ORIGINAL TO GENERAL FILES

# DEPARTMENT OF TRANSPORTATION
# STATE OF GEORGIA

## OFFICE OF DESIGN POLICY & SUPPORT
## INTERDEPARTMENTAL CORRESPONDENCE

**FILE** P.I. # 0009949
Lumpkin County
GDOT District 1 - Gainesville
Roundabout: SR 9 at SR 52

**OFFICE** Design Policy & Support

**DATE** 6/02/2015

**FROM** Kim Phillips 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:

Glenn Bowman, Director of Engineering
Joe Carpenter, Director of P3/Program Delivery
Genetha Rice-Singleton, Assistant Director of P3/Program Delivery
Albert Shelby, State Program Delivery Engineer
Darryl VanMeter, State Innovative Delivery Engineer
Bobby Hilliard, Program Control Administrator
Cindy VanDyke, State Transportation Planning Administrator
Hiral Patel, State Environmental Administrator
Andrew Heath, State Traffic Engineer
Angela Robinson, Financial Management Administrator
Lisa Myers, State Project Review Engineer
Charles "Chuck" Hasty, State Materials Engineer
Lee Upkins, State Utilities Engineer
Richard Cobb, Statewide Location Bureau Chief
Ed David Adams, State Safety Program Manager
Brent Cook, District Engineer
Brandon Kirby, District Preconstruction Engineer
Neil Kantner, District Utilities Engineer
Dylan Curtis, Project Manager
BOARD MEMBER - 9th Congressional District

**DEPARTMENT OF TRANSPORTATION**
**STATE OF GEORGIA**
**PROJECT CONCEPT REPORT**

| | | | |
|---|---|---|---|
| Project Type: | Intersection Improvement | P.I. Number | 0009949 |
| GDOT District: | One | County: | Lumpkin |
| Federal Route Number: | | State Route Number: | 9 & 52 |
| | | Project Number: | 0009949 |

The intersection improvement of SR 9 @ SR 52 located approximately 3.5 miles west of Dahlonega, in Lumpkin County.

**Submitted for approval:**

Clark Patterson Lee — 2/19/2015
Consultant Designer & Firm *or* GDOT Concept/Design Phase Office Head & — Date

N/A
Local Government Sponsor — Date

Albert V. Shelby — 3/16/15
State Program Delivery Engineer — Date

KAN — 2/27/15
GDOT Project Manager — Date

**Recommendation for approval:** *(Delete any inapplicable signature lines)*

* HIRAL PATEL — 3/26/2015
State Environmental Administrator — Date

* ANDREW HEATH — 4/6/2015
State Traffic Engineer — Date

Project Review Engineer — Date

* NICHOLAS FIELDS — 4/2/2015
State Utilities Engineer — Date

for * BRENT COOK — 3/27/2015
District Engineer — Date

~~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).~~

Cynthia L Vaughn — 3-27-15
State Transportation Planning Administrator — Date

☐ **MPO Area: This project is consistent with the MPO adopted Regional Transportation Plan (RTP)/Long Range Transportation Plan (LRTP).**

☑ **Rural Area: This project is consistent with the goals outlined in the Statewide Transportation Plan (SWTP) and/or is included in the State Transportation Improvement Program (STIP).**

Primary PI # 0009949
Add'l PI Nos.
NEPA analyst A. Burress
Recipient:
Copies: OH ___ Asst. OH ___
NEPA ___ A/N ___ Arch ___
Eco ___ Hist ___
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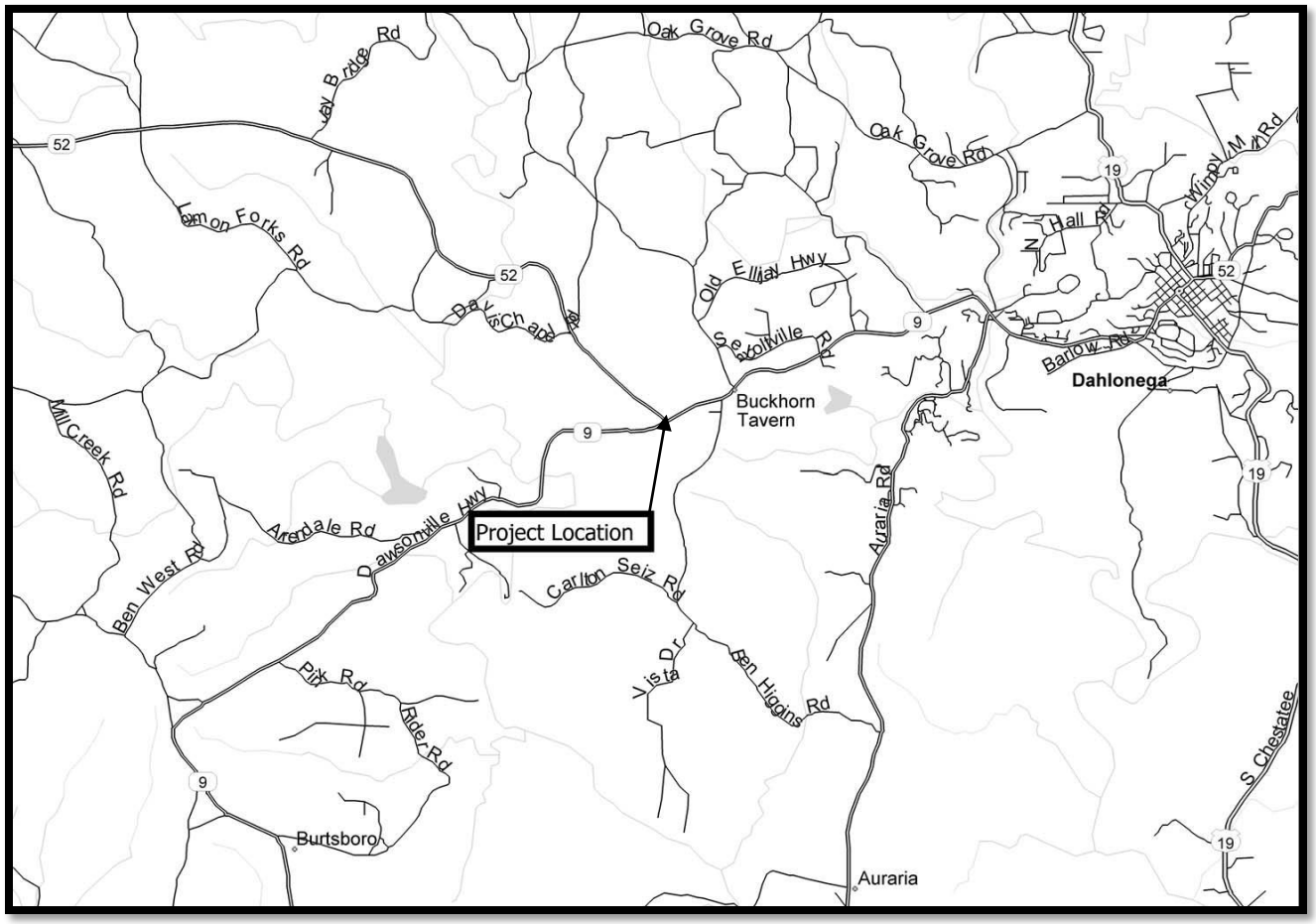
* RECOMMENDATION(S) ON FILE –

# PROJECT LOCATION MAP

## SR 9 @ SR 52



# PLANNING AND BACKGROUND

## Project Justification Statement:

The purpose of the proposed project is to reduce the crash frequency and severity while improving the operational efficiency at the intersection of SR 9 at SR 52 in Lumpkin County, GA. In Georgia, nearly a third of fatal crashes occur at intersections making intersection safety a focus area for the Georgia Department of Transportation. Nationally intersection crashes account for 40% of all reported crashes and approximately 20% of traffic fatalities. Of those fatalities, nearly 50% are the result of angle collisions. Angle collisions are often high speed, high impact crashes which often result in serious injuries or fatalities.

In the project area, SR 9 is a two lane rural major collector with a posted speed limit of 45 mph and an AADT of 4200 vehicles per day. SR 52 is a two lane rural minor arterial with a posted speed limit of 55 mph and an AADT of 2300 vehicles per day. Currently, the Y–intersection has slip lanes and is stop controlled.

Crash data from 2010-2014 indicated that 11 crashes occurred at these intersections resulting in 2 total injuries. Of those crashes 29% were angle collisions. Studies have shown that the installation of a roundabout results in nearly 80% reduction in fatal and serious injury crashes and nearly 40% reduction in property damage crashes. The Office of Traffic Operations recommends constructing a roundabout at this location.

**Existing conditions:** SR 9 and SR 52 are two-lane roadways. The posted speed limit along SR 52 is 55 MPH. The posted speed limit along SR 9 is 45 mph.

**Other projects in the area:** *N/A*

**MPO:** N/A
**TIA Regional Commission:** Georgia Mountains RC
**Congressional District:** 9

**TIP #:** if applicable
RC Project ID (if TIA project)

**Federal Oversight:** ☐ PoDI ☒ Exempt ☐ State Funded ☐ Other

**Projected Traffic:** *ADT or AADT*

SR 9 Current Year (2018): 4200 Open Year (2018): 4600 Design Year (2038): 6200
SR 52 Current Year (2018): 2300 Open Year (2018): 2550 Design Year (2038): 3400
Traffic Projections Performed by: GDOT Office or Planning

**Functional Classification -** SR 52 (classified as a Rural Minor Collector) intersects SR 9 (classified as a Rural Minor Arterial),

**Complete Streets - Bicycle, Pedestrian, and/or Transit Standard Warrants:**

Warrants met: ☐ None ☒ Bicycle ☐ Pedestrian ☐ Transit

SR 9 and SR 52 intersection is within the limits of the designated State Bicycle Route 90 – Mountain Crossing.

**Is this a 3R (Resurfacing, Restoration, & Rehabilitation) Project?** ☒ No ☐ Yes

Preliminary Pavement Evaluation Summary Report Required? ☒ No ☐ Yes

**DESIGN AND STRUCTURAL**
**Description of the proposed project:**

The proposed project would involve the replacement of the existing unsignalized Y intersection of State Route (SR) 9/ Dawsonville Highway and SR 52 with a roundabout. The SR9/SR 52 intersection is located approximately 4.2 mile west of downtown Dahlonega in Lumpkin County, Georgia. The existing right-of-way along SR 9 and SR 52 is approximately 100 feet. The proposed right-of-way on SR 52 varies from approximately 100 to 195 feet, and on SR 9 varies from approximately 110 feet to 235 feet. The total project length would be approximately 0.44 mile.

**Major Structures:** *N/A*

**Mainline Design Features:** SR 52 (classified as a Rural Minor Collector) intersects SR 9 (classified as a Rural Minor Arterial)

| Feature | Existing | Standard* | Proposed |
|---|---|---|---|
| **Typical Section** | | | |
| - **Number of Lanes** | **2** | **2** | **2** |
| - **Lane Width(s)** | **12** | **12** | **12** |
| - **Median Width & Type** | **None** | **None** | **None** |
| - **Outside Shoulder or Border Area Width** | **Varies** | **8' &10' Rural & Urban** | **8' &10' Rural & Urban** |
| - **Outside Shoulder Slope** | **Varies** | **6%Rural & 2% Urban** | **6%Rural & 2% Urban** |
| - **Inside Shoulder Width** | **None** | **None** | **None** |
| - **Sidewalks** | **None** | **None** | **None** |
| - **Auxiliary Lanes** | **None** | **None** | **None** |
| - **Bike Lanes** | **None** | **None** | **None** |
| **Posted Speed** | **45 SR9 / 55 SR52** | | **45 SR9 / 55 SR52** |
| **Intersection Design Speed** | **Stop SR 52/45 SR 9** | | **25 Roundabout** |
| **Min Horizontal Curve Radius at Intersection** | **307' SR9, 631' SR52** | | **500' SR9, 2900' SR52** |
| **Maximum Superelevation Rate** | **6%** | **6%** | **6%** |
| **Maximum Grade** | **4%** | **6%** | **6%** |
| **Access Control** | **By Permit** | **By Permit** | **By Permit** |
| **Design Vehicle** | **WB 67** | **WB 67** | **WB 67** |
| **Pavement Type** | **Asphalt** | | **Asphalt** |
| **Right of Way Width** | **Varies** | | **Varies** |

*According to current GDOT design policy if applicable

**Major Interchanges/Intersections:** Major intersections include: SR 9 at SR 52 (existing stop condition on SR 52). The current geometrics of the existing "Y" configuration is operating as three separate intersections.

**Lighting required:** ☐ No ☒ Yes

**Off-site Detours Anticipated:** ☒ No ☐ Undetermined ☐ Yes

**Transportation Management Plan [TMP] Required:** ☐ No ☒ Yes

**Design Exceptions to FHWA/AASHTO controlling criteria anticipated:**

| FHWA/AASHTO Controlling Criteria | No | Undeter-mined | Yes | Appvl Date (if applicable) |
|---|---|---|---|---|
| 1. Design Speed | ☒ | ☐ | ☐ | |
| 2. Lane Width | ☒ | ☐ | ☐ | |
| 3. Shoulder Width | ☒ | ☐ | ☐ | |
| 4. Bridge Width | ☒ | ☐ | ☐ | |
| 5. Horizontal Alignment | ☒ | ☐ | ☐ | |
| 6. Superelevation | ☒ | ☐ | ☐ | |
| 7. Vertical Alignment | ☒ | ☐ | ☐ | |
| 8. Grade | ☒ | ☐ | ☐ | |
| 9. Stopping Sight Distance | ☒ | ☐ | ☐ | |
| 10. Cross Slope | ☒ | ☐ | ☐ | |
| 11. Vertical Clearance | ☒ | ☐ | ☐ | |
| 12. Lateral Offset to Obstruction | ☒ | ☐ | ☐ | |
| 13. Bridge Structural Capacity | ☒ | ☐ | ☐ | |

**Design Variances to GDOT Standard Criteria anticipated:**

| GDOT Standard Criteria | Reviewing Office | No | Undeter--mined | Yes | Appvl Date (if applicable) |
|---|---|---|---|---|---|
| 1. Access Control/Median Openings | DP&S | ☒ | ☐ | ☐ | |
| 2. Intersection Sight Distance | DP&S | ☒ | ☐ | ☐ | |
| 3. Intersection Skew Angle | DP&S | ☒ | ☐ | ☐ | |
| 4. Lateral Offset to Obstruction | DP&S | ☒ | ☐ | ☐ | |
| 5. Rumble Strips | DP&S | ☒ | ☐ | ☐ | |
| 6. Safety Edge | DP&S | ☒ | ☐ | ☐ | |
| 7. Median Usage | DP&S | ☒ | ☐ | ☐ | |
| 8. Roundabout Illumination Levels | DP&S | ☒ | ☐ | ☐ | |
| 9. Complete Streets | DP&S | ☒ | ☐ | ☐ | |
| 10. ADA & PROWAG | DP&S | ☒ | ☐ | ☐ | |
| 11. GDOT Construction Standards | DP&S | ☒ | ☐ | ☐ | |
| 12. GDOT Drainage Manual | DP&S | ☒ | ☐ | ☐ | |
| 13. GDOT Bridge & Structural Manual | Bridges | ☒ | ☐ | ☐ | |

**VE Study anticipated:** ☒ No ☐ Yes ☐ Completed – Date:

**UTILITY AND PROPERTY**
**Temporary State Route needed:** ☒ No ☐ Yes ☐ Undetermined
**Railroad Involvement:** N/A
.**Utility Involvements:**
Jackson EMC

Windstream CATV
Windstream Telephone

**SUE Required:** ☒ No ☐ Yes ☐ Undetermined

**Public Interest Determination Policy and Procedure recommended?** ☒No ☐Yes

**Right-of-Way (ROW):**

.

Required Right-of-Way anticipated: ☐None ☒Yes ☐Undetermined

Easements anticipated: ☒None ☐Temporary ☐Permanent ☐Utility ☐Other

| | | |
|---|---|---|
| Anticipated total number of impacted parcels: | | 11 |
| Displacements anticipated: | Businesses: | 0 |
| | Residences: | 1 |
| | Other: | 0 |
| | Total Displacements: | 1 |

Existing right-of-way along SR 9 and SR 52 is approximately 100 feet. Proposed right-of-way on SR 52 would vary from approximately 100 to 195 feet, and vary on SR 9 from approximately 110 feet to 235 feet.

**Location and Design approval:** ☐ Not Required ☒ Required

**ROUNDABOUTS**
**Roundabout Lighting Agreement/Commitment Letter received:** ☐ No ☒ Yes
Agreement attached

**Roundabout Planning Level Assessment:** The roundabout checklist is provided in the attachments to this report and within the attached Traffic Report and Roundabout Data sections. All of the items found in the Planning Level Assessment have been addressed and this location is favorable for the inclusion of a roundabout in the design of this project.

**Roundabout Feasibility Study:** The completed feasibility study can be found in the attachments.

**Roundabout Peer Review Required:** ☐ No ☒ Yes ☒ Completed – Date: 12/31/2014
Attach Peer Review Report and responses to all report comments not incorporated into the design.

**CONTEXT SENSITIVE SOLUTIONS**
**Issues of Concern:** N/A

**ENVIRONMENTAL & PERMITS**
**Anticipated Environmental Document:**

**GEPA:** ☐ **NEPA:** ☒ CE ☐ EA/FONSI ☐ EIS

**MS4 Permit Compliance – Is the project located in a MS4 area?** ☒ No ☐ Yes

**Environmental Permits/Variances/Commitments/Coordination anticipated**

| Permit/ Variance/ Commitment/ Coordination Anticipated | No | Yes | Remarks |
|---|---|---|---|
| 1. U.S. Coast Guard Permit | X | | |
| 2. Forest Service/Corps Land | X | | |
| 3. CWA Section 404 Permit | | X | |
| 4. Tennessee Valley Authority Permit | X | | |

| | | | |
|---|---|---|---|
| 5. Buffer Variance | | X | |
| 6. Coastal Zone Management Coordination | X | | |
| 7. NPDES | | X | |
| 8. FEMA | X | | |
| 9. Cemetery Permit | X | | |
| 10. Other Permits | X | | |
| 11. Other Commitments | | X | Possible Special Provision for protected bat species |
| 12. Other Coordination | | X | Possible coordination with USFWS for protected bat species |

**Is a PAR required?** ☒ No ☐ Yes ☐ Completed – Date:

**Environmental Comments and Information:**

**NEPA/GEPA**: In progress. A categorical exclusion (CE) is anticipated. However, the project qualify under conditions of the Programmatic Agreement with FHWA as a Programmatic CE

**Ecology:** Coordination with state and federal agencies has been conducted for threatened and endangered species. One perennial stream and two jurisdictional wetlands were identified within the project area. A combined resource and assessment of effects document will be prepared. The project is within the range of the federally protected Indiana and Northern Long Eared bat. Acoustic and mist netting surveys will occur in May of 2015, after which time the ecology report and bat report will be submitted.

**History:** There are no eligible historic resources within the project area.

Archeology: There are no eligible archaeological sites within the project area. There are no cemeteries within the project area.

**Air Quality:**

| | | |
|---|---|---|
| Is the project located in a PM 2.5 Non-attainment area? | ☒ No | ☐ Yes |
| Is the project located in an Ozone Non-attainment area? | ☒ No | ☐ Yes |
| Is a Carbon Monoxide hotspot analysis required? | ☒ No | ☐ Yes |

**Noise Effects:** A Type III noise assessment will be prepared for the project.

The proposed roundabout would not halve the distance to any noise sensitive receptors.

**Public Involvement:** A public information open house was held on December 4, 2014. Four comments were received. Response letters will be sent to those citizens submitting comments.

**Major stakeholders:** Traveling Public, Lumpkin County

**CONSTRUCTION**

**Issues potentially affecting constructability/construction schedule:** The existing intersection is located on a down grade for SR 9 and at a low point for SR 52. Anticipated improvements will most likely require the elevation of the intersection to be raised. The proposed offset of the new intersection to the East and North provides flexibility for staged construction. No permanent off-site detours are anticipated. Temporary detours are anticipated to construct the roundabout.

**Early Completion Incentives recommended for consideration:** ☒ No ☐ Yes

**COORDINATION, ACTIVITIES, RESPONSIBILITIES, AND COSTS**

**Initial Concept Meeting:** September 17, 2014

**Concept Meeting: N/A**

**Other coordination to date:** Initial concept meeting, PIOH

| Project Activity | Party Responsible for Performing Task(s) |
|---|---|
| Concept Development | Consulting firm |
| Design | Consulting firm |
| Right-of-Way Acquisition | GDOT |
| Utility Relocation | Utility Owner |
| Letting to Contract | GDOT |
| Construction Supervision | GDOT |
| Providing Material Pits | Contractor |
| Providing Detours | In Project |
| Environmental Studies, Documents, & Permits | Consulting firm |
| Environmental Mitigation | GDOT |
| Utility Coordination | GDOT |
| Construction Inspection & Materials Testing | GDOT |

**Project Cost Estimate Summary and Funding Responsibilities:**

| | Breakdown of PE | ROW | Reimbursable Utility | CST* | Environmental Mitigation | Total Cost |
|---|---|---|---|---|---|---|
| Funded By | GDOT | GDOT | GDOT | GDOT | GDOT | |
| $ Amount | $425,000 | $306,000 | $0 | $1,914,420.68 | $0 | $2,645,420.68 |
| Date of Estimate | 1/26/15 | 9/22/14 | 10/1/14 | 2/19/2015 | 1/26/15 | |

*CST Cost includes: Construction, 5% Engineering and Inspection, Contingencies and Liquid AC Cost Adjustment.

**ALTERNATIVES DISCUSSION**

**Alternative selection:** Four conceptual geometric design alternatives were completed to illustrate potential intersection improvement options. The alternatives are as follows:

**Concept A: Roundabout** – Roundabout located on the west edge of existing intersection.

**Concept B: Roundabout** – Roundabout position generally aligned with SR 52 on the north side of the existing intersection footprint.

**Concept C: Roundabout** - Similar to Concept A, with roundabout shifted further to the west.

**Concept D: T-Intersection** – One leg of the existing intersection is removed to simplify the intersection to a traditional "T" configuration. The intersection position is shifted to the west of the existing intersection. Auxiliary right- and left-turn lanes are added.

The project team met with stakeholders at an initial concept meeting that took place on September 17, 2014 with representatives from GDOT, Clark Patterson Lee, Wilburn Engineering, Edwards-Pitman Environmental, Lumpkin County, and Amicalola EMC. The meeting notes are included in the **Roundabout Feasibility Study**. At this meeting, stakeholders identified that Concept B was the preferred option out of the three roundabout concepts that were presented. Generally each of the alternatives provides similar operational performance. Each of the roundabout alternatives is also expected to provide generally similar safety performance. Concept B was the preferred roundabout concept based upon consideration that it best utilized the existing intersection right-of-way, provided a mechanism for speed control through the intersection and was preferred based upon construction staging, vertical considerations, and environmental considerations.

| **Preferred Alternative:** *Roundabout* | | | |
|---|---|---|---|
| **Estimated Property Impacts:** | **11** | **Estimated Total Cost:** | **$2,554,251.13** |
| **Estimated ROW Cost:** | **$306,000.00** | **Estimated CST Time:** | **1 YR** |
| **Rationale:** The "roundabout B alternative" is the preferred alternative. The roundabout is forecasted to meet the project's goal of expanding the capacity of the intersection to meet present and future traffic needs, when analyzed using the HCM 2010 model (with CALTRANS modification). With respect to approach delay and queue length, the roundabout alternative is forecasted to provide better operations than the other alternatives. A roundabout also has many environmental and crash frequency and severity benefits that the other alternatives do not have. | | | |

| **No-Build Alternative:** | | | |
|---|---|---|---|
| **Estimated Property Impacts:** | **0** | **Estimated Total Cost:** | **0 YR** |
| **Estimated ROW Cost:** | **$0** | **Estimated CST Time:** | **$0** |
| **Rationale:** The no-build alternative was discounted as it does not meet the need and purpose for the project. | | | |

| **Alternative 1:** T Intersection | | | |
|---|---|---|---|
| **Estimated Property Impacts:** | **9** | **Estimated Total Cost:** | **$1,932,718.98** |
| **Estimated ROW Cost:** | **$306,000.00** | **Estimated CST Time:** | **1 YR** |
| **Rationale:** This alternative was not selected because it improves operational issues less than the preferred alternate. | | | |

*CST Cost includes: Construction, Engineering and Inspection, Contingencies and Liquid AC Cost Adjustment.

**LIST OF ATTACHMENTS/SUPPORTING DATA**

1. Concept Layout and Detour Plan
2. Typical sections
3. Detailed Cost Estimates:
    a. Construction including Engineering and Inspection
    b. Completed Liquid AC Cost Adjustment forms
    c. Right-of-Way
    d. Utilities
4. Intersection Cost Comparison(Life Cycle Benefit/Cost Ratio)
5. Roundabout Data
    a. Roundabout Checklist
    b. Roundabout Feasibility Study
        1. Traffic Engineering Study
6. Peer Review and responses
7. Lighting commitment letter
8. Minutes of Initial Concept meeting
9. Minutes of any meetings that shows support or objection to the concept *(PIOH.)*

**APPROVALS**

Concur: _____
Director of Engineering

Approve: Margaret B. Pirkle _____ 5.27.15
Chief Engineer Date

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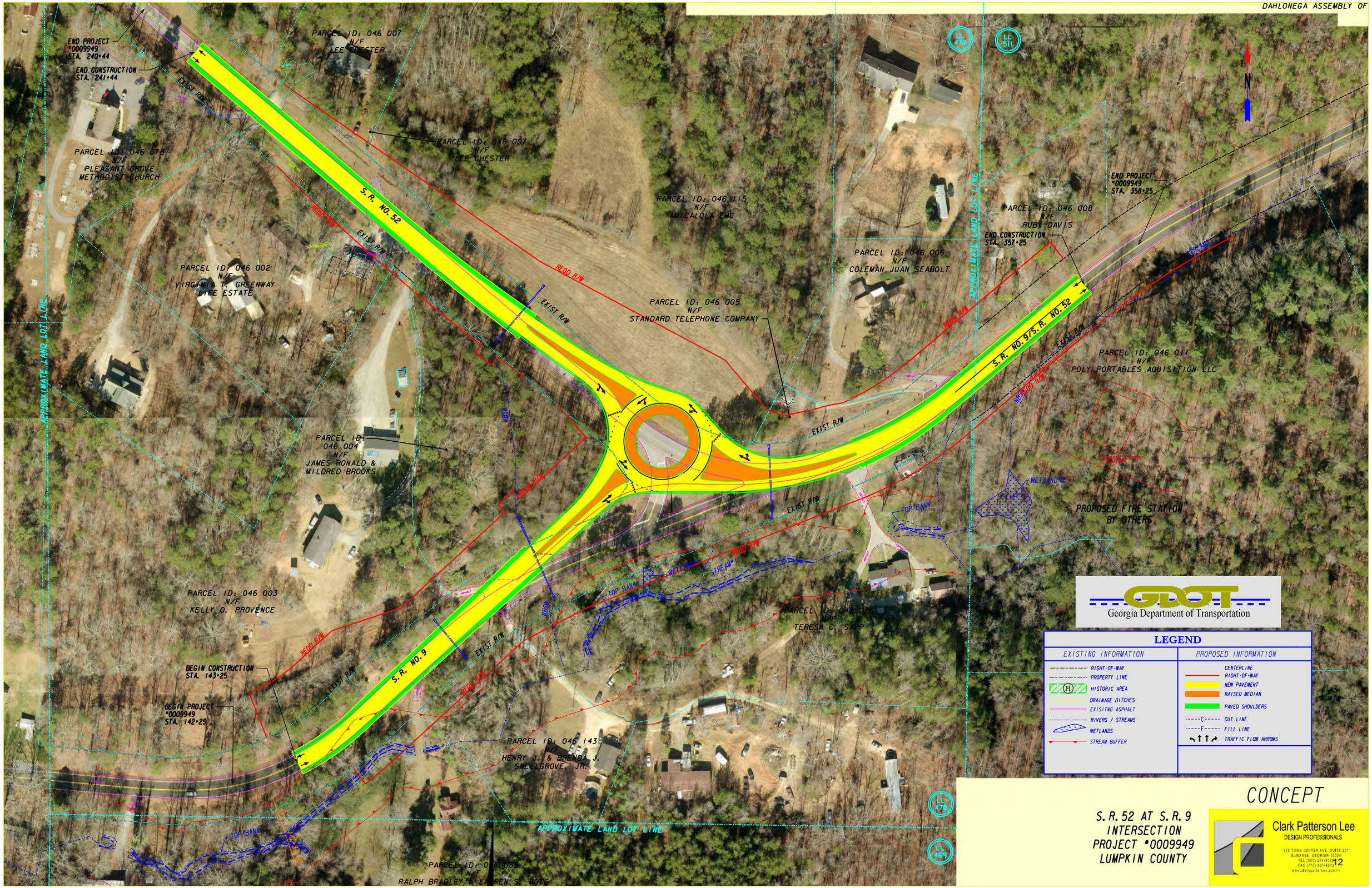
# Attachment #1


DAHLONEGA ASSEMBLY OF
END PROJECT
*0009949
STA. 240+44
END CONSTRUCTION
STA. 241+44
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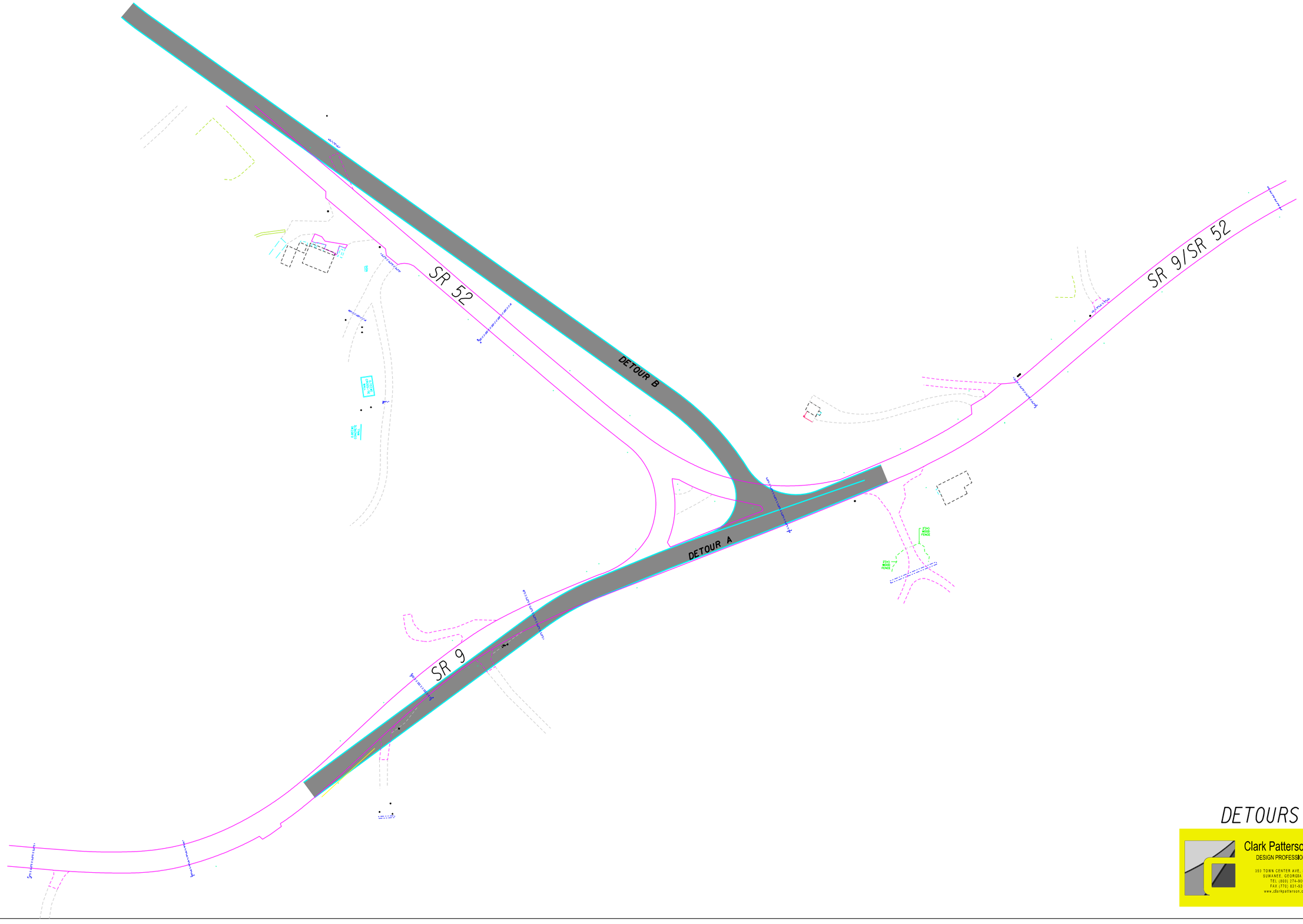
N/F
LEE CHESTER
PARCEL ID: 046 073
N/F
PLEASANT GROVE
METHODIST CHURCH
EXIST R/W
REQD R/W
S.R. NO. 52
PARCEL ID: 046 115
N/F
AMICALOLA EMC
PARCEL ID: 046 002
N/F
VIRGINIA T. GREENWAY
LIFE ESTATE
PARCEL ID: 046 005
N/F
STANDARD TELEPHONE COMPANY
PARCEL ID: 046 006
N/F
COLEMAN JUAN SEABOLT
APPROXIMATE LAND LOT LINE
END PROJECT
*0009949
STA. 358+25
PARCEL ID: 046 008
N/F
RUBY DAVIS
END CONSTRUCTION
STA. 357+25
S.R. NO. 9/S.R. NO. 52
PARCEL ID: 046 011
N/F
POLY PORTABLES AQUISITION LLC
PARCEL ID:
046 004
N/F
JAMES RONALD &
MILDRED BROOKS
WETLANDS
PROPOSED FIRE STATION
BY OTHERS
TOP BANK
STREAM
PARCEL ID: 046 003
N/F
KELLY O. PROVENCE
PARCEL ID: 046 026
N/F
TERESA C. SAPP
S.R. NO. 9
BEGIN CONSTRUCTION
STA. 143+25
BEGIN PROJECT
*0009949
STA. 142+25
PARCEL ID: 046 143
N/F
HENRY J. & BRENDA J.
SNELLGROVE, JR.
APPROXIMATE LAND LOT LINE
PARCEL ID: 046 035
N/F
RALPH BRADLEY & LAUREN S. MOTE
LL 470
LL 469
LL 510
LL 511
N
Georgia Department of Transportation
LEGEND
EXISTING INFORMATION
RIGHT-OF-WAY
PROPERTY LINE
HISTORIC AREA
DRAINAGE DITCHES
EXISITNG ASPHALT
RIVERS / STREAMS
WETLANDS
STREAM BUFFER
PROPOSED INFORMATION
CENTERLINE
RIGHT-OF-WAY
NEW PAVEMENT
RAISED MEDIAN
PAVED SHOULDERS
CUT LINE
FILL LINE
TRAFFIC FLOW ARROWS
CONCEPT
S.R. 52 AT S.R. 9
INTERSECTION
PROJECT *0009949
LUMPKIN COUNTY
Clark Patterson Lee
DESIGN PROFESSIONALS
350 TOWN CENTER AVE, SUITE 201
SUWANEE, GEORGIA 30024
TEL (800) 274-9050
FAX (770) 831-9241
www.clarkpatterson.com>>
12



