

STONECASTLE PASS WAY

BOAT ROCK RD

PROPOSED CONNECTOR RD

NEW HOPE RD



CITGO

CAMPBELLTON RD

PROPOSED SIGNAL

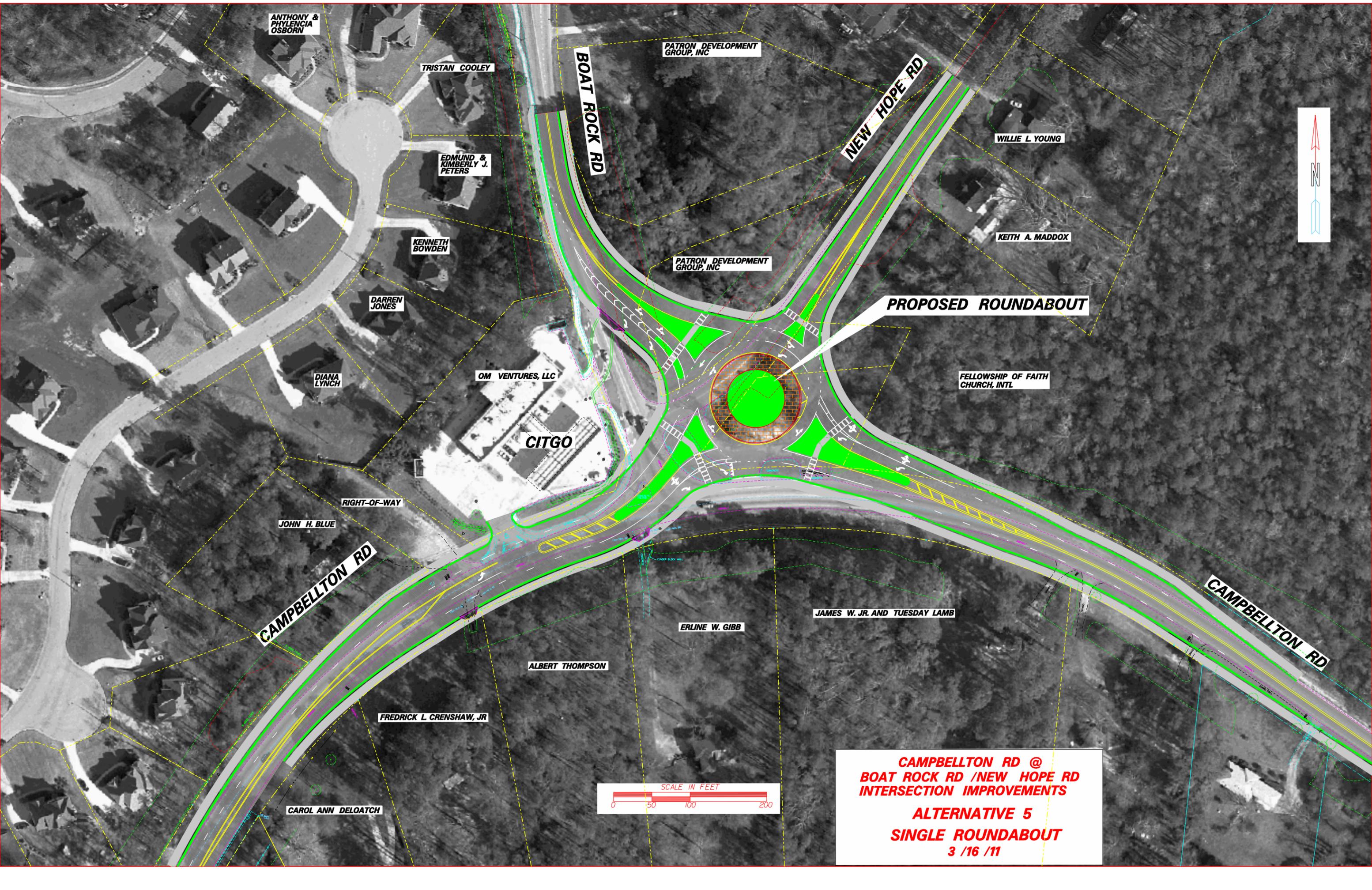
CAMPBELLTON RD

POTENTIAL SIGNAL PHASING

PHASE 1	PHASE 2	PHASE 3	PHASE 4
EB CAMPBELLTON LT TURN TO BOAT ROCK	EB CAMPBELLTON THRU	SB BOAT ROCK LT TURN TO CAMPBELLTON	SB NEW HOPE LT TURN TO CAMPBELLTON
EB CAMPBELLTON LT TURN TO NEW HOPE	WB CAMPBELLTON THRU	SB BOAT ROCK RT TURN TO CAMPBELLTON	SB NEW HOPE RT TURN TO CAMPBELLTON
EB CAMPBELLTON THRU	WB CAMPBELLTON RT TURN TO BOAT ROCK /NEW HOPE	WB CAMPBELLTON RT TURN TO BOAT ROCK /NEW HOPE	
SB BOAT ROCK RT TURN TO CAMPBELLTON			

**CAMPBELLTON RD @
BOAT ROCK RD /NEW HOPE RD
INTERSECTION IMPROVEMENTS
ALTERNATIVE 4
"K" INTERSECTION**

NOTE: SIDEWALKS NOT SHOWN



ANTHONY & PHYLENCIA OSBORN

TRISTAN COOLEY

PATRON DEVELOPMENT GROUP, INC

EDMUND & KIMBERLY J. PETERS

NEW HOPE RD

WILLIE L. YOUNG

KENNETH BOWDEN

PATRON DEVELOPMENT GROUP, INC

KEITH A. MADDOX

DARREN JONES

PROPOSED ROUNDABOUT

DIANA LYNCH

OM VENTURES, LLC

FELLOWSHIP OF FAITH CHURCH, INTL

CITGO

RIGHT-OF-WAY

JOHN H. BLUE

CAMPBELLTON RD

JAMES W. JR. AND TUESDAY LAMB

ERLINE W. GIBB

CAMPBELLTON RD

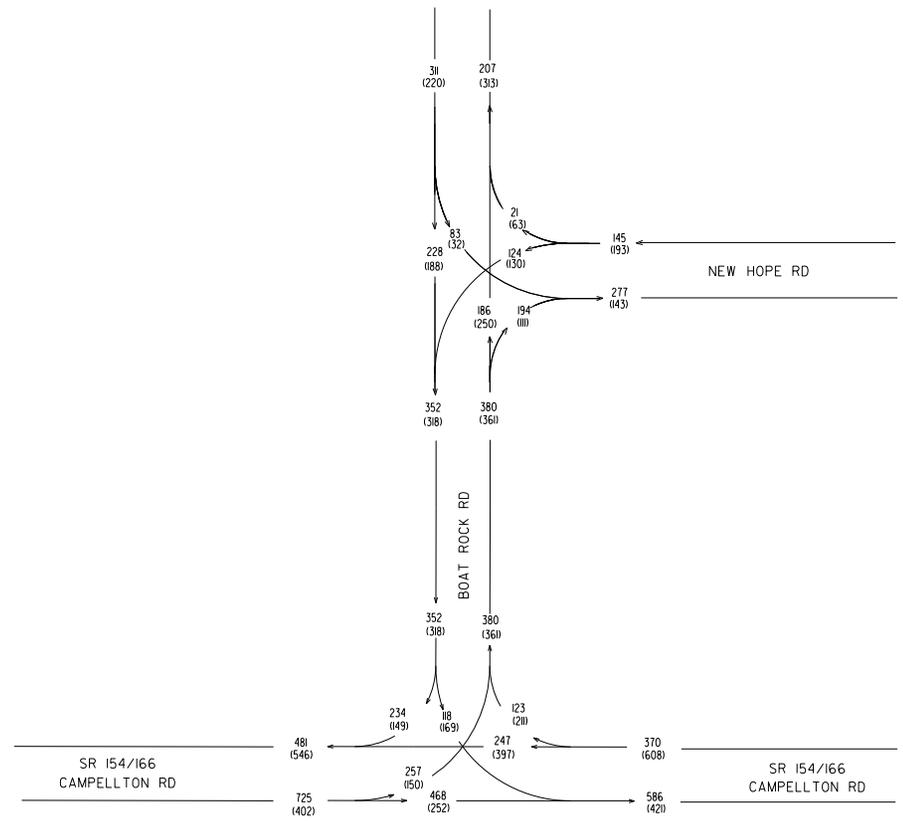
ALBERT THOMPSON

FREDRICK L. CRENSHAW, JR

CAROL ANN DELOATCH



**CAMPBELLTON RD @
BOAT ROCK RD /NEW HOPE RD
INTERSECTION IMPROVEMENTS**
ALTERNATIVE 5
SINGLE ROUNDABOUT
3 /16 /11



SR 154/166
T=6%

BOAT ROCK RD
T=4%

NEW HOPE RD
T=2%

2010 EXISTING
PEAK HOUR
PM = (000) AM = 000
PI#731830 JD
04/10



GEORGIA
DEPARTMENT
OF
TRANSPORTATION

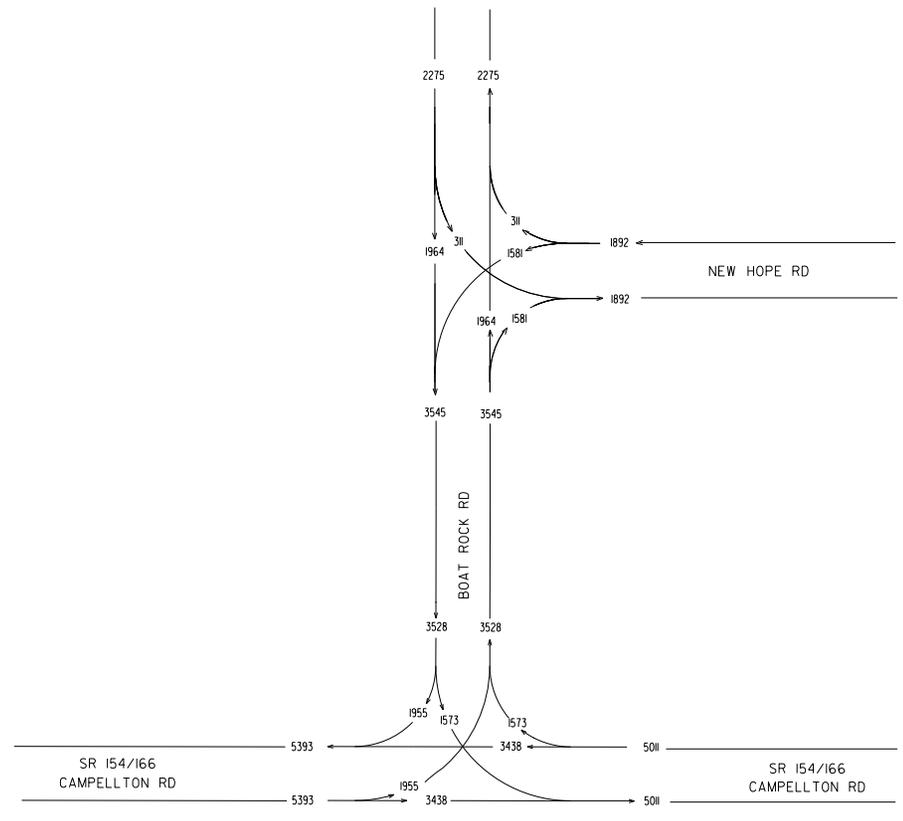
REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY

TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-01

COUNTY	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
FULTON	STP00-01866-01(1038)		



SR 154/166
T=6%

BOAT ROCK RD
T=4%

NEW HOPE RD
T=2%

2010 EXISTING
ADT = 000
PI#731830
JD
04/10



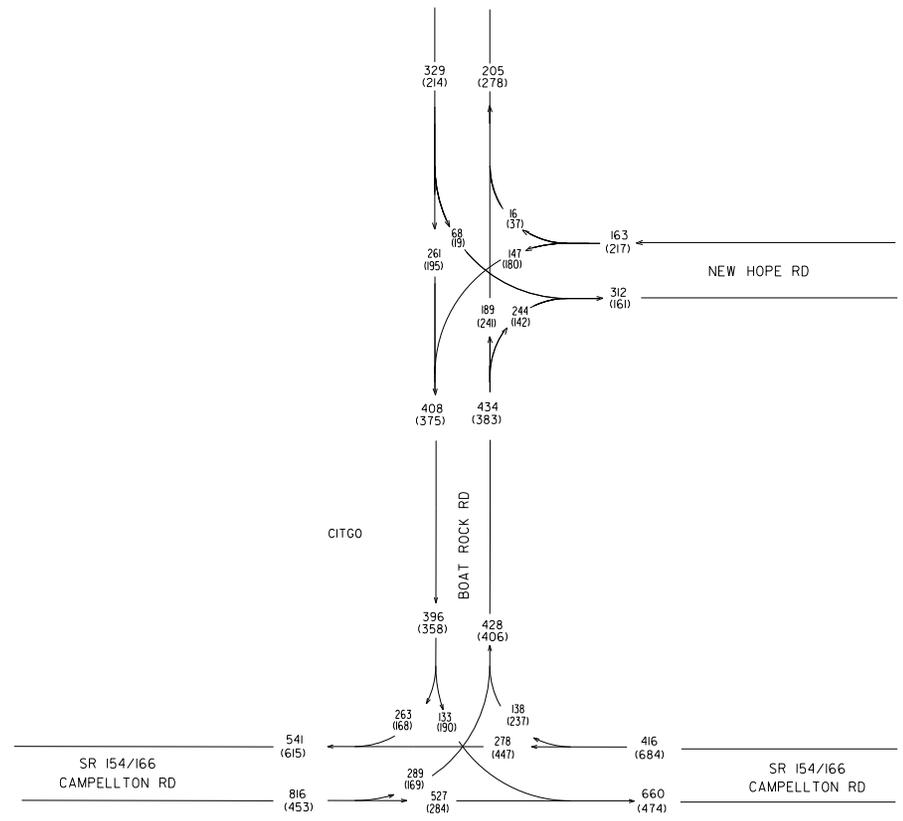
GEORGIA
DEPARTMENT
OF
TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY

TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-02



SR 154/166
T=6%

BOAT ROCK RD
T=4%

NEW HOPE RD
T=2%

2014 DHV
PM = (000)
AM = 000

PI#731830
NO-BUILD JD
04/10



GEORGIA
DEPARTMENT
OF
TRANSPORTATION

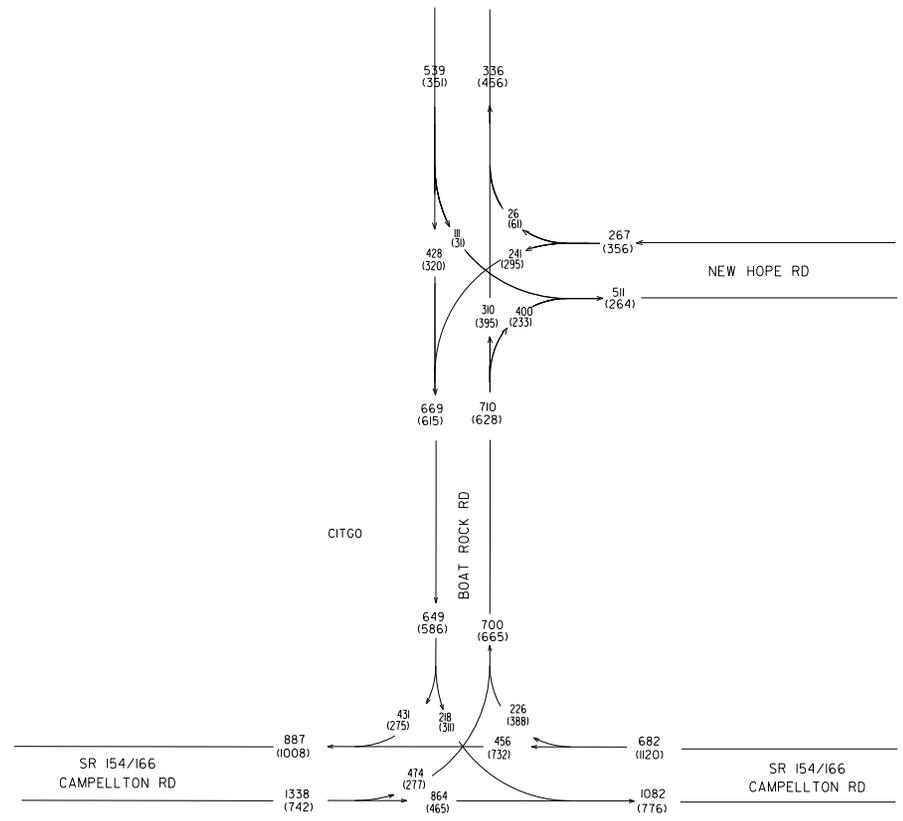
REVISION DATES	

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY

TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-03

COUNTY	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
FULTON	STP00-0186-01(1038)		



SR 154/166
T = 6%
BOAT ROCK RD
T = 4%
NEW HOPE RD
T = 2%

2034 DHV
PM = 000
AM = 000
PI#731830
NO-BUILD
JD 04/10



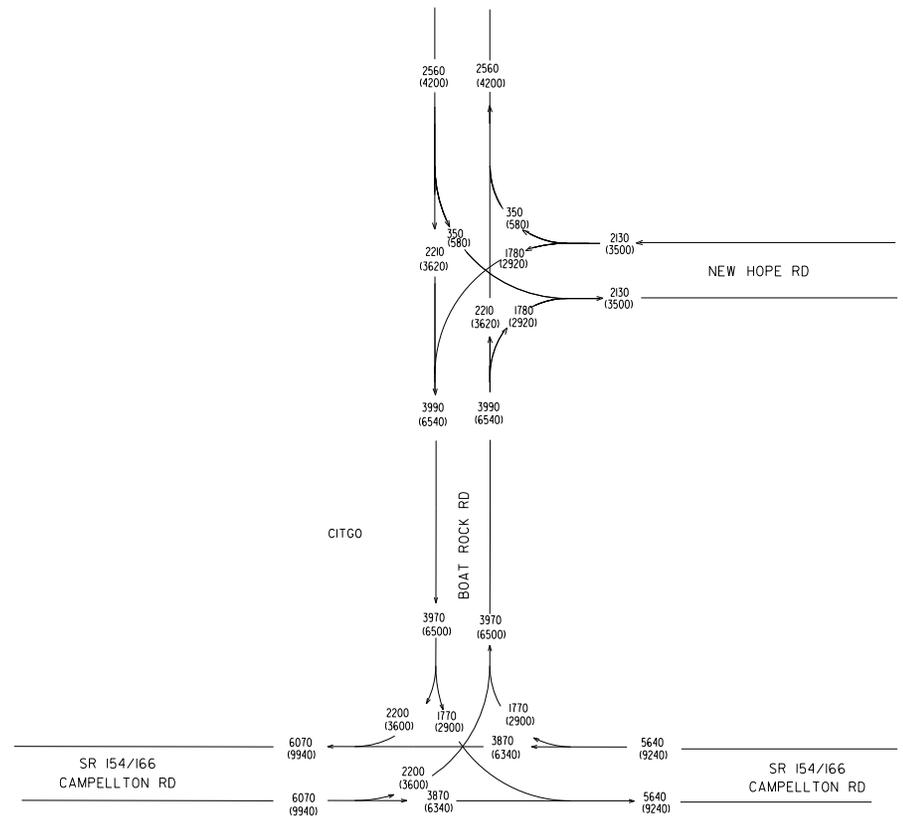
GEORGIA
DEPARTMENT
OF
TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY

TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-04



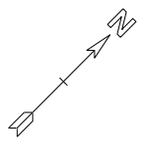
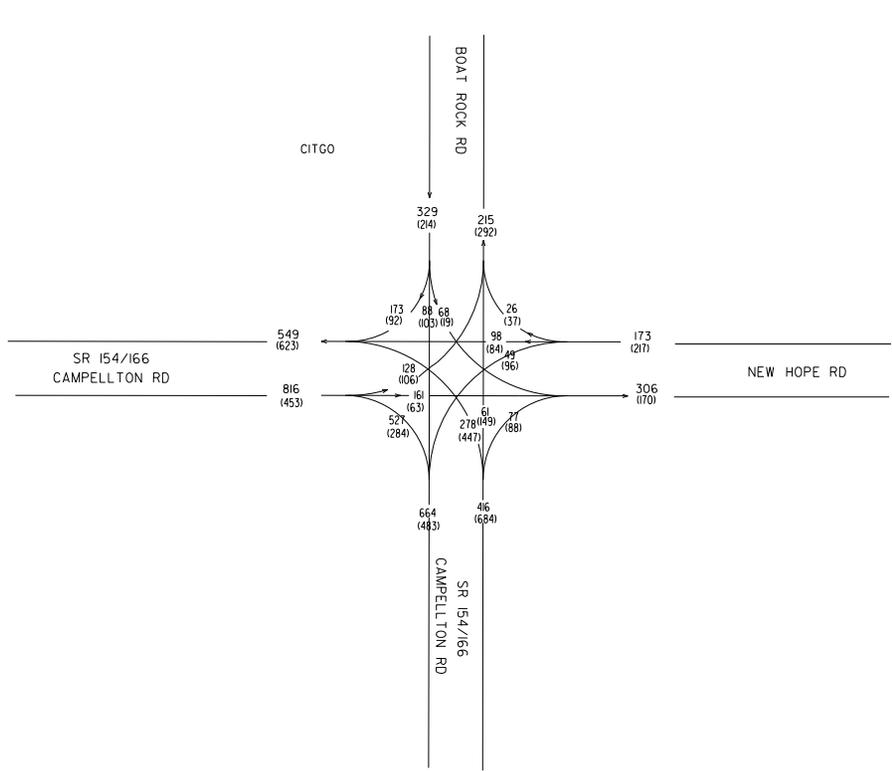
SR 154/166
 2034 AADT = (000)
 2004 AADT = 000
 24-hr T = 6%
 SU = 4%
 COMB = 2%
 PI#731830
 NO-BUILD
 JD
 04/10



