |
| v/c Ratio                               |  |      | 0.20 |  |  |  |  |  |  | 0.03 |  |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |  |      | 0.8  |  |  |  |  |  |  | 0.1  |  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |  |      | 14.1 |  |  |  |  |  |  | 8.4  |  |  |  |  |  |  |  |
| Level of Service (LOS)                  |  |      | B    |  |  |  |  |  |  | A    |  |  |  |  |  |  |  |
| Approach Delay (s/veh)                  |  | 14.1 |      |  |  |  |  |  |  | 1.1  |  |  |  |  |  |  |  |
| Approach LOS                            |  | B    |      |  |  |  |  |  |  | A    |  |  |  |  |  |  |  |



# HCS7 Two-Way Stop-Control Report

| General Information      |                                       |  |  | Site Information           |                       |  |  |
|--------------------------|---------------------------------------|--|--|----------------------------|-----------------------|--|--|
| Analyst                  | ALC                                   |  |  | Intersection               | CSR @ Fretz Rd.       |  |  |
| Agency/Co.               | CCI                                   |  |  | Jurisdiction               | Town of Farragut      |  |  |
| Date Performed           | 11/22/2018                            |  |  | East/West Street           | Fretz Road            |  |  |
| Analysis Year            | 2021                                  |  |  | North/South Street         | Campbell Station Road |  |  |
| Time Analyzed            | PM Peak Combined                      |  |  | Peak Hour Factor           | 0.93                  |  |  |
| Intersection Orientation | North-South                           |  |  | Analysis Time Period (hrs) | 0.25                  |  |  |
| Project Description      | October Park Subdivision w/ NBLT lane |  |  |                            |                       |  |  |



**Vehicle Volumes and Adjustments**

| Approach                   | Eastbound |           |    |    | Westbound |   |   |   | Northbound |    |     |   | Southbound |   |     |    |  |
|----------------------------|-----------|-----------|----|----|-----------|---|---|---|------------|----|-----|---|------------|---|-----|----|--|
|                            | U         | L         | T  | R  | U         | L | T | R | U          | L  | T   | R | U          | L | T   | R  |  |
| Movement                   |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Priority                   |           | 10        | 11 | 12 |           | 7 | 8 | 9 | 1U         | 1  | 2   | 3 | 4U         | 4 | 5   | 6  |  |
| Number of Lanes            |           | 0         | 1  | 0  |           | 0 | 0 | 0 | 0          | 1  | 1   | 0 | 0          | 0 | 1   | 0  |  |
| Configuration              |           |           | LR |    |           |   |   |   |            | L  | T   |   |            |   |     | TR |  |
| Volume (veh/h)             |           | 6         |    | 55 |           |   |   |   |            | 76 | 370 |   |            |   | 463 | 19 |  |
| Percent Heavy Vehicles (%) |           | 3         |    | 3  |           |   |   |   |            | 3  |     |   |            |   |     |    |  |
| Proportion Time Blocked    |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Percent Grade (%)          |           | 4         |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Right Turn Channelized     |           |           |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |
| Median Type   Storage      |           | Undivided |    |    |           |   |   |   |            |    |     |   |            |   |     |    |  |

**Critical and Follow-up Headways**

|                              |  |      |  |      |  |  |  |  |  |      |  |  |  |  |  |  |  |
|------------------------------|--|------|--|------|--|--|--|--|--|------|--|--|--|--|--|--|--|
| Base Critical Headway (sec)  |  | 7.1  |  | 6.2  |  |  |  |  |  | 4.1  |  |  |  |  |  |  |  |
| Critical Headway (sec)       |  | 7.23 |  | 6.63 |  |  |  |  |  | 4.13 |  |  |  |  |  |  |  |
| Base Follow-Up Headway (sec) |  | 3.5  |  | 3.3  |  |  |  |  |  | 2.2  |  |  |  |  |  |  |  |
| Follow-Up Headway (sec)      |  | 3.53 |  | 3.33 |  |  |  |  |  | 2.23 |  |  |  |  |  |  |  |