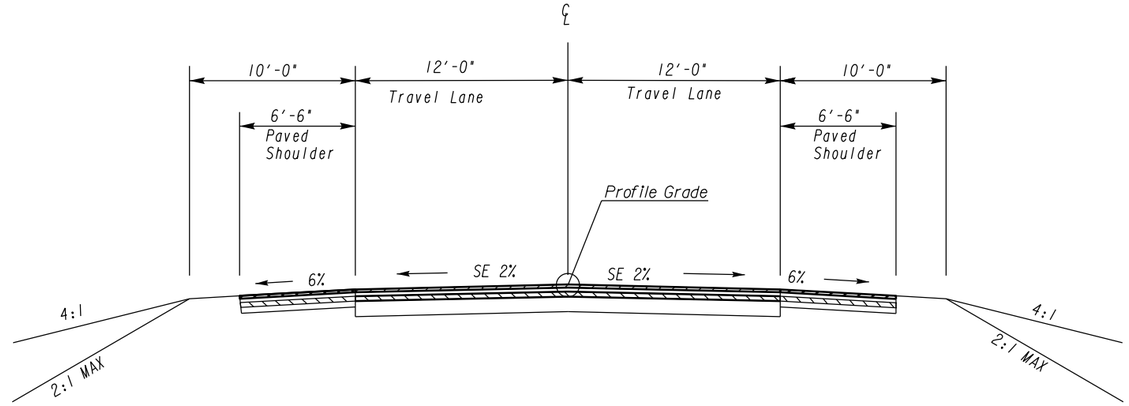

# DETOURS

Clark Patterson Lee
DESIGN PROFESSIONALS
353 TOWN CENTER AVE, SUITE 201
SUWANEE, GEORGIA 30024
TEL (678) 274-9000
FAX (770) 831-9243
www.clarkpatterson.com>>

# Attachment #2

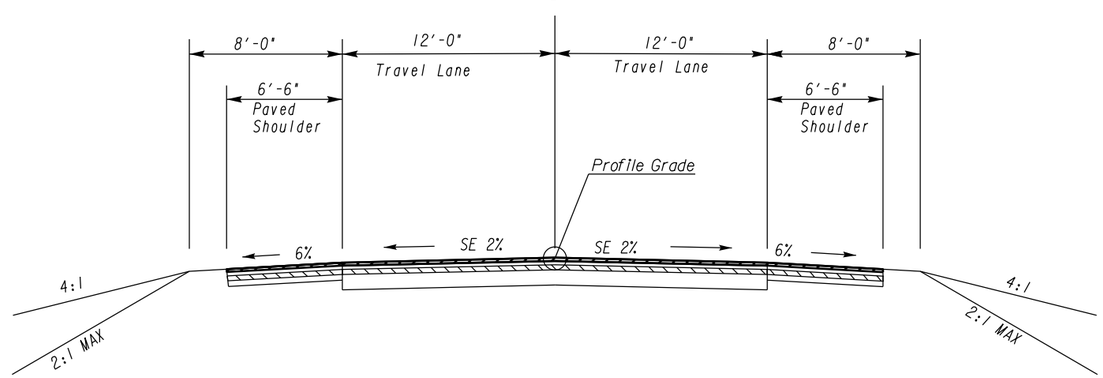
## TYPICAL SECTION #1

S.R. 52




## TYPICAL SECTION #2

S.R. 9

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REVISION DATES

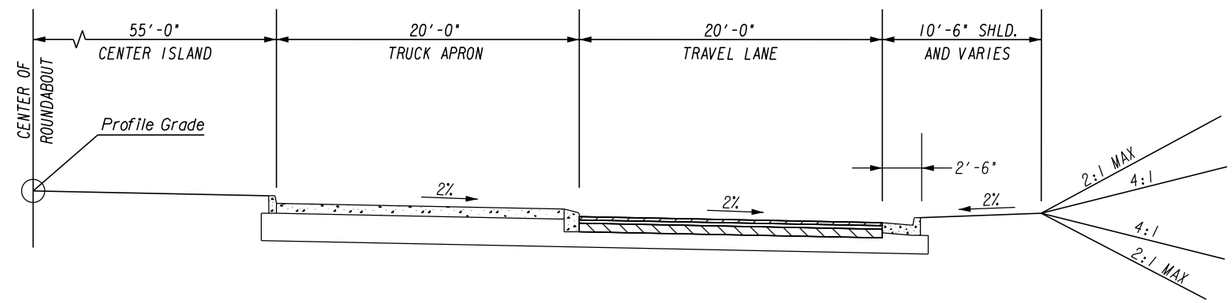
STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

OFFICE:

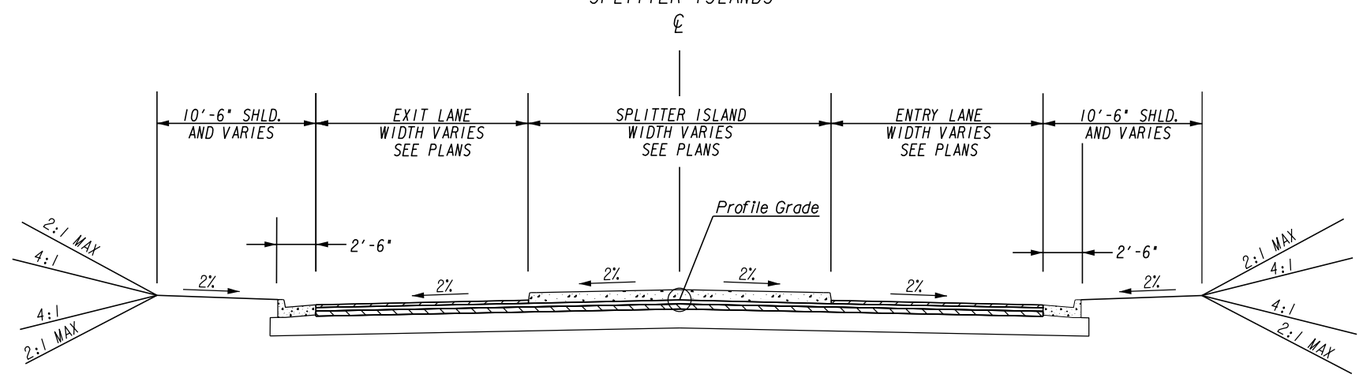
**TYPICAL SECTIONS**
**S.R. 52 AT S.R. 9**

DRAWING No.
05-001

## TS-4
## ROUNDABOUT




## TS-5
## SPLITTER ISLANDS

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REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

OFFICE:

**TYPICAL SECTIONS**
**S.R. 52 AT S.R. 9**

DRAWING No.
05-002

# Attachment #3

JOB ESTIMATE REPORT

JOB NUMBER : 0009949 SPEC YEAR: 13
DESCRIPTION: SR 9 & SR 52 INTERSECTION IMPROVEMENTS

ITEMS FOR JOB 0009949

| LINE | ITEM | ALT | UNITS | DESCRIPTION | QUANTITY | PRICE | AMOUNT |
|---|---|---|---|---|---|---|---|
| 0005 | 150-1000 | | LS | TRAFFIC CONTROL - 0009949 | 1.000 | 50000.00 | 50000.00 |
| 0010 | 153-1300 | | EA | FIELD ENGINEERS OFFICE TP 3 | 1.000 | 78118.02 | 78118.03 |
| 0015 | 163-0232 | | AC | TEMPORARY GRASSING | 3.000 | 383.33 | 1150.00 |
| 0020 | 163-0240 | | TN | MULCH | 90.000 | 219.92 | 19792.85 |
| 0025 | 163-0300 | | EA | CONSTRUCTION EXIT | 3.000 | 1289.55 | 3868.68 |
| 0030 | 163-0520 | | LF | CONSTR AND REMOVE TEMP PIPE SLOPE DRAIN | 5.000 | 15.12 | 75.62 |
| 0035 | 163-0527 | | EA | CNST/REM RIP RAP CKDM,STN P RIPRAP/SN BG | 30.000 | 280.48 | 8414.63 |
| 0040 | 163-0528 | | LF | CONSTR AND REM FAB CK DAM -TP C SLT FN | 100.000 | 4.03 | 403.44 |
| 0045 | 163-0541 | | EA | CONSTR & REM ROCK FILTER DAMS | 3.000 | 479.41 | 1438.24 |
| 0050 | 163-0542 | | EA | CONSTR & REM STONE FILTER RING | 8.000 | 330.65 | 2645.22 |
| 0055 | 163-0550 | | EA | CONS & REM INLET SEDIMENT TRAP | 8.000 | 137.09 | 1096.73 |
| 0060 | 165-0030 | | LF | MAINT OF TEMP SILT FENCE, TP C | 2000.000 | 0.95 | 1905.54 |
| 0065 | 165-0041 | | LF | MAINT OF CHECK DAMS - ALL TYPES | 130.000 | 2.47 | 321.29 |
| 0070 | 165-0101 | | EA | MAINT OF CONST EXIT | 3.000 | 424.69 | 1274.10 |
| 0075 | 165-0105 | | EA | MAINT OF INLET SEDIMENT TRAP | 8.000 | 19.05 | 152.44 |
| 0080 | 165-0110 | | EA | MAINT OF ROCK FILTER DAM | 3.000 | 16.36 | 49.09 |
| 0085 | 165-0111 | | EA | MAINT OF STONE FILTER RING | 8.000 | 119.79 | 958.36 |
| 0090 | 167-1000 | | EA | WATER QUALITY MONITORING AND SAMPLING | 2.000 | 247.36 | 494.73 |
| 0095 | 167-1500 | | MO | WATER QUALITY INSPECTIONS | 24.000 | 335.19 | 8044.78 |
| 0100 | 171-0030 | | LF | TEMPORARY SILT FENCE, TYPE C | 4000.000 | 3.34 | 13395.76 |
| 0105 | 201-1500 | | LS | CLEARING & GRUBBING - 0009949 | 1.000 | 30000.00 | 30000.00 |
| 0110 | 205-0001 | | CY | UNCLASS EXCAV | 30000.000 | 6.13 | 184085.40 |
| 0115 | 402-3103 | | TN | REC AC 9.5 MM SP,TPII,GP2, INCL BM & HL | 1300.000 | 99.15 | 128899.10 |
| 0120 | 402-3190 | | TN | RECYL AC 19 MM SP,GP 1 OR 2 ,INC BM&HL | 1100.000 | 83.22 | 91552.90 |
| 0125 | 402-3121 | | TN | RECYL AC 25MM SP,GP1/2,BM&HL | 3050.000 | 77.03 | 234971.54 |
| 0130 | 310-1101 | | TN | GR AGGR BASE CRS, INCL MATL | 8000.000 | 19.72 | 157763.84 |
| 0135 | 318-3000 | | TN | AGGR SURF CRS | 500.000 | 21.64 | 10822.81 |
| 0139 | 402-1812 | | TN | RECYL AC LEVELING,INC BM&HL | 300.000 | 91.12 | 27337.48 |
| 0140 | 413-1000 | | GL | BITUM TACK COAT | 800.000 | 3.27 | 2620.46 |
| 0145 | 430-0200 | | SY | PLN PC CONC PVMT/CL1C/ 10 TK | 500.000 | 38.25 | 19125.00 |
| 0150 | 432-5010 | | SY | MILL ASPH CONC PVMT,VARB DEPTH | 1000.000 | 6.95 | 6959.90 |
| 0155 | 441-0016 | | SY | DRIVEWAY CONCRETE, 6 IN TK | 100.000 | 39.40 | 3940.62 |
| 0160 | 441-0018 | | SY | DRIVEWAY CONCRETE, 8 IN TK | 180.000 | 41.06 | 7391.87 |
| 0165 | 441-0754 | | SY | CONC MEDIAN, 7 1/2 IN | 900.000 | 43.79 | 39412.97 |
| 0170 | 441-5008 | | LF | CONC HEADER CURB, 6 IN, TP 7 | 260.000 | 11.03 | 2867.98 |
| 0175 | 441-5025 | | LF | CONC HEADER CURB, 4, TP 9 | 350.000 | 13.48 | 4718.00 |
| 0180 | 441-6222 | | LF | CONC CURB & GUTTER/ 8X30TP2 | 1600.000 | 17.54 | 28073.68 |
| 0185 | 444-1000 | | LF | SAWED JTS IN EXIST PVMTS - PCC | 20.000 | 4.76 | 95.22 |
| 0190 | 668-1100 | | EA | CATCH BASIN, GP 1 | 8.000 | 2047.15 | 16377.22 |
| 0195 | 550-1180 | | LF | STM DR PIPE 18,H 1-10 | 850.000 | 34.91 | 29674.22 |
| 0200 | 550-1182 | | LF | STM DR PIPE 18,H 15-20 | 150.000 | 37.14 | 5572.12 |
| 0205 | 550-2180 | | LF | SIDE DR PIPE 18,H 1-10 | 150.000 | 36.68 | 5502.92 |
| 0210 | 550-4218 | | EA | FLARED END SECT 18 IN, ST DR | 8.000 | 533.54 | 4268.36 |
| 0215 | 550-3418 | | EA | SAFETY END SECTION 18,SD,4:1 | 4.000 | 474.17 | 1896.72 |
| 0220 | 550-3618 | | EA | SAFETY END SECTION 18,SD,6:1 | 4.000 | 460.61 | 1842.45 |
| 0225 | 603-2180 | | SY | STN DUMPED RIP RAP, TP 3, 12 | 40.000 | 29.43 | 1177.30 |

JOB ESTIMATE REPORT

| | | | | | | |
|---|---|---|---|---|---|---|
| 0235 | 636-1020 | SF | HWY SGN,TP1MAT,REFL SH TP3 | 60.000 | 13.76 | 825.66 |
| 0240 | 636-1029 | SF | HWY SGN,TP2 MATL,REFL SH TP 3 | 40.000 | 17.61 | 704.50 |
| 0245 | 636-1033 | SF | HWY SIGNS, TP1MAT,REFL SH TP 9 | 150.000 | 16.79 | 2518.80 |
| 0250 | 636-1036 | SF | HWY SGN,TP1MAT,REFL SH TP 11 | 30.000 | 20.00 | 600.00 |
| 0255 | 636-2070 | LF | GALV STEEL POSTS, TP 7 | 250.000 | 7.90 | 1977.25 |
| 0260 | 636-2080 | LF | GALV STEEL POSTS, TP 8 | 20.000 | 8.26 | 165.31 |
| 0265 | 636-2090 | LF | GALV STEEL POSTS, TP 9 | 200.000 | 5.69 | 1139.68 |
| 0270 | 641-1200 | LF | GUARDRAIL, TP W | 300.000 | 21.13 | 6340.38 |
| 0275 | 641-5001 | EA | GUARDRAIL ANCHORAGE, TP 1 | 1.000 | 789.02 | 789.02 |
| 0280 | 641-5012 | EA | GUARDRAIL ANCHORAGE, TP 12 | 1.000 | 1852.58 | 1852.58 |
| 0285 | 643-8200 | LF | BARRIER FENCE (ORANGE), 4 FT | 2000.000 | 1.49 | 2982.28 |
| 0290 | 653-1501 | LF | THERMO SOLID TRAF ST 5 IN, WHI | 3500.000 | 0.54 | 1895.08 |
| 0295 | 653-1502 | LF | THERMO SOLID TRAF ST, 5 IN YEL | 5000.000 | 0.39 | 1968.20 |
| 0300 | 653-0130 | EA | THERM PVMT MARK, ARROW, TP 3 | 6.000 | 76.16 | 457.01 |
| 0305 | 653-3501 | GLF | THERMO SKIP TRAF ST, 5 IN, WHI | 200.000 | 0.41 | 83.26 |
| 0310 | 681-4300 | EA | LT STD, 30' MH, 6' ARM | 12.000 | 2190.90 | 26290.80 |
| 0315 | 681-6364 | EA | LUMINAIRE,TP 3, 400W,M HALIDE | 12.000 | 794.76 | 9537.12 |
| 0320 | 682-1404 | LF | CABLE, TP XHHW, AWG NO 10 | 6030.000 | 0.75 | 4522.50 |
| 0325 | 682-6222 | LF | CONDUIT, NONMETL, TP 2, 2 IN | 1900.000 | 8.73 | 16605.85 |
| 0330 | 682-6225 | LF | CONDUIT, NONMETL, TP 2, 2 1/2 IN | 40.000 | 10.55 | 422.00 |
| 0335 | 682-9000 | LS | MAIN SVC PICK UP POINT | 1.000 | 12063.81 | 12063.81 |
| 0340 | 682-9022 | EA | ELEC JCT BX,REF PLASTIC MORTAR | 5.000 | 375.68 | 1878.43 |
| 0345 | 700-6910 | AC | PERMANENT GRASSING | 6.000 | 1075.57 | 6453.45 |
| 0350 | 700-7000 | TN | AGRICULTURAL LIME | 18.000 | 85.78 | 1544.05 |
| 0355 | 700-8000 | TN | FERTILIZER MIXED GRADE | 7.000 | 548.54 | 3839.81 |
| 0360 | 700-8100 | LB | FERTILIZER NITROGEN CONTENT | 300.000 | 2.08 | 624.53 |
| 0365 | 700-9300 | SY | SOD | 600.000 | 5.81 | 3487.54 |
| 0375 | 702-0212 | EA | CRATAEGUS VIRIDIS - 3 IN CALIPER | 3.000 | 751.50 | 2254.50 |
| 0380 | 702-0470 | EA | ILEX VOMITORIA NANA - 3 GAL | 50.000 | 68.68 | 3434.00 |
| 0385 | 702-9005 | LB | SPRING APPLICATION FERTILIZER | 200.000 | 24.10 | 4820.00 |
| 0390 | 702-9025 | SY | LANDSCAPE MULCH | 350.000 | 5.29 | 1851.95 |
| 0395 | 007-1000 | * | RIGHT OF WAY ACQUISITION | 1.000 | 30600.00 | 30600.00 |

ITEM TOTAL 1395078.93
INFLATED ITEM TOTAL 1569274.07

TOTALS FOR JOB 0009949

ESTIMATED COST: 1569274.10
CONTINGENCY PERCENT ( 10.0 ): 156927.41
ESTIMATED TOTAL: 1726201.51

| | | |
|---|---|---|
| **PROJ. NO.** | Task Order #20 - SR 9 at SR 52 | CALL NO. |
| P.I. NO. | 0009949 | |
| DATE | 1/27/2015 | |

| **INDEX (TYPE)** | **DATE** | **INDEX** |
|---|---|---|
| REG. UNLEADED | Jan-15 | $ 2.186 |
| DIESEL | | $ 3.045 |
| LIQUID AC | | $ 556.00 |

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) | | | | **95910** | **$** | **95,910.00** |
| Monthly Asphalt Cement Price month placed (APM) | Max. Cap | 60% | $ | 889.60 | | |
| Monthly Asphalt Cement Price month project let (APL) | | | $ | 556.00 | | |
| Total Monthly Tonnage of asphalt cement (TMT) | | | | 287.5 | | |

| **ASPHALT** | **Tons** | **%AC** | **AC ton** |
|---|---|---|---|
| Leveling | 300 | 5.0% | 15 |
| 12.5 OGFC | | 5.0% | 0 |
| 12.5 mm | | 5.0% | 0 |
| 9.5 mm SP | 1300 | 5.0% | 65 |
| 25 mm SP | 3050 | 5.0% | 152.5 |
| 19 mm SP | 1100 | 5.0% | 55 |
| | **5750** | | **287.5** |

**BITUMINOUS TACK COAT**

| | | | | | | |
|---|---|---|---|---|---|---|
| Price Adjustment (PA) | | | **$** | **1,146.28** | **$** | **1,146.28** |
| Monthly Asphalt Cement Price month placed (APM) | Max. Cap | 60% | $ | 889.60 | | |
| Monthly Asphalt Cement Price month project let (APL) | | | $ | 556.00 | | |
| Total Monthly Tonnage of asphalt cement (TMT) | | | | 3.436080738 | | |

| Bitum Tack Gals | gals/ton | tons |
|---|---|---|
| 800 | 232.8234 | 3.43608074 |

| | | | |
|---|---|---|---|
| **PROJ. NO.** | Task Order #20 - SR 9 at SR 52 | CALL NO. | |
| P.I. NO. | 0009949 | | |
| DATE | 1/27/2015 | | |

**BITUMINOUS TACK COAT (surface treatment)**

| | | | | | |
|---|---|---|---|---|---|
| Price Adjustment (PA) | | | | **0** | **$ -** |
| Monthly Asphalt Cement Price month placed (APM) | Max. Cap | 60% | $ | 889.60 | |
| Monthly Asphalt Cement Price month project let (APL) | | | $ | 556.00 | |
| 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** | **$ 97,056.28** |

# Department of Transportation

State of Georgia

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Interdepartmental Correspondence

| | | | |
|---|---|---|---|
| **FILE** | R/W Cost Estimate | **OFFICE** | Atlanta |
| | | **DATE** | September 22, 2014 |

**FROM** Phil Copeland, Right of Way Administrator
LaShone Alexander, Right of Way Cost Estimator

**TO** Dylan Curtis, Project Manager

**SUBJECT** **Preliminary Right of Way Cost Estimate**
**Project: Lumpkin County**
**P.I. No.: 0009949**
**Description: SR 9 @ SR 52**

As per your request, attached is a copy of the approved Preliminary Right of Way Cost Estimates on the above referenced projects.

If you have any questions, please contact LaShone Alexander at One Georgia Center 600 West Parkway Street, NW Atlanta, GA 30308, Right of Way Office at (478) 553-1569 or (478) 232-4045.

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PC:LA
Attachments
c: file

GEORGIA DEPARTMENT OF TRANSPORTATION
PRELIMINARY ROW COST ESTIMATE SUMMARY

Date: 9/22/2014 Project: 0009949
Revised: County: Lumpkin County
PI: 0009949

Description: SR 9 @ SR 52
Project Termini: SR 9 @ SR 52

Existing ROW:
Parcels: 4 Required ROW:

| | | |
|---|---|---|
| Land and Improvements | | $196,500.00 |
| *Proximity Damage* | *$0.00* | |
| *Consequential Damage* | *$0.00* | |
| *Cost to Cures* | *$0.00* | |
| *Trade Fixtures* | *$0.00* | |
| *Improvements* | *$45,000.00* | |
| Valuation Services | | $25,000.00 |
| Legal Services | | $40,200.00 |
| Relocation | | $8,000.00 |
| Demolition | | $0.00 |
| Administrative | | $35,500.00 |
| TOTAL ESTIMATED COSTS | | $305,200.00 |
| ***TOTAL ESTIMATED COSTS (ROUNDED)*** | | ***$306,000.00*** |

| Preparation Credits | Hours | Signature |
|---|---|---|
| | | |
| | | |
| | | |

Prepared By: LaShone Alexander CG#: 286999 09/22/2014 (DATE)
Approved By: LaShone Alexander CG#: 286999 09/22/2014 (DATE)

**NOTE: No Market Appreciation is included in this Preliminary Cost Estimate**

allsop

# DEPARTMENT OF TRANSPORTATION STATE OF GEORGIA

## INTERDEPARTMENT CORRESPONDENCE

| | | | |
|---|---|---|---|
| FILE | SR 9 @ SR 52, Roundabout<br>PI No. 0009949, Lumpkin County | OFFICE | GAINESVILLE |
| FROM | for Neil Kantner, P.E., Distr. Utilities Eng. | DATE | 10/1/2014 |

TO Albert Shelby, State Program Delivery Engineer
ATTEN Dylan Curtis, Project Manager

SUBJECT INITIAL PRELIMINARY UTILITY COST ESTIMATE

As requested by your office we are furnishing you with an Initial Preliminary Utility Cost estimate for the subject project.

| FACILITY OWNER | | NON-REIMBURSABLE | | REIMBURSABLE |
|---|---|---|---|---|
| Jackson EMC | | $40,000 | | $0 |
| Windstream CATV | | $9,000 | | $0 |
| Windstream Telephone | | $31,000 | | $0 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| TOTALS | | $80,000 | | $0 |

Total Non-Reimbursable Cost $80,000

Total Reimbursabe Cost $0

NAK
C: Mike Bolden, State Utilities Engineer
Robert Mabry, Area Engineer
File

# Attachment #4

# Intersection Cost Comparison

| Annual Costs | Roundabout | | Existing Two-Way Stop Intersection | |
|---|---|---|---|---|
| **Safety** | **Predicted Annual Crashes** | **Safety Cost** | **Predicted Annual Crashes** | **Safety Cost** |
| *Predicted Fatal/Injury Crashes* | 0.10 | $ 34,086 | 0.78 | $ 262,204 |
| *Predicted PDO Crashes* | 0.57 | $ 4,323 | 1.55 | $ 11,683 |
| | ***Annual Costs of Predicted Crashes*** | **$ 38,409** | ***Annual Costs of Predicted Crashes*** | **$ 273,887** |
| **Delay** | **Annual Intersection Delay (person-hrs)** | **Delay Cost** | **Annual Intersection Delay (person-hrs)** | **Delay Cost** |
| *Average Annual Person (in Vehicle) Delay* | 600 | **$ 7,494** | 519 | **$ 6,486** |
| **Operation and Maintenance** | **Operation and Maintenance** | **O&M Cost** | **Operation and Maintenance** | **O&M Cost** |
| *Annualized Cost of Signal Retiming* | | $ - | Signal Retiming Every 3 Years | $ - |
| *Annual Cost of Power for Signal* | | $ - | Power for Signal | $ - |
| *Annual Cost of Illumination* | Intersection Illumination | $ 750 | Intersection Illumination | $ - |
| *Annual Cost of Maintenance* | Landscaping Costs | $ 2,000 | Signal Maintenance Costs (power outage, detection, etc.) | $ - |
| | ***Total Annual Operation and Maintenance Costs*** | **$ 2,750** | ***Total Annual Operation and Maintenance Costs*** | **$ -** |
| Initial Capital Costs | **Total Capital Costs** | **Cost** | **Total Capital Costs** | **Cost** |
| *Preliminary Engineering* | | $ 425,000 | | $ - |
| *Right-of-way and Utilities* | | $ 306,000 | | $ - |
| *Construction* | | $ 1,823,251 | | $ - |

*Delay cost is based upon a 2 hour analysis period.

| Total Discounted Life Cycle Costs (2018 - 2038) | Roundabout | | Existing Two-Way Stop Intersection | |
|---|---|---|---|---|
| **Safety** | **Total Predicted Crashes** | **Safety Cost** | **Total Predicted Crashes** | **Safety Cost** |
| *Predicted Fatal/Injury Crashes* | 2.02 | $ 507,121 | 15.51 | $ 3,900,929 |
| *Predicted PDO Crashes* | 11.48 | $ 64,312 | 31.03 | $ 173,816 |
| | ***Total Costs of Predicted Crashes*** | **$ 571,432** | ***Total Costs of Predicted Crashes*** | **$ 4,074,745** |
| **Delay** | **Total Intersection Delay (person-hrs)** | **Delay Cost** | **Total Intersection Delay (person-hrs)** | **Delay Cost** |
| *Total Person (in Vehicle) Delay* | 12598 | **$ 157,380** | 10893 | **$ 136,197** |
| **Operation and Maintenance** | **Operation and Maintenance** | **O&M Cost** | **Operation and Maintenance** | **O&M Cost** |
| *Annualized Cost of Signal Retiming* | | $ - | Signal Retiming Every 3 Years | $ - |
| *Annual Cost of Power for Signal* | | $ - | Power for Signal | $ - |
| *Annual Cost of Illumination* | Intersection Illumination | $ 11,158 | Intersection Illumination | $ - |
| *Annual Cost of Maintenance* | Landscaping Costs | $ 29,755 | Signal Maintenance Costs (power outage, detection, etc.) | $ - |
| | ***Total Annual Operation and Maintenance Costs*** | **$ 40,913** | ***Total Annual Operation and Maintenance Costs*** | **$ -** |
| Initial Capital Costs | **Total Capital Costs** | **Cost** | **Total Capital Costs** | **Cost** |
| *Preliminary Engineering* | | $ 425,000 | | $ - |
| *Right-of-way and Utilities* | | $ 306,000 | | $ - |
| *Construction* | | $ 1,823,251 | | $ - |
| | ***Total Initial Capital Costs*** | **$ 2,554,251** | ***Total Initial Capital Costs*** | **$ -** |
| Total Life Cycle Costs (Opening Year $) | **Net Present Value** | **$ 3,323,977** | **Net Present Value** | **$ 4,210,942** |

*Delay cost is based upon a 2 hour analysis period.

Roundabout

Existing Two-Way Stop Intersection

| Life Cycle Benefit/Cost Ratio | | |
|---|---|---|
| *Safety Benefit of a Roundabout* | $ 3,503,313 | |
| *Delay Reduction Benefit of a Roundabout* | $ (21,183) | |
| ***Total Benefits*** | **$ 3,482,130** | |
| *Added Operations&Maintenance Costs of a Roundabout* | $ 40,913 | |
| *Added Capital Costs of a Roundabout* | $ 2,554,251 | |
| ***Total Costs*** | **$ 2,595,164** | |
| Life Cycle Benefit/Cost Ratio | **1.3** | **Roundabout Compared to Existing Two-Way Stop Intersection** |

Roundabout Preferred

# Intersection Cost Comparison

| Annual Costs | Roundabout | | Improved TWSC T-Intersection | |
|---|---|---|---|---|
| **Safety** | **Predicted Annual Crashes** | **Safety Cost** | **Predicted Annual Crashes** | **Safety Cost** |
| *Predicted Fatal/Injury Crashes* | 0.10 | $ 34,086 | 0.75 | $ 253,028 |
| *Predicted PDO Crashes* | 0.57 | $ 4,323 | 1.06 | $ 7,946 |
| | ***Annual Costs of Predicted Crashes*** | **$ 38,409** | ***Annual Costs of Predicted Crashes*** | **$ 260,974** |
| **Delay** | **Annual Intersection Delay (person-hrs)** | **Delay Cost** | **Annual Intersection Delay (person-hrs)** | **Delay Cost** |
| *Average Annual Person (in Vehicle) Delay* | 600 | **$ 7,494** | 453 | **$ 5,659** |
| **Operation and Maintenance** | **Operation and Maintenance** | **O&M Cost** | **Operation and Maintenance** | **O&M Cost** |
| *Annualized Cost of Signal Retiming* | | $ - | Signal Retiming Every 3 Years | $ - |
| *Annual Cost of Power for Signal* | | $ - | Power for Signal | $ - |
| *Annual Cost of Illumination* | Intersection Illumination | $ 750 | Intersection Illumination | $ - |
| *Annual Cost of Maintenance* | Landscaping Costs | $ 2,000 | Signal Maintenance Costs (power outage, detection, etc.) | $ - |
| | ***Total Annual Operation and Maintenance Costs*** | **$ 2,750** | ***Total Annual Operation and Maintenance Costs*** | **$ -** |
| Initial Capital Costs | **Total Capital Costs** | **Cost** | **Total Capital Costs** | **Cost** |
| *Preliminary Engineering* | | $ 425,000 | | $ 425,000 |
| *Right-of-way and Utilities* | | $ 306,000 | | $ 306,000 |
| *Construction* | | $ 1,823,251 | | $ 1,201,719 |

*Delay cost is based upon a 2 hour analysis period.

| Total Discounted Life Cycle Costs (2018 - 2038) | Roundabout | | Improved TWSC T-Intersection | |
|---|---|---|---|---|
| **Safety** | **Total Predicted Crashes** | **Safety Cost** | **Total Predicted Crashes** | **Safety Cost** |
| *Predicted Fatal/Injury Crashes* | 2.02 | $ 507,120 | 14.97 | $ 3,764,413 |
| *Predicted PDO Crashes* | 11.48 | $ 64,312 | 21.10 | $ 118,218 |
| | ***Total Costs of Predicted Crashes*** | **$ 571,432** | ***Total Costs of Predicted Crashes*** | **$ 3,882,631** |
| **Delay** | **Total Intersection Delay (person-hrs)** | **Delay Cost** | **Total Intersection Delay (person-hrs)** | **Delay Cost** |
| *Total Person (in Vehicle) Delay* | 12598 | **$ 157,380** | 9508 | **$ 118,838** |
| **Operation and Maintenance** | **Operation and Maintenance** | **O&M Cost** | **Operation and Maintenance** | **O&M Cost** |
| *Annualized Cost of Signal Retiming* | | $ - | Signal Retiming Every 3 Years | $ - |
| *Annual Cost of Power for Signal* | | $ - | Power for Signal | $ - |
| *Annual Cost of Illumination* | Intersection Illumination | $ 11,158 | Intersection Illumination | $ - |
| *Annual Cost of Maintenance* | Landscaping Costs | $ 29,755 | Signal Maintenance Costs (power outage, detection, etc.) | $ - |
| | ***Total Annual Operation and Maintenance Costs*** | **$ 40,913** | ***Total Annual Operation and Maintenance Costs*** | **$ -** |
| Initial Capital Costs | **Total Capital Costs** | **Cost** | **Total Capital Costs** | **Cost** |
| *Preliminary Engineering* | | $ 425,000 | | $ 425,000 |
| *Right-of-way and Utilities* | | $ 306,000 | | $ 306,000 |
| *Construction* | | $ 1,823,251 | | $ 1,201,719 |
| | ***Total Initial Capital Costs*** | **$ 2,554,251** | ***Total Initial Capital Costs*** | **$ 1,932,719** |
| Total Life Cycle Costs (Opening Year $) | **Net Present Value** | **$ 3,323,976** | **Net Present Value** | **$ 5,934,188** |

*Delay cost is based upon a 2 hour analysis period.