GEORGIA
 DEPARTMENT
 OF
 TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
 DEPARTMENT OF TRANSPORTATION
 OFFICE: PROGRAM DELIVERY
 TRAFFIC DIAGRAM
 SR 154/166 @
 BOAT ROCK RD/NEW HOPE RD
 DRAWING NO.
10-05



SR 154/166
T = 6%
BOAT ROCK RD
T = 4%
NEW HOPE RD
T = 2%

2014 DHV
PM = (000)
AM = 000
PI#731830
BUILD JD
03/11

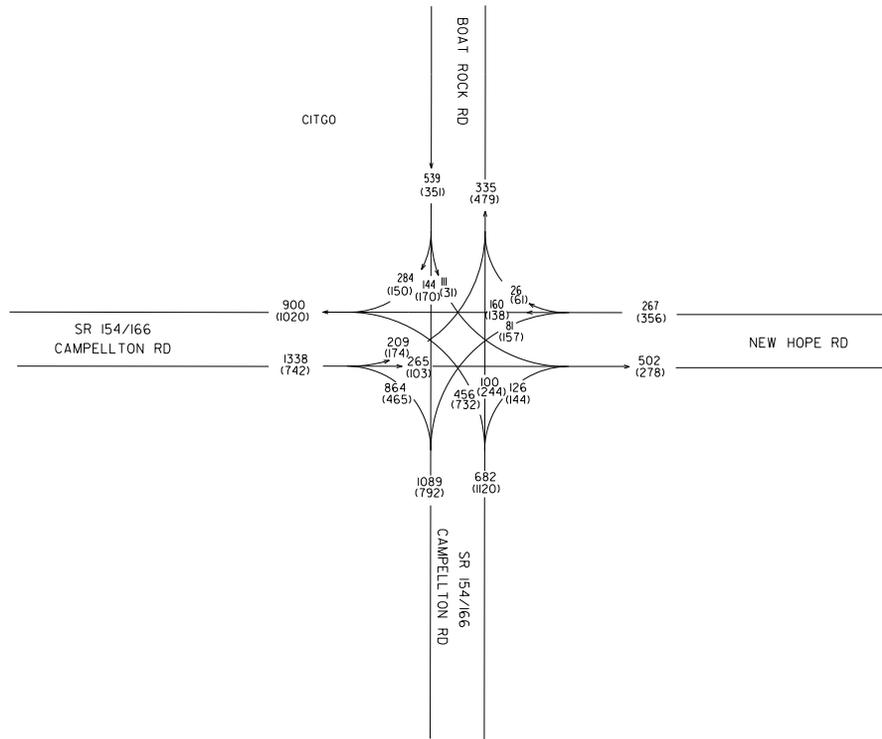


GEORGIA
DEPARTMENT
OF
TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY
TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-06



SR 154/166
T=6%

BOAT ROCK RD
T=4%

NEW HOPE RD
T=2%

2034 DHV
PM = 000
AM = 000
PI#731830
BUILD JD 03/11



• Districts
• Divisions
• Planning
• Construction Management
2007 Chastain Road, Suite 800
Atlanta, Georgia 30339
(404) 896-2000

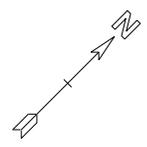
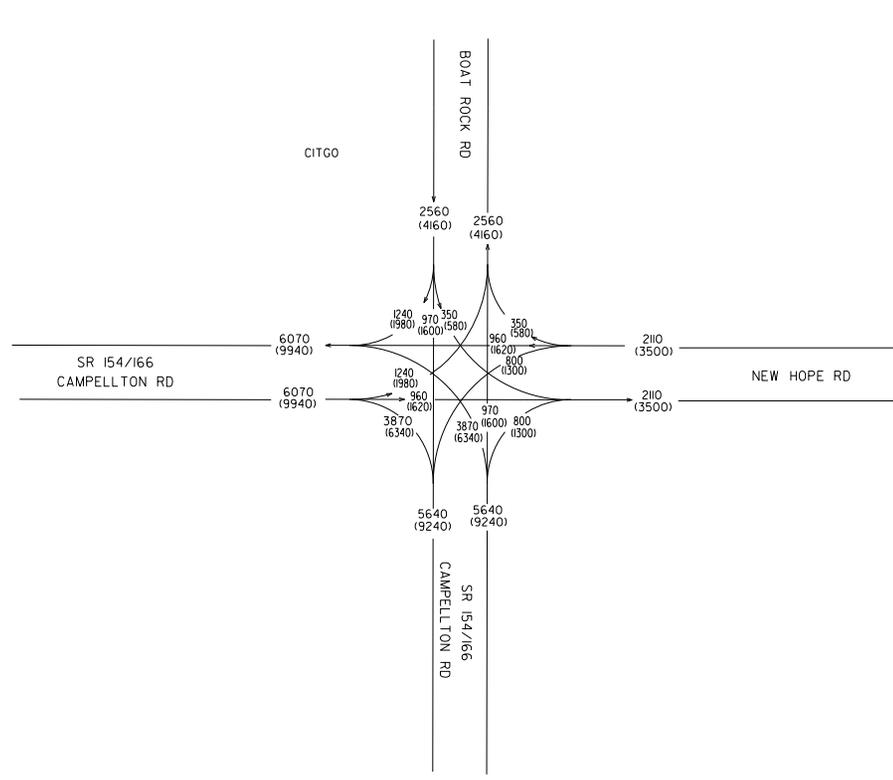
GEORGIA
DEPARTMENT
OF
TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY

TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-07



SR 154/166	2034 AADT = (000)
24-hr T = 6%	2004 AADT = 000
SU = 4%	PI#731830
COMB = 2%	BUILD
	JD 03/11



GEORGIA
DEPARTMENT
OF
TRANSPORTATION

REVISION DATES	

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: PROGRAM DELIVERY

TRAFFIC DIAGRAM
SR 154/166 @
BOAT ROCK RD/NEW HOPE RD

DRAWING NO.
10-08



Architecture

Engineering

Construction

MEMORANDUM

TO: Antonio Valenzuela
FROM: Jeff Dyer
SUBJECT: Build and Design Year Level of Service Summary – “No-Build” and “Build Alternatives”
DATE: 9/21/10, Revised 3/31/11
PROJECT: PI#731830 - Campbellton Road @ Boat Rock Road / New Hope Road

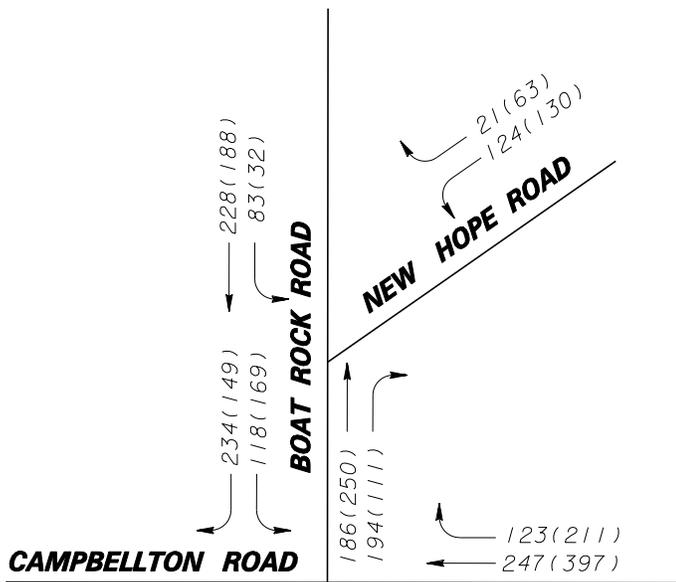
“No-Build” Level of Service Analysis

Existing, build year and design year a.m. and p.m. peak hour traffic volumes for both intersections are shown on (Figure 1 – Traffic Flow Diagrams) on the following page. Intersection level of service analysis was conducted for both Campbellton Road @ Boat Rock Road and Boat Rock Road @ New Hope Road, assuming the existing (No-Build) intersection and roadway configurations. This was done for the existing (2010), build year (2014) and design year (2034).

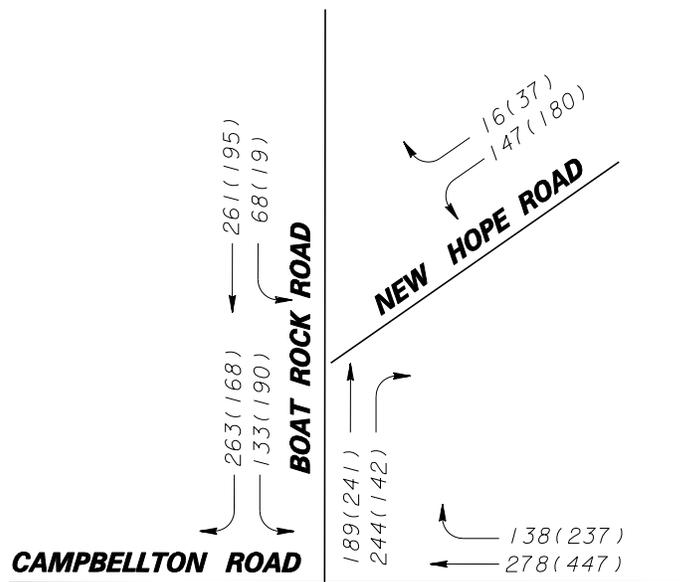
Intersection operational efficiency is expressed in terms of level of service (LOS), which is a measure of the amount of delay and congested expressed by motorists as they pass through an intersection. LOS is designated by the letters “A” through “F”. LOS “A” represents free-flowing conditions with very little delay and LOS “F” indicates forced flow, extreme congestion and long delays. The LOS methodologies are from the current edition of the *Highway Capacity Manual*.

