ESI PROJECT NO.:
T22-045

DATE:
May 2022

TRAFFIC IMPACT STUDY

FOR

FLOWERDALE COMMONS APARTMENTS

@

COLONIAL ESTATES ROAD

IN

TUPELO, MISSISSIPPI

ENGINEERING SOLUTIONS INC

TRAFFIC IMPACT STUDY
FLOWERDALE COMMONS APARTMENTS
@
COLONIAL ESTATES ROAD
TUPELO, MISSISSIPPI

INDEX

1.0 INTRODUCTION

This study has been performed at the request of the City of Tupelo Planning Committee to determine what effects on traffic, if any, may result from the construction of the Flowerdale Commons Apartments due to the increase in traffic along Colonial Estates Road. The results of this study can be found in the attached calculations in Appendix A.

The proposed development will be located along the western edge of Colonial Estates Road approximately 1,000 feet south of McCullough Boulevard. The proposed site will consist of 46 multifamily townhouse apartments. Currently, the site is undeveloped agricultural land. It is bounded by BNSF Railway to the north and Kings Creek to the south. There will be two access points into the development located along Colonial Estates Road.

Due to the anticipated peak hour traffic flows to be generated from this development, pre-development and post-development Levels of Service (LOS) were evaluated for both the affected roadway and proposed intersections. LOS is a quantitative value assigned to each roadway or intersection that defines the conditions within a stream of traffic. Conditions such as maneuverability, speed, travel time, and traffic interruptions are used as measurements in defining the LOS.

Materials utilized in the evaluation of this report include the Institute of Transportation Engineers (ITE) Trip Generation Manual (10^{th} Edition) to determine projected traffic flows to and from the development, The Highway Capacity Manual (HCM2000) published by the Transportation Research Board to determine the LOS, the average travel speed, and other traffic performance measures for both the pre-development and post-development conditions.

2.0 PROPOSED DEVELOPMENT

Colonial Estates Road is the only access route available to serve the proposed development. Traffic inside the development will utilize two proposed drives (henceforth referred to as Drive North and Drive South) that will connect with Colonial Estates Road. For purposes of this report, it was assumed that 50% of the generated traffic would use Drive North and the other 50% would use Drive South. This assumption was based on the layout of the development.

3.0 ROADWAY ANALYSIS

The data used in the analysis of both the pre-development and post-development conditions was a combination of field measurements, historic data, estimated proposed trip generations, and assumptions based on sound engineering practices. Due to variances in traffic patterns, analysis of the affected roadway and both proposed intersections were conducted for both the morning and evening hours.

A traffic count was taken on Thursday, May 9th, 2022 during both the morning and evening high traffic volume hours near the proposed locations of the development entrances. The resulting data was used to determine the peak hour traffic volumes and the projected directional traffic flow patterns for both the peak A.M. and P.M. hours. This data is provided in Table 3-1 below.

For purposes of this report, Colonial Estates Road was classified as a Two-Way Two-Lane Highway. Due to its low speeds and short length, the roadway was evaluated as a Class II Highway and was considered to have a rolling terrain with 20 access points per mile. Due to the pavement markings, it was determined that 100% of this roadway would be considered a no passing zone.

The Peak Hour Factor (PHF) for the roadway during both the A.M. and P.M. hours was determined for both the total roadway (for roadway LOS analysis) and each individual movement along the roadway (for intersection LOS analysis). These values are provided in Appendix A. The directional westbound/eastbound split, based on collected field data, was approximated to be *43/57* during the A.M. peak hour and *59/41* during the P.M. peak hour. Average truck and RV traffic along the roadway was estimated to be *0%* due to the geometry and location of the roadway. Average daily traffic is estimated to be 2,900 vehicles per day based on 2019 data shown on the MDOT website.

Table 3-1 - TRAFFIC DATA FOR COLONIAL ESTATES ROAD								
N 34° 17' 33", W 88° 45' 52" Date: 5/9/2022	Colonial Estates Road North Bound				Colonial Estates Road South Bound			
Start Time - End Time	Left	Thru	Right	Total	Left	Thru	Right	Total
A.M.								
6:00 AM - 6:15 AM	N/A	7	N/A	*7*	N/A	10	N/A	*10*
6:15 AM - 6:30 AM	N/A	17	N/A	*17*	N/A	13	N/A	*13*
6:30 AM - 6:45 AM	N/A	20	N/A	*20*	N/A	20	N/A	*20*
6:45 AM - 7:00 AM	N/A	23	N/A	*23*	N/A	28	N/A	*28*
NOT Peak Hour		67		*67*		71		*71*
7:00 AM - 7:15 AM	N/A	22	N/A	*22*	N/A	32	N/A	*32*
7:15 AM - 7:30 AM	N/A	33	N/A	*33*	N/A	33	N/A	*33*
7:30 AM - 7:45 AM	N/A	29	N/A	*29*	N/A	45	N/A	*45*
7:45 AM - 8:00 AM	N/A	41	N/A	*41*	N/A	57	N/A	*57*
Peak Hour		125		*125*		167		*167*
8:00 AM - 8:15 AM	N/A	24	N/A	*24*	N/A	39	N/A	*39*
8:15 AM - 8:30 AM	N/A	16	N/A	*16*	N/A	21	N/A	*21*
8:30 AM - 8:45 AM	N/A	21	N/A	*21*	N/A	20	N/A	*20*
8:45 AM - 9:00 AM	N/A	22	N/A	*22*	N/A	19	N/A	*19*
NOT Peak Hour		83		*83*		99		*99*
A.M. Total		*275*		***275***		*337*		***337***
P.M.								
3:00 PM - 3:15 PM	N/A	27	N/A	*27*	N/A	27	N/A	*27*
3:15 PM - 3:30 PM	N/A	19	N/A	*19*	N/A	26	N/A	*26*
3:30 PM - 3:45 PM	N/A	44	N/A	*44*	N/A	40	N/A	*40*
3:45 PM - 4:00 PM	N/A	31	N/A	*31*	N/A	24	N/A	*24*
NOT Peak Hour		121		*121*		117		*117*
4:00 PM - 4:15 PM	N/A	32	N/A	*32*	N/A	26	N/A	*26*
4:15 PM - 4:30 PM	N/A	31	N/A	*31*	N/A	33	N/A	*33*
4:30 PM - 4:45 PM	N/A	58	N/A	*58*	N/A	32	N/A	*32*
4:45 PM - 5:00 PM	N/A	52	N/A	*52*	N/A	39	N/A	*39*
NOT Peak Hour		173		*173*		130		*130*
5:00 PM - 5:15 PM	N/A	81	N/A	*81*	N/A	49	N/A	*49*
5:15 PM - 5:30 PM	N/A	39	N/A	*39*	N/A	41	N/A	*41*
5:30 PM - 5:45 PM	N/A	51	N/A	*51*	N/A	30	N/A	*30*
5:45 PM - 6:00 PM	N/A	25	N/A	*25*	N/A	18	N/A	*18*
Peak Hour		196		*196*		138		*138*
P.M. Total		*490*		***490***		*385*		***385***

Table 3-1: Traffic Data (Source: ESI Calculations)

4.0 TRAFFIC ANALYSIS

4.1 EXISTING TRAFFIC

The peak hour traffic counts taken from the field data collected near the proposed intersections with Colonial Estates Road were used in the current operational LOS calculations. As noted in Table 3-1, the A.M. peak hour occurred from *7:00* to *8:00* and the P.M. peak hour occurred from 5*:00* to 6*:00*. It was observed that *292* vehicles per hour used the roadways during the peak A.M. hour and *334* vehicles per hour used the roadways during the peak P.M. hour.

4.2 FUTURE TRAFFIC

To determine future generated traffic conditions, an estimated number of peak hour trip ends generated by the proposed development was calculated to be *21* vehicles per hour during the peak A.M. hour and *26* vehicles per hour during the peak P.M. hour. These numbers were derived from the ITE Trip Generation Manual for Multifamily Housing (Low Rise).

Directional split of the traffic entering/exiting the facility was estimated to be *23/77* for the A.M. peak hour and *63/37* for the P.M. peak hour using information from the Trip Generation Manual. Directional split of the westbound/eastbound traffic was estimated from the existing field data as presented in Section 3.0 of this report and is also shown is Appendix A.