Roundabout

Improved TWSC T-Intersection

| Life Cycle Benefit/Cost Ratio | | |
|---|---|---|
| *Safety Benefit of a Roundabout* | $ 3,311,199 | |
| *Delay Reduction Benefit of a Roundabout* | $ (38,543) | |
| ***Total Benefits*** | **$ 3,272,657** | |
| *Added Operations&Maintenance Costs of a Roundabout* | $ 40,913 | |
| *Added Capital Costs of a Roundabout* | $ 621,532 | |
| ***Total Costs*** | **$ 662,445** | |
| Life Cycle Benefit/Cost Ratio | **4.9** | **Roundabout Compared to Improved TWSC T-Intersection** |

Roundabout Preferred

# Attachment #5

# GDOT ROUNDABOUT DESIGN CHECKLIST - CONCEPT DEVELOPMENT

**Notes:**

**1)** This checklist is specifically written for a standalone intersection project. Some minor adjustments may be needed for a consultant designed roundabout with respect to roles. For linear or interchange reconstruction projects much of the concept development effort can be accomplished during the preliminary design. Additional items should be added as necessary to define/document the design. The preparation of a roundabout design may be terminated at any time during the process, if a decision is made to eliminate a roundabout from further consideration. In this case, documentation should be organized and retained to support this decision.

**2)** This checklist includes work items which are specific to the roundabout project and does not include many items which would be common to all conventional intersection projects. The level of detail and timing of some tasks will vary with the complexities of the roundabout and site constraints.

**3)** The checklist is meant to combine certain categories of information and is not meant to reflect a precise sequence of performance. Any items which do not apply to a specific project can be marked as "N/A" (i.e. not applicable).

| | | | |
|---|---|---|---|
| PI Number: | 0009949 | County: | Lumpkin |
| Design Phase Leader: | | Design Office: | Program Delivery |
| Description: | SR 9 @ SR 52 | | |

| No. | Completed | Action By | Item | Commentary (Can modify text to replace with project specific info, will show in **bold** letters) |
|---|---|---|---|---|
| **1. Operations - Planning Level Assessment - *See DPM section 8.2.1*** | | | | |
| 1 | X | CPL | Vicinity Map | *The preferred roundabout size/location alternative was developed in Microstation. See Feasibility Study memo for additional information* |
| 2 | X | CPL | Intersection Layout | *See Feasibility Study memo for figures illustrating intersections layouts* |
| 3 | X | CPL | Letter of support from local government | *Letter of support is required from local government for project to proceed as a roundabout - See DPM figure 8.1.* |
| 4 | X | CPL | Crash history | *Crash data obtained from GDOT for years 2010 through 2014.* |
| 5 | X | CPL | Pedestrian and bike activity | *Low pedestrian and activity. This intersection is on the Georgia Bicycle and Pedestrian Plan- Statewide Route Network Mountain Crossing Corridor .* |
| 6 | X | CPL | Estimate current traffic volumes | *SR 9 Current Year (2018): 4600 SR 52 Current Year (2018): 2550* |
| 7 | X | CPL | Estimate design year traffic volumes | *SR 9 Design Year (2038): 6200 SR 52 Design Year (2038): 3400* |
| 8 | X | CPL | Percent traffic on major roads | *Traffic volume entering roundabout from the major road is 73% of total volume entering the roundabout for the design year.* |
| 9 | X | CPL | Number of circulatory lanes | *Single lane - ADT < 25,000,* |
| 10 | X | CPL | Favorable conditions | *See section 8.2.1 Planning Level Assessments for list of conditions where roundabouts tend to be advantageous.* |
| 11 | X | CPL | Unfavorable conditions | *Adjacent stream buffers and vertical alignment constraints that impact placement of roundabout.* |
| 12 | X | CPL | Purpose of roundabout | *The purpose of the project is to provide operational and safety improvements at the study intersection.* |
| 13 | X | CPL | Roundabout sketch | *See feasibility study memorandum. Several options for size and placement developed at a sketch level.* |

| | | | |
|---|---|---|---|
| PI Number: | 0009949 | County: | Lumpkin |
| Design Phase Leader: | | Design Office: | Program Delivery |
| Description: | SR 9 @ SR 52 | | |

| No. | Completed | Action By | Item | Commentary (Can modify text to replace with project specific info, will show in **bold** letters) |
|---|---|---|---|---|
| **2. Design - Gather information for Concept - *for existing intersection and for base & design years*** | | | | |
| 1 | X | CPL | Vicinity Map | *The preferred roundabout size/location alternative was further developed in Microstation. See Feasibility Study memo for additional information* |
| 2 | X | CPL | Approach Speeds | *The posted speed limit along SR 52 is 55 MPH. The posted speed limit along SR 9 is 45 mph.* |
| 3 | X | CPL | Grades | *Grade slopes toward the intersection on the east and north legs. Roundabout horizontal placement and vertical profiles "bench" the intersection to minimize cross-slope.* |
| 4 | X | CPL | Functional Classification | *SR 52 (classified as a Rural Minor Collector) intersects SR 9 (classified as a Rural Minor Arterial)* |
| 5 | X | CPL | Current year traffic volumes | *Existing 2018 traffic counts provided by GDOT. All raw data provided in the Traffic Study Report.* |
| 6 | X | CPL | Base year traffic projections | *Base year 2018 traffic projections provided by GDOT.* |
| 7 | X | CPL | Design year traffic projections | *Design Year 2038 traffic projections provided by GDOT.* |
| 8 | X | CPL | Future projects | *N/A* |
| 9 | X | CPL | Desirable LOS | *Refer to DPM Section 6.15, Summary of Design Criteria for Cross Section Elements. For Rural conditions an LOS B is desired.* |
| **3. Design - Roundabout Feasibility Study, Part 1 - *Alternate comparison and selection*** | | | | |
| 1 | X | CPL | Intersection base map | *obtained from survey* |
| 2 | X | CPL | Signal Warrant Study | *N/A* |
| 3 | X | CPL | Identify/sketch alternative intersection forms | *Several sketch level roundabout configurations were developed that illustrated alternatives with different roundabout locations. See feasibliity study memorandum for illustrations.* |
| 4 | X | CPL | Safety assessment | *Estimated reduction of total crashes by 29% and injury crashes by 37% with conversion from existing intersection to a roundabout.* |
| 5 | X | CPL | Number of entry lanes for each approach leg | *Based upon future turning movement volumes, a single-lane roundabout is needed for 2038. See Traffic Study Report for additional detail.* |
| 6 | X | CPL | Operational analyses | *Operational analysis was conducted for the intersection using the GDOT Roundabout Analysis Tool, which is based on the NCHRP-572 methodology.* |
| 7 | X | CPL | Cost comparison | *Costs developed by CPL for a roundabout and t-intersection alternative. T-intersection estimated to cost $1.13million. Roundabout estimated at $1.72 million.* |
| 8 | X | CPL | Select most favorable alternative | *The preferred roundabout location was identified in coordination with Lumpkin County and GDOT District Office. See initial concept meeting notes for additional information.* |

| | | | |
|---|---|---|---|
| PI Number: | 0009949 | County: | Lumpkin |
| Design Phase Leader: | | Design Office: | Program Delivery |
| Description: | SR 9 @ SR 52 | | |

| No. | Completed | Action By | Item | Commentary (Can modify text to replace with project specific info, will show in **bold** letters) |
|---|---|---|---|---|
| **4. Design - Roundabout Feasibility Study, Part 2 - *Roundabout layout (as required to define footprint)*** | | | | |
| 1 | X | CPL | Design alternate roundabout layouts | *The preferred roundabout size/location alternative was further developed in Microstation. See Feasibility Study memo for additional information.* |
| 2 | | | Identify likely impacts | *Identify potential conflicts with underground utilities and likely property and environmental resource impacts, etc.* |
| 3 | X | CPL | Fastest paths | *See Feasibliity Study memo for figures illustrating fastest paths.* |
| 4 | X | CPL | Design vehicle | *WB-67 trucks were accommodated for all movements.* |
| 5 | X | CPL | Design vehicle swept path | *See Feasibility Study memo for figures of design vehicle swept paths.* |
| 6 | X | CPL | Stopping sight distance | *See Feasibility Study for stopping sight distance to roundabout yield line, for each approach.* |
| 7 | X | CPL | Staging improvements | *An on site detour is required for the construction of the roundabout.* |
| 8 | X | CPL | Finalize concept layout | *A finalize concept layout is attached in the concept report.* |
| **5. Design - Other information - *required for Concept Report*** | | | | |
| 1 | X | CPL | Typical section | *Required for concept reports.* |
| 2 | X | CPL | Construction sequencing | *An on site detour is required for the construction of the roundabout. The detour plan was presented at the PIOH.* |
| 3 | X | CPL | Lighting | *A lighting cost estimate is included in the construction cost estimate. A signed lighting agreement is attached to the concept report.* |
| 4 | X | CPL | Landscaping requirements | *landscaping cost estimate is included in the concept report.* |
| 5 | X | CPL | Pavement Type | *Asphalt* |
| **6. Design - Implement program of local government coordination and public involvement** | | | | |
| 1 | X | CPL | Presentation layouts | *Prepare exhibits for meetings.* |
| 2 | X | CPL | Meeting with local officials | *An initial concept meeting with GDOT and Lumpkin County held September 17,2014 (see attached to concept report).* |
| 3 | X | CPL | Public outreach | *PIOH Held December 4, 2014* |

| | | | |
|---|---|---|---|
| PI Number: | 0009949 | County: | Lumpkin |
| Design Phase Leader: | | Design Office: | Program Delivery |
| Description: | SR 9 @ SR 52 | | |

| No. | Completed | Action By | Item | Commentary (Can modify text to replace with project specific info, will show in **bold** letters) |
|---|---|---|---|---|
| **7. Complete quality assurance reviews - *occurs at previous points in the process*** | | | | |
| 1 | | | QA review by design process | *Feasibility studies should be reviewed within the originating design office, in accordance with the Department's QC/QA manual (located on ROADS).* |
| 2 | | | Informal review by GDOT roundabout SME | *Upon request, a GDOT SME will, (prior to peer review), perform an informal review of a feasibility study or any in-progress work products. Contact either Scott Zehngraff (szehngraff@dot.ga.gov) of the Office of Traffic Operations or Daniel Pass (dpass@dot.ga.gov) of the Office of Design Policy and Support.* |
| 3 | X | CPL | Peer review by Consultant peer reviewer | *Peer review by Kittleson & Associates, INC.* |

**Notes:**

***1)*** *Key objectives during concept development includes identifying the best solution that addresses the project need and defining a layout which best considers geometric, operational and other project-specific constraints. Defining an "accurate" footprint is particularly important for projects with significant site constraints and for roundabouts of greater complexity (complex roundabouts). Complex roundabouts include multilane roundabouts and single land roundabouts which addresses difficult conditions such as bad skews or significant geometric or operational constraints.*

***2)*** *It should be recognized that unlike conventional intersection forms (e.g., signalization, stop control, etc.) the configuration and layout of a roundabout can be dramatically affected by the results of capacity, fastest path, and truck turning template studies and thus often requires higher level of engineering during the concept phase.*

***3)*** *Include a completed checklist with the submittal package to the peer reviewer and with submission of the concept report for review and approval. Any peer review recommended changes not implemented must be coordinated with the peer reviewer and/or the Office of Design Policy and Support. The peer review report should also be included in the concept report if any recommended changes are to be made after concept development. At minimum, make all changes which affect impacts, cost, required R/W, basic operation of the roundabout leg, elimination of a bypass lane, etc. prior to submitting the concept report for review and approval.*

**List of Acronyms**

SME - Subject Matter Expert
DPM - Design Policy Manual
ICD - Inscribed Diameter
TPAS - Traffic polling and Analysis System

# ROUNDABOUT FEASIBILITY STUDY

## SR 9 AT SR 52
## LUMPKIN COUNTY, GA

**PREPARED FOR:**
**GEORGIA DEPARTMENT OF TRANSPORTATION**
**P.I. #: 0009949**

**JANUARY 2015**

Project Background

This roundabout feasibility evaluation was prepared for the Georgia Department of Transportation by Clark Pattern Lee and supported by sub-consultants Wilburn Engineering, LLC and Kittelson & Associates, Inc. This report summarizes the findings from the team's operational, safety, and geometric evaluations. Key roles and responsibilities in preparing this feasibility study are summarized below:

- Clark Patterson Lee served as the prime consultant, with work activities including:
    - Preparation of concepts for three different roundabout alternatives and one conceptual design for an improved stop-controlled intersection.
    - Preparation of vertical profiles for the various alternatives.
    - Evaluated constructability of the roundabout alternatives.
    - Coordinated preparation of the Traffic Study and roundabout peer review.
- Wilburn Engineering, LLC completed a Traffic Engineering Study for the intersection of SR 9 at SR 52 dated August 13, 2014. This report included the following:
    - Development of traffic projections;
    - Historical crash analysis; and
    - Operational analysis for roundabout and alternative intersection control options.
- Kittelson & Associates, Inc. (KAI) conducted a peer review of the Traffic Study and roundabout concepts prepared by Clark Patterson. KAI also supported the compilation/summarization of the team work activities into this feasibility study report. KAI activities included the following:
    - Review of Traffic Study to confirm adequacy of a single-lane roundabout lane configuration for serving design year traffic.
    - Peer review of roundabout concepts prepared by Clark Patterson (with a focus on the preferred alternative from September 2014 initial concept meeting with GDOT) to identify possible opportunities for refinement. KAI provided feedback for the fastest path speeds and truck accommodations of the preferred concept.
    - Preparation of an alternative roundabout concept (plan view) along with corresponding design checks for fastest path, design vehicle, and sight-distance.
    - Support for compilation of the roundabout feasibility study.

The intersection of SR 9 at SR 52, in Lumpkin County, Georgia is identified in the State Transportation Improvement Plan (STIP) for improvement. The project (PI 0009949) is scheduled to be let for construction in 2018 and anticipated to be open by the end of 2018. Roundabouts were one treatment specifically evaluated at the study intersection due to the potential for safety and operational benefit. Roundabout alternatives were compared to the existing site conditions and an alternative improved intersection configuration with stop control.

# EXISTING SITE CONDITIONS

The project intersection is located approximately 3.5 miles west of Dahlonega, located in Lumpkin County. The project location is provided in **Figure 1**. The area surrounding the study intersection is generally rural with a few residential properties in the intersection vicinity. Properties on both sides of SR 9 and SR 52 are generally wooded. A fire station is proposed for construction in the intersection vicinity in year 2017.

SR 9 has a series of successive horizontal curves and vertical terrain sloping towards the west in the study intersection vicinity. SR 52 has a generally straight alignment upstream of SR 9 with grades sloping to the south towards the study intersection. The combination of the wooded adjacent properties, horizontal curves, and vertical grades impact visibility of the intersection from a distance. Maintenance of vegetation (along the SR 9 embankments (particularly to the west of the study intersection) is required to maintain minimum stopping sight distance.

The southbound SR 52 left- and right-turn lanes split, forming a triangular intersection configuration with SR 9. This creates three separate two-way stop control intersections within close proximity to each other. No auxiliary left-turn or right-turn lanes are provided along SR 9. The intersection lane configurations are illustrated in **Figure 2**. The intersection and roadway characteristics are summarized in **Table 1.**

**Figure 1: Project Location Map**

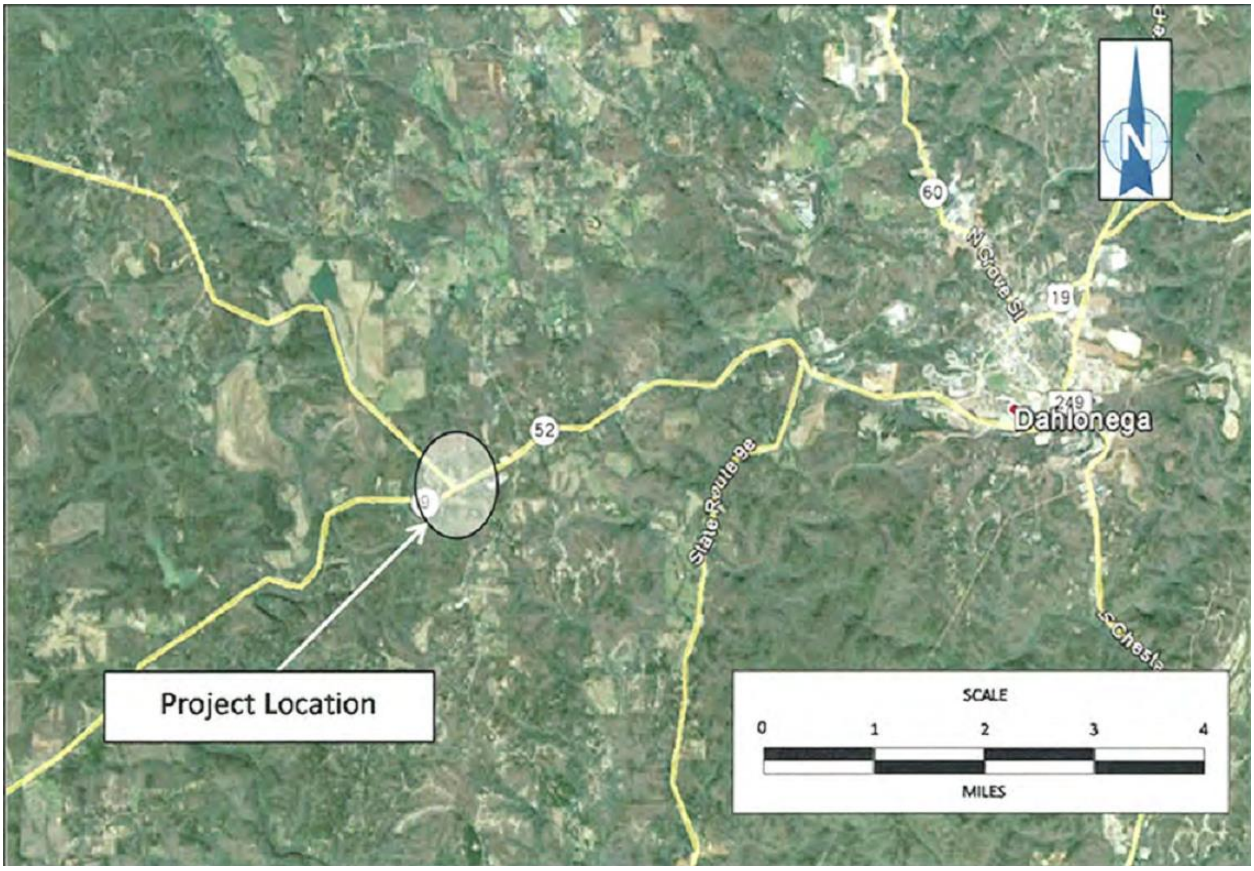


**Figure 2: Existing Intersection Configuration**

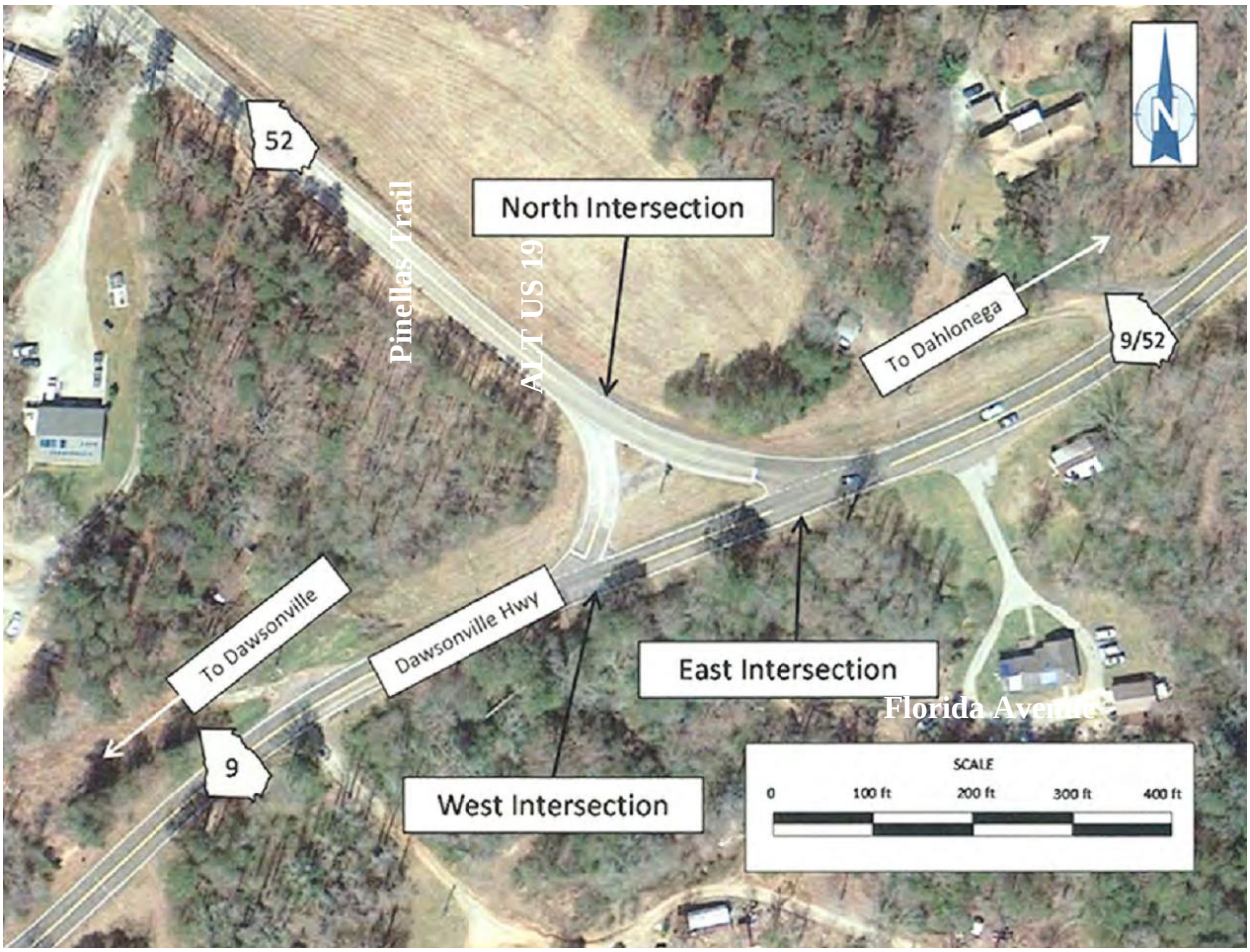



**Table 1: Existing Intersection Characteristics**

| Characteristic | Roadway | |
|---|---|---|
| | **SR 9 (Dawsonville Highway)** | **SR 52** |
| Number of Lanes | 2 | 2 |
| Functional Classification | Rural Minor Arterial | Rural Major Collector |
| Speed Limit | 45 mph | 55 mph |
| Year 2013 ADT | 4200 ADT east of SR 52<br>2200 ADT west of SR 52 | 2300 ADT |
| Truck % | 4% | 2% (Assumed) |
| On GDOT OSOW Route? | No | No |
| Grades | 3.7% | 4.2% |
| Roadway Lighting | None | None |
| Bike Lanes Present? | None | None |
| Sidewalks Present? | None | None |

# INTERSECTION OPERATIONS

Wilburn Engineering performed operational analyses for the various intersection alternatives considered as part of this study, including:

- Existing Conditions
- Construction Year (2018) and Design Year (2038) No-Build Alternative
- Construction Year (2018) and Design Year (2038) Build Alternatives
    - Traditional T-intersection with turn lanes
    - Single-lane roundabout

Analysis results are summarized in this section. Additional information regarding the operational analysis is included in the full **Traffic Engineering Study**.

## TRAFFIC VOLUMES

Base year traffic volumes are based upon GDOT count data collected in 2013. Opening year 2018 and Design Year 2038 traffic volume projections were provided by the Georgia Department of Transportation. Turning movement volumes for the study intersection are summarized in Table 2.

**Table 2: Peak Hour Turning Movement Volumes**

| Year | Time | Eastbound | | Westbound | | Southbound | |
|---|---|---|---|---|---|---|---|
| | | Left | Through | Through | Right | Left | Right |
| 2013 | AM | 0 | 136 | 57 | 30 | 164 | 7 |
| | PM | 4 | 82 | 153 | 127 | 72 | 5 |
| 2018 | AM | 0 | 145 | 60 | 35 | 185 | 10 |
| | PM | 5 | 95 | 160 | 145 | 80 | 5 |
| 2038 | AM | 0 | 195 | 85 | 45 | 245 | 10 |
| | PM | 5 | 120 | 230 | 190 | 110 | 5 |

## EXISTING CONDITIONS

Synchro 8 was utilized to perform the existing conditions operational analyses at the study intersection. The results for the AM and PM peak hours are summarized in **Table 3**. The results indicate that the intersection operate at LOS 'B' or better during the AM and PM peak hours.

**Table 3: Existing Levels of Service, Stop Control**

| Intersection | Movement | AM Peak Hour | PM Peak Hour |
|---|---|---|---|
| North Intersection | EB Left | A (0.0) | A (9.8) |
| East Intersection | SB Left | B (11.4) | B (11.3) |
| West Intersection | EB Left | A (0.0) | A (0.4) |
| | SB Right | A (8.6) | A (9.2) |

## NO-BUILD ALTERNATIVE

The results of the No-Build operational analyses for the Construction Year (2018) and Design Year (2038) are summarized in **Table 4**. The results indicate that all stop control movements at the intersection are expected to operate at LOS 'C' or better during the AM and PM peak hours through the Design Year 2038. In general, all

movements provide LOS 'B' or better through the design year 2038 with the exception of the critical southbound left-turn movement that is 0.1 seconds over the LOS 'B' threshold in the 2038 AM peak hour time period.

**Table 4: No-Build Levels of Service, Stop Control**

| Intersection | Movement | 2018 Construction Year | | 2038 Design Year | |
|---|---|---|---|---|---|
| | | AM Peak Hour | PM Peak Hour | AM Peak Hour | PM Peak Hour |
| North Intersection | EB Left | A (0.0) | A (10.0) | A (0.0) | B (10.6) |
| East Intersection | SB Left | B (11.8) | B (11.6) | B (14.6) | B (14.0) |
| West Intersection | EB Left | A (0.0) | A (0.4) | A (0) | A (0.3) |
| | SB Right | A (8.7) | A (9.2) | A (8.8) | A (9.7) |

## BUILD ALTERNATIVES

Two different Build alternatives were analyzed by Wilburn Engineering. The first scenario analyzed consisted of realigning the intersection into a traditional t-intersection configuration. The second Build Alternative analyzed a single-lane roundabout.

### Alternative 1 - Traditional T-Intersection with Turn Lanes

Under this alternative, one leg of the existing triangular intersection geometry would be removed and reconfigured to a more conventional intersection with SR 52 teeing into SR 9. The addition of exclusive left- and right-turn lanes was evaluated based upon GDOT's *Regulation for Driveway and Encroachment Control*. Based upon this evaluation, a westbound right-turn lane and a southbound left-turn lane would be warranted. **Table 5** summarized the expected operational performance of the t-intersection configuration with the additional turn lanes.

**Table 5: Build Alternative Levels of Service, Unsignalized Traditional T-Intersection**

| Movement | 2018 Construction Year | | 2038 Design Year | |
|---|---|---|---|---|
| | AM Peak Hour | PM Peak Hour | AM Peak Hour | PM Peak Hour |
| EB Left/Through | A (0.0) | A (0.4) | A (0.0) | A (0.4) |
| WB Through/Right | A (0.0) | A (0.0) | A (0.0) | A (0.0) |
| SB Left | B (11.6) | B (11.0) | B (14.0) | B (12.6) |
| SB Right | A (8.7) | A (9.2) | A (8.8) | A (9.7) |

As summarized in Table 5, a traditional T-intersection would provide level of service "B" or better operations through the Design Year 2038. This alternative reduces the intersection footprint, removes some intersection conflict points, and provides a slight improvement in delay to selected movements. However, most movements are expected to maintain the same level-of-service as the no-build condition.

### Alternative 2 - Single-Lane Roundabout

A single-lane roundabout alternative was evaluated to allow for comparison to the more traditional T-intersection stop-control alternative. The operational analyses were performed using the GDOT Roundabout Analysis Tool (Version 2.1). For planning purposes a maximum volume-to capacity (v/c) ratio of approximately 0.85 is typically targeted when evaluating the needed roundabout lane configurations to serve the Design Year traffic volumes.

The roundabout operational results for the AM and PM peak hours of the Construction Year (2018) are shown in **Table 6**. The results for the Design Year (2038) AM and PM peak hours are summarized in **Table 7**.

**Table 7: Build Alternative Levels of Service, Single-Lane Roundabout**
**2018 Construction Year**

| Time Period | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|
| Roundabout Entry | EB | WB | SB | EB | WB | SB |
| V/C Ratio | 0.16 | 0..09 | 0.18 | 0.10 | 0.28 | 0.08 |
| LOS | A | A | A | A | A | A |
| Delay | 5 | 3 | 4 | 4 | 5 | 4 |
| Queue (vehicles) | 1 | 1 | 1 | 1 | 2 | 1 |

Note: Results reflect using the GDOT Roundabout Analysis Tool, which is based on the NCHRP-572 methodology.

**Table 7: Build Alternative Levels of Service, Single-Lane Roundabout**
**2038 Design Year**

| Time Period | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|
| Roundabout Entry | EB | WB | SB | EB | WB | SB |
| V/C Ratio | 0.22 | 0.12 | 0.24 | 0.13 | 0.39 | 0.12 |
| LOS | A | A | A | A | A | A |
| Delay | 6 | 4 | 5 | 4 | 6 | 4 |
| Queue (vehicles) | 1 | 1 | 1 | 1 | 2 | 1 |

Note: Results reflect using the GDOT Roundabout Analysis Tool, which is based on the NCHRP-572 methodology.

As summarized in Tables 6 and 7, a single-lane roundabout is estimated to adequately serve the forecast 2038 AM and PM peak hour Design Year traffic volumes. The single-lane roundabout is expected to provide a level of service 'A' for all roundabout entries through the Design Year. Additionally, the v/c ratios for each entry are well below the desirable threshold of 0.85, indicating spare capacity for additional growth to be accommodated beyond the forecast 2038 Design Year volumes.

# CRASH HISTORY

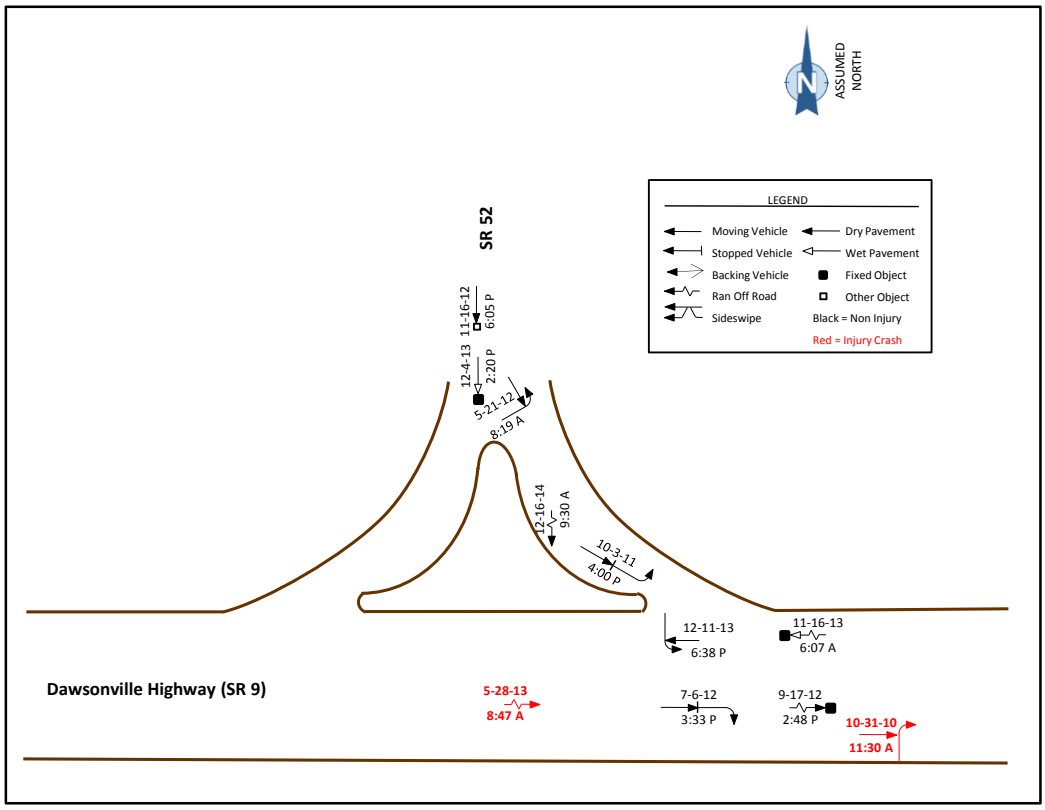
Crash data for the study intersection was obtained from GDOT. A four year period from 2010 to 2013 was analyzed. **Table 7** provides the crash history at the study intersection.