**Delay, Queue Length, and Level of Service**

|   |  |      |      |  |  |  |  |  |  |      |  |  |  |  |  |  |  |
|---|--|------|------|--|--|--|--|--|--|------|--|--|--|--|--|--|--|
| Flow Rate, v (veh/h)                    |  |      | 66   |  |  |  |  |  |  | 82   |  |  |  |  |  |  |  |
| Capacity, c (veh/h)                     |  |      | 444  |  |  |  |  |  |  | 1041 |  |  |  |  |  |  |  |
| v/c Ratio                               |  |      | 0.15 |  |  |  |  |  |  | 0.08 |  |  |  |  |  |  |  |
| 95% Queue Length, Q <sub>95</sub> (veh) |  |      | 0.5  |  |  |  |  |  |  | 0.3  |  |  |  |  |  |  |  |
| Control Delay (s/veh)                   |  |      | 14.5 |  |  |  |  |  |  | 8.8  |  |  |  |  |  |  |  |
| Level of Service (LOS)                  |  |      | B    |  |  |  |  |  |  | A    |  |  |  |  |  |  |  |
| Approach Delay (s/veh)                  |  | 14.5 |      |  |  |  |  |  |  | 1.5  |  |  |  |  |  |  |  |
| Approach LOS                            |  | B    |      |  |  |  |  |  |  | A    |  |  |  |  |  |  |  |

|   |  |
|---|--|
| <b>TABLE 4A</b><br><b>KNOX COUNTY LEFT-TURN LANE VOLUME THRESHOLDS</b><br><b>FOR 2-LANE ROADWAYS WITH A PREVAILING SPEED OF 0 TO 35 MPH</b> | Project No: 01119-0001<br>Project Name: October Park TIS<br>Notes: |
|---|--|

(If the left-turn volume exceeds the table value a left-turn lane is needed)

| OPPOSING<br>VOLUME | THROUGH VOLUME PLUS RIGHT-TURN VOLUME * |           |           |           |           |           |
|--------------------|---|-----------|-----------|-----------|-----------|-----------|
|                    | 100 - 149                               | 150 - 199 | 200 - 249 | 250 - 299 | 300 - 349 | 350 - 399 |
| 100 - 149          | 300                                     | 235       | 185       | 145       | 120       | 100       |
| 150 - 199          | 245                                     | 200       | 160       | 130       | 110       | 90        |
| 200 - 249          | 205                                     | 170       | 140       | 115       | 100       | 80        |
| 250 - 299          | 175                                     | 150       | 125       | 105       | 90        | 70        |
| 300 - 349          | 155                                     | 135       | 110       | 95        | 80        | 65        |
| 350 - 399          | 135                                     | 120       | 100       | 85        | 70        | 60        |
| 400 - 449          | 120                                     | 105*AM*   | 90        | 75        | 65        | 55        |
| 450 - 499          | 105                                     | 90        | 80        | 70        | 60        | 50*PM*    |
| 500 - 549          | 95                                      | 80        | 70        | 65        | 55        | 50        |
| 550 - 599          | 85                                      | 70        | 65        | 60        | 50        | 45        |
| 600 - 649          | 75                                      | 65        | 60        | 55        | 45        | 40        |
| 650 - 699          | 70                                      | 60        | 55        | 50        | 40        | 35        |
| 700 - 749          | 65                                      | 55        | 50        | 45        | 35        | 30        |
| 750 or More        | 60                                      | 50        | 45        | 40        | 35        | 30        |

| OPPOSING<br>VOLUME | THROUGH VOLUME PLUS RIGHT-TURN VOLUME * |           |           |           |           |           |
|--------------------|---|-----------|-----------|-----------|-----------|-----------|
|                    | 350 - 399                               | 400 - 449 | 450 - 499 | 500 - 549 | 550 - 599 | = / > 600 |
| 100 - 149          | 100                                     | 80        | 70        | 60        | 55        | 50        |
| 150 - 199          | 90                                      | 75        | 65        | 55        | 50        | 45        |
| 200 - 249          | 80                                      | 72        | 60        | 55        | 50        | 45        |
| 250 - 299          | 70                                      | 65        | 55        | 50        | 45        | 40        |
| 300 - 349          | 65                                      | 60        | 50        | 50        | 45        | 40        |
| 350 - 399          | 60                                      | 55        | 50        | 45        | 40        | 40        |
| 400 - 449          | 55                                      | 50        | 45        | 45        | 40        | 35        |
| 450 - 499          | 50                                      | 45        | 45        | 40        | 35        | 35        |
| 500 - 549          | 50                                      | 45        | 40        | 40        | 35        | 35        |
| 550 - 599          | 45                                      | 40        | 40        | 35        | 35        | 35        |
| 600 - 649          | 40                                      | 35        | 35        | 35        | 35        | 30        |
| 650 - 699          | 35                                      | 35        | 35        | 30        | 30        | 30        |
| 700 - 749          | 30                                      | 30        | 30        | 30        | 30        | 30        |
| 750 or More        | 30                                      | 30        | 30        | 30        | 30        | 30        |

