# Traffic Impact Study

Proposed Mixed-Use Development
Tyrone Road and GA 74
Town of Tyrone, Georgia

June 1, 2020

MARC R. ACAMPORA, PE, LLC
TRAFFIC ENGINEERING

# Traffic Impact Study

## Proposed Mixed-Use Development
## Tyrone Road and GA 74
## Town of Tyrone, Georgia

study prepared for:

Brent Holdings, LLC
270 North Jeff Davis Drive
Fayetteville, GA 30214

June 1, 2020


MARC R. ACAMPORA, PE, LLC
TRAFFIC ENGINEERING

858 Myrtle Street, NE
Atlanta, Georgia 30308
phone: (678) 637-1763
e-mail: acamporatraffic@comcast.net

# Contents



# Tables

## Figures



## Photographs

# Introduction

This study assesses the traffic impact of a proposed mixed-use commercial and residential development in the Town of Tyrone, Georgia. The site is located south of Tyrone Road, west of GA 74, as shown in the location map in Figure 1. The site will be developed with 204 townhomes and 30,000 square feet of commercial buildings. Vehicular access will be provided along Valleywood Road, with an additional full-movement access on Tyrone Road and one right-in/right-out access on the west side of GA 74.

The purpose of this traffic impact study is to determine existing traffic operating conditions in the vicinity of the proposed development, project future traffic volumes, assess the impact of the subject development, then develop conclusions and recommendations to mitigate the project traffic impact and ensure safe and efficient existing and future traffic conditions in the vicinity of the project.

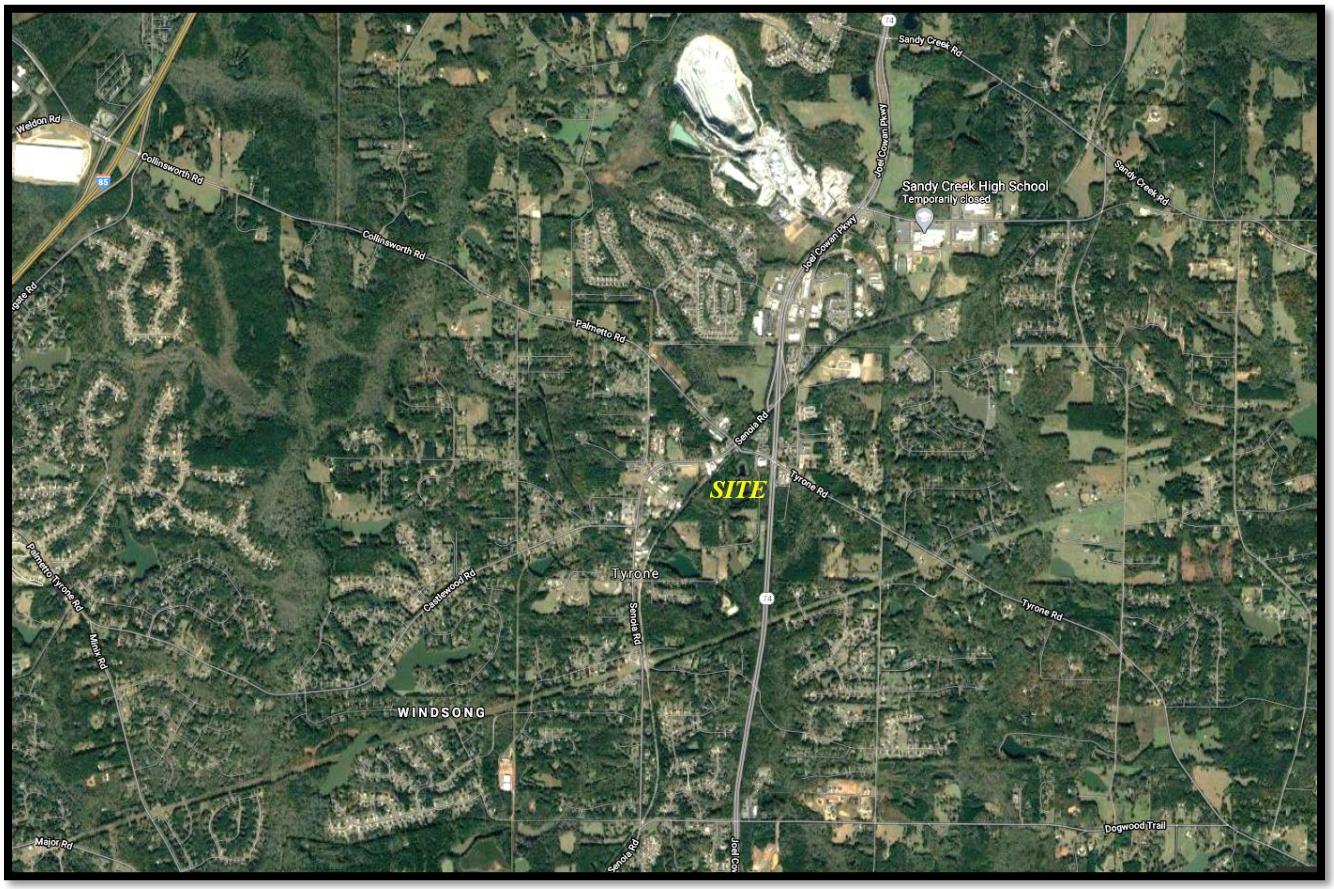



Figure 1 – Site Location Map

# Existing Traffic Conditions

Existing traffic conditions in the vicinity of the proposed mixed-use development were assessed. The following is a description of existing transportation facilities, traffic volumes, and intersection operations.

## Description of Existing Roadways

Palmetto Road / Tyrone Road is an east/west urban minor arterial (Georgia DOT designation). The road changes names several times – it is called Collinsworth Road to the west, with an interchange at Interstate 85, then changes name to Palmetto Road until it reaches Senoia Road, then changes to Tyrone Road and continues across GA 74 to the east. The signage at GA 74 is inconsistent with the other signs in the area and indicates that the road is named Palmetto Road west of GA 74. The road has one through lane in each direction with eastbound and westbound left and right turn lanes at Valleywood Road and at GA 74, but with no turn lanes at Senoia Road. The terrain along Palmetto Road / Tyrone Road is very gently rolling in the study area and the speed limit is 30 mph adjacent to the site and 35 mph west of Senoia Road. There is a railroad crossing across Tyrone Road immediately east of its intersection with Senoia Road. In 2018 (the most recent year for which counts were available at study time) the Georgia Department of Transportation (Georgia DOT) recorded an Annual Average Daily Traffic (AADT) volume of 8,590 vehicles per day (vpd) on Palmetto Road west of Senoia Road.

GA 74 (Joel Cowan Parkway) is a north/south urban principal arterial (Georgia DOT designation) that provides regional mobility. The road has two through lanes in each direction with northbound and southbound left and right turn lanes at Tyrone Road. The terrain along GA 74 is level to very gently rolling in the study area and the posted speed limit is 55 mph. The intersection of GA 74 and Tyrone Road is controlled by a signal. In 2018 the Georgia DOT recorded an AADT volume of 29,100 vpd on GA 74 south of Tyrone Road.

Senoia Road is a southwest/northeast rural minor arterial (Georgia DOT designation) that roughly parallels GA 74 to the west and has ramps to GA 74 to and from the north a short distance north of Tyrone Road. The terrain is gently rolling and the posted speed limit is 35 mph, dropping to 30 mph a short distance south of Tyrone Road. The road has one travel lane per direction with a northbound right turn lane at Tyrone Road. The intersection of Tyrone Road at Senoia Road is controlled by all-way stop sign. In 2018 the Georgia DOT recorded an AADT volume of 5,840 vpd on Senoia Road south of Tyrone Road.

Valleywood Road is a two lane local street that is side street stop sign controlled at Tyrone Road. The road is unpaved south of the driveways to the Dollar Tree. North of Tyrone Road, the street serves the Sycamore Grove office park. The terrain is level to gently rolling and the posted speed limit is 25 mph.

## Pedestrian, Bicycle, and Transit Accessibility

There is an asphalt sidewalk along the south side of Tyrone Road adjacent to the site, which terminates near the railroad tracks. A faded crosswalk accommodates this sidewalk across Valleywood Road. There is a sidewalk along the east side of Senoia Road and an accompanying crosswalk across Tyrone Road. Crosswalks and pedestrian

signal are provided on all approaches on GA 74 at Tyrone Road. There are no dedicated bicycle lanes in the vicinity of the subject site and there is no regularly-scheduled mass transit service in the vicinity of the site.

Photographs 1 through 6 show existing transportation conditions in the vicinity of the subject development.


Photograph 1 – Senoia Road Facing North at Palmetto Road / Tyrone Road

Photograph 2 – Tyrone Road Facing West at Railroad Crossing and Senoia Road

Photograph 3 – Tyrone Road Facing East Near Proposed Site Access with Site Frontage to Right

Photograph 4 – Tyrone Road Facing East at Valleywood Road

Photograph 5 – Tyrone Road Facing East at GA 74

Photograph 6 – GA 74 Facing North Toward Tyrone Road, Site to Left

## Existing Traffic Volumes

The preparation of this traffic study coincided with the quarantining and statewide school and business closures due to the COVID-19 pandemic. The roads in the vicinity of the proposed mixed-use development, and throughout the state, have experienced dramatic decreases in volumes. Therefore, representative existing traffic volume counts could not be collected. A traffic study was performed for Fayette County for the Tyrone Road – Palmetto Road Transportation Corridor in December 2019. That study included collecting turning movement counts at intersections adjacent to the subject site and those counts were used in this impact study due to the inability to collect new data. The following intersection counts from the County's study were included in this current traffic impact study:

1. Palmetto / Tyrone Road at Senoia Road
2. GA 74 at Tyrone Road

The counts were collected in April 2018 and the a.m. and p.m. peak hour counts were presented in the County's report. These volumes make up the typical weekday a.m. and p.m. peak hour traffic volumes at each intersection in April 2018.

In addition to the intersection turning movement counts, Georgia DOT AADT volume counts were obtained on nearby roadways for the five years from 2014 through 2018 (the latest year for which counts were available at

the time of this study). Table 1 presents the historic Georgia DOT counts and the annual growth rates between the counts. Based on the historic growth trends, the available counts at the study intersections were adjusted to 2020 volumes to develop typical current conditions. The volumes were increased by 2.0% per year for two years, or 4.0%. This produces the calculated 2020 "existing" volumes at the two study intersections.

No traffic volume counts were available at Valleywood Road since it is a relatively minor cross street. Traffic volume projections were developed for this intersection using standard trip generation equations provided in the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10th Edition with Supplement* for the land uses on the side streets. This includes a 13,500 square foot variety store (ITE Land Use 814) to calculate the existing Dollar Tree trips and a 31,536 square foot office park (ITE Land Use 750) for the Sycamore Grove development. The size of the Dollar Tree was scaled from Google Maps and the size of the Sycamore Grove office park was obtained from the internet. The trips from the Dollar Tree and Sycamore Grove were assigned by turning movement to the intersection of Tyrone Road at Valleywood Road. The traffic volumes from the counts at the Tyrone Road / Senoia Road intersection were adjusted to 2020 and then extrapolated to Valleywood Road to obtain the through volumes on Tyrone Road. These were combined with the turning movement projections for the Dollar Tree and Sycamore Grove to develop 2020 full turning movement volumes at this intersection.

The "existing" 2020 a.m. and p.m. peak hour turning movement volumes, calculated as described above, are shown in Figure 2. The raw count data is found in Appendix A.

**Table 1 – Historic Georgia DOT Traffic Volume Counts and Annual Growth Rates**

| Year | Senoia S of Tyrone | Annual Growth | Palmetto W of Senoia | Annual Growth | GA 74 S of Tyrone | Annual Growth | Tyrone E of GA 74 | Annual Growth | GA 74 N of Tyrone | Annual Growth |
|---|---|---|---|---|---|---|---|---|---|---|
| Station ID | 113-0125 | | 113-0174 | | 113-0302 | | 113-0176 | | 113-0129 | |
| 2014 | 5,050 | | 5,430 | | 26,700 | | 5,410 | | 33,200 | |
| 2015 | 5,310 | 5.1% | 5,840 | 7.6% | 30,100 | 12.7% | 5,690 | 5.2% | 34,300 | 3.3% |
| 2016 | 5,640 | 6.2% | 6,030 | 3.3% | 31,100 | 3.3% | 5,920 | 4.0% | 34,700 | 1.2% |
| 2017 | 5,810 | 3.0% | 8,600 | 42.6% | 29,100 | -6.4% | 6,100 | 3.0% | 36,700 | 5.8% |
| 2018 | 5,840 | 0.5% | 8,590 | -0.1% | 29,100 | 0.0% | 5,170 | -15.2% | 34,300 | -6.5% |
| *Average Growth* | | 3.7% | | 12.1% | | 2.2% | | -1.1% | | 0.8% |

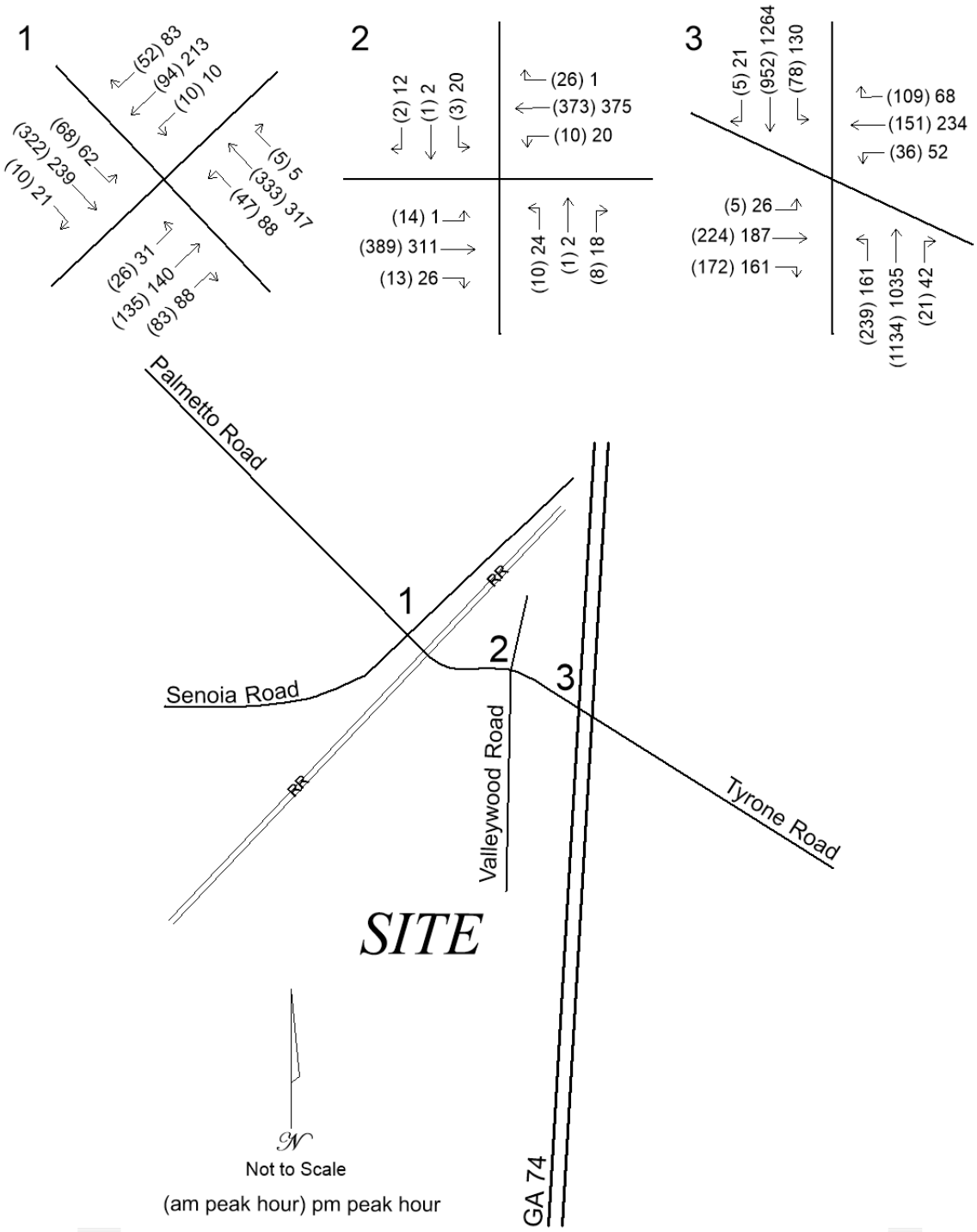



Figure 2 – Existing* Weekday A.M. and P.M. Peak Hour Traffic Volumes

*see text

## Existing Intersection Operations

Existing traffic operations were analyzed at the study intersections using Synchro software, version 10, in accordance with the methodology presented in the Transportation Research Board's 2016 *Highway Capacity Manual* (*HCM 6*). The results of the analysis are shown in Table 2. Computer printouts containing detailed results of the analysis are located in Appendix C. Levels of service and delays are provided for the overall intersection and for each approach or controlled movement. Intersections or approaches that "fail" (operate at LOS F) are shown in bold type.

**Table 2 – Existing Intersection Operations**

| Intersection / Approach | A.M. Peak Hour | | P.M. Peak Hour | |
|---|---|---|---|---|
| | LOS | Delay (s/veh) | LOS | Delay (s/veh) |
| 1. Palmetto Road / Tyrone Road at Senoia Road | E | 47.6 | ***F*** | ***67.7*** |
| northbound approach | C | 18.4 | C | 22.1 |
| southbound approach | C | 21.3 | ***F*** | ***55.9*** |
| eastbound approach | ***F*** | ***67.9*** | ***F*** | ***55.6*** |
| westbound approach | ***F*** | ***59.8*** | ***F*** | ***118.5*** |
| 2. Tyrone Road at Valleywood Road / Sycamore Grove | A | 0.9 | A | 2.1 |
| northbound approach | C | 17.9 | C | 17.3 |
| southbound approach | C | 17.9 | C | 18.1 |
| eastbound left turn | A | 8.3 | A | 8.2 |
| westbound left turn | A | 8.3 | A | 8.2 |
| 3. GA 74 at Tyrone Road | C | 21.1 | C | 22.5 |
| northbound approach | B | 17.9 | B | 16.2 |
| southbound approach | B | 19.5 | B | 19.1 |
| eastbound approach | C | 32.6 | D | 38.1 |
| westbound approach | C | 25.2 | D | 39.4 |

The existing analysis reveals acceptable traffic operations at the GA 74 intersection and at Valleywood Road. However, the Senoia Road intersection experiences high delays during the peak times with the all-way stop sign control. The volumes are somewhat balanced on all approaches which lends itself to conversion to a roundabout. However, the proximity of the railroad tracks could affect the ability to install a roundabout here. Signalization could be an alternative form of mitigation for the high delays. A signal warrant analysis should be performed according to the criteria set forth in the Federal Highway Administration's *Manual on Uniform Traffic Control Devices* (MUTCD) to determine if signalization is justified at this intersection. The County's Palmetto Road – Tyrone Road Transportation Corridor Study identifies the possibility of a roundabout or grade separation and signalization at this intersection which could include realignment of Tyrone Road. This could impact the northwest corner of the proposed mixed-use development. Improvements to mitigate existing delays at this intersection would be system improvements and should be considered whether or not the proposed mixed-use development is built. No mitigation was identified as necessary at the other two study intersections.

## No-Build Traffic Conditions

A future "no-build" condition was developed to identify future traffic operations with other growth and development in the area, but not including the proposed mixed-use development. This allows the traffic impact of the subject development to be isolated from the future conditions that will exist whether or not this project is developed.

