ORIGINAL TO GENERAL FILES

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

OFFICE OF DESIGN POLICY & SUPPORT
INTERDEPARTMENTAL CORRESPONDENCE

FILE P.I. #0007533
CSHPP-007-00(533)
GDOT District 7 - Metro Atlanta
Fulton County
CR 1374/Butner Road @ CR 1386/Stonewall Tell Road

OFFICE Design Policy & Support

DATE July 12, 2012

FROM for Brent Story, State Design Policy Engineer

TO SEE DISTRIBUTION

SUBJECT **APPROVED CONCEPT REPORT**

Attached is the approved Concept Report for the above subject project.

Attachment

DISTRIBUTION:

Bobby Hilliard, Program Control Administrator
Genetha Rice-Singleton, State Program Delivery Engineer
Cindy VanDyke, State Transportation Planning Administrator
Angela Robinson, Financial Management Administrator
Glenn Bowman, State Environmental Administrator
Kathy Zahul, State Traffic Engineer
Georgene Geary, State Materials & Research Engineer
Lisa Myers, State Project Review Engineer
Jeff Baker, State Utilities Engineer
Ken Thompson, Statewide Location Bureau Chief
Michael Henry, Systems & Classification Branch Chief
Rachel Brown, District Engineer
Scott Lee, District Preconstruction Engineer
Jonathan Walker, District Utilities Engineer
Merishia Robinson, Project Manager
BOARD MEMBER - 5th Congressional District
BOARD MEMBER - 13th Congressional District

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

PROJECT CONCEPT REPORT

Project Number: CSHPP-0007-00(533)
County: Fulton
P. I. Number: 0007533
Federal and State Route Number: N/A
County Route Number: CR 1374/CR1386

Butner Road @ Stonewall Tell Road Intersection Improvement

Submitted for approval:

DATE 11/14/11 — Bryan P. Lindsey, T.Y. Lin International

DATE 11/14/11 — Richard Coates, Fulton County, Asst. Dir. Of Public Works

DATE 11/21/11 — Meristha Robinson, EIT
Project Manager

DATE 11/22/2011 — Bobby Hilliard
Office Head

Recommendation for approval:

DATE 5/15/12 — BRYANT POOLE *T.N.
District Engineer

DATE 5/11/12 — GLENN BOWMAN *T.N.
State Environmental Administrator

DATE 6/7/12 — KATHY ZAHUL *T.N.
State Traffic Engineer

DATE 5/8/12 — LISA MYERS *T.N.
Project Review Engineer

DATE _____ — State Utilities Engineer

DATE _____ — Program Control Administrator

DATE _____ — State Transportation Financial Management Administrator

The concept as presented herein and submitted for approval is consistent with that which is included in the Regional Transportation Plan (RTP) and/or the State Transportation Improvement Program (STIP).

DATE 5/8/12 — CYNTHIA L. VAN DYKE *T.N.
State Transportation Planning Administrator

* RECOMMENDATION ON FILE.

PROJECT LOCATION MAP:

Project Justification Statement: Fulton County has identified the intersection of Butner Road and Stonewall Tell Road as a high priority project to mitigate congestion and operations by improving capacity, traffic flow and operations through the reconfiguration of the this intersection. The project originated from Fulton County and their need to improve the traffic flow through and around this intersection. The purpose of this project is to reduce the number and severity of accidents while improving traffic flow and overall operations of the intersection. This project is included as part of the Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP) 2012-2017 developed by the Atlanta Regional Commission (Project FS-208).

Ensuring more efficient traffic operation along both Butner Road and Stonewall Tell Road is essential due to increase in traffic volumes. The Existing Level of Service is presently a LOS of F in both the south and east approaches at the current four-way stop. The proposed LOS for the intersections would be improved to a LOS of A in all directions. The accident rate at the existing intersection of Stonewall Tell and Butner Road is .38 per million vehicles entering from 2006-2008. The increase in traffic volumes without the proposed improvements has the potential to result in an increase in accidents and/or injuries at the intersection.

The crash history and accident data for the study intersection for years 2007, 2008, 2009 and 2010 was obtained from Georgia Department of Transportation and is summarized in the table below. The study intersection had 14 accidents from 2007 to 2010 with 36% being angle collisions and 29% being not a collision with a motor vehicle. These types of collisions are 65% of total collisions. The following table summarizes the accident types at the study intersection. The accident rate at the existing intersection of Stonewall Tell and Butner Rd is .38 per million vehicles entering from 2006-2008.

Crash History Summary

	Crashes by Collision Type						Totals	
Year	Rear-	Angle	Head-	Sideswipe	Other Non-	Crashes Injury Fatal		
	End		On		Collision			
2007	0	0	0	0	2	2	0	0
2008	1	1	0	0	2	4	2	0
2009	0	2	0	1	0	3	1	0
2010	1	2	2	0	0	5	1	0
Percentage	14%	36%	14%	7%	29%	100%		
Total	2	5	2	1	4	14	4	0

The project area consists of the existing all-way stop controlled intersection at Butner Road and Stonewall Tell Road. Pedestrian facilities are not present in terms of sidewalks and crosswalks at the study intersection and there is currently no transit facilities located on either Butner Road or Stonewall Tell Road. The land uses along Butner Road are mostly residential. Stonewall Tell Road is a two-lane roadway. The land uses along Stonewall Tell Road are mostly residential. Stonewall Tell Elementary School is located approximately 1 mile north of the study

intersection. This project involves designing improvements for the existing four-way intersection of Butner Road at Stonewall Tell Road. Butner Road crosses Stonewall Tell Road at a severe skew. This alignment deficiency is compounded as the east and west approaches of Butner Road intersect Stonewall Tell Road at significantly different angles. Approach lanes are approximately 12 feet wide with rural shoulders. There are no provisions for turning lanes on any approach. There is no curb and gutter or provisions for pedestrian crossing. Due to the geometry of the intersection a traditional intersection is not an option.

Description of the proposed project: This proposed project includes two three-legged approach roundabouts located in the southwestern and northeastern corners of the existing intersection connected by a median. The roundabouts will have two inscribed circles of 110 feet with splitter islands on all of the approaches. Access will be provided to the existing gas station and market via the southernmost roundabout. (please refer to alternative 6 in appendix).

Is the project located in a PM 2.5 Non-attainment area? __X__ Yes _____ No

Is this project located in an Ozone Non-attainment area? __X__ Yes _____ No
The referenced project is contained within the RTP/TIP/STIP. The project consists of an operational improvement and does not add capacity. Additionally, the project is consistent with the State Implementation Plan for the attainment of clean air quality in Georgia and is in compliance with both state and federal air quality standards.

PDP Classification: Major_____ Minor ___X___

Federal Oversight: Full Oversight ( ), Exempt(X), State Funded( ), or Other ( )

Functional Classification: Butner Road – Urban Minor Arterial
Stonewall Tell Road - Urban Minor Arterial

U. S. Route Number(s): __N/A_____ **State Route Number(s):** __N/A_____
County Route Number(s): Butner Road (CR 1374) /Stonewall Tell Road (CR1386)

Traffic (AADT):
Open Year: (2014) __6,800__ Design Year: (2034) __7,500__

Existing design features:

- Typical Section: Two 11' lanes on all legs of the existing intersection, no curb & gutter, and no sidewalks.
- Posted speed: Butner Road - 45 mph Minimum radius for curve: 533 ft
  Stonewall Tell Road – 40 mph
- Maximum super-elevation rate for curve: 4%
- Maximum grade: Butner Road - 4 %, Stonewall Tell Road – 4%
- Width of right-of-way: Butner Road - 50 ft. , Stonewall Tell Road – 50 ft.
- Major structures: N/A

- Major interchanges or intersections along the project. Butner Road at Stonewall Tell Road Intersection
- Existing length of roadway segment. Project is an intersection but total length is approximately 2400'.

Proposed Design Features:

- Proposed typical section(s): Two 12' lanes on all approaches of the new roundabouts with splitter islands, 14' lanes on the roadway section between roundabouts, 24" curb & gutter, 2' stamped concrete area and 5'sidewalks. The sidewalk width on the westbound approach of Butner Road will be 12' to allow for a trail extension. A mountable curb will be provided in the median between the two roundabouts.
- Proposed Design Speed 25 mph (roundabout) 45 mph (approaches)
- Proposed Maximum grade: Butner Road 3 % , Stonewall Tell Road 3 %
- Maximum grade allowable 8 %
- Proposed Maximum grade driveway 6 %
- Proposed Minimum radius of curve 363(roundabout) 660 (approaches)
- Minimum radius allowable 154 (roundabout) 660 (approaches)
- Maximum allowable superelevation rate 2 %(roundabout) 6% (approaches)
- Proposed maximum superelevation rate 2 %(roundabout) 6% (approaches)
- Right-of-Way
  - Width 50 ft for normal two lane areas but varies up to 130 feet in flares and roundabout areas.
  - Easements: Temporary ( ), Permanent (X), Utility ( ), Other ( ).
  - Type of access control: Full ( ), Partial ( ), By Permit (X), Other ( ).
  - Number of parcels: 8 Number of displacements:
    - Business: 0
    - Residences: 0
    - Mobile homes: 0
    - Other: 0
- Structures:
  - Bridges – N/A
  - Retaining walls – N/A
- Major intersections and interchanges. – N/A
- Transportation Management Plan Anticipated: Yes ( ) No (X)
- Design Exceptions to controlling criteria anticipated:

	UNDETERMINED	YES	NO
HORIZONTAL ALIGNMENT:	( )	( )	(X)
LANE WIDTH:	( )	( )	(X)
SHOULDER WIDTH:	( )	( )	(X)
VERTICAL GRADES:	( )	( )	(X)
CROSS SLOPES:	( )	( )	(X)
STOPPING SIGHT DISTANCE:	( )	( )	(X)
SUPERELEVATION RATES:	( )	( )	(X)
VERTICAL ALIGNMENT	( )	( )	(X)
SPEED DESIGN:	( )	( )	(X)

VERTICAL CLEARANCE:	( )	( )	(X)
BRIDGE WIDTH:	( )	( )	(X)
BRIDGE STRUCTURAL CAPACITY:	( )	( )	(X)
LATERAL OFFSET TO OBSTRUCTION:	( )	( )	(X)

- Design Variances – None
- Environmental concerns – Potential UST at northwest corner of intersection, Historical home in project corridor but no adverse impact anticipated .
- Anticipated Level of environmental analysis:
  - Are Time Savings Procedures appropriate? Yes (X), No ( ),
  - Categorical exclusion (X),
  - Environmental Assessment/Finding of No Significant Impact (FONSI) ( ), or
  - Environmental Impact Statement (EIS) ( ).
- Utility involvements: Power, Cable, Gas, Water, Fiber Optic
- VE Study/ Anticipated **Yes( ) No(X)**

Project Cost Estimate and Funding Responsibilities:

PE	ROW	UTILITY	CST	MITIGATION
TY Lin	Fulton County	Fulton County	Fulton County	Fulton County
$ 250,275	$ 341,313	$ 315,281	$ 1,326,3330	$ 0

**CST Cost includes: Construction, Engineering and Inspection, Fuel Cost Adjustment, and Asphalt Cement Cost Adjustment:*

Project Activities Responsibilities:

- Design: T.Y. Lin International
- Right-of-Way Acquisition: Fulton County
- Right-of-Way funding (real property): Fulton County
- Relocation of Utilities: Utility Companies
- Letting to contract: Fulton County
- Supervision of construction: Fulton County
- Providing material pits: N/A
- Providing detours: None anticipated
- Environmental Studies/Documents/Permits: The LPA Group, Inc.
- Environmental Mitigation: N/A

Coordination

- Initial Concept Meeting date and brief summary. (Held on 3/26/10)
- Concept meeting date and brief summary. (11/9/10)
- Public involvement – On the 21st of January 2010, Fulton County and the TY Lin consultant team met with the Cliftondale Community at the Cliftondale Community Center. This meeting was a public information gathering session. We supplied 4 initial ideas: two of which were roundabouts place on either side of the existing intersection, reconstructing the Butner approaches into two T-intersections with Stonewall Tell. There

have been multiple follow-up meetings with the community to meet their needs for access and operations.

- PAR Meetings – N/A
- FEMA coordination – N/A
- Peer Review – Kittleson and Associates

Other alternates considered:

Concept 1 – This concept consisted of realigning Butner Road to two new T-intersections with Stonewall Tell Road. Westbound Butner Road T-intersections was offset to the north of the existing intersection and eastbound Butner Road would be offset to the south of the existing intersection. This concept was not chosen for several different reasons: LOS failure in current year traffic, public input did not favor this concept, larger ROW costs than all other concepts. (Layout provided in the appendix of this document) Conceptual Cost Estimate incl. ROW and Utilities - $1,750,254

Concept 2 – This concept placing a signal at the existing intersection. This concept also provided a realignment of Butner Road due to the existing deficient through movement along Butner Road during a green cycle. This concept was not chosen because the intersection does not meet signal warrants. (Layout not drawn due this concept idea not meeting warrants) Conceptual Cost Estimate incl. ROW and Utilities - $650,254

Concept 3 – This concept consisted of slightly realigning the westbound approach of Butner Road and the southbound approach of Stonewall Tell Road into a single lane roundabout north of the existing intersection. On the southside of the existing intersection the concept would realign Stonewall Tell to the west into a new T-intersection with Butner Road. This concept was not chosen for several different reasons: LOS failure in the near future, left turn movements onto southbound Stonewall Tell Road back into roundabout, public input did not favor this concept. (Layout provided in the appendix of this document) Conceptual Cost Estimate incl. ROW and Utilities - $1,850,463

Concept 4 – This concept consisted of slightly realigning the eastbound approach of Butner Road and the northbound approach of Stonewall Tell Road into a single lane roundabout south of the existing intersection. On the northside of the existing intersection the concept would realign Butner Road to the north into a new T-intersection with Stonewall Tell Road. This concept was not chosen for several different reasons: LOS failure in the PM westbound approach along Butner Road, public input did not favor this concept, larger ROW costs than preferred concept. (Layout provided in the appendix of this document) Conceptual Cost Estimate incl. ROW and Utilities - $1,835,463

Concept 5C – This concept consisted of slightly realigning the eastbound approach of Butner Road and the northbound approach of Stonewall Tell Road into a single lane roundabout south of the existing intersection along with slightly realigning the westbound approach of Butner Road and the southbound approach of Stonewall Tell Road into a single lane roundabout north of the existing intersection as well. This concept was originally the preferred alternative until peer

review of the concept. The preferred alternative was changed slightly to allow for larger radii to accommodate the design vehicle (please refer to alternative 6 in appendix). Conceptual Cost Estimate incl. ROW and Utilities - $1,990,463

Attachments:

1. Detailed Cost Estimates:
    a. Construction including Engineering and Inspection.
    b. Right-of-Way.
    c. Utilities.
    d. Fuel Adjustment Spreadsheet
2. Typical sections.
3. Public responses from first and second community meeting held on the 21st of January and 15th of July.
4. Peer Review
5. Minutes of Concept meetings.
6. Fulton County Lighting Commitment Letter
7. Concept Layouts
8. Traffic Impact Study.
9. Traffic diagrams.
10. Accident Summaries.
11. Capacity analysis summary.
12. Summary of signal warrant study.
13. Roundabout analysis.

Exempt projects

Concur: _____
Director of Engineering

Approve: _____ Date: 7/12/2012
Chief Engineer

STATE HIGHWAY AGENCY

DATE : 01/10/2012
PAGE : 1

JOB DETAIL ESTIMATE

JOB NUMBER : PI#0007533 SPEC YEAR: 01
DESCRIPTION: BUTNER ROAD AT STONEWALL TELL ROAD INTERSECTION IMPROVEMENT

ITEMS FOR JOB PI#0007533

LINE	ITEM	ALT	UNITS	DESCRIPTION	QUANTITY	PRICE	AMOUNT
0005	150-0000		$	SEC 150 TRAFFIC CONTROL	1.000	170000.00	170000.00
0010	163-0232		AC	TEMPORARY GRASSING	2.000	389.92	779.84
0015	163-0240		TN	MULCH	5.000	224.86	1124.33
0020	163-0501		EA	CONSTR AND REMOVE SILT CONTROL GATE,TP 1	4.000	748.88	2995.55
0025	163-0527		EA	CNST/REM RIP RAP CKDM,STN P RIPRAP/SN BG	15.000	233.40	3501.07
0030	163-0528		LF	CONSTR AND REM FAB CK DAM -TP C SLT FN	50.000	3.91	195.98
0035	163-0529		LF	CNST/REM TEMP SED BAR OR BLD STRW CK DM	50.000	3.90	195.41
0040	165-0010		LF	MAINT OF TEMP SILT FENCE, TP A	5000.000	0.52	2615.60
0045	165-0041		LF	MAINT OF CHECK DAMS - ALL TYPES	25.000	2.15	54.00
0050	171-0010		LF	TEMPORARY SILT FENCE, TYPE A	10000.000	1.82	18265.70
0060	210-0100		LS	GRADING COMPLETE - ESTIMATED	1.000	350000.00	350000.00
0065	310-1101		TN	GR AGGR BASE CRS, INCL MATL	180.000	22.81	4106.99
0075	402-3121		TN	RECYL AC 25MM SP,GP1/2,BM&HL	500.000	69.29	34648.19
0079	402-3142		TN	RECYL AC 19 MM SP,GP 1 OR 2,INCL BM	350.000	80.00	28000.00
0080	402-3141		TN	RECYL AC 12.5 MM SP,GP 1 OR 2,INCL BM	250.000	90.00	22500.00
0085	413-1000		GL	BITUM TACK COAT	50.000	3.86	193.28
0090	429-1000		EA	RUMBLE STRIPS	16.000	617.66	9882.69
0095	441-0104		SY	CONC SIDEWALK, 4 IN	3500.000	26.76	93674.46
0100	441-0740		SY	CONC MEDIAN, 4 IN	500.000	30.51	15258.94
0105	441-4020		SY	CONC VALLEY GUTTER, 6 IN	350.000	32.50	11376.75
0110	441-6012		LF	CONC CURB & GUTTER/ 6"X24"TP2	5000.000	10.32	51647.30
0115	500-3101		CY	CLASS A CONCRETE	60.000	411.98	24719.36
0120	550-1180		LF	STM DR PIPE 18",H 1-10	300.000	36.14	10844.73
0125	550-1240		LF	STM DR PIPE 24",H 1-10	300.000	38.25	11476.44
0130	550-1300		LF	STM DR PIPE 30",H 1-10	200.000	52.31	10463.53
0135	550-3318		EA	SAFETY END SECTION 18",STD,4:1	10.000	534.21	5342.14
0140	550-3324		EA	SAFETY END SECTION 24",STD,4:1	10.000	927.47	9274.78
0145	550-3330		EA	SAFETY END SECTION 30",STD,4:1	7.000	1677.68	11743.79
0150	636-1020		SF	HWY SGN,TP1MAT,REFL SH TP3	200.000	13.28	2656.93
0155	636-2070		LF	GALV STEEL POSTS, TP 7	500.000	7.05	3529.12
0160	653-0110		EA	THERM PVMT MARK, ARROW, TP 1	16.000	62.74	1003.97
0165	653-0210		EA	THERM PVMT MARK, WORD , TP 1	16.000	100.61	1609.85
0170	653-1501		LF	THERMO SOLID TRAF ST 5 IN, WHI	10000.000	0.35	3539.90
0175	653-1502		LF	THERMO SOLID TRAF ST, 5 IN YEL	7500.000	0.34	2575.05
0180	653-1804		LF	THERM SOLID TRAF STRIPE, 8",WH	1000.000	1.89	1893.09
0185	654-1001		EA	RAISED PVMT MARKERS TP 1	100.000	3.78	378.89
0190	668-1100		EA	CATCH BASIN, GP 1	10.000	2057.19	20571.94
0195	668-1200		EA	CATCH BASIN, GP 2	5.000	2674.30	13371.53
0200	668-2100		EA	DROP INLET, GP 1	5.000	1711.31	8556.58

0205	681-4269	EA	LT STD, 16' MH, 6' ARM	40.000	4635.00	185400.00
0210	681-6220	EA	LUMINAIRE,TP 2, 150W,HP SODIUM	40.000	1190.00	47600.00
0215	700-6910	AC	PERMANENT GRASSING	2.000	822.12	1644.25
0220	702-0030	EA	ACER RUBRUM - LANDSCAPED	75.000	295.04	22128.54
0225	702-0049	EA	AMELANCHIER ARBOREA - LANDSCAPED	50.000	224.08	11204.06
0230	900-0037	SF	CONCRETE PAVERS	500.000	14.70	7351.66
0235	441-6718	LF	CONC CURB & GUTTER,6"X24",TP 7	600.000	12.50	7500.00

ITEM TOTAL 1247396.18

TOTALS FOR JOB PI#0007533

ESTIMATED COST:	1247396.18
CONTINGENCY PERCENT (0.0):	0.00
ESTIMATED TOTAL:	1247396.18

Conceptual Right of Way Cost Estimate

Date: 4/30/12
Project: Butner Road @ Stonewall Tell Road Intersection Improvement **P.I. Number:** 0007533
Existing/Required R/W: **No. Parcels:** 8
Project Termini:
Project Description: This project involves designing improvements for the existing four-way intersection of Butner Road at Stonewall Tell Road. Butner Road crosses Stonewall Tell Road at a severe skew and the two Butner Road approaches do not cross Stonewall Tell Road at similar angles. Approach lanes are approximately 12 feet wide with rural shoulders. There are no provisions for turning lanes on any approach. There is no curb and gutter or provisions for pedestrian crossing. Due to the geometry of the intersection a traditional intersection is not an option.

Land:

Commercial	7500 s.f	@ $	2.50 /s.f.	=	$ 18,750.00
Industrial	0 s.f	@ $	/s.f.	=	$ 0.00
Residential	52,000 s.f	@ $	2.50 /s.f.	=	$ 130,000.00
Agricultural	0 s.f	@ $	/s.f.	=	$ 0.00

TOTAL $ 148,750.00

Improvements:

Relocation:

Commercial	@ $25,000/parcel	=	$ 0.00
Residential	@ $40,000/parcel	=	$ 0.00

TOTAL $ 0.00

Damages:

Proximity	**$ 0.00**	
Misc Damages due to ROW impacts	**$ 10000.00**	
Consequential	**$ 0.00**	
Cost to Cure	$ 0.00	$ 10000.00

TOTAL $ 0.00

SUB-TOTAL: $ 158,750

Net Cost		$	158,750
Scheduling Contingency	55 %	$	87,313
Adm/Court Cost	60 %	$	95,250
TOTAL		$	221,987

Total Cost $ 341,313

Prepared By: Bryan P. Lindsey, P.E.

Reviewed / Approved: Richard L.V. Coates, III, P.E
Fulton County
Assistant Director
Facilities & Transportation Services Department

Conceptual Utility Cost Estimate

Date: 4/30/12
Project: Butner Road @ Stonewall Tell Road Intersection Improvement **P.I. Number:** 0007533
Existing/Required R/W: **No. Utilities:** 3
Project Termini:
Project Description: This project involves designing improvements for the existing four-way intersection of Butner Road at Stonewall Tell Road. Butner Road crosses Stonewall Tell Road at a severe skew and the two Butner Road approaches do not cross Stonewall Tell Road at similar angles. Approach lanes are approximately 12 feet wide with rural shoulders. There are no provisions for turning lanes on any approach. There is no curb and gutter or provisions for pedestrian crossing. Due to the geometry of the intersection a traditional intersection is not an option.

Due to relocation of the roadway to dual roundabouts outside of the existing ROW all utilities will be reimbursable.

GA Power: $201,000

AT&T: $82,500

Comcast: $31,781

Total Cost $ 315,281

Prepared By: _____
Bryan P. Lindsey, P.E.

Reviewed / Approved: _____
Richard L.V. Coates, III, P.E
Fulton County
Assistant Director
Facilities & Transportation Services Department

PROJ. NO.	CSHPP-0007-00(533)
P.I. NO.	0007533
DATE	11/14/2011

CALL NO.

INDEX (TYPE)	DATE	INDEX
REG. UNLEADED	Mar-11	$ 3.314
DIESEL		$ 3.403
LIQUID AC		$ 500.00

Link to Fuel and AC Index:
http://www.dot.ga.gov/doingbusiness/Materials/Pages/asphaltcementindex.aspx

LIQUID AC ADJUSTMENTS

PA=[((APM-APL)/APL)]xTMTxAPL

Asphalt

Price Adjustment (PA)				**16500**	**$**	**16,500.00**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	800.00		
Monthly Asphalt Cement Price month project let (APL)			$	500.00		
Total Monthly Tonnage of asphalt cement (TMT)				55		

ASPHALT	Tons	%AC	AC ton
Leveling		5.0%	0
12.5 OGFC		5.0%	0
12.5 mm	250	5.0%	12.5
9.5 mm SP		5.0%	0
25 mm SP	500	5.0%	25
19 mm SP	350	5.0%	17.5
	1100		**55**

BITUMINOUS TACK COAT

Price Adjustment (PA)			**$**	**64.43**	**$**	**64.43**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	800.00		
Monthly Asphalt Cement Price month project let (APL)			$	500.00		
Total Monthly Tonnage of asphalt cement (TMT)				0.214755046		

Bitum Tack Gals	gals/ton	tons
50	232.8234	0.21475505

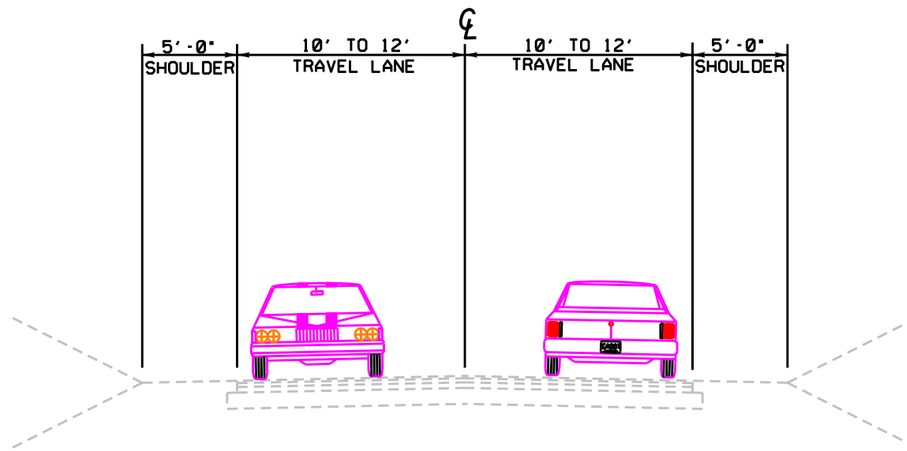
PROJ. NO.	CSHPP-0007-00(533)	CALL NO.	
P.I. NO.	0007533		
DATE	11/14/2011		

BITUMINOUS TACK COAT (surface treatment)

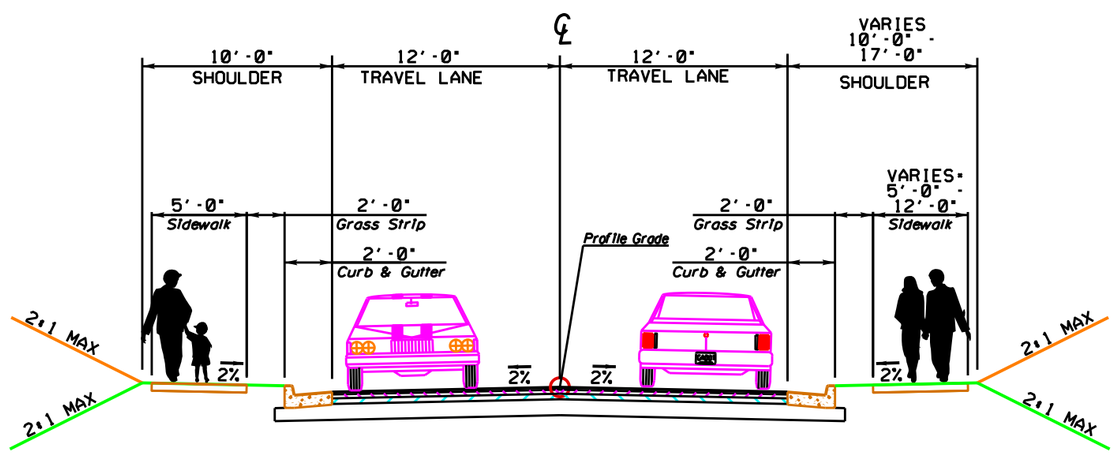
Price Adjustment (PA)				**0**	**$ -**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	800.00	
Monthly Asphalt Cement Price month project let (APL)			$	500.00	
Total Monthly Tonnage of asphalt cement (TMT)				0	