\* Or through volume only if a right-turn lane exists

| Intersection | Time Period | Opposing Volume | Through Volume | Left-Turn Volume | Warrant Threshold | Left-Turn Lane Warranted (Yes / No) |
|--------------|-------------|-----------------|----------------|------------------|-------------------|-------------------------------------|
| CSR/Fretz    | AM Peak     | 418             | 191            | 30               | 105               | No                                  |
| CSR/Fretz    | PM Peak     | 482             | 370            | 76               | 50                | Yes                                 |
|              |             |                 |                |                  |                   |                                     |
|              |             |                 |                |                  |                   |                                     |

Source: Knox County Department of Engineering and Public Works "Access Control and Driveway Design Policy"



|  |  |
|--|--|
| <b>TABLE 4B</b><br><b>KNOX COUNTY RIGHT-TURN LANE VOLUME THRESHOLDS</b><br><b>FOR 2-LANE ROADWAYS WITH A PREVAILING SPEED OF 0 TO 35 MPH</b> | Project No: 01119-0001<br>Project Name: October Park TIS<br>Notes: |
|--|--|

| RIGHT-TURN<br>VOLUME | THROUGH VOLUME PLUS LEFT-TURN VOLUME * |           |           |           |           |           |
|----------------------|--|-----------|-----------|-----------|-----------|-----------|
|                      | < 100                                  | 100 - 199 | 200 - 249 | 250 - 299 | 300 - 349 | 350 - 399 |
| Fewer Than 25        |  |           |           |           |           |           |
| 25 - 49              |  |           |           |           |           |           |
| 50 - 99              |  |           |           |           |           |           |
| 100 - 149            |  |           |           |           |           |           |
| 150 - 199            |  |           |           |           |           |           |
| 200 - 249            |  |           |           |           |           |           |
| 250 - 299            |  |           |           |           |           | Yes       |
| 300 - 349            |  |           |           |           | Yes       | Yes       |
| 350 - 399            |  |           |           | Yes       | Yes       | Yes       |
| 400 - 449            |  |           | Yes       | Yes       | Yes       | Yes       |
| 450 - 499            |  |           | Yes       | Yes       | Yes       | Yes       |
| 500 - 549            |  | Yes       | Yes       | Yes       | Yes       | Yes       |
| 550 - 599            |  | Yes       | Yes       | Yes       | Yes       | Yes       |
| 600 or More          | Yes                                    | Yes       | Yes       | Yes       | Yes       | Yes       |

| RIGHT-TURN<br>VOLUME | THROUGH VOLUME PLUS LEFT-TURN VOLUME * |             |             |           |           |           |
|----------------------|--|-------------|-------------|-----------|-----------|-----------|
|                      | 350 - 399                              | 400 - 449   | 450 - 499   | 500 - 549 | 550 - 599 | = / > 600 |
| Fewer Than 25        |  | **AM PEAK** | **PM Peak** |           |           |           |
| 25 - 49              |  |             |             |           |           | Yes       |
| 50 - 99              |  |             |             |           | Yes       | Yes       |
| 100 - 149            |  |             |             | Yes       | Yes       | Yes       |
| 150 - 199            |  |             | Yes         | Yes       | Yes       | Yes       |
| 200 - 249            |  | Yes         | Yes         | Yes       | Yes       | Yes       |
| 250 - 299            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 300 - 349            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 350 - 399            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 400 - 449            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 450 - 499            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 500 - 549            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 550 - 599            | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |
| 600 or More          | Yes                                    | Yes         | Yes         | Yes       | Yes       | Yes       |

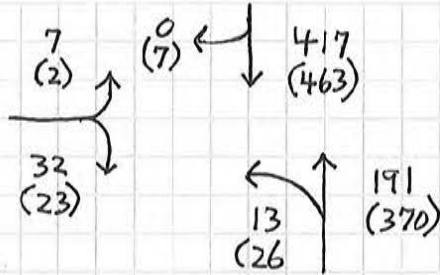
\* Or through volume only if a left-turn lane exists

| Intersection | Time Period | Through Volume | Right-Turn Volume | Right-Turn Lane Warranted (Yes / No) |
|--------------|-------------|----------------|-------------------|--------------------------------------|
| CSR/Fretz    | AM Peak     | 417            | 1                 | No                                   |
| CSR/Fretz    | PM Peak     | 463            | 19                | No                                   |
|              |             |                |                   |                                      |
|              |             |                |                   |                                      |