### No Build Traffic Volumes

Table 1 in this report identified historic traffic volume trends on roadway segments in the study area. Based on those trends, an annual growth rate of 2.0% was selected and applied to the calculated 2020 volumes for a period of five years during which the proposed mixed-use development is anticipated to be built and become operational. The overall growth rate of 2.0% for five years equates to a 10.4% growth rate. This growth rate is anticipated to account for other developments in this vicinity. In addition to the general growth rate, according to the Fayette County Board of Education, it is anticipated that Tyrone Elementary School will reopen in 2021 or 2022, with a capacity of 550 students. Therefore, trips for this school were calculated using standard ITE trip equations for ITE Land Use 520 – Elementary School, and assigned to the study intersections. The calculated 2020 volumes, increased by the background growth rate, plus the reopened Tyrone ES trips, make up the no-build volumes at each study intersection. These are the trips that will be at each intersection in the future when the proposed mixed-use development is built, but excluding the mixed-use development's trips.

### No-Build Lanes and Traffic Control

It was assumed that the potential improvements identified in the County's Palmetto Road – Tyrone Road corridor study would not be selected, designed, and constructed before the mixed-use development build-out in 2025. Therefore, the existing lane configuration and control at each intersection was assumed to be the same for the no-build analysis.

### No-Build Intersection Operations

The study intersections were re-evaluated for a 2025 no-build condition, using the no-build volumes, as described above. The results of the operational analysis are shown in Table 3. Computer printouts containing detailed results of the analysis are located in Appendix D. Levels of service and delays are provided for the overall intersection and for each approach or controlled movement. Intersections or approaches that "fail" (operate at LOS F) are shown in bold type.

**Table 3 – No-Build Intersection Operations**

| Intersection / Approach | A.M. Peak Hour | | P.M. Peak Hour | |
|---|---|---|---|---|
| | LOS | Delay (s/veh) | LOS | Delay (s/veh) |
| 1. Palmetto Road / Tyrone Road at Senoia Road | ***F*** | ***96.8*** | ***F*** | ***110.4*** |
| northbound approach | D | 30.2 | D | 29.4 |
| southbound approach | E | 45.0 | ***F*** | ***101.4*** |
| eastbound approach | ***F*** | ***144.7*** | ***F*** | ***89.9*** |
| westbound approach | ***F*** | ***136.6*** | ***F*** | ***192.2*** |
| 2. Tyrone Road at Valleywood Road / Sycamore Grove | A | 0.9 | A | 2.1 |
| northbound approach | C | 19.8 | C | 18.9 |
| southbound approach | C | 19.7 | C | 19.7 |
| eastbound left turn | A | 8.5 | A | 8.3 |
| westbound left turn | A | 8.5 | A | 8.3 |
| 3. GA 74 at Tyrone Road | C | 24.7 | C | 26.3 |
| northbound approach | B | 19.9 | B | 19.5 |
| southbound approach | C | 21.2 | C | 23.8 |
| eastbound approach | D | 44.0 | D | 40.2 |
| westbound approach | C | 30.0 | D | 43.0 |

The 2025 no-build analysis shows significant deterioration in the already-poor operations at the Senoia Road intersection. This reinforces the conclusions made in the existing analysis, and the County's corridor study, that this intersection should be rebuilt with a roundabout or signalized. The other two study intersections will continue to operate acceptably and no mitigation is identified at those locations.

## Project Traffic Characteristics

This section describes the anticipated traffic characteristics of the proposed mixed-use development, including a site description, how much traffic the project will generate, and where that traffic will travel.

### Project Description

The site will be developed with 204 townhomes and 30,000 square feet of commercial buildings. Vehicular access will be provided along Valleywood Road, with an additional full-movement access on Tyrone Road and one right-in/right-out access on the west side of GA 74. The site plan is presented in Figure 3.

Figure 3 – Site Plan

## Trip Generation

The volume of traffic that will be generated by the proposed mixed-use development was calculated using the equations in the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10th Edition with Supplement* (the current edition). The commercial development will include a mix of retail shops and restaurants and the residential will be comprised of townhomes. ITE Land Use 820 – Shopping Center was chosen as representative of the retail and restaurant uses and ITE Land Use 220 – Multi-Family Housing (Low-Rise) was chosen for the townhomes.

Two adjustments are typically applied to the raw trip generation – a mixed-use adjustment and a pass-by trip adjustment. The mixed-use adjustment is based on the methodology prescribed in the ITE *Trip Generation Handbook, 3rd Edition*, which reflects the principles set forth in *NCHRP Report 684.* This adjustment is used to calculate how many trips will occur between compatible land uses within the same development. The calculations show that the sharing of trips between uses would be minimal, in the low single digits. However, this is considered to be not realistic for this development. For example, some trips exiting the townhomes in the morning might stop by a coffee shop in the retail on the way out to work in the morning. A return trip from work may include a stop at a dry cleaner in the retail before arriving home at the townhomes. The final tenants are unknown at the time of this study, but the interaction is likely to be higher than the negligible result from the ITE methodology analysis. It was assumed that there would be a 5% mixed-use reduction of trips exiting the residential to the retail in the morning and a 5% mixed-use reduction of the entering residential trips from the retail in the evening. The multi-use adjustment calculation worksheets showing the negligible calculated results are found in Appendix A.

An adjustment was made to the retail and restaurant trips to account for the effect of pass-by trips. Pass-by trips are trips that are already driving by the property but will be intercepted for shopping or dining purposes before continuing on their trip. These trips are new to the project driveways, but do not represent new trips to the adjacent roadways, since they are currently occurring and are, therefore, included in existing traffic counts on the adjacent streets. The ITE *Trip Generation Handbook* provides data and average rates for the pass-by percentages for Land Use 820 – Shopping Center, which has an average p.m. peak hour pass-by percentage of 34%. Therefore, a 34% pass-by trip adjustment was applied to the raw p.m. peak hour trips, while a 24% pass-by adjustment was applied to the a.m. and 24-hour numbers.

The trip generation for the proposed mixed-use development is summarized in Table 4.

**Table 4 – Tyrone Road and GA 74 Mixed-Use Development Trip Generation**

| Land Use | ITE Code | Size | A.M. Peak Hour | | | P.M. Peak Hour | | | 24-Hour |
|---|---|---|---|---|---|---|---|---|---|
| | | | In | Out | Total | In | Out | Total | 2-Way |
| Retail/Restaurants | 820 | 30,000 ft² | 103 | 64 | 167 | 107 | 116 | 223 | 2,652 |
| -multi-use adjustment | | | -4 | -4 | -8 | -4 | -4 | -8 | -38 |
| -pass-by adjustment | | 24%/34%/24% | -24 | -14 | -38 | -35 | -38 | -73 | -628 |
| Total Commercial New Trips | | | 75 | 46 | 121 | 68 | 74 | 142 | 1,986 |
| | | | | | | | | | |
| Townhomes | 220 | 204 units | 22 | 72 | 94 | 70 | 41 | 111 | 1,502 |
| -multi-use adjustment | | | -0 | -4 | -4 | -4 | -0 | -4 | -38 |
| Total Residential New Trips | | | 22 | 68 | 90 | 66 | 41 | 107 | 1,464 |
| | | | | | | | | | |
| Total Project New Trips | | | 97 | 114 | 211 | 134 | 115 | 249 | 3,450 |

The proposed mixed-use development will generate 211 new trips in the morning peak hour, 249 new trips in the evening peak hour, and 3,450 new daily trips.

## Trip Distribution and Assignment

The trip distribution percentages indicate what proportion of the project's new trips will travel to and from various directions. The trip distribution percentages were developed based on the locations and proximity of likely trip origins and destinations and the routes of travel to and from those areas. The trip percentages to and from the retail and restaurant were based on population densities and the locations of those populations in the area, weighted for distance from the site (a form of gravity model). The trips from the residential will travel during the peak times primarily to employment centers such as downtown Atlanta, Hartsfield Jackson Airport, Peachtree City, Newnan, and Fayetteville. Other residential trips will be made to schools and retail shopping. Figure 4 shows the project trip distribution percentages for the retail and residential uses and the trips that will be generated solely by the project. Appendix A includes traffic volume worksheets that show the project trips assigned separately for each land use, by movement, at each study intersection and the project accesses.

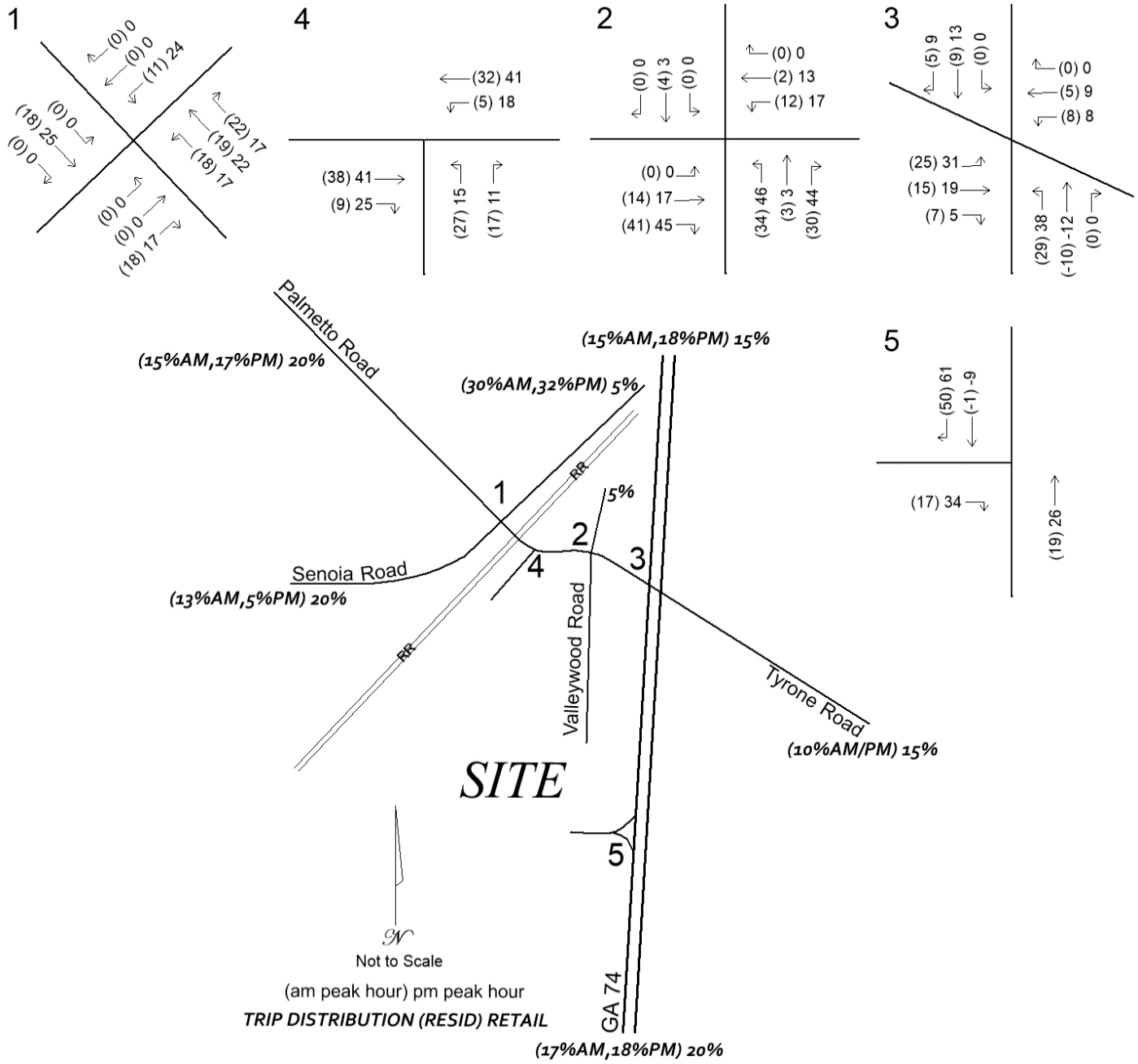



Figure 4 – Weekday A.M. and P.M. Peak Hour Site Trips

## Future Traffic Conditions

A future "build" condition was developed for the anticipated project build-out year of 2025. The build volumes consist of the no-build volumes plus the trips that will be generated by the proposed mixed-use development. The build volumes are shown in Figure 5.

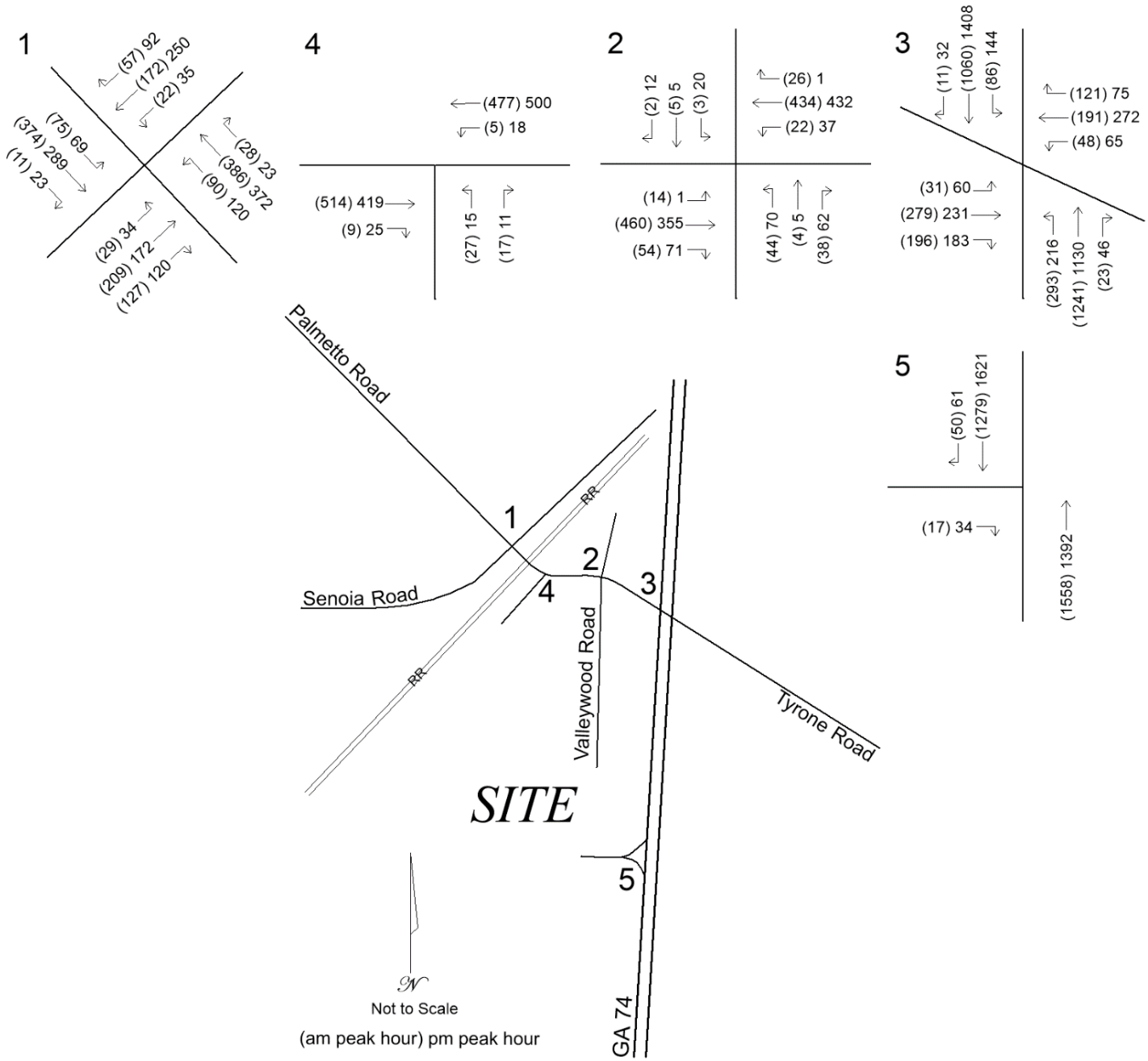



Figure 5 – Future Weekday A.M and P.M. Peak Hour Traffic Volumes

## Lane Configuration at Site Accesses

The proposed mixed-use development will have access to the public roadways along Valleywood Drive plus a new full-movement access on Tyrone Road between Valleywood Road and Senoia Road and a right-in/right-out (RIRO) access on GA 74 south of Tyrone Road. The site development along Valleywood Road and the proposed new access on Tyrone Road were reviewed for Town of Tyrone standards and the new RIRO access on GA 74 was reviewed for Georgia DOT standards.

### Town of Tyrone Code of Ordinances

The Town of Tyrone Code of Ordinances Chapter 109 – Land Development and Subdivisions, Article III – Subdivisions and Site Plans includes the following requirements relevant to the project accesses:

**Sec. 109-174. - Required street improvements.** Any proposed development contiguous to an existing unpaved public town street will be required to bring that portion of the unpaved street adjacent to the development up to current town standards.

**Sec. 109-276. - Design standards.** (c) Access.

1) All entrances or exits of any public or private street or drive onto any state highway must be approved by the state department of transportation and the town council prior to the issuance of a town development permit.
2) Curb cuts on all nonresidential streets shall be located no less than 50 feet, measured from back of curb, from any intersection.
3) In all nonresidential zoning districts, curb cuts shall not be less than 40 feet apart, measured between back of curbs.
4) Curb cuts onto arterial and collector streets shall not be closer than 20 feet, measured from back of curb, to any property line in all zoning districts.
5) All curb cuts onto arterial roads must include a deceleration lane constructed to standards of the state department of transportation.
6) No direct residential access (drive cuts) onto arterial and collector thoroughfares shall be allowed unless a variance is first granted by the town council in accordance with section 109-30.

### Valleywood Road

Valleywood Road is already served by an eastbound right turn lane and a westbound left turn lane on Tyrone Road. According to the Town Code, cited above, the unpaved portions of Valleywood Road that will serve the proposed development must be brought up to Town standards.

## Tyrone Road Access

The new Tyrone Road access should comply with the spacing standards cited above. Tyrone Road is a minor arterial, and, therefore, according to the Town Code, cited above, a deceleration lane is required to be built according to Georgia DOT standards. The Georgia DOT standards are set forth in their *Regulations for Driveway and Encroachment Control* (Driveway Manual), revision 5.0, 7/3/2019. For a roadway section with a 30 mph speed limit, the Driveway Manual Table 4-8 – Minimum Right Turn Deceleration Lengths calls for 75 feet of full-width storage and a 50 foot taper. The developer should obtain any required permits and variances for this access. The design of this access must consider the median section along this immediate section of Tyrone Road and the proximity to the railroad crossing.

The Town Code does not include a provision for left turn lane requirements. The westbound left turn volume is projected as 5 vehicles in the morning peak hour and 18 vehicles in the evening peak hour. This volume is relatively low. However, given the high through volumes on Tyrone Road, coupled with the short median, there would be a benefit if a left turn lane can be accommodated in a comprehensive design solution for this section of Tyrone Road. The design of the site access, as well as the northwest portion of the site and this entire section of Tyrone Road may be modified to accommodate a reconstruction of the Tyrone Road / Senoia Road intersection, as identified previously in this report.

## GA 74 Access

The project includes a right-in/right-out access on GA 74. The standards for accesses on state routes are set forth the Georgia DOT's Driveway Manual. The minimum spacing between site driveways and intersections on a road with a 55 mph posted speed limit is 350 feet and the site plan reviewed for this study complies with that standard.

The lines of sight along this section of GA 74 are clear for a substantial distance in both directions adjacent to the site and no sight distance limitations are identified.