**Table 7: Yearly Crash Frequency for SR 9 at SR 52**

| YEAR | TOTAL CRASHES | INJURY CRASHES / INJURIES | FATALITIES | VEHICLE COLLISION WITH OTHER VEHICLE | | | | Single-Vehicle Crash |
|---|---|---|---|---|---|---|---|---|
| | | | | RIGHT ANGLE | HEAD ON | REAR END | SIDESWIPE | |
| 2010 | 1 | 1/1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 0/0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 2012 | 4 | 0/0 | 0 | 1 | 0 | 1 | 0 | 2 |
| 2013 | 4 | 1/1 | 0 | 1 | 0 | 0 | 0 | 3 |
| 2014 | 1 | 0/0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **TOTALS** | **11** | **2/2** | **0** | **3** | **0** | **2** | **0** | **6** |

During the analysis period (2010 to 2014), right angle and rear end collisions made up 45% of the total crashes at the intersection. There were two injury crashes, nine property-damage-only crashes, and no fatalities during the analysis period. The most common crash type was a single-vehicle collision with an animal, structure or driver inattention with six total crashes. Crashes are illustrated below in the Collision Diagram.

**Collision Diagram**



# CONCEPTUAL GEOMETRIC DESIGN

Four conceptual geometric design alternatives were completed by Clark Patterson Lee to illustrate potential intersection improvement options. The alternatives, illustrated in **Appendix C**, include:

**Concept A: Roundabout** – Roundabout located on the west edge of existing intersection.

**Concept B: Roundabout** – Roundabout position generally aligned with SR 52 on the north side of the existing intersection footprint.

**Concept C: Roundabout** - Similar to Concept A, with roundabout shifted further to the west.

**Concept D: T-Intersection** – One leg of the existing intersection is removed to simplify the intersection to a traditional "T" configuration. The intersection position is shifted to the west of the existing intersection. Auxiliary right- and left-turn lanes are added.

## DESIGN CONSIDERATIONS

The following discussion lists important intersection features that impact concept development for roundabout and traditional intersection alternatives, as illustrated in Figure 3.

- **Environmental Considerations**: There is a dry stream bed along the southern edge of SR 9. Improvement concepts were generally focused on avoiding the limits of the stream bed by keeping construction to the north of SR 9.
- **Archeological and Historical Considerations**: No historical features identified. No archeological information currently available.
- **Adjacent Properties and Land Uses**:
    - New fire station expected to be constructed to the east of the existing intersection. Several residential homes are in the vicinity of the intersection, but not close enough to be directly impacted by improvements. Residential access points will need to be considered relative to the various alternatives.
    - A church and cemetery are located along SR 52 approximately 0.2 miles to the north of the study intersection, but are outside the area that would potentially be impacted by improvements.
- **Pedestrian and Bicycle Considerations:** Pedestrian and bicycle volumes are expected to be low at this intersection. There are bicycle signs posted along SR 9; however, no sidewalks or marked bike lanes are present. Vegetation overgrowing the shoulder limits the effective use of the shoulder for bicycles.
- **Vertical Geometry and Considerations:** Roadway grade changes on all three approaches to the intersection will impact vertical consideration and construction staging:
    - Along SR 9, the road slopes down from east to west. This is shown in **Figure 4**.
    - SR 52 slopes from the north to the south towards the intersection.
- **Adjacent Utilities:** Utilities at the study intersection include the following:
    - An existing pole sits in the middle of the triangle at the center of the intersection. This pole belongs to Amicalola EMC.
    - All electrical utilities are overhead on north side of SR 9 and west side of SR 52.
    - Windstream has underground utilities within the area.

**Figure 3: Key Intersection Features**

A figure showing ROW lines, environmental features, utilities, and other pertinent constraints.

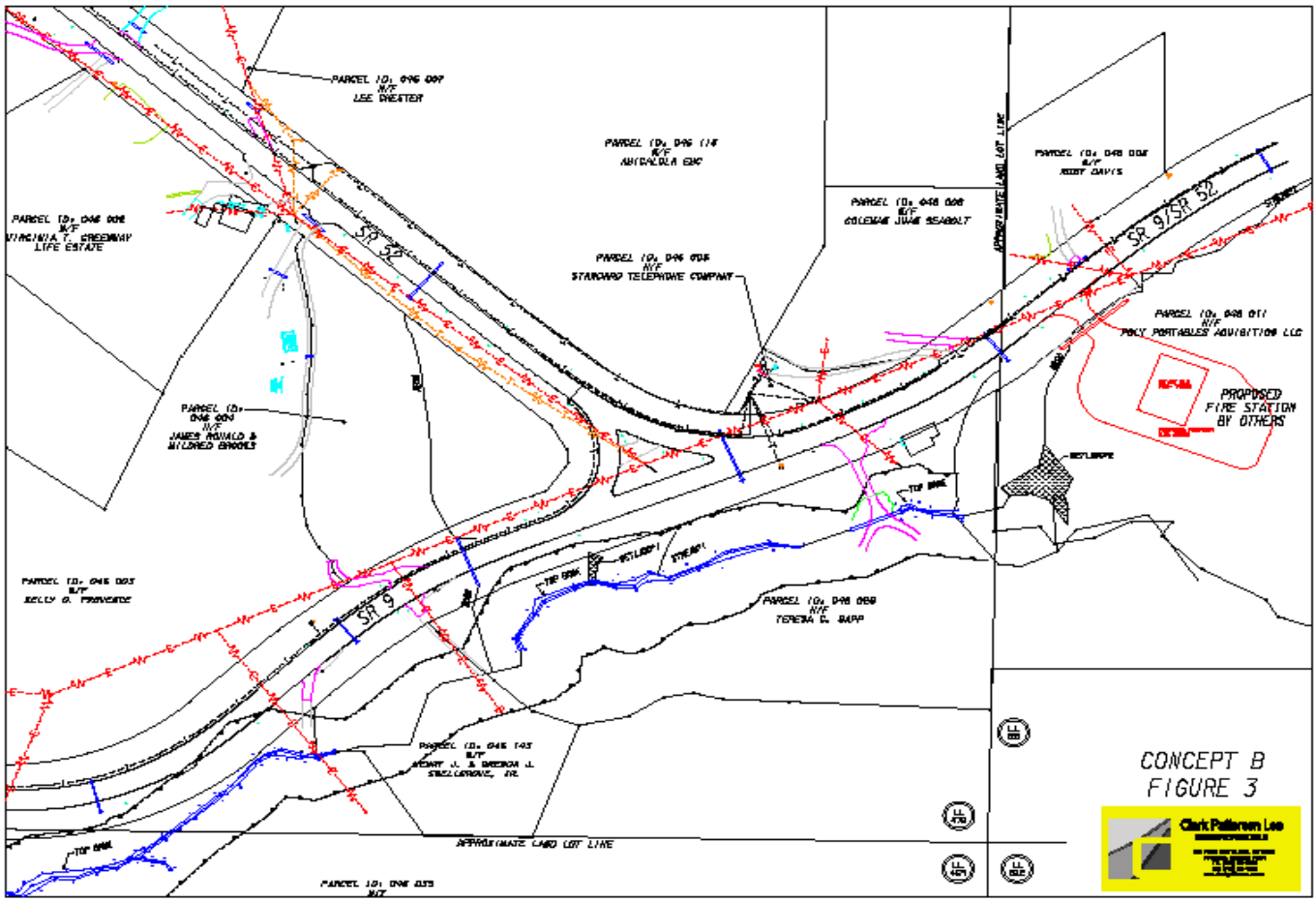
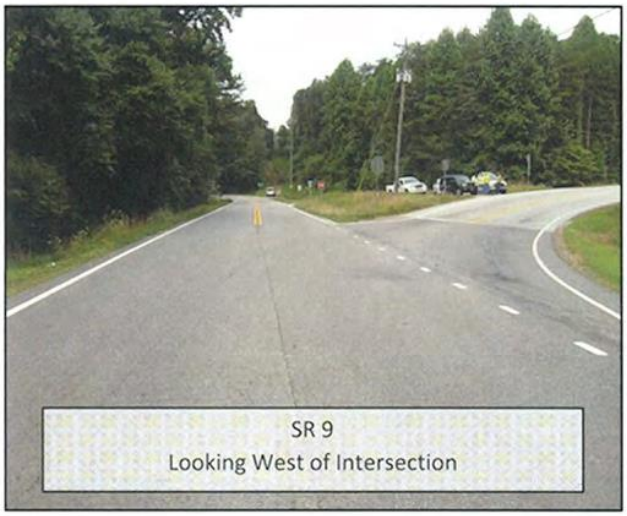
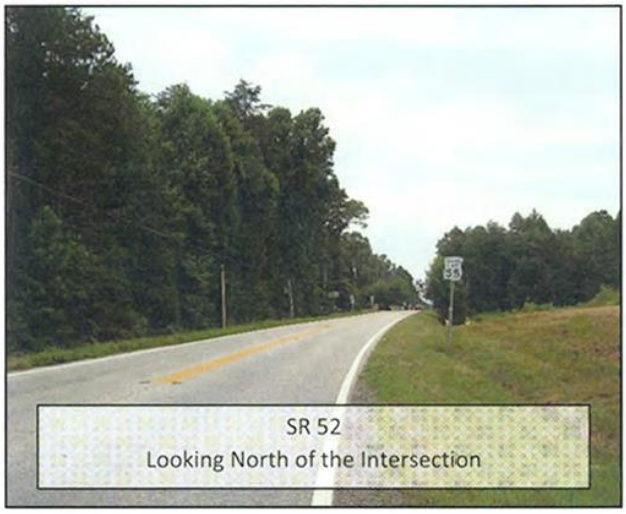
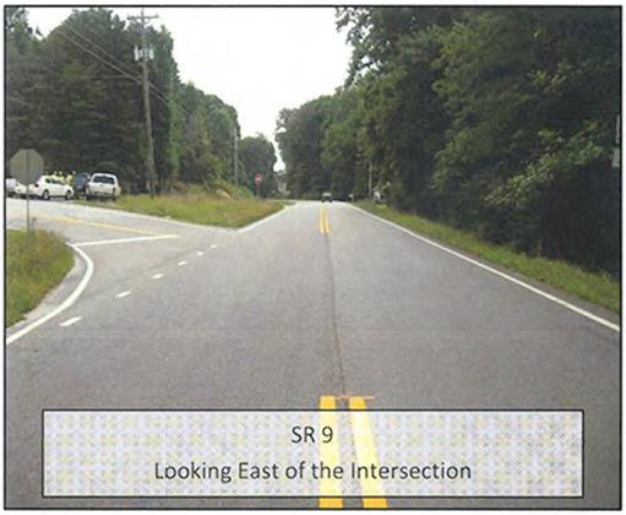
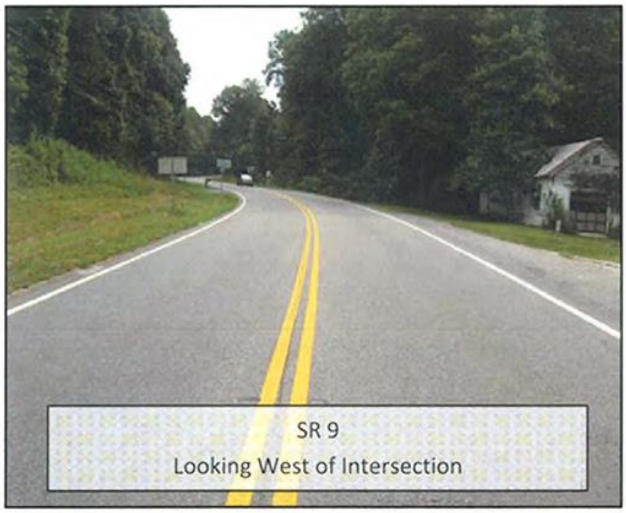


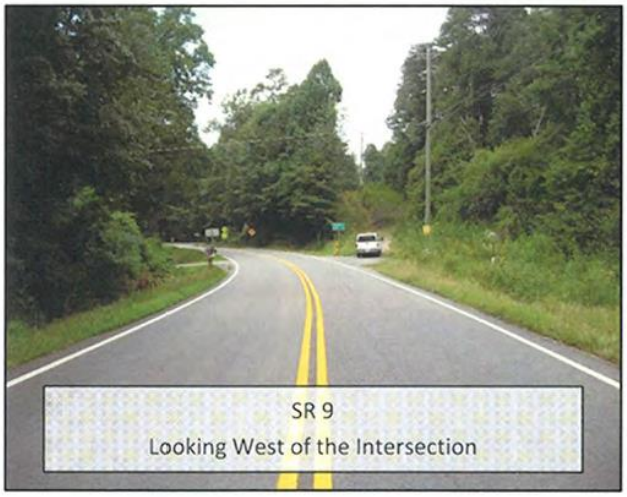
**Figure 4: Grade Change along SR 9 and SR 52**

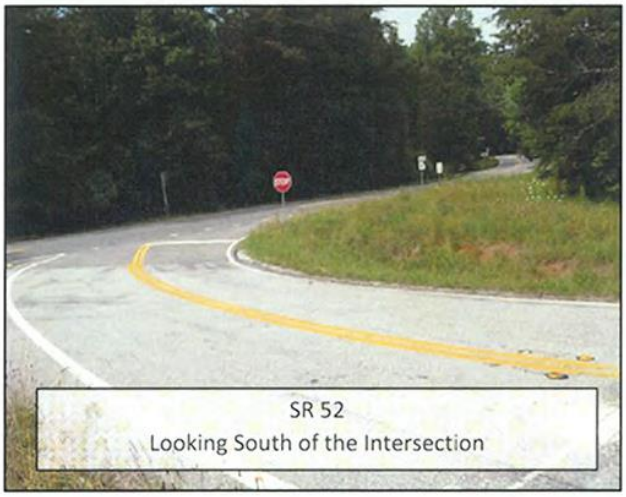


## CONCEPT DEVELOPMENT

Conceptual designs were prepared by Clark Patterson Lee for each of the four alternatives (three roundabout concepts and one traditional T-intersection concept). Concepts were developed to a sufficient level of detail to illustrate the intersection footprint and possible impacts. The layouts are the basis for evaluation so that the most feasible and appealing options can be selected and advanced to a more detailed level of design.

### Considerations for Roundabout Concept Development

- Emphasis on maximizing the safety performance of the intersection and controlling vehicle speeds along SR 9.
- Rural speed environment with 45 and 55 mph posted speeds on the various intersection legs. Drivers have an expectation of generally uninterrupted flow along SR 9, which requires design consideration for advance warning prior to a roundabout through changes in cross-section, longer splitter islands, approach treatments, etc. The roundabout should maintain fastest path entry speeds at or below 25 mph on all entries.
- WB-67 design vehicle for all turning movements. The study intersection is not on a Georgia Oversize/Overweight vehicle network.
- No existing pedestrian facilities and no bicycle amenities are present along SR 9 or SR 52.
    - The existing shoulder should be transitioned to curb and gutter upstream of the roundabout and any bicycles using the shoulder would merge into the travel lane to travel through the roundabout.
    - Given the lack of a continuous clear shoulder, bicyclists are expected to primarily be sharing the road under existing conditions. Additionally, given the posted speed and grades, any cyclists currently using SR 9 are expected to be experienced riders. Given that the roundabout promotes slow vehicle speeds (similar to those of bicyclists) along with the simple single-lane configuration that minimizes vehicle conflicts, these experienced cyclists are expected to prefer to travel through the roundabout as a vehicle rather than exit onto an adjacent multi-use path. Therefore, consistent with guidance contained in NCHRP Report 672, bicycle ramps and adjacent multi-use paths may be omitted for the single-lane roundabout at this location.
    - Sidewalk could be provided around the roundabout, but would be optional in this rural environment given the lack of pedestrian activity and the lack of connection to any other pedestrian facilities. Even if sidewalk facilities and pedestrian crossing are not provided initially, the splitter islands are set up to provide sufficient width to allow for an appropriately sized pedestrian refuge to be added in the future if pedestrian facilities are desired in the future.

### Roundabout Geometric Characteristics

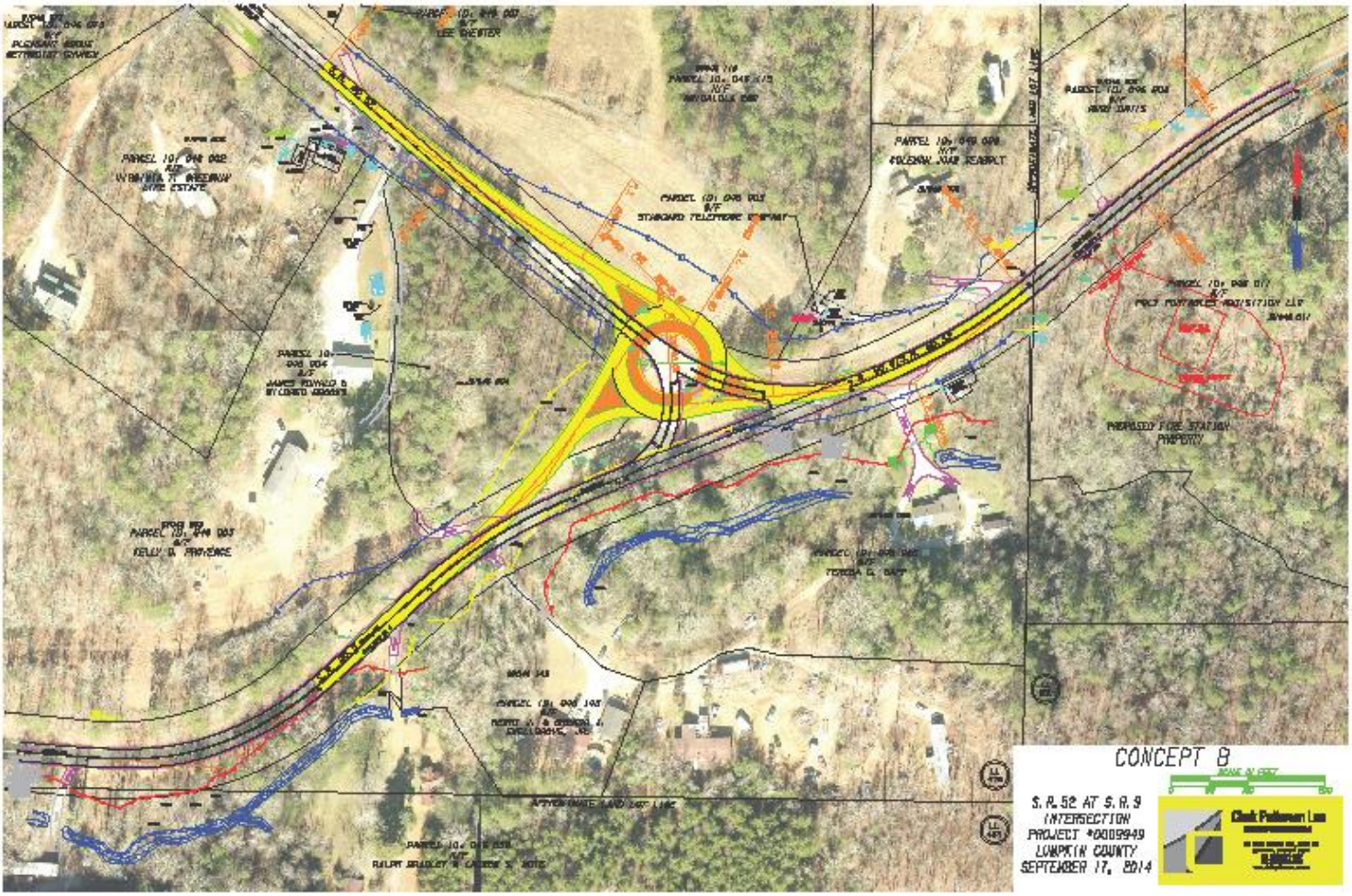
- **Inscribed Circle Diameter:** The concepts utilize a 150 foot inscribed circle diameter. For a rural roundabout with a WB-67 design vehicle, the typical range of inscribed circle diameter for a single-lane roundabout is 130 to 180 feet according to *NCHRP Report 672.* The selected diameter is slightly larger than the minimum required accommodating a WB-67, but allows more flexibility for balancing the needs of speed control and intersection visibility.

- **Roundabout Position –** three different positions for the roundabout were considered, each located on the north side of SR 9 to facilitate maintenance of traffic during construction and avoid stream buffers on the south side of SR 9.
- **Approach Alignment –** the concepts generally utilized an offset-left approach alignment to maximize speed control and vehicle channelization through the entries.
- **Lane Widths –** The concept designs utilize a 20 foot circulatory roadway width. Typical widths are 16 to 20 feet for single-lane roundabouts. A 20-foot width was selected due to the rural environment and needs to accommodate WB-67 design vehicles. Entry and exit lane widths flare out to match the width of circulatory roadway near the yield line.

The project team met with stakeholders at an initial concept meeting that took place on September 17, 2014 with representatives from GDOT, Clark Patterson Lee, Wilburn Engineering, Edwards-Pitman Environmental, Lumpkin County, and Amicalola EMC. The meeting notes are included in **Appendix B**. At this meeting, stakeholders identified that Concept B was the preferred option out of the three roundabout concepts that were presented. Concept B is illustrated in **Figure 5.**

Generally each of the alternatives provides similar operational performance. Each of the roundabout alternatives is also expected to provide generally similar safety performance. Concept B was the preferred roundabout concept based upon consideration that it best utilized the existing intersection right-of-way, provided a mechanism for speed control through the intersection and was preferred based upon construction staging, vertical considerations, and environmental considerations.

Figure 5 - Preferred Alternative – Original Clark Patterson Concept B

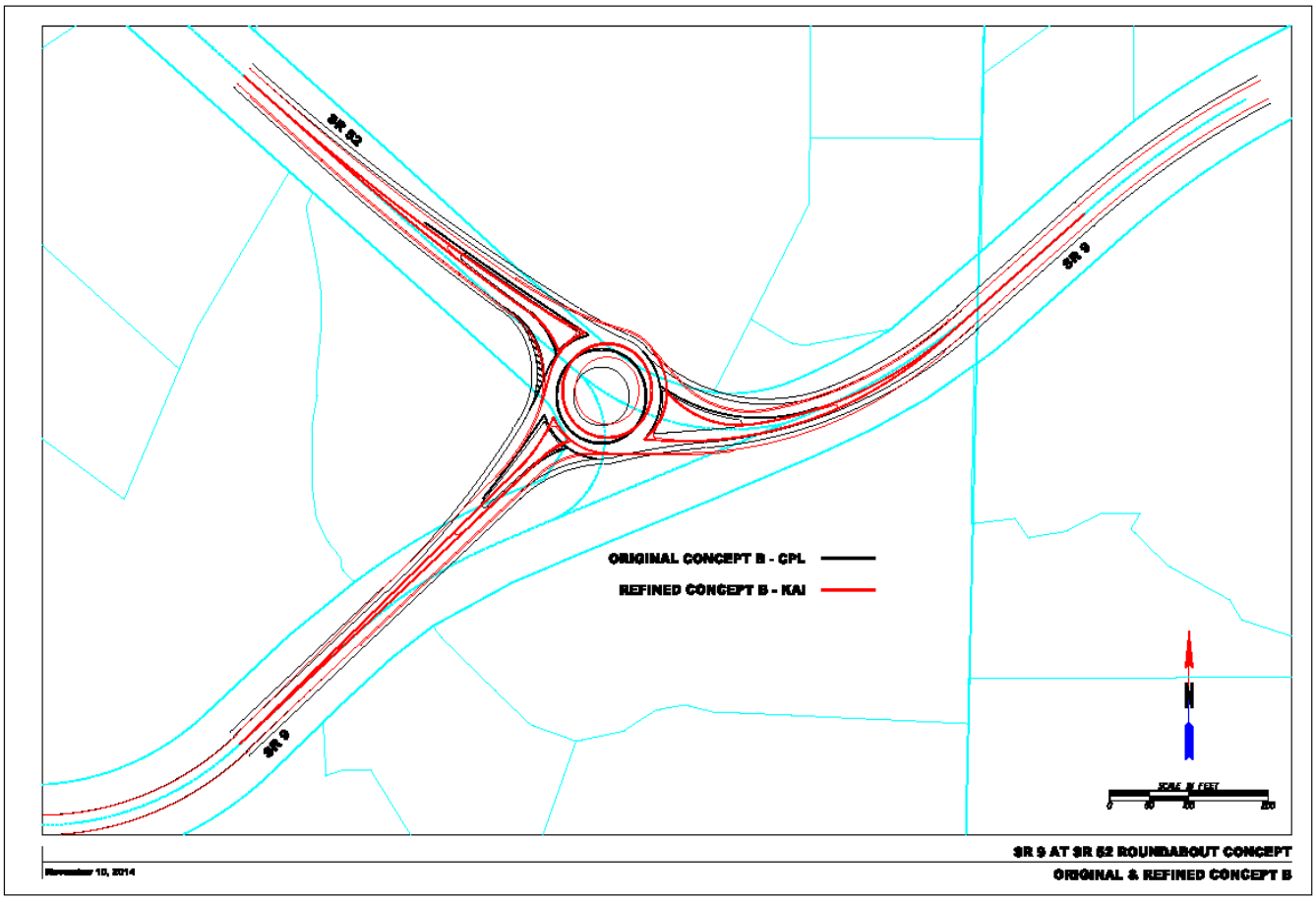


## ROUNDABOUT PEER REVIEW AND REFINEMENT

KAI conducted a roundabout peer review for the preferred Concept B. KAI identified refinements based on the design environment and context, speed control, and design vehicle considerations. The following bullet-point discussion summarizes the key considerations in the refinement of Concept B. The refined Concept B is shown in **Figure 6** overlaid on top of the original concept.

- Design Environment and Context
    - The splitter island lengths were extended. For rural and suburban environments it is suggested that splitter islands should be at least 100 feet, with a more desirable length of 200 feet to provide additional intersection visibility and advance notification to drivers to begin speed reductions.
- Fastest Path Speed Control
    - The northbound and westbound entries in the original concept allowed for fastest path speeds above 30 mph. The design was refined based upon the fastest path criteria from *NCHRP Report 672* to maintain fastest path speeds entering the roundabout of 25 mph or less for each of the single-lane approaches. Outside shoulders were removed in lieu of raised curb around the roundabout. Adjustments to the roundabout position and approach alignments were also made to achieve entering speeds on all approaches at or below 25 mph.
    - Fastest paths for the various intersection turning movements for the refined Concept B are provided in **Appendix D**.
- Design Vehicle Considerations
    - WB-67 trucks were accommodated in the original design with the use of shoulders around the outside of the roundabout. However, the use of the shoulders prevented fastest path speed control objectives from being met. Adjustments to the roundabout position and approach alignment, in combination with incorporation of outside curb lines, were made in order to achieve both speed control and accommodation of the WB-67 design vehicle for all movements. On the west leg of SR 9, the approach alignment was modified to be closer to radial instead of offset-left to better provide truck accommodation for the SB to WB right-turn.
    - WB-67 truck check figures for the refined Concept B are included in **Appendix E**.
- Sight Distance Considerations
    - The refined concept was reviewed for both stopping sight distance and intersection sight distance triangles. Figures are located in **Appendix F**.
    - By overlaying the stopping sight distance and intersection sight distance triangles, the resulting combined sight distance diagram indicates the locations where clear zones must be maintained and where taller landscaping can be incorporated into the design.

**Figure 6: Refined Concept B Overlaid on Original Design**



## COST COMPARISON

Each alternate with the exception of the no build condition would require a larger footprint than what is currently in place. The cost of additional right of way would be similar for the roundabout B alternate and the T intersection. Constructing a single lane roundabout will have a higher estimated total cost. The table below represents cost for each alternate.

| | | | |
|---|---|---|---|
| **Preferred Alternative: Roundabout B** | | | |
| **Estimated Property Impacts:** | **11** | **Estimated Total Cost:** | **$2,554,251.13** |
| **Estimated ROW Cost:** | **$306,000.00** | **Estimated CST Time:** | **1 YR** |
| **Alternative 1: T Intersection** | | | |
| **Estimated Property Impacts:** | **9** | **Estimated Total Cost:** | **$1,932,718.98** |
| **Estimated ROW Cost:** | **$306,000.00** | **Estimated CST Time:** | **1 YR** |
| **No-Build Alternative:** | | | |
| **Estimated Property Impacts:** | **0** | **Estimated Total Cost:** | **$0** |
| **Estimated ROW Cost:** | **$0** | **Estimated CST Time:** | **0** |

In attachment #4 of the concept report the Intersection Cost Comparison shows that the preferred Roundabout Alternate has a Life Cycle Benefit/Cost Ratio of 4.9 compared to the improved T Intersection Alternate.

## ALTERNATE SELECTION

Based on the results of the analyses, Alternate B has been selected as the recommended alternate. The roundabout is most feasible due to the following:

- Improved operations: A roundabout will always provide a higher capacity and lower delays than stop-control operating with the same traffic volumes. This alternate will provide the best operating capacity in both the opening and design years.

- Safety: This alternate will reduce the number of conflict points that exist within the current Y configuration of the intersection. It is expected that the selected alternate will reduce the number of angle and head-on crashes.

Research has shown a 35% reduction for all crashes and 75.8% for injury crashes occurs when an intersection is converted from a stop control to a roundabout. Also, because of the low circulating speed through the roundabout, the severity of crashes is expected to be minimized.

## STAGE CONSTRUCTION

The roadway grade changes on all three approaches to the intersection will impact vertical consideration and construction staging: Along SR 9, the road slopes down from east to west. SR 52 slopes from the north to the south towards the intersection. An onsite detour will be required for the construction of each alternate considered.

## CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicates that a single lane roundabout will be the most feasible solution to provide both safety and functional capacity at this intersection in build and design years based on the projected traffic volumes.

# Appendix A

# Traffic Engineering Study - Wilburn Engineering

# Appendix A

# Traffic Engineering Study - Wilburn Engineering

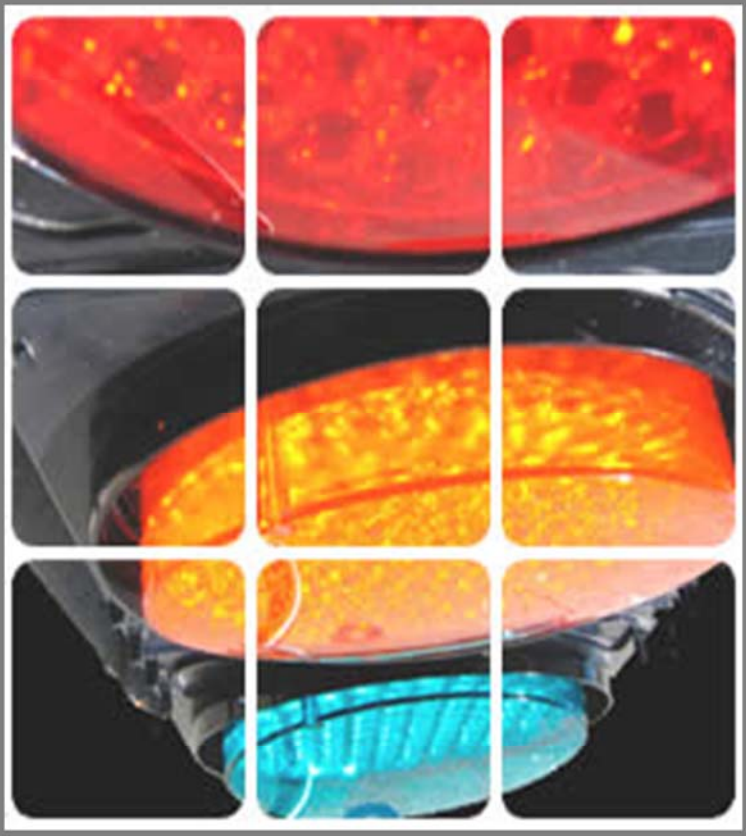
# Traffic Engineering Study

## SR 9 @ SR 52

# P.I. # 0009949

Lumpkin County, GA

January 2015



Wilburn Engineering, LLC

*Title*

**Traffic Study**
**SR 9 @ SR 52**
**P.I. # 0009949**
**Lumpkin County, GA**

| *Prepared For* | *Date* |
|---|---|
| Georgia Department of Transportation<br><br>*On Behalf of:*<br>Clark Patterson Engineers, Surveyor and Architects, P.C.<br>350 Town Center Avenue<br>Suwanee, Georgia 30024<br>Mr. Adolfo A. Guzman, P.E.<br>800.274.9000 | August 2014<br>Revised November 2014<br>Revised January 2015<br>Revised February 2015 |
| *Prepared By*<br><br>Wilburn Engineering, LLC<br>931 Lower Fayetteville Rd, Suite I<br>Newnan, Georgia 30263<br><br>770.977.8920 | *Principal Investigator*<br><br>Donald "Speedy" Boutwell, PE, PTOE<br><br>*Additional Investigator*<br><br>Vern Wilburn, PE, PTOE<br>Drew Ritter |

*Summary*

This study evaluates the existing and projected traffic conditions to identify the necessary improvements and operational needs for the intersection of SR 9 @ SR 52 west of Dahlonega in Lumpkin County.

The following statements summarize the findings of this study:

1. Capacity analysis of existing conditions showed that the intersection currently operates at level of service (LOS) 'B' or better and would continue to operate at LOS 'B' or better through the Design Year (2038) without any improvements.

2. Capacity analysis of an improved conventional T-Intersection with turn lanes show that the intersection would operate at LOS 'B' or better through the Design Year (2038).

3. Capacity analysis of a roundabout alternative show that the intersection would operate at LOS 'A' through the Design Year (2038).

4. It is recommended that a cost benefit analysis be conducted to determine if the improved operations with a roundabout are sufficient to warrant the additional construction cost.