FUTURE TRAFFIC FLOW & DISTRIBUTION DURING PEAK HOURS						
Estimated Future Traffic Volumes						
Roadway Name	Future A.M. Volume (veh/hr)		Future P.M. Volume (veh/hr)			
Colonial Estates Rd.	312		360			
Estimated Future Traffic Flow Distribution for Intersection Proposed Drive North						
Hour	Pr. Drive North (EB)		Colonial Est. (NB)		Colonial Est. (SB)	
	Left	Right	Through	Left	Right	Through
A.M.	5	4	125	2	1	167
P.M.	2	3	196	5	3	138
Estimated Future Traffic Flow Distribution for Intersection Proposed Drive North						
Hour	Pr. Drive South (EB)		Colonial Est. (NB)		Colonial Est. (SB)	
	Left	Right	Through	Left	Right	Through
A.M.	5	4	125	2	1	167
P.M.	2	3	196	5	3	138

Table 4-1 (Source: ESI Calculations, Appendix A)

5.0 ROADWAY LEVEL-OF-SERVICE ANALYSIS

Roadway LOS for a Class II Two-Way Two-Lane Highway is determined by calculating the value for the Percent Time Spent Following (PTSF) during peak hour conditions. The PTSF value is an estimated percentage of time that an average traveler may experience while on the roadway. A summary of each roadway analysis is listed below. Full calculations and results can be found in Appendix A.

5.1 COLONIAL ESTATES ROAD

A. PRE-DEVELOPMENT (A.M.)

To determine the pre-developed PTSF value for Colonial Estates Road during the peak A.M. hour, the Passenger-Car Equivalent Flow Rate for peak 15-min period was adjusted to be *512* vehicles per hour for two-directional flow and *293* vehicles per hour for the highest directional flow. From this value, the Base PTSF was determined to be *36.3%*. After adjusting the value for both Directional Distribution of Traffic and Percentage of No Passing Zones, the PTSF was determined to be 57*.6%*.

From the PTSF value, it was determined that Colonial Estates Road has a pre-developed **LOS of "C"** during the A.M. hour.

B. POST-DEVELOPMENT (A.M.)

To determine the post-developed PTSF value for Colonial Estates Road during the peak A.M. hour, the Passenger-Car Equivalent Flow Rate for peak 15-min period was adjusted to be *550* vehicles per hour for two-directional flow and *314* vehicles per hour for the highest directional flow. From this value, the Base PTSF was determined to be *38.3%*. After adjusting the value for both Directional Distribution of Traffic and Percentage of No Passing Zones, the PTSF was determined to be *59.4%*.

From the PTSF value, it was determined that Colonial Estates Road will have a post-developed **LOS of "C"** during the A.M. hour.

C. PRE-DEVELOPMENT (P.M.)

To determine the pre-developed PTSF value for Colonial Estates Road during the peak P.M. hour, the Passenger-Car Equivalent Flow Rate for peak 15-min period was adjusted to be *678* vehicles per hour for two-directional flow and *398* vehicles per hour for the highest directional flow. From this value, the Base PTSF was determined to be *44.9%*. After adjusting the value for both Directional Distribution of Traffic and Percentage of No Passing Zones, the PTSF was determined to be *56.8%*.

From the PTSF value, it was determined that Colonial Estates Road has a pre-developed **LOS of "C"** during the P.M. hour.

D. POST-DEVELOPMENT (P.M.)

To determine the post-developed PTSF value for Colonial Estates Road during the peak P.M. hour, the Passenger-Car Equivalent Flow Rate for peak 15-min period was adjusted to be *730* vehicles per hour for two-directional flow and *428* vehicles per hour for the highest directional flow. From this value, the Base PTSF was determined to be *47.4%*. After adjusting the value for both Directional Distribution of Traffic and Percentage of No Passing Zones, the PTSF was determined to be *64.0%*.

From the PTSF value, it was determined that Colonial Estates Road will have a post-developed **LOS of "C"** during the P.M. hour.

6.0 STOP-CONTROLLED INTERSECTION LEVEL-OF-SERVICE ANALYSIS

The LOS of a Two-Way Stop-Controlled Intersection is determined by the intersections Control Delay value. In this case, Control Delay can be defined as the difference in the total actual time experienced and the reference time that occurs during base conditions. It is calculated using the relationship between the traffic volume and the movement capacity.

For intersection LOS analysis, each minor movement within the intersection is defined individually rather than as a whole as is the case for roadway LOS. Movement nomenclature, as defined in the HCM2000, is shown below in Figure 6-1.

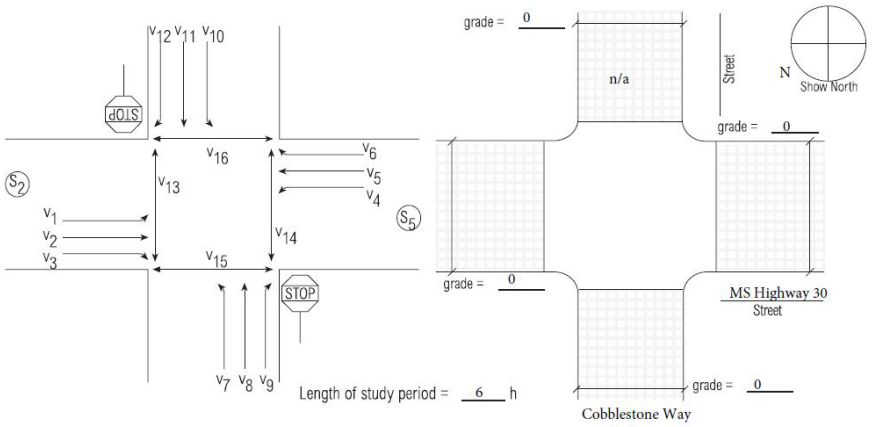


Figure 6-1 – Intersection Traffic Movement Terms (Source: HCM2000)

A summary of each intersection analysis is listed below. Full calculations and results can be found in Appendix A. It should be noted that, since they have yet to be constructed, no pre-development analysis was provided for the proposed intersections.

6.1 COLONIAL ESTATES ROAD & PROPOSED DRIVE NORTH

A. POST-DEVELOPMENT (A.M.)

The Control Delay occurring during the peak A.M. hour for the post-developed intersection of Colonial Estates Road and the Proposed Drive North was determined by analyzing the three conflicting traffic movements as defined in Figure 6-1; major left turn (1), minor right turn (12), and minor left turn (10). Two significant factors, the Critical Gap and Follow Up Times, were calculated for each movement using quantities related to the intersections geometry and grade as defined in the HCM2000. The Critical Gap time for each movement was determined to be *4.1*, *6.2*, and *6.4* seconds for movements 1, 12, and 10, respectively. The Follow Up Time was determined to be *2.2*, *3.3*, and *3.5* seconds, respectively.

From the Critical Gap and Follow Up Times, and after adjusting for the Impedance of the Conflicting Traffic as defined in the HCM2000, the Movement Capacity was determined to be *1,477*, *934*, and *775* vehicles per hour for movements 1, 12, and 10, respectively. From these values, the Shared-Lane Capacity of the intersection was calculated to be *974* vehicles per hour. The Control Delay was then calculated to be *9* seconds per vehicle.

With a Control Delay of between 0 and 10 seconds, the post-developed intersection of Colonial Estates Road and the Proposed Drive North will have a **LOS of "A"** during the peak A.M. hour.

B. POST-DEVELOPMENT (P.M.)

The Control Delay occurring during the peak P.M. hour for the post-developed intersection of Colonial Estates Road and the Proposed Drive North was determined by analyzing the three conflicting traffic movements as defined in Figure 6-1; major left turn (1), minor right turn (12), and minor left turn (9). Two significant factors, the Critical Gap and Follow Up Times, were calculated for

each movement using quantities related to the intersections geometry and grade as defined in the HCM2000. The Critical Gap time for each movement was determined to be *4.1*, *6.2*, and *6.4* seconds for movements 1, 12, and 10, respectively. The Follow Up Time was determined to be *2.2*, *3.3*, and *3.5* seconds, respectively.

From the Critical Gap and Follow Up Times, and after adjusting for the Impedance of the Conflicting Traffic as defined in the Highway Capacity Manual, the Movement Capacity was determined to be *1,509*, *965*, and *777* vehicles per hour for movements 1, 12, and 10, respectively. From these values, the Shared-Lane Capacity of the intersection was calculated to be *1,089* vehicles per hour. The Control Delay was then calculated to be *8* seconds per vehicle.

With a Control Delay of between 0 and 10 seconds, the post-developed intersection of Colonial Estates Road and the Proposed Drive North will have a **LOS of "A"** during the peak P.M. hour.