On a route with more than two lanes with an AADT greater than 6,000 vpd and a posted speed limit of 55 to 60 mph, the minimum right turn volume/vehicles (RTV) threshold above which a deceleration lane is required is 50 RTV per day. It is projected that approximately 780 RTV per day will turn right into the site RIRO access on GA 74. Therefore, a deceleration lane is required at this access according to the Georgia DOT standards. The Georgia DOT design standards for this deceleration lane, set forth in Table 4-8 of the Driveway Manual, call for 250 feet of full-width storage and a 100 foot taper. This access is located along a median-divided section of GA 74 and movements will be restricted to RIRO. Therefore, no left turn lane is required to serve this access on GA 74.

The Georgia DOT will require an Intersection Control Evaluation (ICE) for the access to the state route. The access may qualify for an ICE Waiver due to its restricted movements. This ICE Waiver Request is included in Appendix F of this report.

## Future Intersection Operations

An operational analysis was performed for the anticipated 2025 project build-out conditions. The analysis was performed for the study intersections and the two new proposed project accesses (one on Tyrone Road and one on GA 74). The analysis assumes an eastbound exclusive right turn lane will be built at the site access on Tyrone Road and a southbound exclusive right turn lane will be constructed at the GA 74 access. Both accesses were modeled to include one inbound and one outbound lane with side street stop sign control. The Valleywood Road intersection was modeled with its existing lanes and stop sign control. Table 5 presents the results the future analysis. Computer printouts containing detailed results of the analysis are located in Appendix E. Levels of service and delays are provided for the overall intersection and for each approach or controlled movement. Intersections or approaches that "fail" (operate at LOS F) are shown in bold type.

**Table 5 – Future Intersection Operations**

| Intersection / Approach | A.M. Peak Hour | | P.M. Peak Hour | |
|---|---|---|---|---|
| | LOS | Delay (s/veh) | LOS | Delay (s/veh) |
| 1. Palmetto Road / Tyrone Road at Senoia Road | ***F*** | ***130.4*** | ***F*** | ***150.9*** |
| northbound approach | D | 31.9 | D | 31.1 |
| southbound approach | ***F*** | ***53.8*** | ***F*** | ***134.7*** |
| eastbound approach | ***F*** | ***176.2*** | ***F*** | ***119.8*** |
| westbound approach | ***F*** | ***209.0*** | ***F*** | ***268.1*** |
| 2. Tyrone Road at Valleywood Road / Sycamore Grove | A | 3.1 | A | 6.3 |
| northbound approach | D | 29.7 | D | 34.3 |
| southbound approach | C | 24.5 | D | 25.7 |
| eastbound left turn | A | 8.5 | A | 8.4 |
| westbound left turn | A | 8.7 | A | 8.5 |
| 3. GA 74 at Tyrone Road | C | 26.9 | C | 30.9 |
| northbound approach | C | 21.9 | C | 23.5 |
| southbound approach | C | 23.6 | C | 30.9 |
| eastbound approach | D | 45.3 | D | 39.3 |
| westbound approach | C | 31.6 | D | 45.2 |
| 4. Tyrone Road at Site Access | A | 1.1 | A | 0.7 |
| northbound approach (exiting site) | C | 20.9 | C | 18.1 |
| westbound left turn (entering site) | A | 8.7 | A | 8.5 |
| 5. GA 74 at Site Access | A | 0.1 | A | 0.2 |
| eastbound right turn (exiting site) | B | 14.9 | C | 18.5 |

The analysis of the future build condition reveals that the Tyrone Road / Senoia Road intersection will continue to deteriorate and requires mitigation, as identified for the existing and no-build conditions. This mitigation is a system improvement which is necessary whether or not the subject mixed-use development is built. An analysis of this intersection with future volumes, shows acceptable operations for all approaches, if rebuilt as a single lane roundabout. The other study intersections will continue to operate acceptably in the future. All site accesses will operate acceptably with the lanes and control stated in the assumptions. No other mitigation is recommended.

## Conclusions and Recommendations

This traffic study evaluates the impact of a proposed mixed-use development to be built in the Town of Tyrone. The following is a summary of the findings and recommendations of this study:

1. The existing analysis reveals unacceptable delays at the Tyrone Road / Senoia Road intersection with the current all-way stop sign control. Mitigation could include signalizing the intersection or rebuilding it as a roundabout.

2. The County's Palmetto Road – Tyrone Road Transportation Corridor Study identified potential improvements at Senoia Road including grade separation and signalization, or a roundabout. These changes could include a realignment of Tyrone Road adjacent to the proposed mixed-use development and may impact the northwest corner of the site.

3. The intersections of Tyrone Road / Valleywood Road and GA 74 / Tyrone Road currently operate acceptably.

4. The no-build analysis indicates that operations at the Tyrone Road / Senoia Road intersection will continue to deteriorate. The other two study intersections will continue to operate acceptably.

5. The proposed mixed-use development will generate 211 new trips in the a.m. peak hour, 249 new trips in the p.m. peak hour, and 3,450 daily new trips.

6. The site plan may require adaptation depending on the Tyrone Road improvements that are chosen. Any improvements or changes made to Tyrone Road in conjunction with the proposed mixed-use development should be consistent with and/or not preclude the recommendations in the County's study. The site plan should be designed to accommodate, or not preclude, anticipated infrastructure improvements along Tyrone Road.

7. The intersection of GA 74 at Tyrone Road will operate acceptably in the future and no mitigation is identified for this intersection.

8. The Tyrone Code requires an eastbound right turn lane on Tyrone Road at the proposed new site access. The design of this access should consider the corridor improvements anticipated on Tyrone Road. If feasible, a westbound left turn lane on Tyrone Road at this new site access would be beneficial. This access should be designed with one entering and one exiting lane with the exiting approach controlled by stop sign and accompanying stop bar.

9. The unpaved section of Valleywood Road should be improved to meet Town standards, as required by the Town Code.

10. The intersection of Tyrone Road at Valleywood Road is currently served by exclusive left and right turn lanes in both directions on Tyrone Road. This design, and the side street stop sign control, will continue to operate acceptably with the added traffic from the proposed mixed-use development.

11. The site access on GA 74 should be restricted to right-in/right-out movements. A 250 foot deceleration lane with 100 foot taper is required on GA 74 at this access. This access should be constructed with one entering lane and one exiting lane and the exiting approach should be side street stop sign controlled with accompanying stop bar.

12. The project civil/site engineer is advised to refer to applicable Town of Tyrone and Georgia DOT driveway design standards to ensure design compliance at all project accesses, including turn lane design, driveway spacing, turn radii, grades, and sight distances.

Appendix A

Traffic Count Data and Volume Worksheets

**Tyrone Mixed-Use Development - Traffic Impact Study**
Town of Tyrone, Georgia

June 2020

**Intersection: 1. Senoia Road at Palmetto Road / Tyrone Road**

| **Weekday A.M. Peak Hour** | **Northbound Senoia Road** | | | | **Southbound Senoia Road** | | | | **Eastbound Palmetto Road** | | | | **Westbound Tyrone Road** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | 25 | 130 | 80 | 235 | 10 | 90 | 50 | 150 | 65 | 310 | 10 | 385 | 45 | 320 | 5 | 370 |
| Adjustment to May 2020 | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | |
| **Calculated May 2020 Volumes** | **26** | **135** | **83** | **244** | **10** | **94** | **52** | **156** | **68** | **322** | **10** | **400** | **47** | **333** | **5** | **385** |
| Total Annual Background Growth | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | |
| Reopened Tyrone Elementary School Trips | 0 | 60 | 17 | 77 | 0 | 69 | 0 | 69 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 20 |
| **No-Build Volumes** | **29** | **209** | **109** | **347** | **11** | **172** | **57** | **241** | **75** | **356** | **11** | **442** | **72** | **367** | **6** | **445** |
| Tyrone Mixed-Use Residential Trips | 0 | 0 | 3 | 3 | 7 | 0 | 0 | 7 | 0 | 3 | 0 | 3 | 9 | 10 | 20 | 39 |
| Tyrone Mixed-Use Retail New Trips | 0 | 0 | 15 | 15 | 4 | 0 | 0 | 4 | 0 | 15 | 0 | 15 | 9 | 9 | 2 | 20 |
| Tyrone Mixed-Use Retail Pass-by Trips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **0** | **0** | **18** | **18** | **11** | **0** | **0** | **11** | **0** | **18** | **0** | **18** | **18** | **19** | **22** | **59** |
| **Build Volumes** | **29** | **209** | **127** | **365** | **22** | **172** | **57** | **252** | **75** | **374** | **11** | **460** | **90** | **386** | **28** | **504** |

| **Weekday P.M. Peak Hour** | **Northbound Senoia Road** | | | | **Southbound Senoia Road** | | | | **Eastbound Palmetto Road** | | | | **Westbound Tyrone Road** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | 30 | 135 | 85 | 250 | 10 | 205 | 80 | 295 | 60 | 230 | 20 | 310 | 85 | 305 | 5 | 395 |
| Adjustment to May 2020 | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | |
| **Calculated May 2020 Volumes** | **31** | **140** | **88** | **260** | **10** | **213** | **83** | **307** | **62** | **239** | **21** | **322** | **88** | **317** | **5** | **411** |
| Total Annual Background Growth | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | |
| Reopened Tyrone Elementary School Trips | 0 | 17 | 5 | 22 | 0 | 15 | 0 | 15 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 5 |
| **No-Build Volumes** | **34** | **172** | **103** | **309** | **11** | **250** | **92** | **354** | **69** | **264** | **23** | **356** | **103** | **350** | **6** | **459** |
| Tyrone Mixed-Use Residential Trips | 0 | 0 | 3 | 3 | 21 | 0 | 0 | 21 | 0 | 11 | 0 | 11 | 2 | 7 | 13 | 22 |
| Tyrone Mixed-Use Retail New Trips | 0 | 0 | 14 | 14 | 3 | 0 | 0 | 3 | 0 | 14 | 0 | 14 | 15 | 15 | 4 | 34 |
| Tyrone Mixed-Use Retail Pass-by Trips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **0** | **0** | **17** | **17** | **24** | **0** | **0** | **24** | **0** | **25** | **0** | **25** | **17** | **22** | **17** | **56** |
| **Build Volumes** | **34** | **172** | **120** | **326** | **35** | **250** | **92** | **378** | **69** | **289** | **23** | **381** | **120** | **372** | **23** | **515** |

**Tyrone Mixed-Use Development - Traffic Impact Study**
Town of Tyrone, Georgia

June 2020

**Intersection: 2. Tyrone Road at Valleywood Road / Sycamore Grove**

| **Weekday A.M. Peak Hour** | **Northbound Valleywood Road** | | | | **Southbound Sycamore Grove** | | | | **Eastbound Tyrone Road** | | | | **Westbound Tyrone Road** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | | | | | | | | | | 400 | | 400 | | 370 | | 370 |
| Dollar Tree Trips | 10 | 1 | 8 | 19 | 0 | 1 | 0 | 1 | 0 | 0 | 13 | 13 | 10 | 0 | 0 | 10 |
| Sycamore Grove Office Park Trips | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 5 | 14 | 0 | 0 | 14 | 0 | 0 | 26 | 26 |
| Adjustment to May 2020 | 0.0% | 0.0% | 0.0% | | 0.0% | 0.0% | 0.0% | | 0.0% | 4.0% | 0.0% | | 0.0% | 4.0% | 0.0% | |
| **Calculated May 2020 Volumes** | **10** | **1** | **8** | **19** | **3** | **1** | **2** | **6** | **14** | **389** | **13** | **416** | **10** | **373** | **26** | **385** |
| Total Annual Background Growth | 0.0% | 0.0% | 0.0% | | 0.0% | 0.0% | 0.0% | | 0.0% | 10.4% | 0.0% | | 0.0% | 10.4% | 0.0% | |
| Reopened Tyrone Elementary School Trips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 17 | 0 | 20 | 0 | 20 |
| **No-Build Volumes** | **10** | **1** | **8** | **19** | **3** | **1** | **2** | **6** | **14** | **446** | **13** | **473** | **10** | **432** | **26** | **468** |
| Tyrone Mixed-Use Residential Trips | 12 | 0 | 8 | 20 | 0 | 0 | 0 | 0 | 0 | 17 | 4 | 21 | 3 | 5 | 0 | 8 |
| Tyrone Mixed-Use Retail New Trips | 20 | 3 | 14 | 37 | 0 | 4 | 0 | 4 | 0 | 0 | 34 | 34 | 6 | 0 | 0 | 6 |
| Tyrone Mixed-Use Retail Pass-by Trips | 2 | 0 | 8 | 10 | 0 | 0 | 0 | 0 | 0 | -3 | 3 | 0 | 3 | -3 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **34** | **3** | **30** | **67** | **0** | **4** | **0** | **4** | **0** | **14** | **41** | **55** | **12** | **2** | **0** | **14** |
| **Build Volumes** | **44** | **4** | **38** | **86** | **3** | **5** | **2** | **10** | **14** | **460** | **54** | **528** | **22** | **434** | **26** | **482** |

| **Weekday P.M. Peak Hour** | **Northbound Valleywood Road** | | | | **Southbound Sycamore Grove** | | | | **Eastbound Tyrone Road** | | | | **Westbound Tyrone Road** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | | | | | | | | | | 325 | | 325 | | 395 | | 395 |
| Dollar Tree Trips | 24 | 2 | 18 | 44 | 0 | 2 | 0 | 2 | 0 | 0 | 26 | 26 | 20 | 0 | 0 | 20 |
| Sycamore Grove Office Park Trips | 0 | 0 | 0 | 0 | 20 | 0 | 12 | 32 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| Adjustment to May 2020 | 0.0% | 0.0% | 0.0% | | 0.0% | 0.0% | 0.0% | | 0.0% | 4.0% | 0.0% | | 0.0% | 4.0% | 0.0% | |
| **Calculated May 2020 Volumes** | **24** | **2** | **18** | **44** | **20** | **2** | **12** | **34** | **1** | **311** | **26** | **338** | **20** | **375** | **1** | **411** |
| Total Annual Background Growth | 0.0% | 0.0% | 0.0% | | 0.0% | 0.0% | 0.0% | | 0.0% | 10.4% | 0.0% | | 0.0% | 10.4% | 0.0% | |
| Reopened Tyrone Elementary School Trips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 |
| **No-Build Volumes** | **24** | **2** | **18** | **44** | **20** | **2** | **12** | **34** | **1** | **348** | **26** | **375** | **20** | **419** | **1** | **440** |
| Tyrone Mixed-Use Residential Trips | 7 | 0 | 5 | 12 | 0 | 0 | 0 | 0 | 0 | 11 | 10 | 21 | 8 | 18 | 0 | 26 |
| Tyrone Mixed-Use Retail New Trips | 34 | 3 | 22 | 59 | 0 | 3 | 0 | 3 | 0 | 0 | 31 | 31 | 4 | 0 | 0 | 4 |
| Tyrone Mixed-Use Retail Pass-by Trips | 5 | 0 | 17 | 22 | 0 | 0 | 0 | 0 | 0 | -4 | 4 | 0 | 5 | -5 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **46** | **3** | **44** | **93** | **0** | **3** | **0** | **3** | **0** | **7** | **45** | **52** | **17** | **13** | **0** | **30** |
| **Build Volumes** | **70** | **5** | **62** | **137** | **20** | **5** | **12** | **37** | **1** | **355** | **71** | **427** | **37** | **432** | **1** | **470** |

**Tyrone Mixed-Use Development - Traffic Impact Study**
Town of Tyrone, Georgia

June 2020

**Intersection: 3. GA 74 at Tyrone Road**

| **Weekday A.M. Peak Hour** | **Northbound GA 74** | | | | **Southbound GA 74** | | | | **Eastbound Tyrone Road** | | | | **Westbound Tyrone Road** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | 230 | 1090 | 20 | 1340 | 75 | 915 | 5 | 995 | 5 | 215 | 165 | 385 | 35 | 145 | 105 | 285 |
| Adjustment to May 2020 | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | |
| **Calculated May 2020 Volumes** | **239** | **1134** | **21** | **1394** | **78** | **952** | **5** | **1035** | **5** | **224** | **172** | **400** | **36** | **151** | **109** | **296** |
| Total Annual Background Growth | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | |
| Reopened Tyrone Elementary School Trips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 17 | 0 | 20 | 0 | 20 |
| **No-Build Volumes** | **264** | **1251** | **23** | **1539** | **86** | **1051** | **6** | **1142** | **6** | **264** | **189** | **459** | **40** | **186** | **121** | **347** |
| Tyrone Mixed-Use Residential Trips | 4 | 0 | 0 | 4 | 0 | 1 | 2 | 3 | 11 | 7 | 7 | 25 | 0 | 2 | 0 | 2 |
| Tyrone Mixed-Use Retail New Trips | 15 | 0 | 0 | 15 | 0 | 8 | 3 | 11 | 7 | 7 | 0 | 14 | 8 | 3 | 0 | 11 |
| Tyrone Mixed-Use Retail Pass-by Trips | 10 | -10 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 0 | 8 | 0 | 0 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **29** | **-10** | **0** | **19** | **0** | **9** | **5** | **14** | **25** | **15** | **7** | **47** | **8** | **5** | **0** | **13** |
| **Build Volumes** | **293** | **1241** | **23** | **1558** | **86** | **1060** | **11** | **1156** | **31** | **279** | **196** | **506** | **48** | **191** | **121** | **360** |

| **Weekday P.M. Peak Hour** | **Northbound GA 74** | | | | **Southbound GA 74** | | | | **Eastbound Tyrone Road** | | | | **Westbound Tyrone Road** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | 155 | 995 | 40 | 1190 | 125 | 1215 | 20 | 1360 | 25 | 180 | 155 | 360 | 50 | 225 | 65 | 340 |
| Adjustment to May 2020 | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | | 4.0% | 4.0% | 4.0% | |
| **Calculated May 2020 Volumes** | **161** | **1035** | **42** | **1238** | **130** | **1264** | **21** | **1414** | **26** | **187** | **161** | **374** | **52** | **234** | **68** | **354** |
| Total Annual Background Growth | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | | 10.4% | 10.4% | 10.4% | |
| Reopened Tyrone Elementary School Trips | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 |
| **No-Build Volumes** | **178** | **1142** | **46** | **1366** | **144** | **1395** | **23** | **1561** | **29** | **212** | **178** | **418** | **57** | **263** | **75** | **395** |
| Tyrone Mixed-Use Residential Trips | 12 | 0 | 0 | 12 | 0 | 5 | 7 | 12 | 7 | 4 | 5 | 16 | 0 | 7 | 0 | 7 |
| Tyrone Mixed-Use Retail New Trips | 14 | 0 | 0 | 14 | 0 | 8 | 2 | 10 | 11 | 11 | 0 | 22 | 8 | 2 | 0 | 10 |
| Tyrone Mixed-Use Retail Pass-by Trips | 12 | -12 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 4 | 0 | 17 | 0 | 0 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **38** | **-12** | **0** | **26** | **0** | **13** | **9** | **22** | **31** | **19** | **5** | **55** | **8** | **9** | **0** | **17** |
| **Build Volumes** | **216** | **1130** | **46** | **1392** | **144** | **1408** | **32** | **1583** | **60** | **231** | **183** | **473** | **65** | **272** | **75** | **412** |