Bitum Tack	SY	Gals/SY	Gals	gals/ton	tons
Single Surf. Trmt.		0.20	0	232.8234	0
Double Surf.Trmt.		0.44	0	232.8234	0
Triple Surf. Trmt		0.71	0	232.8234	0
					0

TOTAL LIQUID AC ADJUSTMENT	**$**	**16,564.43**

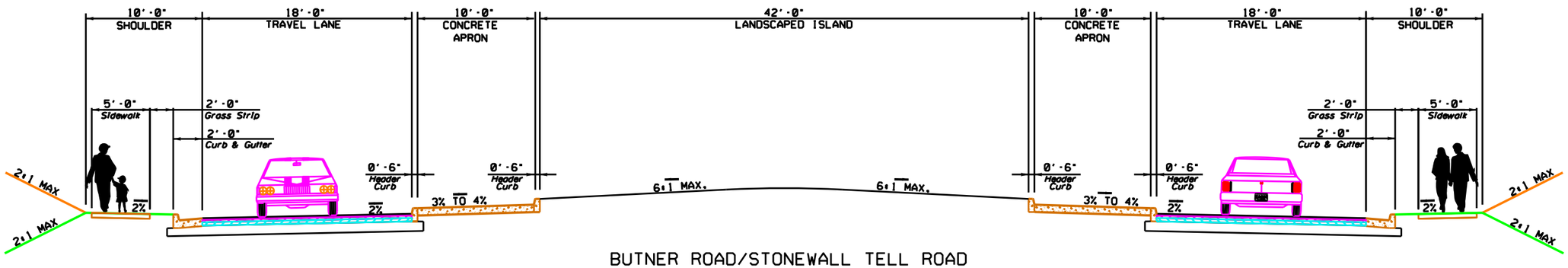


BUTNER ROAD/STONEWALL TELL ROAD
EXISTING ROADWAY TYPICAL SECTION

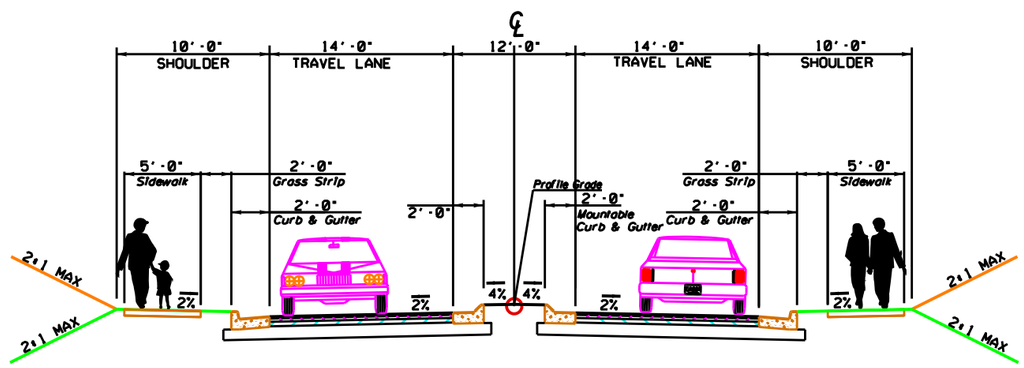


BUTNER ROAD/STONEWALL TELL ROAD
PROPOSED ROADWAY TYPICAL SECTION

* SIDEWALK WILL BE 12' ALONG THE NORTHSIDE OF WESTBOUND APPROACH OF BUTNER ROAD TO ALLOW FOR A TRAIL EXTENSION



BUTNER ROAD/STONEWALL TELL ROAD
ROUNDABOUT TYPICAL SECTION



BUTNER ROAD/STONEWALL TELL ROAD
PROPOSED ROADWAY TYPICAL SECTION
BETWEEN ROUNDABOUTS

FULTON COUNTY

Butner Road at Stonewall Tell Road Intersection Improvements Project
Public Information Meeting Summary – January 21, 2010
Cliftondale Community Center

A total of 61 persons attended the first public information for the Butner Road at Stonewall Tell Road Intersection Improvements Project. The purpose of the meeting was to provide an overview of the project and present preliminary concepts for public feedback. Attendees were provided a project fact sheet and comment form after signing in. The meeting was opened by Earnest Slaughter with the Fulton County Public Works Department who welcomed the attendees and introduced County staff and the TY Lin consulting team. Mr. Slaughter provided a general project overview, purpose and schedule. The meeting was turned over to Bryan Lindsey, Project Manager, for TY Lin who explained the goal of the meeting and the preliminary concepts on display. Mr. Lindsey requested attendees to spend time at the displays and learn more about each of the four preliminary concepts. Inga Kennedy, Public Involvement Coordinator for the project, facilitated questions regarding process and the attendees dispersed to the displays. Attendees were encouraged to submit written feedback on the comment forms before leaving but were also provided the opportunity to submitt additional comments prior to February 4, 2010 by direct mail, e-mail and facsimile. The following table summarizes the comments received by status of support:

1. Do you support the project?

SUPPORT STATUS	TOTAL COMMENTS	CONCEPT # 1	CONCEPT # 2	CONCEPT # 3	CONCEPT # 4	NO CONCEPT SELECTED
For	19	3	0	6	2	8
Against	4	0	0	0	0	4
Conditional	16	4	3	2	1	7
Uncommitted	3	1	0	0	0	2

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Specific comments on this project by support categories:

For

Concept 1

- I support Concept 1; I think it will make a difference for the better. Other areas of concern in this area are: Jonesboro Rd. and Hwy. 92, Derrick Rd and South Fulton Parkway, Stonewall Tell and South Fulton Parkway (turning arrow at intersections)
- I think Concept 1 is the best plan for the intersection. Jones Road at 92 needs to be addressed also for safety reasons.
- Concept 1

Concept 2

No boxes checked for support

Concept 3

- Good idea…Need more sidewalks…I like Concept 3 because it maintains Butner and like the low impact on land and property owners.
- Concept 3 looks ok but would need to know the size of the traffic circle i.e. 1 or 2 lanes and all Concepts appear that some form of traffic control will be needed.
- I like Concept 3 and absolutely hate 1 and 2. I like 3 because it is the closest Concept to flow on Butner. The others have too many turns. Additionally I think there should be consideration to make the roundabout four legs with the fourth leg acting as a driveway to the gas station/Young's and not access to Stonewall.
- We need to get a traffic light installed but if that can be justified, we like option 3 best.
- I like Concepts 3 and 4 with the roundabouts. However, I don't like splitting off of the roads. With roundabouts at leastthe traffic will keep moving. Concepts 1 and 2 are out of the question.
- I am in favor of Concept 3.

Concept 4

- Project Concept 4, east leg with 3 way stop sign.
- I support either of the two roundabout plans for this intersection.

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Against

- I did not like Concepts 3 and 4 which included the roundabouts. I am concerned with how to get to the businesses (gas station and store). Neither Concept show good consistency with entrance to the plaza. You mentioned an increase of accidents and injuries but no data was given to truly support use of funds for this project. Also, will there be a tax increase and what is the projected cost for each concept? I need more info as to why there is a need to make changes. I would support broadening streets and fixing potholes.
- I know that I hate the circles. I don't see how having two intersections is better than having one. No proposal looked helpful to me. Why don't we save tax dollars and keep the intersections as it is, but put up a traffic light. I like simple solutions.
- I am not in favor of any plans presented. All we need is a traffic light. An additional intersection will only create more problems and I don't like roundabouts.
- Traffic light should be all that is needed without damaging so much property. Two intersections is not a solution but another problem. I did not like any of the proposals. A roundabout is for people who are not disciplined enough to stop at a sign or light. Just remember, they will not yield in a roundabout either…sounds dangerous to me. Five foot sidewals make me laugh – are you building them for the soccor people to park on?
- Sidewalks need to be extended to populated areas for whatever design is decided upon, consider keeping the traffic caution light.
- The light at South Fulton Parkway and Stonewall Tell Rd. needs more attention.

Conditional

- Do not like the idea of roundabouts. I feel this is a dangerous and unpractical option. Concept 1 seems to generate the most interest.
- In reviewing the maps, I am leaning more toward Concepts 1 and 2 as far as accommodating growth for this area.
- I'm in favor of the "2" four-way stop concept of Concept 1 and this seems to keep the integrity of the area as close to it is now. Concept 1 look to be safe for all modes of transportation. Make sure any concept keeps access to existing businesses.
- Off ramp signal would make Concept 1 work more efficient and Concept 4 needs more work.

FULTON COUNTY

- I'm in favor of the "2" four-way stop concept of Concept 1 and this seems to keep the integrity of the area as close to it is now. Concept 1 look to be safe for all modes of transportation. Make sure any concept keeps access to existing businesses.
- Concept 2 is a better choice at this time.
- From experience, I don't like the roundabouts. They are not going to work well for trucks that come through the neighborhood. I like Concept 2. Will there be traffic signals at the 3 way intersections?
- Because of the time factor to complete the project but I favor Concept 3.
- I like Concepts 3 and 4 with the roundabouts. However, I don't like splitting off of the roads. With roundabouts at leastthe traffic will keep moving. Concepts 1 and 2 are out of the question.
- Clearly something needs to be done but each concept has some shortcomings. Concept 2 is the worst; no left turn lane on SWT and no pedestrian crossings.
- My suggestions is that we need safety such as a light. Also, Butner Road needs to be four lanes with sidewalks.
- Traffic light is definitely a necessity for the safety of all, extend sidewalks and widen the roads.
- My support is dependent upon continuous traffic flow during the construction period. Butner Rd. is the only avenue for many in the community to reach major thoroughfares. Congestion on Butner would be detrimental and unacceptable.
- Need red light and all lanes should be wider to accommodate large size vehicles, trucks, vans, etc..
- Sidewalks from Camp Creek to Hwy. 92 on Butner Road and from Campbellton to South Fulton Parkway on Stonewall Tell.
- .No Concept presented solves all problems. Each concept creates another problem. If concern is with north bound SWT to west bound Butner, install a "jug handle" with left turn lane on northbout SWT (see sketch attached).

Uncommitted

- Not sure if any of the plans will completely solve the problem.
- All Concepts presented breaking a single-point problem (the current intersection) in a multi-point problem creating multiple intersections; I would prefer a solution that maintains a single point intersection utilizing either a traffic signal or round-about to control flow.

- Favor Concept 1 (first) but concerned about the stop sign. Favor Concept 3 (second choice) but concerned about turnabout.

2. How did you hear about the meeting?

a. Radio - 0
b. Newspaper - 0
c. Signs - 20
d. Word of Mouth - 7
e. Other – Internet (1), Cliftondale E-mail (11), Cliftondale Meeting (5), County web site (1)

3. Was the location of the meeting convenient for you to attend?

a. Yes – 40 (need more parking)
b. No – 9

4. Was the time of the meeting convenient for you to attend?

a. Yes - 40
b. No – 1 (7 pm)

5. Do you understand the project after attending this meetings

a. Yes - 38
b. No – 1 (more information needed)
c. Did not attend - 2

6. Please share your suggestions on improving the way Fulton County Public Works conducts public meetings:

- Needs to be more informative.
- The meetings should have been a forum to ask the community what they would like to see and how to see it developed instead of presenting 4 ideas and asking to choose; then present our ideas with your idea. Antonio Valenzuela should have respectfully attended this meeting.
- The meeting went fine.

FULTON COUNTY

- I appreciate each time Cliftondale is used as an informative meeting site; thanks.
- Future meetings should be singular to encourage idea sharing among all participants at once.
- This meeting concept is very good; it gives time and access to talk and discuss the project with project people.
- We need to hear from the homeowners and need many more meetings.
- Maybe send flyers out to local schools.
- Do an overview of the entire proposal and point out the pros and cons of each idea.
- At next meeting use the big screen on stage and give individual copies of all four concepts to each attendee. Present pros and cons of each concept and have a Q&A after each concept presentation. Put concepts on County web site and Cliftondale.org web site.
- Share more data such as the criteria for getting a traffic light and how today's traffic compares to the criteria.
- I feel we need a "full" meeting using the screen at our next meeting. Each design should be critiqued as a group so we all can hear each other's concerns and ideas.
- There are community members of Cliftondale that have been working on this project for years. I think their ideas should also be taken inot consideration. They have been her working for the community strongly.
- The organizers should inform all people present as to how conceptual displays can be obtained (included with handout information versus call or e-mail someone).
- Also, I do not believe there was any discussion on accident history at this intersection.

Butner Road at Stonewall Tell Road Intersection Improvements

Public Meeting – June 15, 2010
Cliftondale Park Community Center

A total of 20 persons attended the second public information meeting for the Butner Road at Stonewall Tell Road Intersection Improvements Project. The purpose of the meeting was to provide the recommended alternative for the intersection based on the data collected from previous public outreach as well as technical

Attendees were provided a project fact sheet and comment form after signing in. The meeting was opened by Angela Parker with the Fulton County Public Works Department who welcomed the attendees and introduced County staff and the TY Lin consulting team. Ms. Parker provided an overview of the timeline and background for the project. The meeting was turned over to Bryan Lindsey, Project Manager, for TY Lin who gave a brief PowerPoint presentation on current status of the intersection and went into further detail on the preferred alternative. Inga Kennedy, Public Involvement Coordinator for the project, facilitated questions regarding the preferred alternative.

The following comments were provided:

Comments:

- I can see that a great deal of work has gone into this project however, I still want a traffic signal rather than the roundabout
- Considering the way folks drive in the area I can only see problems with a roundabout
- Would like the traffic signal explored a little more for the intersection. The way the roundabouts are presented they would hinder the businesses at this location
- If the traffic signal is out of the question can the access in and out for the businesses be explored more
- The animation was very good but as you know once you include the human factor things change- drivers with various knowledge, experience, ages and personalities will enter the picture
- Improvements are needed but the roundabouts are not the answer
- The visual has completely taken away the intersection and made it quite confusing by going through two roundabouts to make left hand turns
- Cost is another factor. Red lights and turn lanes are sufficient and much less confusing. I have experienced roundabouts and do not see them working well in this high traffic area

- Limited access may cause more congestion
- What is the time frame for completion of the roundabouts including construction
- 20 years from now there will be a new local subdivision that will definitely affect the current traffic flow for the intersection
- What warrants this project being looked at versus other more dangerous intersections such as State Route 92/ Ridge Road and State Route 92/ Butner Road Intersections
- The Butner Road/Stonewall Tell intersection has not had an accident in the last four years that I'm aware of
- What are the safety red flags for the project
- Are the roundabouts raised
- What are the criteria that warrants a traffic light
- Are there any other examples to reference for the dog bone design of a roundabout
- Stonewall Tell Road/ South Fulton Parkway has a traffic signal but it does not reduce travel time
- Maybe we can break the project into phases…traffic light now and later roundabouts
- I viewed the screening of the two roundabouts for the intersection mentioned above, and I can see that the accident occurrences will surely increase with the volume of traffic through this intersection and the uncertainty of drivers.
- Presently we have very few accidents
- Turn lanes and a red light would be more efficient and more cost effective.
- We certainly need improvements in this intersection, but Cliftondale has many other needs (Enon Road resurfacing for instance or a red light at Butner and Hwy 92) that should be considered for spending funds in the area.
- Will construction type trucks such as flat beds, concrete, large box trucks be able to maneuver through the intersection? This intersection accommodates more than cars.

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TRANSPORTATION ENGINEERING / PLANNING
225 E Robinson Street, Suite 450, Orlando, FL 32801 P 407.540.0555 F 407.540.0550

TECHNICAL MEMORANDUM

Butner Road at Stonewall Tell Road

Roundabout Peer Review

Date: May 12, 2011 Project #: 11748

To: Bryan Lindsay, TY-Lin International

From: Justin Bansen; Brian Ray, P.E.

Kittelson & Associates, Inc. (KAI) reviewed the conceptual roundabout designs for two single-lane roundabouts proposed as part of an improvement for the existing unsignalized intersection of Butner Road at Stonewall Road in Fulton County Georgia. The improvement proposes to separate the existing skewed four-legged all-way stop intersection into two "T" intersections under roundabout control. The design concept was developed by TY-Lin International (TY-Lin) and the traffic analysis prepared by Southeastern Engineering, Inc. (SEI) dated December 9, 2010.

We conducted our review in general accordance with the guidance provided in NCHRP Report 672, *Roundabouts: An Informational Guide, Second Edition* (Reference 1). KAI reviewed the operational analysis and horizontal design for both proposed roundabouts. KAI recommends modifying both roundabout designs to better serve the WB-50 design vehicle at each of the approach entry and exits. At the southern roundabout, KAI also recommends eliminating the southbound right-turn bypass lane from the design as it is unnecessary from a capacity perspective and creates additional roadway crossings for pedestrians. The following sections summarize our review and more detailed comments.

TRAFFIC OPERATIONS AND LANE NEEDS

KAI reviewed the projected 2032 design year traffic operations as documented in SEI's December 2010 *Traffic Study* (Reference 2). SEI analysis was performed using the GDOT Roundabout Analysis Tool that implements the operational analysis procedures of NCHRP Report 572 (Reference 3). Overall, KAI confirmed that single-lane roundabouts are expected to provide adequate operations for the identified 2032 design year volumes. KAI's review assumes that the 0.5% annual growth rate and

future year 2032 traffic volumes used in the SEI study have been previously approved by Fulton County and GDOT. Additional comments related to the operations analysis are provided below:

- Consider removing the right-turn bypass on the southbound approach at the southern roundabout. The analysis documented in the SEI *Traffic Study* (Reference 2) documents that the southbound approach will operate with a v/c ratio of 0.60 during the 2032 PM Peak Hour without the use of the bypass. The bypass lane, as currently designed, presents two specific issues:
    - The angle of the bypass lane results in a driver view angle of 25 degrees. This severe angle makes it difficult for drivers to see conflicting exiting vehicles. A view angle of 75 degrees or greater is recommended in NCHRP Report 672 to provide an adequate driver visibility. See Exhibit 6-61 in NCHRP Report 672.
    - The bypass lane creates additional pedestrian and vehicular conflict points, a wider pedestrian crossing, and adds to the complexity of the signing and markings.
- The analysis used a Peak Hour Factor (PHF) of 0.92 for all time periods and analysis years. From the 2009 traffic counts, the AM peak hour had a PHF of 0.865 and the PM peak hour had a PHF of 0.956. Therefore, the analysis may be underestimating the peak 15 minute traffic demands during the AM peak hour, but may be conservative during the PM peak hour.
- The analysis assumed 100% autos and no trucks. No heavy vehicle data was provided in the SEI *Traffic Study*. It is unclear what level of truck demand is anticipated through the intersection. KAI conducted a cursory analysis of the 2032 traffic conditions and identified that a truck demand of 5% or less is not anticipated to change the conclusions of the analysis.
- At the Southern roundabout, the southbound right-turn volume is double-counted in the analysis. It is shown as part of the volume entering the roundabout and it is also shown in the bypass lane calculations. If a right-turn bypass is provided, the right-turn volume should not be entered into the roundabout calculations (it should be shown in the bypass calculations only). This does not impact the conclusions of the SEI study since the southbound approach has significant reserve capacity; however, we note this for SEI's future roundabout analyses.

DESIGN FEATURES

Fastest Path Speeds

KAI checked fastest path speeds for both roundabouts; these checks are shown in the attachments. All entry speeds were found to be in the range of 21 to 22 mph and speed differentials between conflicting movements were 7 mph or less. Typically entry speeds for single-lane roundabouts are designed for 25 mph or less.

While the design provides adequate speed control, KAI found the combination of the 100-foot inscribed circle diameter and 50-foot (typical) entry and exit radii to overly restrict speeds for some movements (and also create issues for design vehicles). As an example, exiting the southern roundabout in the northbound direction, the fastest path speed is 16 mph for the exit. Overly tight entry and exit radii may reduce capacity. Research from the United Kingdom found that entry radii below 65 feet results in a decrease in capacity, such that the roundabout may not operate to the level predicted in the operations analysis. Refinements to the entry and exit geometry could be considered to slightly relax the geometry while still maintaining entry speeds below 25 mph.

Design Vehicle Accommodation

KAI checked selected truck turning movements using the AutoTurn 6 software to evaluate the turning paths of a WB-50 design vehicle. Design vehicle paths were not provided by TY-LIN as part of the review package. Our use of the WB-50 design vehicle is based upon correspondence with TY-LIN and assumes that this design vehicle has been previously confirmed with GDOT as the appropriate vehicle for this location.

KAI recommends adjusting the entry and exit geometry on each leg of the roundabout to accommodate the turning path of the WB-50 design vehicle without over-running the outside curbline. As previously discussed, the TY-Lin concepts use 50-foot entry and exit curb radii for most of the approaches to both roundabouts. The truck turn paths show that a WB-50 trailer is expected to track over the curbline on each of the entry and exits. This may result in damage to the curb and rutting in the landscape buffer between the curb and sidewalk. Entry radii are typically in the range of 65 to 90 feet for a small diameter single-lane roundabout with a WB-50 design vehicle. Exit radii are typically larger, with a curb radius of 100 feet or greater. KAI also suggests consideration be given to increasing the inscribed circle diameter, increasing the entry/exit width, and/or modifying the approach alignment to better accommodate the design vehicle.

After geometric modifications are made, fastest paths should be checked again by TY-Lin staff to verify that speed control objectives are still being met. Adjustments to the entry and exit radii alone may result in higher than desirable speeds, which could precipitate the need for additional design adjustments such as adjusting the approach alignment or inscribed circle diameter.

General Layout and Geometry

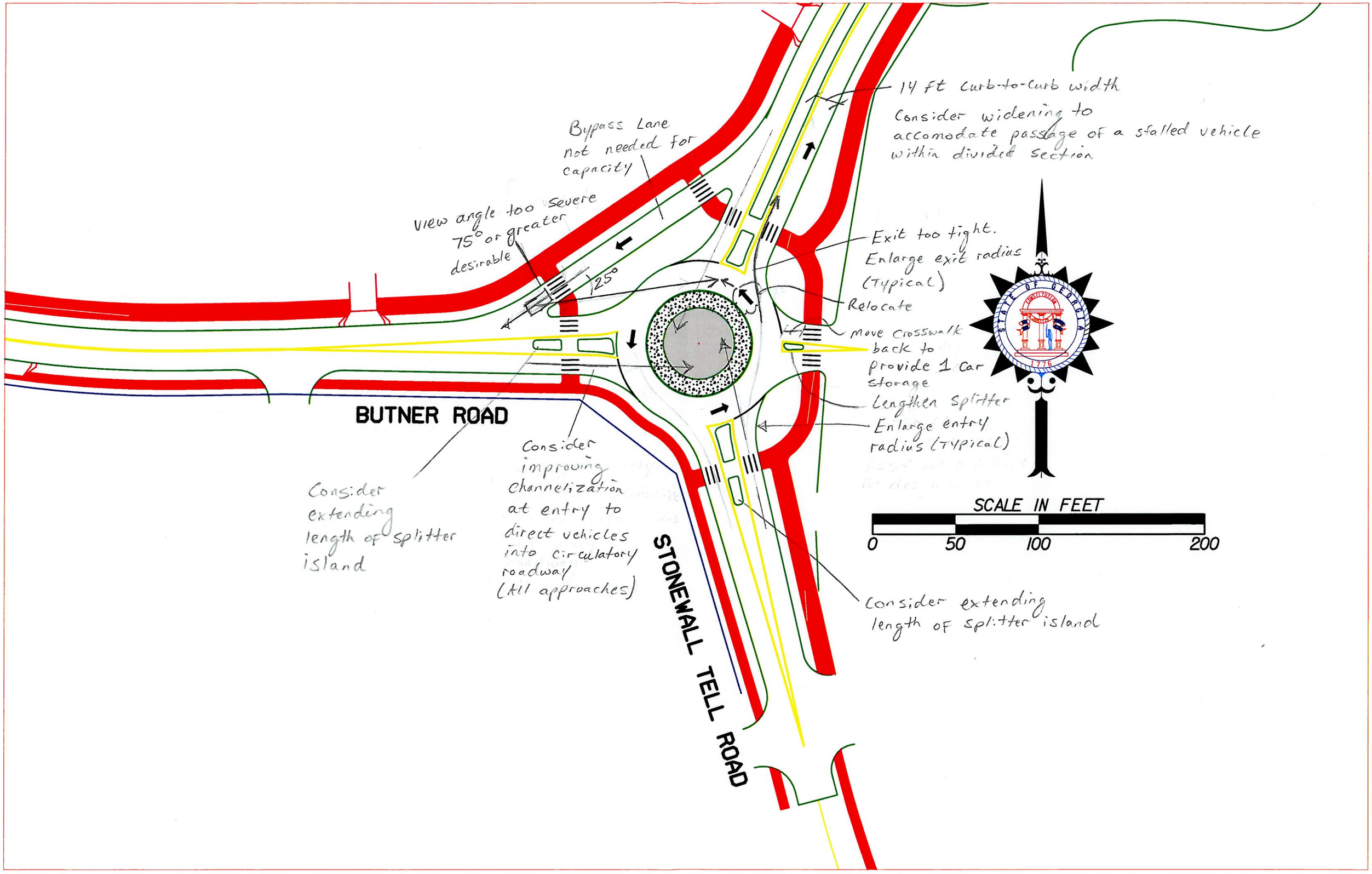
Our comments on the two roundabout concepts are indicated with mark-ups in the attachments. Comments are also summarized below.

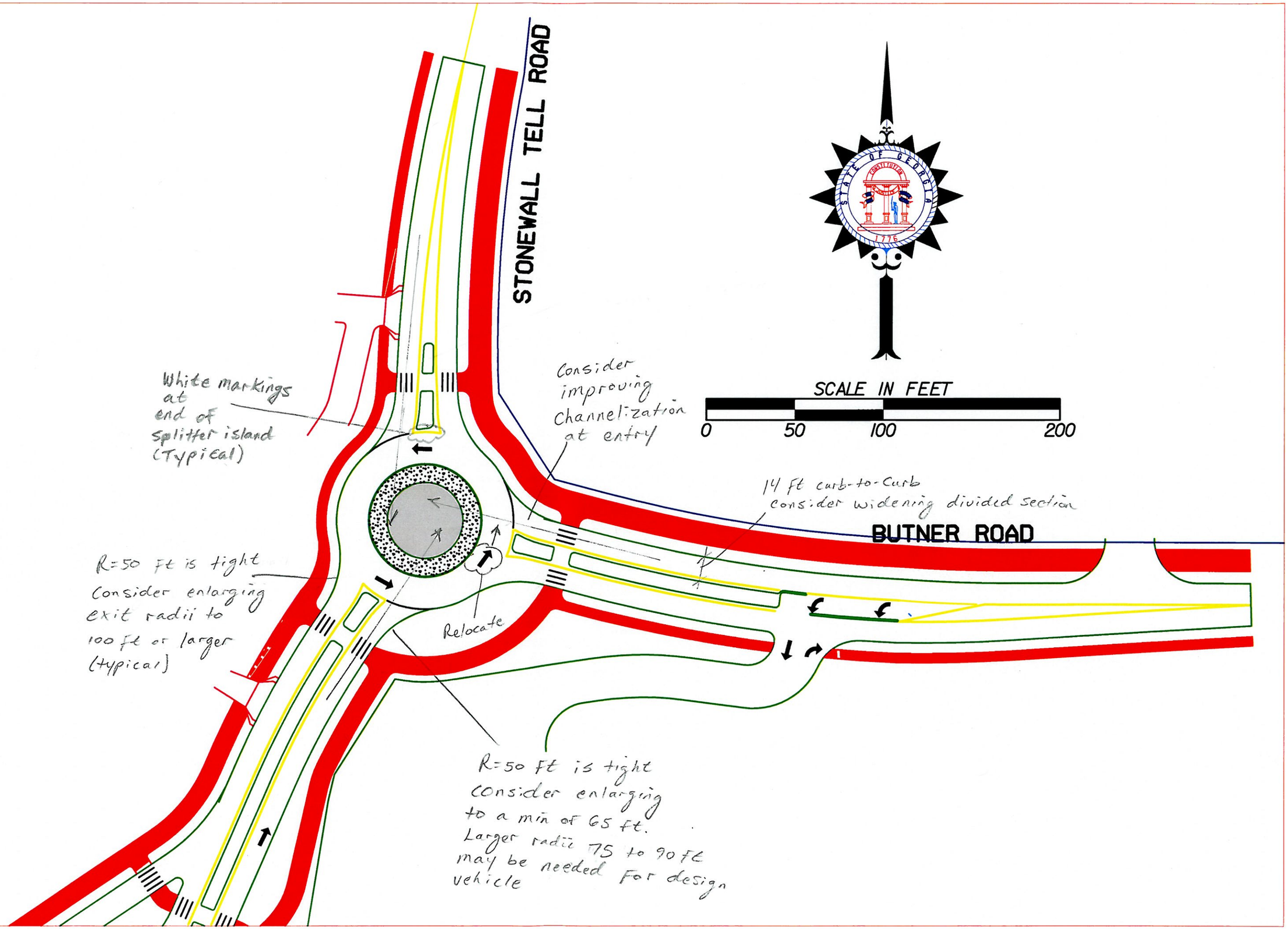
1) Enlarge the entry radii to a range of 65 to 90 feet to better accommodate the design vehicle and avoid creating an entry capacity constraint.
2) Enlarge the exit radii to be 100 feet or greater to better accommodate the design vehicle and avoid creating an exit capacity constraint, which could also impact the crash potential at the intersection.
3) Remove the right-turn bypass lane at the southern intersection. Removing the bypass lane will help facilitate a slightly larger inscribed circle diameter.
4) Consider a left of center approach alignment on each of the legs of the two roundabouts. See Exhibit 6-10 of NCHRP Report 672. This would help to enhance the channelization of vehicles into the correct direction of the circulatory roadway and discourage drivers from making wrong-way left-turns. The current design concept does not provide positive channelization for drivers at the entry and allows vehicles to travel straight ahead into the central island. While not a fatal flaw, the current design places more emphasis on the central island and truck apron to provide vehicle deflection. Therefore, careful planning is needed for the truck apron vertical profile to discourage passenger car use. The design should not place fixed objects within areas of the central island that are susceptible to errant vehicle paths. Modifying the approach alignments by using a left of center approach alignment is one potential option for achieving additional deflection/channelization on the entry.
5) At the southern roundabout, move the crosswalk (across the east leg) further away from the roundabout to provide one-car length of storage between the yield line and crosswalk.
6) At the southern roundabout, consider enlarging the length and width of the splitter island on the east leg to improve visibility of the island. The current island provides less than 50 sq. ft. of surface area. See Exhibit 6-13 in NCHRP Report 572.
7) Pavement marking arrows used within the circulatory roadway should be located in front of the splitter islands. One of the arrows should be relocated at each roundabout.