Table 1 summarizes the level of service results for the “No-Build” condition for the existing (2010), opening (2014) and design years (2034). Both intersections are currently unsignalized. The LOS methodology for unsignalized intersections provides individual levels of service for each movement that does not have the right-of-way at the intersection. Table 1 lists the LOS for the worst approach, along with the approach delay (in seconds) that is associated with each level of service.

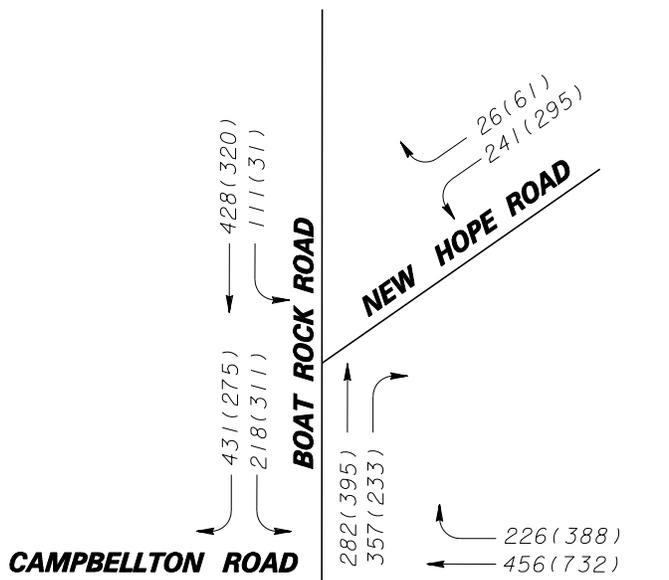
Appendix A contains the level of service printouts that Table 1 is based on.



**EXISTING (2010)
PEAK HOUR TRAFFIC**



**BUILD YEAR (2014)
PEAK HOUR TRAFFIC**



**DESIGN YEAR (2034)
PEAK HOUR TRAFFIC**

AM = 000
PM = (000)

Engineering
Planning
Construction Mgmt

3619 Holcomb Bridge Rd, Suite 455
Norcross, Georgia 30071
(404) 329-5900

**FIGURE 1
CAMPBELLTON RD @
BOAT ROCK RD /NEW HOPE RD
INTERSECTION IMPROVEMENTS
TRAFFIC FLOW DIAGRAMS**



Architecture

Engineering

Construction

MEMORANDUM

Table 1: Existing and “No-Build” - Level of Service Summary

Intersection Name	Year	Time Period	Worst Approach (2-way unsig)	Level of Service (worst approach)	Approach Delay (sec)
Campbellton Rd @ Boat Rock Rd	2010	a.m. peak	SB LT	F	82.3
Boat Rock Rd @ New Hope Rd	2010	a.m. peak	WB	C	18.2
Campbellton Rd @ Boat Rock Rd	2014	a.m. peak	SB LT	F	195.7
Boat Rock Rd @ New Hope Rd	2014	a.m. peak	WB	C	22.4
Campbellton Rd @ Boat Rock Rd	2034	a.m. peak	SB LT	F	4580.0
Boat Rock Rd @ New Hope Rd	2034	a.m. peak	WB	F	317.9
Campbellton Rd @ Boat Rock Rd	2010	p.m. peak	SB LT	E	48.3
Boat Rock Rd @ New Hope Rd	2010	p.m. peak	WB	C	15.4
Campbellton Rd @ Boat Rock Rd	2014	p.m. peak	SB LT	F	104.7
Boat Rock Rd @ New Hope Rd	2014	p.m. peak	WB	C	17.9
Campbellton Rd @ Boat Rock Rd	2034	p.m. peak	SB LT	F	2451.0
Boat Rock Rd @ New Hope Rd	2034	p.m. peak	WB	F	160.8

Table 1 shows LOS “F” in the a.m. peak and LOS “E” in the p.m. peak for the southbound left-turn movement from Boat Rock Road onto Campbellton Road in 2010. The delay increases substantially as the traffic volumes increase for 2014 and 2034. The LOS in the p.m. peak hour deteriorates to LOS “F” by 2014.

Even though the LOS doesn’t fall below LOS “C” for the westbound left-turn movement from New Hope Road onto southbound Boat Rock Road, the more important issue is that the queuing of the southbound left-turn movement from Boat Rock to Campbellton blocks the New Hope Road intersection, and correspondingly creates a substantial back-up of the New Hope Road approach traffic during peak hours.

As this area grows in population and traffic, this intersection will experience increasing congestion and potential for accidents. There are two keys to improving the operation of both of these intersections. One is to signalize Campbellton Road @ Boat Rock Road so that the southbound queue can clear Boat Rock Road at regular intervals. The other is to move the New Hope Road approach to Boat Rock Road farther away from Campbellton Road so the two intersections have less interference with each other.



Architecture

Engineering

Construction

MEMORANDUM

Signal Warrant Analysis

A Traffic Signal Warrant Evaluation was conducted for the intersections of Campbellton Road @ Boat Rock Road and Boat Rock Road @ New Hope Road to determine if the installation of a traffic signal is warranted under the criteria presented in the *Manual of Uniform Traffic Control Devices* (MUTCD), published by the Federal Highway Administration. Two or more warrants are satisfied for the existing (2010), opening (2014) and design years (2034) for Campbellton Road @ Boat Rock Road. No signal warrant is satisfied for Boat Rock Road @ New Hope Road in any year. The 70% tables are allowed to be used, since the major street speed exceeds 40 MPH. The posted speed limit for Campbellton Road is 45 MPH. Table 2 summarizes the signal warrant analysis for Campbellton Road @ Boat Rock Road.

**Table 2 - Signal Warrant Analysis Summary (based on 70% tables)
Intersection of Campbellton Road at Boat Rock Road**

Warrant	Description	2010 Analysis Results	2014 Analysis Results	2034 Analysis Results
1	Eight-Hour Vehicular Volume	Not Satisfied	Not Satisfied	Satisfied
2	Four-Hour Vehicular Volume	Satisfied	Satisfied	Satisfied
3	Peak Hour	Satisfied	Satisfied	Satisfied
4	Pedestrian Volume	Not Applicable	Not Applicable	Not Applicable
5	School Crossing	Not Applicable	Not Applicable	Not Applicable
6	Coordinated Signal System	Not Applicable	Not Applicable	Not Applicable
7	Crash Experience	See Note	See Note	See Note
8	Roadway Network	Not Applicable	Not Applicable	Not Applicable
9	Intersection Near A Grade Crossing	Not Applicable	Not Applicable	Not Applicable

Note: Right-angle accidents are often susceptible to correction by a traffic signal. Table 1 indicates That warrant #7 may be satisfied in 2007 and 2008. However, police reports are needed to verify the details of the individual accidents before it can be determined if this warrant is satisfied.

Table 2 shows a minimum of two traffic signal warrants being satisfied for the existing year (2010) and proposed opening year (2014) for Campbellton Road @ Boat Rock Road. A minimum of three signal warrants are satisfied for the design year (2034). Only one warrant needs to be satisfied before the installation of a traffic signal can be considered. Signal Warrant analysis spreadsheets for Campbellton Road @ Boat Rock Road are included in Appendix B. The spreadsheets contain detailed information about each warrant, including approach volumes per hour.



Architecture

Engineering

Construction

MEMORANDUM

Level of Service Analysis - Alternatives 1 and 2

The original “Build” alternatives proposed the signalization of Campbellton Road @ Boat Rock Road, along with an eastbound left-turn lane along Campbellton Road. They relocated the New Hope Road approach to Boat Rock Road approximately 220 feet farther north, in order to separate the two intersections. Alternatives 1 and 2 differed at Boat Rock Road @ New Hope Road. Alternative 1 would have constructed Boat Rock Road @ Campbellton Road as a conventional intersection, either with side street stop control or as a multi-way stop. Alternative 2 would construct the intersection as a three-legged roundabout. Table 3 summarizes the LOS for both Alternatives 1 and 2 at Campbellton Road @ Boat Rock Road. Table 4 summarizes the LOS for Alternatives 1 and 2 at Boat Rock Road @ New Hope Road.

Table 3: - Level of Service Summary – Campbellton Rd @ Boat Rock Rd – Alternatives 1 and 2

Traffic Control	Year	Time Period	Level of Service	Intersection Delay (sec)
Signalized	2014	a.m. peak	B	14.4
Signalized	2034	a.m. peak	C	24.5
Signalized	2014	p.m. peak	B	16.7
Signalized	2034	p.m. peak	D	35.3

Table 4: - Level of Service Summary – Boat Rock Rd @ New Hope Rd – Alternatives 1 and 2

Traffic Control	Year	Time Period	Worst Approach (roundabout/ Side st. stop)	Level of Service	Approach Delay (roundabout/ s.s. stop) Intersection Delay (mult-way stop)
Alt 1 – Side Street Stop	2014	a.m. peak	WB	C	20.5
Alt 1 – 3-way Stop	2014	a.m. peak	-	B	10.18
Alt 2 - Roundabout	2014	a.m. peak	NB	A	6
Alt 1 – Side Street Stop	2034	a.m. peak	WB	F	226.8
Alt 1 – 3-way Stop	2034	a.m. peak	-	C	16.47
Alt 2 - Roundabout	2034	a.m. peak	NB	B	13
Alt 1 – Side Street Stop	2014	p.m. peak	WB	C	16.9
Alt 1 – 3-way Stop	2014	p.m. peak	-	B	10.38
Alt 2 - Roundabout	2014	p.m. peak	NB	A	5
Alt 1 – Side Street Stop	2014	p.m. peak	WB	F	114.5
Alt 1 – 3-way Stop	2014	p.m. peak	-	C	17.96
Alt 2 - Roundabout	2034	p.m. peak	WB	B	11



Architecture

Engineering

Construction

MEMORANDUM

As can be seen from Tables 3 and 4, the LOS and resulting delay at both intersections would improve substantially compared to the “No-Build” Alternative. The only scenario where level of service/delay issues would remain is for the p.m. peak for Alternative 1 on the New Hope Road approach assuming a side street stop.

Both Alternatives 1 and 2 would further separate the two intersections compared to existing conditions, and both intersections would operate better, compared to “No-Build”. However, conventional HCM level of service tools are not able to take into account the proximity of the two intersections and how each intersection affects the operation of the other. Even though 310 feet would be better separation than the current 90 feet, both intersections would remain close enough together where they could still interfere with each other.