**Tyrone Mixed-Use Development - Traffic Impact Study**
Town of Tyrone, Georgia

June 2020

**Intersection: 4. Tyrone Road at Site Access**

| **Weekday A.M. Peak Hour** | **Northbound Site Access** | | | | **Eastbound Tyrone Road** | | | **Westbound Tyrone Road** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **R** | **Tot** | | **T** | | **Tot** | **L** | **T** | **Tot** |
| Counted Volumes April 2018 | | | | | 400 | | 400 | | 370 | 370 |
| Dollar Tree Trips | | | | | 0 | | 0 | | 0 | 0 |
| 1015 Tyrone Road Trips | | | | | 0 | | 0 | | 0 | 0 |
| Adjustment to May 2020 | | | | | 4.0% | | | | 4.0% | |
| **Calculated May 2020 Volumes** | | | | | **416** | | **416** | | **385** | **385** |
| | | | | | | | | | | |
| Total Annual Background Growth | | | | | 10.4% | | | | 10.4% | |
| Reopened Tyrone Elementary School Trips | | | | | 17 | | 17 | | 20 | 20 |
| **No-Build Volumes** | | | | | **476** | | **476** | | **445** | **445** |
| | | | | | | | | | | |
| Tyrone Mixed-Use Residential Trips | 27 | 17 | 44 | | 4 | 9 | 13 | 5 | 12 | 17 |
| Tyrone Mixed-Use Retail New Trips | 0 | 0 | 0 | | 34 | 0 | 34 | 0 | 20 | 20 |
| Tyrone Mixed-Use Retail Pass-by Trips | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **27** | **17** | **44** | | **38** | **9** | **47** | **5** | **32** | **37** |
| | | | | | | | | | | |
| **Build Volumes** | **27** | **17** | **44** | | **514** | **9** | **523** | **5** | **477** | **482** |

| **Weekday P.M. Peak Hour** | **Valleywood Road** | | | | **Eastbound Tyrone Road** | | | **Westbound Tyrone Road** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **L** | **R** | **Tot** | | **T** | **R** | **Tot** | **L** | **T** | **Tot** |
| Counted Volumes April 2018 | | | | | 325 | | 325 | | 395 | 395 |
| Dollar Tree Trips | | | | | 0 | | 0 | | 0 | 0 |
| 1015 Tyrone Road Trips | | | | | 0 | | 0 | | 0 | 0 |
| Adjustment to May 2020 | | | | | 4.0% | | | | 4.0% | |
| **Calculated May 2020 Volumes** | | | | | **338** | | **338** | | **411** | **411** |
| | | | | | | | | | | |
| Total Annual Background Growth | | | | | 10.4% | | | | 10.4% | |
| Reopened Tyrone Elementary School Trips | | | | | 5 | | 5 | | 5 | 5 |
| **No-Build Volumes** | | | | | **378** | | **378** | | **459** | **459** |
| | | | | | | | | | | |
| Tyrone Mixed-Use Residential Trips | 15 | 11 | 26 | | 10 | 25 | 35 | 18 | 7 | 25 |
| Tyrone Mixed-Use Retail New Trips | 0 | 0 | 0 | | 31 | 0 | 31 | 0 | 34 | 34 |
| Tyrone Mixed-Use Retail Pass-by Trips | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Tyrone Mixed-Use Project Trips** | **15** | **11** | **26** | | **41** | **25** | **66** | **18** | **41** | **59** |
| | | | | | | | | | | |
| **Build Volumes** | **15** | **11** | **26** | | **419** | **25** | **444** | **18** | **500** | **518** |

**Tyrone Mixed-Use Development - Traffic Impact Study**
Town of Tyrone, Georgia

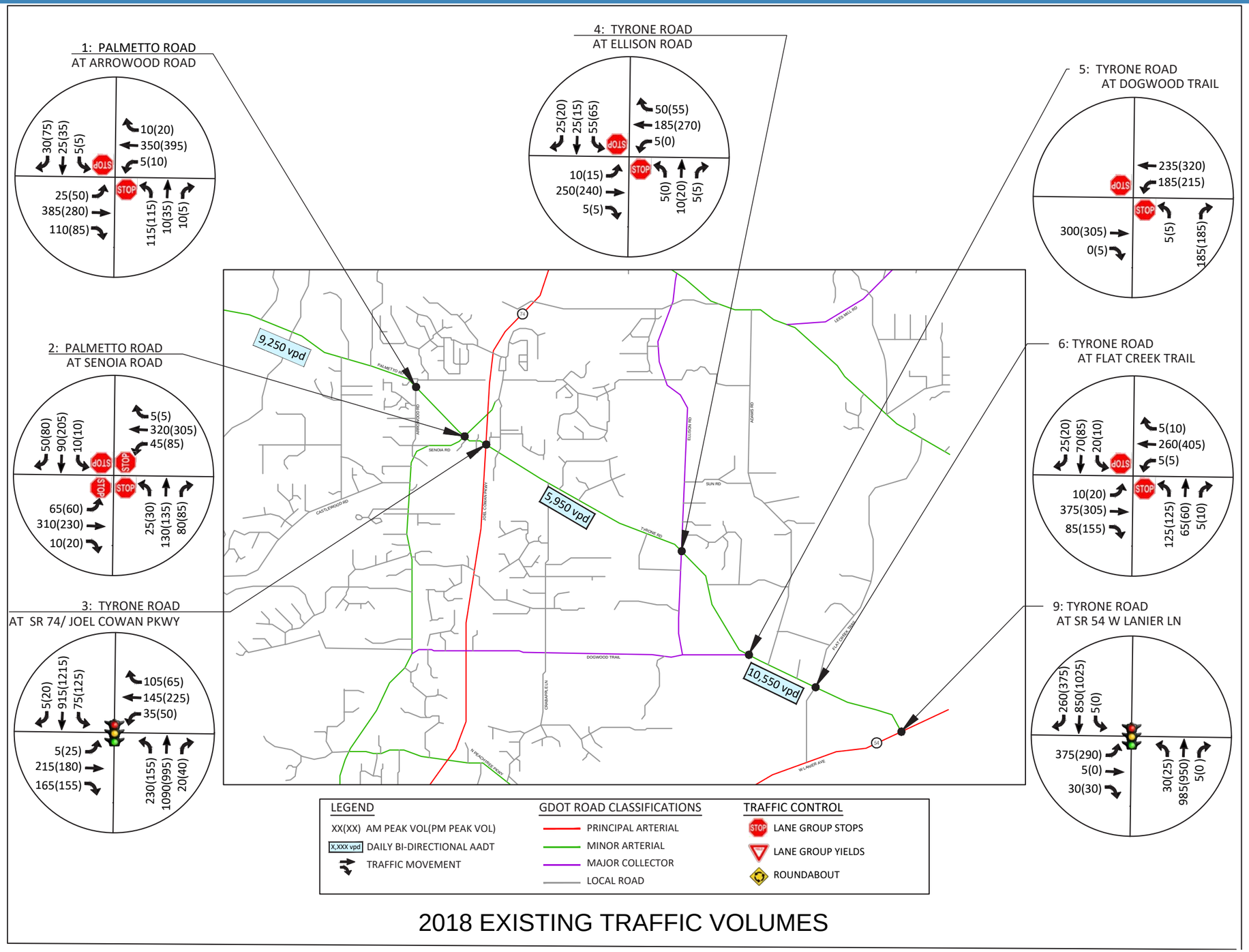
June 2020

**Intersection: 5. GA 74 at Site Right-In/Right-Out Access**

| **Weekday A.M. Peak Hour** | **Northbound GA 74** | | **Southbound GA 74** | | | **Eastbound Site RIRO Access** | | |
|---|---|---|---|---|---|---|---|---|
| | **T** | **Tot** | **T** | **R** | **Tot** | | **R** | **Tot** |
| Counted Volumes April 2018 | 1340 | 1340 | 1115 | | 1115 | | | |
| Adjustment to May 2020 | 4.0% | | 4.0% | | | | | |
| **Calculated May 2020 Volumes** | **1394** | **1394** | **1160** | | **1160** | | | |
| Total Annual Background Growth | 10.4% | | 10.4% | | | | | |
| Reopened Tyrone Elementary School Trips | 0 | 0 | 0 | | 0 | | | |
| **No-Build Volumes** | **1539** | **1539** | **1280** | | **1280** | | | |
| Tyrone Mixed-Use Residential Trips | 4 | 4 | 7 | 1 | 8 | | 4 | 4 |
| Tyrone Mixed-Use Retail New Trips | 15 | 15 | 0 | 31 | 31 | | 9 | 9 |
| Tyrone Mixed-Use Retail Pass-by Trips | 0 | 0 | -8 | 18 | 10 | | 4 | 4 |
| **Total Tyrone Mixed-Use Project Trips** | **19** | **19** | **-1** | **50** | **49** | | **17** | **17** |
| **Build Volumes** | **1558** | **1558** | **1279** | **50** | **1329** | | **17** | **17** |

| **Weekday P.M. Peak Hour** | **Northbound GA 74** | | **Southbound GA 74** | | | **Eastbound Site RIRO Access** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **T** | **Tot** | **T** | **R** | **Tot** | **L** | **T** | **R** | **Tot** |
| Counted Volumes April 2018 | 1190 | 1190 | 1420 | | 1420 | | | | |
| Adjustment to May 2020 | 4.0% | | 4.0% | | | | | | |
| **Calculated May 2020 Volumes** | **1238** | **1238** | **1477** | | **1477** | | | | |
| Total Annual Background Growth | 10.4% | | 10.4% | | | | | | |
| Reopened Tyrone Elementary School Trips | 0 | 0 | 0 | | 0 | | | | |
| **No-Build Volumes** | **1366** | **1366** | **1630** | | **1630** | | | | |
| Tyrone Mixed-Use Residential Trips | 12 | 12 | 5 | 5 | 10 | | | 3 | 3 |
| Tyrone Mixed-Use Retail New Trips | 14 | 14 | 0 | 30 | 30 | | | 15 | 15 |
| Tyrone Mixed-Use Retail Pass-by Trips | 0 | 0 | -14 | 26 | 12 | | | 16 | 16 |
| **Total Tyrone Mixed-Use Project Trips** | **26** | **26** | **-9** | **61** | **52** | | | **34** | **34** |
| **Build Volumes** | **1392** | **1392** | **1621** | **61** | **1682** | | | **34** | **34** |

# Figure 1.2 - Tyrone Road-Palmetto Road - 2018 Existing Traffic Volumes



Appendix B

Intersection Analysis Methodology

## Intersection Analysis Methodology

The methodology used for evaluating traffic operations at intersections is presented in the Transportation Research Board's *Highway Capacity Manual*, 2016 edition (HCM 6). Synchro 10 software, which emulates the HCM 6 methodology, was used for all analyses. The following is an overview of the methodology employed for the analysis of signalized intersections and roundabouts and stop-sign controlled (unsignalized) intersections. Levels of service (LOS) are assigned letters A through F. LOS A indicates operations with very low control delay while LOS F describes operations with high control delay. LOS F is considered to be unacceptable by most drivers, while LOS E is typically considered to be the limit of acceptable delay.

Signalized Intersections and Roundabouts – Level of service for a signalized intersection and a roundabout is defined in terms of control delay per vehicle. For signalized intersections and roundabouts, a composite intersection level of service is determined. The thresholds for each level of service are higher for signalized intersections and roundabouts than for unsignalized intersections. This is attributable to a variety of factors including expectation and acceptance of higher delays at signals/roundabouts, and the fact that drivers can relax when waiting at a signal as opposed to having to remain attentive as they proceed through the unsignalized intersection. The level of service criteria for signalized intersections and roundabouts are shown in Table A.

**Table A – Level of Service Criteria for Signalized Intersections and Roundabouts**

| Control Delay (s/veh) | LOS |
|---|---|
| ≤ 10 | A |
| > 10 and ≤ 20 | B |
| > 20 and ≤ 35 | C |
| > 35 and ≤ 55 | D |
| > 55 and ≤ 80 | E |
| > 80 | F |

*Source: Highway Capacity Manual 6*

Unsignalized Intersections – Level of service for an unsignalized intersection is defined in terms of control delay per vehicle. Control delay is that portion of delay attributable to the control device and includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The delays at unsignalized intersections are based on gap acceptance theory, factoring in availability of gaps, usefulness of the gaps, and the priority of right-of-way given to each traffic stream. The level of service criteria for unsignalized intersections are presented in Table B.

**Table B – Level of Service Criteria for Unsignalized Intersections**

| Control Delay (s/veh) | LOS |
|---|---|
| 0 – 10 | A |
| > 10 and ≤ 15 | B |
| > 15 and ≤ 25 | C |
| > 25 and ≤ 35 | D |
| > 35 and ≤ 50 | E |
| > 50 | F |

*Source: Highway Capacity Manual 6*

Appendix C

Existing Intersection Operational Analysis

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 47.6 |
| Intersection LOS | E |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 68 | 322 | 10 | 47 | 333 | 5 | 26 | 135 | 83 | 10 | 94 | 52 |
| Future Vol, veh/h | 68 | 322 | 10 | 47 | 333 | 5 | 26 | 135 | 83 | 10 | 94 | 52 |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.77 | 0.77 | 0.77 | 0.70 | 0.70 | 0.70 |
| Heavy Vehicles, % | 5 | 9 | 3 | 3 | 9 | 3 | 3 | 5 | 3 | 3 | 5 | 5 |
| Mvmt Flow | 80 | 379 | 12 | 55 | 392 | 6 | 34 | 175 | 108 | 14 | 134 | 74 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 1 | 1 |
| HCM Control Delay | 67.9 | 59.8 | 18.4 | 21.3 |
| HCM LOS | F | F | C | C |