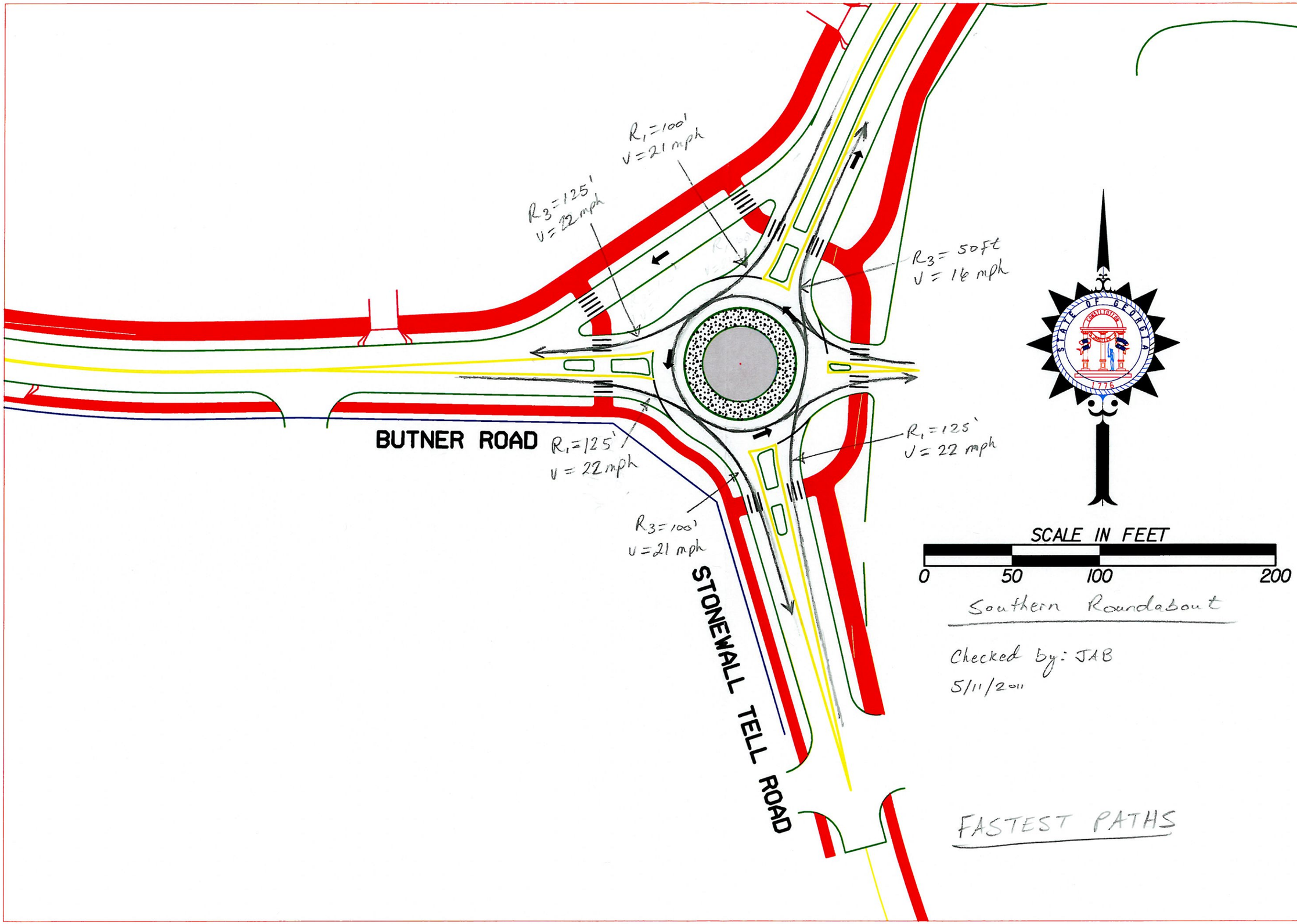
8) For the closed section between the two roundabouts, 14 feet of width is provided between the splitter island and outside curbs. Consider widening the lane widths through this section to allow for passage of a stalled vehicle or passage by an emergency vehicle. Mountable curb within this area is a means to give emergency vehicles the ability to drive over the median, if necessary, in an emergency situation.
9) Along the outside edges of the circulatory roadway, adjacent to the ends of the splitter islands, a white edge line marking should be used instead of a yellow marking.
10) Consider extending the length of the splitter island on the eastbound and northbound approaches at the south roundabout. 100 feet or longer is desirable for the 45 mph posted speed along Butner Road and 40 mph posted speed on Stonewall Tell Road. See Exhibit 6-12 in NCHRP Report 672.

REFERENCES

1. Rodegerdts, L., J. Bansen, C. Tiesler, J. Knudsen, E. Myers, M. Johnson, M. Moule, B. Persaud, C. Lyon, S. Hallmark, H. Isebrands, R. B. Crown, B. Guichet, and A. O'Brien. *NCHRP Report 672: Roundabouts: An Informational Guide, Second Edition.* Transportation Research Board of the National Academies, Washington, D.C., 2010.
2. Southeastern Engineering Inc. *Traffic Study, Butner Road & Stonewall Tell, Fulton County Georgia.* Prepared for TY-LIN International. December 9, 2010
3. Rodegerdts, L., M. Blogg, E. Wemple, E. Myers, M. Kyte, M. Dixon, G. List, A. Flannery, R. Troutbeck, W. Brilon, N. Wu, B. Persaud, C. Lyon, D. Harkey, and D. Carter. *NCHRP Report 572: Roundabouts in the United States*. Transportation Research Board of the National Academies, Washington, D.C., 2007.


14 ft curb-to-curb width
Consider widening to accomodate passage of a stalled vehicle within divided section
Bypass Lane not needed for capacity
View angle too severe 75° or greater desirable
125°
Exit too tight. Enlarge exit radius (Typical)
Relocate
Move crosswalk back to provide 1 car storage
Lengthen splitter
Enlarge entry radius (Typical)
BUTNER ROAD
Consider improving channelization at entry to direct vehicles into circulatory roadway (All approaches)
Consider extending length of splitter island
STONEWALL TELL ROAD
Consider extending length of splitter island
SCALE IN FEET
0
50
100
200

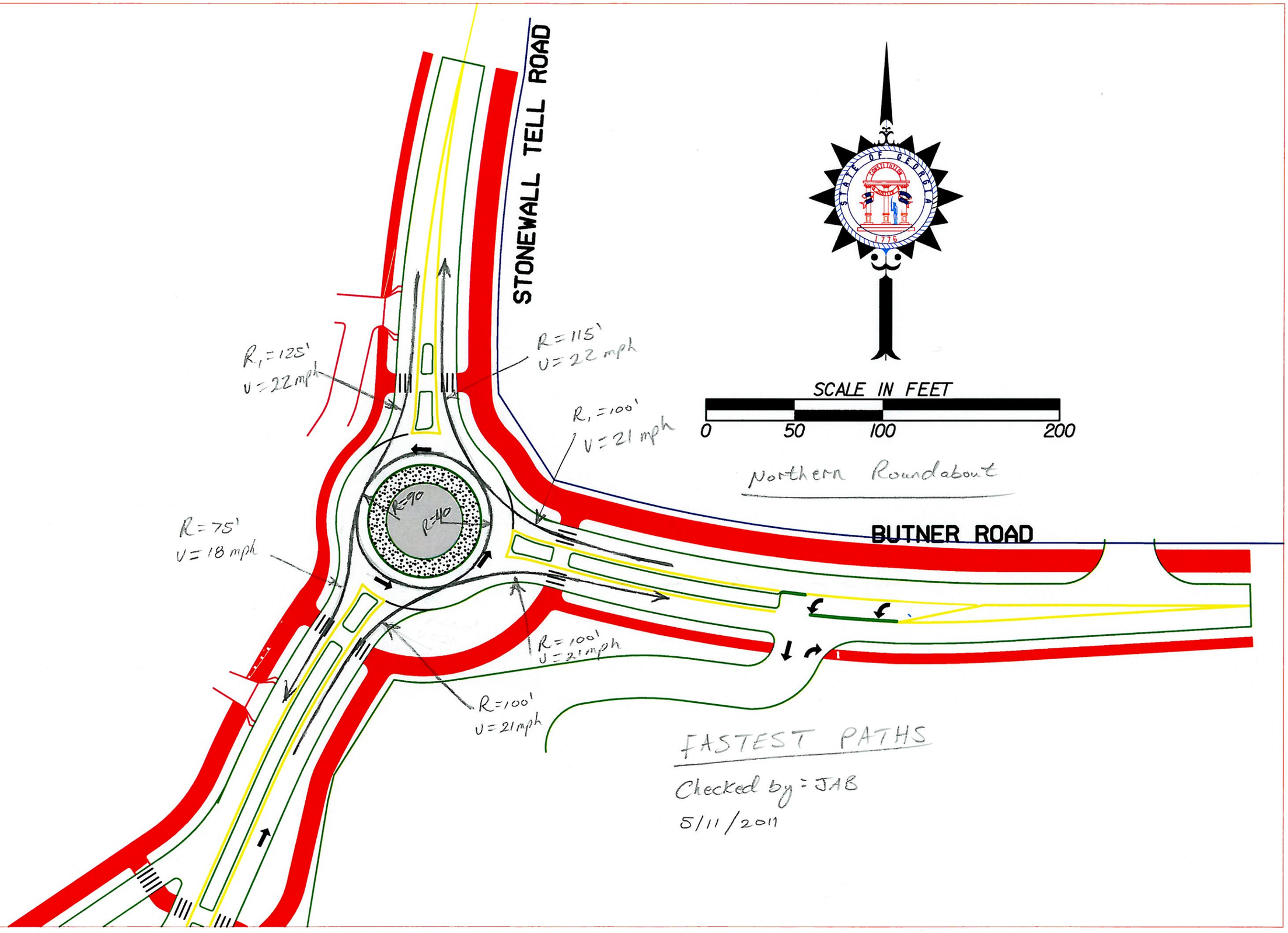

STONEWALL TELL ROAD
BUTNER ROAD
SCALE IN FEET
0
50
100
200
White markings at end of splitter island (Typical)
Consider improving Channelization at entry
14 ft curb-to-Curb consider widening divided section
R=50 ft is tight Consider enlarging exit radii to 100 ft or larger (typical)
Relocate
R=50 ft is tight consider enlarging to a min of 65 ft. Larger radii 75 to 90 ft may be needed for design vehicle

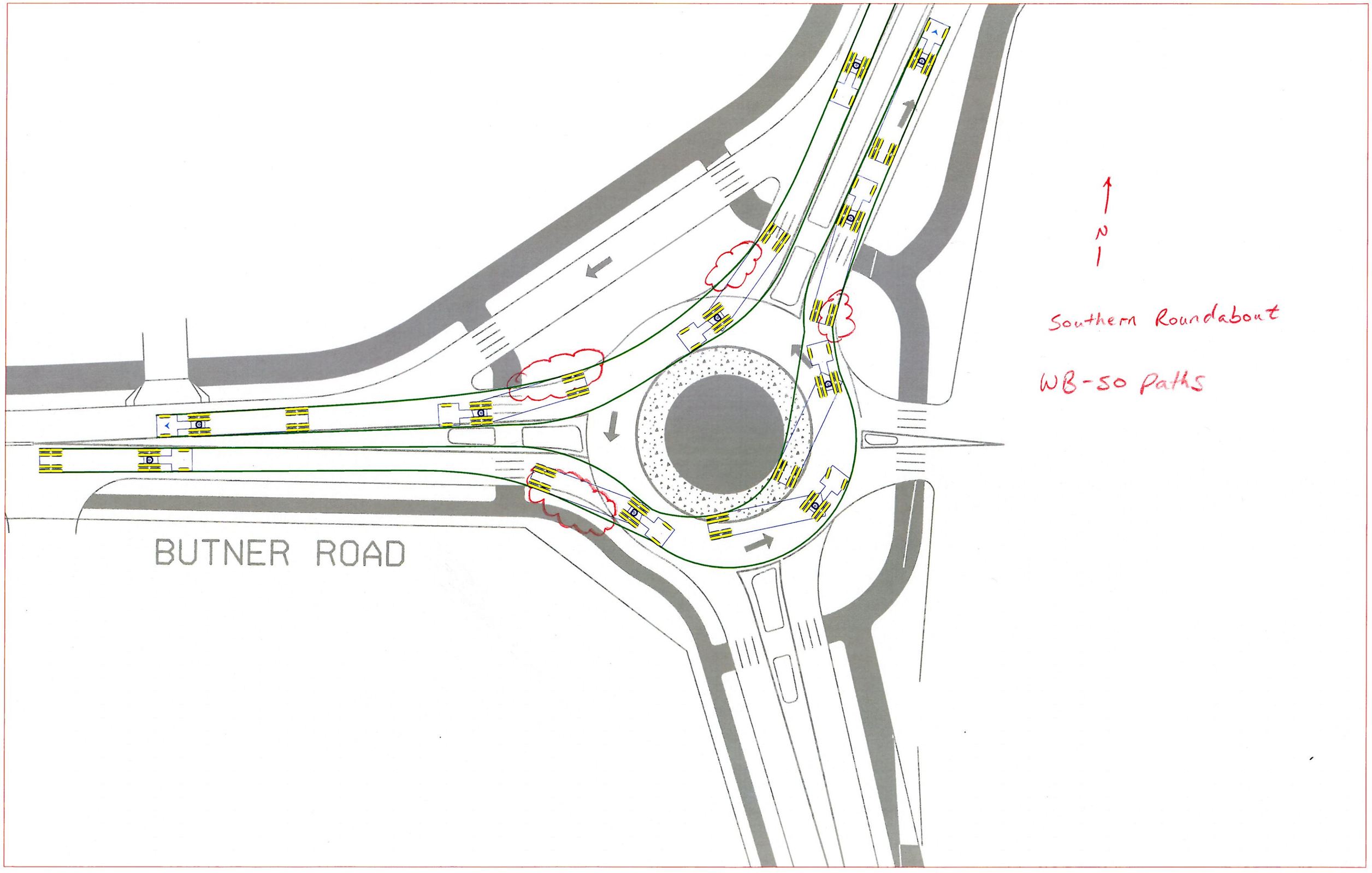


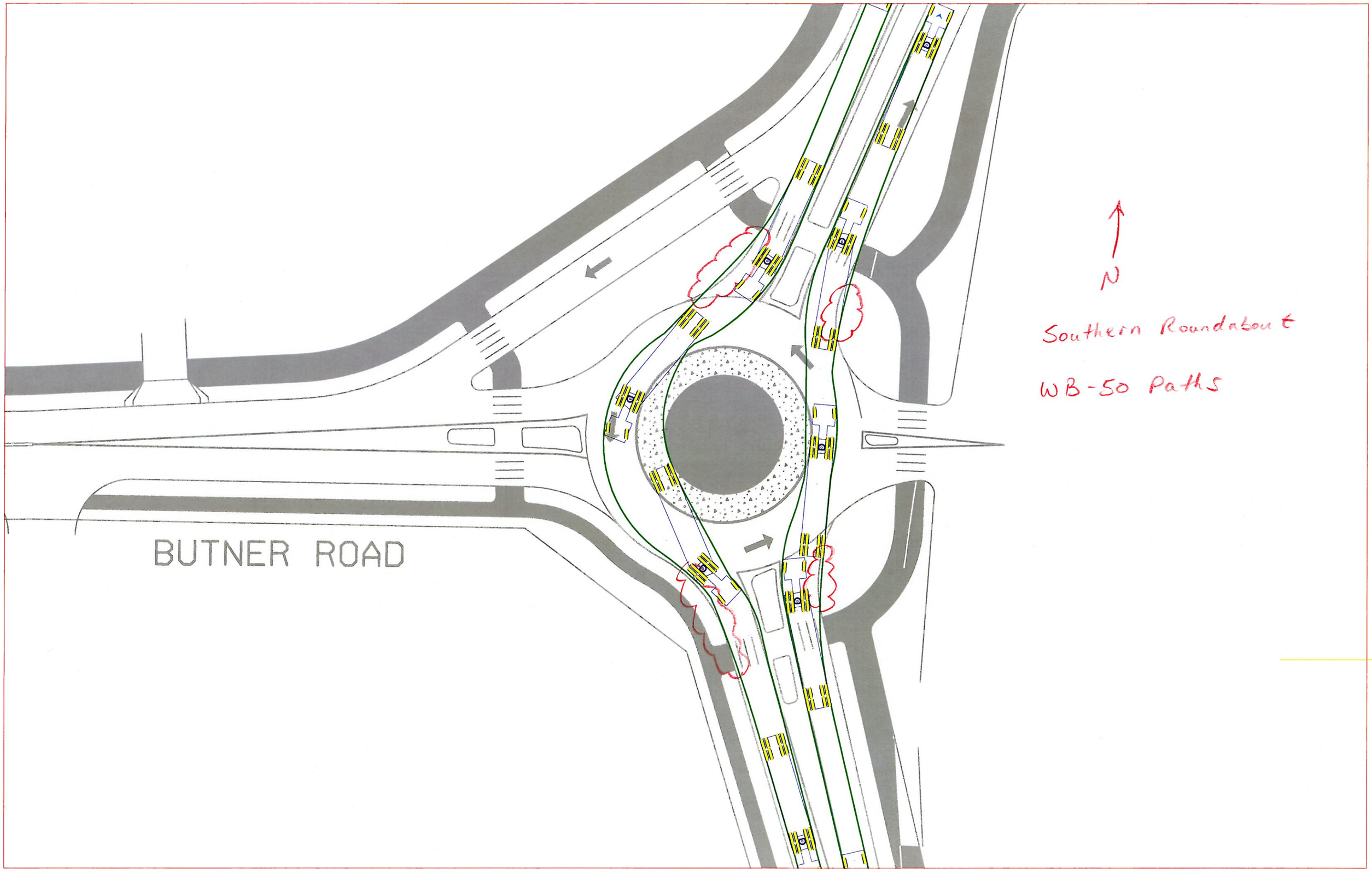
Southern Roundabout

Checked by: JAB
5/11/2011

FASTEST PATHS


STONEWALL TELL ROAD
BUTNER ROAD
SCALE IN FEET
0
50
100
200
R1=125'
V=22mph
R=115'
V=22 mph
R1=100'
V=21 mph
R=90
R=40
R=75'
V=18 mph
R=100'
V=21mph
R=100'
V=21mph
Northern Roundabout
FASTEST PATHS
Checked by: JAB
5/11/2011


BUTNER ROAD
N
Southern Roundabout
WB-50 Paths


BUTNER ROAD
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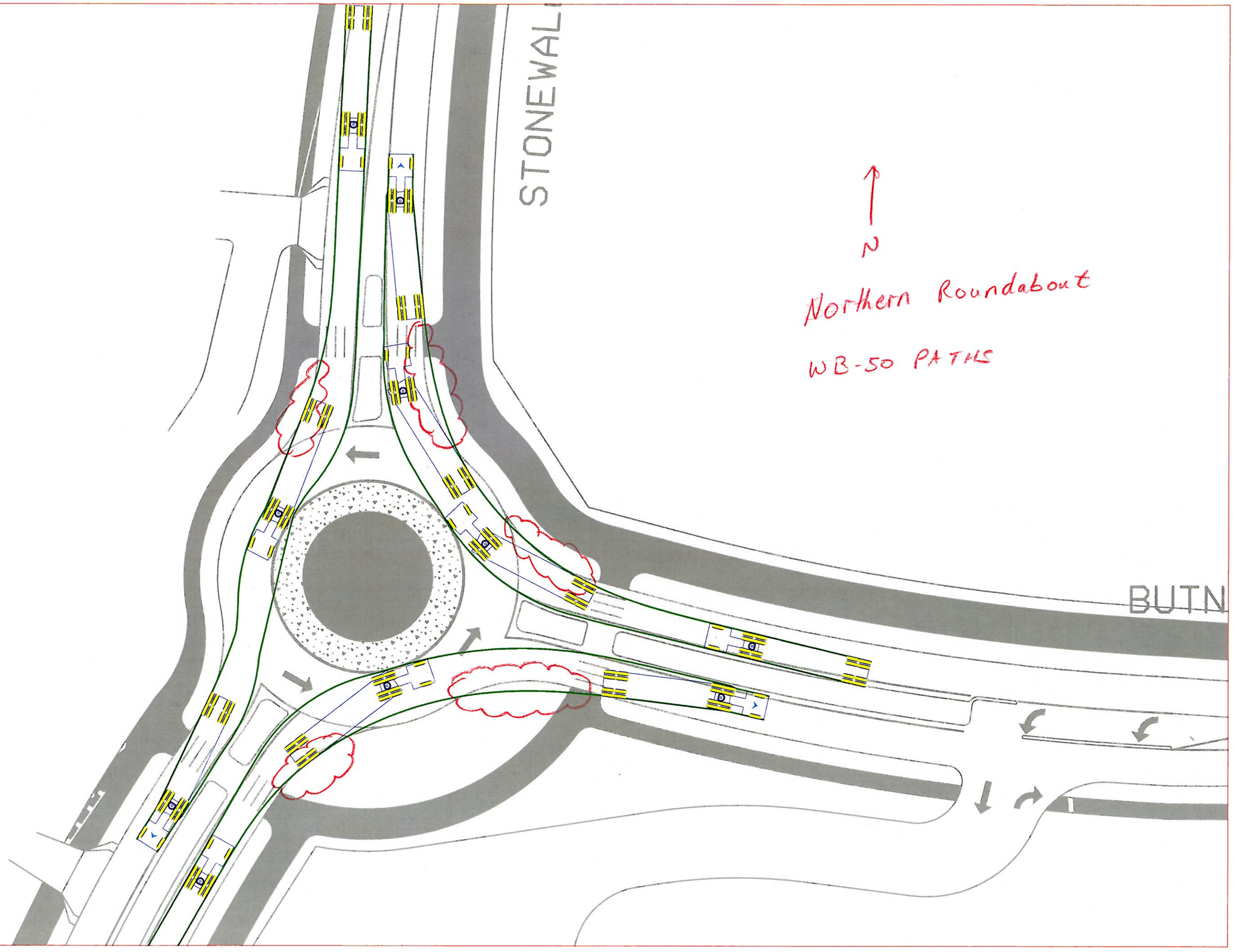
Southern Roundabout
WB-50 Paths



Northern Roundabout

WB-50 PATHS

F|R|A
A T·Y·LIN INTERNATIONAL COMPANY
404 841 7886
FAX: 404 841 7887
260 Peachtree Street, Suite 900
Atlanta, GA 30303-1237

MEETING MINUTES

MEETING TITLE	T242 Butner Road at Stonewall Tell Road Intersection Improvements	
DATE AND TIME	March 26, 2010 1:00 p.m.	
ATTENDEES	Antonio Valenzuela	Fulton County Public Works
	Bryan Lindsey	TYLIN
	Teresa Epple	SEI
	Mike Lobdell	GDOT
	Daniel Gethi	GDOT
	Gerald Ford	GDOT
ORGANIZED BY	Bryan Lindsey, TYLIN	

Discussion

- Overall concepts discussed with each alternative being discussed individually.
- The public meetings were discussed.
- The public did not like the three alternatives presented and wanted a different alternative.
- Fulton County wanted public sign-off for the Sandtown area.
- Commissioner is very sensitive to their input.
- The idea of providing two roundabouts was discussed. This alternative will be worked on and represented to the leadership of the Sandtown Community
- We discussed what type of traffic results would be needed for GDOT to be satisfied
- Schedule was discussed, it was determined that a revised schedule would be submitted.

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Atlanta, GA 30303-1237

MEETING MINUTES

MEETING TITLE	T242 Butner Road at Stonewall Tell Road Intersection Improvements	
DATE AND TIME	November 9, 2010 10:00 a.m.	
ATTENDEES	Antonio Valenzuela	Fulton County Public Works
	Bryan Lindsey	TYLIN
	Teresa Epple	SEI
	Mike Lobdell	GDOT
	Daniel Gethi	GDOT
	Gerald Ford	GDOT
ORGANIZED BY	Bryan Lindsey, TYLIN	

Discussion

- Overall concepts discussed with each alternative being discussed individually.
- It was determined that alternative 5c was the best alternative and public would prefer this option as well.
- Schedule was discussed, it was determined that a revised schedule would submitted
- GDOT would need a lighting commitment letter from Fulton County.
- Concept to be submitted in March of 2011

Department of Public Works
141 Pryor Street S. W., Suite 6001
Atlanta, Georgia 30303
Telephone: 404-612-8102
Fax: 404-730-6325

FULTON COUNTY

Angela Parker
Director

April 26, 2011

Brent A. Story, P.E.
Georgia Department of Transportation
One Georgia Center
600 West Peachtree Street, NW
Atlanta, Georgia 30308

RE: Lighting required for roundabout intersection project
GDOT Project: CSHPP-0007-00(533) P. I. No. 0007533 Fulton County
Butner Road at Stonewall Tell Road

Dear Mr. Story:

The above-referenced project is now in the Concept stage according the Georgia Department of Transportation (GDOT) Plan Development Process. For this project, roundabout lighting is both a necessary design component and requirement. The warranting conditions for lighting, based on the illuminating Engineering Society of North America (IESNA) and American Association of State Highway and Transportation Officials (AASHTO) guidelines would be met.

At this time, the GDOT is requesting a written commitment from the County. Fulton County is willing to share in the costs of the lighting by funding the Energy, Operation and Maintenance of the installed Lighting system along county roads. The GDOT's responsibility shall be the design and construction costs, including all materials.