## CONTENTS

INTRODUCTION ..... 1
Project Location ..... 1
Study Area ..... 2
FUNCTIONAL CLASSIFICATION ..... 3
EXISTING CONDITIONS ..... 4
Existing Peak Hour Volumes ..... 5
Existing Daily Volumes ..... 5
Intersection Sight Distance ..... 5
CRASH HISTORY ..... 8
TRAFFIC PROJECTIONS ..... 9
Peak Hour Traffic Projections, Construction Year (2018) ..... 9
Peak Hour Traffic Projections, Design Year (2038) ..... 10
Daily Traffic Projections, Construction Year (2018) ..... 11
Daily Traffic Projections, Design Year (2038) ..... 12
CAPACITY ANALYSIS ..... 13
Existing Conditions ..... 13
Projected Conditions ..... 14
Build Alternatives ..... 15
SUMMARY OF FINDINGS ..... 18
RECOMMENDATIONS ..... 18

APPENDICES ..... 19
A – PHOTOGRAPHIC INVENTORY
B – EXISTING PEAK HOUR AND DAILY TRAFFIC VOLUMES
C – CRASH DATA
D – PROJECTED PEAK HOUR AND DAILY TRAFFIC VOLUMES
E – CAPACITY ANALYSIS - EXISTING
F – CAPACITY ANALYSIS – NO BUILD
G – CAPACITY ANALYSIS - BUILD
H – ROUNDABOUT ANALYSIS

## LIST OF ILLUSTRATIONS

Figure 1: PROJECT LOCATION MAP ..... 1
Figure 2: STUDY AREA MAP ..... 2
Figure 3: FUNCTIONAL CLASSIFICATION ..... 3
Figure 4: EXISTING TRAFFIC CONDITIONS ..... 4
Figure 5: EXISTING PEAK HOUR TRAFFIC VOLUMES ..... 6
Figure 6: EXISTING DAILY TRAFFIC VOLUMES ..... 6
Figure 7: SIGHT DISTANCE ..... 7
Figure 8: COLLISION DIAGRAM ..... 8
Figure 9: CONSTRUCTION YEAR (2018) PEAK HOUR VOLUMES ..... 9
Figure 10: DESIGN YEAR (2038) PEAK HOUR VOLUMES ..... 10
Figure 11: CONSTRUCTION YEAR (2018) DAILY VOLUMES ..... 11
Figure 12: DESIGN YEAR (2038) DAILY VOLUMES ..... 12

## LIST OF TABLES

Table 1: YEARLY CRASH FREQUENCY ..... 8
Table 2: LEVEL OF SERVICE CRITERIA ..... 13
Table 3: EXISTING LEVELS OF SERVICE ..... 13
Table 4: NO BUILD LEVELS OF SERVICE ..... 14
Table 5: LEFT TURN LANE CRITERIA ..... 15
Table 6: RIGHT TURN LANE CRITERIA ..... 15
Table 7: TURN LANE EVALUATION ..... 15
Table 8: BUILD ALTERNATIVE, LEVELS OF SERVICE, UNSIGNALIZED CONVENTIONAL T-INTERSECTION .. 15
Table 9: ROUNDABOUT SUITABILITY SCREENING CRITERIA ..... 16
Table 10: ROUNDABOUT ALTERNATIVE LEVEL OF SERVICE – 2018 ..... 16
Table 11: ROUNDABOUT ALTERNATIVE LEVEL OF SERVICE – 2038 ..... 17

## INTRODUCTION

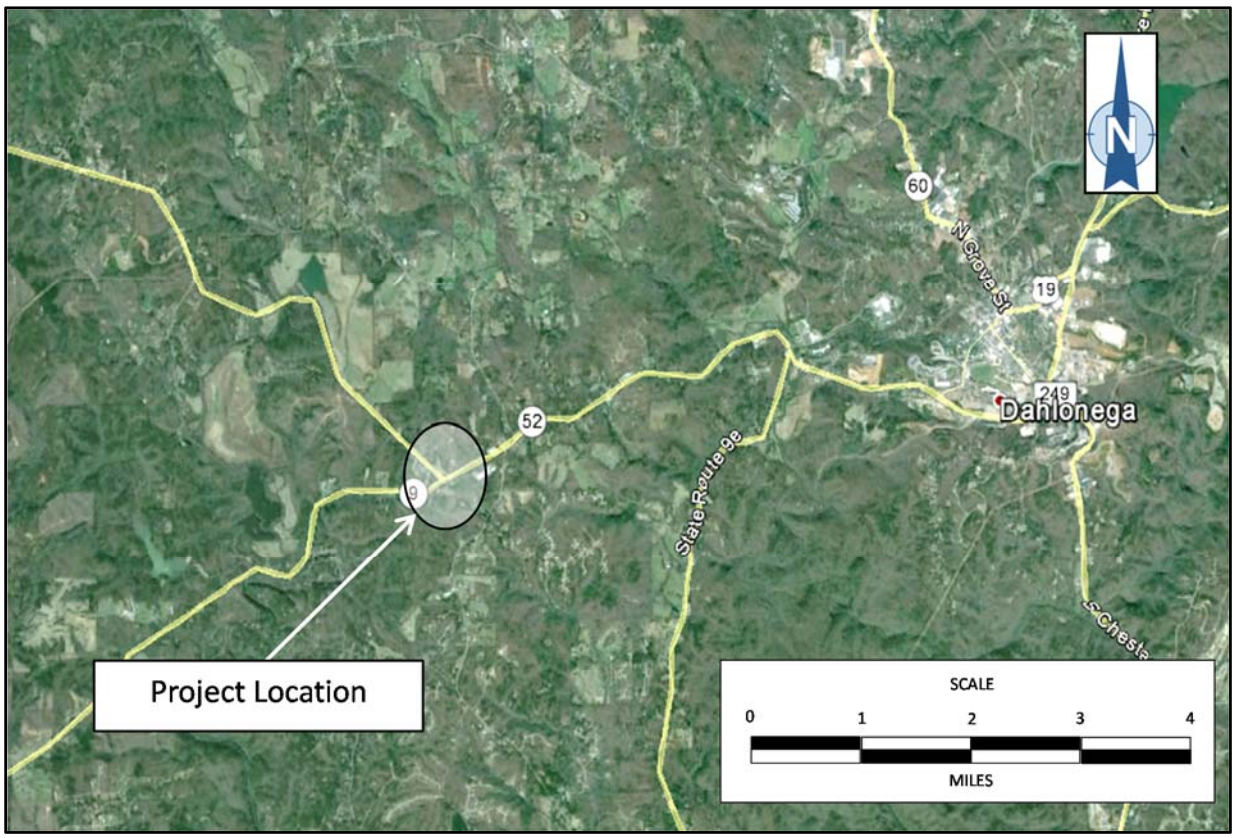
The intersection of SR 9 @ SR 52 is planned to be improved and is identified in the State Transportation Improvement Plan (STIP). The project (PI 0009949) is scheduled to be Let for construction in 2018 and anticipated to be open by the end of 2018.

This study includes traffic projections, crash analysis, capacity analysis and recommended improvements necessary to address the operational and safety conditions.

### Project Location

The project is located approximately 3.5 miles west of Dahlonega, in Lumpkin County. Figure 1 shows the project location.

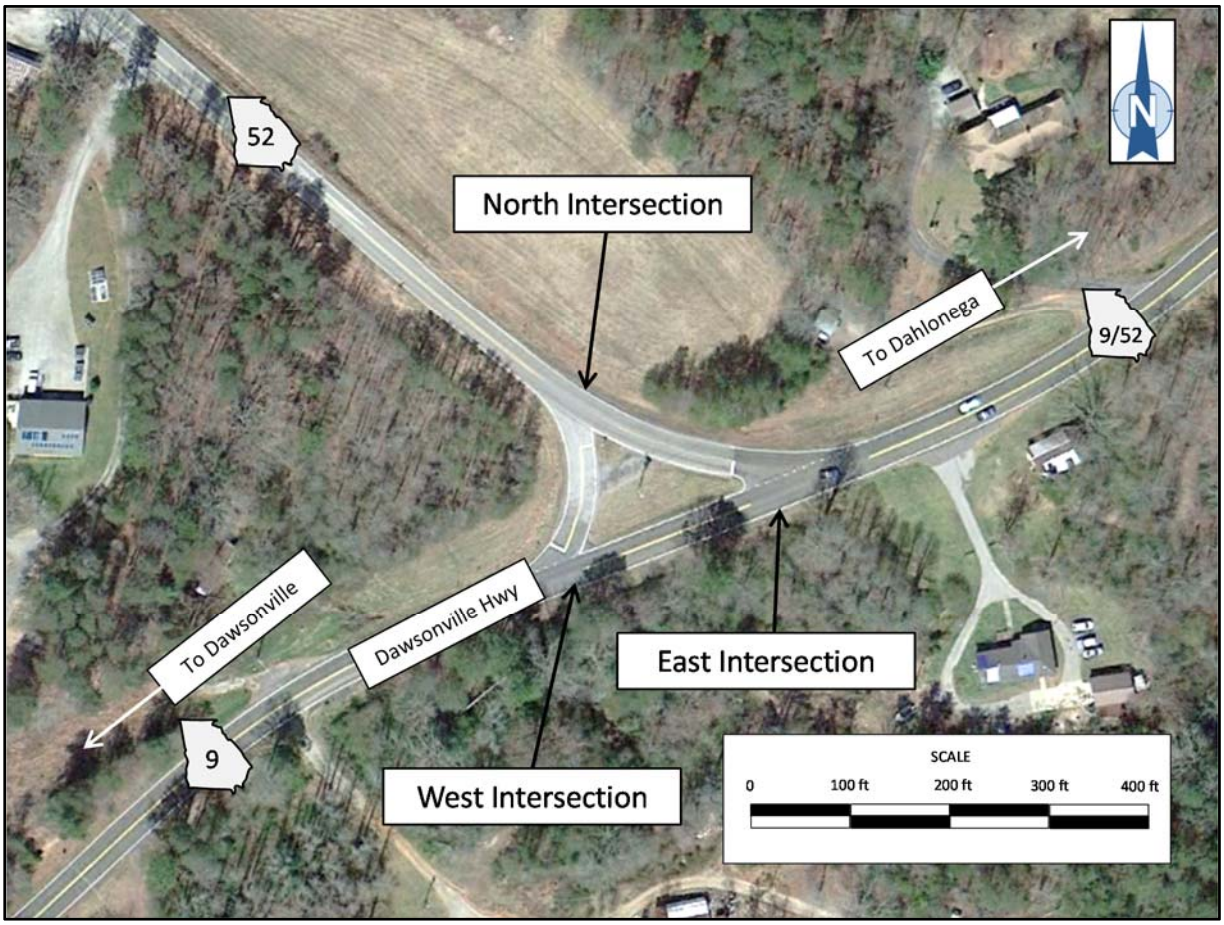
**Figure 1: PROJECT LOCATION MAP**



## Study Area

Figure 2 shows the study area in more detail.

**Figure 2: STUDY AREA MAP**

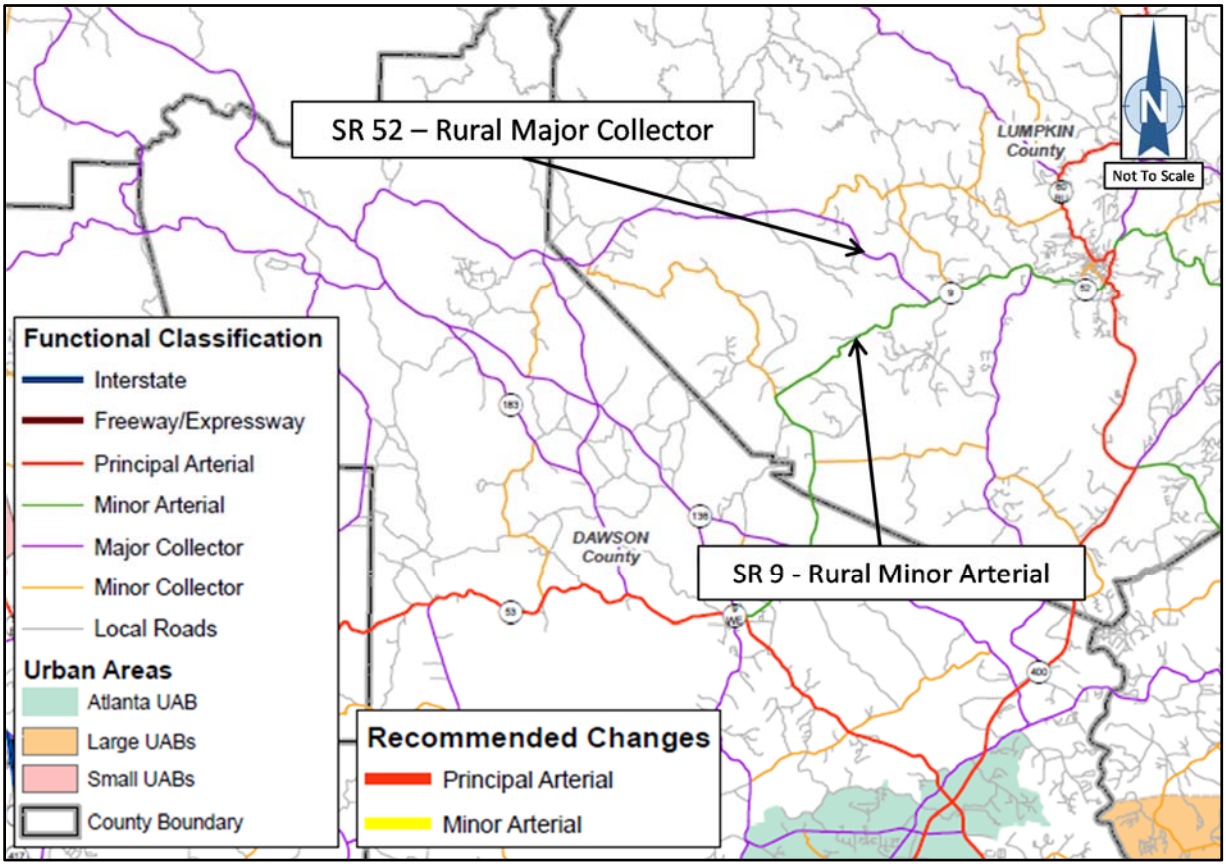



Since the intersection actually operates as three separate intersections, when the operations are described herein, the three intersections will be referred to as the east, west, and north intersection as designated in Figure 2 above.

## FUNCTIONAL CLASSIFICATION

SR 9 is classified as a Rural Minor Arterial and SR 52 is classified as a Rural Major Collector. Figure 3 below shows a GDOT functional classification map.

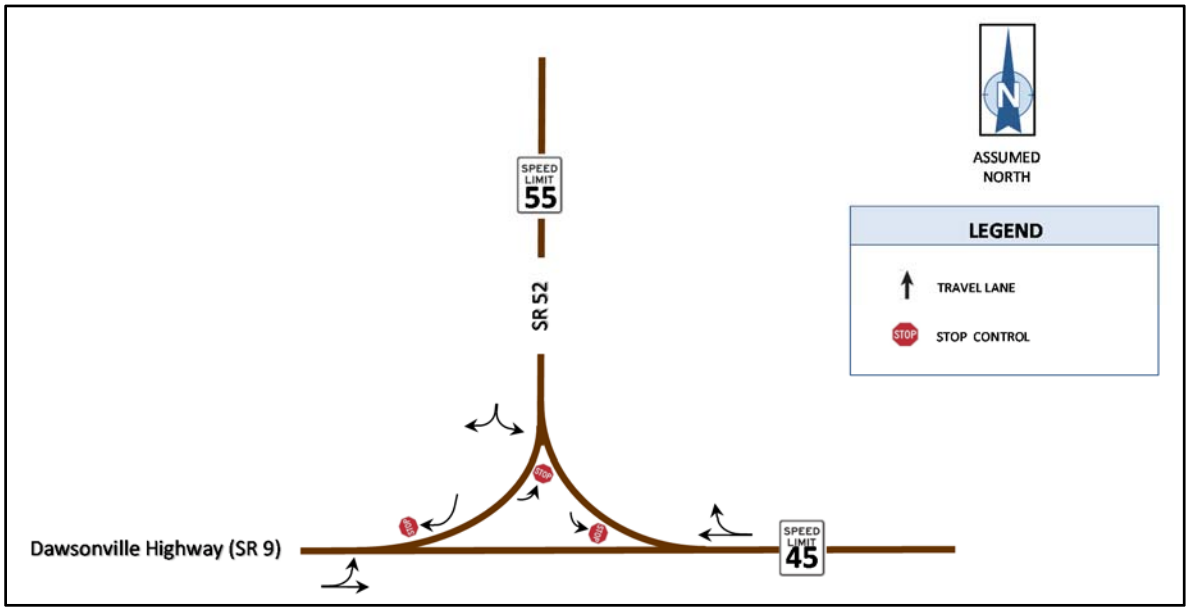
**Figure 3: FUNCTIONAL CLASSIFICATION**



## EXISTING CONDITIONS

SR 9 and SR 52 are two-lane roadways. The posted speed limit along SR 52 is 55 MPH. The posted speed limit along SR 9 is 45 mph. Figure 4 illustrates the existing roadway infrastructure and traffic control at the intersection. A photographic inventory of the area is provided in Appendix A.

**Figure 4: EXISTING TRAFFIC CONDITIONS**



## Existing Peak Hour Volumes

Existing AM and PM Peak Hour volumes were collected by GDOT in May 2013. The peak hour volumes are shown in Figure 5, on the following page. Truck and bus traffic were determined to be approximately 4% during the peak hours. The existing peak hour traffic volumes provided by GDOT are provided in Appendix B.

## Existing Daily Volumes

Georgia DOT (GDOT) traffic count stations (TC #1870005 & #1870001) are located on SR 9 to the east and west of SR 52, respectively. The average daily traffic (ADT) for TC #1870005 is 4200 vehicles per day (vpd) and 2200 vpd for TC #1870001 as reported by GDOT. The truck percentage reported for the Year 2013 was 4% along SR 9.

GDOT TC #1870038 is located on SR 52. GDOT reports an ADT of 2300 vpd for this location.

The existing daily traffic volumes are shown in Figure 6, on the following page. The existing daily traffic volumes provided by GDOT are provided in Appendix B.

## Intersection Sight Distance

A publication from the National Cooperative Research Program was used as guidance on sight distance. This document, *NCHRP 383, Intersection Sight Distance*, is the basis for AASHTO Guidelines. For traffic entering from the stop-controlled approach, the driver must be able to see far enough to negotiate the intersection before main street traffic arrives at the intersection. For two-lane main streets, NCHRP 383 suggests that it takes 7.5 seconds (minimum) to turn left or right onto a two-lane highway and an additional 0.5 seconds for each additional lane that is crossed.

The posted speed limit of 45 mph was used for the calculation.

SR 9 is a two-lane minor arterial; so a vehicle will have to cross two lanes of traffic to execute a left turn. Therefore, 7.5 seconds was used to calculate the required sight distance. At 45 mph (66.2 fps), vehicles will travel 500 feet in 7.5 seconds. Sight distance looking east exceeded 500 feet. The embankment with vegetation looking west creates an obstruction and should be trimmed to provide adequate sight distance (at least 500’). Figure 7, on page seven, shows sight distance looking east and west at the intersection.

**Figure 5: EXISTING PEAK HOUR TRAFFIC VOLUMES**

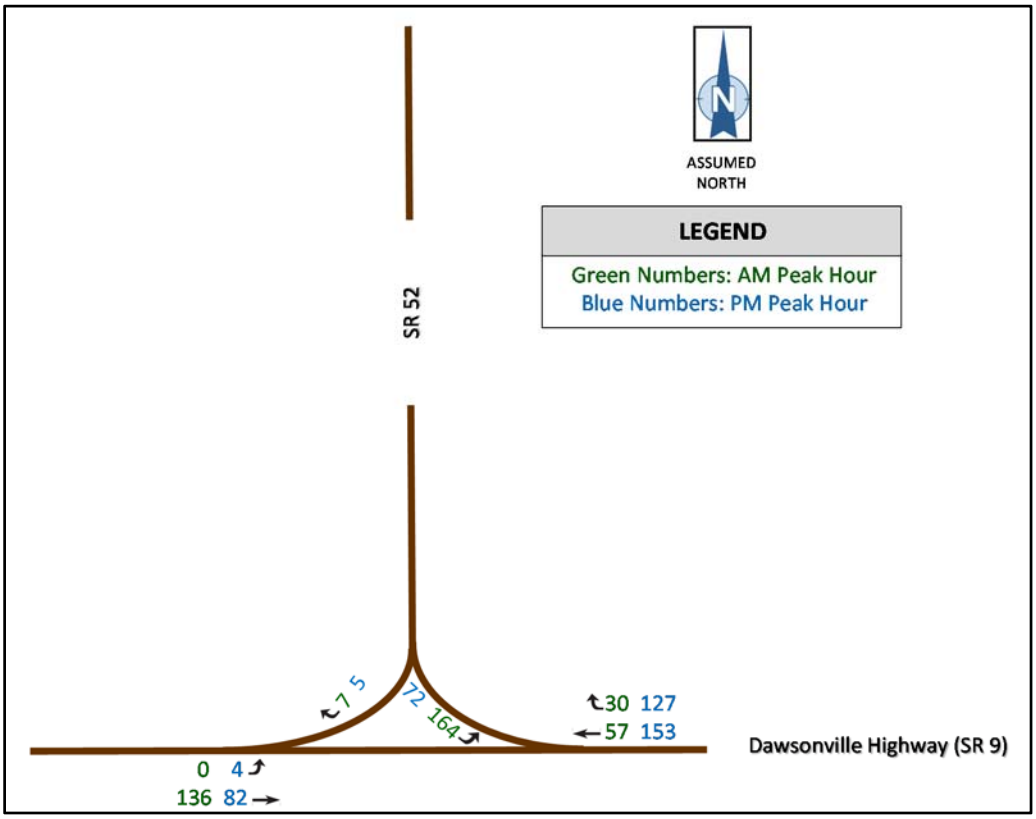



**Figure 6: EXISTING DAILY TRAFFIC VOLUMES**

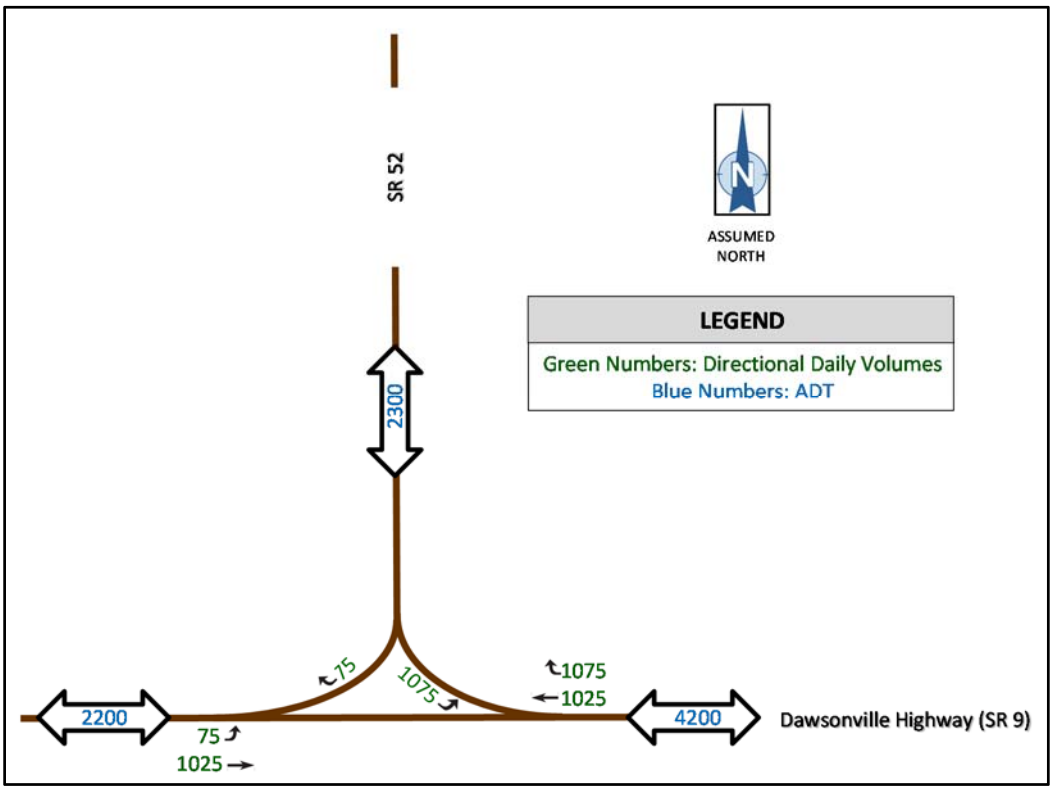


**Figure 7: SIGHT DISTANCE**

## CRASH HISTORY

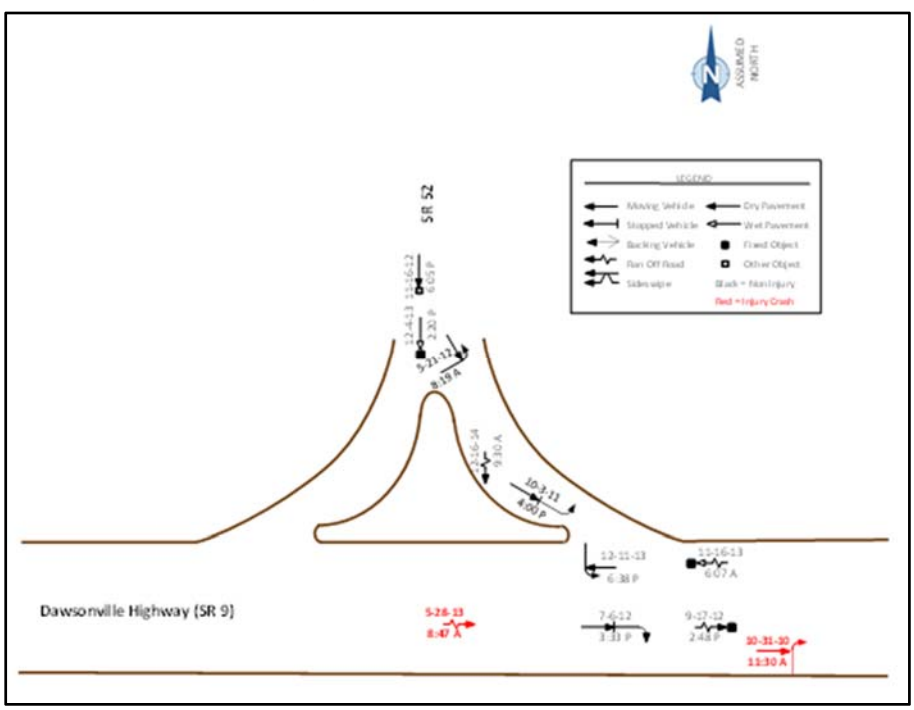
Crash data for the study area was obtained from the Georgia Department of Transportation. Table 1 summarizes the crash frequency along the corridor for the most recent four year period from 2010 through 2014. The totals given in Table 1 include all crashes at the intersection. The raw data is provided in Appendix C.

**Table 1: YEARLY CRASH FREQUENCY**

| YEAR | TOTAL CRASHES | INJURY CRASHES /INJURIES | FATALITIES | VEHICLE COLLISION With OTHER VEHICLE | | | | VEHICLE COLLISION With ANIMAL/STRUCTURE |
|---|---|---|---|---|---|---|---|---|
| | | | | RIGHT ANGLE | HEAD ON | REAR END | SIDESWIPE | |
| 2010 | 1 | 1/1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2011 | 1 | 0/0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 2012 | 4 | 0/0 | 0 | 1 | 0 | 1 | 0 | 2 |
| 2013 | 4 | 1/1 | 0 | 1 | 0 | 0 | 0 | 3 |
| 2014 | 1 | 0/0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Totals** | **11** | **2/2** | **0** | **3** | **0** | **2** | **0** | **6** |

During the analysis period (2010 to 2014), right angle and rear end collisions made up 45% of the total crashes at the intersection. There were two injury crashes, nine property-damage-only crashes, and no fatalities during the analysis period. The most common crash type was a single-vehicle collision with an animal, structure or driver inattention with six total crashes. Figure 8 illustrates the crashes in a collision diagram.

**Figure 8: COLLISION DIAGRAM**



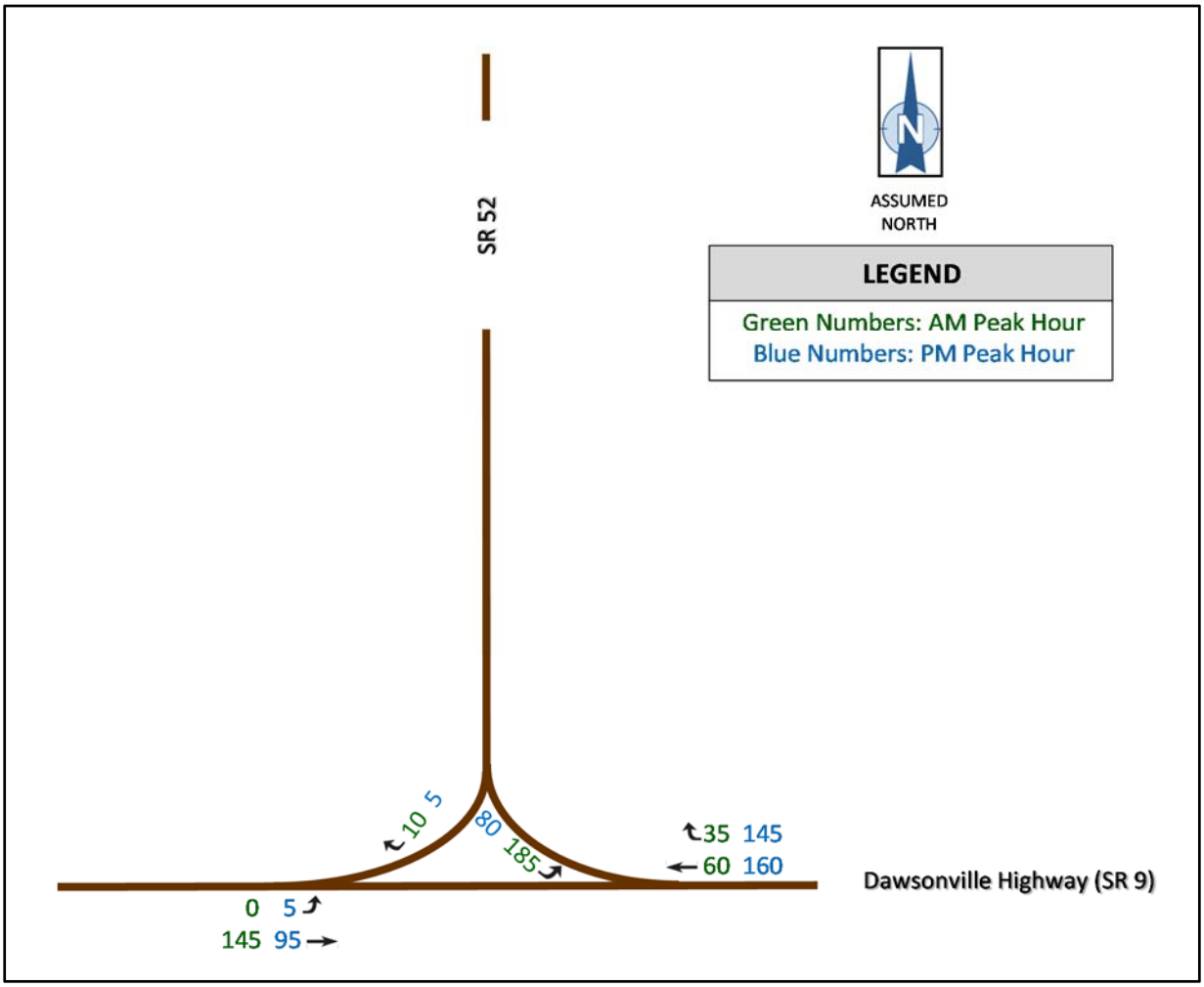
## TRAFFIC PROJECTIONS

The GDOT provided the Projected Traffic for the Construction Year (2018) and Design Year (2038). The data provided by GDOT shows that the No Build and Build Volumes are the same. Truck traffic percentages are expected to remain constant throughout the design life of the facility. The GDOT projected volumes are provided in Appendix D.

### Peak Hour Traffic Projections, Construction Year (2018)

Figure 9 illustrates the peak hour projections for the Construction Year (2018).