| Lane | NBLn1 | NBLn2 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|---|
| Vol Left, % | 16% | 0% | 17% | 12% | 6% |
| Vol Thru, % | 84% | 0% | 80% | 86% | 60% |
| Vol Right, % | 0% | 100% | 3% | 1% | 33% |
| Sign Control | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 161 | 83 | 400 | 385 | 156 |
| LT Vol | 26 | 0 | 68 | 47 | 10 |
| Through Vol | 135 | 0 | 322 | 333 | 94 |
| RT Vol | 0 | 83 | 10 | 5 | 52 |
| Lane Flow Rate | 209 | 108 | 471 | 453 | 223 |
| Geometry Grp | 7 | 7 | 2 | 2 | 5 |
| Degree of Util (X) | 0.517 | 0.243 | 0.994 | 0.959 | 0.534 |
| Departure Headway (Hd) | 8.899 | 8.123 | 7.605 | 7.626 | 8.634 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes |
| Cap | 406 | 442 | 475 | 476 | 417 |
| Service Time | 6.662 | 5.885 | 5.664 | 5.686 | 6.707 |
| HCM Lane V/C Ratio | 0.515 | 0.244 | 0.992 | 0.952 | 0.535 |
| HCM Control Delay | 20.9 | 13.5 | 67.9 | 59.8 | 21.3 |
| HCM Lane LOS | C | B | F | F | C |
| HCM 95th-tile Q | 2.9 | 0.9 | 13.1 | 11.8 | 3.1 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.9 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 14 | 389 | 13 | 10 | 373 | 26 | 10 | 1 | 8 | 3 | 1 | 2 |
| Future Vol, veh/h | 14 | 389 | 13 | 10 | 373 | 26 | 10 | 1 | 8 | 3 | 1 | 2 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 120 | - | 120 | 140 | - | 210 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 85 | 85 | 85 | 85 | 85 | 85 | 70 | 70 | 70 | 60 | 60 | 60 |
| Heavy Vehicles, % | 2 | 5 | 2 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 16 | 458 | 15 | 12 | 439 | 31 | 14 | 1 | 11 | 5 | 2 | 3 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 470 | 0 | 0 | 473 | 0 | 0 | 971 | 984 | 458 | 967 | 968 | 439 |
| Stage 1 | - | - | - | - | - | - | 490 | 490 | - | 463 | 463 | - |
| Stage 2 | - | - | - | - | - | - | 481 | 494 | - | 504 | 505 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1092 | - | - | 1089 | - | - | 232 | 248 | 603 | 234 | 254 | 618 |
| Stage 1 | - | - | - | - | - | - | 560 | 549 | - | 579 | 564 | - |
| Stage 2 | - | - | - | - | - | - | 566 | 546 | - | 550 | 540 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1092 | - | - | 1089 | - | - | 225 | 242 | 603 | 224 | 247 | 618 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 225 | 242 | - | 224 | 247 | - |
| Stage 1 | - | - | - | - | - | - | 552 | 541 | - | 570 | 558 | - |
| Stage 2 | - | - | - | - | - | - | 555 | 540 | - | 530 | 532 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.3 | 0.2 | 17.9 | 17.9 |
| HCM LOS | | | C | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 307 | 1092 | - | - | 1089 | - | - | 290 |
| HCM Lane V/C Ratio | 0.088 | 0.015 | - | - | 0.011 | - | - | 0.034 |
| HCM Control Delay (s) | 17.9 | 8.3 | - | - | 8.3 | - | - | 17.9 |
| HCM Lane LOS | C | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 0.3 | 0 | - | - | 0 | - | - | 0.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 5 | 224 | 172 | 36 | 151 | 109 | 239 | 1134 | 21 | 78 | 952 | 5 |
| Future Volume (veh/h) | 5 | 224 | 172 | 36 | 151 | 109 | 239 | 1134 | 21 | 78 | 952 | 5 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1796 | 1826 | 1826 | 1796 | 1826 |
| Adj Flow Rate, veh/h | 6 | 255 | 195 | 42 | 178 | 128 | 252 | 1194 | 22 | 85 | 1035 | 5 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.85 | 0.85 | 0.85 | 0.95 | 0.95 | 0.95 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 7 | 5 |
| Cap, veh/h | 244 | 325 | 275 | 210 | 383 | 324 | 378 | 1619 | 734 | 285 | 1451 | 658 |
| Arrive On Green | 0.01 | 0.18 | 0.18 | 0.04 | 0.21 | 0.21 | 0.11 | 0.47 | 0.47 | 0.06 | 0.43 | 0.43 |
| Sat Flow, veh/h | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 3413 | 1547 | 1739 | 3413 | 1547 |
| Grp Volume(v), veh/h | 6 | 255 | 195 | 42 | 178 | 128 | 252 | 1194 | 22 | 85 | 1035 | 5 |
| Grp Sat Flow(s),veh/h/ln | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 1706 | 1547 | 1739 | 1706 | 1547 |
| Q Serve(g_s), s | 0.2 | 9.6 | 8.5 | 1.4 | 6.1 | 5.1 | 5.5 | 20.3 | 0.5 | 1.9 | 17.9 | 0.1 |
| Cycle Q Clear(g_c), s | 0.2 | 9.6 | 8.5 | 1.4 | 6.1 | 5.1 | 5.5 | 20.3 | 0.5 | 1.9 | 17.9 | 0.1 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 244 | 325 | 275 | 210 | 383 | 324 | 378 | 1619 | 734 | 285 | 1451 | 658 |
| V/C Ratio(X) | 0.02 | 0.78 | 0.71 | 0.20 | 0.46 | 0.39 | 0.67 | 0.74 | 0.03 | 0.30 | 0.71 | 0.01 |
| Avail Cap(c_a), veh/h | 352 | 459 | 389 | 263 | 459 | 389 | 424 | 1619 | 734 | 308 | 1451 | 658 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 23.9 | 28.1 | 27.7 | 23.2 | 24.8 | 24.4 | 13.3 | 15.2 | 10.0 | 12.5 | 17.0 | 11.9 |
| Incr Delay (d2), s/veh | 0.0 | 5.8 | 3.4 | 0.5 | 0.9 | 0.8 | 3.4 | 3.0 | 0.1 | 0.6 | 3.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 4.5 | 3.3 | 0.6 | 2.6 | 1.9 | 2.2 | 7.6 | 0.2 | 0.7 | 7.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 24.0 | 33.9 | 31.1 | 23.6 | 25.7 | 25.2 | 16.7 | 18.3 | 10.1 | 13.1 | 20.0 | 11.9 |
| LnGrp LOS | C | C | C | C | C | C | B | B | B | B | C | B |
| Approach Vol, veh/h | | 456 | | | 348 | | | 1468 | | | 1125 | |
| Approach Delay, s/veh | | 32.6 | | | 25.2 | | | 17.9 | | | 19.5 | |
| Approach LOS | | C | | | C | | | B | | | B | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 8.6 | 38.5 | 7.3 | 17.3 | 12.1 | 35.0 | 5.1 | 19.5 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 5.0 | 34.0 | 5.0 | 18.0 | 9.5 | 29.5 | 5.0 | 18.0 |
| Max Q Clear Time (g_c+I1), s | 3.9 | 22.3 | 3.4 | 11.6 | 7.5 | 19.9 | 2.2 | 8.1 |
| Green Ext Time (p_c), s | 0.0 | 6.6 | 0.0 | 1.2 | 0.2 | 4.9 | 0.0 | 1.0 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 21.1 |
| HCM 6th LOS | C |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 67.7 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 62 | 239 | 21 | 88 | 317 | 5 | 31 | 140 | 88 | 10 | 213 | 83 |
| Future Vol, veh/h | 62 | 239 | 21 | 88 | 317 | 5 | 31 | 140 | 88 | 10 | 213 | 83 |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.77 | 0.77 | 0.77 | 0.80 | 0.80 | 0.80 |
| Heavy Vehicles, % | 5 | 9 | 3 | 3 | 9 | 3 | 3 | 5 | 3 | 3 | 5 | 5 |
| Mvmt Flow | 73 | 281 | 25 | 104 | 373 | 6 | 40 | 182 | 114 | 13 | 266 | 104 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 1 | 1 |
| HCM Control Delay | 55.6 | 118.5 | 22.1 | 55.9 |
| HCM LOS | F | F | C | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|---|
| Vol Left, % | 18% | 0% | 19% | 21% | 3% |
| Vol Thru, % | 82% | 0% | 74% | 77% | 70% |
| Vol Right, % | 0% | 100% | 7% | 1% | 27% |
| Sign Control | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 171 | 88 | 322 | 410 | 306 |
| LT Vol | 31 | 0 | 62 | 88 | 10 |
| Through Vol | 140 | 0 | 239 | 317 | 213 |
| RT Vol | 0 | 88 | 21 | 5 | 83 |
| Lane Flow Rate | 222 | 114 | 379 | 482 | 382 |
| Geometry Grp | 7 | 7 | 2 | 2 | 5 |
| Degree of Util (X) | 0.58 | 0.275 | 0.906 | 1.145 | 0.908 |
| Departure Headway (Hd) | 9.981 | 9.189 | 9.151 | 8.547 | 9.121 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes |
| Cap | 364 | 393 | 398 | 424 | 402 |
| Service Time | 7.681 | 6.889 | 7.151 | 6.638 | 7.121 |
| HCM Lane V/C Ratio | 0.61 | 0.29 | 0.952 | 1.137 | 0.95 |
| HCM Control Delay | 25.6 | 15.3 | 55.6 | 118.5 | 55.9 |
| HCM Lane LOS | D | C | F | F | F |
| HCM 95th-tile Q | 3.5 | 1.1 | 9.5 | 17.7 | 9.5 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 1 | 311 | 26 | 20 | 375 | 1 | 24 | 2 | 18 | 20 | 2 | 12 |
| Future Vol, veh/h | 1 | 311 | 26 | 20 | 375 | 1 | 24 | 2 | 18 | 20 | 2 | 12 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 120 | - | 120 | 140 | - | 210 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 85 | 85 | 85 | 85 | 85 | 85 | 75 | 75 | 75 | 75 | 75 | 75 |
| Heavy Vehicles, % | 2 | 5 | 2 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 1 | 366 | 31 | 24 | 441 | 1 | 32 | 3 | 24 | 27 | 3 | 16 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 442 | 0 | 0 | 397 | 0 | 0 | 867 | 858 | 366 | 886 | 888 | 441 |
| Stage 1 | - | - | - | - | - | - | 368 | 368 | - | 489 | 489 | - |
| Stage 2 | - | - | - | - | - | - | 499 | 490 | - | 397 | 399 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1118 | - | - | 1162 | - | - | 273 | 294 | 679 | 265 | 283 | 616 |
| Stage 1 | - | - | - | - | - | - | 652 | 621 | - | 561 | 549 | - |
| Stage 2 | - | - | - | - | - | - | 554 | 549 | - | 629 | 602 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1118 | - | - | 1162 | - | - | 260 | 288 | 679 | 250 | 277 | 616 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 260 | 288 | - | 250 | 277 | - |
| Stage 1 | - | - | - | - | - | - | 651 | 620 | - | 560 | 537 | - |
| Stage 2 | - | - | - | - | - | - | 526 | 537 | - | 604 | 601 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 0.4 | 17.3 | 18.1 |
| HCM LOS | | | C | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 350 | 1118 | - | - | 1162 | - | - | 319 |
| HCM Lane V/C Ratio | 0.168 | 0.001 | - | - | 0.02 | - | - | 0.142 |
| HCM Control Delay (s) | 17.3 | 8.2 | - | - | 8.2 | - | - | 18.1 |
| HCM Lane LOS | C | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 0.6 | 0 | - | - | 0.1 | - | - | 0.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 26 | 187 | 161 | 52 | 234 | 68 | 161 | 1035 | 42 | 130 | 1264 | 21 |
| Future Volume (veh/h) | 26 | 187 | 161 | 52 | 234 | 68 | 161 | 1035 | 42 | 130 | 1264 | 21 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1796 | 1826 | 1826 | 1796 | 1826 |
| Adj Flow Rate, veh/h | 31 | 220 | 189 | 59 | 266 | 77 | 175 | 1125 | 46 | 137 | 1331 | 22 |
| Peak Hour Factor | 0.85 | 0.85 | 0.85 | 0.88 | 0.88 | 0.88 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.95 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 7 | 5 |
| Cap, veh/h | 175 | 292 | 247 | 209 | 318 | 269 | 286 | 1762 | 799 | 321 | 1722 | 781 |
| Arrive On Green | 0.03 | 0.16 | 0.16 | 0.05 | 0.17 | 0.17 | 0.07 | 0.52 | 0.52 | 0.06 | 0.50 | 0.50 |
| Sat Flow, veh/h | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 3413 | 1547 | 1739 | 3413 | 1547 |
| Grp Volume(v), veh/h | 31 | 220 | 189 | 59 | 266 | 77 | 175 | 1125 | 46 | 137 | 1331 | 22 |
| Grp Sat Flow(s),veh/h/ln | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 1706 | 1547 | 1739 | 1706 | 1547 |
| Q Serve(g_s), s | 1.2 | 9.5 | 9.6 | 2.3 | 11.6 | 3.6 | 3.9 | 19.5 | 1.2 | 3.1 | 26.0 | 0.6 |
| Cycle Q Clear(g_c), s | 1.2 | 9.5 | 9.6 | 2.3 | 11.6 | 3.6 | 3.9 | 19.5 | 1.2 | 3.1 | 26.0 | 0.6 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 175 | 292 | 247 | 209 | 318 | 269 | 286 | 1762 | 799 | 321 | 1722 | 781 |
| V/C Ratio(X) | 0.18 | 0.75 | 0.76 | 0.28 | 0.84 | 0.29 | 0.61 | 0.64 | 0.06 | 0.43 | 0.77 | 0.03 |
| Avail Cap(c_a), veh/h | 227 | 403 | 341 | 236 | 403 | 341 | 320 | 1762 | 799 | 356 | 1722 | 781 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 28.1 | 32.9 | 33.0 | 27.4 | 32.8 | 29.5 | 15.4 | 14.3 | 9.9 | 11.4 | 16.5 | 10.2 |
| Incr Delay (d2), s/veh | 0.5 | 5.2 | 6.7 | 0.7 | 11.7 | 0.6 | 2.8 | 1.8 | 0.1 | 0.9 | 3.4 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.5 | 4.5 | 4.0 | 1.0 | 6.0 | 1.3 | 1.6 | 7.3 | 0.4 | 1.1 | 10.0 | 0.2 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 28.5 | 38.2 | 39.7 | 28.2 | 44.5 | 30.1 | 18.2 | 16.1 | 10.0 | 12.3 | 20.0 | 10.3 |
| LnGrp LOS | C | D | D | C | D | C | B | B | B | B | B | B |
| Approach Vol, veh/h | | 440 | | | 402 | | | 1346 | | | 1490 | |
| Approach Delay, s/veh | | 38.1 | | | 39.4 | | | 16.2 | | | 19.1 | |
| Approach LOS | | D | | | D | | | B | | | B | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 9.4 | 46.9 | 8.2 | 17.6 | 10.4 | 45.9 | 7.0 | 18.8 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 6.5 | 42.4 | 5.0 | 18.1 | 7.5 | 41.4 | 5.0 | 18.1 |
| Max Q Clear Time (g_c+I1), s | 5.1 | 21.5 | 4.3 | 11.6 | 5.9 | 28.0 | 3.2 | 13.6 |
| Green Ext Time (p_c), s | 0.0 | 8.8 | 0.0 | 1.1 | 0.1 | 8.0 | 0.0 | 0.7 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 22.5 |
| HCM 6th LOS | C |

Appendix D

No-Build Intersection Operational Analysis

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 96.8 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 75 | 356 | 11 | 72 | 367 | 6 | 29 | 209 | 109 | 11 | 172 | 57 |
| Future Vol, veh/h | 75 | 356 | 11 | 72 | 367 | 6 | 29 | 209 | 109 | 11 | 172 | 57 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.90 | 0.90 | 0.90 | 0.85 | 0.85 | 0.85 | 0.75 | 0.75 | 0.75 |
| Heavy Vehicles, % | 5 | 9 | 3 | 3 | 9 | 3 | 3 | 5 | 3 | 3 | 5 | 5 |
| Mvmt Flow | 85 | 405 | 13 | 80 | 408 | 7 | 34 | 246 | 128 | 15 | 229 | 76 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 1 | 1 |
| HCM Control Delay | 144.7 | 136.6 | 30.2 | 45 |
| HCM LOS | F | F | D | E |

| Lane | NBLn1 | NBLn2 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|---|
| Vol Left, % | 12% | 0% | 17% | 16% | 5% |
| Vol Thru, % | 88% | 0% | 81% | 82% | 72% |
| Vol Right, % | 0% | 100% | 2% | 1% | 24% |
| Sign Control | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 238 | 109 | 442 | 445 | 240 |
| LT Vol | 29 | 0 | 75 | 72 | 11 |
| Through Vol | 209 | 0 | 356 | 367 | 172 |
| RT Vol | 0 | 109 | 11 | 6 | 57 |
| Lane Flow Rate | 280 | 128 | 502 | 494 | 320 |
| Geometry Grp | 7 | 7 | 2 | 2 | 5 |
| Degree of Util (X) | 0.729 | 0.308 | 1.209 | 1.187 | 0.808 |
| Departure Headway (Hd) | 10.389 | 9.625 | 9.316 | 9.334 | 10.304 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes |
| Cap | 350 | 376 | 392 | 396 | 355 |
| Service Time | 8.089 | 7.325 | 7.316 | 7.334 | 8.304 |
| HCM Lane V/C Ratio | 0.8 | 0.34 | 1.281 | 1.247 | 0.901 |
| HCM Control Delay | 36.5 | 16.6 | 144.7 | 136.6 | 45 |
| HCM Lane LOS | E | C | F | F | E |
| HCM 95th-tile Q | 5.5 | 1.3 | 19.2 | 18.4 | 6.9 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.9 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 14 | 446 | 13 | 10 | 432 | 26 | 10 | 1 | 8 | 3 | 1 | 2 |
| Future Vol, veh/h | 14 | 446 | 13 | 10 | 432 | 26 | 10 | 1 | 8 | 3 | 1 | 2 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 120 | - | 120 | 140 | - | 210 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 88 | 88 | 88 | 89 | 89 | 89 | 70 | 70 | 70 | 60 | 60 | 60 |
| Heavy Vehicles, % | 2 | 5 | 2 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 16 | 507 | 15 | 11 | 485 | 29 | 14 | 1 | 11 | 5 | 2 | 3 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 514 | 0 | 0 | 522 | 0 | 0 | 1063 | 1075 | 507 | 1060 | 1061 | 485 |
| Stage 1 | - | - | - | - | - | - | 539 | 539 | - | 507 | 507 | - |
| Stage 2 | - | - | - | - | - | - | 524 | 536 | - | 553 | 554 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1052 | - | - | 1044 | - | - | 201 | 220 | 566 | 202 | 224 | 582 |
| Stage 1 | - | - | - | - | - | - | 527 | 522 | - | 548 | 539 | - |
| Stage 2 | - | - | - | - | - | - | 537 | 523 | - | 517 | 514 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1052 | - | - | 1044 | - | - | 195 | 214 | 566 | 193 | 218 | 582 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 195 | 214 | - | 193 | 218 | - |
| Stage 1 | - | - | - | - | - | - | 519 | 514 | - | 540 | 533 | - |
| Stage 2 | - | - | - | - | - | - | 527 | 517 | - | 497 | 506 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.3 | 0.2 | 19.8 | 19.7 |
| HCM LOS | | | C | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 271 | 1052 | - | - | 1044 | - | - | 255 |
| HCM Lane V/C Ratio | 0.1 | 0.015 | - | - | 0.011 | - | - | 0.039 |
| HCM Control Delay (s) | 19.8 | 8.5 | - | - | 8.5 | - | - | 19.7 |
| HCM Lane LOS | C | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 0.3 | 0 | - | - | 0 | - | - | 0.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 6 | 264 | 189 | 40 | 186 | 121 | 264 | 1251 | 23 | 86 | 1051 | 6 |
| Future Volume (veh/h) | 6 | 264 | 189 | 40 | 186 | 121 | 264 | 1251 | 23 | 86 | 1051 | 6 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1796 | 1826 | 1826 | 1796 | 1826 |
| Adj Flow Rate, veh/h | 7 | 293 | 210 | 45 | 211 | 138 | 275 | 1303 | 24 | 92 | 1130 | 6 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.88 | 0.88 | 0.88 | 0.96 | 0.96 | 0.96 | 0.93 | 0.93 | 0.93 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 7 | 5 |
| Cap, veh/h | 216 | 344 | 291 | 180 | 397 | 337 | 358 | 1741 | 789 | 259 | 1561 | 708 |
| Arrive On Green | 0.01 | 0.19 | 0.19 | 0.04 | 0.22 | 0.22 | 0.10 | 0.51 | 0.51 | 0.05 | 0.46 | 0.46 |
| Sat Flow, veh/h | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 3413 | 1547 | 1739 | 3413 | 1547 |
| Grp Volume(v), veh/h | 7 | 293 | 210 | 45 | 211 | 138 | 275 | 1303 | 24 | 92 | 1130 | 6 |
| Grp Sat Flow(s),veh/h/ln | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 1706 | 1547 | 1739 | 1706 | 1547 |
| Q Serve(g_s), s | 0.3 | 13.2 | 10.9 | 1.8 | 8.7 | 6.5 | 6.6 | 25.8 | 0.7 | 2.3 | 22.9 | 0.2 |
| Cycle Q Clear(g_c), s | 0.3 | 13.2 | 10.9 | 1.8 | 8.7 | 6.5 | 6.6 | 25.8 | 0.7 | 2.3 | 22.9 | 0.2 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 216 | 344 | 291 | 180 | 397 | 337 | 358 | 1741 | 789 | 259 | 1561 | 708 |
| V/C Ratio(X) | 0.03 | 0.85 | 0.72 | 0.25 | 0.53 | 0.41 | 0.77 | 0.75 | 0.03 | 0.36 | 0.72 | 0.01 |
| Avail Cap(c_a), veh/h | 303 | 396 | 336 | 215 | 397 | 337 | 431 | 1741 | 789 | 270 | 1561 | 708 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 27.8 | 33.5 | 32.5 | 27.2 | 29.5 | 28.6 | 15.9 | 16.5 | 10.4 | 14.3 | 18.8 | 12.6 |
| Incr Delay (d2), s/veh | 0.1 | 14.7 | 6.3 | 0.7 | 1.3 | 0.8 | 6.8 | 3.0 | 0.1 | 0.8 | 2.9 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.1 | 7.1 | 4.5 | 0.7 | 3.9 | 2.4 | 3.0 | 9.9 | 0.2 | 0.9 | 9.1 | 0.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 27.9 | 48.1 | 38.8 | 28.0 | 30.8 | 29.4 | 22.7 | 19.5 | 10.5 | 15.1 | 21.7 | 12.6 |
| LnGrp LOS | C | D | D | C | C | C | C | B | B | B | C | B |
| Approach Vol, veh/h | | 510 | | | 394 | | | 1602 | | | 1228 | |
| Approach Delay, s/veh | | 44.0 | | | 30.0 | | | 19.9 | | | 21.2 | |
| Approach LOS | | D | | | C | | | B | | | C | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 8.9 | 48.0 | 7.8 | 20.5 | 13.4 | 43.5 | 5.3 | 23.1 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 5.0 | 43.5 | 5.0 | 18.5 | 12.5 | 36.0 | 5.0 | 18.5 |
| Max Q Clear Time (g_c+I1), s | 4.3 | 27.8 | 3.8 | 15.2 | 8.6 | 24.9 | 2.3 | 10.7 |
| Green Ext Time (p_c), s | 0.0 | 8.7 | 0.0 | 0.8 | 0.3 | 6.0 | 0.0 | 1.0 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 24.7 |
| HCM 6th LOS | C |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 110.4 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 69 | 264 | 23 | 103 | 350 | 6 | 34 | 172 | 103 | 11 | 250 | 92 |
| Future Vol, veh/h | 69 | 264 | 23 | 103 | 350 | 6 | 34 | 172 | 103 | 11 | 250 | 92 |
| Peak Hour Factor | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.81 | 0.81 | 0.81 | 0.82 | 0.82 | 0.82 |
| Heavy Vehicles, % | 5 | 9 | 3 | 3 | 9 | 3 | 3 | 5 | 3 | 3 | 5 | 5 |
| Mvmt Flow | 79 | 303 | 26 | 118 | 402 | 7 | 42 | 212 | 127 | 13 | 305 | 112 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 1 | 1 |
| HCM Control Delay | 89.9 | 192.2 | 29.4 | 101.4 |
| HCM LOS | F | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|---|
| Vol Left, % | 17% | 0% | 19% | 22% | 3% |
| Vol Thru, % | 83% | 0% | 74% | 76% | 71% |
| Vol Right, % | 0% | 100% | 6% | 1% | 26% |
| Sign Control | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 206 | 103 | 356 | 459 | 353 |
| LT Vol | 34 | 0 | 69 | 103 | 11 |
| Through Vol | 172 | 0 | 264 | 350 | 250 |
| RT Vol | 0 | 103 | 23 | 6 | 92 |
| Lane Flow Rate | 254 | 127 | 409 | 528 | 430 |
| Geometry Grp | 7 | 7 | 2 | 2 | 5 |
| Degree of Util (X) | 0.693 | 0.32 | 1.031 | 1.328 | 1.073 |
| Departure Headway (Hd) | 11.014 | 10.226 | 10.338 | 9.605 | 10.127 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes |
| Cap | 331 | 354 | 356 | 385 | 362 |
| Service Time | 8.714 | 7.926 | 8.338 | 7.605 | 8.127 |
| HCM Lane V/C Ratio | 0.767 | 0.359 | 1.149 | 1.371 | 1.188 |
| HCM Control Delay | 35.2 | 17.7 | 89.9 | 192.2 | 101.4 |
| HCM Lane LOS | E | C | F | F | F |
| HCM 95th-tile Q | 4.9 | 1.4 | 12.3 | 23.4 | 13.7 |