Sincerely yours,

Angela Parker

Cc: Scott A. MacLean

T·Y·LIN INTERNATIONAL
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ATLANTA, GEORGIA 30303
PHONE: (404) 841-7886 FAX: (404) 841-7887

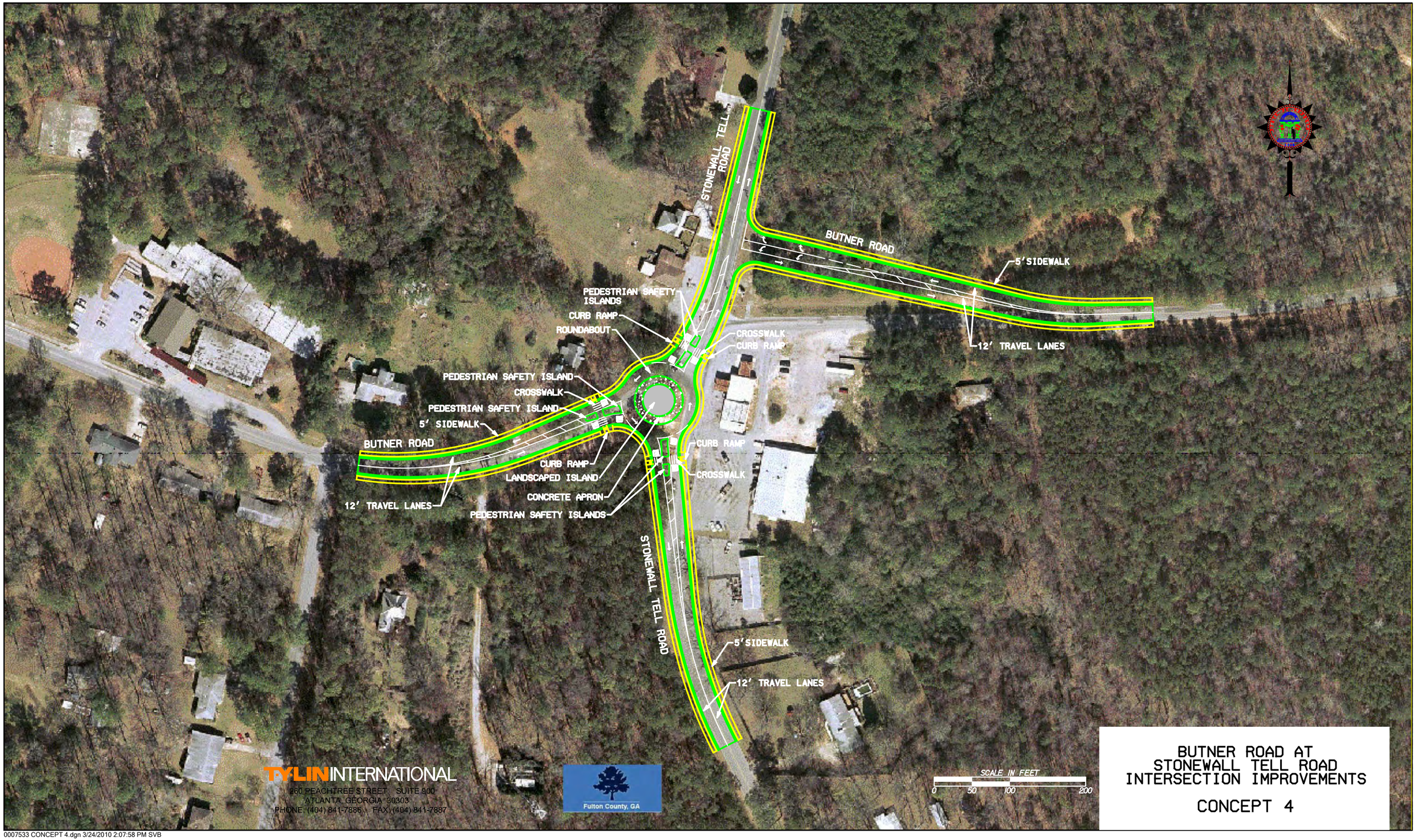
BUTNER ROAD AT
STONEWALL TELL ROAD
INTERSECTION IMPROVEMENTS

CONCEPT 1

BUTNER ROAD AT
STONEWALL TELL ROAD
INTERSECTION IMPROVEMENTS

CONCEPT 3

0007533 CONCEPT 3A.dgn 10/6/2010 2:29:55 PM BPL



BUTNER ROAD AT
STONEWALL TELL ROAD
INTERSECTION IMPROVEMENTS

CONCEPT 4

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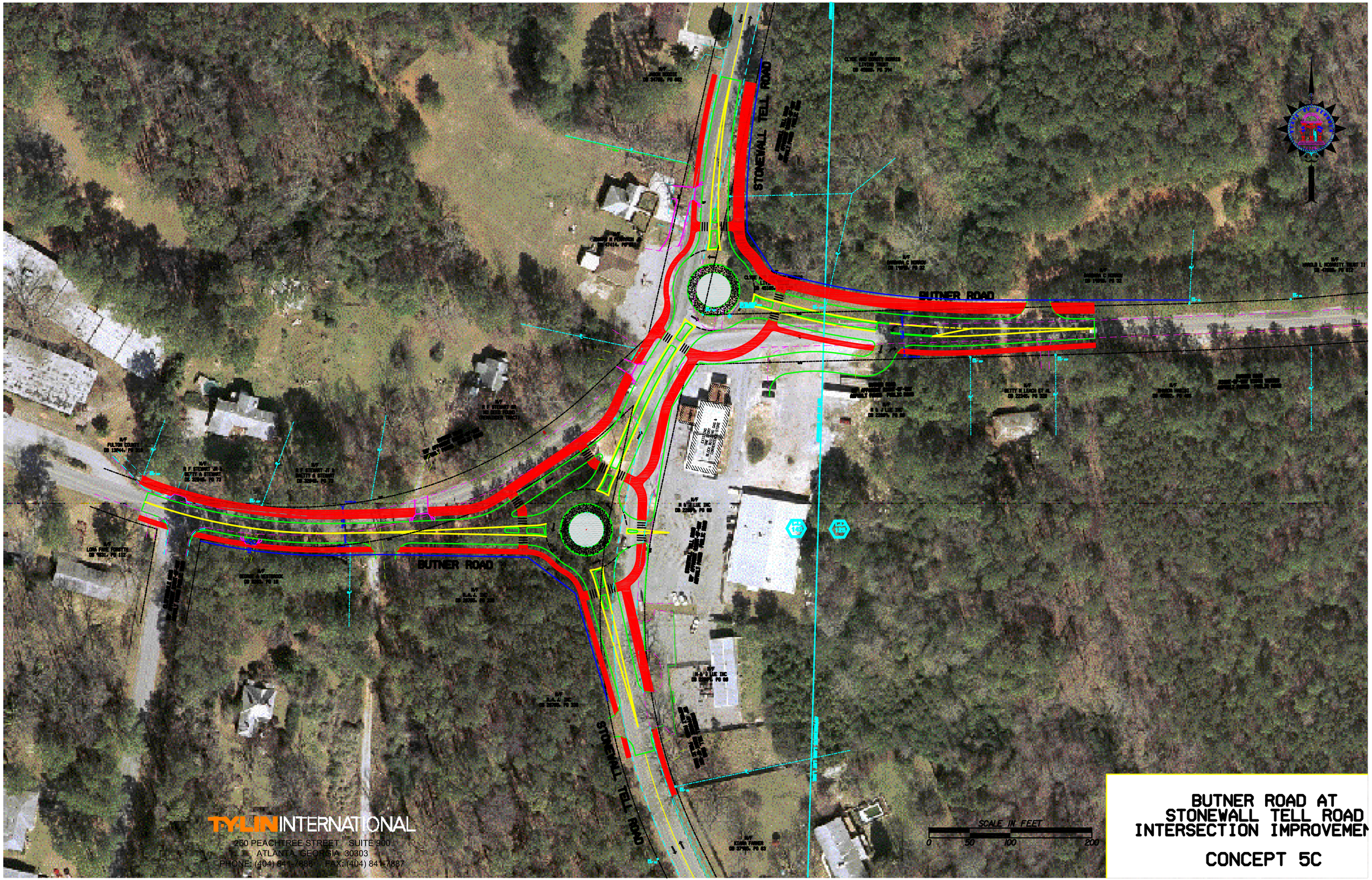

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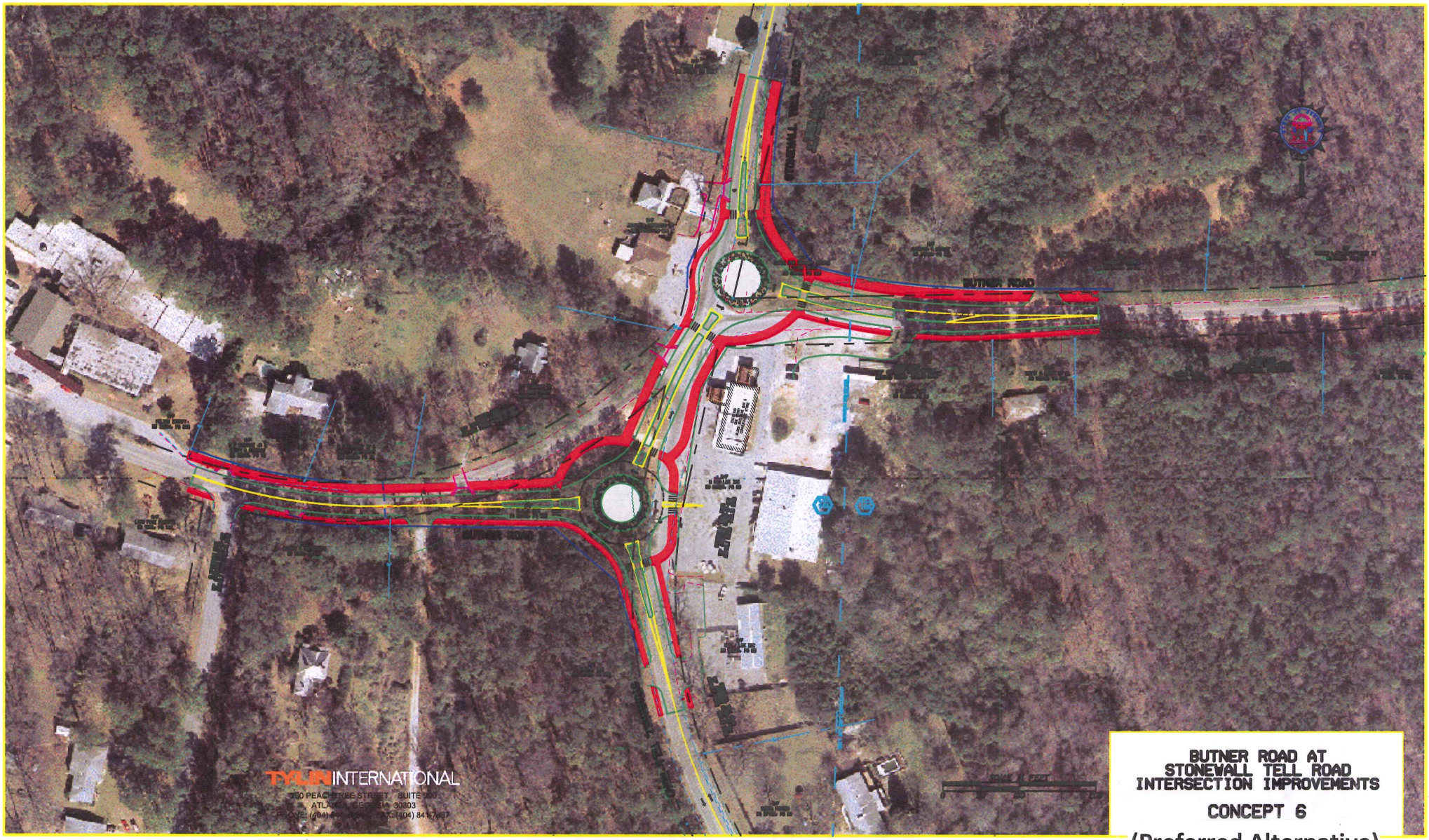
BUTNER ROAD AT
STONEWALL TELL ROAD
INTERSECTION IMPROVEMEN

CONCEPT 5C



BUTNER ROAD AT STONEWALL TELL ROAD INTERSECTION IMPROVEMENTS

CONCEPT 6

(Preferred Alternative)

SOUTHEASTERN ENGINEERING, INC.

CIVIL & TRANSPORTATION ENGINEERING, LAND SURVEYING AND PLANNING

TRAFFIC STUDY
BUTNER ROAD & STONEWALL TELL ROAD
FULTON COUNTY, GA
GDOT PI # 0007533

Prepared By:
Southeastern Engineering Inc.
2470 Sandy Plains Road
Marietta, GA 30066
770-321-3936
www.seengineering.com

Prepared For:

TY-LIN INTERNATIONAL

August 22, 2011

Butner Road & Stonewall Tell Road Traffic Study Fulton County, Georgia

For:

TY-LIN INTERNATIONAL

PI # 0007533

Prepared by:

SOUTHEASTERN ENGINEERING, INC.

August 22, 2011

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I. INTRODUCTION

A traffic study has been conducted for the proposed improvement project for the intersection of Butner Rd and Stonewall Tell Rd. The purpose of the traffic study is to evaluate possible improvement alternatives and to determine the best alternative for improvements to traffic safety and operations. The report includes analyses of capacity and level of service, Roundabout, safety and signal warrants for the existing all-way stop controlled intersection of Butner Road and Stonewall Tell Road in Fulton County, Georgia as seen in **Figure 1** – Vicinity Map.

The existing intersection is geometrically challenged. Currently, Butner Road intersects Stonewall Tell Road at a severe skew and with a significant offset in alignment of the east and westbound approaches of Butner Road. The gas stations on the southeast and northwest corners have no defined access points which allows vehicles to enter and exiting mid-intersection. Given these existing geometric conditions, traversing the intersection safely and efficiently is a challenge.

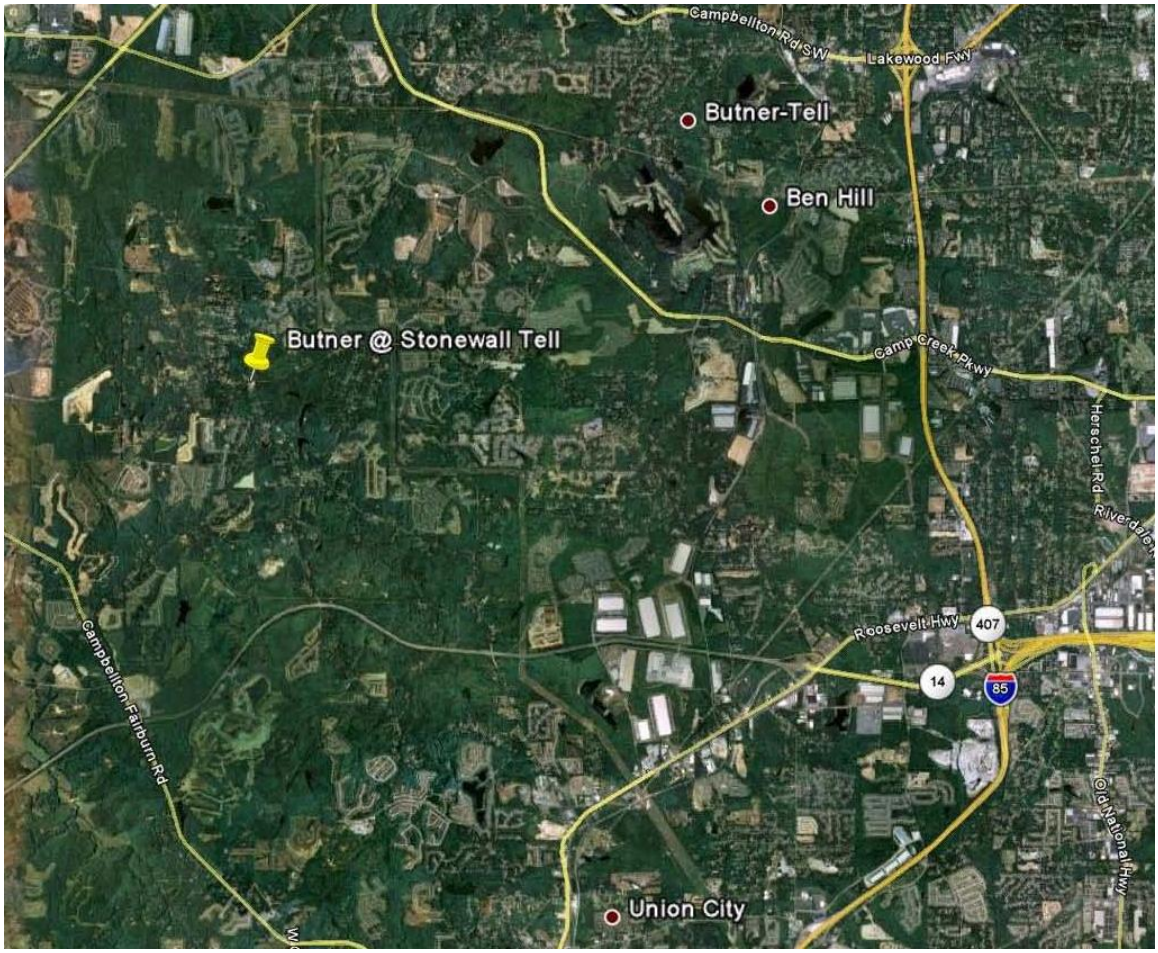
The project purpose is to improve the traffic and safety operations of the intersection as well as the geometric design of the existing intersection. These improvements were based on an evaluation of possible traffic signalization, exclusive turn lanes, Roundabout potential, realignment of approaches, pedestrian facilities, ADA requirements, lighting, curb and gutter, shoulders, access management and improved drainage.

The improvement project is federally funded with a 20% local jurisdiction funds match. The Georgia Department of Transportation (GDOT) P.I. Number is 007533. The project requires coordination with GDOT, Fulton County and local utilities. The traffic study and all facets of this project must follow the GDOT Plan Development Process (PDP).

The Butner Road and Stonewall Tell traffic study includes:

- Conducting a preliminary site investigation to gather the existing conditions
- Documenting and Projecting existing, build and design year traffic volumes
- Performing capacity analyses to determine the existing and future Levels of Service (LOS) of all improvement alternatives
- Evaluating Traffic Signal and Roundabout Warrants
- Providing Conclusions and Recommendations

Figure 1
VICINITY MAP



II. EXISTING CONDITIONS

The study area encompasses the existing all-way stop controlled intersection and all four approaches of Butner Road and Stonewall Tell Road. Pedestrian facilities are not present in terms of sidewalks and crosswalks at the study intersection and there are currently no transit facilities located on Butner Road and Stonewall Tell Road within the study area. Descriptions of the roadways are as follows:

Roadway Conditions

Butner Road is a two-lane roadway. According to GDOT Highway System Status Maps, Butner Road is functionally classified as an Urban Minor Arterial Street. Butner Road intersects Stonewall Tell Rd at a severe skew and offset. Butner Road travels in east-west direction with a posted speed limit of 45 mph. Average Daily Traffic counts were collected on Butner Road in November of 2009 with a recorded two-way volume of 5,762 vpd east of Stonewall Tell Road and 3,261 vpd west of Stonewall Tell Road. The land uses along Butner Road are majorly residential with a commercial node at the intersection Stonewall Tell Road.

Stonewall Tell Road is a two-lane roadway. According to GDOT Highway System Status Maps, Stonewall Tell Road is functionally classified as an Urban Minor Arterial Street. Stonewall Tell Road travels in a north-south direction with a posted speed limit of 40 mph. Average Daily Traffic counts were collected on Stonewall Tell Road in November of 2009 with a recorded two-way volume of 5,588 vpd north and 2,901 vpd south of Butner Road. The land uses along Stonewall Tell Road are majorly residential with a commercial node at the intersection with Butner Road .

Stonewall Tell Elementary School is located approximately 1 mile north of the study intersection. Stonewall Tell Elementary has approximately 1,050 students and 75 Faculty and Staff Members. Due to the close proximity of the school to the study intersection, additional traffic counts were taken during the peak school hours.

Existing Traffic Volumes

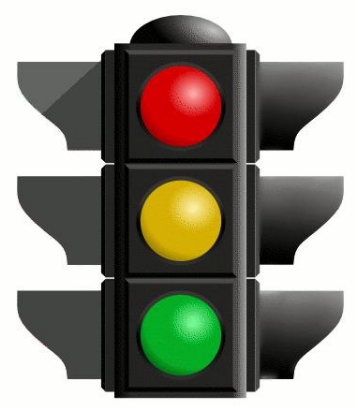
Traffic volumes were collected on Butner Rd and Stonewall Tell Rd approaching the intersection for a 24 hour period on November 2009. Turning movement counts were also collected at the intersection during the am, school and pm peak hours. Georgia Department of Transportation (GDOT) Office of Planning provided approval to use the 2009 traffic volumes as 2011 existing traffic volumes as growth remained flat because of recession. The AM, PM, Average Daily Traffic and School peak hour volumes for the study intersection are shown in the **figures 2 through 4**. Traffic count data is provided in **Appendix A**.

Level of Service Criteria

The capacity analyses were conducted using projected weekday peak hour volumes as discussed above. Capacity analyses were conducted using *Synchro* version 7.0 software. *Synchro* documents procedures to determine the Levels of Service (LOS) ranging from "A", the best, to "F", the worst, for intersections. An intersection's LOS is based upon the delay per vehicle for various movements within the intersection. Delay is a measure of quality of service to the road user.

Signalized intersections' analyses include calculating the amount of control delay experienced by vehicles based upon the capacity of each approach and the volume of traffic being served (v/c ratio). Once the delay per vehicle is determined each intersection is classified by its' LOS. Below is a description of each LOS category:

LOS A describes operations with very low control delay, up to 10 seconds per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.



LOS B describes operation with control delay greater than 10 and up to 20 seconds per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than those with LOS A, causing higher levels of average delay.

LOS C describes operations with control delay greater than 20 and up to 35 seconds of delay per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with control delay greater than 35 and up to 55 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with control delay greater than 55 and up to 80 seconds per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.

LOS F describes operations with control delay in excess of 80 seconds per vehicle. This level, considered to be unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors to such delay levels.

The LOS for a two-way, stop-controlled (TWSC) intersection is determined by the computed control delay and is defined for each minor movement. The LOS criteria for un-signalized intersections are shown in **Table 1**.

Table 1
Un-signalized Intersection Level of Service Criteria

LOS	Delay Range (seconds/vehicle)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Note: The levels of service for un-signalized intersections are based upon the ability of left turns to find acceptable gaps. A failing approach does not indicate an unacceptable LOS for the intersection as a whole.

Figure 2
Existing Year 2011 Peak Hour Volumes

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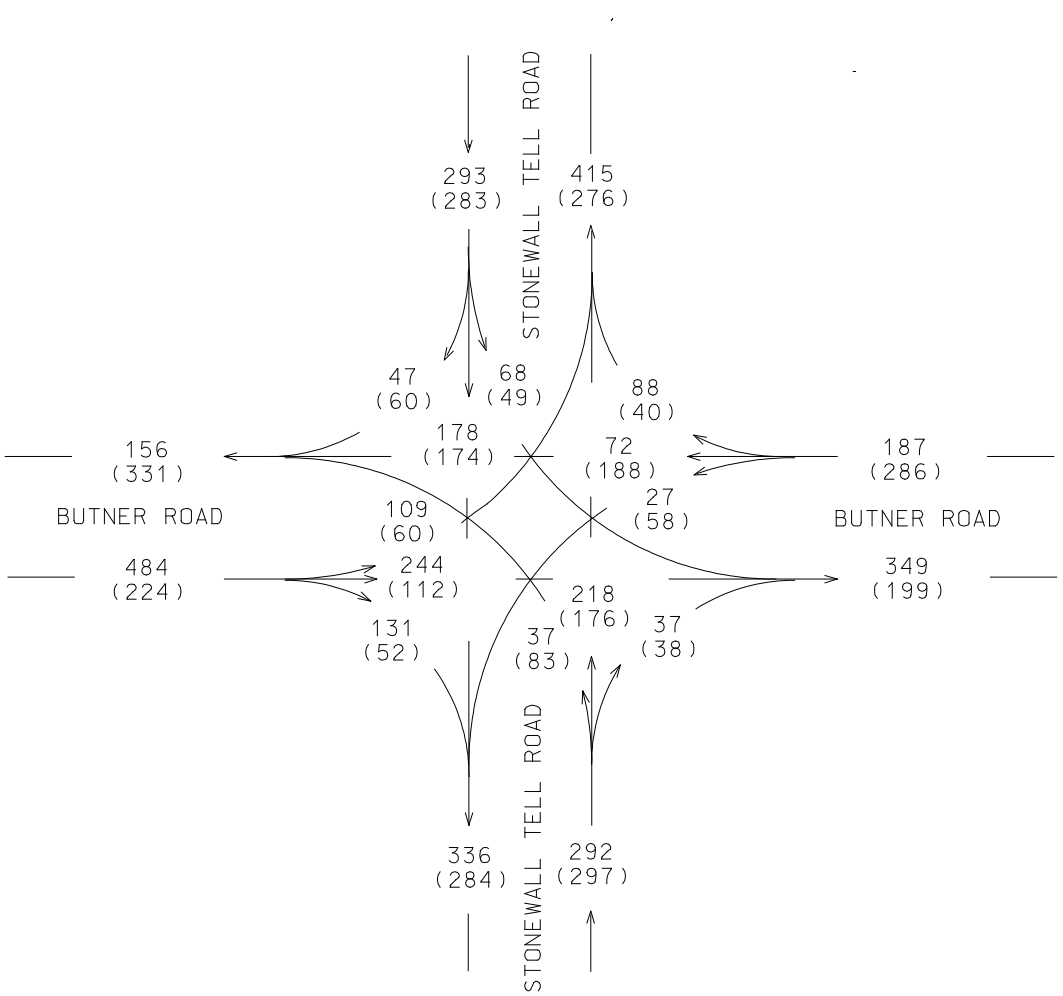

N

FULTON COUNTY

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FULTON COUNTY
P. I. NO. 0007533
BUTNER RD @
STONEWALL
TELL RD

2011 EXISTING DHV
AM PEAK = 000
PM PEAK = (000)

T = 2%

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Figure 3
Existing Year 2011 Average Daily Traffic

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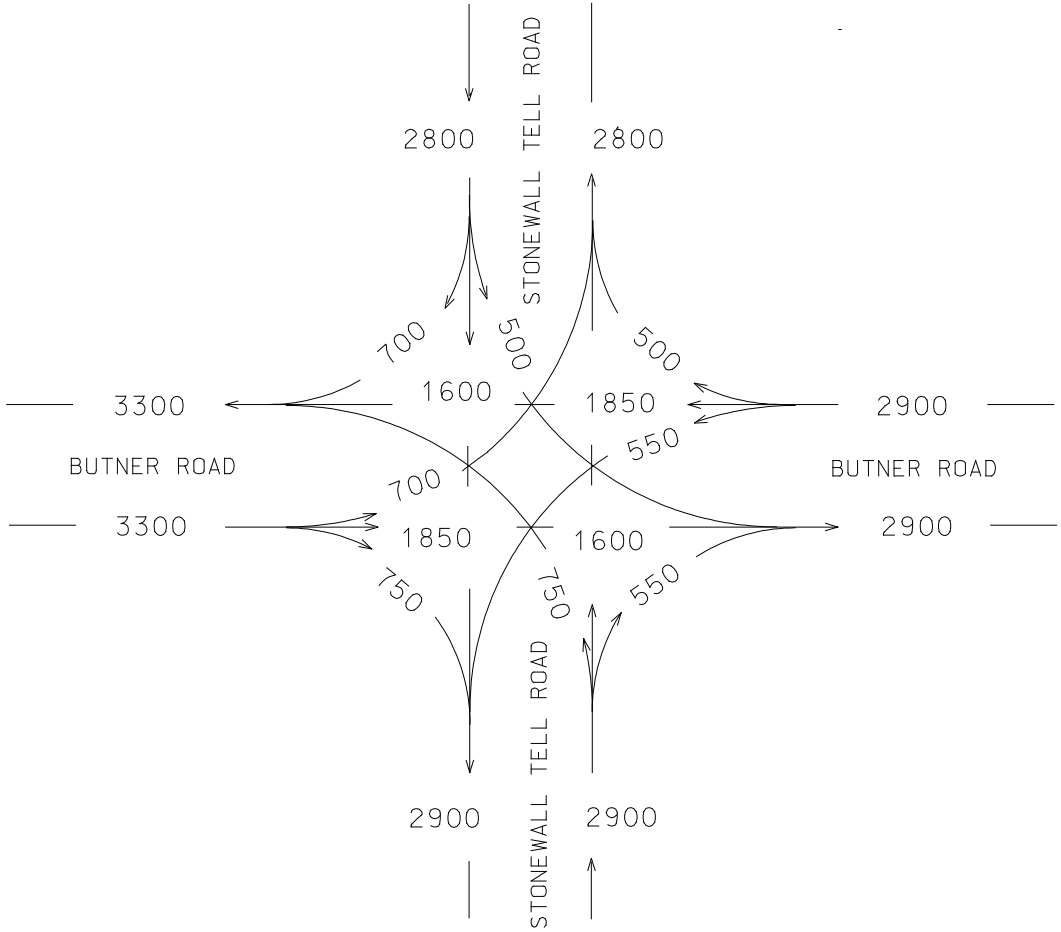

N

FULTON COUNTY

CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533

BUTNER RD @
STONEWALL
TELL RD

2011 EXISTING ADT

T = 2%
S.U. = 1.5%
COMB. = 0.5%

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Figure 4
Existing Year 2011 School Peak Hour Volumes

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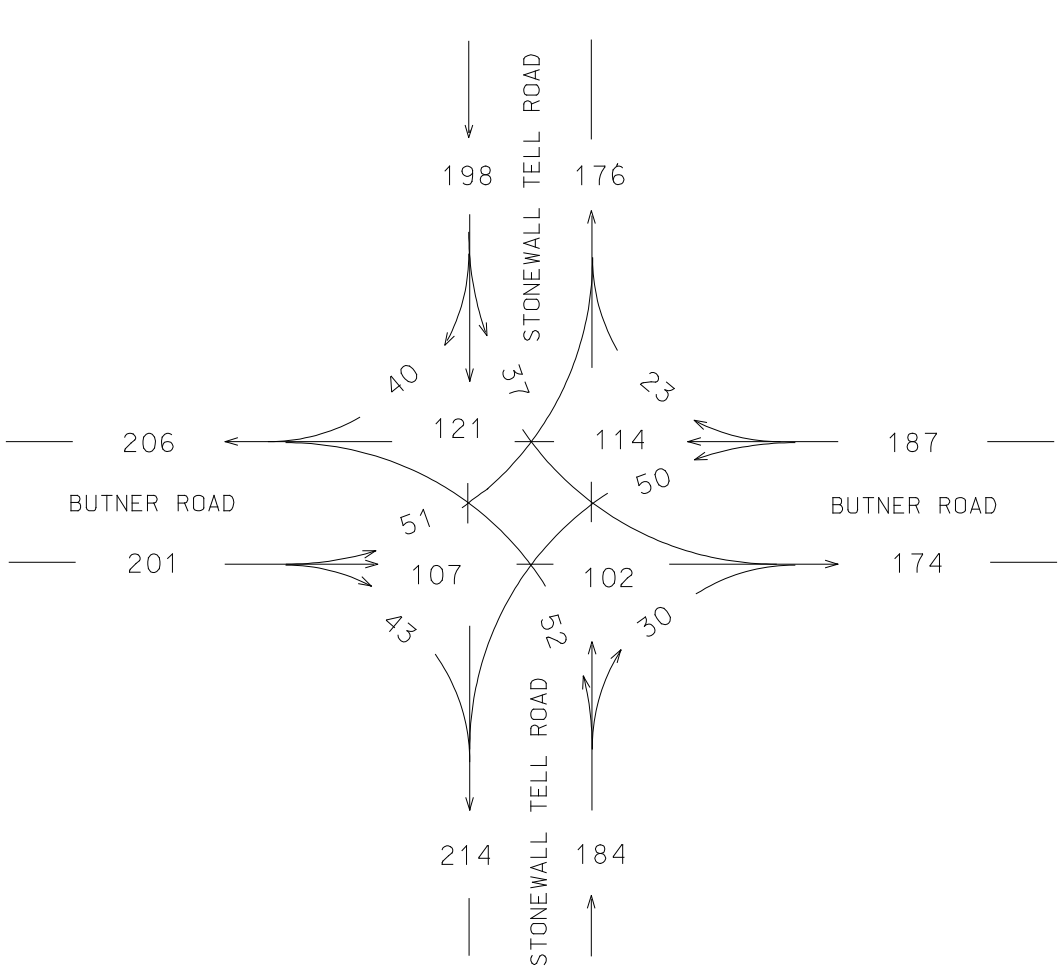

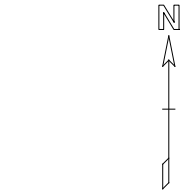

FULTON COUNTY

CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533

BUTNER RD @
STONEWALL
TELL RD

2011 EXISTING
SCHOOL DHV

T = 2%
S.U. = 1.5%
COMB. = 0.5%

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Existing Level of Service

Capacity analysis was conducted for existing AM, School and PM peak hour traffic conditions during the hours of 7:00am to 9:00am and 2:00pm to 6:00pm. **Table 2** shows the existing LOS, delays and v/c ratios of the study intersection.