Source: Knox County Department of Engineering and Public Works "Access Control and Driveway Design Policy"



Background Volumes:  
(From report)



XX - A.M. Peak Volume  
(YY) - P.M. Peak Volume

Per T.I.S. report, after development, there will be 76 NB left-turns in the P.M. Peak. The number to satisfy the Left-turn lane volume threshold is 50. The background year number of LT's is 26, so 24 more are needed to meet threshold. ( $50 - 26 = 24$ )

\*→ Key Question - How many units will generate 24 NB left-turns? \*

- In P.M., per Trip Distribution, 80% of Entering generated trips are NBLT.
- Also, 63% of Total generated trips are entering in P.M. peak.
- Use Fitted Curve equation for Single Family Detached Housing (ITE Code 210): (PM Peak)

$$\ln(T) = 0.96 \ln(X) + 0.20 \quad \leftarrow \text{Find } X \text{ (No. of units)}$$

$$\ln\left(\frac{24}{0.80 \times 0.63}\right) = 0.96 \ln(X) + 0.20$$

$$\ln(X) = 3.8159$$

$$X = 45.4 \quad \leftarrow \text{Units to generate 24 NBLTs}$$

Use 46 units as Left-turn lane trigger



Tarren Barrett &lt;tarren.barrett@knoxmpc.org&gt;

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**RE: October Park TIS - Sight Distance Follow-up**

---

**Alan Childers** <achilders@cannon-cannon.com>

Tue, Dec 4, 2018 at 10:47 AM

To: Tarren Barrett &lt;tarren.barrett@knoxmpc.org&gt;

Cc: John Sexton &lt;John.Sexton@knoxcounty.org&gt;, Aaron Fritts &lt;aaron.fritts@knoxcounty.org&gt;, Jim Snowden &lt;Jim.Snowden@knoxcounty.org&gt;, Tom Brechko &lt;tom.brechko@knoxmpc.org&gt;, david campbell &lt;dcamp44@tds.net&gt;, Mike Conger &lt;mike.conger@knoxmpc.org&gt;

Tarren,

The results of today's follow-up field review of sight distance are summarized below. The distances given are clearly the minimum values available. This project will have no problem meeting sight distance requirements as long as a few obstructing trees are cut.

## 1.) Project West Site Entrance (Road A):

- Looking right (west) – Some trees have been cut and we were able to measure from 15 feet back from EOP.

We measured about 400 feet and could have gone a bit further.

- Looking left (east) – Trees have not been cut, so we viewed from edge of pavement.

The sight distance is great, well over 1000 feet.

## 2.) Project East Site Entrance (Multifamily Units):

- Looking right (west) – Trees have not been cut, so we viewed from edge of pavement.

The sight distance is at least 700 feet, possibly a little further.

- Looking left (east) – Trees have not been cut, so we viewed from edge of pavement.

The sight distance is great, well over 800 feet.

**ALAN CHILDERS, P.E.**

DIRECT: 865.770.4065

MAIN: 865.670.8555

FAX: 865.670.8866

EMAIL: achilders@cannon-cannon.com

Cannon & Cannon, Inc.  
8550 Kingston Pike  
Knoxville, Tennessee 37919  
[www.cannon-cannon.com](http://www.cannon-cannon.com)

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**From:** Tarren Barrett [mailto:[tarren.barrett@knoxmpc.org](mailto:tarren.barrett@knoxmpc.org)]  
**Sent:** Tuesday, November 20, 2018 4:21 PM  
**To:** Alan Childers  
**Cc:** John Sexton; Aaron Fritts; Jim Snowden; Tom Brechko; david campbell; Mike Conger  
**Subject:** October Park TIS

Alan,

After review of the traffic impact study (TIS) for October Park by Knox County Engineering staff and Knoxville-Knox County Planning Staff that was submitted on 29 October 2018, staff would like to know what the available (or measured) sight distances are for the entrances of the subdivision along Hatmaker Lane. This was not discussed on page 13 of the traffic study.

Please send back an email as a response to this request. This is the only additional request that is required for the complete review of the TIS at this time.

V/R,

Tarren

---

Tarren Barrett, EIT  
Transportation Engineer  
Knoxville Regional TPO &  
Metropolitan Planning Commission  
400 Main St, Suite 403  
Knoxville, TN 37902  
Phone: [865-215-3826](tel:865-215-3826)  
Fax: 865-215-2068  
[tarren.barrett@knoxtrans.org](mailto:tarren.barrett@knoxtrans.org)