6.2 COLONIAL ESTATES ROAD & PROPOSED DRIVE SOUTH

A. POST-DEVELOPMENT (A.M.)

The Control Delay occurring during the peak A.M. hour for the post-developed intersection of Colonial Estates Road and the Proposed Drive South was determined by analyzing the three conflicting traffic movements as defined in Figure 6-1; major left turn (1), minor right turn (12), and minor left turn (10). Two significant factors, the Critical Gap and Follow Up Times, were calculated for each movement using quantities related to the intersections geometry and grade as defined in the HCM2000. The Critical Gap time for each movement was determined to be *4.1*, *6.2*, and *6.4* seconds for movements 1, 12, and 10, respectively. The Follow Up Time was determined to be *2.2*, *3.3*, and *3.5* seconds, respectively.

From the Critical Gap and Follow Up Times, and after adjusting for the Impedance of the Conflicting Traffic as defined in the HCM2000, the Movement Capacity was determined to be *1,477*, *934*, and *775* vehicles per hour for movements 1, 12, and 10, respectively. From these values, the Shared-Lane Capacity of the intersection was calculated to be *974* vehicles per hour. The Control Delay was then calculated to be *9* seconds per vehicle.

With a Control Delay of between 0 and 10 seconds, the post-developed intersection of CR 202 and the Proposed Drive East will have a **LOS of "A"** during the peak A.M. hour.

B. POST-DEVELOPMENT (P.M.)

The Control Delay occurring during the peak P.M. hour for the post-developed intersection of Colonial Estates Road and the Proposed Drive South was determined by analyzing the three conflicting traffic movements as defined in Figure 6-1; major left turn (1), minor right turn (12), and minor left turn (9). Two significant factors, the Critical Gap and Follow Up Times, were calculated for each movement using quantities related to the intersections geometry and grade as defined in the HCM2000. The Critical Gap time for each movement was determined to be *4.1*, *6.2*, and *6.4* seconds for movements 1, 12, and 10, respectively. The Follow Up Time was determined to be *2.2*, *3.3*, and *3.5* seconds, respectively.

From the Critical Gap and Follow Up Times, and after adjusting for the Impedance of the Conflicting Traffic as defined in the Highway Capacity Manual, the Movement Capacity was determined to be *1,509*, *965*, and *777* vehicles per hour for movements 1, 12, and 10, respectively. From these values, the Shared-Lane Capacity of the intersection was calculated to be *1,089* vehicles per hour. The Control Delay was then calculated to be *8* seconds per vehicle.

With a Control Delay of between 0 and 10 seconds, the post-developed intersection of Colonial Estates Road and the Proposed Drive South will have a **LOS of "A"** during the peak P.M. hour.

7.0 CONCLUSION

Based on the comparison of the results from the analysis for the pre and post development scenarios, the additional traffic flow generated by the proposed Flowerdale Commons Apartments will not have a significant impact on the quality and level of service on Colonial Estates Road. A Level of Service C will be maintained both before and after the estimated additional traffic generated by the proposed development.

Based on the results from the Two-Way Stop-Controlled intersection for both the peak A.M. and P.M. hours, it was determined that the delay time of the proposed intersection is not significant enough to adversely affect traffic flows.

With a post-development volume to capacity ratio of approximately 25%, the roadway will sustain additional traffic flows before reaching maximum capacity. If additional future growth and development occurs, the City may need to consider improvements to the existing roadway to maintain an acceptable Level of Service and also to allow for higher travel speeds while still maintaining safe conditions.

APPENDIX A

ESI Project Number:	T22-045
Project Name:	Flowerdale Commons
Project Location:	Tupelo, MS
Calculations Completed By:	John White
Date of Calculations:	5/9/2022
Date of Traffic Study:	5/9/2022
Primary Roadway Name:	Colonial Estates Road
Secondary Roadway Name:	N/A
Intersection 1 ID:	Colonial Estates Rd / Proposed Entrance North
Intersection 2 ID:	Colonial Estates Rd / Proposed Entrance South
Coordinates:	N 34° 17' 33", W 88° 45' 52"

Traffic Statistics			
MS Hwy 30 (Peak Hour)			
Directional Split (A.M.):	75%	-	25%
Directional Split (P.M.):	34%	-	66%
% SB Turning Left (A.M.):	N/A		
% NB Turning Right (A.M.):	N/A		
% SB Turning Left (P.M.):	N/A		
% NB Turning Right (P.M.):	N/A		
PHF_{am}={hr. vol}/(4*{15 max})=	0.87		
PHF_{pm}={hr. vol}/(4*{15 max})=	0.71		

Trip Ends Generated

Roadway Name: Colonial Estates Road

Post-Development A.M.

Peak Hour: 7:00 AM

$Vol._{Pre\text{-}Dev\ -\ WB}$ (veh/hr)= 125

$Vol._{Pre\text{-}Dev\ -\ EB}$ (veh/hr)= 167

$Vol._{Pre\text{-}Dev\ -\ TOTAL}$ (veh/hr)= 292

Generation Type:	Multifamily Housing (Lowrise) Weekday A.M. Peak Hour *See Trip Generation Manual, 10th Ed., Page 3	
Number of Dwellings	46	
Trips per Unit=	0.46	
Trip Ends Generated=	21	
Directional Split Entering and	23%	Enter
Leaving (%):	77%	Exit
$Trip_{Enter}$ (pc/hr)=	5	
$Trip_{Exit}$ (pc/hr)=	16	
Directional Split North Bound and	43%	North Bound
South Bound (%):	57%	South Bound
$Trip_{Enter\text{-}WB}$ (pc/hr)=	2	
$Trip_{Enter\text{-}EB}$ (pc/hr)=	3	
$Trip_{Exit\text{-}WB}$ (pc/hr)=	7	
$Trip_{Exit\text{-}EB}$ (pc/hr)=	9	

Trip Ends Generated

Roadway Name: Colonial Estates Road

Post-Development P.M.

Peak Hour: 5:00 PM

$Vol._{Pre\text{-}Dev\ -\ WB}$ (veh/hr)= 196

$Vol._{Pre\text{-}Dev\ -\ EB}$ (veh/hr)= 138

$Vol._{Pre\text{-}Dev\ -\ TOTAL}$ (veh/hr)= 334

Generation Type:	Multifamily Housing (Lowrise) Weekday P.M. Peak Hour *See Trip Generation Manual, 10th Ed., Page 4	
Number of Dwellings=	46	
Trips per Unit=	0.56	
Trip Ends Generated=	26	
Directional Split Entering and	63%	Enter
Leaving (%):	37%	Exit
$Trip_{Enter}$ (pc/hr)=	16	
$Trip_{Exit}$ (pc/hr)=	10	
Directional Split North Bound and	59%	North Bound
South Bound (%):	41%	South Bound
$Trip_{Enter\text{-}WB}$ (pc/hr)=	10	
$Trip_{Enter\text{-}EB}$ (pc/hr)=	7	
$Trip_{Exit\text{-}WB}$ (pc/hr)=	6	
$Trip_{Exit\text{-}EB}$ (pc/hr)=	4	

PROJECT: T22-045 CALCULATIONS BY: John White Date: 5/9/2022

TWO-LANE HIGHWAY LEVEL OF SERVICE

ROADWAY INFORMATION

Roadway Name: Colonial Estates Road
Project Location: Tupelo, MS

PRE-DEV A.M.

INPUT DATA

Peak Hour: 7:00 AM

veh/hr=	292		Split:	43% /	57%
BFFS (mph)=	30	*Posted Limit	Terrain:	Rolling	
PHF=	0.74		Sholder Width (Ft):	2	
P_t (%)=	0		Lane Width (ft):	10	
P_r (%)=	0		No-Pass Zone (%):	100	
			Access (Points/mile):	20	
Directional Flow (veh/hr):	125		Class:	II	

AVERAGE TRAVEL SPEEDS CALCULATIONS

(Use Exhibit 20-7) (Use Exhibit 20-9)

f_g= 0.71 E_t= 2.5 E_r= 1.1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1.000

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 556 <3,200 pc/hr

Max Split (%)= 0.571918

$v_{p\text{-directional}}$ (pc/hr)= $v_p*\{split\}$= 318 <1,700 pc/hr

(Use Exhibits 20-5 and 20-6)

f_{ls} (mph)= 3.7

f_A (mph)= 5 (*Interpolated Value)

FFS (mph)= $BFFS-f_{ls}-f_A$= 21

(Use Exhibit 20-11)

f_{np} (mph)= 4 (*Interpolated Value)

ATS (mph)= $FFS-0.00776*v_p-f_{np}$= 13.0

PERCENT TIME-SPENT-FOLLOWING CALCULATIONS

(Use Exhibit 20-8) (Use Exhibit 20-10)

f_g= 0.77 E_t= 1.8 E_r= 1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 512 <3,200 pc/hr

Max Split (%)= 0.571918

$v_{p\text{-directional}}$ (pc/hr)= $v_p*\{split\}$= 293 <1,700 pc/hr

BPTSF (%)= $100(1-exp(-0.000879*v_p))$= 36.3

(Use Exhibit 20-12)

$f_{d/np}$ (%)= 21.36 (*Min. Value)

PTSF (%)= $BPTSF+f_{d/np}$= 57.6

LEVEL OF SERVICE

(Use Exhibit 20-2 for class I and 20-4 for class II)

LOS= C

ESI ENGINEERING SOLUTIONS INC

PROJECT: T22-045 CALCULATIONS BY: John White Date: 5/9/2022

TWO-LANE HIGHWAY LEVEL OF SERVICE

ROADWAY INFORMATION

Roadway Name: Colonial Estates Road
Project Location: Tupelo, MS

POST-DEV A.M.