Table 2
2011 Existing Intersection Level of Service (LOS) and Delay, sec with V/C ratio

Intersection	Traffic Control	Approach	AM Peak Hour		School Peak Hour		PM Peak Hour	
			LOS(Delay)	V/C	LOS (Delay)	V/C	LOS (Delay)	V/C
Butner Road and Stonewall Tell Road	Un-Signalized	North	D (33.9)	1.28	B (12.1)	0.41	C (23.8)	0.68
		South	F (67.3)		B (12.5)		C (22.2)	
		East	F (165.2)		B (12.6)		C (18.1)	
		West	C (23.5)		B (12.4)		C (24.0)	

Crash History

Accident data for the study intersection for years 2007, 2008, 2009 and 2010 was obtained from Georgia Department of Transportation and is summarized in the table below. The study intersection had 14 accidents from 2007 to 2010 with 36% being angle collisions and 29% being not a collision with a motor vehicle. These types of collisions are 65% of total collisions. **Table 3** summarizes the accident types at the study intersection. Accident details are included in **Appendix C**.

Table 3: Crash History Summary

Year	Crashes by Collision Type					Totals		
	Rear-End	Angle	Head-On	Sideswipe	Other Non-Collision	Crashes	Injury	Fatal
2007	0	0	0	0	2	2	0	0
2008	1	1	0	0	2	4	2	0
2009	0	2	0	1	0	3	1	0
2010	1	2	2	0	0	5	1	0
Percentage	14%	36%	14%	7%	29%	100%		
Total	**2**	**5**	**2**	**1**	**4**	**14**	**4**	**0**

Source: SEI, Inc., Georgia Department of Transportation

Sight Distance

Intersection sight distance is the sight distance needed for driver decisions at a complex location, such entering and crossing an intersection. Intersection sight distance values are substantially greater than those of stopping sight distance.

As seen in the photo above Butner Road intersects Stonewall Tell Road from the west with an angle greater than that desired by GDOT and AASHTO. The proposed intersection must meet current GDOT and AASHTO guideline requirements for entering sight distance.

III. FUTURE TRAFFIC VOLUMES

Based on historical traffic data and Fulton County Transportation plans for develop in the area, future traffic projections were estimated. The traffic volumes in the area have decreased significantly in the most recent three years by approximately 10%. Traffic volumes are expected to rebound somewhat, however, long term growth is not expected to increase significantly over the next twenty years. The improvements are expected to be implemented by 2014 and the design year for study purposes is 2034. There are no future projects planned in the area that should affect the projected traffic volumes.

Future Background Traffic Volumes

Based on historic Annual Average Daily Traffic (AADT), current traffic volumes and expected future growth for the area, a 1% traffic growth rate was used to project the existing background volumes to the build-out year 2014. Based on the expected slow growth and planned development in the area, a 0.5% traffic growth rate was used to project the existing background volumes to the design year of 2034. GDOT approved traffic flow diagram sheets are provided in **Appendix B**.

Future Level of Service

The intersection is expected to continue to operate at unacceptable levels of service in the future build year and the future design year under the existing conditions.

IV. IMPROVEMENT ALTERNATIVES

The intersection is currently operating at an unacceptable level of service, LOS F during the am and pm peak hours. Also, the current geometric configuration of the intersection does not meet current standards. Based on the current traffic and geometric conditions, several design alternatives were considered to enhance the traffic safety and operations at the study intersection. Traffic signal control, Roundabout configurations and realigned intersection configurations were evaluated to determine potential alternatives for improving the traffic operations at the intersection. The alternatives were compared and ranked based on the improvement to the traffic operations of the intersection.

Signal Warrant Analysis (Alternative #1)

A traffic signal warrant investigation must be conducted to determine whether the installation of a traffic control signal is justified at a particular location. The Manual on Uniform Traffic Control Devices (MUTCD) 2003 Edition, explains the methodology for conducting an investigation. The MUTCD describes eight warrants that may be considered and four of them are applicable to our investigations. The Signal Warrant analysis for Butner Road and Stonewall Tell Road was based on the existing ADT volumes 100% right turn reductions.
Warrant 1 – Eight-Hour Vehicular Volume

The Minimum Vehicular Volume, Condition A, is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

The Interruption of Continuous Traffic, Condition B, is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Warrant 1 – Eight Hour Vehicular Volumes
Warrant 1 is met if the requirements for Condition A or Condition B are fulfilled for any eight hours of an average day or if a Combination of Warrants, 100% of Condition A and 100% of Condition B, is fulfilled for any eight hours of an average day.

Warrant 2 – Four Hour Vehicular Volume
The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. Warrant 2 is met if the requirements are met for any four hours of an average day.

Warrant 3 – Peak Hour
The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. This signal warrant shall be applied only in unusual cases. Such cases include, but are not limited to, office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

Warrant 7 – Crash Experience

The crash experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. The need for a traffic control signal shall be considered if the engineering study finds that all of the standard criteria detailed in the MUTCD Section 4C.08 Warrant 7, Crash Experience are met.

A signal warrant study was performed at the proposed intersection of Butner Road and Stonewall Tell Road to determine if a traffic signal is warranted at the intersection in its proposed condition. An analysis on the need for a traffic signal based on the traffic signal warrants found in the MUTCD for the intersections was made using the 2007 version of PC-Warrants. This software compares traffic volumes and accident experience at an intersection with the traffic signal warrant thresholds detailed in the MUTCD.

The intersection was evaluated for the existing conditions based on existing volumes and traffic conditions. The build year 2014 and the future design year 2034 signal warrant analyses were based the future traffic volumes projected as part of this study and the proposed improvements needed for the intersection.

The summary of the signal warrant analyses is listed below in **Table 4**, and the detailed analysis is provided in the appendix of this write-up.

Table 4
Signal Warrant Analysis Summary

	Warrant 1	Warrant 2	Warrant 3	Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8
2011	Not Satisfied	Not Satisfied	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Satisfied	Not Evaluated
2014	Not Satisfied	Not Satisfied	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Satisfied	Not Evaluated
2034	Not Satisfied	Not Satisfied	Not Evaluated	Not Evaluated	Not Evaluated	Not Evaluated	Not Satisfied	Not Evaluated

The results show that the intersection of Butner Road and Stonewall Tell Road currently does not meet any warrants and a traffic signal is not justified. Also, the future traffic volumes and proposed conditions are not expected to meet any warrants to justify the installation of a traffic signal. Therefore a signal would not be considered by GDOT as an improvement alternative until the traffic volumes are present or nearly meet the volume thresholds at the intersection to justify a signal. Signal Warrant Analyses are provided in **Appendix D.**

Roundabout Analysis (Alternative #2)

A modern Roundabout is a type of circulatory roadway in which all traffic flows counter-clockwise around a central island. The Georgia Department of Transportation (GDOT) recognizes that the Roundabout is a viable intersection alternative when placed in the appropriate location, and designed properly for the local conditions. Research has shown that Roundabouts are significantly safer than traffic signals in certain conditions and will eliminate the ongoing cost for maintaining the traffic signals. Roundabouts have also been proven to provide improved capacity and safety over all-way stops.

Roundabouts are the preferred safety and operational alternative for a wide range of intersections of public roads. A Roundabout shall be considered as an alternative in the following instances:

- Any intersection in a project that is being designed as new or is being reconstructed.
- All existing intersections that have been identified as needing major safety or operational improvements.
- All signal requests at intersections (provide justification in the Traffic Engineering Study if a Roundabout is not selected).

Table 5 shows the expected results of implementing a four approach single lane Roundabout at the study intersection as an improvement alternative using the more appropriate UK Model for the design years. The output from the Roundabout analysis tool is included in the appendix.

Table 5
Roundabout Analysis Results Summary – 4 Approach

2014	AM				PM			
	N	E	S	W	N	E	S	W
Entry Capacity, pcu/h	1114	906	901	1054	1011	1004	1066	1037
Leg v/c ratio	.30	.25	.52	.64	.33	.31	.33	.26
Delay (s/veh)	5	5	8	9	5	5	5	5
LOS	A	A	A	A	A	A	A	A
95% Queue (ft)	41	25	79	124	36	34	37	27
2034	**AM**				**PM**			
	N	E	S	W	N	E	S	W
Entry Capacity, pcu/h	1110	873	873	1024	991	986	1054	1017
Leg v/c ratio	.33	.29	.60	.72	.37	.36	.37	.29
Delay (s/veh)	5	6	10	12	6	6	5	5
LOS	A	A	B	B	A	A	A	A
95% Queue (ft)	37	31	106	165	43	42	43	30

T - Intersections with Left Turn Lanes (Alternative #3)

The realignment of the eastbound and westbound approaches of Butner Road at Stonewall Tell Road was also considered as an improvement alternative for this project. In this alternative Stonewall Tell Road would be opened up to a free-flow thru roadway with two T-Intersections.

Left turns were evaluated at the proposed study intersection. GDOT and AASHTO both have set a maximum allowance for left turns without an exclusive left turn lane having to be constructed. The minimum requirements are based on design configuration, daily traffic volumes and speed limits of the roadway. Based on the configuration, speed limits and projected traffic volumes. All approaches to the study intersection exceed the maximum number of allowable left turns before full construction of a left turn lane is required.

Table 6 summarizes the projected intersection LOS, delays and v/c ratios for T-Intersections with left turn lanes if chosen as the improvement alternative.

Table 6
Future Level of Service (LOS) and Delay, sec with V/C ratio

Intersection	Traffic Control	Movement	AM Peak Hour		PM Peak Hour	
			LOS (Delay)	V/C	LOS (Delay)	V/C
2014						
Butner Road and Stonewall Tell Road (Northern Intersection)	Un-Signalized	Southbound LT	A(9.4)	.09	A (8.4)	.05
		Westbound LT	C (21.3)	.43	E (36.6)	.77
Butner Road and Stonewall Tell Road (South Intersection)	Un-Signalized	Northbound LT	A (8.1)	.04	A (8.9)	.10
		Eastbound LT	F (81.2)	1.05	D (31.6)	.66
2034						
Butner Road and Stonewall Tell Road (Northern Intersection)	Un-Signalized	Southbound LT	A (9.7)	.10	A (8.6)	.06
		Westbound LT	D (27.2)	.57	F (71.2)	.96
Butner Road and Stonewall Tell Road (South Intersection)	Un-Signalized	Northbound LT	A (8.3)	.04	A (9.1)	.11
		Eastbound LT	F (230.6)	1.40	F (65.9)	.85

Note: The levels of service for un-signalized intersections are based upon the ability of left turns to find acceptable gaps.

As seen in **Table 6,** the capacity analysis results show that the T-Intersection alternative yields unacceptable levels of service and/or volume to capacity ratios for the study intersection through the year 2034. The westbound approach of the northern intersection is operating below capacity in 2034; however, the left turn movement experiences an unacceptable level of service, LOS F. Capacity analysis results are provided in **Appendix F** of this report.

Dual Roundabouts (Alternative #4)

In this alternative, the realignment of the intersections to form two T-Intersections with Roundabouts was considered. **Table 7** shows the expected results of implementing two separate Roundabouts; a three approach single lane Roundabout at the northern intersection and a four approach single lane Roundabouts at the realigned study intersection to the south, respectively. The table shows the results of the realignment to accommodate two separate intersections with Roundabouts as an improvement alternative using the more appropriate UK Model for the future conditions. The output from the Roundabout analysis tool for each Roundabout is included in the appendix.

Table 7 - Dual Roundabouts Roundabout Analysis Results Summary								
Northern Roundabout (3 Approach)								
2014	**AM**				**PM**			
	N	**E**	**S**	**W**	**N**	**E**	**S**	**W**
Entry Capacity, pcu/h	1132	939	1156	n/a	1009	1013	1173	n/a
Leg v/c ratio	.30	.24	.61	n/a	0.33	.33	.39	n/a
Delay (s/veh)	5	5	8	n/a	5	5	5	n/a
LOS	A	A	A	n/a	A	A	A	n/a
95% Queue (ft)	33	23	111	n/a	37	37	47	n/a
2034	**AM**				**PM**			
	N	**E**	**S**	**W**	**N**	**E**	**S**	**W**
Entry Capacity, pcu/h	1120	910	1152	n/a	984	992	1169	n/a
Leg v/c ratio	.34	.27	.67	n/a	.37	.37	.43	n/a
Delay (s/veh)	5	5	9	n/a	6	6	5	n/a
LOS	A	A	A	n/a	A	A	A	n/a
95% Queue (ft)	38	28	141	n/a	44	45	56	n/a
Southern Roundabout (4 Approach)								
2014	**AM**				**PM**			
	N	**E**	**S**	**W**	**N**	**E**	**S**	**W**
Entry Capacity, pcu/h	1175	664	900	1025	1134	808	1052	1005
Leg v/c ratio	.33	.04	.39	.55	.50	.03	.34	.27
Delay (s/veh)	5	6	6	8	6	5	5	5
LOS	A	A	A	A	A	A	A	A
95% Queue (ft)	37	3	47	89	74	3	39	28
2034	**AM**				**PM**			
	N	**E**	**S**	**W**	**N**	**E**	**S**	**W**
Entry Capacity, pcu/h	1171	607	872	1005	1130	771	1040	980
Leg v/c ratio	.35	.04	.44	.62	.56	.04	.38	.30
Delay (s/veh)	5	6	7	9	7	5	6	5
LOS	A	A	A	A	A	A	A	A
95% Queue (ft)	44	4	59	113	91	3	45	32

The results of the analyses show that a Roundabout is warranted in existing and a projected condition since less than 80% of the traffic at the intersection is on the major road (Butner Road). A Roundabout is projected to improve the LOS of the intersection in the future design

year as well. Therefore, two separate Roundabouts is a feasible alternative that would help to improve the LOS in future years. A full summary of the Roundabout analysis is provided in **Appendix E** of this report.

Potential combinations of realigning the study intersection two separate intersections with a TWSC intersection T-intersection paired with a Roundabout at the remaining T-intersection were analyzed for the design year 2034 only.

Northern Roundabout w/ Southern T-Intersection (Alternative #5)

Table 8 - Northern Roundabout (3 Approach)
Roundabout Analysis Results Summary

2034	AM				PM			
	N	E	S	W	N	E	S	W
Entry Capacity, pcu/h	1120	910	1152	n/a	984	992	1169	n/a
Leg v/c ratio	.34	.27	.67	n/a	.37	.37	.43	n/a
Delay (s/veh)	5	5	9	n/a	6	6	5	n/a
LOS	A	A	A	n/a	A	A	A	n/a
95% Queue (ft)	38	28	141	n/a	44	45	56	n/a

2034			AM		PM	
Butner Road and Stonewall Tell Road (South Intersection)	Un-Signalized	Northbound LT	A (8.3)	.04	A (9.1)	.11
		Eastbound LT	F (230.6)	1.40	F (65.9)	.85

Southern Roundabout w/North T-Intersection Stonewall Tell Rd Stop Condition (Alternative #6)

Table 9 - Southern Roundabout (4 Approach)
Roundabout Analysis Results Summary

2034	AM				PM			
	N	E	S	W	N	E	S	W
Entry Capacity, pcu/h	1171	607	872	1005	1130	771	1040	980
Leg v/c ratio	.35	.04	.44	.62	.56	.04	.38	.30
Delay (s/veh)	5	6	7	9	7	5	6	5
LOS	A	A	A	A	A	A	A	A
95% Queue (ft)	44	4	59	113	91	3	45	32

2034			AM		PM	
Butner Road and Stonewall Tell Road (Northern Intersection)	Un-Signalized	Southbound LT	A (9.7)	.10	A (8.6)	.06
		Westbound LT	D (27.2)	.57	F (71.2)	.96

Both of the TWSC intersections with Butner Rd as the stop condition are expected to reach an unacceptable level of service in the future design year. The pairing of a Roundabout and a TWSC intersection was not considered as a feasible improvement alternative.

Roundabout W/South T-Intersection Stonewall Tell Rd Stop Condition (Alternative #7)

A final alternative, with a Roundabout at the northern intersection and a TWSC T-Intersection with Stonewall Tell Rd as the stop condition, was considered. The results are shown in the table below.

Table 10 - Northern Roundabout (3 Approach)
Roundabout Analysis Results Summary

2034	AM				PM			
	N	E	S	W	N	E	S	W
Entry Capacity, pcu/h	1120	910	1152	n/a	984	992	1169	n/a
Leg v/c ratio	.34	.27	.67	n/a	.37	.37	.43	n/a
Delay (s/veh)	5	5	9	n/a	6	6	5	n/a
LOS	A	A	A	n/a	A	A	A	n/a
95% Queue (ft)	38	28	141	n/a	44	45	56	n/a

2034 - Butner Rd Stop Condition			AM		PM	
Butner Road and Stonewall Tell Road (South Intersection)	Un-Signalized	Northbound LT	A (8.3)	.04	A (9.1)	.11
		Eastbound LT	F (230.6)	1.40	F (65.9)	.85

This alternative was also considered not feasible since the southbound left turn from Stonewall Tell Rd to Butner Road would require a minimum of 300' of storage and would interfere with the operations of the northern Roundabout.

V. CONCLUSIONS

Based on the results of the alternatives analysis, the following conclusions for each alternative are detailed below.

Alternative I – Traffic Signal Installation

- The need for a traffic signal was evaluated at the intersection of Butner Road and Stonewall Tell Road. Based on GDOT's application of the signal warrant criteria given in current edition of the MUTCD, the intersection is not expected to meet any warrants and a traffic signal installation is not justified.

Alternative 2 – Single Lane-Four Approach Roundabout

- A single lane four approach Roundabout was evaluated. A single lane Roundabout with by-pass lanes, if needed, was found to operate at acceptable levels of service and below capacity in the future design year. A Roundabout would be the most effective traffic control measure to enhance safety and level of service at the intersection.

  For Alternative 2, the proposed configuration would require the realignment of at least two approaches of the intersection in order to properly design and operate the Roundabout. The Roundabout should be located to improve the sight distance on the northbound approach on Stonewall Tell Road and the eastbound approach on Butner Road. Access to the adjacent retail developments should be located outside of the Roundabout and the effective approaches.

Alternative 3 – Realignment - Two Two-Way Stop Controlled (TWSC) T-Intersections

- Realigning the east and westbound approaches of Butner Road to create two new two-way stop controlled T-Intersections was evaluated. The levels of service at both intersections are expected to reach an unacceptable level, LOS F, in the future design year.

Alternative 4 – Realignment - Dual Full Access Roundabouts

- Realigning the east and westbound approaches of Butner Road to create two new T-intersections operating as Roundabouts was evaluated. With both realigned intersections as Roundabouts, the intersections are expected to operate at acceptable levels of service in the future design year. Due to the geometric constraints with regard to adjacent site access, the site access to the retail development on the southeast corner should be designed as the fourth approach to the Southern Roundabout.

Alternative 5 – Realignment - Northern Roundabout with Southern TWSC T-Intersection

- Realigning the east and westbound approaches of Butner Road to create two new T-Intersections with a Northern Roundabout and a Southern TWSC T-Intersection was evaluated. The replacement of the TWSC operation with a Roundabout at the Northern intersection does not fully address the undesirable LOS of southern TWSC intersection. With the Roundabout at the Northern intersection, the Southern intersection is expected to continue to operate at an undesirable level of service during the am peak hour.

Alternatives 6 – Realignment - Southern Roundabout with Northern TWSC T-Intersection

- Realigning the east and westbound approaches of Butner Road to create two new T-Intersections with a Southern Roundabout and a Northern TWSC T-Intersection was evaluated The replacement of the TWSC operation with a Roundabout at the Southern T-intersection does not fully address the undesirable LOS of the TWSC intersection. With the Roundabout at the Southern intersection, the westbound left turn movement of the Northern TWSC intersection is expected to continue to operate at an undesirable level of service during the pm peak hour in the future design year. However, the westbound approach is LOS E which may be considered as an acceptable level of service for a two-way stop controlled intersection. The westbound left turn movement operates at an acceptable level of service through the year 2033 and only reaches an undesirable level of service, LOS F, in the design year 2034.

Alternative 7 – Realignment - Northern Roundabout with Southern TWSC T-Intersection, Butner Road as the stop condition.

- Realigning the westbound approach of Butner and the northbound approach of Stonewall Tell Rd to create two new T-Intersections with a Northern Roundabout and a Southern TWSC with Stonewall Tell Rd as the stopped condition was evaluated. The intersections are expected to operate at acceptable levels of service in the future design year. For Alternative 6, the intersections would need to be spaced adequately to accommodate a minimum of 300’ of storage and appropriate taper for the southbound left turn from Butner Road to Stonewall Tell road without impacting the operations of the northern Roundabout.

VI. RECOMMENDATIONS

Based on the findings and conclusions of the alternatives analysis, the following recommendations have been made for the improvement of the intersection of Butner Rd and Stonewall Tell Rd.

A single four approach Roundabout (Alternative 2) is the most effective traffic control measure to ensure continued traffic safety and enhance traffic operations at the intersection. To address possible design constraints that complicate the installation of a single four approach Roundabout, the following alternative design configurations can be considered.

Dual Roundabouts (Alternative 4) as well as a Northern Roundabout with a TWSC southern T-Intersection with Butner Rd as the stop condition (Alternative 7) operate at acceptable levels of service in the future design year 2034. A Southern Roundabout with a TWSC northern T intersection (Alternative 6) reaches an undesirable level of service, LOS F, for the westbound left turn movement only in the design year 2034. Also, the westbound approach is LOS E which may be considered as an acceptable level of service for a two-way stop controlled intersection.

In summary, the alternatives have been ranked, based on the benefits to traffic operations per GDOT requirements, in the following order:

1. Alternative 2- Single Roundabout
2. Alternative 4 - Dual Roundabouts
3. Alternative 7 – Northern Roundabout with Southern TWSC T-Intersection with Stonewall Tell Rd as the stop condition.
4. Alternative 6 – Southern Roundabout with a Northern TWSC T-Intersection

Since the benefits to traffic operations are not significantly different between the alternatives, further ranking of the alternatives based on the GDOT benefit/cost analysis is strongly encouraged to determine the best alternative.

RECOMMENDED BY: _____ Date: _____
SEI, Inc.