VISSIM Queue Analysis – Alternatives 1 and 2

VISSIM simulation was used as a tool to help evaluate the operations of the adjacent intersections of Campbellton Road @ Boat Rock Road and Boat Rock Road @ Relocated New Hope Road as a system. Simulation was used for evaluation, since these two intersections are proposed to be located within 400 feet from each other. HCS will only evaluate queuing of a signalized intersection in isolation.

VISSIM Simulation had been run for the existing conditions (existing roadways and 2010 traffic). VISSIM was also run for the two alternatives at Boat Rock Road @ New Hope Road that were originally under active consideration. These included Alternative 1 (side street stop and 3-Way Stop) and Alternative 2 (roundabout) using design year traffic (2034). In the case of Alternative 1, the VISSIM simulation assumed a three-way stop for Boat Rock Road @ New Hope Road.

Animation files were derived from each simulation run and displayed at the initial Concept Team Meeting and at the second Public Information Open House. Qualitatively, the simulations for both “Build” Scenarios showed significant improvements in congestion and reduction in queuing compared to existing conditions. The animations also showed smoother operation for Alternative 2 versus Alternative 1, since the roundabout in Alternative 2 reduces delay by not forcing all traffic to stop.

The animation files display approximately 2 minutes of typical operation of each scenario run. That actual simulation that VISSIM evaluates lasts a full hour. Queuing analysis done by VISSIM considers the full hour of simulation time. For the purposes of this analysis, queue analysis was run at three critical locations for both alternatives in both the a.m. and p.m. peak hours. The four locations are listed below:



Architecture

Engineering

Construction

MEMORANDUM

- Southbound approach to Boat Rock Road @ Relocated New Hope Road
- Northbound approach to Boat Rock Road @ Relocated New Hope Road
- Southbound approach to Boat Rock Road @ Campbellton Road
- Westbound New Hope approach to Boat Rock Road

Table 5 (next page) summarizes both the average queue and maximum queue lengths for each scenario run. The underlined text signifies queues that could overlap into the adjacent intersection causing operational problems that would not be identified by the Level of Service analysis. There are several rows where the queue lengths are underlined, all being maximum (95th percentile) queue lengths. None of the average (50th percentile) queues would be long enough to reach the adjacent intersection.

One factor that was taken into account for each simulation run that affects queue lengths is the presence of the entrance to the CITGO station. This entrance is located approximately half way between Campbellton Road and Relocated New Hope Road and is currently full movement. The turning movement volumes using this driveway had been counted and factored into this analysis. As is the existing condition, this driveway was assumed to be full-movement in the VISSIM simulation.

The presence of occasional left-turning vehicles wanting to enter the CITGO station tends to affect some of the queue lengths, especially the maximum queue lengths in the northbound direction. This driveway could be closed to left-turn traffic if a raised median were constructed on this section of roadway. Northbound vehicles would have to access the CITGO station via the entrance along Campbellton Road, or use the roundabout at New Hope Road to change direction and access the CITGO station as a right-turn in the southbound direction.

Table 5 reveals that Alternative 2 (Roundabout) tends to have a substantially shorter queue length than Alternative 1 (3-way stop) for the southbound approach to the New Hope Road intersection during the a.m. peak hour. This makes sense since many vehicles don't have to stop when entering the roundabout, while all vehicles would have to stop when approaching the 3-way stop. This difference would result in a longer queue length for the 3-way stop. During the p.m. peak hour, the queues are predicted to be longer (especially for the average queue) for Alternative 2. This doesn't make intuitive sense, unless the queues from Campbellton @ Boat Rock are a contributing factor.



Architecture

Engineering

Construction

MEMORANDUM

Southbound traffic queuing through the roundabout results in operational issues with the roundabout itself within the peak hours when this condition would occur. A long southbound queue from Campbellton Road can extend beyond New Hope Road, not allowing westbound left-turns from New Hope Road anywhere to turn. It is likely that these vehicles would be stuck in the roundabout, forcing a northbound queue. An excessive queue in the northbound direction could spill into the signalized intersection of Campbellton Road @ Boat Rock Road affecting Campbellton Road traffic as well as the safe operation of the signalized intersection.

Table 5: - VISSIM Queue Analysis Summary

Alternative / Time Period	Location	Average Queue (ft)	Maximum Queue (ft)
1 – a.m. peak	SB Boat Rock @ New Hope	68	400
2 – a.m. peak	SB Boat Rock @ New Hope	6	161
1 – p.m. peak	SB Boat Rock @ New Hope	28	234
2 – p.m. peak	SB Boat Rock @ New Hope	567	742
1 – a.m. peak	NB Boat Rock @ New Hope	20	145
2 – a.m. peak	NB Boat Rock @ New Hope	8	236
1 – p.m. peak	NB Boat Rock @ New Hope	76	<u>464</u>
2 – p.m. peak	NB Boat Rock @ New Hope	6	253
1 – a.m. peak	SB Boat Rock @ Campbellton	47	<u>335</u>
2 – a.m. peak	SB Boat Rock @ Campbellton	62	<u>405</u>
1 – p.m. peak	SB Boat Rock @ Campbellton	268	<u>568</u>
2 – p.m. peak	SB Boat Rock @ Campbellton	112	<u>349</u>
1 – a.m. peak	WB New Hope @ Boat Rock	10	128
2 – a.m. peak	WB New Hope @ Boat Rock	3	116
1 – p.m. peak	WB New Hope @ Boat Rock	26	166
2 – p.m. peak	WB New Hope @ Boat Rock	37	296



Architecture

Engineering

Construction

MEMORANDUM

The same issue could occur if Boat Rock Road @ New Hope Road were a 3-way stop, but probably not as severe. For one, westbound vehicles on New Hope Road would be under stop sign control, and not encouraged to flow into the intersections if Boat Rock Road were backed up. However, some vehicles would likely still try to jump the stop sign and join the southbound queue, blocking northbound traffic through the intersection. Traffic control could be changed at the conventional intersection by removing the northbound stop sign, which would give northbound Boat Rock Road traffic the right-of-way through the intersection, reducing the likelihood of a northbound queue backing up into Campbellton Road.

Queue analysis was not specifically run for the “No-Build” Alternative. However, both intersections are located within 90 feet, and there is already severe queuing with existing traffic volumes. 24 years of additional traffic growth would make the already bad situation even worse. That is the primary reason why this project is being considered in the first place.

Moving New Hope Road 220 further away from Campbellton Road would improve the safety and operation of both intersections. However, 310 feet is still a fairly close distance between these two intersections, and by the design year, there is a good possibility that queuing caused by a signal at Campbellton Road @ Boat Rock Road would still impair the operation of Boat Rock Road @ New Hope Road.

Moving New Hope Road even farther north would allow more queuing room on Boat Rock Campbellton Road but greatly increase the cost of this project. Lining relocated New Hope Road up with Stonecastle Pass Way would result in a distance of 800 feet between the two intersections, but require the total acquisition of four residential parcels with existing large homes and construction of a much longer section of relocated New Hope Road.

Due to the issues discussed in this section, it was determined that additional alternatives should be considered in meeting the purpose and need for this project.

Level of Service Analysis - Alternative 4

This alternative would create a single signalized intersection at the existing location of Campbellton Road @ Boat Rock Road. This alternative would create an intersection shaped like a “K” that would leave the Campbellton Road and Boat Rock Road approaches at their current locations while relocating the New Hope Road approach to intersect Campbellton Road adjacent to the existing Boat Rock Road approach.

Separate left-turn lanes for Boat Rock Road and New Hope Road would need to be designated and properly signed and marked on the eastbound approach along Campbellton Road. The geometry of this configuration would not allow



Architecture

Engineering

Construction

MEMORANDUM

direct turns between Boat Rock Road and New Hope Road. A separate connector road would be required to accommodate those movements. Finally a signal with a minimum of four phases would need to be provided at this intersection. A conventional three-legged signal for Campbellton Road @ Boat Rock Road could operate with three phases.

Level of service analysis for this intersection configuration was run for the design year of 2034 using Synchro. Table 6 summarizes the results of this analysis. As can be seen, the overall intersection would operate at level of service “E” for both time periods, with at least one movement at level of service “F”.

Table 6: - Level of Service Summary – Campbellton Rd @Boat Rock Rd / New Hope Rd – Alternative 4

Traffic Control	Year	Time Period	Overall LOS	LOS / Worst Approach	Intersection Delay / Worst Approach Delay (sec)
Alt 4 – Single Signalized Intersection	2034	a.m. peak	E	F / WB TH	66.8 / 156.2
Alt 4 – Single Signalized Intersection	2034	p.m. peak	E	F / EB LT to Boat Rock	74.3 / 131.0

One of the factors contributing to the poor operation of this alternative is the fact that Campbellton Road is currently a two-lane facility, and there is no currently programmed project to widen it to a four-lane facility. Adding a traffic signal with this many phases would reduce the available green time for through traffic on Campbellton Road, compared to other alternatives that would signalize this intersection. The peak hour through volumes along Campbellton Road are high enough that the introduction of the extra signal phase for the “K-intersection” becomes a critical factor in breaking down this intersection.

If Campbellton Road were a four-lane facility, this would more likely be a more viable alternative than it is under the existing circumstances. Appendix C contains the Synchro analysis worksheets for this alternative.

Level of Service Analysis - Alternative 5 (Preferred Alternative)

Alternative 5 consolidates all four approaches to the existing two intersections into a single four-legged intersection, located immediately east of the existing Campbellton Road @ Boat Rock Road intersection. The orientation of this intersection would be NE-NW-SE-SW, being that this orientation best fits the horizontal alignment of the approach roadways.



Architecture

Engineering

Construction

MEMORANDUM

The southwest approach would connect to the existing Campbellton Road west approach, the southeast approach to the existing Campbellton east approach, the northeast approach to the existing New Hope east approach, and the northwest approach to the existing Boat Rock north approach.

Since the heaviest traffic movements through this intersection would be the SE-SW movement (left-turn through intersection) and its inverse, a roundabout would be the optimum form of traffic control for this intersection. If this intersection were signalized, the left-turn storage requirement for westbound Campbellton Road traffic would be excessive.

Various lane configurations were studied for this alternative. It was found that a single-lane roundabout was inadequate to accommodate the Campbellton Road through volumes. It was also found that a dual-lane roundabout is not necessary to accommodate the Boat Rock Road and New Hope Road approaches. In order to determine the optimum lane configuration and overall footprint for this roundabout concept, Kittelson & Associates was hired to prepare an Operational Evaluation.

The Kittelson evaluation performed level of service analysis for various lane configuration alternatives, and recommends a partial multi-lane roundabout. It recommends dual lanes for Campbellton Road traffic through the roundabout, and single lanes for other movements. For the design year, it also recommends a second southbound approach lane for Boat Rock Road. It also includes discussion of an optional bypass lane for eastbound Campbellton Road traffic that could be studied during the preliminary design phase of this project.