INPUT DATA

Peak Hour: 7:00 AM

veh/hr=	313		Split:	43% /	57%
BFFS (mph)=	30	*Posted Limit	Terrain:	Rolling	
PHF=	0.74		Sholder Width (Ft):	2	
P_t (%)=	0		Lane Width (ft):	10	
P_r (%)=	0		No-Pass Zone (%):	100	
			Access (Points/mile):	20	
Directional Flow (veh/hr):	134		Class:	II	

AVERAGE TRAVEL SPEEDS CALCULATIONS

(Use Exhibit 20-7) (Use Exhibit 20-9)

f_g= 0.71 E_t= 2.5 E_r= 1.1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1.000

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 596 <3,200 pc/hr

Max Split (%)= 0.571918

$v_{p\text{-directional}}$ (pc/hr)= $v_p*\{split\}$= 341 <1,700 pc/hr

(Use Exhibits 20-5 and 20-6)

f_{ls} (mph)= 3.7

f_A (mph)= 5 (*Interpolated Value)

FFS (mph)= $BFFS-f_{ls}-f_A$= 21

(Use Exhibit 20-11)

f_{np} (mph)= 3.91 (*Interpolated Value)

ATS (mph)= $FFS-0.00776*v_p-f_{np}$= 12.8

PERCENT TIME-SPENT-FOLLOWING CALCULATIONS

(Use Exhibit 20-8) (Use Exhibit 20-10)

f_g= 0.77 E_t= 1.8 E_r= 1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 550 <3,200 pc/hr

Max Split (%)= 0.571918

$v_{p\text{-directional}}$ (pc/hr)= $v_p*\{split\}$= 314 <1,700 pc/hr

BPTSF (%)= $100(1-exp(-0.000879*v_p))$= 38.3

(Use Exhibit 20-12)

$f_{d/np}$ (%)= 21.1 (*Interpolated Value)

PTSF (%)= $BPTSF+f_{d/np}$= 59.4

LEVEL OF SERVICE

(Use Exhibit 20-2 for class I and 20-4 for class II)

LOS= C

ESI ENGINEERING SOLUTIONS INC

PROJECT: T22-045 CALCULATIONS BY: John White Date: 5/9/2022

TWO-LANE HIGHWAY LEVEL OF SERVICE

ROADWAY INFORMATION

Roadway Name: Colonial Estates Road

Project Location: Tupelo, MS

PRE-DEV P.M.

INPUT DATA

Peak Hour: 5:00 PM

veh/hr=	334		Split:	59% /	41%
BFFS (mph)=	30	*Posted Limit	Terrain:	Rolling	
PHF=	0.64		Sholder Width (Ft):	2	
P_t (%)=	0		Lane Width (ft):	10	
P_r (%)=	0		No-Pass Zone (%):	100	
			Access (Points/mile):	20	
Directional Flow (veh/hr):	196		Class:	II	

AVERAGE TRAVEL SPEEDS CALCULATIONS

(Use Exhibit 20-7) (Use Exhibit 20-9)

f_g= 0.71 E_t= 2.5 E_r= 1.1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1.000

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 735 <3,200 pc/hr

Max Split (%)= 0.586826

$v_{p\text{-directional}}$ (pc/hr)= $v_p*\{split\}$= 431 <1,700 pc/hr

(Use Exhibits 20-5 and 20-6)

f_{ls} (mph)= 3.7

f_A (mph)= 5 (*Interpolated Value)

FFS (mph)= $BFFS-f_{ls}-f_A$= 21

(Use Exhibit 20-11)

f_{np} (mph)= 3.29 (*Interpolated Value)

ATS (mph)= $FFS-0.00776*v_p-f_{np}$= 12.3

PERCENT TIME-SPENT-FOLLOWING CALCULATIONS

(Use Exhibit 20-8) (Use Exhibit 20-10)

f_g= 0.77 E_t= 1.8 E_r= 1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 678 <3,200 pc/hr

Max Split (%)= 0.586826

$v_{p\text{-directional}}$ (pc/hr)= $v_p*\{split\}$= 398 <1,700 pc/hr

BPTSF (%)= $100(1-exp(-0.000879*v_p))$= 44.9

(Use Exhibit 20-12)

$f_{d/np}$ (%)= 11.9 (*Interpolated Value)

PTSF (%)= $BPTSF+f_{d/np}$= 56.8

LEVEL OF SERVICE

(Use Exhibit 20-2 for class I and 20-4 for class II)

LOS= C

ESI ENGINEERING SOLUTIONS INC

PROJECT: T22-045 CALCULATIONS BY: John White Date: 5/9/2022

TWO-LANE HIGHWAY LEVEL OF SERVICE

ROADWAY INFORMATION

Roadway Name: Colonial Estates Road

Project Location: Tupelo, MS

POST-DEV P.M.

INPUT DATA

Peak Hour: 5:00 PM

veh/hr=	360		Split:	59% /	41%
BFFS (mph)=	30	*Posted Limit	Terrain:	Rolling	
PHF=	0.64		Sholder Width (Ft):	2	
P_t (%)=	0		Lane Width (ft):	10	
P_r (%)=	0		No-Pass Zone (%):	100	
			Access (Points/mile):	20	
Directional Flow (veh/hr):	211		Class:	II	

AVERAGE TRAVEL SPEEDS CALCULATIONS

(Use Exhibit 20-7) (Use Exhibit 20-9)

f_g= 0.71 E_t= 2.5 E_r= 1.1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1.000

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 792 <3,200 pc/hr

Max Split (%)= 0.586826

$v_{p\text{-directional}}$ (pc/hr)= v_p*{split}= 465 <1,700 pc/hr

(Use Exhibits 20-5 and 20-6)

f_{ls} (mph)= 3.7

f_A (mph)= 5 (*Interpolated Value)

FFS (mph)= $BFFS-f_{ls}-f_A$= 21

(Use Exhibit 20-11)

f_{np} (mph)= 3.04 (*Interpolated Value)

ATS (mph)= $FFS-0.00776*v_p-f_{np}$= 12.1

PERCENT TIME-SPENT-FOLLOWING CALCULATIONS

(Use Exhibit 20-8) (Use Exhibit 20-10)

f_g= 0.77 E_t= 1.8 E_r= 1

f_{hv}= $1/[1+P_t(E_t-1)+P_r(E_r-1)]$= 1

v_p (pc/hr)= $v/[PHF*f_g*f_{hv}]$= 730 <3,200 pc/hr

Max Split (%)= 0.586826

$v_{p\text{-directional}}$ (pc/hr)= v_p*{split}= 428 <1,700 pc/hr

BPTSF (%)= $100(1-\exp(-0.000879*v_p))$= 47.4

(Use Exhibit 20-12)

$f_{d/np}$ (%)= 16.6 (*Interpolated Value)

PTSF (%)= $BPTSF+f_{d/np}$= 64.0

LEVEL OF SERVICE

(Use Exhibit 20-2 for class I and 20-4 for class II)

LOS= C

ESI ENGINEERING SOLUTIONS INC

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (1 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance North
Project Location: Tupelo, MS

POST-DEV. A.M.

VEHICLE VOLUMES AND ADJUSTMENTS

Movement:	1	2	3	4	5	6	7	8	9	10	11	12
Volume (veh/hr):	2	125	0	0	167	1	0	0	0	5	0	4
PHF:	0.00	0.76	0.74	0.82	0.73	0.00				0.82	0.00	0.82
Hourly Flow (veh/hr):	0	95	0	0	122	0	0	0	0	4	0	3
P_{hv}:	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

*Can Estimate from Chapter 12 in Book.