RECOMMENDED BY: _____ Date: _____
District Traffic Engineer

RECOMMENDED BY: _____ Date: _____
State Traffic Safety & Design Engineer

APPROVED BY: _____ Date: _____
Director of Operations

VII. Appendix

Appendix A: Traffic Counts

Appendix B: Traffic Volume Calculations

Appendix C: Accident Analysis

Appendix D: Signal Warrant Analysis

Appendix E: Roundabout Analysis

Appendix F: Capacity Analysis

Appendix A: Traffic Counts

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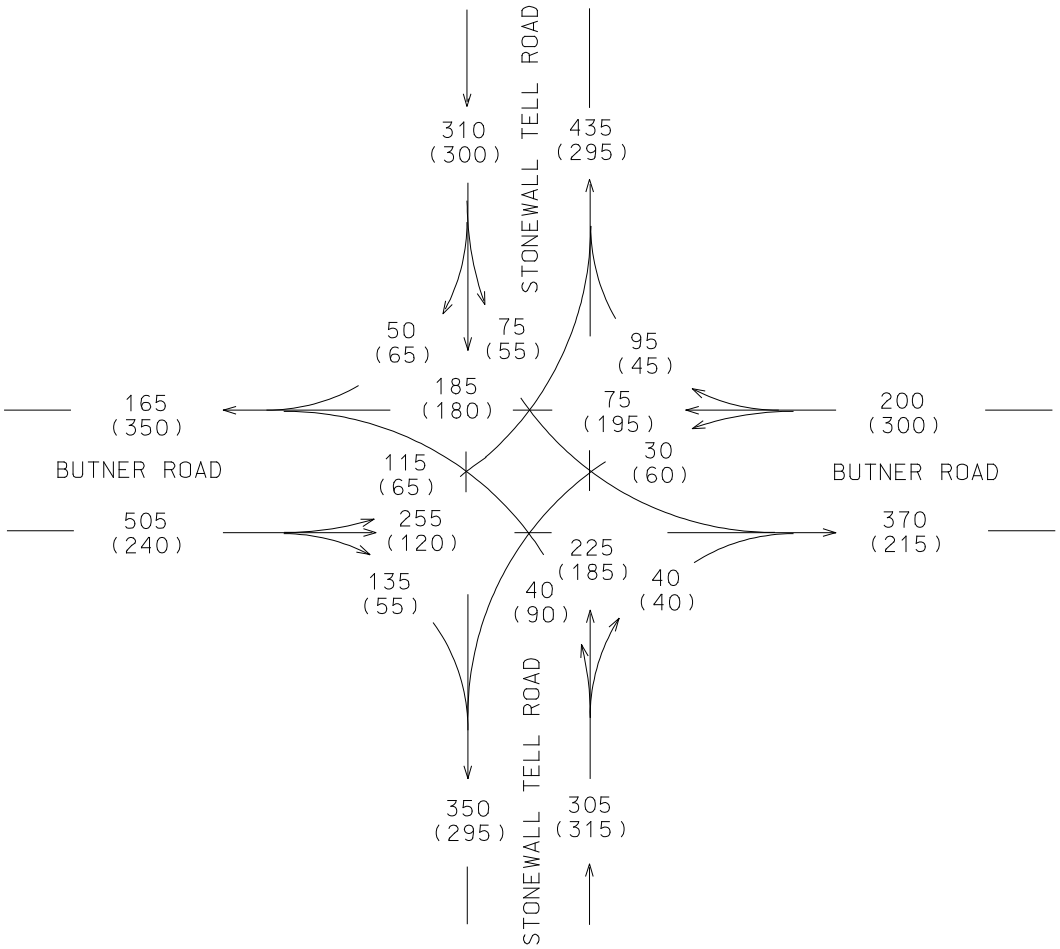

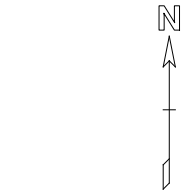

FULTON COUNTY

CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533
BUTNER RD @
STONEWALL
TELL RD

2014 NO-BUILD DHV
AM PEAK = 000
PM PEAK = (000)

T = 2%

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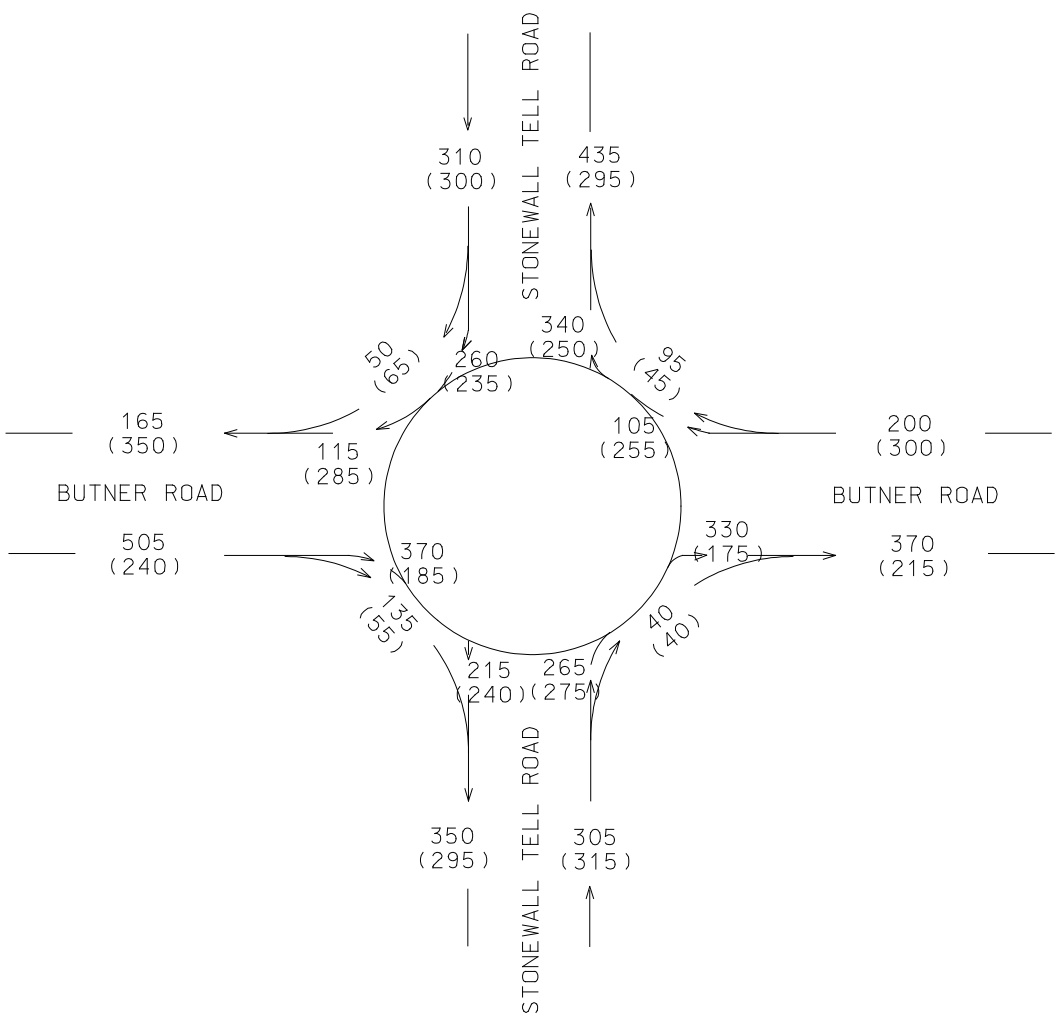

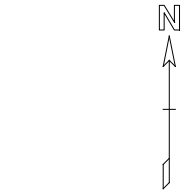

FULTON COUNTY

CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533
BUTNER RD @
STONEWALL
TELL RD

2014 BUILD DHV
AM PEAK = 000
PM PEAK = (000)

T = 2%

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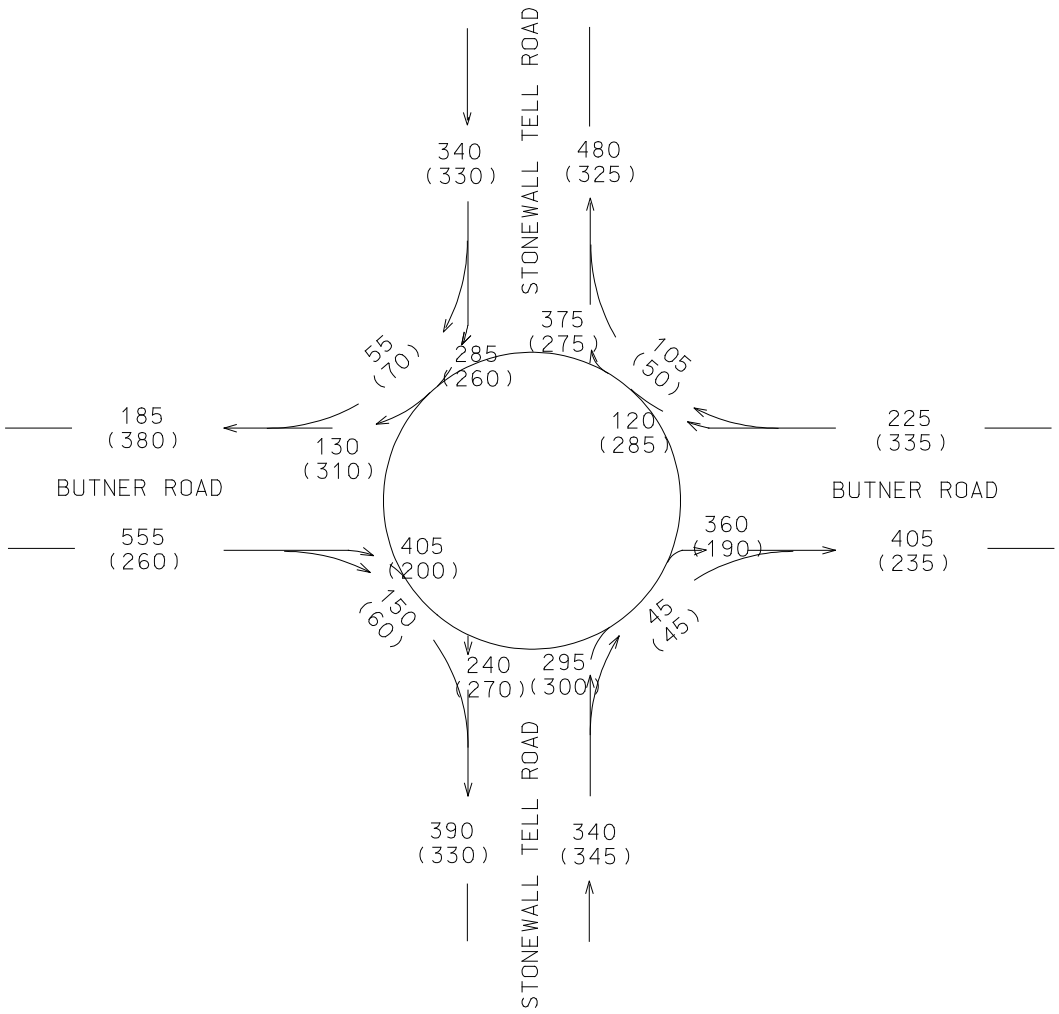

N

FULTON COUNTY

CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533

BUTNER RD @
STONEWALL
TELL RD

2034 BUILD DHV
AM PEAK = 000
PM PEAK = (000)

T = 2%

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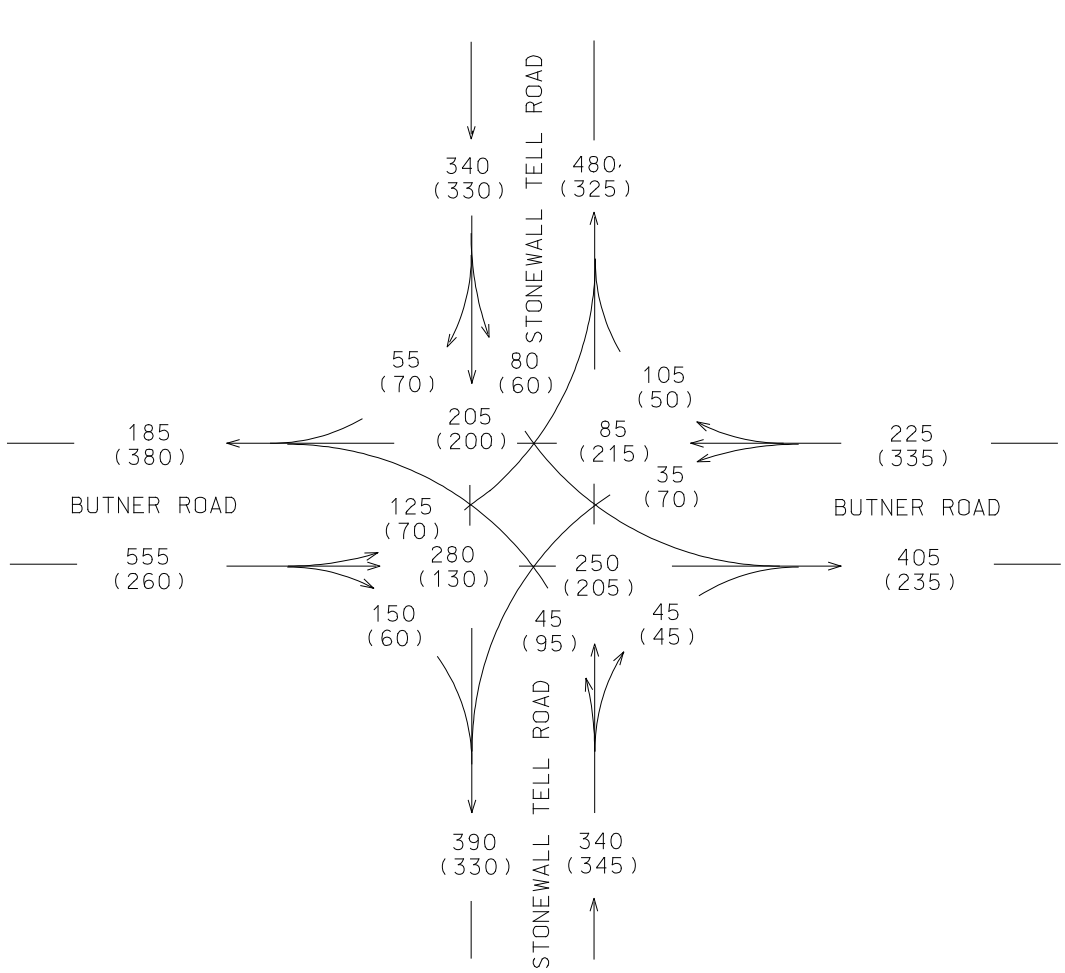

N

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FULTON COUNTY
P. I. NO. 0007533

BUTNER RD @
STONEWALL
TELL RD

2034 NO-BUILD DHV
AM PEAK = 000
PM PEAK = (000)

T = 2%

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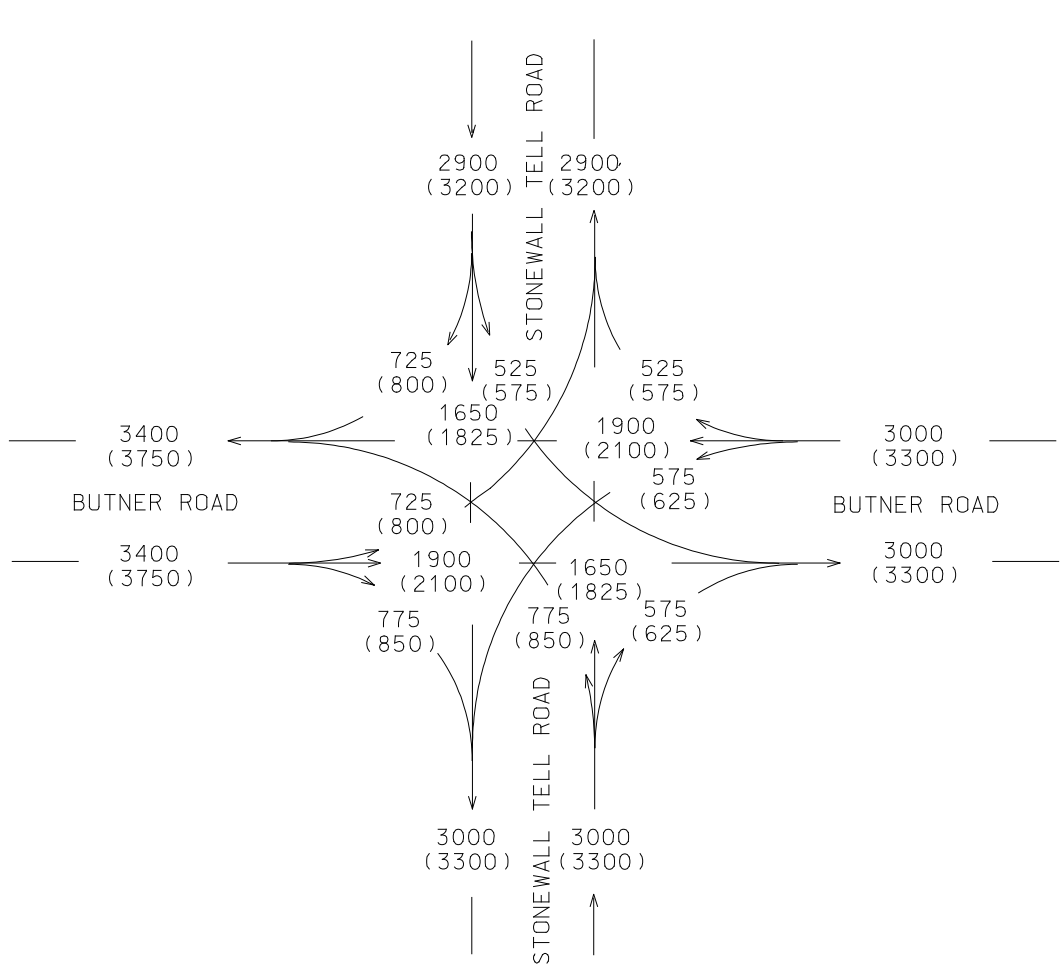

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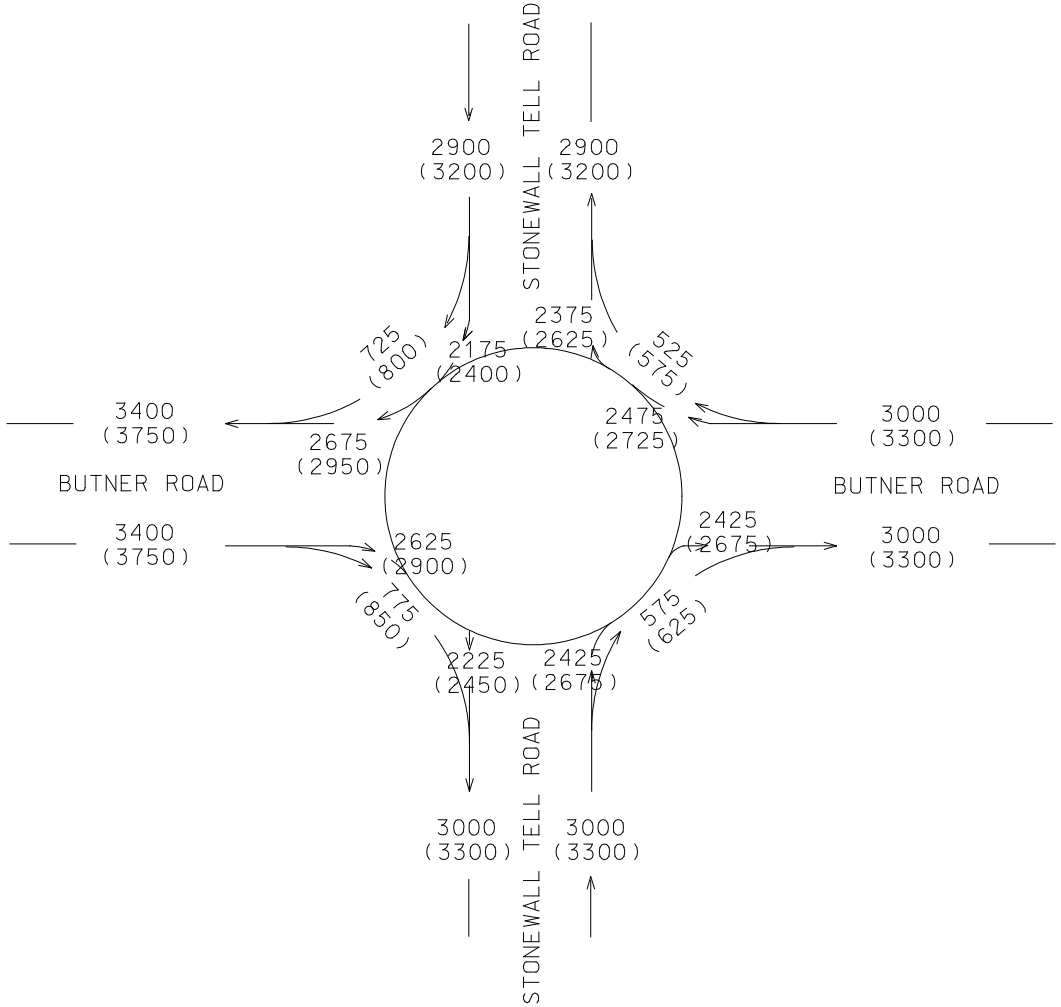
CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533

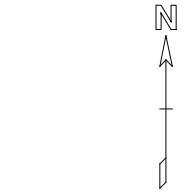
BUTNER RD @
STONEWALL
TELL RD

2014 (2034) NO-BUILD
ADT

T = 3%
S.U. = 2%
COMB. = 1%

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING





FULTON COUNTY

CSHPP-0007-00(533)
FULTON COUNTY
P. I. NO. 0007533

BUTNER RD @
STONEWALL
TELL RD

2014 (2034) BUILD
ADT

T = 3%
S.U. = 2%
COMB. = 1%

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Reliable Traffic Data Services, LLC
Tel: (770) 578-8158 Fax: (770) 578-8159
Email: reliabletraffic@msn.com

TMC Data
Stonewall Tell Rd @ Butner Rd

File Name : 28110001
Site Code : 28110001
Start Date : 11/11/2009
Page No : 1

Groups Printed- Cars, Trucks & Buses

	Stonewall Tell Rd Northbound					Stonewall Tell Rd Southbound					Butner Rd Eastbound					Butner Rd Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	10	55	11	0	76	11	33	10	0	54	26	62	27	0	115	5	19	27	0	51	296
07:15 AM	11	59	7	0	77	17	48	11	0	76	28	71	31	0	130	9	22	30	0	61	344
07:30 AM	7	54	11	0	72	31	63	17	0	111	26	65	43	0	134	6	18	22	0	46	363
07:45 AM	9	50	8	0	67	9	34	9	0	52	29	46	30	0	105	7	13	9	0	29	253
Total	37	218	37	0	292	68	178	47	0	293	109	244	131	0	484	27	72	88	0	187	1256
08:00 AM	11	37	13	0	61	6	33	13	0	52	12	39	17	0	68	11	9	7	0	27	208
08:15 AM	12	33	8	0	53	4	37	21	0	62	10	35	12	0	57	5	11	5	0	21	193
08:30 AM	10	25	8	0	43	6	29	13	0	48	6	41	15	0	62	7	9	4	0	20	173
08:45 AM	9	21	6	0	36	5	26	10	0	41	7	37	12	0	56	6	7	3	0	16	149
Total	42	116	35	0	193	21	125	57	0	203	35	152	56	0	243	29	36	19	0	84	723
*** BREAK ***																					
02:00 PM	8	18	8	0	34	5	21	6	0	32	13	21	12	0	46	12	18	8	0	38	150
02:15 PM	11	20	10	0	41	7	24	7	0	38	17	24	17	0	58	14	22	9	0	45	182
02:30 PM	9	24	11	0	44	10	25	9	0	44	21	31	10	0	62	9	37	10	0	56	206
02:45 PM	11	20	2	0	33	19	27	11	0	57	15	22	9	0	46	12	21	5	0	38	174
Total	39	82	31	0	152	41	97	33	0	171	66	98	48	0	212	47	98	32	0	177	712
03:00 PM	17	25	6	0	48	16	31	12	0	59	11	25	12	0	48	11	23	6	0	40	195
03:15 PM	13	21	8	0	42	8	25	8	0	41	8	23	11	0	42	12	35	8	0	55	180
03:30 PM	12	29	7	0	48	5	31	10	0	46	15	26	15	0	56	10	22	5	0	37	187
03:45 PM	10	27	9	0	46	8	34	10	0	52	17	33	5	0	55	17	34	4	0	55	208
Total	52	102	30	0	184	37	121	40	0	198	51	107	43	0	201	50	114	23	0	187	770
04:00 PM	9	20	7	0	36	8	37	12	0	57	13	20	10	0	43	10	26	6	0	42	178
04:15 PM	12	29	11	0	52	10	40	12	0	62	5	20	8	0	33	15	34	8	0	57	204
04:30 PM	9	25	9	0	43	9	48	18	0	75	28	23	7	0	58	11	30	9	0	50	226
04:45 PM	16	55	10	0	81	11	25	19	0	55	10	22	12	0	44	9	35	12	0	56	236
Total	46	129	37	0	212	38	150	61	0	249	56	85	37	0	178	45	125	35	0	205	844
05:00 PM	21	51	8	0	80	15	44	19	0	78	15	31	10	0	56	11	40	10	0	61	275
05:15 PM	24	44	9	0	77	10	46	16	0	72	13	29	12	0	54	15	45	9	0	69	272
05:30 PM	20	41	11	0	72	12	49	17	0	78	17	27	14	0	58	19	47	11	0	77	285
05:45 PM	18	40	10	0	68	12	35	8	0	55	15	25	16	0	56	13	56	10	0	79	258
Total	83	176	38	0	297	49	174	60	0	283	60	112	52	0	224	58	188	40	0	286	1090
Grand Total	299	823	208	0	1330	254	845	298	0	1397	377	798	367	0	1542	256	633	237	0	1126	5395
Apprch %	22.5	61.9	15.6	0		18.2	60.5	21.3	0		24.4	51.8	23.8	0		22.7	56.2	21	0		
Total %	5.5	15.3	3.9	0	24.7	4.7	15.7	5.5	0	25.9	7	14.8	6.8	0	28.6	4.7	11.7	4.4	0	20.9	

Reliable Traffic Data Services, LLC
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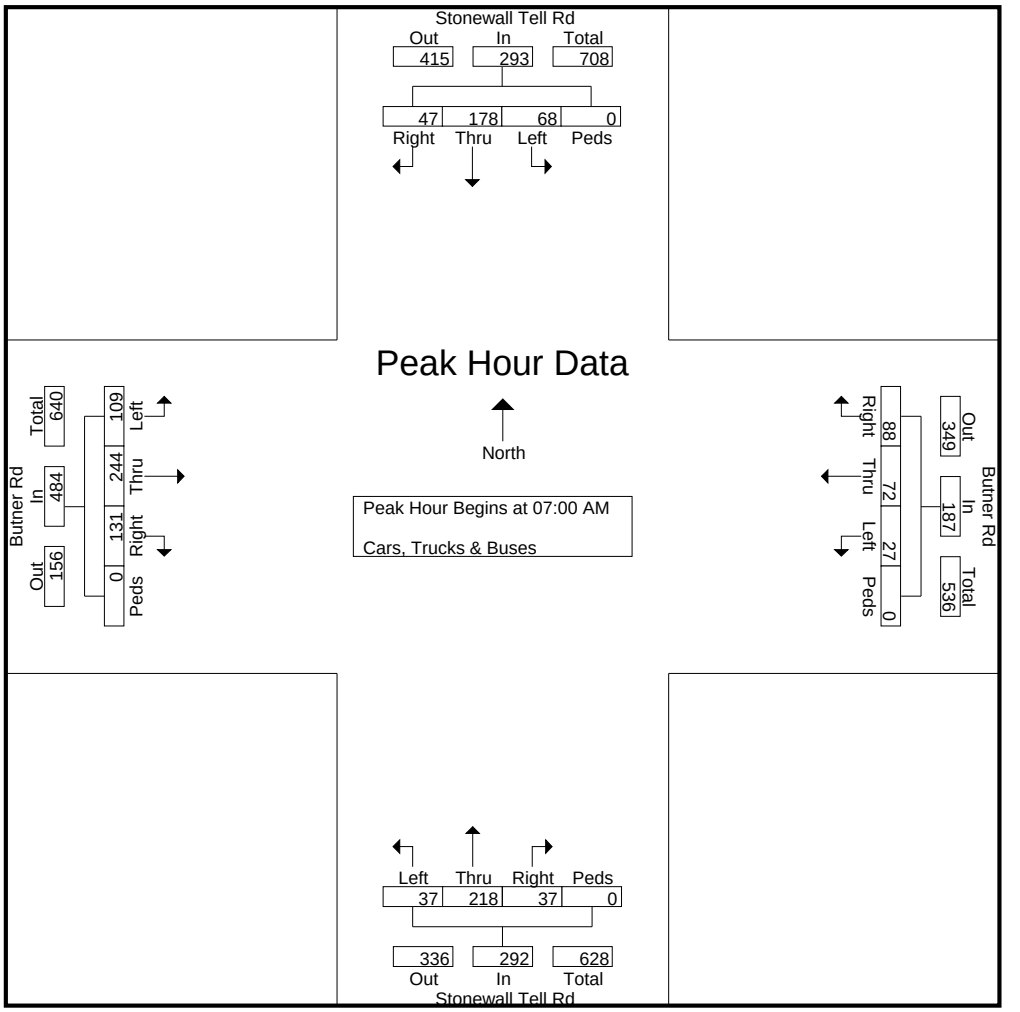
TMC Data
Stonewall Tell Rd @ Butner Rd

File Name : 28110001
Site Code : 28110001
Start Date : 11/11/2009
Page No : 2

	Stonewall Tell Rd Northbound					Stonewall Tell Rd Southbound					Butner Rd Eastbound					Butner Rd Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	10	55	11	0	76	11	33	10	0	54	26	62	27	0	115	5	19	27	0	51	296
07:15 AM	11	59	7	0	77	17	48	11	0	76	28	71	31	0	130	9	22	30	0	61	344
07:30 AM	7	54	11	0	72	31	63	17	0	111	26	65	43	0	134	6	18	22	0	46	363
07:45 AM	9	50	8	0	67	9	34	9	0	52	29	46	30	0	105	7	13	9	0	29	253
Total Volume	37	218	37	0	292	68	178	47	0	293	109	244	131	0	484	27	72	88	0	187	1256
% App. Total	12.7	74.7	12.7	0		23.2	60.8	16	0		22.5	50.4	27.1	0		14.4	38.5	47.1	0		
PHF	.841	.924	.841	.000	.948	.548	.706	.691	.000	.660	.940	.859	.762	.000	.903	.750	.818	.733	.000	.766	.865