Analysis was performed using both NCHRP-572 methodology and SIDRA analysis software. The complete analyses using both methodologies and all lane configuration alternatives are included in the Kittelson Report. Table 8 summarizes the overall SIDRA intersection level of service results for Alternative 5.

Table 7: SIDRA Alternative 5 Level of Service Summary–Campbellton Rd @ Boat Rock Rd/New Hope Rd

Traffic Control	Year	Time Period	Level of Service	Average Delay (sec)
Roundabout	2014	a.m. peak	B	13.7
Roundabout	2034	a.m. peak	C*	12.3*
Roundabout	2014	p.m. peak	B	10.7
Roundabout	2034	p.m. peak	B	13.2

* Level of service is better for 2034 due to addition of second approach lane for Boat Rock Rd that was not included in 2014 approach.



Architecture

Engineering

Construction

MEMORANDUM

This alternative has the efficiency of meeting the purpose and need for this project with a single intersection and without signalization. It also results in acceptable level of service for the design year, without the complications of queuing affecting the adjacent intersection. For these reasons, Alternative 5 was selected as the preferred alternative for this project.

List of Appendices

Appendix A – “No-Build” Level of Service Printouts

Appendix B – Signal Warrant Analysis Spreadsheets

Appendix C – Alternative 4 Synchro Traffic Analysis Worksheets

Appendix A:

“No-Build” Level of Service Printouts

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd			
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA			
Date Performed	1/15/2010			Analysis Year	2010			
Analysis Time Period	a.m. peak							
Project Description <i>Exist. Volumes, Exist Lane Config.</i>								
East/West Street: <i>Campbellton Rd</i>				North/South Street: <i>Boat Rock Rd</i>				
Intersection Orientation: <i>East-West</i>				Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	257	468			247	133		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	257	468	0	0	247	133		
Percent Heavy Vehicles	4	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0				0	
Lanes	0	1	0	0	1	1		
Configuration	LT				T	R		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				118		234		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	0	0	0	118	0	234		
Percent Heavy Vehicles	0	0	0	4	0	4		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	1	0	1		
Configuration				L		R		
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (veh/h)	257					118		234
C (m) (veh/h)	1168					152		787
v/c	0.22					0.78		0.30
95% queue length	0.84					4.86		1.25
Control Delay (s/veh)	8.9					82.3		11.5
LOS	A					F		B
Approach Delay (s/veh)	--	--						35.2
Approach LOS	--	--						E

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2010		
Analysis Time Period	a.m. peak						
Project Description <i>Exist. Volumes, Exist Lane Config.</i>							
East/West Street: <i>New Hope</i>				North/South Street: <i>Boat Rock Rd</i>			
Intersection Orientation: <i>North-South</i>				Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		186	194	83	228		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	186	194	83	228	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		0
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				124	0	21	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	124	0	21	
Percent Heavy Vehicles	4	0	0	4	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	1		0
Configuration					LTR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LTR			
v (veh/h)		83		145			
C (m) (veh/h)		1168		416			
v/c		0.07		0.35			
95% queue length		0.23		1.54			
Control Delay (s/veh)		8.3		18.2			
LOS		A		C			
Approach Delay (s/veh)	--	--	18.2				
Approach LOS	--	--	C				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2014		
Analysis Time Period	a.m. peak						
Project Description 2014 Volumes, Exist Lane Config., NB Scenario							
East/West Street: Campbellton Rd				North/South Street: Boat Rock Rd			
Intersection Orientation: East-West				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	289	527			278	138	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	289	527	0	0	278	138	
Percent Heavy Vehicles	4	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	1	
Configuration	LT				T	R	
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				133		263	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	133	0	263	
Percent Heavy Vehicles	0	0	0	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	1	0	1	
Configuration				L		R	
Delay, Queue Length, and Level of Service							
Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT					L	R
v (veh/h)	289					133	263
C (m) (veh/h)	1132					117	756
v/c	0.26					1.14	0.35
95% queue length	1.02					8.13	1.56
Control Delay (s/veh)	9.3					195.7	12.3
LOS	A					F	B
Approach Delay (s/veh)	--	--				73.9	
Approach LOS	--	--				F	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2014		
Analysis Time Period	a.m. peak						
Project Description							
East/West Street: <i>New Hope</i>				North/South Street: <i>Boat Rock Rd</i>			
Intersection Orientation: <i>North-South</i>				Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		209	218	94	256		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	209	218	94	256	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		0
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				140	0	24	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	140	0	24	
Percent Heavy Vehicles	4	0	0	4	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	1	0	
Configuration					LTR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LTR			
v (veh/h)		94		164			
C (m) (veh/h)		1122		368			
v/c		0.08		0.45			
95% queue length		0.27		2.22			
Control Delay (s/veh)		8.5		22.4			
LOS		A		C			
Approach Delay (s/veh)	--	--	22.4				
Approach LOS	--	--	C				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2034		
Analysis Time Period	a.m. peak						
Project Description 2034 Volumes, Exist Lane Config. - NB Scenario							
East/West Street: Campbellton Rd				North/South Street: Boat Rock Rd			
Intersection Orientation: East-West				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	474	864			456	226	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	474	864	0	0	456	226	
Percent Heavy Vehicles	4	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		1
Configuration	LT				T		R
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				218		431	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	218	0	431	
Percent Heavy Vehicles	0	0	0	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	1	0		1
Configuration				L			R
Delay, Queue Length, and Level of Service							
Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT					L	R
v (veh/h)	474					218	431
C (m) (veh/h)	901					21	600
v/c	0.53					10.38	0.72
95% queue length	3.14					27.59	5.97
Control Delay (s/veh)	13.3					4580	24.8
LOS	B					F	C
Approach Delay (s/veh)	--	--				1555	
Approach LOS	--	--				F	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2034		
Analysis Time Period	a.m. peak						
Project Description 2034 Volumes, Exist Lane Config., NB Scenario							
East/West Street: New Hope				North/South Street: Boat Rock Rd			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		343	357	154	419		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	343	357	154	419	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		0
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				229	0	39	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	229	0	39	
Percent Heavy Vehicles	4	0	0	4	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	1	0	
Configuration					LTR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LTR			
v (veh/h)		154		268			
C (m) (veh/h)		888		174			
v/c		0.17		1.54			
95% queue length		0.63		17.49			
Control Delay (s/veh)		9.9		317.9			
LOS		A		F			
Approach Delay (s/veh)	--	--	317.9				
Approach LOS	--	--	F				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2010		
Analysis Time Period	a.m. peak						
Project Description <i>Exist. Volumes, Exist Lane Config.</i>							
East/West Street: <i>Campbellton Rd</i>				North/South Street: <i>Boat Rock Rd</i>			
Intersection Orientation: <i>East-West</i>				Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	150	252			397	211	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	150	252	0	0	397	211	
Percent Heavy Vehicles	4	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	1	
Configuration	LT				T	R	
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				169		149	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	169	0	149	
Percent Heavy Vehicles	0	0	0	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	1	0	1	
Configuration				L		R	
Delay, Queue Length, and Level of Service							
Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT					L	R
v (veh/h)	150					169	149
C (m) (veh/h)	961					242	648
v/c	0.16					0.70	0.23
95% queue length	0.55					4.61	0.88
Control Delay (s/veh)	9.4					48.3	12.2
LOS	A					E	B
Approach Delay (s/veh)	--	--				31.4	
Approach LOS	--	--				D	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2010		
Analysis Time Period							
Project Description <i>Exist. Volumes, Exist Lane Config.</i>							
East/West Street: <i>New Hope</i>				North/South Street: <i>Boat Rock Rd</i>			
Intersection Orientation: <i>North-South</i>				Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		250	111	32	188		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	250	111	32	188	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		0
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				130	0	63	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	130	0	63	
Percent Heavy Vehicles	4	0	0	4	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	1	0	
Configuration					LTR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LTR			
v (veh/h)		32		193			
C (m) (veh/h)		1187		537			
v/c		0.03		0.36			
95% queue length		0.08		1.62			
Control Delay (s/veh)		8.1		15.4			
LOS		A		C			
Approach Delay (s/veh)	--	--	15.4				
Approach LOS	--	--	C				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2014		
Analysis Time Period	p.m. peak						
Project Description 2014 Volumes, Exist Lane Config., NB Scenario							
East/West Street: Campbellton Rd				North/South Street: Boat Rock Rd			
Intersection Orientation: East-West				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	169	284			447	237	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	169	284	0	0	447	237	
Percent Heavy Vehicles	4	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	1	
Configuration	LT				T	R	
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				190		168	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	190	0	168	
Percent Heavy Vehicles	0	0	0	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	1	0	1	
Configuration				L		R	
Delay, Queue Length, and Level of Service							
Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT					L	R
v (veh/h)	169					190	168
C (m) (veh/h)	900					197	607
v/c	0.19					0.96	0.28
95% queue length	0.69					8.01	1.13
Control Delay (s/veh)	9.9					104.7	13.2
LOS	A					F	B
Approach Delay (s/veh)	--	--				61.8	
Approach LOS	--	--				F	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year			
Analysis Time Period	p.m. peak						
Project Description							
East/West Street: <i>New Hope</i>				North/South Street: <i>Boat Rock Rd</i>			
Intersection Orientation: <i>North-South</i>				Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		281	125	36	211		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	281	125	36	211	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		0
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				146	0	71	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	146	0	71	
Percent Heavy Vehicles	4	0	0	4	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	1	0	
Configuration					LTR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LTR			
v (veh/h)		36		217			
C (m) (veh/h)		1142		493			
v/c		0.03		0.44			
95% queue length		0.10		2.22			
Control Delay (s/veh)		8.3		17.9			
LOS		A		C			
Approach Delay (s/veh)	--	--	17.9				
Approach LOS	--	--	C				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2034		
Analysis Time Period	p.m. peak						
Project Description 2034 Volumes, Exist Lane Config. - NB Scenario							
East/West Street: Campbellton Rd				North/South Street: Boat Rock Rd			
Intersection Orientation: East-West				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	277	465			732	388	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	277	465	0	0	732	388	
Percent Heavy Vehicles	4	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		1
Configuration	LT				T		R
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				311		275	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	311	0	275	
Percent Heavy Vehicles	0	0	0	4	0	4	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	1	0		1
Configuration				L			R
Delay, Queue Length, and Level of Service							
Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT					L	R
v (veh/h)	277					311	275
C (m) (veh/h)	616					51	418
v/c	0.45					6.10	0.66
95% queue length	2.32					35.76	4.59
Control Delay (s/veh)	15.5					2451	28.7
LOS	C					F	D
Approach Delay (s/veh)	--	--				1314	
Approach LOS	--	--				F	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JWD			Intersection	Campbellton Rd @ Boat Rock Rd		
Agency/Co.	Qk4			Jurisdiction	Fulton Co., GA		
Date Performed	1/15/2010			Analysis Year	2010		
Analysis Time Period	p.m. peak						
Project Description 2034 Volumes, Exist Lane Config., NB Scenario							
East/West Street: New Hope				North/South Street: Boat Rock Rd			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		461	205	59	346		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	461	205	59	346	0	
Percent Heavy Vehicles	0	--	--	4	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1		0
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				239	0	117	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	239	0	117	
Percent Heavy Vehicles	4	0	0	4	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	1		0
Configuration					LTR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LTR			
v (veh/h)		59		356			
C (m) (veh/h)		914		293			
v/c		0.06		1.22			
95% queue length		0.21		16.14			
Control Delay (s/veh)		9.2		160.8			
LOS		A		F			
Approach Delay (s/veh)	--	--	160.8				
Approach LOS	--	--	F				