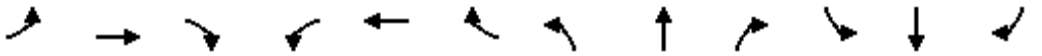
| Intersection | |
|---|---|
| Int Delay, s/veh | 2.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 1 | 348 | 26 | 20 | 419 | 1 | 24 | 2 | 18 | 20 | 2 | 12 |
| Future Vol, veh/h | 1 | 348 | 26 | 20 | 419 | 1 | 24 | 2 | 18 | 20 | 2 | 12 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 120 | - | 120 | 140 | - | 210 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 87 | 87 | 87 | 88 | 88 | 88 | 75 | 75 | 75 | 75 | 75 | 75 |
| Heavy Vehicles, % | 2 | 5 | 2 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 1 | 400 | 30 | 23 | 476 | 1 | 32 | 3 | 24 | 27 | 3 | 16 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 477 | 0 | 0 | 430 | 0 | 0 | 934 | 925 | 400 | 953 | 954 | 476 |
| Stage 1 | - | - | - | - | - | - | 402 | 402 | - | 522 | 522 | - |
| Stage 2 | - | - | - | - | - | - | 532 | 523 | - | 431 | 432 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1085 | - | - | 1129 | - | - | 246 | 269 | 650 | 239 | 259 | 589 |
| Stage 1 | - | - | - | - | - | - | 625 | 600 | - | 538 | 531 | - |
| Stage 2 | - | - | - | - | - | - | 531 | 530 | - | 603 | 582 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1085 | - | - | 1129 | - | - | 233 | 263 | 650 | 225 | 254 | 589 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 233 | 263 | - | 225 | 254 | - |
| Stage 1 | - | - | - | - | - | - | 624 | 599 | - | 537 | 520 | - |
| Stage 2 | - | - | - | - | - | - | 503 | 519 | - | 578 | 581 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 0.4 | 18.9 | 19.7 |
| HCM LOS | | | C | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 318 | 1085 | - | - | 1129 | - | - | 290 |
| HCM Lane V/C Ratio | 0.184 | 0.001 | - | - | 0.02 | - | - | 0.156 |
| HCM Control Delay (s) | 18.9 | 8.3 | - | - | 8.3 | - | - | 19.7 |
| HCM Lane LOS | C | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 0.7 | 0 | - | - | 0.1 | - | - | 0.5 |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 29 | 212 | 178 | 57 | 263 | 75 | 178 | 1142 | 46 | 144 | 1395 | 23 |
| Future Volume (veh/h) | 29 | 212 | 178 | 57 | 263 | 75 | 178 | 1142 | 46 | 144 | 1395 | 23 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1796 | 1826 | 1826 | 1796 | 1826 |
| Adj Flow Rate, veh/h | 33 | 241 | 202 | 63 | 292 | 83 | 191 | 1228 | 49 | 150 | 1453 | 24 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.90 | 0.90 | 0.90 | 0.93 | 0.93 | 0.93 | 0.96 | 0.96 | 0.96 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 7 | 5 |
| Cap, veh/h | 170 | 313 | 265 | 206 | 338 | 287 | 259 | 1728 | 783 | 293 | 1687 | 765 |
| Arrive On Green | 0.03 | 0.17 | 0.17 | 0.05 | 0.19 | 0.19 | 0.08 | 0.51 | 0.51 | 0.06 | 0.49 | 0.49 |
| Sat Flow, veh/h | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 3413 | 1547 | 1739 | 3413 | 1547 |
| Grp Volume(v), veh/h | 33 | 241 | 202 | 63 | 292 | 83 | 191 | 1228 | 49 | 150 | 1453 | 24 |
| Grp Sat Flow(s),veh/h/ln | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 1706 | 1547 | 1739 | 1706 | 1547 |
| Q Serve(g_s), s | 1.3 | 10.7 | 10.5 | 2.5 | 13.1 | 3.9 | 4.5 | 23.5 | 1.4 | 3.5 | 31.8 | 0.7 |
| Cycle Q Clear(g_c), s | 1.3 | 10.7 | 10.5 | 2.5 | 13.1 | 3.9 | 4.5 | 23.5 | 1.4 | 3.5 | 31.8 | 0.7 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 170 | 313 | 265 | 206 | 338 | 287 | 259 | 1728 | 783 | 293 | 1687 | 765 |
| V/C Ratio(X) | 0.19 | 0.77 | 0.76 | 0.31 | 0.86 | 0.29 | 0.74 | 0.71 | 0.06 | 0.51 | 0.86 | 0.03 |
| Avail Cap(c_a), veh/h | 217 | 388 | 329 | 230 | 388 | 329 | 272 | 1728 | 783 | 336 | 1687 | 765 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 28.3 | 33.5 | 33.5 | 27.7 | 33.5 | 29.7 | 18.0 | 16.1 | 10.7 | 13.7 | 18.9 | 11.0 |
| Incr Delay (d2), s/veh | 0.6 | 7.3 | 8.0 | 0.8 | 16.3 | 0.6 | 9.6 | 2.5 | 0.2 | 1.4 | 6.0 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.6 | 5.3 | 4.4 | 1.1 | 7.2 | 1.5 | 2.4 | 9.0 | 0.5 | 1.3 | 12.8 | 0.2 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 28.8 | 40.8 | 41.4 | 28.5 | 49.8 | 30.3 | 27.6 | 18.6 | 10.8 | 15.0 | 24.9 | 11.1 |
| LnGrp LOS | C | D | D | C | D | C | C | B | B | B | C | B |
| Approach Vol, veh/h | | 476 | | | 438 | | | 1468 | | | 1627 | |
| Approach Delay, s/veh | | 40.2 | | | 43.0 | | | 19.5 | | | 23.8 | |
| Approach LOS | | D | | | D | | | B | | | C | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 9.9 | 47.4 | 8.4 | 19.0 | 11.0 | 46.4 | 7.2 | 20.2 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 7.5 | 41.5 | 5.0 | 18.0 | 7.1 | 41.9 | 5.0 | 18.0 |
| Max Q Clear Time (g_c+I1), s | 5.5 | 25.5 | 4.5 | 12.7 | 6.5 | 33.8 | 3.3 | 15.1 |
| Green Ext Time (p_c), s | 0.1 | 8.4 | 0.0 | 1.0 | 0.0 | 5.8 | 0.0 | 0.6 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 26.3 |
| HCM 6th LOS | C |

Appendix E

Build Intersection Operational Analysis

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 130.4 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 75 | 374 | 11 | 90 | 386 | 28 | 29 | 209 | 127 | 22 | 172 | 57 |
| Future Vol, veh/h | 75 | 374 | 11 | 90 | 386 | 28 | 29 | 209 | 127 | 22 | 172 | 57 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.90 | 0.90 | 0.90 | 0.85 | 0.85 | 0.85 | 0.75 | 0.75 | 0.75 |
| Heavy Vehicles, % | 5 | 9 | 3 | 3 | 9 | 3 | 3 | 5 | 3 | 3 | 5 | 5 |
| Mvmt Flow | 85 | 425 | 13 | 100 | 429 | 31 | 34 | 246 | 149 | 29 | 229 | 76 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 1 | 1 |
| HCM Control Delay | 176.2 | 209 | 31.9 | 53.8 |
| HCM LOS | F | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|---|
| Vol Left, % | 12% | 0% | 16% | 18% | 9% |
| Vol Thru, % | 88% | 0% | 81% | 77% | 69% |
| Vol Right, % | 0% | 100% | 2% | 6% | 23% |
| Sign Control | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 238 | 127 | 460 | 504 | 251 |
| LT Vol | 29 | 0 | 75 | 90 | 22 |
| Through Vol | 209 | 0 | 374 | 386 | 172 |
| RT Vol | 0 | 127 | 11 | 28 | 57 |
| Lane Flow Rate | 280 | 149 | 523 | 560 | 335 |
| Geometry Grp | 7 | 7 | 2 | 2 | 5 |
| Degree of Util (X) | 0.737 | 0.363 | 1.285 | 1.369 | 0.852 |
| Departure Headway (Hd) | 10.989 | 10.223 | 9.91 | 9.667 | 11.023 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes |
| Cap | 333 | 354 | 371 | 381 | 331 |
| Service Time | 8.689 | 7.923 | 7.91 | 7.667 | 9.023 |
| HCM Lane V/C Ratio | 0.841 | 0.421 | 1.41 | 1.47 | 1.012 |
| HCM Control Delay | 39 | 18.6 | 176.2 | 209 | 53.8 |
| HCM Lane LOS | E | C | F | F | F |
| HCM 95th-tile Q | 5.5 | 1.6 | 21.2 | 24.9 | 7.6 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 3.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 14 | 460 | 54 | 22 | 434 | 26 | 44 | 4 | 38 | 3 | 5 | 2 |
| Future Vol, veh/h | 14 | 460 | 54 | 22 | 434 | 26 | 44 | 4 | 38 | 3 | 5 | 2 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 120 | - | 120 | 140 | - | 210 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 88 | 88 | 88 | 89 | 89 | 89 | 80 | 80 | 80 | 60 | 60 | 60 |
| Heavy Vehicles, % | 2 | 5 | 2 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 16 | 523 | 61 | 25 | 488 | 29 | 55 | 5 | 48 | 5 | 8 | 3 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 517 | 0 | 0 | 584 | 0 | 0 | 1113 | 1122 | 523 | 1150 | 1154 | 488 |
| Stage 1 | - | - | - | - | - | - | 555 | 555 | - | 538 | 538 | - |
| Stage 2 | - | - | - | - | - | - | 558 | 567 | - | 612 | 616 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1049 | - | - | 991 | - | - | 186 | 206 | 554 | 175 | 197 | 580 |
| Stage 1 | - | - | - | - | - | - | 516 | 513 | - | 527 | 522 | - |
| Stage 2 | - | - | - | - | - | - | 514 | 507 | - | 480 | 482 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1049 | - | - | 991 | - | - | 173 | 198 | 554 | 152 | 189 | 580 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 173 | 198 | - | 152 | 189 | - |
| Stage 1 | - | - | - | - | - | - | 508 | 505 | - | 519 | 509 | - |
| Stage 2 | - | - | - | - | - | - | 490 | 494 | - | 428 | 475 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.2 | 0.4 | 29.7 | 24.5 |
| HCM LOS | | | D | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 251 | 1049 | - | - | 991 | - | - | 201 |
| HCM Lane V/C Ratio | 0.428 | 0.015 | - | - | 0.025 | - | - | 0.083 |
| HCM Control Delay (s) | 29.7 | 8.5 | - | - | 8.7 | - | - | 24.5 |
| HCM Lane LOS | D | A | - | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 2 | 0 | - | - | 0.1 | - | - | 0.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 31 | 279 | 196 | 48 | 191 | 121 | 293 | 1241 | 23 | 86 | 1060 | 11 |
| Future Volume (veh/h) | 31 | 279 | 196 | 48 | 191 | 121 | 293 | 1241 | 23 | 86 | 1060 | 11 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1796 | 1826 | 1826 | 1796 | 1826 |
| Adj Flow Rate, veh/h | 34 | 310 | 218 | 55 | 217 | 138 | 305 | 1293 | 24 | 92 | 1140 | 12 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.88 | 0.88 | 0.88 | 0.96 | 0.96 | 0.96 | 0.93 | 0.93 | 0.93 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 7 | 5 |
| Cap, veh/h | 238 | 356 | 302 | 183 | 375 | 317 | 361 | 1717 | 778 | 254 | 1493 | 677 |
| Arrive On Green | 0.03 | 0.20 | 0.20 | 0.04 | 0.21 | 0.21 | 0.12 | 0.50 | 0.50 | 0.05 | 0.44 | 0.44 |
| Sat Flow, veh/h | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 3413 | 1547 | 1739 | 3413 | 1547 |
| Grp Volume(v), veh/h | 34 | 310 | 218 | 55 | 217 | 138 | 305 | 1293 | 24 | 92 | 1140 | 12 |
| Grp Sat Flow(s),veh/h/ln | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 1706 | 1547 | 1739 | 1706 | 1547 |
| Q Serve(g_s), s | 1.3 | 14.2 | 11.4 | 2.2 | 9.3 | 6.7 | 7.8 | 26.2 | 0.7 | 2.5 | 24.4 | 0.4 |
| Cycle Q Clear(g_c), s | 1.3 | 14.2 | 11.4 | 2.2 | 9.3 | 6.7 | 7.8 | 26.2 | 0.7 | 2.5 | 24.4 | 0.4 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 238 | 356 | 302 | 183 | 375 | 317 | 361 | 1717 | 778 | 254 | 1493 | 677 |
| V/C Ratio(X) | 0.14 | 0.87 | 0.72 | 0.30 | 0.58 | 0.43 | 0.85 | 0.75 | 0.03 | 0.36 | 0.76 | 0.02 |
| Avail Cap(c_a), veh/h | 282 | 391 | 331 | 210 | 391 | 331 | 429 | 1717 | 778 | 265 | 1493 | 677 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 26.8 | 33.7 | 32.6 | 27.2 | 31.0 | 30.0 | 16.9 | 17.2 | 10.9 | 15.1 | 20.5 | 13.8 |
| Incr Delay (d2), s/veh | 0.3 | 17.6 | 6.8 | 0.9 | 2.0 | 0.9 | 12.7 | 3.1 | 0.1 | 0.9 | 3.8 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.6 | 7.9 | 4.7 | 0.9 | 4.2 | 2.5 | 3.9 | 10.2 | 0.2 | 1.0 | 9.9 | 0.1 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 27.0 | 51.4 | 39.4 | 28.1 | 33.0 | 30.9 | 29.6 | 20.3 | 10.9 | 15.9 | 24.3 | 13.8 |
| LnGrp LOS | C | D | D | C | C | C | C | C | B | B | C | B |
| Approach Vol, veh/h | | 562 | | | 410 | | | 1622 | | | 1244 | |
| Approach Delay, s/veh | | 45.3 | | | 31.6 | | | 21.9 | | | 23.6 | |
| Approach LOS | | D | | | C | | | C | | | C | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 9.0 | 48.0 | 8.2 | 21.4 | 14.6 | 42.3 | 7.3 | 22.2 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 5.0 | 43.5 | 5.0 | 18.5 | 13.5 | 35.0 | 5.0 | 18.5 |
| Max Q Clear Time (g_c+I1), s | 4.5 | 28.2 | 4.2 | 16.2 | 9.8 | 26.4 | 3.3 | 11.3 |
| Green Ext Time (p_c), s | 0.0 | 8.5 | 0.0 | 0.6 | 0.3 | 5.0 | 0.0 | 1.0 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 26.9 |
| HCM 6th LOS | C |

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.1 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 514 | 9 | 5 | 477 | 27 | 17 |
| Future Vol, veh/h | 514 | 9 | 5 | 477 | 27 | 17 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 88 | 88 | 89 | 89 | 75 | 75 |
| Heavy Vehicles, % | 5 | 2 | 2 | 5 | 2 | 2 |
| Mvmt Flow | 584 | 10 | 6 | 536 | 36 | 23 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 594 | 0 | 1132 | 584 |
| Stage 1 | - | - | - | - | 584 | - |
| Stage 2 | - | - | - | - | 548 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 982 | - | 225 | 512 |
| Stage 1 | - | - | - | - | 557 | - |
| Stage 2 | - | - | - | - | 579 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 982 | - | 223 | 512 |
| Mov Cap-2 Maneuver | - | - | - | - | 223 | - |
| Stage 1 | - | - | - | - | 552 | - |
| Stage 2 | - | - | - | - | 579 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.1 | 20.9 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 285 | - | - | 982 | - |
| HCM Lane V/C Ratio | 0.206 | - | - | 0.006 | - |
| HCM Control Delay (s) | 20.9 | - | - | 8.7 | 0 |
| HCM Lane LOS | C | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.8 | - | - | 0 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.1 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 17 | 0 | 1558 | 1279 | 50 |
| Future Vol, veh/h | 0 | 17 | 0 | 1558 | 1279 | 50 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 70 | 92 | 96 | 93 | 93 |
| Heavy Vehicles, % | 2 | 2 | 2 | 7 | 2 | 7 |
| Mvmt Flow | 0 | 24 | 0 | 1623 | 1375 | 54 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 688 | - | 0 | - | 0 |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 0 | 389 | 0 | - | - | - |
| Stage 1 | 0 | - | 0 | - | - | - |
| Stage 2 | 0 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | - | 389 | - | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 14.9 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|
| Capacity (veh/h) | - | 389 | - | - |
| HCM Lane V/C Ratio | - | 0.062 | - | - |
| HCM Control Delay (s) | - | 14.9 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0.2 | - | - |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 150.9 |
| Intersection LOS | F |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 69 | 289 | 23 | 120 | 372 | 23 | 34 | 172 | 120 | 35 | 250 | 92 |
| Future Vol, veh/h | 69 | 289 | 23 | 120 | 372 | 23 | 34 | 172 | 120 | 35 | 250 | 92 |
| Peak Hour Factor | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.81 | 0.81 | 0.81 | 0.82 | 0.82 | 0.82 |
| Heavy Vehicles, % | 5 | 9 | 3 | 3 | 9 | 3 | 3 | 5 | 3 | 3 | 5 | 5 |
| Mvmt Flow | 79 | 332 | 26 | 138 | 428 | 26 | 42 | 212 | 148 | 43 | 305 | 112 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 2 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 2 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 2 | 1 | 1 | 1 |
| HCM Control Delay | 119.8 | 268.1 | 31.1 | 134.7 |
| HCM LOS | F | F | D | F |

| Lane | NBLn1 | NBLn2 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|---|
| Vol Left, % | 17% | 0% | 18% | 23% | 9% |
| Vol Thru, % | 83% | 0% | 76% | 72% | 66% |
| Vol Right, % | 0% | 100% | 6% | 4% | 24% |
| Sign Control | Stop | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 206 | 120 | 381 | 515 | 377 |
| LT Vol | 34 | 0 | 69 | 120 | 35 |
| Through Vol | 172 | 0 | 289 | 372 | 250 |
| RT Vol | 0 | 120 | 23 | 23 | 92 |
| Lane Flow Rate | 254 | 148 | 438 | 592 | 460 |
| Geometry Grp | 7 | 7 | 2 | 2 | 5 |
| Degree of Util (X) | 0.694 | 0.373 | 1.117 | 1.507 | 1.164 |
| Departure Headway (Hd) | 11.829 | 11.038 | 11.134 | 10.1 | 10.847 |
| Convergence, Y/N | Yes | Yes | Yes | Yes | Yes |
| Cap | 308 | 329 | 328 | 367 | 340 |
| Service Time | 9.529 | 8.738 | 9.134 | 8.1 | 8.847 |
| HCM Lane V/C Ratio | 0.825 | 0.45 | 1.335 | 1.613 | 1.353 |
| HCM Control Delay | 37.5 | 20.2 | 119.8 | 268.1 | 134.7 |
| HCM Lane LOS | E | C | F | F | F |
| HCM 95th-tile Q | 4.8 | 1.7 | 14.2 | 29.4 | 15.9 |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 13.9 |
| Intersection LOS | B |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Entry Lanes | 1 | 1 | 2 | 1 |
| Conflicting Circle Lanes | 1 | 1 | 1 | 1 |
| Adj Approach Flow, veh/h | 437 | 592 | 402 | 460 |
| Demand Flow Rate, veh/h | 472 | 636 | 418 | 482 |
| Vehicles Circulating, veh/h | 506 | 349 | 489 | 652 |
| Vehicles Exiting, veh/h | 628 | 558 | 489 | 333 |
| Ped Vol Crossing Leg, #/h | 0 | 0 | 0 | 0 |
| Ped Cap Adj | 1.000 | 1.000 | 1.000 | 1.000 |
| Approach Delay, s/veh | 13.7 | 14.6 | 6.7 | 19.2 |
| Approach LOS | B | B | A | C |