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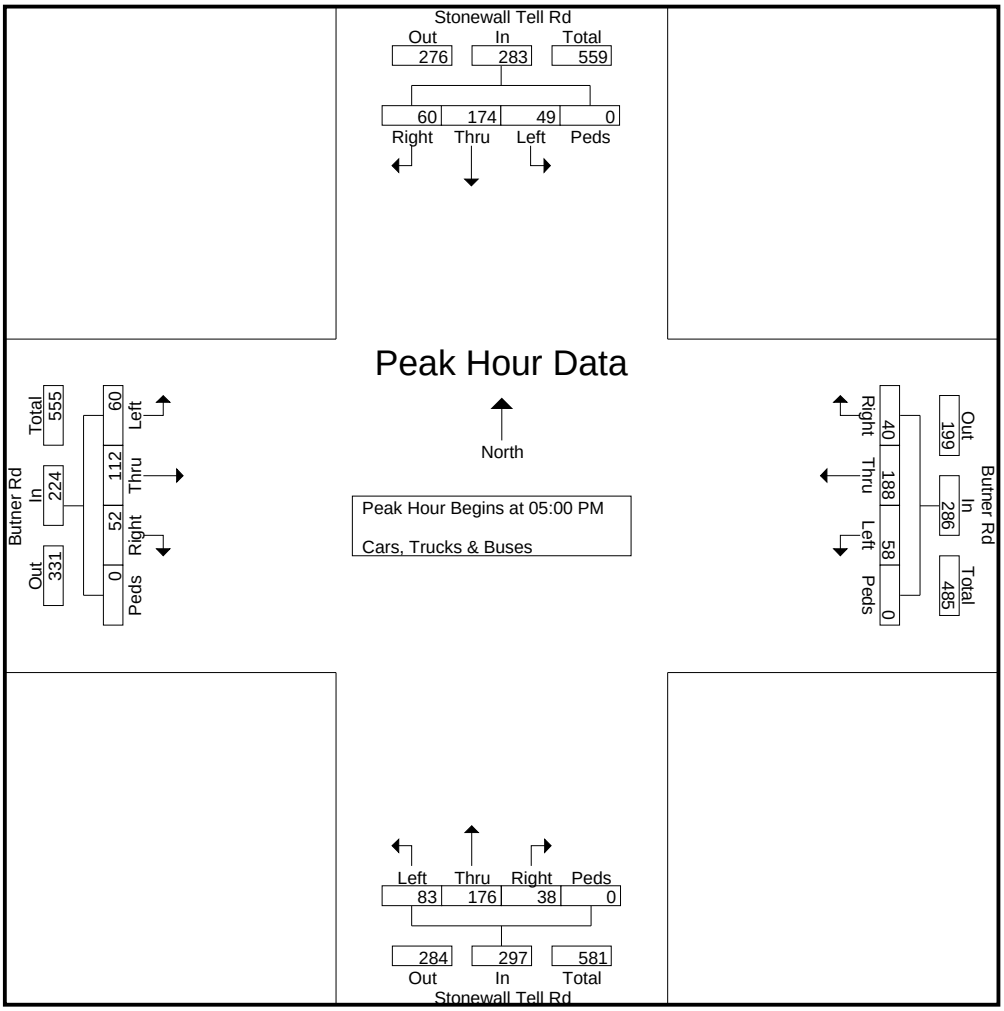
TMC Data
Stonewall Tell Rd @ Butner Rd

File Name : 28110001
Site Code : 28110001
Start Date : 11/11/2009
Page No : 3

	Stonewall Tell Rd Northbound					Stonewall Tell Rd Southbound					Butner Rd Eastbound					Butner Rd Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	21	51	8	0	80	15	44	19	0	78	15	31	10	0	56	11	40	10	0	61	275
05:15 PM	24	44	9	0	77	10	46	16	0	72	13	29	12	0	54	15	45	9	0	69	272
05:30 PM	20	41	11	0	72	12	49	17	0	78	17	27	14	0	58	19	47	11	0	77	285
05:45 PM	18	40	10	0	68	12	35	8	0	55	15	25	16	0	56	13	56	10	0	79	258
Total Volume	83	176	38	0	297	49	174	60	0	283	60	112	52	0	224	58	188	40	0	286	1090
% App. Total	27.9	59.3	12.8	0		17.3	61.5	21.2	0		26.8	50	23.2	0		20.3	65.7	14	0		
PHF	.865	.863	.864	.000	.928	.817	.888	.789	.000	.907	.882	.903	.813	.000	.966	.763	.839	.909	.000	.905	.956



ADT Data

Reliable Traffic Data Services, LLC
Tel: (770) 578-8158 Fax: (770) 578-8159
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Site Code: 28110101
Stonewall Tell Rd North of Butner Rd

Start Time	12-Nov-09 Thu	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		4	35			4	30				
12:15		5	37			4	29				
12:30		4	26			2	36				
12:45		4	19	17	117	3	19	13	114	30	231
01:00		3	31			2	42				
01:15		3	27			5	45				
01:30		2	35			8	34				
01:45		2	42	10	135	2	28	17	149	27	284
02:00		0	39			2	35				
02:15		5	45			0	28				
02:30		1	55			2	46				
02:45		0	40	6	179	1	66	5	175	11	354
03:00		0	41			5	48				
03:15		4	47			2	40				
03:30		1	44			2	59				
03:45		3	42	8	174	3	55	12	202	20	376
04:00		4	49			1	62				
04:15		3	46			1	65				
04:30		2	59			5	61				
04:45		4	62	13	216	3	59	10	247	23	463
05:00		8	64			3	67				
05:15		8	68			5	71				
05:30		12	75			11	74				
05:45		8	71	36	278	6	69	25	281	61	559
06:00		7	65			10	62				
06:15		14	56			12	65				
06:30		32	77			27	65				
06:45		47	38	100	236	40	57	89	249	189	485
07:00		93	39			41	42				
07:15		130	31			63	35				
07:30		116	27			121	33				
07:45		78	22	417	119	69	31	294	141	711	260
08:00		51	19			52	28				
08:15		53	20			61	15				
08:30		35	22			58	28				
08:45		31	19	170	80	35	34	206	105	376	185
09:00		23	25			27	25				
09:15		18	19			19	18				
09:30		17	15			20	22				
09:45		20	18	78	77	26	16	92	81	170	158
10:00		16	11			27	12				
10:15		27	18			26	15				
10:30		38	12			26	12				
10:45		30	12	111	53	22	7	101	46	212	99
11:00		35	10			24	14				
11:15		26	9			27	10				
11:30		26	7			37	10				
11:45		29	8	116	34	27	5	115	39	231	73
Total		1082	1698			979	1829			2061	3527
Percent		38.9%	61.1%			34.9%	65.1%			36.9%	63.1%
Grand Total		1082	1698			979	1829			2061	3527
Percent		38.9%	61.1%			34.9%	65.1%			36.9%	63.1%

ADT ADT 5,588 AADT 5,588

ADT Data

Reliable Traffic Data Services, LLC
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Site Code: 28110102
Butner Rd East of Stonewall Tell Rd

Start Time	12-Nov-09 Thu	Eastbound Morning	Eastbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Westbound Morning	Westbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		4	38			6	34				
12:15		3	47			8	38				
12:30		2	45			7	37				
12:45		1	25	10	155	5	41	26	150	36	305
01:00		2	42			4	27				
01:15		3	42			1	40				
01:30		2	37			2	26				
01:45		2	35	9	156	1	39	8	132	17	288
02:00		1	39			7	38				
02:15		1	37			5	35				
02:30		2	41			0	60				
02:45		1	49	5	166	3	48	15	181	20	347
03:00		0	40			5	35				
03:15		2	52			2	37				
03:30		0	37			1	62				
03:45		6	42	8	171	5	46	13	180	21	351
04:00		4	37			4	48				
04:15		3	41			0	58				
04:30		4	39			1	43				
04:45		6	45	17	162	1	51	6	200	23	362
05:00		13	43			1	63				
05:15		13	38			2	65				
05:30		16	38			3	81				
05:45		16	74	58	193	5	79	11	288	69	481
06:00		31	48			4	75				
06:15		27	54			3	82				
06:30		44	58			15	85				
06:45		49	48	151	208	17	81	39	323	190	531
07:00		61	36			50	73				
07:15		112	35			45	70				
07:30		95	31			76	68				
07:45		82	28	350	130	23	62	194	273	544	403
08:00		62	25			21	59				
08:15		44	22			18	55				
08:30		41	18			19	52				
08:45		56	20	203	85	24	49	82	215	285	300
09:00		40	23			23	37				
09:15		37	15			12	31				
09:30		29	12			14	29				
09:45		35	14	141	64	29	34	78	131	219	195
10:00		29	11			30	21				
10:15		27	15			25	28				
10:30		37	13			34	28				
10:45		23	11	116	50	33	12	122	89	238	139
11:00		41	7			33	8				
11:15		46	5			25	26				
11:30		47	5			32	15				
11:45		57	6	191	23	37	8	127	57	318	80
Total		1259	1563			721	2219			1980	3782
Percent		44.6%	55.4%			24.5%	75.5%			34.4%	65.6%
Grand Total		1259	1563			721	2219			1980	3782
Percent		44.6%	55.4%			24.5%	75.5%			34.4%	65.6%

ADT ADT 5,762 AADT 5,762

Reliable Traffic Data Services, LLC

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Approach Data

Site Code: 28110103
Stonewall Tell Rd South of Butner Rd

Start Time	12-Nov-09 Thu	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		12	44		
12:15		5	33		
12:30		6	37		
12:45		3	25	26	139
01:00		9	27		
01:15		6	35		
01:30		2	31		
01:45		2	35	19	128
02:00		0	37		
02:15		4	34		
02:30		1	47		
02:45		0	35	5	153
03:00		1	47		
03:15		5	52		
03:30		2	49		
03:45		4	45	12	193
04:00		4	44		
04:15		2	54		
04:30		5	57		
04:45		3	55	14	210
05:00		11	61		
05:15		11	70		
05:30		11	84		
05:45		12	87	45	302
06:00		15	88		
06:15		20	61		
06:30		27	79		
06:45		45	53	107	281
07:00		78	54		
07:15		95	36		
07:30		74	28		
07:45		54	0	301	118
08:00		59	24		
08:15		51	27		
08:30		45	21		
08:45		36	30	191	102
09:00		38	33		
09:15		27	17		
09:30		30	17		
09:45		30	28	125	95
10:00		25	11		
10:15		33	20		
10:30		33	14		
10:45		26	21	117	66
11:00		30	6		
11:15		26	8		
11:30		34	10		
11:45		27	11	117	35
Total		1079	1822		
Percent		37.2%	62.8%		
Grand Total		1079	1822		
Percent		37.2%	62.8%		
ADT		ADT 2,901			AADT 2,901

Reliable Traffic Data Services, LLC

Tel: (770) 578-8158 Fax: (770) 578-8159
Email: reliabletraffic@msn.com

Approach Data

Site Code: 28110104
Butner Rd West of Stonewall Tell Rd

Start Time	12-Nov-09 Thu	Eastbound Morning	Eastbound Afternoon	Hour Totals Morning	Hour Totals Afternoon
12:00		5	41		
12:15		5	40		
12:30		1	39		
12:45		2	30	13	150
01:00		1	44		
01:15		4	30		
01:30		2	40		
01:45		3	52	10	166
02:00		3	48		
02:15		2	56		
02:30		3	53		
02:45		0	51	8	208
03:00		1	55		
03:15		3	52		
03:30		1	47		
03:45		5	42	10	196
04:00		4	37		
04:15		3	49		
04:30		5	38		
04:45		4	53	16	177
05:00		12	55		
05:15		16	51		
05:30		24	57		
05:45		21	68	73	231
06:00		35	65		
06:15		26	54		
06:30		63	58		
06:45		74	48	198	225
07:00		118	47		
07:15		125	45		
07:30		127	42		
07:45		111	37	481	171
08:00		82	34		
08:15		63	25		
08:30		59	19		
08:45		43	13	247	91
09:00		38	21		
09:15		44	17		
09:30		29	13		
09:45		30	10	141	61
10:00		34	13		
10:15		29	27		
10:30		36	13		
10:45		28	13	127	66
11:00		48	8		
11:15		42	5		
11:30		35	8		
11:45		41	8	166	29
Total		1490	1771		
Percent		45.7%	54.3%		
Grand Total		1490	1771		
Percent		45.7%	54.3%		
ADT		ADT 3,261			AADT 3,261

Appendix B: Traffic Volume Calculations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	109	244	131	27	72	88	37	218	37	68	178	47
Peak Hour Factor	0.94	0.86	0.76	0.75	0.82	0.73	0.84	0.92	0.84	0.55	0.71	0.69
Hourly flow rate (vph)	116	284	172	36	88	121	44	237	44	124	251	68

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	572	244	325	442
Volume Left (vph)	116	36	44	124
Volume Right (vph)	172	121	44	68
Hadj (s)	-0.11	-0.23	-0.02	0.00
Departure Headway (s)	8.0	8.7	8.4	8.0
Degree Utilization, x	1.28	0.59	0.76	0.98
Capacity (veh/h)	455	395	415	445
Control Delay (s)	165.2	23.5	33.9	67.3
Approach Delay (s)	165.2	23.5	33.9	67.3
Approach LOS	F	C	D	F

Intersection Summary			
Delay	89.0		
HCM Level of Service	F		
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	60	112	52	58	188	40	83	176	38	49	174	60
Peak Hour Factor	0.88	0.90	0.81	0.76	0.84	0.91	0.86	0.86	0.86	0.82	0.89	0.79
Hourly flow rate (vph)	68	124	64	76	224	44	97	205	44	60	196	76

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	257	344	345	331
Volume Left (vph)	68	76	97	60
Volume Right (vph)	64	44	44	76
Hadj (s)	-0.06	0.00	0.01	-0.07
Departure Headway (s)	7.3	7.1	7.1	7.1
Degree Utilization, x	0.52	0.68	0.68	0.65
Capacity (veh/h)	429	466	467	468
Control Delay (s)	18.1	24.0	23.8	22.2
Approach Delay (s)	18.1	24.0	23.8	22.2
Approach LOS	C	C	C	C

Intersection Summary			
Delay	22.3		
HCM Level of Service	C		
Intersection Capacity Utilization	52.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	51	107	43	50	114	23	52	102	30	37	121	40
Peak Hour Factor	0.75	0.81	0.72	0.74	0.81	0.72	0.76	0.88	0.83	0.58	0.89	0.83
Hourly flow rate (vph)	68	132	60	68	141	32	68	116	36	64	136	48

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	260	240	220	248
Volume Left (vph)	68	68	68	64
Volume Right (vph)	60	32	36	48
Hadj (s)	-0.05	0.01	0.00	-0.03
Departure Headway (s)	5.7	5.8	5.8	5.8
Degree Utilization, x	0.41	0.39	0.36	0.40
Capacity (veh/h)	577	565	552	567
Control Delay (s)	12.6	12.4	12.1	12.5
Approach Delay (s)	12.6	12.4	12.1	12.5
Approach LOS	B	B	B	B

Intersection Summary			
Delay	12.4		
HCM Level of Service	B		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	105	95	340	295	75	235
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	103	370	321	82	255
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	948	530			690	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	948	530			690	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	57	81			91	
cM capacity (veh/h)	263	549			904	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	217	690	82	255
Volume Left	114	0	82	0
Volume Right	103	321	0	0
cSH	501	1700	904	1700
Volume to Capacity	0.43	0.41	0.09	0.15
Queue Length 95th (ft)	54	0	7	0
Control Delay (s)	21.3	0.0	9.4	0.0
Lane LOS	C		A	
Approach Delay (s)	21.3	0.0	2.3	
Approach LOS	C			

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	370	135	40	265	215	125
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	402	147	43	288	234	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	677	302	370			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	677	302	370			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	80	96			
cM capacity (veh/h)	403	738	1189			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	549	43	288	370
Volume Left	402	43	0	0
Volume Right	147	0	0	136
cSH	523	1189	1700	1700
Volume to Capacity	1.05	0.04	0.17	0.22
Queue Length 95th (ft)	402	3	0	0
Control Delay (s)	81.2	8.1	0.0	0.0
Lane LOS	F	A		
Approach Delay (s)	81.2	1.1		0.0
Approach LOS	F			

Intersection Summary			
Average Delay	36.0		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	255	45	250	160	55	245
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	277	49	272	174	60	266
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	745	359			446	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	745	359			446	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	23	93			95	
cM capacity (veh/h)	361	686			1115	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	326	446	60	266
Volume Left	277	0	60	0
Volume Right	49	174	0	0
cSH	425	1700	1115	1700
Volume to Capacity	0.77	0.26	0.05	0.16
Queue Length 95th (ft)	162	0	4	0
Control Delay (s)	36.6	0.0	8.4	0.0
Lane LOS	E		A	
Approach Delay (s)	36.6	0.0	1.5	
Approach LOS	E			

Intersection Summary			
Average Delay	11.3		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	185	55	90	225	240	260
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	201	60	98	245	261	283
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	842	402	543			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	842	402	543			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	34	91	90			
cM capacity (veh/h)	302	648	1025			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	261	98	245	543
Volume Left	201	98	0	0
Volume Right	60	0	0	283
cSH	392	1025	1700	1700
Volume to Capacity	0.66	0.10	0.14	0.32
Queue Length 95th (ft)	116	8	0	0
Control Delay (s)	31.6	8.9	0.0	0.0
Lane LOS	D	A		
Approach Delay (s)	31.6	2.5		0.0
Approach LOS	D			

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	120	105	375	325	80	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	130	114	408	353	87	283
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1041	584			761	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1041	584			761	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	43	78			90	
cM capacity (veh/h)	229	511			851	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	245	761	87	283
Volume Left	130	0	87	0
Volume Right	114	353	0	0
cSH	429	1700	851	1700
Volume to Capacity	0.57	0.45	0.10	0.17
Queue Length 95th (ft)	86	0	9	0
Control Delay (s)	27.7	0.0	9.7	0.0
Lane LOS	D		A	
Approach Delay (s)	27.7	0.0	2.3	
Approach LOS	D			

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	405	8	150	5	8	12	45	295	5	12	240	140
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	440	9	163	5	9	13	49	321	5	13	261	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			7									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	723	711	261	712	860	323	413			326		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	723	711	261	712	860	323	413			326		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	97	79	98	97	98	96			99		
cM capacity (veh/h)	314	339	778	258	278	718	1146			1234		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	440	172	27	49	326	274	152
Volume Left	440	0	5	49	0	13	0
Volume Right	0	163	13	0	5	0	152
cSH	314	819	385	1146	1700	1234	1700
Volume to Capacity	1.40	0.21	0.07	0.04	0.19	0.01	0.09
Queue Length 95th (ft)	574	20	6	3	0	1	0
Control Delay (s)	230.6	11.1	15.0	8.3	0.0	0.5	0.0
Lane LOS	F	B	C	A		A	
Approach Delay (s)	169.0		15.0	1.1		0.3	
Approach LOS	F		C				

Intersection Summary			
Average Delay	72.5		
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	285	50	275	175	60	270
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	310	54	299	190	65	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	818	394			489	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	818	394			489	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	5	92			94	
cM capacity (veh/h)	325	655			1074	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	364	489	65	293
Volume Left	310	0	65	0
Volume Right	54	190	0	0
cSH	378	1700	1074	1700
Volume to Capacity	0.96	0.29	0.06	0.17
Queue Length 95th (ft)	272	0	5	0
Control Delay (s)	71.2	0.0	8.6	0.0
Lane LOS	F		A	
Approach Delay (s)	71.2	0.0	1.6	
Approach LOS	F			

Intersection Summary			
Average Delay	21.9		
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	200	8	60	5	8	12	95	250	5	12	270	285
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	9	65	5	9	13	103	272	5	13	293	310
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			7									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	815	803	293	805	1110	274	603			277		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	815	803	293	805	1110	274	603			277		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	15	97	91	98	95	98	89			99		
cM capacity (veh/h)	256	280	746	245	185	764	974			1286		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	217	74	27	103	277	307	310
Volume Left	217	0	5	103	0	13	0
Volume Right	0	65	13	0	5	0	310
cSH	256	845	315	974	1700	1286	1700
Volume to Capacity	0.85	0.09	0.09	0.11	0.16	0.01	0.18
Queue Length 95th (ft)	173	7	7	9	0	1	0
Control Delay (s)	65.9	11.2	17.5	9.1	0.0	0.4	0.0
Lane LOS	F	B	C	A		A	
Approach Delay (s)	52.0		17.5	2.5		0.2	
Approach LOS	F		C				

Intersection Summary			
Average Delay	12.7		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	120	105	375	325	80	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	130	114	408	353	87	283
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1041	584			761	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1041	584			761	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	43	78			90	
cM capacity (veh/h)	229	511			851	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	245	761	87	283
Volume Left	130	0	87	0
Volume Right	114	353	0	0
cSH	429	1700	851	1700
Volume to Capacity	0.57	0.45	0.10	0.17
Queue Length 95th (ft)	86	0	9	0
Control Delay (s)	27.7	0.0	9.7	0.0
Lane LOS	D		A	
Approach Delay (s)	27.7	0.0	2.3	
Approach LOS	D			

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	405	8	150	5	8	12	45	295	5	12	240	140
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	440	9	163	5	9	13	49	321	5	13	261	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			7									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	723	711	261	712	860	323	413			326		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	723	711	261	712	860	323	413			326		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	97	79	98	97	98	96			99		
cM capacity (veh/h)	314	339	778	258	278	718	1146			1234		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	440	172	27	49	326	274	152
Volume Left	440	0	5	49	0	13	0
Volume Right	0	163	13	0	5	0	152
cSH	314	819	385	1146	1700	1234	1700
Volume to Capacity	1.40	0.21	0.07	0.04	0.19	0.01	0.09
Queue Length 95th (ft)	574	20	6	3	0	1	0
Control Delay (s)	230.6	11.1	15.0	8.3	0.0	0.5	0.0
Lane LOS	F	B	C	A		A	
Approach Delay (s)	169.0		15.0	1.1		0.3	
Approach LOS	F		C				

Intersection Summary			
Average Delay	72.5		
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	285	50	275	175	60	270
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	310	54	299	190	65	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	818	394			489	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	818	394			489	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	5	92			94	
cM capacity (veh/h)	325	655			1074	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	364	489	65	293
Volume Left	310	0	65	0
Volume Right	54	190	0	0
cSH	378	1700	1074	1700
Volume to Capacity	0.96	0.29	0.06	0.17
Queue Length 95th (ft)	272	0	5	0
Control Delay (s)	71.2	0.0	8.6	0.0
Lane LOS	F		A	
Approach Delay (s)	71.2	0.0	1.6	
Approach LOS	F			

Intersection Summary			
Average Delay	21.9		
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix C: Accident Analysis

FULTON COUNTY, Butner Road (CR 1374) @ Stonewall Tell Road (CR 1386)																					
Accident No	Date	Year	Time	County	Route Type	Route	Milelog	Intersecting Rt	Injuries	Fatalities	Harmful Event	Collision	Location of Impact	Light	Surface	DirVeh1	DirVeh2	MnvrVeh1	MnvrVeh2	LatDecimal	LongDecimal
'70090116	1/6/2007	2007	10:05 PM	Fulton	County Road	'137400	5.72	CR 1386	0	0	Deer	Not A Collision With A Motor Vehicle	On Roadway	Dark-Not Lighted	Dry	W		Straight			
'71650222	4/3/2007	2007	2:13 AM	Fulton	County Road	'137400	5.72	CR 1386	0	0	Tree	Not A Collision With A Motor Vehicle	Off Roadway	Dark-Not Lighted	Dry	S		Straight			
'80460282	2/9/2008	2008	7:36 PM	Fulton	County Road	'137400	5.72	CR 1386	1	0	Guardrail Face	Not A Collision With A Motor Vehicle	Off Roadway	Dark-Not Lighted	Dry	W		Straight			
'81360480	3/11/2008	2008	9:03 AM	Fulton	County Road	'137400	5.72	CR 1386	0	0	Guardrail Face	Not A Collision With A Motor Vehicle	Off Roadway	Dark-Not Lighted	Dry	S		Straight			
'82550114	5/17/2008	2008	9:21 AM	Fulton	County Road	'137400	5.72	CR 1386	2	0	Motor Vehicle in Motion	Angle	On Roadway	Daylight	Dry	S	N	Turning Left	Turning Left		
'83800200	9/20/2008	2008	12:25 PM	Fulton	County Road	'137400	5.72	CR 1386	0	0	Motor Vehicle in Motion	Rear End	On Roadway	Daylight	Dry	S	S	Straight	Stopped		
'91840323	4/29/2009	2009	7:47 AM	Fulton	County Road	'137400	5.72	CR 1386	0	0	Parked Motor Vehicle	Sideswipe - Same Direction	On Roadway	Daylight	Dry	S	N	Backing	Stopped		
'92820094	6/8/2009	2009	10:33 AM	Fulton	County Road	'137400	5.72	CR 1386	0	0	Motor Vehicle in Motion	Angle	On Roadway	Daylight	Dry	N	N	Turning Left	Turning Left		
95120460	11/20/2009	2009	10:15 AM	FULTON	STONEWALL TELL RD			BUTNER RD	1	0	Motor Vehicle In Motion	Angle	On Roadway	Daylight	Dry	East	North	Straight	Turning Left	33.651408	-84.594528
A1100144	3/22/2010	2010	2:34 PM	FULTON	STONEWALL TELL RD			BUTNER RD	0	0	Parked Motor Vehicle	Angle	On Roadway	Daylight	Dry	North	North	Backing	Parked	-1	-1
A1110332	3/27/2010	2010	1:50 PM	FULTON	BUTNER RD			STONEWALL TELL	0	0	Motor Vehicle In Motion	Rear End	On Roadway	Daylight	Dry	Northe	Northea	Straight	Stopped	33.651408	-84.594528
A1690170	5/5/2010	2010	3:00 PM	FULTON	STONEWALL TELL RD			BUTNER RD	0	0	Parked Motor Vehicle	Angle	On Roadway	Daylight	Dry	North	North	Backing	Parked	33.651408	-84.594528
A4260430	11/11/2010	2010	12:49 AM	FULTON	STONEWALL TELL RD			BUTNER RD	0	0	Animal	Head On	On Roadway	Dark-Lighted	Dry	North	None	Straight		33.651408	-84.594528
A3970492	12/28/2010	2010	1:23 AM	FULTON	BUTNER RD			STONEWALL TELL	1	0	Tree	Head On	Off Roadway	Dark-Not Lighted	Dry	North	None	Straight		-1	-1
B0540215	2/7/2011	2011	12:12 AM	FULTON	BUTNER RD			STONEWALL TELL	0	0	Tree	Not A Collision with Motor Vehicle	On Roadway	Dark-Lighted	Dry	North	None	Straight		33.651408	-84.594528
B1250772	4/21/2011	2011	6:30 PM	FULTON	BUTNER RD			STONEWALL TELL	0	0						None	None			33.651408	-84.594528
B1240771	5/24/2011	2011	7:22 PM	FULTON	BUTNER RD			STONEWALL TELL	0	0	Motor Vehicle In Motion	Sideswipe-Opposite Direction	On Roadway	Daylight	Dry	None	None	Straight	Straight	33.651408	-84.594528

Appendix D: Signal Warrant Analysis

SEI, Inc.

Existing Year 2011

Butner Road @ Stonewall Tell Road

Study Name : **Existing Year-2011**
Study Date : **08/10/11**
Page No. : **1**

Signal Warrants - Summary

Major Street Approaches

Eastbound: **Butner Road 3261**
Number of Lanes: **1**
Approach Speed: **45**
Total Approach Volume: **2,781**

Westbound: **Butner Road 2940**
Number of Lanes: **1**
Approach Speed: **45**
Total Approach Volume: **2,287**

Minor Street Approaches

Northbound: **Stonewall Tell Road 2901**
Number of Lanes: **1**
Total Approach Volume: **2,581**

Southbound: **Stonewall Tell Road 2808**
Number of Lanes: **1**
Total Approach Volume: **2,271**

Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Not Satisfied**
Number of hours (1) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour ..... **Not Satisfied**

Warrant 3A - Peak Hour Volumes ..... **Not Satisfied**
Volumes do not exceed minimums for any hour.

Warrant 3B - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 4 - Pedestrian Volumes ..... **Not Evaluated**

Warrant 5 - School Crossing ..... **Not Evaluated**

Warrant 6 - Coordinated Signal System ..... **Not Satisfied**
No adjacent coordinated signals are present

Warrant 7 - Crash Experience ..... **Not Satisfied**
Number of accidents (0) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network ..... **Not Satisfied**
Major Route conditions not met. One or more volume requirement met.

SEI, Inc.

Build Year 2014

Butner Road @ Stonewall Tell Road

Study Name : **Build Year-2014**
Study Date : **08/10/11**
Page No. : **1**

Signal Warrants - Summary

Major Street Approaches

Eastbound: **Butner Road 3360**
Number of Lanes: **1**
Approach Speed: **45**
Total Approach Volume: **2,529**

Westbound: **Butner Road 3029**
Number of Lanes: **1**
Approach Speed: **45**
Total Approach Volume: **2,357**

Minor Street Approaches

Northbound: **Stonewall Tell Road 2989**
Number of Lanes: **1**
Total Approach Volume: **2,646**

Southbound: **Stonewall Tell Road 2893**
Number of Lanes: **1**
Total Approach Volume: **2,330**

Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 0 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 0 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 0 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Not Satisfied**
Number of hours (0) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour ..... **Not Satisfied**

Warrant 3A - Peak Hour Volumes ..... **Not Satisfied**
Volumes do not exceed minimums for any hour.