Appendix B:

**Signal Warrant Analysis Spreadsheets –
Campbellton Road @ Boat Rock Road**

Campbellton Road @ Boat Rock Road - Signal Warrant Worksheet - 2010 Volumes - 70% Tables

Time Period		Campbellton Road				E-W approach	Boat Rock Rd	SB approach	Warrant 1A-70%		Warrant 1B - 70%		Warrant 2-70%		Warrant 3-70%		
Beginning	Ending	# Lanes	# Lanes	33% Ded.	WB Thru	Volumes Used For Analysis	Orig Volumes Southbound	40% RT Deduction	Threshold 350 EB & WB	Threshold 105 SB	Threshold 525 EB & WB	Threshold 53 SB	Threshold varies EB & WB	Threshold 60 min SB	Threshold varies EB & WB	Threshold 75 min SB	
		1 Eastbound	1 Westbound														
12:00 AM	1:00 AM	66	73	24	49	115	27	11	16								
1:00 AM	2:00 AM	39	28	9	19	58	12	5	7								
2:00 AM	3:00 AM	21	34	11	23	44	7	3	4								
3:00 AM	4:00 AM	13	18	6	12	25	14	6	8								
4:00 AM	5:00 AM	16	32	11	21	37	12	5	7								
5:00 AM	6:00 AM	26	76	25	51	77	34	14	20								
6:00 AM	7:00 AM	72	145	48	97	169	113	45	68			68		68			
7:00 AM	8:00 AM	369	332	110	222	591	291	116	175	591	175	591	175	591	175	175	
8:00 AM	9:00 AM	718	299	99	200	918	178	71	107	918	107	918	107	918	107	107	
9:00 AM	10:00 AM	486	176	58	118	604	98	39	59	604		604	59				
10:00 AM	11:00 AM	260	204	67	137	397	104	42	62	397			61	61			
11:00 AM	12:00 PM	185	212	70	142	327	76	30	46								
12:00 PM	1:00 PM	187	223	74	149	336	125	50	75				75	75			
1:00 PM	2:00 PM	208	289	95	194	402	111	44	67	402			67	67			
2:00 PM	3:00 PM	247	342	113	229	476	168	67	101	476			101	101		101	
3:00 PM	4:00 PM	363	514	170	344	707	154	62	92	707		707	92	707	92	92	
4:00 PM	5:00 PM	395	609	201	408	803	199	80	119	803	119	803	119	803	119	119	
5:00 PM	6:00 PM	389	528	174	354	743	160	64	96	743		743	96	743	96	96	
6:00 PM	7:00 PM	288	391	129	262	550	118	47	71	550		550	71		71		
7:00 PM	8:00 PM	223	238	79	159	382	87	35	52	382							
8:00 PM	9:00 PM	139	186	61	125	264	59	24	35								
9:00 PM	10:00 PM	92	108	36	72	164	33	13	20								
10:00 PM	11:00 PM	65	99	33	66	131	35	14	21								
11:00 PM	12:00 AM	56	60	20	40	96	40	16	24								
		4923	5216	1721	3495	8418	2255		1353	3 hours not met	3 hours not met	7 hours not met	7 hours not met	5 hours met	5 hours met	3 hours met	3 hours met
		Total	Total			Total	Total		Total								

Assumptions:

- Westbound approach volume deduction of 33% to remove RT lanes from analysis
- South approach volume deduction of 40% to remove RT lanes from analysis
- Major street speed exceeds 40 MPH, so 70% tables applicable

Warrant Summary:

- Warrant 1: Not Satisfied
- Warrant 2: Satisfied
- Warrant 3: Satisfied
- Warrants 4 - 9: Not Applicable

Campbellton Road @ Boat Rock Road - Signal Warrant Worksheet - 2034 Volumes, 70% Tables

Time Period		# Thru Lns	# Thru Lns	E-W approach		Boat Rock Rd	Boat Rock Rd	SB approach		Warrant 1A-100%		Warrant 1B - 100%		Warrant 2-100%		Warrant 3-100%		
Beginning	Ending	1	1	33% Ded.		1	1	40% RT	Used For	Threshold	Threshold	Threshold	Threshold	Threshold	Threshold	Threshold	Threshold	
		EB	WB	WB RT	WB Thru	Orig Volumes	Orig Volumes	Deduction	Analysis	350	105	525	53	varies	60 min	varies	75 min	
						Southbound	SB			EB & WB	SB	EB & WB	SB	EB & WB	SB	EB & WB	SB	
12:00 AM	1:00 AM	108	120	39	80	188	27	18	27									
1:00 AM	2:00 AM	64	46	15	31	95	12	8	12									
2:00 AM	3:00 AM	34	56	18	37	72	7	5	7									
3:00 AM	4:00 AM	21	29	10	20	41	14	9	14									
4:00 AM	5:00 AM	26	52	17	35	61	12	8	12									
5:00 AM	6:00 AM	43	125	41	83	126	34	22	33									
6:00 AM	7:00 AM	118	238	78	159	277	113	74	111				111		111		111	
7:00 AM	8:00 AM	605	544	180	365	969	291	191	286	969	286	969	286	969	286	969	286	
8:00 AM	9:00 AM	1177	490	162	328	1505	178	117	175	1505	175	1505	175	1505	175	1505	175	
9:00 AM	10:00 AM	796	288	95	193	990	98	64	96	990		990	96	990	96	990	96	
10:00 AM	11:00 AM	426	334	110	224	650	104	68	102	650		650	102	650	102	650	102	
11:00 AM	12:00 PM	303	347	115	233	536	76	50	75	536		536	75		75		75	
12:00 PM	1:00 PM	306	365	121	245	551	125	82	123	551	123	551	123	551	123	551	123	
1:00 PM	2:00 PM	341	474	156	317	658	111	73	109	658	109	658	109	658	109	658	109	
2:00 PM	3:00 PM	405	560	185	375	780	168	110	165	780	165	780	165	780	165	780	165	
3:00 PM	4:00 PM	595	842	278	564	1159	154	101	151	1159	151	1159	151	1159	151	1159	151	
4:00 PM	5:00 PM	647	998	329	669	1316	199	130	196	1316	196	1316	196	1316	196	1316	196	
5:00 PM	6:00 PM	637	865	286	580	1217	160	105	157	1217	157	1217	157	1217	157	1217	157	
6:00 PM	7:00 PM	472	641	211	429	901	118	77	116	901	116	901	116	901	116	901	116	
7:00 PM	8:00 PM	365	390	129	261	627	87	57	86	627		627	86	627	86		86	
8:00 PM	9:00 PM	228	305	101	204	432	59	39	58	432			58					
9:00 PM	10:00 PM	151	177	58	119	269	33	22	32									
10:00 PM	11:00 PM	107	162	54	109	215	35	23	34									
11:00 PM	12:00 AM	92	98	32	66	158	40	26	39									
				2821	5727	13794	2255			2217	9 hours	9 hours	13 hours	13 hours	12 hours	12 hours	11 hours	11 hours
						Total	Total			Total	met	met	met	met	met	met	met	met

Assumptions:

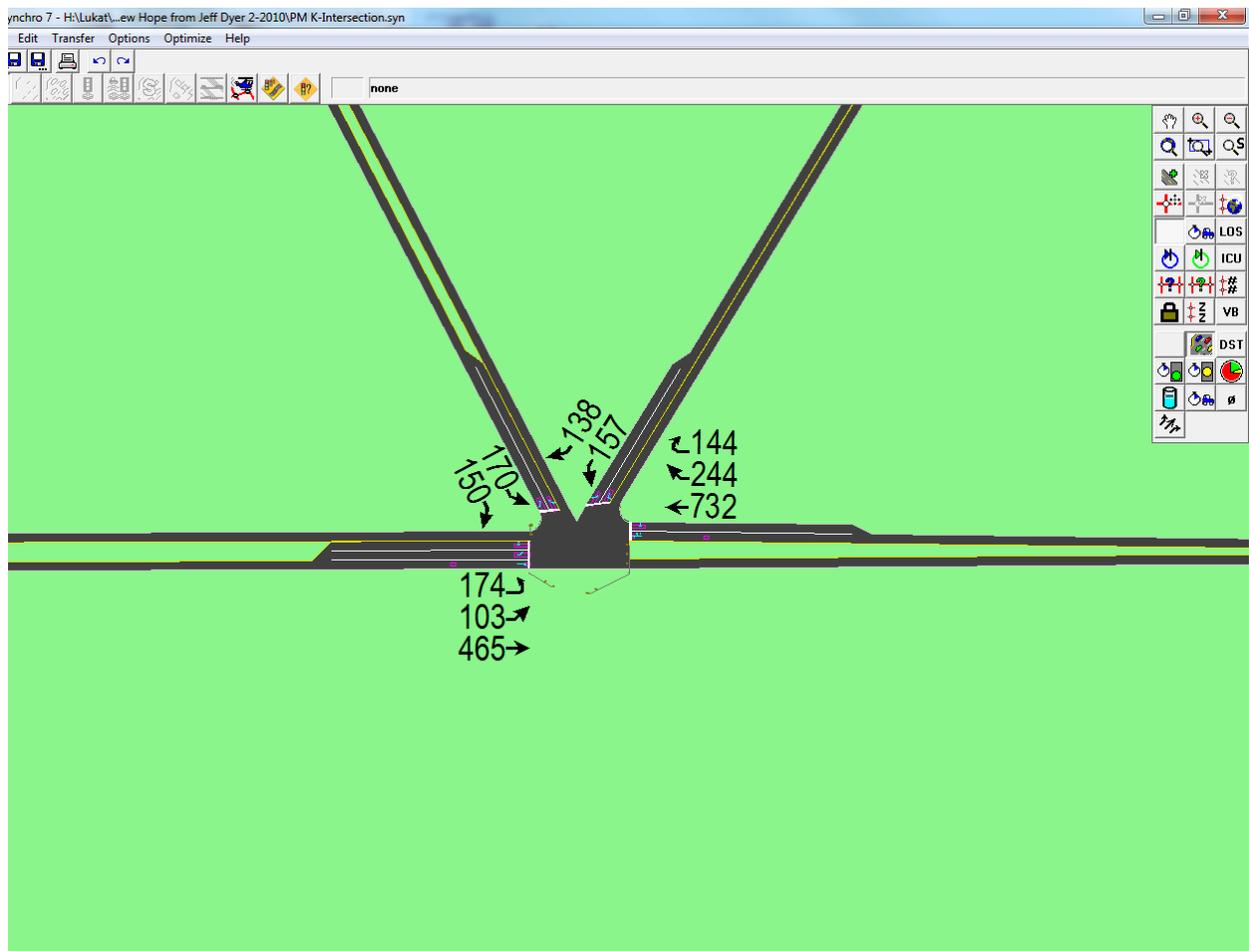
- Westbound approach volume deduction of 33% to remove RT lanes from analysis
- South approach volume deduction of 40% to remove RT lanes from analysis
- Major street speed exceeds 40 MPH, so 70% tables applicable