| Lane | Left | Left | Left | Right | Left |
|---|---|---|---|---|---|
| Designated Moves | LTR | LTR | LT | R | LTR |
| Assumed Moves | LTR | LTR | LT | R | LTR |
| RT Channelized | | | | | |
| Lane Util | 1.000 | 1.000 | 0.636 | 0.364 | 1.000 |
| Follow-Up Headway, s | 2.609 | 2.609 | 2.535 | 2.535 | 2.609 |
| Critical Headway, s | 4.976 | 4.976 | 4.544 | 4.544 | 4.976 |
| Entry Flow, veh/h | 472 | 636 | 266 | 152 | 482 |
| Cap Entry Lane, veh/h | 824 | 967 | 910 | 910 | 710 |
| Entry HV Adj Factor | 0.926 | 0.932 | 0.956 | 0.974 | 0.954 |
| Flow Entry, veh/h | 437 | 592 | 254 | 148 | 460 |
| Cap Entry, veh/h | 763 | 900 | 870 | 886 | 677 |
| V/C Ratio | 0.573 | 0.658 | 0.292 | 0.167 | 0.679 |
| Control Delay, s/veh | 13.7 | 14.6 | 7.3 | 5.7 | 19.2 |
| LOS | B | B | A | A | C |
| 95th %tile Queue, veh | 4 | 5 | 1 | 1 | 5 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 6.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 1 | 355 | 71 | 37 | 432 | 1 | 70 | 5 | 62 | 20 | 5 | 12 |
| Future Vol, veh/h | 1 | 355 | 71 | 37 | 432 | 1 | 70 | 5 | 62 | 20 | 5 | 12 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | 120 | - | 120 | 140 | - | 210 | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 87 | 87 | 87 | 88 | 88 | 88 | 75 | 75 | 75 | 75 | 75 | 75 |
| Heavy Vehicles, % | 2 | 5 | 2 | 2 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 1 | 408 | 82 | 42 | 491 | 1 | 93 | 7 | 83 | 27 | 7 | 16 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 492 | 0 | 0 | 490 | 0 | 0 | 997 | 986 | 408 | 1071 | 1067 | 491 |
| Stage 1 | - | - | - | - | - | - | 410 | 410 | - | 575 | 575 | - |
| Stage 2 | - | - | - | - | - | - | 587 | 576 | - | 496 | 492 | - |
| Critical Hdwy | 4.12 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.12 | 6.52 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.12 | 5.52 | - |
| Follow-up Hdwy | 2.218 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.518 | 4.018 | 3.318 |
| Pot Cap-1 Maneuver | 1071 | - | - | 1073 | - | - | 223 | 248 | 643 | 198 | 222 | 578 |
| Stage 1 | - | - | - | - | - | - | 619 | 595 | - | 503 | 503 | - |
| Stage 2 | - | - | - | - | - | - | 496 | 502 | - | 556 | 548 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1071 | - | - | 1073 | - | - | 205 | 238 | 643 | 164 | 213 | 578 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 205 | 238 | - | 164 | 213 | - |
| Stage 1 | - | - | - | - | - | - | 618 | 594 | - | 502 | 483 | - |
| Stage 2 | - | - | - | - | - | - | 457 | 482 | - | 479 | 547 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 0.7 | 34.3 | 25.7 |
| HCM LOS | | | D | D |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 299 | 1071 | - | - | 1073 | - | - | 223 |
| HCM Lane V/C Ratio | 0.611 | 0.001 | - | - | 0.039 | - | - | 0.221 |
| HCM Control Delay (s) | 34.3 | 8.4 | - | - | 8.5 | - | - | 25.7 |
| HCM Lane LOS | D | A | - | - | A | - | - | D |
| HCM 95th %tile Q(veh) | 3.7 | 0 | - | - | 0.1 | - | - | 0.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 60 | 231 | 183 | 65 | 272 | 75 | 216 | 1130 | 46 | 144 | 1408 | 32 |
| Future Volume (veh/h) | 60 | 231 | 183 | 65 | 272 | 75 | 216 | 1130 | 46 | 144 | 1408 | 32 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1826 | 1796 | 1826 | 1826 | 1796 | 1826 |
| Adj Flow Rate, veh/h | 68 | 262 | 208 | 72 | 302 | 83 | 232 | 1215 | 49 | 150 | 1467 | 33 |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.90 | 0.90 | 0.90 | 0.93 | 0.93 | 0.93 | 0.96 | 0.96 | 0.96 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 7 | 5 | 5 | 7 | 5 |
| Cap, veh/h | 191 | 343 | 290 | 212 | 345 | 292 | 267 | 1678 | 761 | 288 | 1582 | 717 |
| Arrive On Green | 0.05 | 0.19 | 0.19 | 0.05 | 0.19 | 0.19 | 0.09 | 0.49 | 0.49 | 0.07 | 0.46 | 0.46 |
| Sat Flow, veh/h | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 3413 | 1547 | 1739 | 3413 | 1547 |
| Grp Volume(v), veh/h | 68 | 262 | 208 | 72 | 302 | 83 | 232 | 1215 | 49 | 150 | 1467 | 33 |
| Grp Sat Flow(s),veh/h/ln | 1739 | 1826 | 1547 | 1739 | 1826 | 1547 | 1739 | 1706 | 1547 | 1739 | 1706 | 1547 |
| Q Serve(g_s), s | 2.7 | 11.8 | 11.0 | 2.9 | 14.0 | 4.0 | 6.2 | 24.4 | 1.4 | 3.9 | 35.1 | 1.0 |
| Cycle Q Clear(g_c), s | 2.7 | 11.8 | 11.0 | 2.9 | 14.0 | 4.0 | 6.2 | 24.4 | 1.4 | 3.9 | 35.1 | 1.0 |
| Prop In Lane | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 191 | 343 | 290 | 212 | 345 | 292 | 267 | 1678 | 761 | 288 | 1582 | 717 |
| V/C Ratio(X) | 0.36 | 0.76 | 0.72 | 0.34 | 0.88 | 0.28 | 0.87 | 0.72 | 0.06 | 0.52 | 0.93 | 0.05 |
| Avail Cap(c_a), veh/h | 210 | 378 | 320 | 229 | 378 | 320 | 277 | 1678 | 761 | 321 | 1582 | 717 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 27.7 | 33.5 | 33.1 | 27.4 | 34.3 | 30.2 | 19.8 | 17.4 | 11.6 | 14.8 | 21.9 | 12.8 |
| Incr Delay (d2), s/veh | 1.1 | 8.2 | 6.7 | 0.9 | 18.9 | 0.5 | 23.8 | 2.8 | 0.2 | 1.5 | 10.9 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.2 | 5.9 | 4.6 | 1.2 | 7.9 | 1.5 | 4.0 | 9.5 | 0.5 | 1.5 | 15.3 | 0.4 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 28.9 | 41.7 | 39.8 | 28.3 | 53.2 | 30.8 | 43.6 | 20.2 | 11.8 | 16.3 | 32.8 | 12.9 |
| LnGrp LOS | C | D | D | C | D | C | D | C | B | B | C | B |
| Approach Vol, veh/h | | 538 | | | 457 | | | 1496 | | | 1650 | |
| Approach Delay, s/veh | | 39.3 | | | 45.2 | | | 23.5 | | | 30.9 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 10.3 | 47.2 | 8.6 | 20.8 | 12.7 | 44.8 | 8.5 | 20.9 |
| Change Period (Y+Rc), s | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| Max Green Setting (Gmax), s | 7.4 | 41.6 | 5.0 | 18.0 | 8.7 | 40.3 | 5.0 | 18.0 |
| Max Q Clear Time (g_c+I1), s | 5.9 | 26.4 | 4.9 | 13.8 | 8.2 | 37.1 | 4.7 | 16.0 |
| Green Ext Time (p_c), s | 0.1 | 8.0 | 0.0 | 0.9 | 0.0 | 2.5 | 0.0 | 0.4 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 30.9 |
| HCM 6th LOS | C |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.7 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 419 | 25 | 18 | 500 | 15 | 11 |
| Future Vol, veh/h | 419 | 25 | 18 | 500 | 15 | 11 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 87 | 87 | 88 | 88 | 75 | 75 |
| Heavy Vehicles, % | 5 | 2 | 2 | 5 | 2 | 2 |
| Mvmt Flow | 482 | 29 | 20 | 568 | 20 | 15 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 511 | 0 | 1090 | 482 |
| Stage 1 | - | - | - | - | 482 | - |
| Stage 2 | - | - | - | - | 608 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1054 | - | 238 | 584 |
| Stage 1 | - | - | - | - | 621 | - |
| Stage 2 | - | - | - | - | 543 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1054 | - | 231 | 584 |
| Mov Cap-2 Maneuver | - | - | - | - | 231 | - |
| Stage 1 | - | - | - | - | 604 | - |
| Stage 2 | - | - | - | - | 543 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.3 | 18.1 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 310 | - | - | 1054 | - |
| HCM Lane V/C Ratio | 0.112 | - | - | 0.019 | - |
| HCM Control Delay (s) | 18.1 | - | - | 8.5 | 0 |
| HCM Lane LOS | C | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.4 | - | - | 0.1 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.2 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 34 | 0 | 1392 | 1621 | 61 |
| Future Vol, veh/h | 0 | 34 | 0 | 1392 | 1621 | 61 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 85 | 92 | 93 | 96 | 96 |
| Heavy Vehicles, % | 2 | 2 | 2 | 7 | 2 | 7 |
| Mvmt Flow | 0 | 40 | 0 | 1497 | 1689 | 64 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 845 | - | 0 | - | 0 |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 0 | 306 | 0 | - | - | - |
| Stage 1 | 0 | - | 0 | - | - | - |
| Stage 2 | 0 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | - | 306 | - | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 18.5 | 0 | 0 |
| HCM LOS | C | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|
| Capacity (veh/h) | - | 306 | - | - |
| HCM Lane V/C Ratio | - | 0.131 | - | - |
| HCM Control Delay (s) | - | 18.5 | - | - |
| HCM Lane LOS | - | C | - | - |
| HCM 95th %tile Q(veh) | - | 0.4 | - | - |

Appendix F

ICE Waiver Request for Proposed GA 74 RIRO Access

MARC R. ACAMPORA, PE, LLC
TRAFFIC ENGINEERING

# Memorandum

**Date:** May 18, 2020

**From:** Marc R. Acampora, PE

**Subject:** Intersection Control Evaluation Waiver Request for GA 74 at Proposed Site RIRO Access to Tyrone Mixed-Use Development, Town of Tyrone, Fayette County, Georgia

---

An Intersection Control Evaluation (ICE) Waiver Request was prepared for the proposed site access on GA 74 to a proposed mixed-use development in the Town of Tyrone in Fayette County, Georgia. The location of the development is shown in Figure 1. Figure 2 is an aerial photograph along the existing adjacent section of GA 74. Figure 3 is a site plan showing the proposed access that is the subject of this study and Figure 4 is a photograph of the existing section on GA 74.

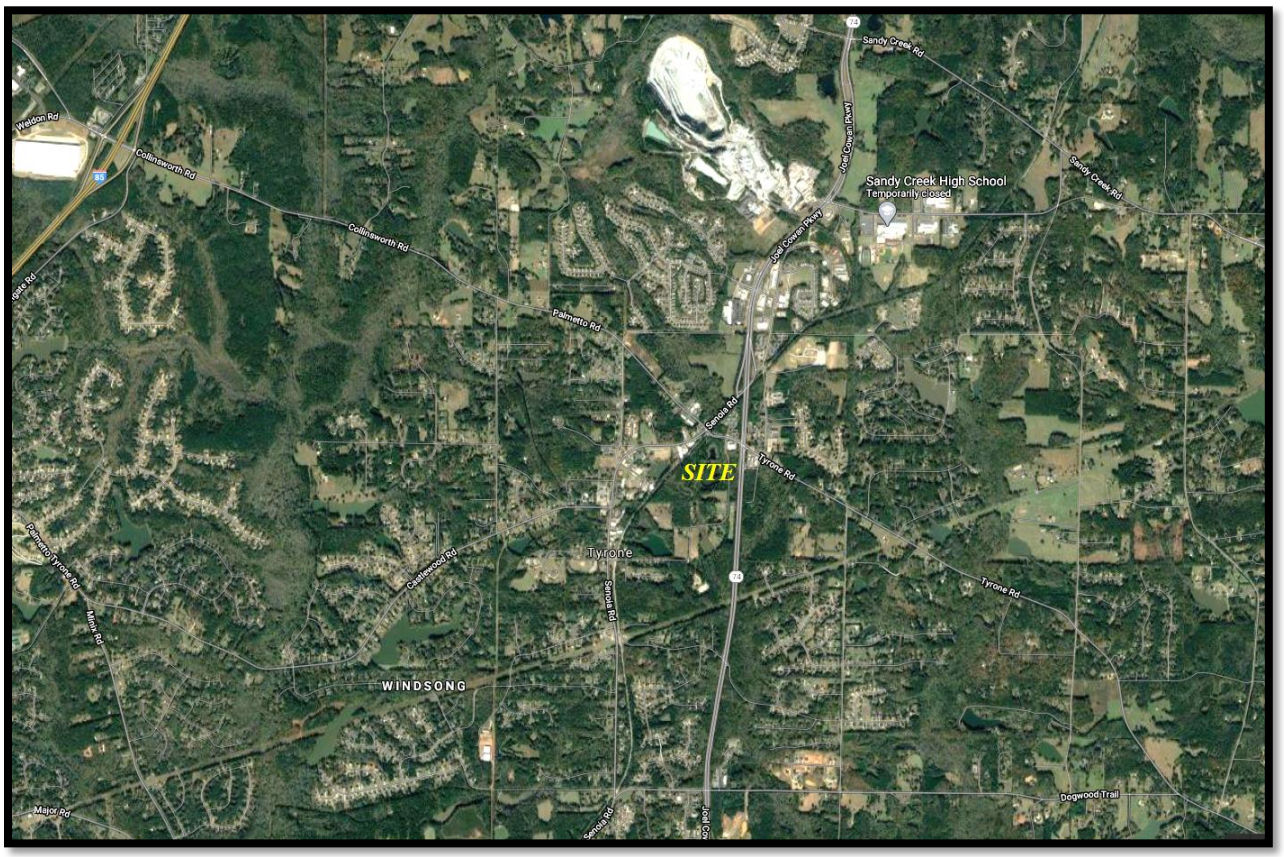



Figure 1 – Site Location Map

858 Myrtle Street, NE
Atlanta, Georgia 30308

phone (678) 637-1763
e-mail acamporatraffic@comcast.net


Figure 2 – Aerial Photograph of GA 74 Adjacent to Site


Figure 3 – Proposed Mixed-Use Development Site Plan Showing Proposed RIRO Access


Figure 4 – Photograph of GA 74 Facing South, South of Tyrone Road

## Existing Conditions

GA 74 (Joel Cowan Parkway) is a north/south urban principal arterial (Georgia DOT designation) that provides regional mobility. The road is median-divided with two through lanes in each direction, with northbound and southbound left and right turn lanes at Tyrone Road. The terrain along GA 74 is level to very gently rolling in the study area and the speed limit is 55 mph. The intersection of GA 74 and Tyrone Road is controlled by a signal, located approximately 1,400 feet north of the proposed RIRO access. In 2018 the Georgia DOT recorded an AADT volume of 29,100 vpd on GA 74 south of Tyrone Road. Crosswalks and pedestrian signal are provided on all approaches on GA 74 at Tyrone Road. There are no dedicated bicycle lanes in the vicinity of the subject site and there is no regularly-scheduled mass transit service in the vicinity of the site.

## Proposed Mixed-Use Development

This ICE waiver request is for a proposed right-in/right-out (RIRO) access on GA 74 to a proposed mixed-use development. Additional site access will be provided along Tyrone Road. The mixed-use development will consist of 204 townhomes and 30,000 square feet of commercial buildings. A traffic impact study for the proposed development was prepared in May 2020, concurrently with this ICE Waiver Request. The results of that study will not be reproduced here and the reader is referred to that study for detailed findings and recommendations. Table 1 presents the trip generation calculations for the proposed development.

Table 1 – Proposed Mixed-Use Development Trip Generation

| Land Use | ITE Code | Size | A.M. Peak Hour | | | P.M. Peak Hour | | | 24-Hour |
|---|---|---|---|---|---|---|---|---|---|
| | | | In | Out | Total | In | Out | Total | 2-Way |
| Retail/Restaurants | 820 | 30,000 ft² | 103 | 64 | 167 | 107 | 116 | 223 | 2,652 |
| -multi-use adjustment | | | -4 | -4 | -8 | -4 | -4 | -8 | -38 |
| -pass-by adjustment | | 24%/34%/24% | -24 | -14 | -38 | -35 | -38 | -73 | -628 |
| Total Commercial New Trips | | | 75 | 46 | 121 | 68 | 74 | 142 | 1,986 |
| | | | | | | | | | |
| Townhomes | 220 | 204 units | 22 | 72 | 94 | 70 | 41 | 111 | 1,502 |
| -multi-use adjustment | | | -0 | -4 | -4 | -4 | -0 | -4 | -38 |
| Total Residential New Trips | | | 22 | 68 | 90 | 66 | 41 | 107 | 1,464 |
| | | | | | | | | | |
| Total Project New Trips | | | 97 | 114 | 211 | 134 | 115 | 249 | 3,450 |

## Existing Traffic Volumes

The preparation of the traffic impact study and this ICE Waiver Request coincided with the onset of quarantining and statewide school closures due to the COVID-19 pandemic. GA 74, and roads throughout the state, saw dramatic decreases in volumes. Therefore, existing traffic volume counts could not be collected. Previously-collected turning movement counts were obtained from the Palmetto Road – Tyrone Road Transportation Corridor Study prepared for Fayette County in December 2019. The counts were collected in April 2018 and adjusted based on growth trends in the area to develop a 2020 "existing" condition. In addition to the intersection turning movement count, Georgia DOT AADT count data was obtained at nearby count station 113-0302, on GA 74 south of Tyrone Road. The 2018 AADT was 29,100 vpd.

## Future Traffic Volumes

Historic Georgia DOT AADT count data at station 113-0302 and other nearby count stations were used to develop traffic volume growth projections. This data is documented in the traffic impact study for the mixed-use development. It is projected that volumes will increase at a rate of approximately 2% per year. Additionally, Tyrone Elementary School, on Senoia Road south of Tyrone Road, is expected to reopen after being closed for several years, in 2021 or 2022. The 2020 "existing" volumes were increased by the 2% annual growth rate for five years. The Tyrone ES volumes and the trips from the proposed mixed-use development were added to develop future volumes at the subject RIRO site access. Figure 5 presents the 2025 volumes developed in the traffic impact study at the subject RIRO access. The ICE spreadsheets, attached to this memorandum, calculate the 2045 intersection volumes that were also used in the ICE analysis.