Warrant 3B - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 4 - Pedestrian Volumes ..... **Not Evaluated**

Warrant 5 - School Crossing ..... **Not Evaluated**

Warrant 6 - Coordinated Signal System ..... **Not Satisfied**
No adjacent coordinated signals are present

Warrant 7 - Crash Experience ..... **Not Satisfied**
Number of accidents (0) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network ..... **Not Satisfied**
Major Route conditions not met. No volume requirement met.

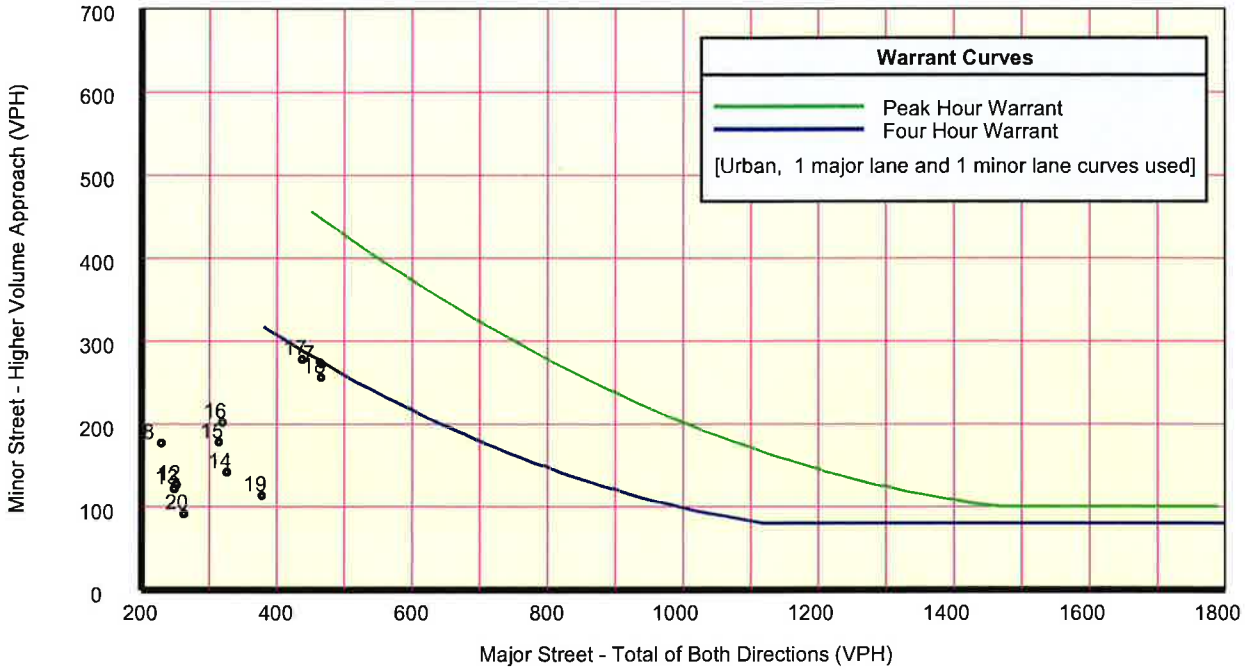
SEI, Inc.

Build Year 2014

Butner Road @ Stonewall Tell Road

Study Name : **Build Year-2014**
Study Date : **08/10/11**
Page No. : **2**

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

Hour	Major	Higher Minor		War-1A			War-1B			War-1A&B		
Begin	Total	Vol	Dir	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?
00:00	24	24	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
01:00	12	18	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
02:00	15	5	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
03:00	16	12	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
04:00	16	13	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
05:00	60	38	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
06:00	169	98	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
07:00	466	272	NB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
08:00	229	177	SB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
09:00	149	113	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
10:00	164	103	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
11:00	195	106	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
12:00	251	127	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
13:00	248	122	SB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
14:00	326	142	SB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
15:00	314	178	NB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
16:00	319	202	SB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
17:00	437	278	NB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
18:00	465	256	NB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
19:00	378	114	SB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
20:00	262	92	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
21:00	166	86	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
22:00	133	60	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
23:00	72	32	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---

SEI, Inc.

Design Year 2034

Butner Road @ Stonewall Tell Road

Study Name : **Design Year 2034**
Study Date : **08/05/11**
Page No. : **1**

Signal Warrants - Summary

Major Street Approaches

Eastbound: **Butner Road 3712**
Number of Lanes: **1**
Approach Speed: **45**
Total Approach Volume: **2,790**

Westbound: **Butner Road 3347**
Number of Lanes: **1**
Approach Speed: **45**
Total Approach Volume: **2,603**

Minor Street Approaches

Northbound: **Stonewall Tell Road 3302**
Number of Lanes: **1**
Total Approach Volume: **2,928**

Southbound: **Stonewall Tell Road 3197**
Number of Lanes: **1**
Total Approach Volume: **2,584**

Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 2 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 0 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 0 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Not Satisfied**
Number of hours (3) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour ..... **Not Satisfied**

Warrant 3A - Peak Hour Volumes ..... **Not Satisfied**
Volumes do not exceed minimums for any hour.

Warrant 3B - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 4 - Pedestrian Volumes ..... **Not Evaluated**

Warrant 5 - School Crossing ..... **Not Evaluated**

Warrant 6 - Coordinated Signal System ..... **Not Satisfied**
No adjacent coordinated signals are present

Warrant 7 - Crash Experience ..... **Not Satisfied**
Number of accidents (-1) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network ..... **Not Satisfied**
Major Route conditions not met. One or more volume requirement met.

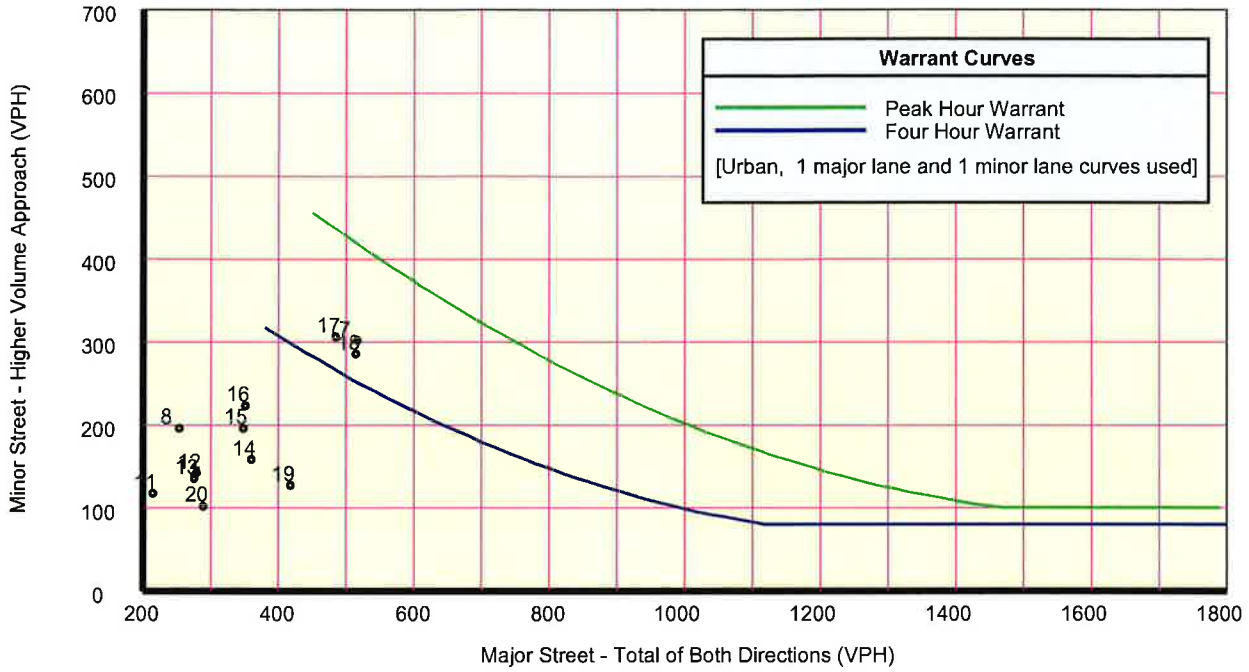
SEI, Inc.

Design Year 2034

Butner Road @ Stonewall Tell Road

Study Name : **Design Year 2034**
Study Date : **08/05/11**
Page No. : **2**

Signal Warrants - Summary



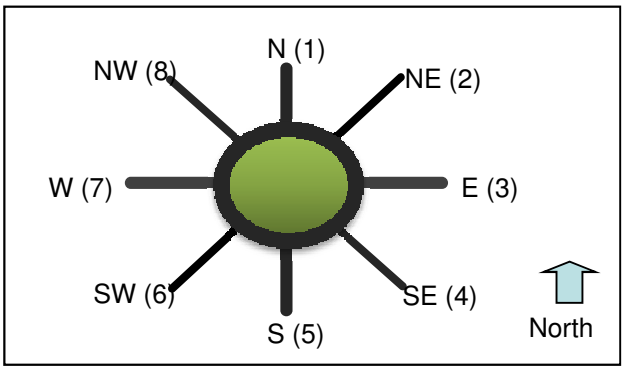
Analysis of 8-Hour Volume Warrants:

Hour	Major	Higher Minor		War-1A			War-1B			War-1A&B		
Begin	Total	Vol	Dir	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?
00:00	27	26	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
01:00	13	19	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
02:00	16	5	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
03:00	16	12	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
04:00	16	14	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
05:00	65	45	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
06:00	188	107	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
07:00	516	302	NB	500-Yes	150-Yes	Both	750-No	75-Yes	Minor	600-No	120-Yes	Minor
08:00	253	196	SB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
09:00	166	125	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
10:00	178	117	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
11:00	214	117	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
12:00	279	142	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
13:00	275	135	SB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
14:00	360	158	SB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
15:00	348	196	NB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
16:00	351	223	SB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
17:00	484	306	NB	500-No	150-Yes	Minor	750-No	75-Yes	Minor	600-No	120-Yes	Minor
18:00	514	285	NB	500-Yes	150-Yes	Both	750-No	75-Yes	Minor	600-No	120-Yes	Minor
19:00	418	127	SB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-Yes	Minor
20:00	289	102	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
21:00	182	96	NB	500-No	150-No	---	750-No	75-Yes	Minor	600-No	120-No	---
22:00	143	66	NB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---
23:00	82	36	SB	500-No	150-No	---	750-No	75-No	---	600-No	120-No	---

Appendix E: Roundabout Analysis

General & Site Information

Analyst:	VK
Agency/Company:	SEI,Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2014, AM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Northern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			95		340			
	NE (2), vph								
	E (3), vph	75				295			
	SE (4), vph								
	S (5), vph	235		105					
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Output	Total Vehicles	310	0	200	0	635	0	0	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	98%	100%	98%	100%	100%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	2%	0%	2%	0%	0%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	0.980	1.000	0.980	1.000	1.000	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	105	0	377	0	0	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	83	0	0	0	327	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	261	0	116	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	0	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	344	0	222	0	704	0	0	0
Conflicting flow, pcu/h	116	0	377	0	83	0	0	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1006	NA	775	NA	1040	NA	NA	NA
V/C ratio	**0.34**		**0.29**		**0.68**			
Control Delay, sec/pcu	**5**		**6**		**10**			
LOS	A		A		B			
95th % Queue (ft)	**39**		**30**		**142**			

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1132	NA	939	NA	1156	NA	NA	NA
V/C ratio	**0.30**		**0.24**		**0.61**			
Control Delay, sec/pcu	**5**		**5**		**8**			
LOS	A		A		A			
95th % Queue (ft)	**33**		**23**		**111**			

Notes:

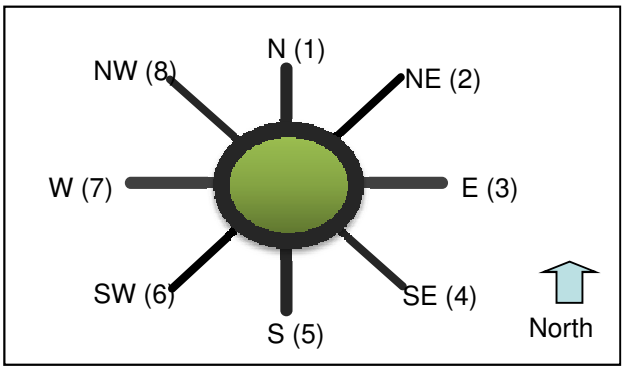
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2014, PM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Northern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			45		250			
	NE (2), vph								
	E (3), vph	55				160			
	SE (4), vph								
	S (5), vph	245		255					
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Output	Total Vehicles	300	0	300	0	410	0	0	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	98%	100%	98%	100%	100%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	2%	0%	2%	0%	0%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	0.980	1.000	0.980	1.000	1.000	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	50	0	277	0	0	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	61	0	0	0	177	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	272	0	283	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	0	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	333	0	333	0	455	0	0	0
Conflicting flow, pcu/h	283	0	277	0	61	0	0	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	852	NA	856	NA	1063	NA	NA	NA
V/C ratio	**0.39**		**0.39**		**0.43**			
Control Delay, sec/pcu	**7**		**7**		**6**			
LOS	A		A		A			
95th % Queue (ft)	**48**		**47**		**56**			

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1009	NA	1013	NA	1173	NA	NA	NA
V/C ratio	**0.33**		**0.33**		**0.39**			
Control Delay, sec/pcu	**5**		**5**		**5**			
LOS	A		A		A			
95th % Queue (ft)	**37**		**37**		**47**			

Notes:

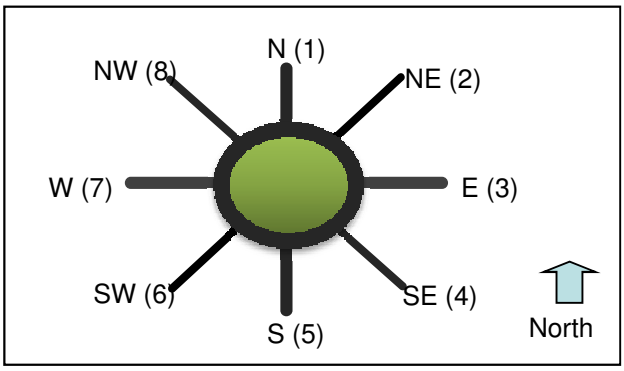
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2014, AM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Southern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			12		265		370	
	NE (2), vph								
	E (3), vph	12				8		5	
	SE (4), vph								
	S (5), vph	215		8				135	
	SW (6), vph								
	W (7), vph	125		5		40			
	NW (8), vph								
Output	Total Vehicles	352	0	25	0	313	0	510	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	100%	100%	98%	100%	98%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	0%	0%	2%	0%	2%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	1.000	1.000	0.980	1.000	0.980	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	13	0	294	0	410	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	13	0	0	0	9	0	6	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	238	0	9	0	0	0	150	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	139	0	5	0	44	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	390	0	27	0	347	0	565	0
Conflicting flow, pcu/h	58	0	748	0	429	0	260	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1066	NA	535	NA	736	NA	871	NA
V/C ratio	**0.37**		**0.05**		**0.47**		**0.65**	
Control Delay, sec/pcu	**5**		**7**		**9**		**11**	
LOS	A		A		A		B	
95th % Queue (ft)	**43**		**4**		**65**		**125**	

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1175	NA	664	NA	900	NA	1025	NA
V/C ratio	**0.33**		**0.04**		**0.39**		**0.55**	
Control Delay, sec/pcu	**5**		**6**		**6**		**8**	
LOS	A		A		A		A	
95th % Queue (ft)	**37**		**3**		**47**		**89**	

Notes:

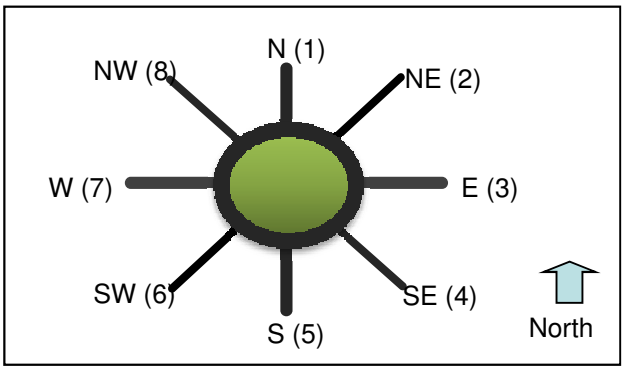
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2014, PM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Southern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			12		225		185	
	NE (2), vph								
	E (3), vph	12				8		5	
	SE (4), vph								
	S (5), vph	240		8				55	
	SW (6), vph								
	W (7), vph	260		5		90			
	NW (8), vph								
Output	Total Vehicles	512	0	25	0	323	0	245	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	100%	100%	98%	100%	98%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	0%	0%	2%	0%	2%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	1.000	1.000	0.980	1.000	0.980	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	13	0	249	0	205	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	13	0	0	0	9	0	6	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	266	0	9	0	0	0	61	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	288	0	5	0	100	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	568	0	27	0	358	0	272	0
Conflicting flow, pcu/h	114	0	554	0	224	0	288	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1008	NA	649	NA	903	NA	847	NA
V/C ratio	**0.56**		**0.04**		**0.40**		**0.32**	
Control Delay, sec/pcu	**8**		**6**		**7**		**6**	
LOS	A		A		A		A	
95th % Queue (ft)	**92**		**3**		**49**		**35**	

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1134	NA	808	NA	1052	NA	1005	NA
V/C ratio	**0.50**		**0.03**		**0.34**		**0.27**	
Control Delay, sec/pcu	**6**		**5**		**5**		**5**	
LOS	A		A		A		A	
95th % Queue (ft)	**74**		**3**		**39**		**28**	

Notes:

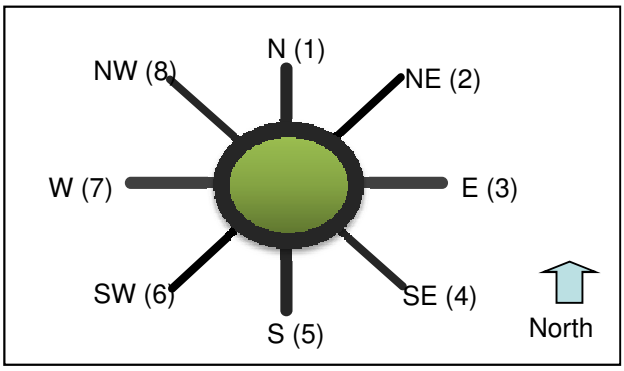
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2034, AM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Northern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			105		375			
	NE (2), vph								
	E (3), vph	80				325			
	SE (4), vph								
	S (5), vph	260		120					
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Output	Total Vehicles	340	0	225	0	700	0	0	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	98%	100%	98%	100%	100%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	2%	0%	2%	0%	0%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	0.980	1.000	0.980	1.000	1.000	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	116	0	416	0	0	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	89	0	0	0	360	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	288	0	133	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	0	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	377	0	249	0	776	0	0	0
Conflicting flow, pcu/h	133	0	416	0	89	0	0	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	989	NA	746	NA	1034	NA	NA	NA
V/C ratio	**0.38**		**0.33**		**0.75**			
Control Delay, sec/pcu	**6**		**7**		**13**			
LOS	A		A		B			
95th % Queue (ft)	**46**		**38**		**187**			

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1120	NA	910	NA	1152	NA	NA	NA
V/C ratio	**0.34**		**0.27**		**0.67**			
Control Delay, sec/pcu	**5**		**5**		**9**			
LOS	A		A		A			
95th % Queue (ft)	**38**		**28**		**141**			

Notes:

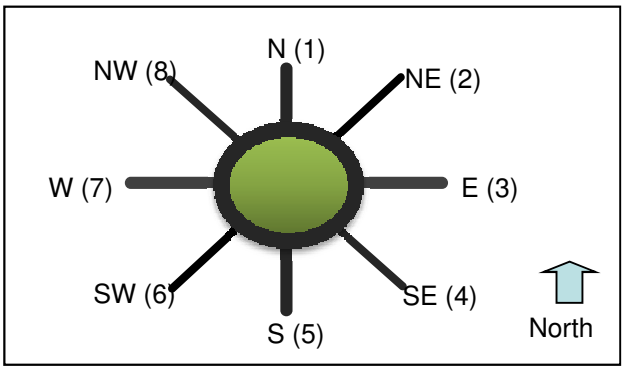
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2034, PM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Northern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			50		275			
	NE (2), vph								
	E (3), vph	60				175			
	SE (4), vph								
	S (5), vph	270		285					
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Output	Total Vehicles	330	0	335	0	450	0	0	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	98%	100%	98%	100%	100%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	2%	0%	2%	0%	0%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	0.980	1.000	0.980	1.000	1.000	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	55	0	305	0	0	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	67	0	0	0	194	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	299	0	316	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	0	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	366	0	371	0	499	0	0	0
Conflicting flow, pcu/h	316	0	305	0	67	0	0	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	824	NA	833	NA	1057	NA	NA	NA
V/C ratio	**0.44**		**0.45**		**0.47**			
Control Delay, sec/pcu	**8**		**8**		**6**			
LOS	A		A		A			
95th % Queue (ft)	**59**		**59**		**66**			

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	984	NA	992	NA	1169	NA	NA	NA
V/C ratio	**0.37**		**0.37**		**0.43**			
Control Delay, sec/pcu	**6**		**6**		**5**			
LOS	A		A		A			
95th % Queue (ft)	**44**		**45**		**56**			

Notes:

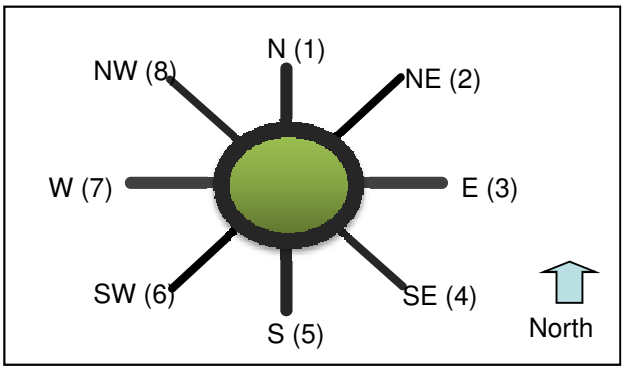
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2034, AM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Southern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			12		295		405	
	NE (2), vph								
	E (3), vph	12				8		5	
	SE (4), vph								
	S (5), vph	240		8				150	
	SW (6), vph								
	W (7), vph	140		5		45			
	NW (8), vph								
Output	Total Vehicles	392	0	25	0	348	0	560	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	100%	100%	98%	100%	98%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	0%	0%	2%	0%	2%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	1.000	1.000	0.980	1.000	0.980	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	13	0	327	0	449	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	13	0	0	0	9	0	6	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	266	0	9	0	0	0	166	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	155	0	5	0	50	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	435	0	27	0	386	0	621	0
Conflicting flow, pcu/h	64	0	826	0	468	0	288	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1060	NA	495	NA	708	NA	847	NA
V/C ratio	**0.41**		**0.05**		**0.55**		**0.73**	
Control Delay, sec/pcu	**6**		**8**		**11**		**15**	
LOS	A		A		B		B	
95th % Queue (ft)	**52**		**4**		**85**		**170**	

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1171	NA	607	NA	872	NA	1005	NA
V/C ratio	**0.37**		**0.04**		**0.44**		**0.62**	
Control Delay, sec/pcu	**5**		**6**		**7**		**9**	
LOS	A		A		A		A	
95th % Queue (ft)	**44**		**4**		**59**		**113**	

Notes:

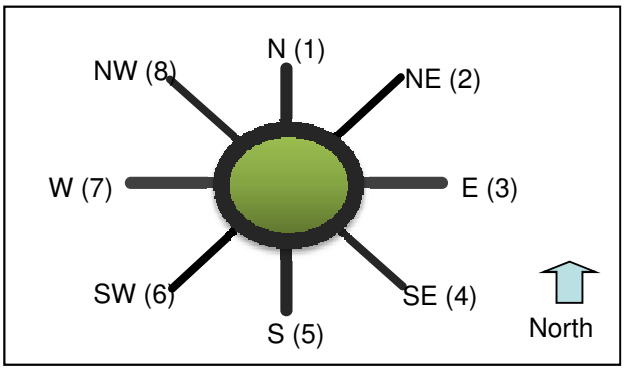
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

General & Site Information

Analyst:	VK
Agency/Company:	SEI, Inc.
Date:	8/10/2011
Project Name or PI#:	0007533
Year, Peak Hour:	2034, PM Peak
County/District:	Fulton/District 7
Intersection:	Butner Rd and Stonewall Tell Rd Southern Intersection



Volumes

		Entry Legs (FROM)							
		N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
Exit Legs (TO)	N (1), vph			12		250		200	
	NE (2), vph								
	E (3), vph	12				8		5	
	SE (4), vph								
	S (5), vph	270		8				60	
	SW (6), vph								
	W (7), vph	285		5		95			
	NW (8), vph								
Output	Total Vehicles	567	0	25	0	353	0	265	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98%	100%	100%	100%	98%	100%	98%	100%
% SU/ Bus	0%	0%	0%	0%	0%	0%	0%	0%
% Trucks/ Combin.	2%	0%	0%	0%	2%	0%	2%	0%
% Bicycle	0%	0%	0%	0%	0%	0%	0%	0%
PHF	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
F_{HV}	0.980	1.000	1.000	1.000	0.980	1.000	0.980	1.000

Entry/Conflicting Flows	N	NE	E	SE	S	SW	W	NW
Flow to Leg # N (1), pcu/h	0	0	13	0	277	0	222	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	13	0	0	0	9	0	6	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	299	0	9	0	0	0	67	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	316	0	5	0	105	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	629	0	27	0	391	0	294	0
Conflicting flow, pcu/h	119	0	604	0	241	0	321	0

Roundabout Type	Standard Single Lane or Urban Compact
Enter type here…	Urban Compact

Results: Approach Measures of Effectiveness

NCHRP-572 Model	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1003	NA	618	NA	888	NA	819	NA
V/C ratio	**0.63**		**0.04**		**0.44**		**0.36**	
Control Delay, sec/pcu	**9**		**6**		**7**		**7**	
LOS	A		A		A		A	
95th % Queue (ft)	**117**		**3**		**58**		**42**	

UK Model**	N	NE	E	SE	S	SW	W	NW
Entry Capacity, pcu/h	1130	NA	771	NA	1040	NA	980	NA
V/C ratio	**0.56**		**0.04**		**0.38**		**0.30**	
Control Delay, sec/pcu	**7**		**5**		**6**		**5**	
LOS	A		A		A		A	
95th % Queue (ft)	**91**		**3**		**45**		**32**	

Notes:

Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
F_{HV} = heavy vehicle factor
pcu = passenger car unit

Bypass Lane Merge Point Analysis (if applicable)

Bypass Characteristics	Bypass #1	Bypass #2	Bypass #3	Bypass #4	Bypass #5	Bypass #6
Select Entry Leg from Bypass (FROM)						
Select Exit Leg for Bypass (TO)						
Volumes						
Right Turn Volume removed from Entry Leg						
Volume Characteristics (for entry leg)						
PHF						
F_{HV}						
NOTE: Volume Characteristics for Exit Leg are already taken into account						
Entry/Conflicting Flows						
Entry Flow						
Conflicting Flow						
Bypass Lane Results (NCHRP-572 Model)						
Entry Capacity at bypass mergepoint, pcu/hr						
V/C ratio						
Control Delay, sec/pcu						
LOS						
95th % Queue (ft)						

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	200	8	60	5	8	12	95	250	5	12	270	285
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	9	65	5	9	13	103	272	5	13	293	310
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			7									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	815	803	293	805	1110	274	603			277		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	815	803	293	805	1110	274	603			277		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	15	97	91	98	95	98	89			99		
cM capacity (veh/h)	256	280	746	245	185	764	974			1286		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	217	74	27	103	277	307	310
Volume Left	217	0	5	103	0	13	0
Volume Right	0	65	13	0	5	0	310
cSH	256	845	315	974	1700	1286	1700
Volume to Capacity	0.85	0.09	0.09	0.11	0.16	0.01	0.18
Queue Length 95th (ft)	173	7	7	9	0	1	0
Control Delay (s)	65.9	11.2	17.5	9.1	0.0	0.4	0.0
Lane LOS	F	B	C	A		A	
Approach Delay (s)	52.0		17.5	2.5		0.2	
Approach LOS	F		C				

Intersection Summary			
Average Delay	12.7		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		