PEDESTRIAN VOLUMES AND ADJUSTMENTS

Movement:	13	14	15	16
V_x (ped/hr):	0	0	0	0
Lane Width, w (ft):				
Walking Speed, S_p (ft/s):				
f_p (%):				

FLARED MINOR-STREET APPROACH

Movement 9: No m= n/a
Movement 12: No m= n/a

MEDIAN STORAGE

Movements 7/8: No
Movements 10/11: No

UPSTREAM SIGNALS

N/A

CRITICAL GAP & FOLLOW UP TIME

$t_c=t_{c,base}+t_{c,hv}P_{hv}+t_{c,G}G-t_{c,T}-t_{3,LT}$ ((Eq. 17-1))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{c,base}$ (s) [exh. 17-5]:	4.1			6.2				7.1	
$t_{c,hv}$ (s):	1			1				1	*1 for 2-lane; 2 for 4-lane
P_{hv} :	0%	0%	0%	0%	0%	0%	0%	0%	
$t_{c,G}$ (s):			0.1	0.1	0.2	0.2	0.2	0.2	*Set Values
G [wksht 3]:	0	0	0	0	0	0	0	0	*Percent Grade/100
$t_{3,LT}$ (s):		0	0					0.7	*See Book pg 17-7
$t_{c,T}$ (s) {Single}:							0		
$t_{c,T}$ (s) {two}:									
t_c (s) {Single}:	4.1	0	0	6.2	0	0	0	6.4	
t_c (s) {two}:									

$t_f=t_{f,base}+t_{f,hv}P_{hv}$ ((Eq. 17-2))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{f,base}$ (s) [exh 17-5]:	2.2			3.3				3.5	
$t_{f,hv}$ (s):	0.9			0.9				0.9	*0.9 for 2-lane; 1 for 4-lane
P_{hv}:	0%	0%	0%	0%	0%	0%	0%	0%	
t_f (s):	2.2	0	0	3.3	0	0	0	3.5	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (2 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance North

Project Location: Tupelo, MS

POST-DEV. A.M.

TIME TO CLEAR STANDING QUEUE (COMPUTATION 1)

N/A

IMPEDANCE AND CAPACITY CALCULATION

Step 1: RT from Minor Street

	v_9	USE?= NO	v_{12}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		122	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		934	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		934	
$p_{0,x}$ [eq 17-5]:	0.000		0.997	

N= 1 *Number of Through Lanes

Step 2: LT from Major Street

	v_4	USE?= NO	v_1	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		122	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		1,477	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		1,477	
$p_{0,x}$ [eq 17-5]:	0.000		1.000	
$p_{0,x*}$ [eq 17-16]:	0.000		1.000	
Maj. Shared Left, $p_{0,x}$ [eq 17-5]:				

s (veh/hr)= 1900 *Value from CH 10 (Pg 10-17) in book

Step 3: TH from Minor Street (4-Leg Only)

N/A

Step 4: LT from Minor Street (4-Leg Only)

N/A

Step 5: LT from Minor Street (T-Intersections Only)

	v_7	USE?= NO	v_{10}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		218	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		775	
$P_{p,x}$ [eq 17-12]:	1		1	
f_x [eq 17-13]:	0.000		1.000	
$c_{m,x}$ [eq 17-7]:	0		775	

*Number of Through Lanes [b] N= 1 **Major St Multilane?=** NO **Right Turn Lane on Major?=** NO

[d] V_3= 0 v_6= 0 [c] V_3= 0 V_6= 0

Minor St Multilane/Dedicated Right Lane?= NO **Minor St Single Lane Flaired?=** NO

[e] [f] v_9= 0 v_{12}= 2.8713

Quest. N/A: Mark 'NO' Here= NO

[a] v_3= 0 v_6= 0 [see Exhibit 17-4]

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (3 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance North
Project Location: Tupelo, MS

POST-DEV. A.M.

SHARED-LANE CAPACITY

(*Use Eq 17-15)

	v (veh/hr)			C_m (veh/hr)			C_{SH} (veh/hr)
Lane	mv 7	mv 8	mv 9	mv 7	mv 8	mv 9	
1	0		0	0		0	0
2							
3							
	mv 10	mv 11	mv 12	mv 10	mv 11	mv 12	
1	4		3	775		1,477	974
2							
3							

CONTROL DELAY, QUEUE LENGTH, LEVEL OF SERVICE

				*Eq. 17-37	*Eq. 17-38	*Exh 17-2
Lane	v (v/h)	C_m (v/h)	v/c	Queue (<2)	Control Delay	LOS
1 [7, 8, 9]	0	0	0.000	N/A	N/A	N/A
2 [7, 8, 9]						
3 [7, 8, 9]						
1 [10, 11, 12]	7	974	0.007	-162.96	9	A
2 [10, 11, 12]						
3 [10, 11, 12]						

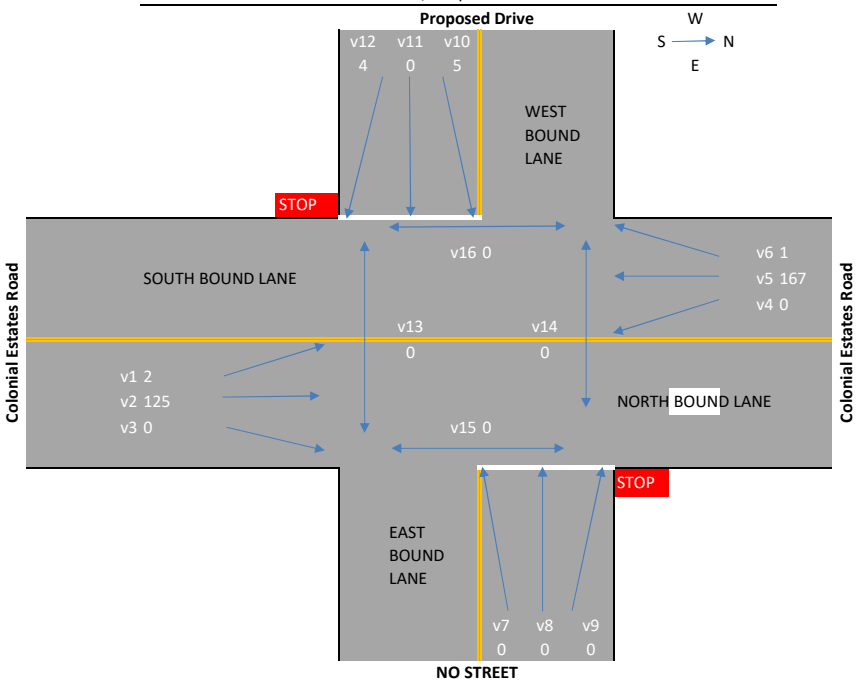
T= 0.25 *T=0.25 for 15 Min. Period

Exhibit 17-2

A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

*HCM2000

Intersection: Colonial Estates Rd / Proposed Entrance North



% of Gen. Traffic Using this Intersection to Turn: 50%

Pre-Developed A.M. Peak Hour Traffic Count													
		Proposed Drive				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
		LT	TH	RT	%	RT	TH	LT	%	RT	TH	LT	%
0-15		0	0	0		0	32	0	19%	0	22	0	18%
15-30		0	0	0		0	33	0	20%	0	33	0	26%
30-45		0	0	0		0	45	0	27%	0	29	0	23%
45-60		0	0	0		0	57	0	34%	0	41	0	33%
∑		0	0	0		0	167	0		0	125	0	
PHF													

Post-Developed A.M. Peak Hour Traffic Count													
		Proposed Drive				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
	Distrib.	LT	TH	RT		RT	TH	LT		RT	TH	LT	
0-15	20%	1	0	1		0	32	0		0	22	0	
15-30	22%	1	0	1		0	33	0		0	33	0	
30-45	31%	1	0	1		0	45	0		0	29	1	
45-60	28%	1	0	1		0	57	0		0	41	1	
∑		5	0	4		1	167	0		0	125	2	
PHF		0.82		0.82		0.82	0.73	0.00		0.00	0.76	0.74	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (1 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance North
Project Location: Tupelo, MS

POST-DEV. P.M.

VEHICLE VOLUMES AND ADJUSTMENTS

Movement:	1	2	3	4	5	6	7	8	9	10	11	12
Volume (veh/hr):	5	196	0	0	138	3	0	0	0	2	0	3
PHF:	0.00	0.60	0.65	0.65	0.70	0.00				0.65	0.00	0.65
Hourly Flow (veh/hr):	0	119	0	0	97	0	0	0	0	1	0	2
P_{hv}:	0%	13%	0%	0%	13%	0%	0%	0%	0%	0%	0%	0%

*Can Estimate from Chapter 12 in Book.