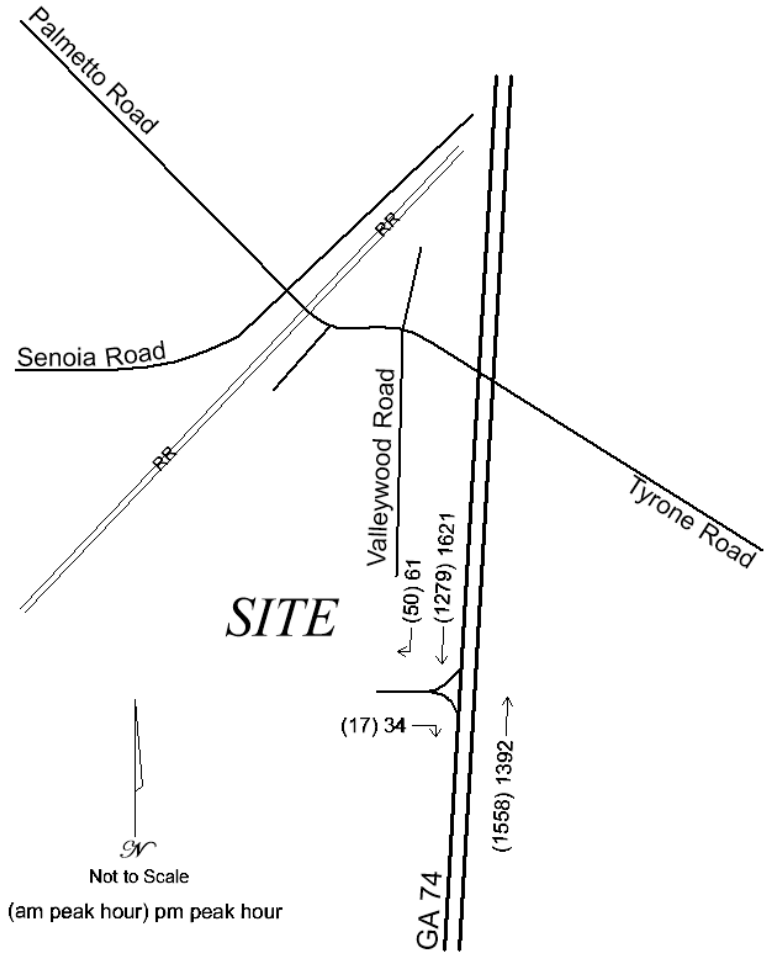



Figure 5 – 2025 Volumes at Subject Site RIRO Access

## Auxiliary Lane Requirements

The auxiliary lane standards for accesses on state routes are set forth the Georgia DOT's *Regulations for Driveway and Encroachment Control* (Driveway Manual), revision 5.0, 7/3/2019. The minimum spacing between site driveways and intersections on a road with a 55 mph posted speed limit is 350 feet and the site plan reviewed for this study complies with that standard. The lines of sight along this section of GA 74 are clear for a substantial distance in both directions adjacent to the site and no sight distance limitations are identified.

On a route with more than two lanes with an AADT greater than 6,000 vpd and a posted speed limit of 55 to 60 mph, the minimum right turn volume/vehicles (RTV) threshold above which a deceleration lane is required is 50 RTV per day. It is projected that approximately 780 RTV per day will turn right into the site RIRO access on GA 74. Therefore, a deceleration lane is required at this access according to the Georgia DOT standards. The Georgia DOT design standards for this deceleration lane, set forth in Table 4-8 of the Driveway Manual, call for 250 feet of full-width storage and a 100 foot taper. This access is located along a median-divided section of GA 74 and movements will be restricted to RIRO. Therefore, no left turn lane is required to serve this access on GA 74.

## Intersection Control Evaluation Waiver Request

An Intersection Control Evaluation Waiver Request was prepared for the proposed RIRO site access on GA 74. The analysis used Georgia DOT ICE Tool v2.15, revised July 1, 2019, which was confirmed to be the latest version at the time of this study. The Introduction Sheet and Waiver Request Sheet are attached to this report. The results are summarized as follows:

This intersection is proposed to be restricted to right-in/right-out (RIRO) on a median-divided section of a multi-lane highway. The operational analysis shows acceptable operations as a RIRO. Therefore, an ICE Waiver is being requested for this access according to criterion #2.

# GDOT INTERSECTION CONTROL EVALUATION (ICE) TOOL

ICE Version 2.15 | Revised 07/01/2019

| | | | |
|---|---|---|---|
| GDOT PI # (or N/A): | | Request By: | Brent Holdings LLC |
| County: | Fayette | GDOT District: | 3 - Thomaston |
| Major (State) Road: | GA 74 | Speed Limit: | 55 mph |
| Minor (Crossing) ST: | RIRO access | Speed Limit: | < 35 mph |
| Major ST Direction: | North/South | Area Type: | Suburb/Transition |
| Intersection Control: | New Intersection or Other | | |
| Prepared By: | MRA | Analyst: | MRA |
| Date: | 5/17/2020 | Project ID: | |
| Project Purpose: | request a driveway permit for a new RIRO access to a proposed mixed-use development | | |

| | |
|---|---|
| 2020 | Existing Data Year |
| 2025 | Project Opening Year |
| 2045 | Project Design Year |

Annual Growth Rate: 2.0%

K Factor*: 9%

## 2020 Existing Year Volumes

1160 (1477) [30200]

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (0) | (0) | (1477) | (0) | SB GA 74 | | |
| | | 0 | 0 | 1,160 | 0 | | | |
| EB RIRO access | Peds | | | | | Peds | 0 | (0) |
| (0) | 0 | | 2020 Intersection Daily Entering Volume (est): 30,200 | | | | 0 | (0) |
| (0) | 0 | | | | | | 0 | (0) |
| (0) | 0 | | | | | | 0 | (0) |
| (0) | 0 | Peds | | | | Peds | WB RIRO access | |
| NB GA 74 | | 0 | 1,394 | 0 | 0 | | | |
| | | (0) | (1238) | (0) | (0) | | | |

0 (0) [0] | [0] 0 (0)

1394 (1238) [30200]

| Peak Hour % Trucks | | | |
|---|---|---|---|
| EB | WB | NB | SB |
| 0% | 0% | 7% | 7% |

Legend:

000 = AM Peak Approach Vol

(000) = PM Peak Approach Vol

[000] = ADT Volume (Estimate)

Approach Splits: GA 74 - 1 / RIRO access - 0

## 2025 Opening Year Volumes

1329 (1682) [34200]

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (0) | (61) | (1621) | (0) | SB GA 74 | | |
| | | 0 | 50 | 1,279 | 0 | | | |
| EB RIRO access | Peds | | | | | Peds | 0 | (0) |
| (0) | 0 | | 2025 Intersection Daily Entering Volume (est): 34,600 | | | | 0 | (0) |
| (0) | 0 | | | | | | 0 | (0) |
| (34) | 17 | | | | | | 0 | (0) |
| (0) | 0 | Peds | | | | Peds | WB RIRO access | |
| NB GA 74 | | 0 | 1,558 | 0 | 0 | | | |
| | | (0) | (1392) | (0) | (0) | | | |

17 (34) [1100] | [0] 0 (0) 0

1558 (1392) [33900]

## 2045 Design Year Volumes

1955 (2486) [50200]

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (0) | (61) | (2425) | (0) | SB GA 74 | | |
| | | 0 | 50 | 1,905 | 0 | | | |
| EB RIRO access | Peds | | | | | Peds | 0 | (0) |
| (0) | 0 | | 2045 Intersection Daily Entering Volume (est): 50,600 | | | | 0 | (0) |
| (0) | 0 | | | | | | 0 | (0) |
| (34) | 17 | | | | | | 0 | (0) |
| (0) | 0 | Peds | | | | Peds | WB RIRO access | |
| NB GA 74 | | 0 | 2,285 | 0 | 0 | | | |
| | | (0) | (2030) | (0) | (0) | | | |

17 (34) [1100] | [0] 0 (0) 0

2285 (2030) [49900]

**Introduction:** In 2005, SAFETEA-LU established the Highway Safety Improvement Program (HSIP) and mandated that each state prepare a Strategic Highway Safety Plan (SHSP) to prioritize safety funding investments. Intersections quickly became a common component of most states' SHSP emphasis areas and HSIP project lists, including Georgia's SHSP. Intersection Control Evaluation (ICE) policies and procedures represent a traceable and transparent procedure to streamline the evaluation of intersection control alternatives, and further leverage safety advancements for intersection improvements beyond just the safety program. Approximately one-third of all traffic fatalities and roughly seventy five percent of all traffic crashes in Georgia occur at or adjacent to intersections. Accordingly, the Georgia SHSP includes an emphasis on enhancing intersection safety to advance the Toward Zero Deaths vision embraced by the Georgia Governor's Office of Highway Safety (GOHS). This ICE tool was developed to support the ICE policy, developed and adopted to help ensure that intersection investments across the entire Georgia highway system are selected, prioritized and implemented with defensible benefits for safety towards those ends.

**Tool Goal:** The goal of this ICE tool is to provide a simplified and consistent way of importing traffic, safety, cost, environmental impact and stakeholder posture data to assess and quantify intersection control improvement benefits. The tool supports the ICE policy and procedures to provide traceability, transparency, consistency and accountability when identifying and selecting an intersection control solution that both meets project purpose and reflects overall best value in terms of specific performance-based criteria.

**Requirements:** An ICE is required for any intersection improvement (e.g. new or modified intersection, widening/reconstruction or corridor project, or work accomplished through a driveway or encroachment permit that affects an intersection) where: 1) the intersection includes at least one roadway designated as a State Route (State Highway System) or as part of the National Highway System; or 2) the intersection will be designed or constructed using State or Federal funding. In certain circumstances where an ICE would otherwise be required, the requirement may be waived based on appropriate evidence presented with a written request. (See the "Waiver" tab to review criteria that may make a project waiver eligible and for instructions to submit a waiver request to the Department). An ICE is not required when the proposed work does not include any changes to the intersection design, involves only routine traffic signal timing and equipment maintenance, or for driveway permits where the driveway is not a new leg to an already existing intersection on either 1) a divided, multi-lane highway with a closed median and only right-in/right-out access or 2) an undivided roadway where the development is not required to construct left and/or right turn lanes (as per the Driveway Manual and District Traffic Engineer).

**Two-Stage Process:** A complete ICE process consists of two (2) distinct stages, and it is expected that the respective level of effort for completing both stages of ICE will correspond to the magnitude and complexity of the intersection. Prior to starting an ICE, the District Traffic Engineer and/or State Traffic Engineer should be consulted for advice on an appropriate level of effort. The Stage 1 and Stage 2 ICE forms are designed minimize required data inputs using drop-down menu choices and limiting text entry. All fields shaded grey include drop down menu choices and all fields shaded blue require data entry. All other cells in the worksheet are locked.

**Stage 1: Screening Decision Record** Stage 1 should be conducted early in the project development process and is intended to inform which alternatives are worthy of further evaluation in Stage 2. Stage 1 serves as a screening effort meant to eliminate non-competitive options and identify which alternatives merit further considerations based on their practical feasibility. Users should use good engineering judgement in responding to the seven policy questions by selecting "Yes" or "No" in the drop-down boxes. Alternatives should not be summarily eliminated without due consideration, and reasons for eliminating or advancing an alternative should be documented in the "Screening Decision Justification" column.

**Stage 2: Alternative Selection Decision Record** Stage 2 involves a more detailed and familiar evaluation of the alternatives identified in Stage 1 in order to support the selection of a preferred alternative that may be advanced to detailed design. Stage 2 data entry may require the use of external analysis tools to determine costs, operations and/or safety data that, combined with environmental and stakeholder posture data, form the basis of the ICE evaluation. A separate "CostEst" worksheet tab helps users develop pre-planning-level cost estimates for each Stage 2 alternative evaluated, and a separate Users Guide has been prepared to give guidance on Stage 1 and Stage 2 data entry. Once all data is entered, each alternative is scored and ranked, with the results reported at the bottom of the Stage 2 worksheet to inform on the best of the intersection controls evaluated for project recommendation.

**Documentation:** A complete ICE document consists of the combination of the outputs from either a completed and signed waiver form or both Stage 1 and Stage 2 worksheets (along with supporting costing and/or environmental documentation), to be included in the approved project Concept Report (or equivalent) or as a stand-alone document.

# GDOT INTERSECTION CONTROL EVALUATION (ICE) WAIVER FORM

ICE Version 2.15 | Revised 07/01/2019

**Waiver Request - Level 2 / 3**

In certain circumstances where an ICE would otherwise be required, an ICE may be waived based on appropriate evidence presented with a written request. Scenarios in which an ICE waiver request may be considered include:

1. Proposed improvements do not substantially alter the character of the intersection, and are considered minor in nature, such as extending existing turn lane(s) or modifying signal phasing at an existing traffic signal
2. The intersection consists of a public roadway intersecting a divided, multilane roadway where the access will be limited to a closed median with only right-in/right-out access that will operate acceptably; or
3. The intersection is along an undivided, two-lane roadway that will not be widened and meets the following criteria:
   - Low risk in terms of exposure (total intersection entering volume less than 1,000 vehicles /day)
   - Latest 5 years of crash history is not indicative of a crash problem (no discernible crash patterns coupled with low crash frequency and severity)
   - Layout has no unusual or undesirable geometric features (such as restricted sight distance)
   - The proposed changes are not expected to adversely affect safety

If only one alternative is determined to be feasible from the ICE Stage 1, then a waiver may be submitted in lieu of completing ICE Stage 2. The waiver must clearly explain why there is no other feasible alternative. A Waiver Form should also be submitted to document an agreed upon decision to select a preferred alternative other than the highest scoring alternative in Stage 2.

ICE waiver forms with supporting documentation should be submitted for approval to the Office of Traffic Operations or District Engineer (depending on Waiver level). Questions regarding the waiver process should be routed to the State Traffic Engineer.

**Project Information:**

| | | | |
|---|---|---|---|
| Location: | GA 74 @ RIRO access | GDOT PI # (or N/A): | 0000000 |
| County: | Fayette | Requested By: | Brent Holdings LLC |
| GDOT District: | 3 - Thomaston | Prepared By: | MRA |
| Area Type: | Suburb/Transition | Analyst: | MRA |
| Existing Intersection Control: | New Intersection or Other | Date: | 5/17/2020 |
| | | Waiver Request Type: | Driveway Permit |

**Traffic and Operations Data:**[1]

| | | |
|---|---|---|
| Intersection meets signal/AWS warrants? | None | |
| Traffic Analysis Type: | Intersection Delay | |
| Existing Avg Daily Traffic (Major Street): | 29,100 | |
| Existing Avg Daily Traffic (Minor Street): | 0 | |
| Analysis Period: | AM Peak | PM Peak |
| 2025 Opening Yr Peak Hour Intersection Delay: | 0.1 sec | 0.2 sec |
| 2025 Opening Yr Peak Hour Intersection V/C: | 0.06 | 0.13 |
| 2045 Design Yr Peak Hour Intersection Delay: | 0.1 sec | 0.3 sec |
| 2045 Design Yr Peak Hour Intersection V/C: | 0.10 | 0.25 |

[1]Crash data required for all existing intersections. ADT's required if available (from data collected or nearest GDOT count station site). Capacity data is optional unless needed to justify basis of the waiver request.

**Crash Data (Required):**[1]

| Crash Type | Crash Data: Enter most recent 5 years of crash data | Crash Severity: PDO | Injury Crash* | Fatal Crash* | |
|---|---|---|---|---|---|
| | Angle | 0 | 0 | 0 | <- |
| | Head-On | 0 | 0 | 0 | |
| | Rear End | 0 | 0 | 0 | |
| | Sideswipe - same | 0 | 0 | 0 | |
| | Sideswipe - opposite | 0 | 0 | 0 | |
| | Not Collision w/Motor Veh | 0 | 0 | 0 | |
| | TOTALS: | 0 | 0 | 0 | |

* Number of crashes resulting in injuries / fatalities, not number of persons

| | |
|---|---|
| Description of Work / Justification for Waiver (Required): | Intersection will be a future RIRO access. Intersection does not currently exist. Waiver being requested per criterion 2. |
| Proposed Intersection Control: | --- select one --- |

**REQUESTED BY:** Marc R. Acampora, PE Date: 5/18/2020

Title: Traffic Engineer

**APPROVED BY:** _____ Date: _____

Name: _____

District Engineer or (Approved Delegate)

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.1 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 17 | 0 | 1558 | 1279 | 50 |
| Future Vol, veh/h | 0 | 17 | 0 | 1558 | 1279 | 50 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 70 | 92 | 96 | 93 | 93 |
| Heavy Vehicles, % | 2 | 2 | 2 | 7 | 2 | 7 |
| Mvmt Flow | 0 | 24 | 0 | 1623 | 1375 | 54 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 688 | - | 0 | - | 0 |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 0 | 389 | 0 | - | - | - |
| Stage 1 | 0 | - | 0 | - | - | - |
| Stage 2 | 0 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | - | 389 | - | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 14.9 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|
| Capacity (veh/h) | - | 389 | - | - |
| HCM Lane V/C Ratio | - | 0.062 | - | - |
| HCM Control Delay (s) | - | 14.9 | - | - |
| HCM Lane LOS | - | B | - | - |
| HCM 95th %tile Q(veh) | - | 0.2 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.2 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 34 | 0 | 1392 | 1621 | 61 |
| Future Vol, veh/h | 0 | 34 | 0 | 1392 | 1621 | 61 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 85 | 92 | 93 | 96 | 96 |
| Heavy Vehicles, % | 2 | 2 | 2 | 7 | 2 | 7 |
| Mvmt Flow | 0 | 40 | 0 | 1497 | 1689 | 64 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 845 | - | 0 | - | 0 |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 0 | 306 | 0 | - | - | - |
| Stage 1 | 0 | - | 0 | - | - | - |
| Stage 2 | 0 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | - | 306 | - | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 18.5 | 0 | 0 |
| HCM LOS | C | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|
| Capacity (veh/h) | - | 306 | - | - |
| HCM Lane V/C Ratio | - | 0.131 | - | - |
| HCM Control Delay (s) | - | 18.5 | - | - |
| HCM Lane LOS | - | C | - | - |
| HCM 95th %tile Q(veh) | - | 0.4 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.1 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 17 | 0 | 2285 | 1905 | 50 |
| Future Vol, veh/h | 0 | 17 | 0 | 2285 | 1905 | 50 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 70 | 92 | 96 | 93 | 93 |
| Heavy Vehicles, % | 2 | 2 | 2 | 7 | 2 | 7 |
| Mvmt Flow | 0 | 24 | 0 | 2380 | 2048 | 54 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 1024 | - | 0 | - | 0 |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 0 | 233 | 0 | - | - | - |
| Stage 1 | 0 | - | 0 | - | - | - |
| Stage 2 | 0 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | - | 233 | - | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 22.2 | 0 | 0 |
| HCM LOS | C | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|
| Capacity (veh/h) | - | 233 | - | - |
| HCM Lane V/C Ratio | - | 0.104 | - | - |
| HCM Control Delay (s) | - | 22.2 | - | - |
| HCM Lane LOS | - | C | - | - |
| HCM 95th %tile Q(veh) | - | 0.3 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.3 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 0 | 34 | 0 | 2030 | 2425 | 61 |
| Future Vol, veh/h | 0 | 34 | 0 | 2030 | 2425 | 61 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | 0 | - | - | - | 0 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 85 | 92 | 93 | 96 | 96 |
| Heavy Vehicles, % | 2 | 2 | 2 | 7 | 2 | 7 |
| Mvmt Flow | 0 | 40 | 0 | 2183 | 2526 | 64 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | - | 1263 | - | 0 | - | 0 |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |
| Critical Hdwy | - | 6.94 | - | - | - | - |
| Critical Hdwy Stg 1 | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - |
| Follow-up Hdwy | - | 3.32 | - | - | - | - |
| Pot Cap-1 Maneuver | 0 | 161 | 0 | - | - | - |
| Stage 1 | 0 | - | 0 | - | - | - |
| Stage 2 | 0 | - | 0 | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | - | 161 | - | - | - | - |
| Mov Cap-2 Maneuver | - | - | - | - | - | - |
| Stage 1 | - | - | - | - | - | - |
| Stage 2 | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 34.6 | 0 | 0 |
| HCM LOS | D | | |

| Minor Lane/Major Mvmt | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|
| Capacity (veh/h) | - | 161 | - | - |
| HCM Lane V/C Ratio | - | 0.248 | - | - |
| HCM Control Delay (s) | - | 34.6 | - | - |
| HCM Lane LOS | - | D | - | - |
| HCM 95th %tile Q(veh) | - | 0.9 | - | - |