Warrant Summary:

- Warrant 1: Satisfied
- Warrant 2: Satisfied
- Warrant 3: Satisfied
- Warrants 4 - 9: Not Applicable

Appendix C:

Alternate 4 Synchro Traffic Analysis Worksheets



Synchro 7 - H:\Lukat...ew Hope from Jeff Dyer 2-2010\PM K-Intersection.syn

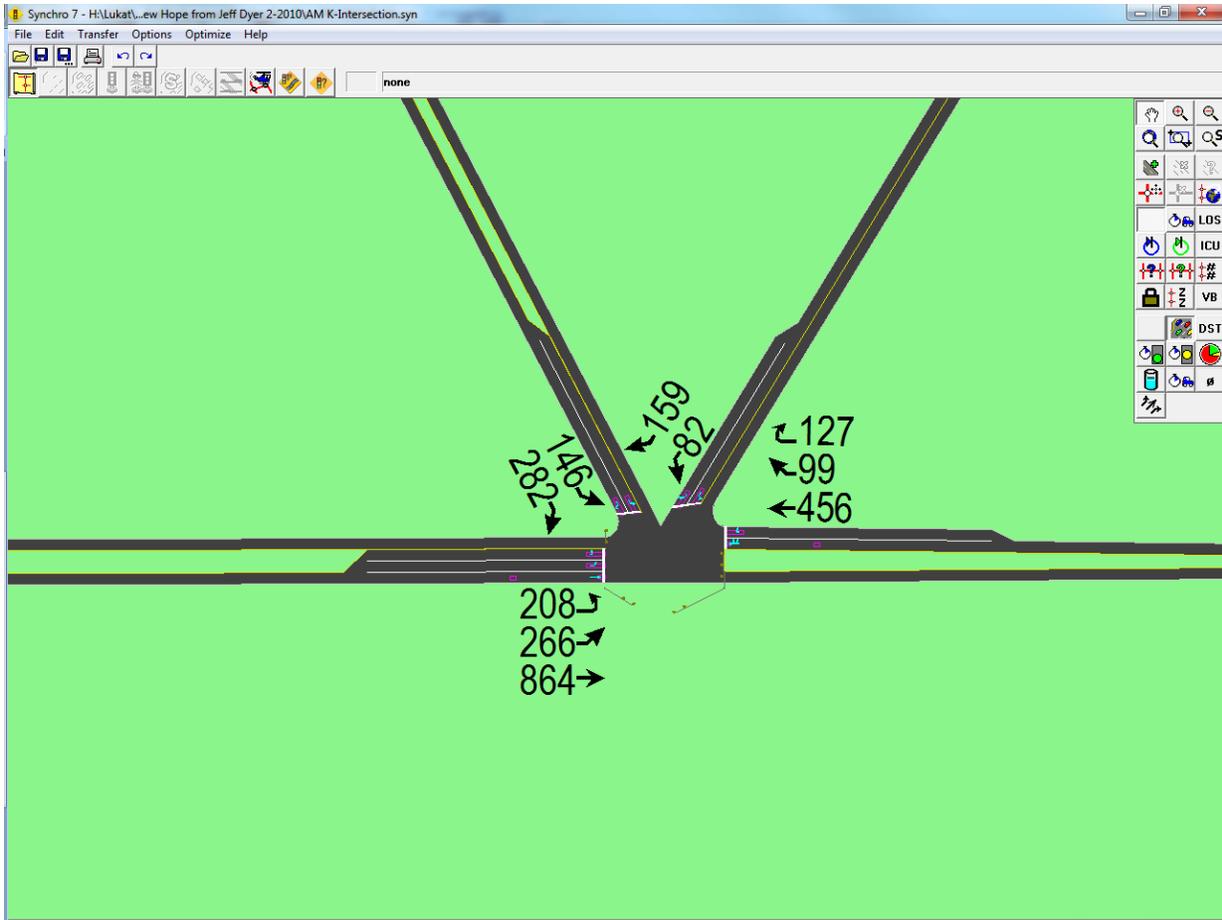
File Edit Transfer Options Optimize Help

4 &

NODE SETTINGS		TIMING SETTINGS													
		EBL2	EBL	EBT	WBT	WBR	WBR2	SBL2	SBL	SBR	SWL	SWR	SWR2	PED	HOLD
Node #	4	Lanes and Sharing (HRL)													
Zone		Traffic Volume (vph)													
X East (ft)	10590	174	103	465	732	244	144	0	170	150	157	138	0		
Y North (ft)	10610	Turn Type													
Z Elevation (ft)	0	Prot	Prot				Prot			custom			Perm		
Description		Protected Phases													
Control Type	Pretimed	5	5	2	6		6				4				
Cycle Length (s)	150.0	Permitted Phases													
Lock Timings:	<input type="checkbox"/>								3	3			4	4	
Optimize Cycle Length:	Optimize	Detector Phases													
Optimize Splits:	Optimize	5	5	2	6		6		3	3	4	4			
Actuated Cycle(s):	150.0	Switch Phase													
Natural Cycle(s):	150.0	0	0	0	0		0		0	0	0	0			
Max v/c Ratio:	1.10	Leading Detector (ft)													
Intersection Delay (s):	74.3	20	20	100	100		20		20	20	20	20			
Intersection LOS:	E	Trailing Detector (ft)													
ICU:	0.97	0	0	0	0		0		0	0	0	0			
ICU LOS:	F	Minimum Initial (s)													
Offset (s):	0.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0			
Referenced to:	Begin of Green	Minimum Split (s)													
Reference Phase:	2+6 - EBT WBT	20.0	20.0	20.0	20.0		20.0		20.0	20.0	20.0	20.0			
Master Intersection:	<input type="checkbox"/>	Total Split (s)													
Yield Point:	Single	20.0	20.0	110.0	90.0		90.0		20.0	20.0	20.0	20.0			
		Yellow Time (s)													
		3.5	3.5	3.5	3.5		3.5		3.5	3.5	3.5	3.5			
		All-Red Time (s)													
		0.5	0.5	0.5	0.5		0.5		0.5	0.5	0.5	0.5			
		Lost Time Adjust (s)													
		0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0			
		Lagging Phase?													
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
		Allow Lead/Lag Optimize?													
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
		Recall Mode													
		Max	Max	Max	Max		Max		Max	Max	Max	Max			
		Actuated Effct. Green (s)													
		16.0	16.0	106.0	86.0		86.0		16.0	16.0	16.0	16.0			
		Actuated g/C Ratio													
		0.11	0.11	0.71	0.57		0.57		0.11	0.11	0.11	0.11			
		Volume to Capacity Ratio													
		1.00	0.59	0.38	1.10		0.16		0.98	0.52	0.90	0.89			
		Control Delay (s)													
		131.0	77.6	9.9	92.7		6.1		125.7	14.7	109.9	110.0			
		Queue Delay (s)													
		0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0			
		Total Delay (s)													
		131.0	77.6	9.9	92.7		6.1		125.7	14.7	109.9	110.0			
		Level of Service													
		F	E	A	F		A		F	B	F	F			
		Approach Delay (s)													
				47.7	82.7				73.7		109.9				
		Approach LOS													
				D	F				E		F				
		Queue Length 50th (ft)													
		~188	106	183	~1260		22		184	0	168	147			
		Queue Length 95th (ft)													
		#396	175	244	#1542		56		#348	72	#312	#283			

→ e2 110 s ← e3 20 s ← e4 20 s

← e5 20 s ← e6 90 s



Synchro 7 - H:\Lukat...ew Hope from Jeff Dyer 2-2010\AM K-Intersection.syn

File Edit Transfer Options Optimize Help

4

NODE SETTINGS		TIMING SETTINGS													
Node #	4	EBL2	EBL	EBT	WBT	WBR	WBR2	SBL2	SBL	SBR	SWL	SWR	SWR2	PED	HOLD
Zone:		Lanes and Shading (BRL)													
X East (ft):	10530	Traffic Volume (vph)													
Y North (ft):	10610	Prot													
Z Elevation (ft):	0	Turn Type													
Description:		Protected Phases													
Control Type:	Prelimed	Permitted Phases													
Cycle Length (s):	90.0	Detector Phases													
Lock Timings:	<input type="checkbox"/>	Switch Phase													
Optimize Cycle Length:	Optimize	Leading Detector (ft)													
Optimize Splits:	Optimize	Trailing Detector (ft)													
Actuated Cycle(s):	90.0	Minimum Initial (s)													
Natural Cycle(s):	90.0	Minimum Split (s)													
Max v/c Ratio:	1.24	Total Split (s)													
Intersection Delay (s):	66.8	Yellow Time (s)													
Intersection LOS:	E	All-Red Time (s)													
ICU:	0.73	Lost Time Adjust (s)													
ICU LOS:	D	Lagging Phase?													
Offset (s):	0.0	Allow Lead/Lag Optimize?													
Referenced to:	Begin of Green	Recall Mode													
Reference Phase:	2+6 - EBT WBT	Actuated Effct. Green (s)													
Yield Point:	Single	Actuated g/C Ratio													
		Volume to Capacity Ratio													
		Control Delay (s)													
		Queue Delay (s)													
		Total Delay (s)													
		Level of Service													
		Approach Delay (s)													
		Approach LOS													
		Queue Length 50th (ft)													
		Queue Length 95th (ft)													

→ e2 → e3 → e4

← e5 ← e6