PEDESTRIAN VOLUMES AND ADJUSTMENTS

Movement:	13	14	15	16
V_x (ped/hr):	0	0	0	0
Lane Width, w (ft):				
Walking Speed, S_p (ft/s):				
f_p (%):				

FLARED MINOR-STREET APPROACH

Movement 9: No m= n/a
Movement 12: No m= n/a

MEDIAN STORAGE

Movements 7/8: No
Movements 10/11: No

UPSTREAM SIGNALS

N/A

CRITICAL GAP & FOLLOW UP TIME

$t_c=t_{c,base}+t_{c,hv}P_{hv}+t_{c,G}G-t_{c,T}-t_{3,LT}$ ((Eq. 17-1))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{c,base}$ (s) [exh. 17-5]:	4.1			6.2				7.1	
$t_{c,hv}$ (s):	1			1				1	*1 for 2-lane; 2 for 4-lane
P_{hv} :	0%	0%	0%	0%	0%	0%	0%	0%	
$t_{c,G}$ (s):			0.1	0.1	0.2	0.2	0.2	0.2	*Set Values
G [wksht 3]:	0	0	0	0	0	0	0	0	*Percent Grade/100
$t_{3,LT}$ (s):		0	0					0.7	*See Book pg 17-7
$t_{c,T}$ (s) {Single}:							0		
$t_{c,T}$ (s) {two}:									
t_c (s) {Single}:	4.1	0	0	6.2	0	0	0	6.4	
t_c (s) {two}:									

$t_f=t_{f,base}+t_{f,hv}P_{hv}$ ((Eq. 17-2))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{f,base}$ (s) [exh 17-5]:	2.2			3.3				3.5	
$t_{f,hv}$ (s):	0.9			0.9				0.9	*0.9 for 2-lane; 1 for 4-lane
P_{hv}:	0%	0%	0%	0%	0%	0%	0%	0%	
t_f (s):	2.2	0	0	3.3	0	0	0	3.5	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (2 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance North

Project Location: Tupelo, MS

POST-DEV. P.M.

TIME TO CLEAR STANDING QUEUE (COMPUTATION 1)

N/A

IMPEDANCE AND CAPACITY CALCULATION

Step 1: RT from Minor Street

	v_9	USE?= NO	v_{12}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		97	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		965	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		965	
$p_{0,x}$ [eq 17-5]:	0.000		0.998	

N= 1 *Number of Through Lanes

Step 2: LT from Major Street

	v_4	USE?= NO	v_1	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		97	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		1,509	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		1,509	
$p_{0,x}$ [eq 17-5]:	0.000		1.000	
$p_{0,x*}$ [eq 17-16]:	0.000		1.000	
Maj. Shared Left, $p_{0,x}$ [eq 17-5]:				

s (veh/hr)= 1900 *Value from CH 10 (Pg 10-17) in book

Step 3: TH from Minor Street (4-Leg Only)

N/A

Step 4: LT from Minor Street (4-Leg Only)

N/A

Step 5: LT from Minor Street (T-Intersections Only)

	v_7	USE?= NO	v_{10}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		216	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		777	
$P_{p,x}$ [eq 17-12]:	1		1	
f_x [eq 17-13]:	0.000		1.000	
$c_{m,x}$ [eq 17-7]:	0		777	

*Number of Through Lanes [b] N= 1 **Major St Multilane?=** NO **Right Turn Lane on Major?=** NO

[d] V_3= 0 v_6= 0 [c] V_3= 0 V_6= 0

Minor St Multilane/Dedicated Right Lane?= NO **Minor St Single Lane Flaired?=** NO

[e] [f] v_9= 0 v_{12}= 1.8297

Quest. N/A: Mark 'NO' Here= NO

[a] v_3= 0 v_6= 0 [see Exhibit 17-4]

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (3 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance North
Project Location: Tupelo, MS

POST-DEV. P.M.

SHARED-LANE CAPACITY

(*Use Eq 17-15)

	v (veh/hr)			C_m (veh/hr)			C_{SH} (veh/hr)
Lane	mv 7	mv 8	mv 9	mv 7	mv 8	mv 9	
1	0		0	0		0	0
2							
3							
	mv 10	mv 11	mv 12	mv 10	mv 11	mv 12	
1	1		2	777		1,509	1,089
2							
3							

CONTROL DELAY, QUEUE LENGTH, LEVEL OF SERVICE

				*Eq. 17-37	*Eq. 17-38	*Exh 17-2
Lane	v (v/h)	C_m (v/h)	v/c	Queue (<2)	Control Delay	LOS
1 [7, 8, 9]	0	0	0.000	N/A	N/A	N/A
2 [7, 8, 9]						
3 [7, 8, 9]						
1 [10, 11, 12]	3	1,089	0.003	-156.51	8	A
2 [10, 11, 12]						
3 [10, 11, 12]						

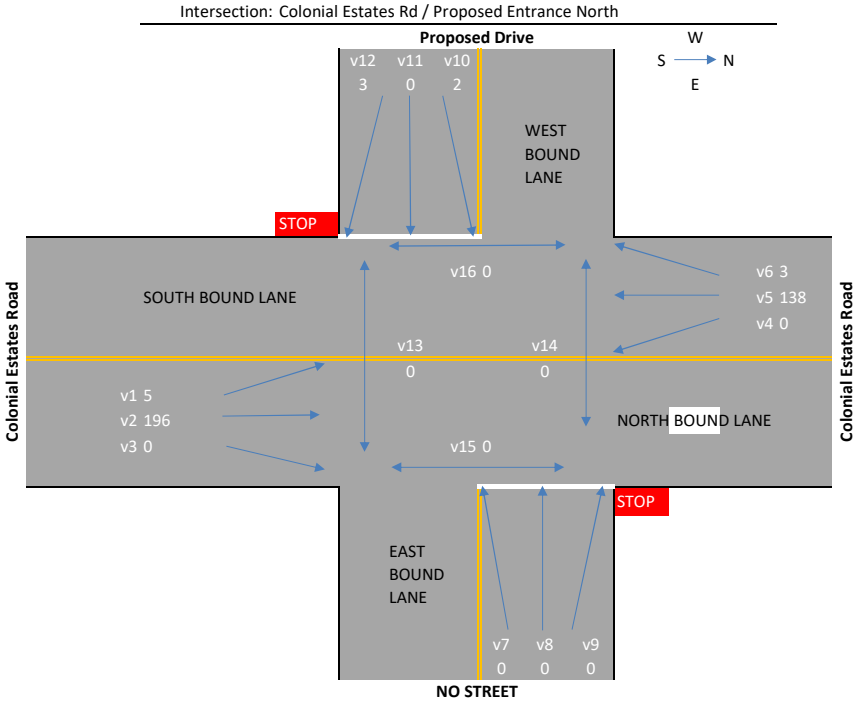
T= 0.25 *T=0.25 for 15 Min. Period

Exhibit 17-2

A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

*HCM2000

Intersection: Colonial Estates Rd / Proposed Entrance North



% of Gen. Traffic Using this Intersection to Turn: 50%

Pre-Developed P.M. Peak Hour Traffic Count													
		Proposed Drive				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
		LT	TH	RT	%	RT	TH	LT	%	RT	TH	LT	%
0-15		0	0	0		0	49	0	36%	0	81	0	41%
15-30		0	0	0		0	41	0	30%	0	39	0	20%
30-45		0	0	0		0	30	0	22%	0	51	0	26%
45-60		0	0	0		0	18	0	13%	0	25	0	13%
∑		0	0	0		0	138	0		0	196	0	
PHF													

Post-Developed A.M. Peak Hour Traffic Count													
		Proposed Drive				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
	Distrib.	LT	TH	RT		RT	TH	LT		RT	TH	LT	
0-15	38%	1	0	1		1	49	0		0	81	2	
15-30	25%	0	0	1		1	41	0		0	39	1	
30-45	24%	0	0	1		1	30	0		0	51	1	
45-60	13%	0	0	0		0	18	0		0	25	1	
∑		2	0	3		3	138	0		0	196	5	
PHF		0.65		0.65		0.65	0.70	0.00		0.00	0.60	0.65	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (1 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance South
Project Location: Tupelo, MS

POST-DEV. A.M.

VEHICLE VOLUMES AND ADJUSTMENTS

Movement:	1	2	3	4	5	6	7	8	9	10	11	12
Volume (veh/hr):	2	125	0	0	167	1	0	0	0	5	0	4
PHF:	0.00	0.76	0.74	0.82	0.73	0.00				0.82	0.00	0.82
Hourly Flow (veh/hr):	0	95	0	0	122	0	0	0	0	4	0	3
P_{hv}:	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

*Can Estimate from Chapter 12 in Book.