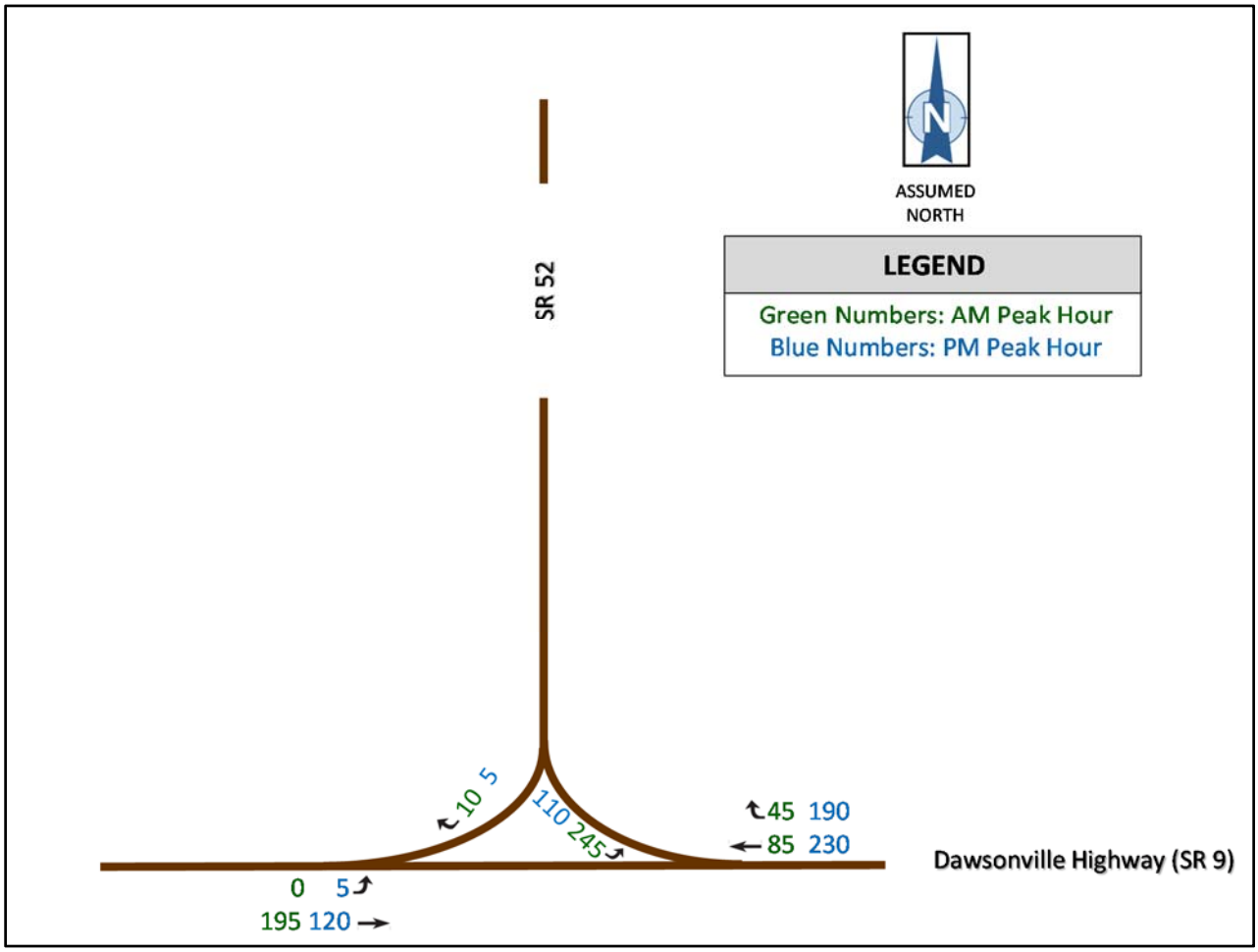
**Figure 9: CONSTRUCTION YEAR (2018) PEAK HOUR VOLUMES**



## Peak Hour Traffic Projections, Design Year (2038)

Figure 10 illustrates the peak hour projections for the Design Year (2038).

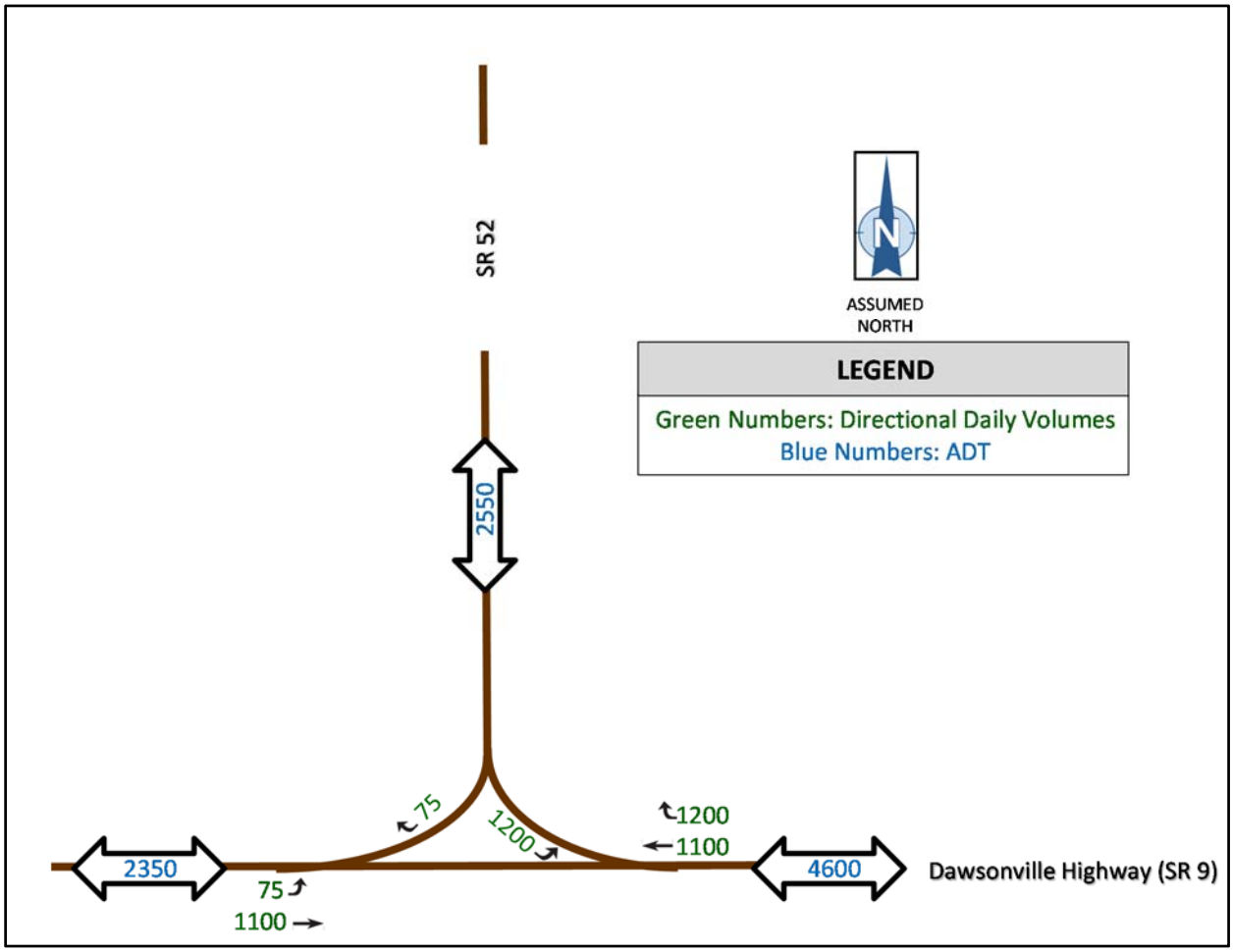
**Figure 10: DESIGN YEAR (2038) PEAK HOUR VOLUMES**



## Daily Traffic Projections, Construction Year (2018)

Figure 11 illustrates the peak hour projections for the Construction Year (2018).

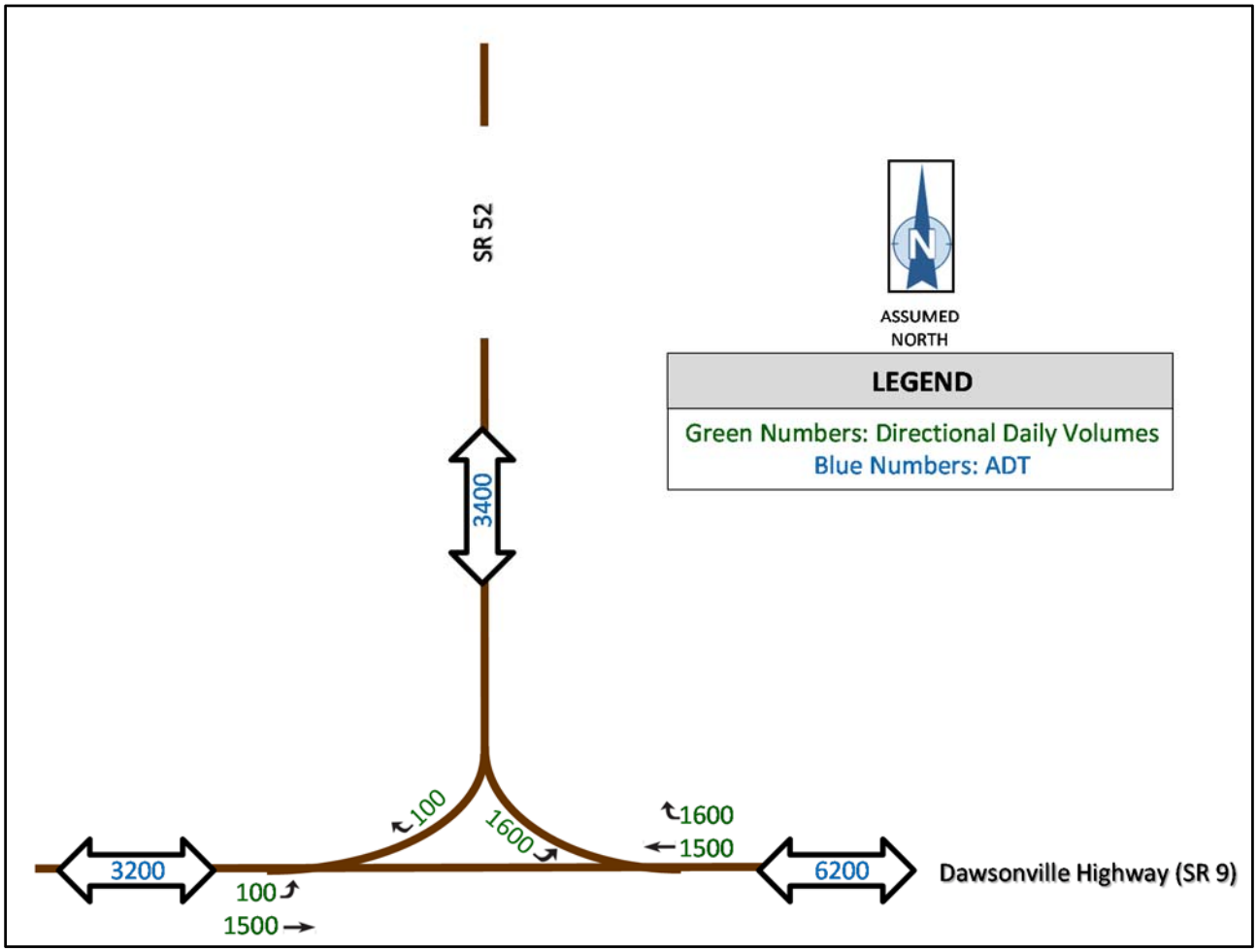
**Figure 11: CONSTRUCTION YEAR (2018) DAILY VOLUMES**



## Daily Traffic Projections, Design Year (2038)

Figure 12 illustrates the peak hour projections for the Design Year (2038).

**Figure 12: DESIGN YEAR (2038) DAILY VOLUMES**



## CAPACITY ANALYSIS

Capacity analysis was used to evaluate both existing and projected traffic volumes. The *Synchro* Program (Version 8) was used to conduct the capacity analysis. This program implements methods of both the 2000 and 2010 Highway Capacity Manuals (HCM).

The level of service definitions are provided in Table 2. The HCM has different LOS definitions for signalized intersections than for stop controlled intersections.

**Table 2: LEVEL OF SERVICE CRITERIA**

| LEVEL OF SERVICE (LOS) | SIGNALIZED INTERSECTION CONTROL DELAY PER VEHICLE (SECONDS) | STOP CONTROLLED INTERSECTION CONTROL DELAY PER VEHICLE (SECONDS) |
|---|---|---|
| A | ≤10 | ≤10 |
| B | >10 and ≤20 | >10 and ≤15 |
| C | >20 and ≤35 | >15 and ≤25 |
| D | >35 and ≤55 | >25 and ≤35 |
| E | >55 and ≤80 | >35 and ≤50 |
| F | >80 | >50 |

Capacity analysis results for an unsignalized intersection provide estimates of level of service (LOS) for each minor movement that is required to yield to free flow movements. LOS for each movement is shown followed by the estimated delay per vehicle in seconds.

### Existing Conditions

Table 3 summarizes the results of the capacity analysis for the existing unsignalized intersection. Capacity analysis reports for Existing Conditions are provided in Appendix E.

**Table 3: EXISTING LEVELS OF SERVICE**

| INTERSECTION | MOVEMENT | AM PEAK HOUR | PM PEAK HOUR |
|---|---|---|---|
| East Intersection | SB Left | B (11.4) | B (11.3) |
| West Intersection | SB Right | A (8.6) | A (9.2) |
| North Intersection | EB Left | A (0.0) | A (9.8) |

The intersection of SR 9 and SR 52 operates at LOS ‘B’ or better during both the AM and PM Peak Hours.

## Projected Conditions

### No-Build Alternative

Table 4 summarizes the results of the capacity analysis for No Build Construction Year (2018) and Design Year (2038) projected volumes. Capacity analysis reports for 2018 and 2038 No Build Conditions are provided in Appendix F.

**Table 4: NO-BUILD LEVELS OF SERVICE**

| INTERSECTION | MOVEMENT | 2018 CONSTRUCTION YEAR | | 2038 DESIGN YEAR | |
|---|---|---|---|---|---|
| | | AM PEAK HOUR | PM PEAK HOUR | AM PEAK HOUR | PM PEAK HOUR |
| East Intersection | SB Left | B (11.8) | B (11.6) | B (14.6) | B (14.0) |
| West Intersection | SB Right | A (8.7) | A (9.2) | A (8.8) | A (9.7) |
| North Intersection | EB Left | A (0.0) | A (10.0) | A (0.0) | B (10.6) |

**The intersection is projected to operate at LOS 'B' or better through the Design Year.**

### Build Alternatives

The previous section established that the intersection would operate at LOS 'B' or better through 2038 if no improvements are made.

This section provides capacity analysis results for Build Alternatives evaluated. The Build Alternatives considered included:

### Alternative 1 - Traditional T-Intersection with Turn Lanes

- The current geometrics of the intersection would be reconfigured to that of a conventional intersection with SR 52 teeing into SR 9. Tables 5 and 6 lists the conditions under which separate turn lanes should be provided as shown in GDOT's *Regulations for Driveway and Encroachment Control Manual*. Table 7 shows an evaluation of the projected volumes to determine when turn lanes would be needed for the different movements.

**Table 5: LEFT TURN LANE CRITERIA**

| | LEFT TURN LANE |
|---|---|
| | ADT < 6000 |
| ≥ 55 MPH | 200 LTV / day |

**Table 6: RIGHT TURN LANE CRITERIA**

| | RIGHT TURN LANE |
|---|---|
| | ADT < 6000 |
| 40 TO 50 MPH | 200 LTV / day |

**Table 7: TURN LANE EVALUATION**

| TURN LANE | EXISTING | | 2018 | | 2038 | |
|---|---|---|---|---|---|---|
| | Daily Volume | Y/N | Daily Volume | Y/N | Daily Volume | Y/N |
| EBL | 75 | N | 75 | N | 100 | N |
| WBR | 1075 | Y | 1200 | Y | 1600 | Y |
| SBL | 1075 | Y | 1200 | Y | 1600 | Y |

Turn lanes would be warranted for the westbound right and southbound left.

Table 8 summarizes the capacity analysis for the conventional T-Intersection. Capacity analysis reports for this alternative are provided in Appendix G.

**Table 8: BUILD ALTERNATIVE LEVELS OF SERVICE, UNSIGNALIZED CONVENTIONAL T-INTERSECTION**

| INTERSECTION | MOVEMENT | 2018 CONSTRUCTION YEAR | | 2038 DESIGN YEAR | |
|---|---|---|---|---|---|
| | | AM PEAK HOUR | PM PEAK HOUR | AM PEAK HOUR | PM PEAK HOUR |
| SR 9 & SR 52 | EB | A (0.0) | A (0.4) | A (0.0) | A (0.4) |
| | WB Right | A (0.0) | A (0.0) | A (0.0) | A (0.0) |
| | SB Left | B (11.6) | B (11.0) | B (14.0) | B (12.6) |
| | SB Right | A (8.7) | B (9.2) | A (8.8) | A (9.7) |

The intersection of SR 9 and 52, as a conventional T-Intersection, is projected to operate at LOS 'B' or better through the Design Year.

## Alternative Two: Single Lane Roundabout

This alternative is to construct a roundabout at the intersection.

GDOT's criteria for determining if a single-lane roundabout might be appropriate suggests that this type of intersection could be considered if the following conditions are expected:

1. The total entering volume is less than 25,000 vehicles for a single lane roundabout, and
2. The percentage of volume on the main roadway is less than 90% of the total volume.

Table 9 compares the projected conditions to the two criteria listed above.

**Table 9: ROUNDABOUT SUITABILITY SCREENING CRITERIA**

| HORIZON YEAR | DAILY VOLUME | | | | | |
|---|---|---|---|---|---|---|
| | SR 9 | Side Street | Total | Less Than 25,000? | Portion On Mainline | Mainline Portion Less than 90 % |
| 2018 | 3,475 | 1,275 | 4,750 | Yes | 73% | Yes |
| 2038 | 4,700 | 1,700 | 6,400 | Yes | 73% | Yes |

The projected conditions indicate that the intersection could be candidate for a single-lane roundabout operation.

Operational analysis was conducted for the intersection using the GDOT Roundabout Analysis Tool, which is based on the NCHRP-572 methodology.

Table 10 shows the results for the projected conditions for the Construction Year (2018).

**Table 10: ROUNDABOUT ALTERNATIVE, LEVEL OF SERVICE, 2018**

| | AM PEAK HOUR | | | PM PEAK HOUR | | |
|---|---|---|---|---|---|---|
| | SR 9 | | SR 52 | SR 9 | | SR 52 |
| | EB | WB | SB | EB | WB | SB |
| V/C RATIO | 0.16 | 0.09 | 0.18 | 0.10 | 0.28 | 0.08 |
| LOS | A | A | A | A | A | A |
| DELAY (sec/veh) | 5 | 3 | 4 | 4 | 5 | 4 |
| QUEUE (ft) | 14 | 7 | 16 | 8 | 30 | 7 |

The capacity analysis results for the Design Year (2038) projections are summarized in Table 11.

**Table 11: ROUNDABOUT ALTERNATIVE, LEVEL OF SERVICE, 2038**

| | AM PEAK HOUR | | | PM PEAK HOUR | | |
|---|---|---|---|---|---|---|
| | SR 9 | | SR 52 | SR 9 | | SR 52 |
| | EB | WB | SB | EB | WB | SB |
| V/C RATIO | 0.22 | 0.12 | 0.24 | 0.13 | 0.39 | 0.12 |
| LOS | A | A | A | A | A | A |
| DELAY (sec/veh) | 6 | 4 | 5 | 4 | 6 | 4 |
| QUEUE (ft) | 22 | 10 | 23 | 11 | 48 | 10 |

Appendix H includes the GDOT analysis worksheets.

The roundabout analysis indicates that a roundabout would operate at LOS 'A' through the Design Year (2038).

## SUMMARY OF FINDINGS

The following conclusions are based on the newly collected data, field observations, intersection capacity analyses and warrant analysis.

1. The intersection of SR 9 @ SR 52 in Lumpkin County currently is an unsignalized T-Intersection with unconventional geometrics that actually forms three closely spaced intersections.

2. The GDOT collected traffic data in May of 2013 and provided traffic projections for the Construction Year (2018) and the Design Year (2038).

3. Capacity analysis of the existing volumes show that the intersection of SR 9 and SR 52 currently operates at level of service (LOS) 'B' or better.

4. Capacity analysis of the projected volumes for the No-Build Alternative show that the intersection would be expected to operate at LOS 'B' or better through the Design Year.

5. The Build conventional T-Intersection alternative included separate turn lanes for the westbound right movement and southbound left movement. This alternative would operate at LOS 'B' or better through the Design Year.

6. Capacity analysis of the Build volumes for the roundabout alternative show that the intersection would be expected to operate at LOS 'A' through the Design Year.

## RECOMMENDATIONS

1. If the conventional T-Intersection alternative is selected, the turn lane lengths should be as follows:

    - 175' westbound right
    - 310' southbound left
    - 235' eastbound left

2. The roundabout alternative would provide improved operations for the projected volumes. However, it is recommended that a cost/benefit analysis be conducted prior to selecting the roundabout alternative. It is unclear without cost estimates if the improvements in operations are great enough to warrant the additional construction cost.

# APPENDICES

A – PHOTOGRAPHIC INVENTORY

B – EXISTING PEAK HOUR AND DAILY TRAFFIC VOLUMES

C – CRASH DATA

D – PROJECTED PEAK HOUR AND DAILY TRAFFIC VOLUMES

E – CAPACITY ANALYSIS – EXISTING

F – CAPACITY ANALYSIS – NO BUILD

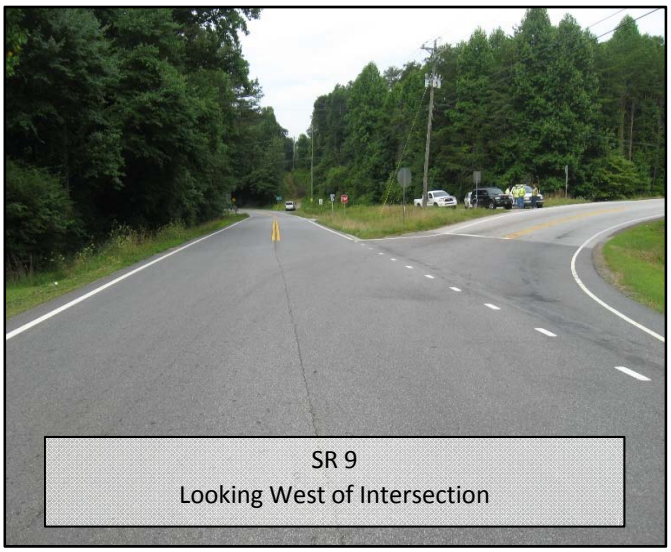
G – CAPACITY ANALYSIS – BUILD

H – ROUNDABOUT ANALYSIS

# APPENDIX A

# PHOTOGRAPHIC INVENTORY

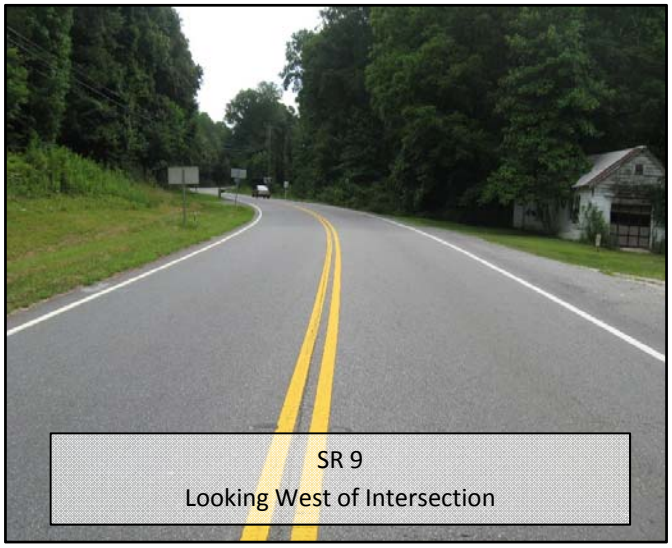
# SR 9 @ SR 52



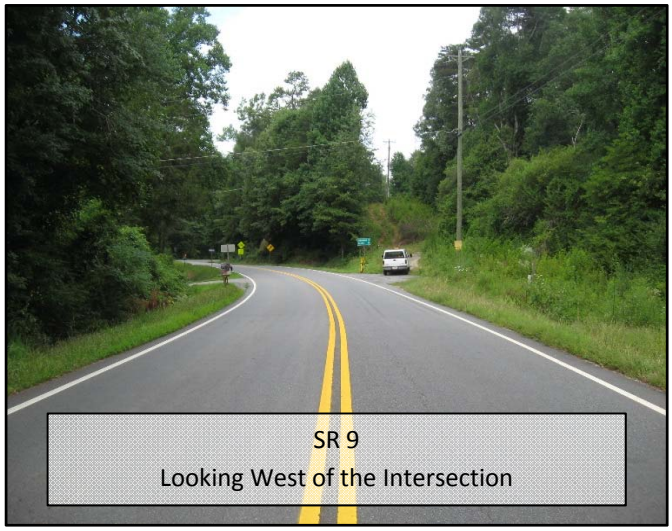
SR 9
Looking West of Intersection

SR 52
Looking North of the Intersection

SR 9
Looking East of the Intersection



SR 9
Looking West of Intersection



SR 9
Looking West of the Intersection

SR 52
Looking South of the Intersection

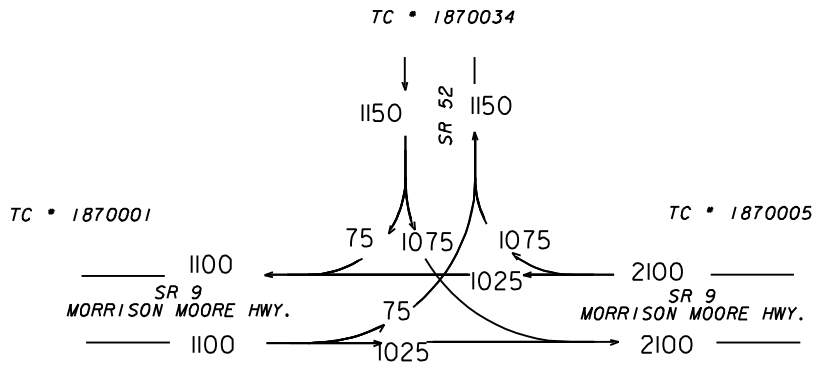
# APPENDIX B

# EXISTING PEAK HOUR AND DAILY TRAFFIC VOLUMES

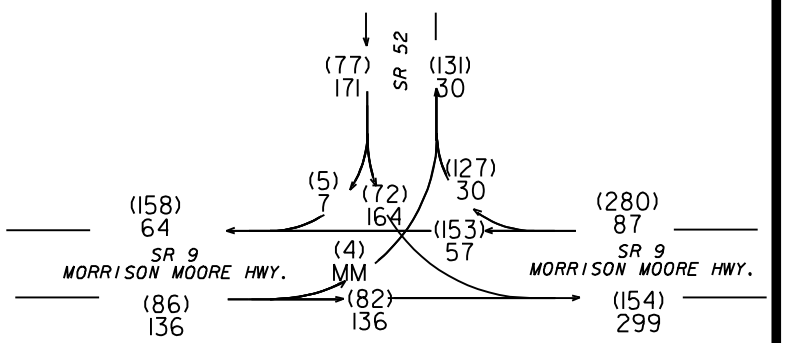
SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING

LUMPKIN COUNTY




EXISTING 2013 ADT
SR 9
24 HOURS T = 4%
S.U. = 3.5%
COMB. = 0.5%




EXISTING 2013 PM/AM
SR 9
T = 3.5%
S.U. = 3.5%
COMB. = 0%

SR 9 @ SR 52
P.I. 0009949

LUMPKIN COUNTY

AFE
05/2013

# APPENDIX C

# CRASH DATA

| 2010 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INTERSECTION OF SR 9 @ SR 52 | | | | | | | | | | | | | | |
| Accident No | Date | Time | County | Route | Intersecting Route | Injuries | Fatalities | Manner Of Collision | Light | Surface | DV 1 | DV 2 | MV 1 | MV 2 |
| 3530203 | 10/31/2010 | 11:30:00 | LUMPKIN | SR 9 | SR 52 | 1 | 0 | Angle | Daylight | Dry | North | South | Turning Right | Straight |

| 2011 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INTERSECTION OF SR 9 @ SR 52 | | | | | | | | | | | | | | |
| Accident No | Date | Time | County | Route | Intersecting Route | Injuries | Fatalities | Manner Of Collision | Light | Surface | DV 1 | DV 2 | MV 1 | MV 2 |
| 3880472 | 10/3/2011 | 16:00:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Rear End | Daylight | Dry | East | East | Straight | Stopped |

| 2012 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INTERSECTION OF SR 9 @ SR 52 | | | | | | | | | | | | | | |
| Accident No | Date | Time | County | Route | Intersecting Route | Injuries | Fatalities | Manner Of Collision | Light | Surface | DV 1 | DV 2 | MV 1 | MV 2 |
| 4140973 | 7/6/2012 | 15:33:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Rear End | Daylight | Dry | East | East | Straight | Stopped |
| 4162778 | 5/21/2012 | 8:19:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Angle | Daylight | Dry | West | East | Turning Left | Straight |
| 4209379 | 9/17/2012 | 14:48:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Not A Collision with Motor Vehicle | Daylight | Dry | North | | Straight | |
| 4292102 | 11/16/2012 | 18:05:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Not A Collision with Motor Vehicle | Dark-Not Lighted | Dry | East | | Negotiating A Curve | |

| 2013 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INTERSECTION OF SR 9 @ SR 52 | | | | | | | | | | | | | | |
| Accident No | Date | Time | County | Route | IntersectingRoute | Injuries | Fatalities | MannerOfCollision | Light | Surface | DV 1 | DV 2 | MV 1 | MV 2 |
| 4459754 | 5/28/2013 | 8:47:00 | LUMPKIN | SR 9 | SR 52 | 1 | 0 | Not A Collision with Motor Vehicle | Daylight | Dry | North | | Straight | |
| 4643698 | 11/16/2013 | 6:07:00 | LUMPKIN | SR 9 | SR 52 | 0 | 0 | Not A Collision with Motor Vehicle | Dark-Not Lighted | Wet | South | | Negotiating A Curve | |
| 4664475 | 12/4/2013 | 14:20:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Not A Collision with Motor Vehicle | Daylight | Wet | East | | Negotiating A Curve | |
| 4673225 | 12/11/2013 | 16:38:00 | LUMPKIN | SR 9 | SR 52 | 0 | 0 | Angle | Daylight | Dry | East | South | Turning Left | Straight |

| 2014 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INTERSECTION OF SR 9 @ SR 52 | | | | | | | | | | | | | | |
| AccidentNo | Date | Time | County | Route | IntersectingRoute | Injuries | Fatalities | MannerOfCollision | Light | Surface | DV1 | DV2 | MV1 | MV2 |
| 5112451 | 12/16/2014 | 9:30:00 | LUMPKIN | SR 52 | SR 9 | 0 | 0 | Not A Collision with Motor Vehicle | Daylight | Dry | East | | Straight | |

# APPENDIX D

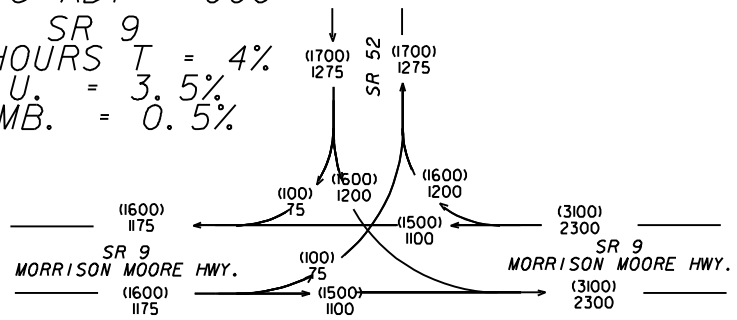
# PROJECTED PEAK HOUR AND DAILY TRAFFIC VOLUMES

SHEET 1 OF 1

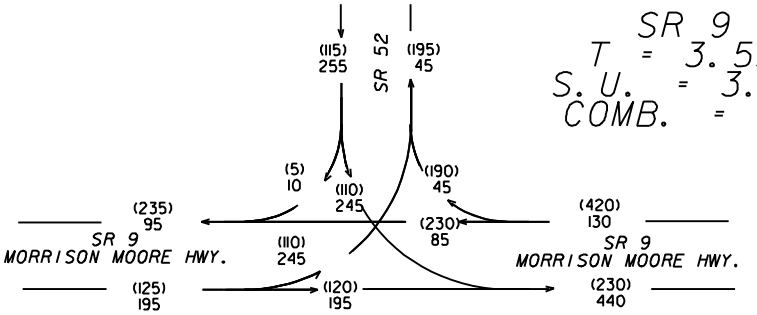
GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING

# LUMPKIN COUNTY
# NO BUILD

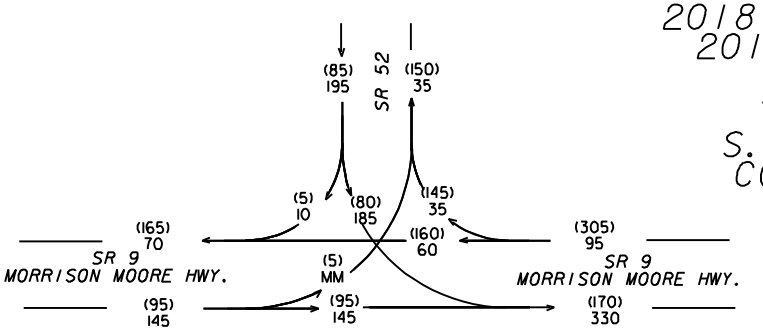
2038 ADT = (000)
2018 ADT = 000
SR 9
24 HOURS T = 4%
S.U. = 3.5%
COMB. = 0.5%




2038 PM DHV = (000)
2038 AM DHV = 000
SR 9
T = 3.5%
S.U. = 3.5%
COMB. = 0%




2018 PM DHV = (000)
2018 AM DHV = 000
SR 9
T = 3.5%
S.U. = 3.5%
COMB. = 0%




SR 9 @ SR 52
P.I. 0009949

LUMPKIN COUNTY

AFE
05/2013

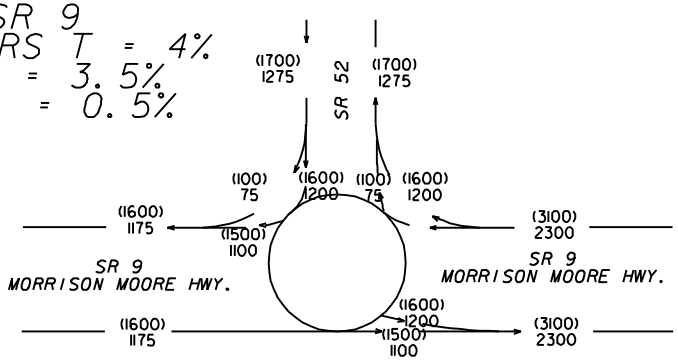
SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING

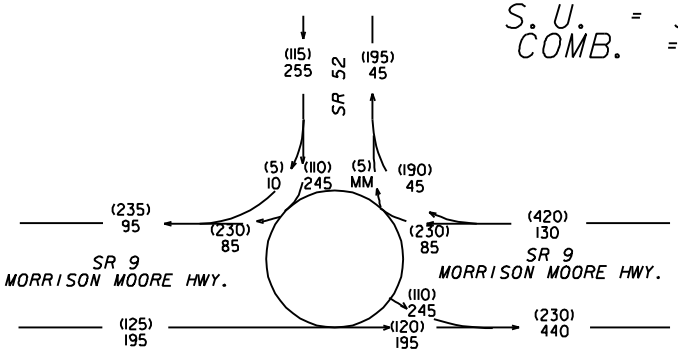
LUMPKIN COUNTY
BUILD

N

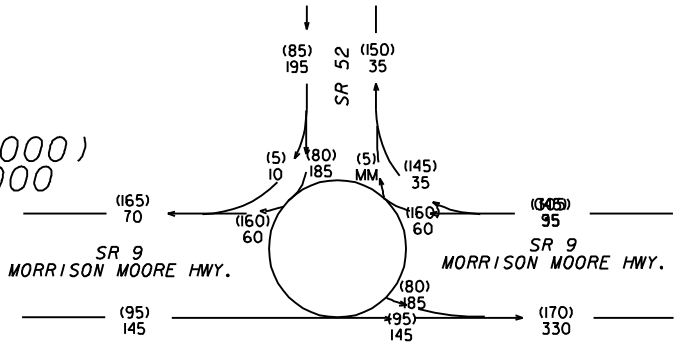
2038 ADT = (000)
2018 ADT = 000
SR 9
24 HOURS T = 4%
S.U. = 3.5%
COMB. = 0.5%




2038 PM DHV = (000)
2038 AM DHV = 000
SR 9
T = 3.5%
S.U. = 3.5%
COMB. = 0%




2018 PM DHV = (000)
2018 AM DHV = 000
SR 9
T = 3.5%
S.U. = 3.5%
COMB. = 0%




SR 9 @ SR 52
P.I. 0009949

LUMPKIN COUNTY

AFE
05/2013

# APPENDIX E

# CAPACITY ANALYSIS – EXISTING

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 136 | 57 | 30 | 164 | 0 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 155 | 65 | 34 | 186 | 0 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 99 | | | | 236 | 82 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 99 | | | | 236 | 82 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 75 | 100 |
| cM capacity (veh/h) | 1494 | | | | 752 | 978 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 155 | 99 | 186 |
| Volume Left | 0 | 0 | 186 |
| Volume Right | 0 | 34 | 0 |
| cSH | 1700 | 1700 | 752 |
| Volume to Capacity | 0.09 | 0.06 | 0.25 |
| Queue Length 95th (ft) | 0 | 0 | 24 |
| Control Delay (s) | 0.0 | 0.0 | 11.4 |
| Lane LOS | | | B |
| Approach Delay (s) | 0.0 | 0.0 | 11.4 |
| Approach LOS | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.8 | | |
| Intersection Capacity Utilization | 22.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 136 | 57 | 0 | 0 | 7 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 155 | 65 | 0 | 0 | 8 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 65 | | | | 219 | 65 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 65 | | | | 219 | 65 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 99 |
| cM capacity (veh/h) | 1537 | | | | 769 | 999 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 155 | 65 | 8 |
| Volume Left | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 8 |
| cSH | 1537 | 1700 | 999 |
| Volume to Capacity | 0.00 | 0.04 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 1 |
| Control Delay (s) | 0.0 | 0.0 | 8.6 |
| Lane LOS | | | A |
| Approach Delay (s) | 0.0 | 0.0 | 8.6 |
| Approach LOS | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 13.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 0 | 0 | 30 | 164 | 7 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 34 | 186 | 8 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 224 | 190 | 194 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 224 | 190 | 194 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 100 | 100 | | | |
| cM capacity (veh/h) | 764 | 851 | 1379 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 0 | 34 | 194 |
| Volume Left | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 8 |
| cSH | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.02 | 0.11 |
| Queue Length 95th (ft) | 0 | 0 | 0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | |
| Approach Delay (s) | 0.0 | 0.0 | 0.0 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.0 | | |
| Intersection Capacity Utilization | 12.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 82 | 153 | 127 | 72 | 0 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 93 | 174 | 144 | 82 | 0 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 318 | | | | 339 | 246 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 318 | | | | 339 | 246 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 88 | 100 |
| cM capacity (veh/h) | 1242 | | | | 657 | 793 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 93 | 318 | 82 |
| Volume Left | 0 | 0 | 82 |
| Volume Right | 0 | 144 | 0 |
| cSH | 1700 | 1700 | 657 |
| Volume to Capacity | 0.05 | 0.19 | 0.12 |
| Queue Length 95th (ft) | 0 | 0 | 11 |
| Control Delay (s) | 0.0 | 0.0 | 11.3 |
| Lane LOS | | | B |
| Approach Delay (s) | 0.0 | 0.0 | 11.3 |
| Approach LOS | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.9 | | |
| Intersection Capacity Utilization | 26.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 4 | 82 | 153 | 0 | 0 | 5 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 5 | 93 | 174 | 0 | 0 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 174 | | | | 276 | 174 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 174 | | | | 276 | 174 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 99 |
| cM capacity (veh/h) | 1403 | | | | 711 | 870 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 98 | 174 | 6 |
| Volume Left | 5 | 0 | 0 |
| Volume Right | 0 | 0 | 6 |
| cSH | 1403 | 1700 | 870 |
| Volume to Capacity | 0.00 | 0.10 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 |
| Control Delay (s) | 0.4 | 0.0 | 9.2 |
| Lane LOS | A | | A |
| Approach Delay (s) | 0.4 | 0.0 | 9.2 |
| Approach LOS | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 18.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 4 | 0 | 0 | 127 | 72 | 5 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 5 | 0 | 0 | 144 | 82 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 229 | 85 | 88 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 229 | 85 | 88 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 99 | 100 | 100 | | | |
| cM capacity (veh/h) | 759 | 974 | 1508 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 5 | 144 | 88 |
| Volume Left | 5 | 0 | 0 |
| Volume Right | 0 | 0 | 6 |
| cSH | 759 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.08 | 0.05 |
| Queue Length 95th (ft) | 0 | 0 | 0 |
| Control Delay (s) | 9.8 | 0.0 | 0.0 |
| Lane LOS | A | | |
| Approach Delay (s) | 9.8 | 0.0 | 0.0 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 16.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# APPENDIX F

# CAPACITY ANALYSIS – NO BUILD

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 145 | 60 | 35 | 185 | 0 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 165 | 68 | 40 | 210 | 0 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 108 | | | | 253 | 88 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 108 | | | | 253 | 88 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 71 | 100 |
| cM capacity (veh/h) | 1483 | | | | 736 | 970 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 165 | 108 | 210 |
| Volume Left | 0 | 0 | 210 |
| Volume Right | 0 | 40 | 0 |
| cSH | 1700 | 1700 | 736 |
| Volume to Capacity | 0.10 | 0.06 | 0.29 |
| Queue Length 95th (ft) | 0 | 0 | 29 |
| Control Delay (s) | 0.0 | 0.0 | 11.8 |
| Lane LOS | | | B |
| Approach Delay (s) | 0.0 | 0.0 | 11.8 |
| Approach LOS | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.2 | | |
| Intersection Capacity Utilization | 24.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 145 | 60 | 0 | 0 | 10 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 165 | 68 | 0 | 0 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 68 | | | | 233 | 68 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 68 | | | | 233 | 68 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 99 |
| cM capacity (veh/h) | 1533 | | | | 755 | 995 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 165 | 68 | 11 |
| Volume Left | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 11 |
| cSH | 1533 | 1700 | 995 |
| Volume to Capacity | 0.00 | 0.04 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 1 |
| Control Delay (s) | 0.0 | 0.0 | 8.7 |
| Lane LOS | | | A |
| Approach Delay (s) | 0.0 | 0.0 | 8.7 |
| Approach LOS | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.4 | | |
| Intersection Capacity Utilization | 13.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 0 | 0 | 35 | 185 | 10 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 40 | 210 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 256 | 216 | 222 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 256 | 216 | 222 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 100 | 100 | | | |
| cM capacity (veh/h) | 733 | 824 | 1347 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 0 | 40 | 222 |
| Volume Left | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 11 |
| cSH | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.02 | 0.13 |
| Queue Length 95th (ft) | 0 | 0 | 0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | |
| Approach Delay (s) | 0.0 | 0.0 | 0.0 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.0 | | |
| Intersection Capacity Utilization | 13.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 95 | 160 | 145 | 80 | 0 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 1.00 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 108 | 182 | 145 | 91 | 0 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 327 | | | | 362 | 254 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 327 | | | | 362 | 254 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 86 | 100 |
| cM capacity (veh/h) | 1233 | | | | 637 | 784 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 108 | 327 | 91 |
| Volume Left | 0 | 0 | 91 |
| Volume Right | 0 | 145 | 0 |
| cSH | 1700 | 1700 | 637 |
| Volume to Capacity | 0.06 | 0.19 | 0.14 |
| Queue Length 95th (ft) | 0 | 0 | 12 |
| Control Delay (s) | 0.0 | 0.0 | 11.6 |
| Lane LOS | | | B |
| Approach Delay (s) | 0.0 | 0.0 | 11.6 |
| Approach LOS | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.0 | | |
| Intersection Capacity Utilization | 28.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 5 | 95 | 160 | 0 | 0 | 5 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 6 | 108 | 182 | 0 | 0 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 182 | | | | 301 | 182 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 182 | | | | 301 | 182 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 99 |
| cM capacity (veh/h) | 1393 | | | | 688 | 861 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 114 | 182 | 6 |
| Volume Left | 6 | 0 | 0 |
| Volume Right | 0 | 0 | 6 |
| cSH | 1393 | 1700 | 861 |
| Volume to Capacity | 0.00 | 0.11 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 |
| Control Delay (s) | 0.4 | 0.0 | 9.2 |
| Lane LOS | A | | A |
| Approach Delay (s) | 0.4 | 0.0 | 9.2 |
| Approach LOS | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 18.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 5 | 0 | 0 | 145 | 80 | 5 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 6 | 0 | 0 | 165 | 91 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 259 | 94 | 97 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 259 | 94 | 97 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 99 | 100 | 100 | | | |
| cM capacity (veh/h) | 730 | 963 | 1497 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 6 | 165 | 97 |
| Volume Left | 6 | 0 | 0 |
| Volume Right | 0 | 0 | 6 |
| cSH | 730 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.10 | 0.06 |
| Queue Length 95th (ft) | 1 | 0 | 0 |
| Control Delay (s) | 10.0 | 0.0 | 0.0 |
| Lane LOS | A | | |
| Approach Delay (s) | 10.0 | 0.0 | 0.0 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 17.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 195 | 85 | 45 | 245 | 0 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 222 | 97 | 51 | 278 | 0 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 148 | | | | 344 | 122 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 148 | | | | 344 | 122 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 57 | 100 |
| cM capacity (veh/h) | 1434 | | | | 653 | 929 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 222 | 148 | 278 |
| Volume Left | 0 | 0 | 278 |
| Volume Right | 0 | 51 | 0 |
| cSH | 1700 | 1700 | 653 |
| Volume to Capacity | 0.13 | 0.09 | 0.43 |
| Queue Length 95th (ft) | 0 | 0 | 53 |
| Control Delay (s) | 0.0 | 0.0 | 14.6 |
| Lane LOS | | | B |
| Approach Delay (s) | 0.0 | 0.0 | 14.6 |
| Approach LOS | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 6.3 | | |
| Intersection Capacity Utilization | 30.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 195 | 85 | 0 | 0 | 10 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 222 | 97 | 0 | 0 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 97 | | | | 318 | 97 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 97 | | | | 318 | 97 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 99 |
| cM capacity (veh/h) | 1497 | | | | 675 | 960 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 222 | 97 | 11 |
| Volume Left | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 11 |
| cSH | 1497 | 1700 | 960 |
| Volume to Capacity | 0.00 | 0.06 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 1 |
| Control Delay (s) | 0.0 | 0.0 | 8.8 |
| Lane LOS | | | A |
| Approach Delay (s) | 0.0 | 0.0 | 8.8 |
| Approach LOS | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 14.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 0 | 0 | 45 | 245 | 10 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 51 | 278 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 335 | 284 | 290 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 335 | 284 | 290 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 100 | 100 | | | |
| cM capacity (veh/h) | 660 | 755 | 1272 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 0 | 51 | 290 |
| Volume Left | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 11 |
| cSH | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.03 | 0.17 |
| Queue Length 95th (ft) | 0 | 0 | 0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | |
| Approach Delay (s) | 0.0 | 0.0 | 0.0 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.0 | | |
| Intersection Capacity Utilization | 16.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 120 | 230 | 190 | 110 | 0 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 136 | 261 | 216 | 125 | 0 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 477 | | | | 506 | 369 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 477 | | | | 506 | 369 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 76 | 100 |
| cM capacity (veh/h) | 1085 | | | | 526 | 676 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 136 | 477 | 125 |
| Volume Left | 0 | 0 | 125 |
| Volume Right | 0 | 216 | 0 |
| cSH | 1700 | 1700 | 526 |
| Volume to Capacity | 0.08 | 0.28 | 0.24 |
| Queue Length 95th (ft) | 0 | 0 | 23 |
| Control Delay (s) | 0.0 | 0.0 | 14.0 |
| Lane LOS | | | B |
| Approach Delay (s) | 0.0 | 0.0 | 14.0 |
| Approach LOS | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.4 | | |
| Intersection Capacity Utilization | 36.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 5 | 120 | 230 | 0 | 0 | 5 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 6 | 136 | 261 | 0 | 0 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 261 | | | | 409 | 261 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 261 | | | | 409 | 261 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 100 | 99 |
| cM capacity (veh/h) | 1303 | | | | 596 | 777 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 142 | 261 | 6 |
| Volume Left | 6 | 0 | 0 |
| Volume Right | 0 | 0 | 6 |
| cSH | 1303 | 1700 | 777 |
| Volume to Capacity | 0.00 | 0.15 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 1 |
| Control Delay (s) | 0.3 | 0.0 | 9.7 |
| Lane LOS | A | | A |
| Approach Delay (s) | 0.3 | 0.0 | 9.7 |
| Approach LOS | | | A |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 22.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 5 | 0 | 0 | 190 | 110 | 5 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 6 | 0 | 0 | 216 | 125 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 344 | 128 | 131 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 344 | 128 | 131 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 99 | 100 | 100 | | | |
| cM capacity (veh/h) | 653 | 922 | 1455 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 6 | 216 | 131 |
| Volume Left | 6 | 0 | 0 |
| Volume Right | 0 | 0 | 6 |
| cSH | 653 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.13 | 0.08 |
| Queue Length 95th (ft) | 1 | 0 | 0 |
| Control Delay (s) | 10.6 | 0.0 | 0.0 |
| Lane LOS | B | | |
| Approach Delay (s) | 10.6 | 0.0 | 0.0 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.2 | | |
| Intersection Capacity Utilization | 20.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

# APPENDIX G

# CAPACITY ANALYSIS – BUILD

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 145 | 60 | 35 | 185 | 10 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 165 | 68 | 40 | 210 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 108 | | | | 233 | 68 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 108 | | | | 233 | 68 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 72 | 99 |
| cM capacity (veh/h) | 1483 | | | | 755 | 995 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|
| Volume Total | 165 | 68 | 40 | 210 | 11 |
| Volume Left | 0 | 0 | 0 | 210 | 0 |
| Volume Right | 0 | 0 | 40 | 0 | 11 |
| cSH | 1483 | 1700 | 1700 | 755 | 995 |
| Volume to Capacity | 0.00 | 0.04 | 0.02 | 0.28 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 28 | 1 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 11.6 | 8.7 |
| Lane LOS | | | | B | A |
| Approach Delay (s) | 0.0 | 0.0 | | 11.4 | |
| Approach LOS | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.1 | | |
| Intersection Capacity Utilization | 24.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 5 | 95 | 160 | 145 | 80 | 5 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 6 | 108 | 182 | 165 | 91 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 347 | | | | 301 | 182 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 347 | | | | 301 | 182 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 87 | 99 |
| cM capacity (veh/h) | 1212 | | | | 687 | 861 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|
| Volume Total | 114 | 182 | 165 | 91 | 6 |
| Volume Left | 6 | 0 | 0 | 91 | 0 |
| Volume Right | 0 | 0 | 165 | 0 | 6 |
| cSH | 1212 | 1700 | 1700 | 687 | 861 |
| Volume to Capacity | 0.00 | 0.11 | 0.10 | 0.13 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 11 | 0 |
| Control Delay (s) | 0.4 | 0.0 | 0.0 | 11.0 | 9.2 |
| Lane LOS | A | | | B | A |
| Approach Delay (s) | 0.4 | 0.0 | | 10.9 | |
| Approach LOS | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.0 | | |
| Intersection Capacity Utilization | 20.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 0 | 195 | 85 | 45 | 245 | 10 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 0 | 222 | 97 | 51 | 278 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 148 | | | | 318 | 97 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 148 | | | | 318 | 97 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 59 | 99 |
| cM capacity (veh/h) | 1434 | | | | 675 | 960 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|
| Volume Total | 222 | 97 | 51 | 278 | 11 |
| Volume Left | 0 | 0 | 0 | 278 | 0 |
| Volume Right | 0 | 0 | 51 | 0 | 11 |
| cSH | 1434 | 1700 | 1700 | 675 | 960 |
| Volume to Capacity | 0.00 | 0.06 | 0.03 | 0.41 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 51 | 1 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 14.0 | 8.8 |
| Lane LOS | | | | B | A |
| Approach Delay (s) | 0.0 | 0.0 | | 13.8 | |
| Approach LOS | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 6.1 | | |
| Intersection Capacity Utilization | 30.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 5 | 120 | 230 | 190 | 110 | 5 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Hourly flow rate (vph) | 6 | 136 | 261 | 216 | 125 | 6 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 477 | | | | 409 | 261 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 477 | | | | 409 | 261 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 79 | 99 |
| cM capacity (veh/h) | 1085 | | | | 595 | 777 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|
| Volume Total | 142 | 261 | 216 | 125 | 6 |
| Volume Left | 6 | 0 | 0 | 125 | 0 |
| Volume Right | 0 | 0 | 216 | 0 | 6 |
| cSH | 1085 | 1700 | 1700 | 595 | 777 |
| Volume to Capacity | 0.01 | 0.15 | 0.13 | 0.21 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 20 | 1 |
| Control Delay (s) | 0.4 | 0.0 | 0.0 | 12.6 | 9.7 |
| Lane LOS | A | | | B | A |
| Approach Delay (s) | 0.4 | 0.0 | | 12.5 | |
| Approach LOS | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.3 | | |
| Intersection Capacity Utilization | 25.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

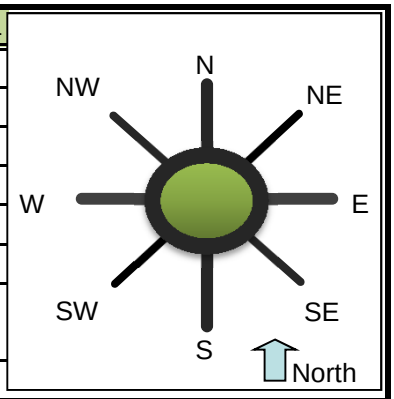
# APPENDIX H

# ROUNDABOUT ANALYSIS

## General & Site Information

v2.1

| | |
|---|---|
| Analyst: | SPEEDY |
| Agency/Co: | WILBURN ENGINEERING |
| Date: | 7/21/2014 |
| Project or PI#: | PI# 0009949 |
| Year, Peak Hour: | 2018, AM PEAK HOUR |
| County/District: | LUMPKIN |
| Intersection Name: | SR 9 @ SR 52 |




| Volumes | | Entry Legs (FROM) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N (1) | NE (2) | E (3) | SE (4) | S (5) | SW (6) | W (7) | NW (8) |
| | N (1), vph | | | 35 | | | | | |
| Exit | NE (2), vph | | | | | | | | |
| Legs | E (3), vph | 185 | | | | | | 145 | |
| (TO) | SE (4), vph | | | | | | | | |
| | S (5), vph | | | | | | | | |
| | SW (6), vph | | | | | | | | |
| | W (7), vph | 10 | | 60 | | | | | |
| | NW (8), vph | | | | | | | | |
| Output | Total Vehicles | 195 | 0 | 95 | 0 | 0 | 0 | 145 | 0 |

| Volume Characteristics | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|
| % Cars | 100% | 100% | 96% | 100% | 100% | 100% | 96% | 100% |
| % Heavy Vehicles | 0% | 0% | 4% | 0% | | 0% | 4% | 0% |
| % Bicycle | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| # of Pedestrians **(ped/hr)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *PHF* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* |
| $F_{HV}$ | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 |
| $F_{ped}$ | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 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 | 41 | 0 | 0 | 0 | 0 | 0 |
| NE (2), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E (3), pcu/h | 210 | 0 | 0 | 0 | 0 | 0 | 171 | 0 |
| SE (4), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S (5), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW (6), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W (7), pcu/h | 11 | 0 | 71 | 0 | 0 | 0 | 0 | 0 |
| NW (8), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Entry flow, pcu/h | 222 | 0 | 112 | 0 | 0 | 0 | 171 | 0 |
| Conflicting flow, pcu/h | 71 | 0 | 0 | 0 | 0 | 0 | 210 | 0 |

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

## Results: Approach Measures of Effectiveness

| HCM 2010 Model (build) | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|
| Entry Capacity, vph | 1053 | NA | 1092 | NA | NA | NA | 885 | NA |
| Entry Flow Rates, vph | 222 | NA | 108 | NA | NA | NA | 165 | NA |
| **V/C ratio** | **0.21** | | **0.10** | | | | **0.19** | |
| **Control Delay, s/veh** | **5** | | **4** | | | | **6** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **20** | | **8** | | | | **18** | |
| **Calibrated Model (future)** | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** |
| Entry Capacity, vph | 1260 | NA | 1288 | NA | NA | NA | 1089 | NA |
| Entry Flow Rates, vph | 222 | NA | 108 | NA | NA | NA | 165 | NA |
| **V/C ratio** | **0.18** | | **0.09** | | | | **0.16** | |
| **Control Delay, sec/pcu** | **4** | | **3** | | | | **5** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **16** | | **7** | | | | **14** | |

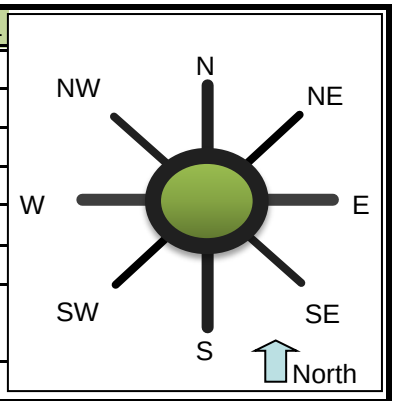
**Notes:** v2.1

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) | | | | | | |
| **Does the bypass have a dedicated receiving lane?** | | | | | | |
| *Volumes* | | | | | | |
| Right Turn Volume removed from Entry Leg | | | | | | |
| *Volume Characteristics (for entry leg)* | | | | | | |
| PHF | | | | | | |
| $F_{HV}$ | | | | | | |
| $F_{ped}$ | | | | | | |
| ***NOTE: Volume Characteristics for Exit Leg are already taken into account*** | | | | | | |
| *Entry/Conflicting Flows* | | | | | | |
| Entry Flow, pcu/hr | | | | | | |
| Conflicting Flow, pcu/hr | | | | | | |
| **Bypass Lane Results (HCM 2010 Model)** | | | | | | |
| Entry Capacity of Bypass, vph | | | | | | |
| Flow Rates of Exiting Traffic, vph | | | | | | |
| **V/C ratio** | | | | | | |
| **Control Delay, s/veh** | | | | | | |
| LOS | | | | | | |
| **95th % Queue (ft)** | | | | | | |
| *Approach w/Bypass Delay, s/veh* | | | | | | |
| *Approach w/Bypass LOS* | | | | | | |

| General & Site Information | | v2.1 |
|---|---|---|
| Analyst: | SPEEDY | |
| Agency/Co: | WILBURN ENGINEERING | |
| Date: | 7/21/2014 | |
| Project or PI#: | PI# 0009949 | |
| Year, Peak Hour: | 2018, PM PEAK HOUR | |
| County/District: | LUMPKIN | |
| Intersection Name: | SR 9 @ SR 52 | |




| Volumes | | Entry Legs (FROM) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N (1) | NE (2) | E (3) | SE (4) | S (5) | SW (6) | W (7) | NW (8) |
| | N (1), vph | | | 145 | | | | 5 | |
| Exit | NE (2), vph | | | | | | | | |
| Legs | E (3), vph | 80 | | | | | | 95 | |
| (TO) | SE (4), vph | | | | | | | | |
| | S (5), vph | | | | | | | | |
| | SW (6), vph | | | | | | | | |
| | W (7), vph | 5 | | 160 | | | | | |
| | NW (8), vph | | | | | | | | |
| Output | Total Vehicles | 85 | 0 | 305 | 0 | 0 | 0 | 100 | 0 |

| Volume Characteristics | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|
| % Cars | 100% | 100% | 96% | 100% | 100% | 100% | 96% | 100% |
| % Heavy Vehicles | 0% | 0% | 4% | 0% | | 0% | 4% | 0% |
| % Bicycle | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| # of Pedestrians **(ped/hr)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *PHF* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* |
| $F_{HV}$ | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 |
| $F_{ped}$ | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 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 | 171 | 0 | 0 | 0 | 6 | 0 |
| NE (2), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E (3), pcu/h | 91 | 0 | 0 | 0 | 0 | 0 | 112 | 0 |
| SE (4), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S (5), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW (6), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W (7), pcu/h | 6 | 0 | 188 | 0 | 0 | 0 | 0 | 0 |
| NW (8), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Entry flow, pcu/h | 97 | 0 | 359 | 0 | 0 | 0 | 118 | 0 |
| Conflicting flow, pcu/h | 188 | 0 | 6 | 0 | 0 | 0 | 91 | 0 |

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

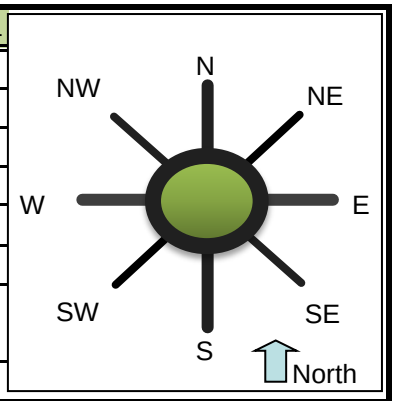
| Results: Approach Measures of Effectiveness | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **HCM 2010 Model (build)** | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** |
| Entry Capacity, vph | 936 | NA | 1085 | NA | NA | NA | 997 | NA |
| Entry Flow Rates, vph | 97 | NA | 347 | NA | NA | NA | 114 | NA |
| **V/C ratio** | **0.10** | | **0.32** | | | | **0.11** | |
| **Control Delay, s/veh** | **5** | | **6** | | | | **5** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **9** | | **36** | | | | **10** | |
| **Calibrated Model (future)** | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** |
| Entry Capacity, vph | 1147 | NA | 1282 | NA | NA | NA | 1198 | NA |
| Entry Flow Rates, vph | 97 | NA | 347 | NA | NA | NA | 114 | NA |
| **V/C ratio** | **0.08** | | **0.28** | | | | **0.10** | |
| **Control Delay, sec/pcu** | **4** | | **5** | | | | **4** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **7** | | **30** | | | | **8** | |

**Notes:** v2.1

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) | | | | | | |
| **Does the bypass have a dedicated receiving lane?** | | | | | | |
| *Volumes* | | | | | | |
| Right Turn Volume removed from Entry Leg | | | | | | |
| *Volume Characteristics (for entry leg)* | | | | | | |
| PHF | | | | | | |
| $F_{HV}$ | | | | | | |
| $F_{ped}$ | | | | | | |
| ***NOTE: Volume Characteristics for Exit Leg are already taken into account*** | | | | | | |
| *Entry/Conflicting Flows* | | | | | | |
| Entry Flow, pcu/hr | | | | | | |
| Conflicting Flow, pcu/hr | | | | | | |
| **Bypass Lane Results (HCM 2010 Model)** | | | | | | |
| Entry Capacity of Bypass, vph | | | | | | |
| Flow Rates of Exiting Traffic, vph | | | | | | |
| **V/C ratio** | | | | | | |
| **Control Delay, s/veh** | | | | | | |
| LOS | | | | | | |
| **95th % Queue (ft)** | | | | | | |
| *Approach w/Bypass Delay, s/veh* | | | | | | |
| *Approach w/Bypass LOS* | | | | | | |

| General & Site Information | | v2.1 |
|---|---|---|
| Analyst: | SPEEDY | |
| Agency/Co: | WILBURN ENGINEERING | |
| Date: | 7/21/2014 | |
| Project or PI#: | PI# 0009949 | |
| Year, Peak Hour: | 2038, AM PEAK HOUR | |
| County/District: | LUMPKIN | |
| Intersection Name: | SR 9 @ SR 52 | |




| Volumes | | Entry Legs (FROM) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N (1) | NE (2) | E (3) | SE (4) | S (5) | SW (6) | W (7) | NW (8) |
| | N (1), vph | | | 45 | | | | | |
| Exit | NE (2), vph | | | | | | | | |
| Legs | E (3), vph | 245 | | | | | | 195 | |
| (TO) | SE (4), vph | | | | | | | | |
| | S (5), vph | | | | | | | | |
| | SW (6), vph | | | | | | | | |
| | W (7), vph | 10 | | 85 | | | | | |
| | NW (8), vph | | | | | | | | |
| Output | Total Vehicles | 255 | 0 | 130 | 0 | 0 | 0 | 195 | 0 |

| Volume Characteristics | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|
| % Cars | 100% | 100% | 96% | 100% | 100% | 100% | 96% | 100% |
| % Heavy Vehicles | 0% | 0% | 4% | 0% | | 0% | 4% | 0% |
| % Bicycle | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| # of Pedestrians **(ped/hr)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *PHF* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* |
| $F_{HV}$ | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 |
| $F_{ped}$ | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 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 | 53 | 0 | 0 | 0 | 0 | 0 |
| NE (2), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E (3), pcu/h | 278 | 0 | 0 | 0 | 0 | 0 | 229 | 0 |
| SE (4), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S (5), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW (6), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W (7), pcu/h | 11 | 0 | 100 | 0 | 0 | 0 | 0 | 0 |
| NW (8), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Entry flow, pcu/h | 290 | 0 | 153 | 0 | 0 | 0 | 229 | 0 |
| Conflicting flow, pcu/h | 100 | 0 | 0 | 0 | 0 | 0 | 278 | 0 |

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

| Results: Approach Measures of Effectiveness | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **HCM 2010 Model (build)** | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** |
| Entry Capacity, vph | 1022 | NA | 1092 | NA | NA | NA | 826 | NA |
| Entry Flow Rates, vph | 290 | NA | 148 | NA | NA | NA | 222 | NA |
| **V/C ratio** | **0.28** | | **0.14** | | | | **0.27** | |
| **Control Delay, s/veh** | **6** | | **4** | | | | **7** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **29** | | **12** | | | | **28** | |
| **Calibrated Model (future)** | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** |
| Entry Capacity, vph | 1231 | NA | 1288 | NA | NA | NA | 1031 | NA |
| Entry Flow Rates, vph | 290 | NA | 148 | NA | NA | NA | 222 | NA |
| **V/C ratio** | **0.24** | | **0.12** | | | | **0.22** | |
| **Control Delay, sec/pcu** | **5** | | **4** | | | | **6** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **23** | | **10** | | | | **22** | |

**Notes:** v2.1

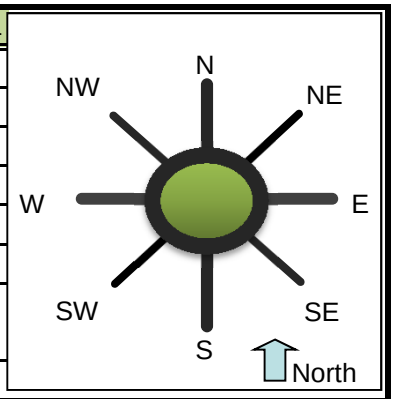
Unit Legend:
vph = vehicles per hour
PHF = peak hour factor
$F_{HV}$ = heavy vehicle factor
pcu = passenger car unit

| 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) | | | | | | |
| **Does the bypass have a dedicated receiving lane?** | | | | | | |
| *Volumes* | | | | | | |
| Right Turn Volume removed from Entry Leg | | | | | | |
| *Volume Characteristics (for entry leg)* | | | | | | |
| PHF | | | | | | |
| $F_{HV}$ | | | | | | |
| $F_{ped}$ | | | | | | |
| ***NOTE: Volume Characteristics for Exit Leg are already taken into account*** | | | | | | |
| *Entry/Conflicting Flows* | | | | | | |
| Entry Flow, pcu/hr | | | | | | |
| Conflicting Flow, pcu/hr | | | | | | |
| **Bypass Lane Results (HCM 2010 Model)** | | | | | | |
| Entry Capacity of Bypass, vph | | | | | | |
| Flow Rates of Exiting Traffic, vph | | | | | | |
| **V/C ratio** | | | | | | |
| **Control Delay, s/veh** | | | | | | |
| LOS | | | | | | |
| **95th % Queue (ft)** | | | | | | |
| *Approach w/Bypass Delay, s/veh* | | | | | | |
| *Approach w/Bypass LOS* | | | | | | |

## General & Site Information

v2.1

| | |
|---|---|
| Analyst: | SPEEDY |
| Agency/Co: | WILBURN ENGINEERING |
| Date: | 7/21/2014 |
| Project or PI#: | PI# 0009949 |
| Year, Peak Hour: | 2038, PM PEAK HOUR |
| County/District: | LUMPKIN |
| Intersection Name: | SR 9 @ SR 52 |




| Volumes | | Entry Legs (FROM) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N (1) | NE (2) | E (3) | SE (4) | S (5) | SW (6) | W (7) | NW (8) |
| | N (1), vph | | | 190 | | | | 5 | |
| Exit | NE (2), vph | | | | | | | | |
| Legs | E (3), vph | 110 | | | | | | 120 | |
| (TO) | SE (4), vph | | | | | | | | |
| | S (5), vph | | | | | | | | |
| | SW (6), vph | | | | | | | | |
| | W (7), vph | 5 | | 230 | | | | | |
| | NW (8), vph | | | | | | | | |
| Output | Total Vehicles | 115 | 0 | 420 | 0 | 0 | 0 | 125 | 0 |

| Volume Characteristics | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|
| % Cars | 100% | 100% | 96% | 100% | 100% | 100% | 96% | 100% |
| % Heavy Vehicles | 0% | 0% | 4% | 0% | | 0% | 4% | 0% |
| % Bicycle | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| # of Pedestrians **(ped/hr)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *PHF* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* | *0.88* |
| $F_{HV}$ | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 |
| $F_{ped}$ | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 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 | 223 | 0 | 0 | 0 | 6 | 0 |
| NE (2), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E (3), pcu/h | 125 | 0 | 0 | 0 | 0 | 0 | 141 | 0 |
| SE (4), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S (5), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW (6), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W (7), pcu/h | 6 | 0 | 271 | 0 | 0 | 0 | 0 | 0 |
| NW (8), pcu/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Entry flow, pcu/h | 131 | 0 | 494 | 0 | 0 | 0 | 147 | 0 |
| Conflicting flow, pcu/h | 271 | 0 | 6 | 0 | 0 | 0 | 125 | 0 |

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

## Results: Approach Measures of Effectiveness

| HCM 2010 Model (build) | N | NE | E | SE | S | SW | W | NW |
|---|---|---|---|---|---|---|---|---|
| Entry Capacity, vph | 862 | NA | 1085 | NA | NA | NA | 963 | NA |
| Entry Flow Rates, vph | 131 | NA | 477 | NA | NA | NA | 142 | NA |
| **V/C ratio** | **0.15** | | **0.44** | | | | **0.15** | |
| **Control Delay, s/veh** | **6** | | **8** | | | | **5** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **13** | | **59** | | | | **13** | |
| **Calibrated Model (future)** | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** |
| Entry Capacity, vph | 1074 | NA | 1282 | NA | NA | NA | 1165 | NA |
| Entry Flow Rates, vph | 131 | NA | 477 | NA | NA | NA | 142 | NA |
| **V/C ratio** | **0.12** | | **0.39** | | | | **0.13** | |
| **Control Delay, sec/pcu** | **4** | | **6** | | | | **4** | |
| LOS | A | | A | | | | A | |
| **95th % Queue (ft)** | **10** | | **48** | | | | **11** | |

**Notes:** v2.1

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) | | | | | | |
| **Does the bypass have a dedicated receiving lane?** | | | | | | |
| *Volumes* | | | | | | |
| Right Turn Volume removed from Entry Leg | | | | | | |
| *Volume Characteristics (for entry leg)* | | | | | | |
| PHF | | | | | | |
| $F_{HV}$ | | | | | | |
| $F_{ped}$ | | | | | | |
| ***NOTE: Volume Characteristics for Exit Leg are already taken into account*** | | | | | | |
| *Entry/Conflicting Flows* | | | | | | |
| Entry Flow, pcu/hr | | | | | | |
| Conflicting Flow, pcu/hr | | | | | | |
| **Bypass Lane Results (HCM 2010 Model)** | | | | | | |
| Entry Capacity of Bypass, vph | | | | | | |
| Flow Rates of Exiting Traffic, vph | | | | | | |
| **V/C ratio** | | | | | | |
| **Control Delay, s/veh** | | | | | | |
| LOS | | | | | | |
| **95th % Queue (ft)** | | | | | | |
| *Approach w/Bypass Delay, s/veh* | | | | | | |
| *Approach w/Bypass LOS* | | | | | | |

# Appendix B

# Initial Concept Meeting Notes – 9/17/2014

**MEETING MINUTES**

PROJECT: PI# 0009949 S.R. 52 at S.R. 9, Lumpkin County
TIME & LOCATION: GDOT District Office #1, 10:00 AM
CPL PROJECT NO.: 13197.00

DATE: September 17, 2014

ATTENDEES:
Dylan Curtis – GDOT
Aaron Burgess – GDOT
Vickie Simmons – GDOT
Doug Fadool – GDOT
Kim Coley – GDOT
William Hunter – GDOT
Davis Olson – GDOT
Justin Lott – GDOT
Brent Cook – GDOT
Bobby Dollar – GDOT
Joe Garland – Clark Patterson Lee
Adolfo Guzman - Clark Patterson Lee
Mark Hanson - Clark Patterson Lee
Ben Morden - Clark Patterson Lee
Speedy Boutwell – Wilburn Engineering
Josh Earhart – Edwards-Pitman Environmental
Charles Trammell – Lumpkin County
Larry Reiter – Lumpkin County
Ted Almond – Amicalola EMC
Ray Roberts – Amicalola EMC

**INTRODUCTIONS:**

- Project Manager commenced meeting by having each attendee introduce themselves
- Consultant introduced themselves and proceeded to begin the review of alternates designs considered to date.