PEDESTRIAN VOLUMES AND ADJUSTMENTS

Movement:	13	14	15	16
V_x (ped/hr):	0	0	0	0
Lane Width, w (ft):				
Walking Speed, S_p (ft/s):				
f_p (%):				

FLARED MINOR-STREET APPROACH

Movement 9: No m= n/a
Movement 12: No m= n/a

MEDIAN STORAGE

Movements 7/8: No
Movements 10/11: No

UPSTREAM SIGNALS

N/A

CRITICAL GAP & FOLLOW UP TIME

$t_c=t_{c,base}+t_{c,hv}P_{hv}+t_{c,G}G-t_{c,T}-t_{3,LT}$ ((Eq. 17-1))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{c,base}$ (s) [exh. 17-5]:	4.1			6.2				7.1	
$t_{c,hv}$ (s):	1			1				1	*1 for 2-lane; 2 for 4-lane
P_{hv} :	0%	0%	0%	0%	0%	0%	0%	0%	
$t_{c,G}$ (s):			0.1	0.1	0.2	0.2	0.2	0.2	*Set Values
G [wksht 3]:	0	0	0	0	0	0	0	0	*Percent Grade/100
$t_{3,LT}$ (s):		0	0					0.7	*See Book pg 17-7
$t_{c,T}$ (s) {Single}:							0		
$t_{c,T}$ (s) {two}:									
t_c (s) {Single}:	4.1	0	0	6.2	0	0	0	6.4	
t_c (s) {two}:									

$t_f=t_{f,base}+t_{f,hv}P_{hv}$ ((Eq. 17-2))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{f,base}$ (s) [exh 17-5]:	2.2			3.3				3.5	
$t_{f,hv}$ (s):	0.9			0.9				0.9	*0.9 for 2-lane; 1 for 4-lane
P_{hv}:	0%	0%	0%	0%	0%	0%	0%	0%	
t_f (s):	2.2	0	0	3.3	0	0	0	3.5	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (2 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance South

Project Location: Tupelo, MS

POST-DEV. A.M.

TIME TO CLEAR STANDING QUEUE (COMPUTATION 1)

N/A

IMPEDANCE AND CAPACITY CALCULATION

Step 1: RT from Minor Street

	v_9	USE?= NO	v_{12}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		122	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		934	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		934	
$p_{0,x}$ [eq 17-5]:	0.000		0.997	

N= 1 *Number of Through Lanes

Step 2: LT from Major Street

	v_4	USE?= NO	v_1	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		122	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		1,477	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		1,477	
$p_{0,x}$ [eq 17-5]:	0.000		1.000	
$p_{0,x*}$ [eq 17-16]:	0.000		1.000	
Maj. Shared Left, $p_{0,x}$ [eq 17-5]:				

s (veh/hr)= 1900 *Value from CH 10 (Pg 10-17) in book

Step 3: TH from Minor Street (4-Leg Only)

N/A

Step 4: LT from Minor Street (4-Leg Only)

N/A

Step 5: LT from Minor Street (T-Intersections Only)

	v_7	USE?= NO	v_{10}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		218	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		775	
$P_{p,x}$ [eq 17-12]:	1		1	
f_x [eq 17-13]:	0.000		1.000	
$c_{m,x}$ [eq 17-7]:	0		775	

*Number of Through Lanes [b] N= 1 **Major St Multilane?=** NO **Right Turn Lane on Major?=** NO

[d] V_3= 0 v_6= 0 [c] V_3= 0 V_6= 0

Minor St Multilane/Dedicated Right Lane?= NO **Minor St Single Lane Flaired?=** NO

[e] [f] v_9= 0 v_{12}= 2.8713

Quest. N/A: Mark 'NO' Here= NO

[a] v_3= 0 v_6= 0 [see Exhibit 17-4]

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (3 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance South
Project Location: Tupelo, MS

POST-DEV. A.M.

SHARED-LANE CAPACITY

(*Use Eq 17-15)

	v (veh/hr)			C_m (veh/hr)			C_{SH} (veh/hr)
Lane	mv 7	mv 8	mv 9	mv 7	mv 8	mv 9	
1	0		0	0		0	0
2							
3							
	mv 10	mv 11	mv 12	mv 10	mv 11	mv 12	
1	4		3	775		1,477	974
2							
3							

CONTROL DELAY, QUEUE LENGTH, LEVEL OF SERVICE

				*Eq. 17-37	*Eq. 17-38	*Exh 17-2
Lane	v (v/h)	C_m (v/h)	v/c	Queue (<2)	Control Delay	LOS
1 [7, 8, 9]	0	0	0.000	N/A	N/A	N/A
2 [7, 8, 9]						
3 [7, 8, 9]						
1 [10, 11, 12]	7	974	0.007	-162.96	9	A
2 [10, 11, 12]						
3 [10, 11, 12]						

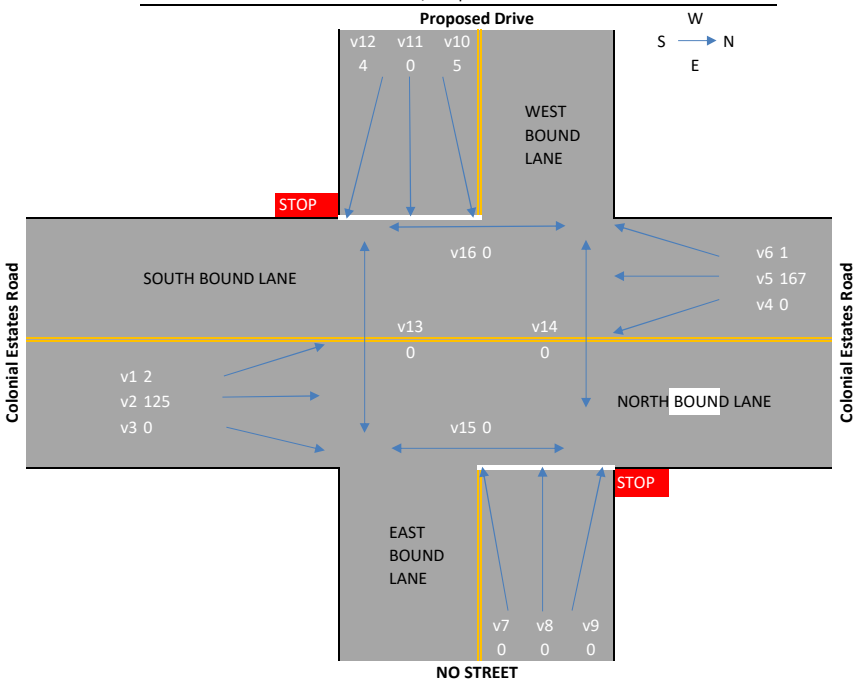
T= 0.25 *T=0.25 for 15 Min. Period

Exhibit 17-2

A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

*HCM2000

Intersection: Colonial Estates Rd / Proposed Entrance South



% of Gen. Traffic Using this Intersection to Turn: 50%

Pre-Developed A.M. Peak Hour Traffic Count		*Proposed Drive*				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
		LT	TH	RT	%	RT	TH	LT	%	RT	TH	LT	%
0-15		0	0	0		0	32	0	19%	0	22	0	18%
15-30		0	0	0		0	33	0	20%	0	33	0	26%
30-45		0	0	0		0	45	0	27%	0	29	0	23%
45-60		0	0	0		0	57	0	34%	0	41	0	33%
∑		0	0	0		0	167	0		0	125	0	
PHF													

Post-Developed A.M. Peak Hour Traffic Count		*Proposed Drive*				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
	Distrib.	LT	TH	RT		RT	TH	LT		RT	TH	LT	
0-15	20%	1	0	1		0	32	0		0	22	0	
15-30	22%	1	0	1		0	33	0		0	33	0	
30-45	31%	1	0	1		0	45	0		0	29	1	
45-60	28%	1	0	1		0	57	0		0	41	1	
∑		5	0	4		1	167	0		0	125	2	
PHF		0.82		0.82		0.82	0.73	0.00		0.00	0.76	0.74	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (1 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance South
Project Location: Tupelo, MS

POST-DEV. P.M.

VEHICLE VOLUMES AND ADJUSTMENTS

Movement:	1	2	3	4	5	6	7	8	9	10	11	12
Volume (veh/hr):	5	196	0	0	138	3	0	0	0	2	0	3
PHF:	0.00	0.60	0.65	0.65	0.70	0.00				0.65	0.00	0.65
Hourly Flow (veh/hr):	0	119	0	0	97	0	0	0	0	1	0	2
P_{hv}:	0%	13%	0%	0%	13%	0%	0%	0%	0%	0%	0%	0%

*Can Estimate from Chapter 12 in Book.

PEDESTRIAN VOLUMES AND ADJUSTMENTS

Movement:	13	14	15	16
V_x (ped/hr):	0	0	0	0
Lane Width, w (ft):				
Walking Speed, S_p (ft/s):				
f_p (%):				

FLARED MINOR-STREET APPROACH

Movement 9: No m= n/a
Movement 12: No m= n/a

MEDIAN STORAGE

Movements 7/8: No
Movements 10/11: No

UPSTREAM SIGNALS

N/A

CRITICAL GAP & FOLLOW UP TIME

$t_c=t_{c,base}+t_{c,hv}P_{hv}+t_{c,G}G-t_{c,T}-t_{3,LT}$ ((Eq. 17-1))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{c,base}$ (s) [exh. 17-5]:	4.1			6.2				7.1	
$t_{c,hv}$ (s):	1			1				1	*1 for 2-lane; 2 for 4-lane
P_{hv} :	0%	0%	0%	0%	0%	0%	0%	0%	
$t_{c,G}$ (s):			0.1	0.1	0.2	0.2	0.2	0.2	*Set Values
G [wksht 3]:	0	0	0	0	0	0	0	0	*Percent Grade/100
$t_{3,LT}$ (s):		0	0					0.7	*See Book pg 17-7
$t_{c,T}$ (s) {Single}:							0		
$t_{c,T}$ (s) {two}:									
t_c (s) {Single}:	4.1	0	0	6.2	0	0	0	6.4	
t_c (s) {two}:									

$t_f=t_{f,base}+t_{f,hv}P_{hv}$ ((Eq. 17-2))

	Major LT		Minor RT		Minor TH		Minor LT		
Movement:	1	4	9	12	8	11	7	10	
$t_{f,base}$ (s) [exh 17-5]:	2.2			3.3				3.5	
$t_{f,hv}$ (s):	0.9			0.9				0.9	*0.9 for 2-lane; 1 for 4-lane
P_{hv}:	0%	0%	0%	0%	0%	0%	0%	0%	
t_f (s):	2.2	0	0	3.3	0	0	0	3.5	

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (2 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance South

Project Location: Tupelo, MS

POST-DEV. P.M.

TIME TO CLEAR STANDING QUEUE (COMPUTATION 1)

N/A

IMPEDANCE AND CAPACITY CALCULATION

Step 1: RT from Minor Street

	v_9	USE?= NO	v_{12}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		97	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		965	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		965	
$p_{0,x}$ [eq 17-5]:	0.000		0.998	

N= 1 *Number of Through Lanes

Step 2: LT from Major Street

	v_4	USE?= NO	v_1	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		97	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		1,509	
$P_{p,x}$ [eq 17-12]:	1		1	
$c_{m,x}$ () [eq 17-4]:	0		1,509	
$p_{0,x}$ [eq 17-5]:	0.000		1.000	
$p_{0,x*}$ [eq 17-16]:	0.000		1.000	
Maj. Shared Left, $p_{0,x}$ [eq 17-5]:				

s (veh/hr)= 1900 *Value from CH 10 (Pg 10-17) in book

Step 3: TH from Minor Street (4-Leg Only)

N/A

Step 4: LT from Minor Street (4-Leg Only)

N/A

Step 5: LT from Minor Street (T-Intersections Only)

	v_7	USE?= NO	v_{10}	USE?= YES
$v_{c,x}$ (veh/hr) [exh 17-4]:	0		216	
$C_{p,x}$ (veh/hr) [eq 17-3 or 17-29]:	0		777	
$P_{p,x}$ [eq 17-12]:	1		1	
f_x [eq 17-13]:	0.000		1.000	
$c_{m,x}$ [eq 17-7]:	0		777	

*Number of Through Lanes [b] N= 1 **Major St Multilane?=** NO **Right Turn Lane on Major?=** NO

[d] V_3= 0 v_6= 0 [c] V_3= 0 V_6= 0

Minor St Multilane/Dedicated Right Lane?= NO **Minor St Single Lane Flaired?=** NO

[e] [f] v_9= 0 v_{12}= 1.8297

Quest. N/A: Mark 'NO' Here= NO

[a] v_3= 0 v_6= 0 [see Exhibit 17-4]

PROJECT: T22-045 CALCULATIONS BY: John White DATE: 5/9/2022

2-Way Stop Controlled Intersection (3 of 3)

ROADWAY INFORMATION

Intersection ID: Colonial Estates Rd / Proposed Entrance South
Project Location: Tupelo, MS

POST-DEV. P.M.

SHARED-LANE CAPACITY

(*Use Eq 17-15)

	v (veh/hr)			C_m (veh/hr)			C_{SH} (veh/hr)
Lane	mv 7	mv 8	mv 9	mv 7	mv 8	mv 9	
1	0		0	0		0	0
2							
3							
	mv 10	mv 11	mv 12	mv 10	mv 11	mv 12	
1	1		2	777		1,509	1,089
2							
3							

CONTROL DELAY, QUEUE LENGTH, LEVEL OF SERVICE

				*Eq. 17-37	*Eq. 17-38	*Exh 17-2
Lane	v (v/h)	C_m (v/h)	v/c	Queue (<2)	Control Delay	LOS
1 [7, 8, 9]	0	0	0.000	N/A	N/A	N/A
2 [7, 8, 9]						
3 [7, 8, 9]						
1 [10, 11, 12]	3	1,089	0.003	-156.51	8	A
2 [10, 11, 12]						
3 [10, 11, 12]						

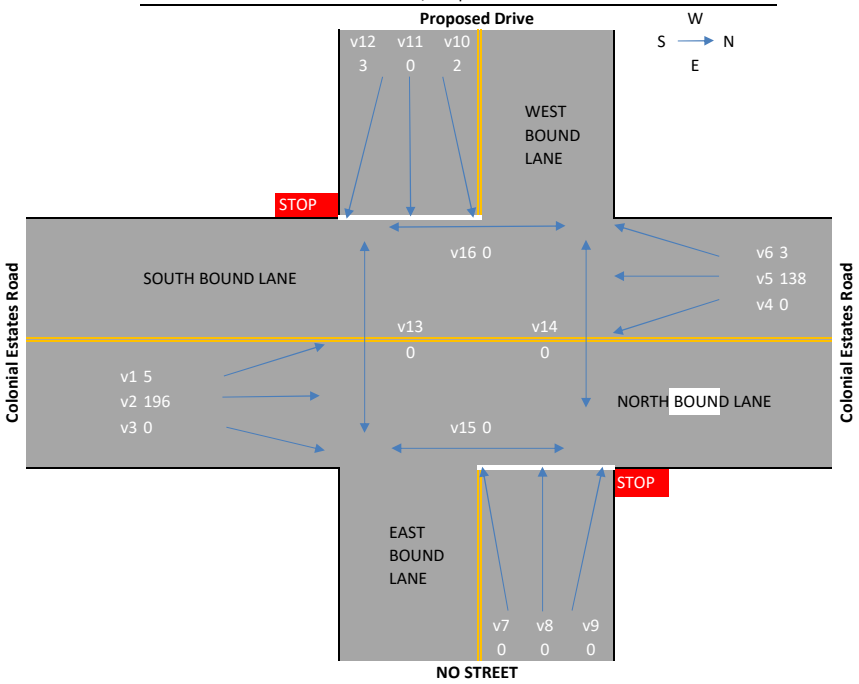
T= 0.25 *T=0.25 for 15 Min. Period

Exhibit 17-2

A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

*HCM2000

Intersection: Colonial Estates Rd / Proposed Entrance South



% of Gen. Traffic Using this Intersection to Turn: 50%

Pre-Developed P.M. Peak Hour Traffic Count		*Proposed Drive*				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
		LT	TH	RT	%	RT	TH	LT	%	RT	TH	LT	%
0-15		0	0	0		0	49	0	36%	0	81	0	41%
15-30		0	0	0		0	41	0	30%	0	39	0	20%
30-45		0	0	0		0	30	0	22%	0	51	0	26%
45-60		0	0	0		0	18	0	13%	0	25	0	13%
∑		0	0	0		0	138	0		0	196	0	
PHF													

Post-Developed A.M. Peak Hour Traffic Count		*Proposed Drive*				*Colonial Estates Road SB*				*Colonial Estates Road NB*			
	Distrib.	LT	TH	RT		RT	TH	LT		RT	TH	LT	
0-15	38%	1	0	1		1	49	0		0	81	2	
15-30	25%	0	0	1		1	41	0		0	39	1	
30-45	24%	0	0	1		1	30	0		0	51	1	
45-60	13%	0	0	0		0	18	0		0	25	1	
∑		2	0	3		3	138	0		0	196	5	
PHF		0.65		0.65		0.65	0.70	0.00		0.00	0.60	0.65	