**DISCUSSION:**

A field review of the project on location with the GDOT Project Manager, Consultants and District One Traffic Operations personnel was held on July 15, 2014.

**Evaluate the Project Justification**

The intersection of SR 9 @ SR 52 is planned to be improved and is identified in the State Transportation Improvement Plan (STIP). The project (PI 0009949) is scheduled to be LET for construction in 2018 and anticipated to be open by the end of 2018.

**Project Location**

The project is located approximately 3.5 miles west of Dahlonega, in Lumpkin County.

**Safety concerns.**
The current geometrics of the existing Y configuration is operating as three separate intersections.

**Review alternates considered to date**

ROUNDABOUT

*Concept A*

*Concept B*

*Concept C*

*Concept D* (T- INTERSECTION)

**Preliminary design traffic ("Build Alternative" and "No-Build Alternatives").**

**Accident data for the previous three years.**

- 10 accidents total, 2 Injury, 0 fatalities, 6 collisions with animal/structure.

**Location of potential roundabouts or traffic signals.**

- Left offset approaches are desirable for traffic calming effect leading into the roundabout.

**Traffic Engineering Study**

- Capacity analysis was studied for year 2038 projections for No Build, T-Intersection with traffic signal, and roundabout alternatives.
- No Build – LOS C (2038)
- T-Intersection, unsignalized – LOS B (2038)
- Roundabout – LOS A (2038)

**Staging and traffic control**.
-Work zone safety and mobility requirements.
-Traffic calming techniques to be implemented.

- T-intersection will require detour for the staging.
- Roundabout must include vertical elements within center isle to increase visibility.

**Maintenance problems, including drainage and pavement problems.**

-Roundabout will require lighting

**Proposed design criteria including speed design.**

-SR 9 is classified as a Rural Minor Arterial and SR 52 is classified as a Rural Minor Collector.

-SR 9 is posted 45 MPH

-SR 52 is posted 55 MPH

-Bicycle signs are posted along SR 9

**Proposed type of access control**.

-Approved by permit.

**District information on public contacts and concerns to date**.

-Lumpkin County proposed fire station site

**Evaluate the extent of public outreach efforts and coordination needed**.

- Community outreach will be needed for roundabout.

-Coordination with FHWA, FTA, GRTA, and other non-environmental Federal, state and local agencies and/or governments.

**Proximity to (< 200' of existing crossing) and impacts to railroads and railroad right-of-ways**. N/A

**Proximity to and impacts to airports**. N/A

**Existing structures and their condition**.

-15"PVC SR 52

-18"CMP SR 9 West of the intersection

-15" RCP SR 9 Ease leg of the intersection

**Environmental concerns:**

-History

- Nothing eligible as of now.

-Potential for Archaeology

- Study yet to be started. Need better determinate of construction limits.

-Neighborhoods

-Special interest groups

- Church on S.R. 52 is outside of current construction limits.

-Context Sensitive Design

-Cemeteries

- Cemetery on S.R. 52 is outside of current construction limits.

-Parks and recreation

- No parks or recreation areas within project limits.

-Need for a Practical Alternatives Report (PAR)

- No need for a PAR report. ?(Parks and Recreation Report)?

-Wetlands and streams, open waters, buffers, floodplains

- Assessment in progress and ecologist will determine "streams".

-Endangered species

-Erosion and Sedimentation Control

-Air Quality

- Air Quality assessment in progress. Not expected to be a problem.

-Potential for noise impacts

- Impacts will be dependent upon which alternate is ultimately selected.

**Possible permits required:**

-U. S. Army Corps of Engineers Section 404 Permit

-Tennessee Valley Authority (TVA)

-U. S. Coast Guard (USCG)

-Stream Buffer Variance

- Buffer variance will likely be required based on which alternate is selected.

Opportunities to accommodate other modes of transportation.

Coordination with other GDOT and local projects.

**Existing right-of-way.**

- Impacts of Right-of-Way will be determined once closer to selected alternate.

General location, size of utilities, and the need to employ an Overhead/Subsurface Utility Engineering (SUE) investigation (Quality Level D-records research only) to be used for further concept development.

**Determine if the Public Interest Determination Policy and Procedure should be used for the Project**.

Concurrence to proposed project schedule.

The outcome of the Initial Concept Meeting should be a better understanding of the project scope, identification of information that is available and what is needed, and the next steps to be accomplished in the concept development. The participants should agree on assignments and schedules for detailed concept development.

The Project Manager will update the project management system and provide meeting notes to the participants within 15 working days of the Initial Concept Meeting.

**ADDITIONAL DISCUSSION:**

-Utilities

- Noted that pole existed in middle of triangle at center of intersection. Pole belongs to Amicalola EMC.
- Involved utilities will require a PDF or DGN of existing to insert existing utilities.
- Concept 'B' was preferred due to the minimal impacts of Right of Way.
- Windstream has underground utilities within area.
- All electric utilities are overhead.
- Will be evaluated whether lighting for intersection will be attached to existing poles or will require separate structures.

-Lumpkin County

- Main concern relates to the proposed Fire Station.
- Lumpkin County on board and has agreed to lighting of intersection.
- County has no issue with roundabout placement next to proposed fire station.
- Spring of 2017 is possible for the begin construction date of the fire station.

-Additional Items

- The limits of construction are not expected to encroach on the curve west of the intersection on S.R. 9.
- T-intersection is preferred if cost is 10% or less of roundabout.
- Target dates of December 2nd or 4th for PIOH.
    - Worksheet is needed as soon as possible and will be done by GDOT.
    - Location will be needed soon for PIOH.

- Concept 'B' seems to be preferred alternate.
    - Concept 'B' incorporated the most existing Right of Way
- Noted that T-intersection will promote high speeds in front of the proposed fire station.
- Not certain yet whether fire station will be open before construction of the intersection project begins.

**ACTION ITEMS:**

1. Involved utilities will need PDFs or DGNs of existing base map to place in existing utility locations.
2. Target dates of December 2nd or 4th for PIOH.
    - PIOH Worksheet is needed as soon as possible.
    - Location will be needed for PIOH.
3. Identify detour construction limits for environmental field survey.

The foregoing constitutes our understanding of matters discussed and conclusions reached. If there are any errors or omissions in the basic discussion, please notify the Author in writing within seven days.

Cc: All Attendees
File

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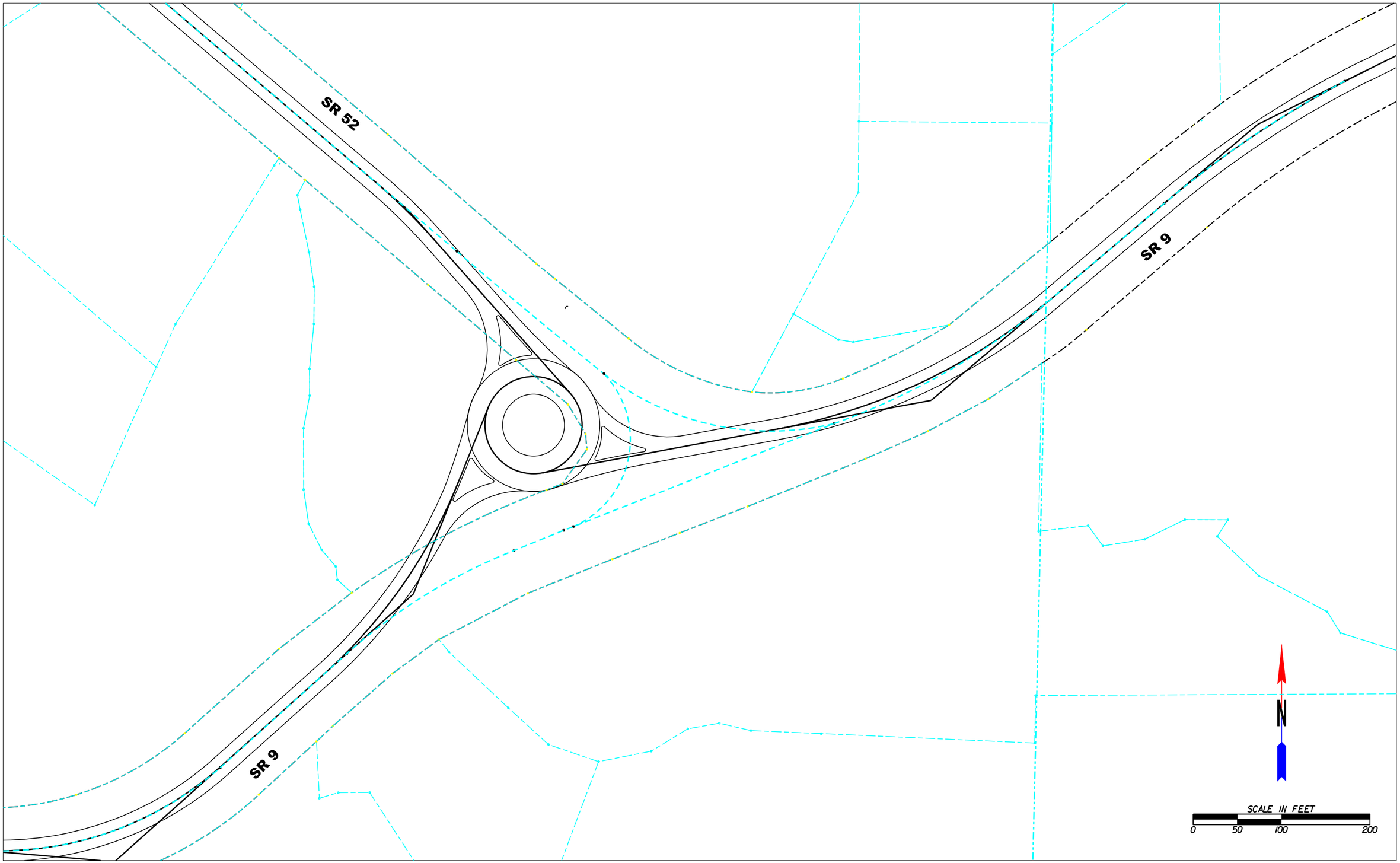
# Appendix C

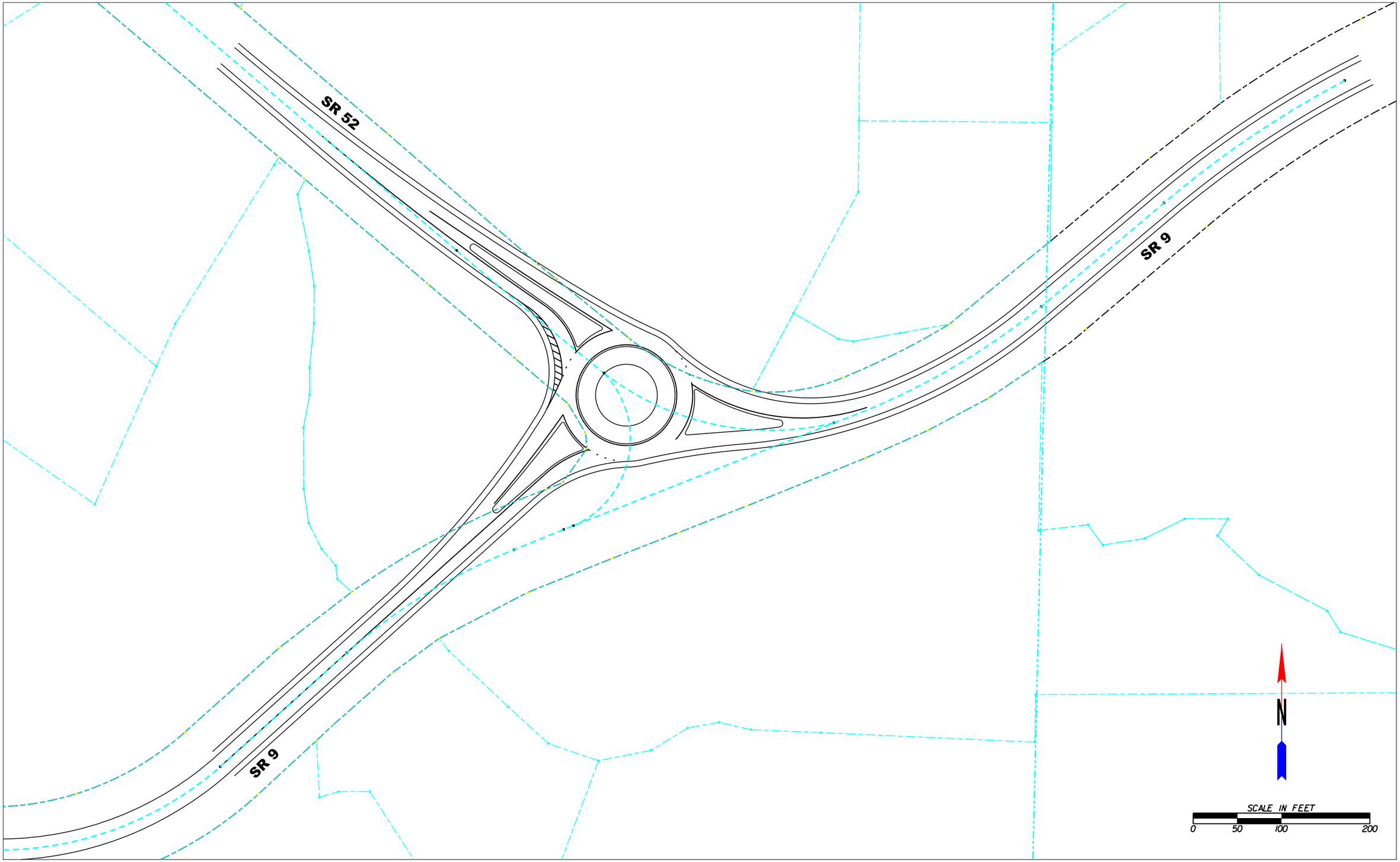
# Clark Patterson Lee Conceptual Designs




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**November 10, 2014**

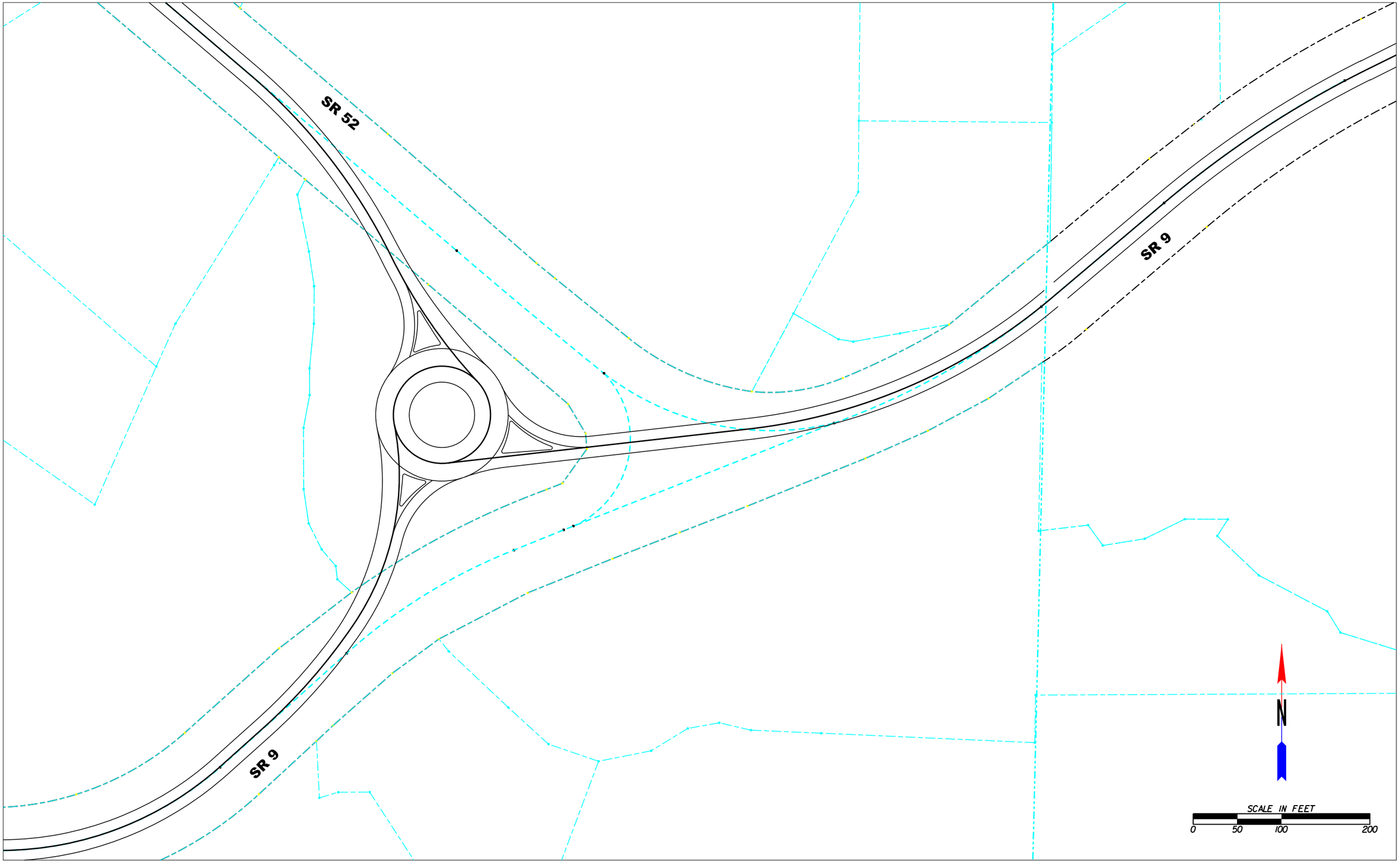
**CONCEPT A**




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**CONCEPT B**

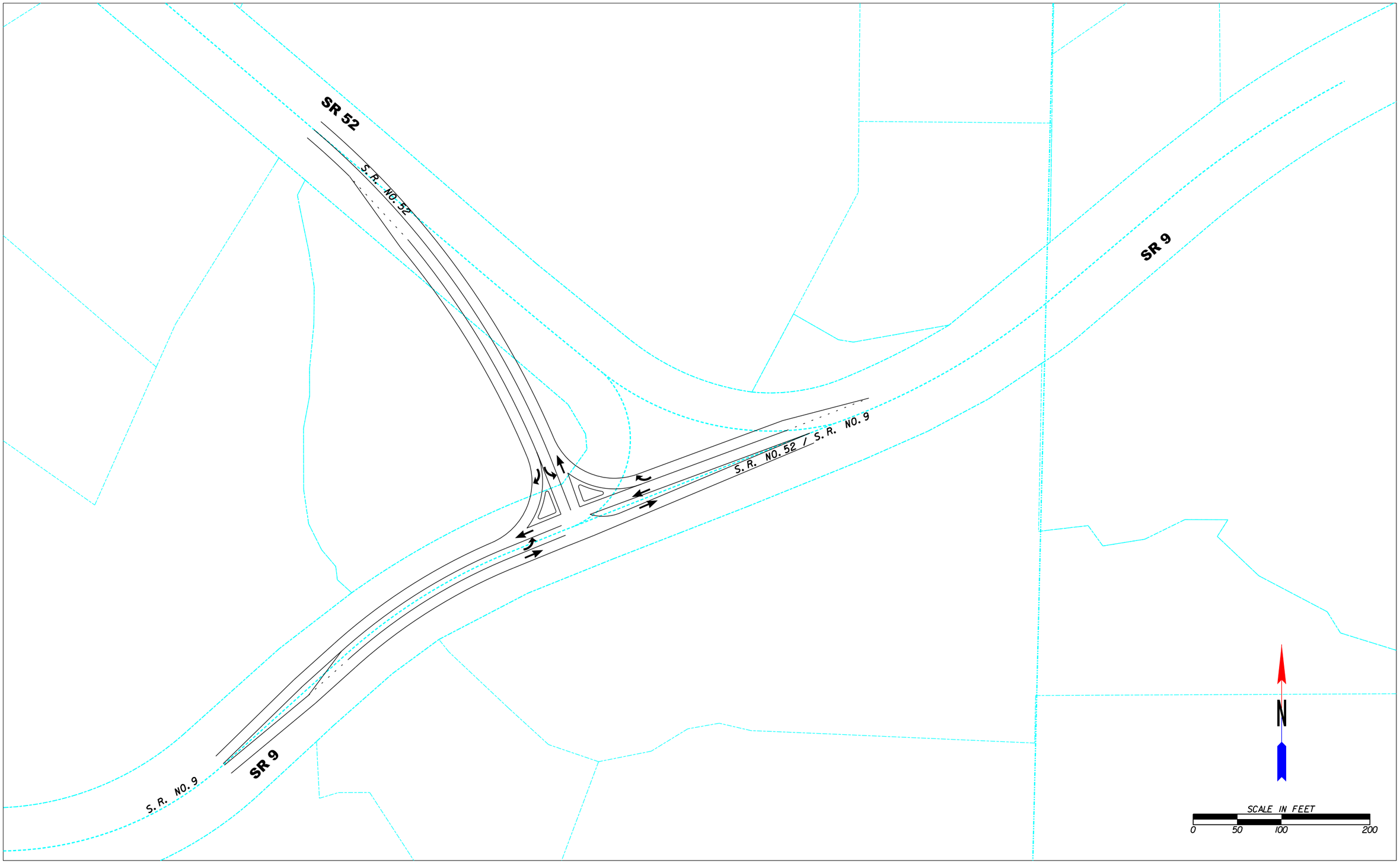
**November 10, 2014**




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**November 10, 2014**

**CONCEPT C**



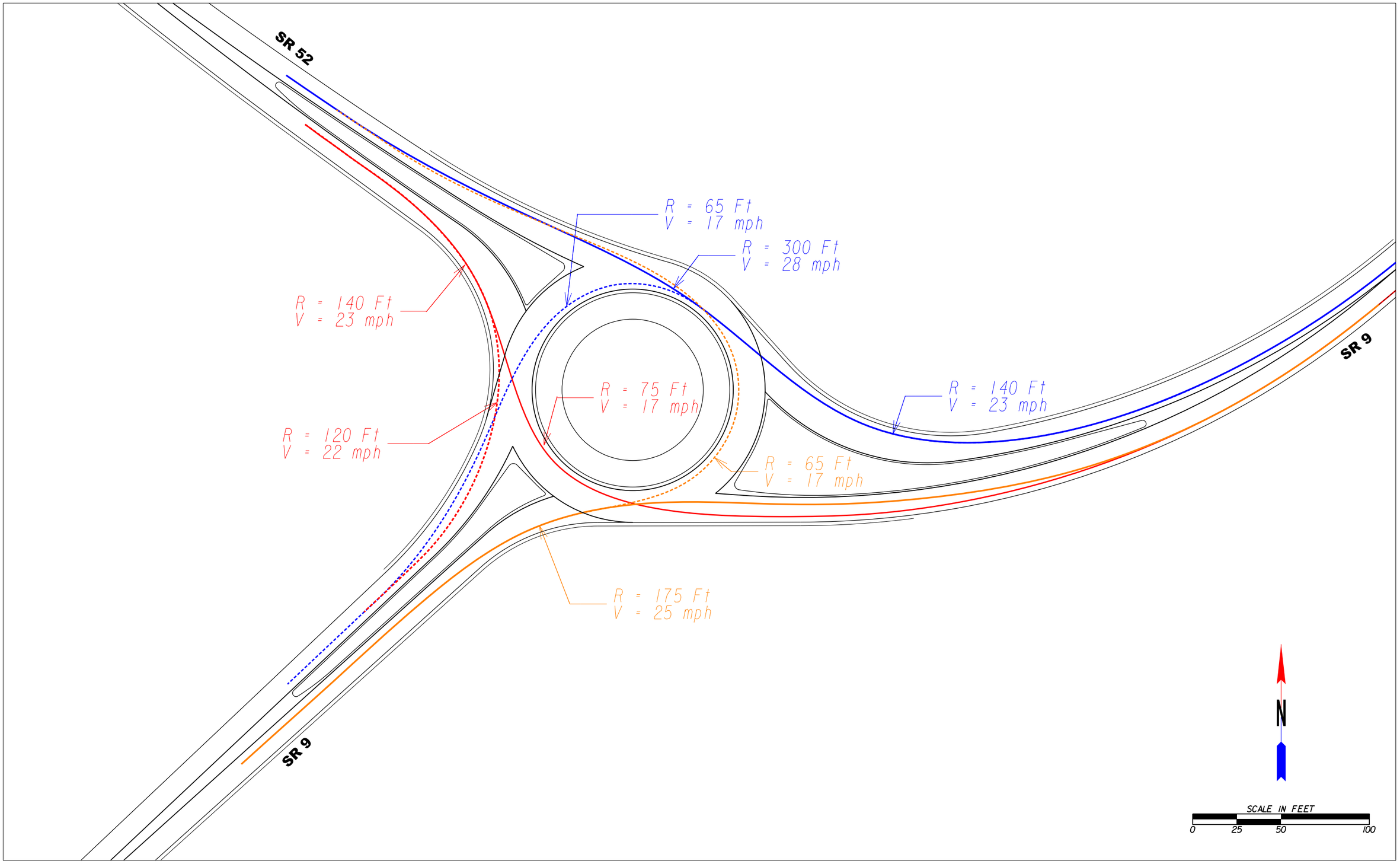

**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**November 10, 2014**

**CONCEPT D**

# Appendix D

# Fastest Paths Figure



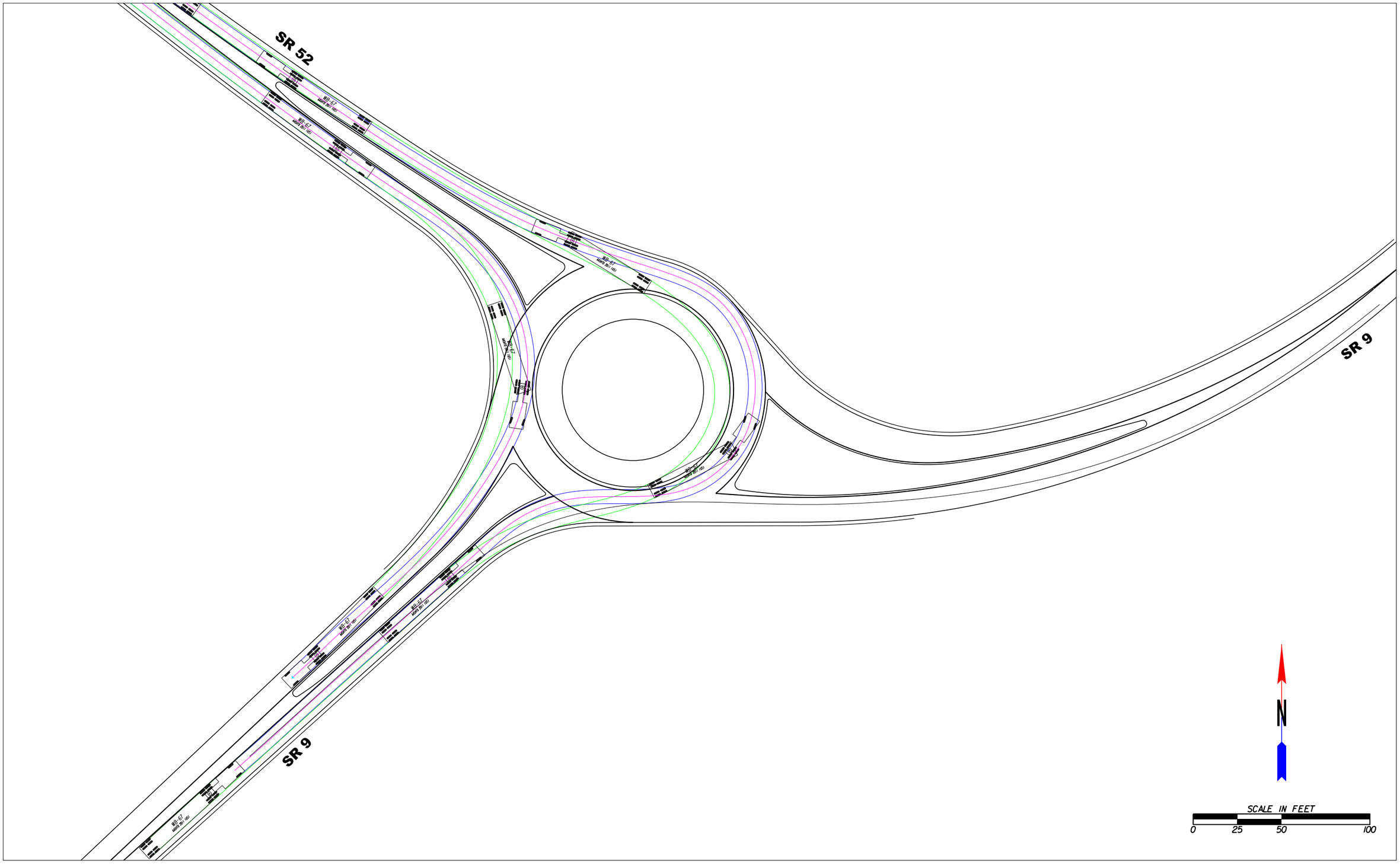

**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**FASTEST PATH SPEED CHECKS**

**November 5, 2014**

# Appendix E

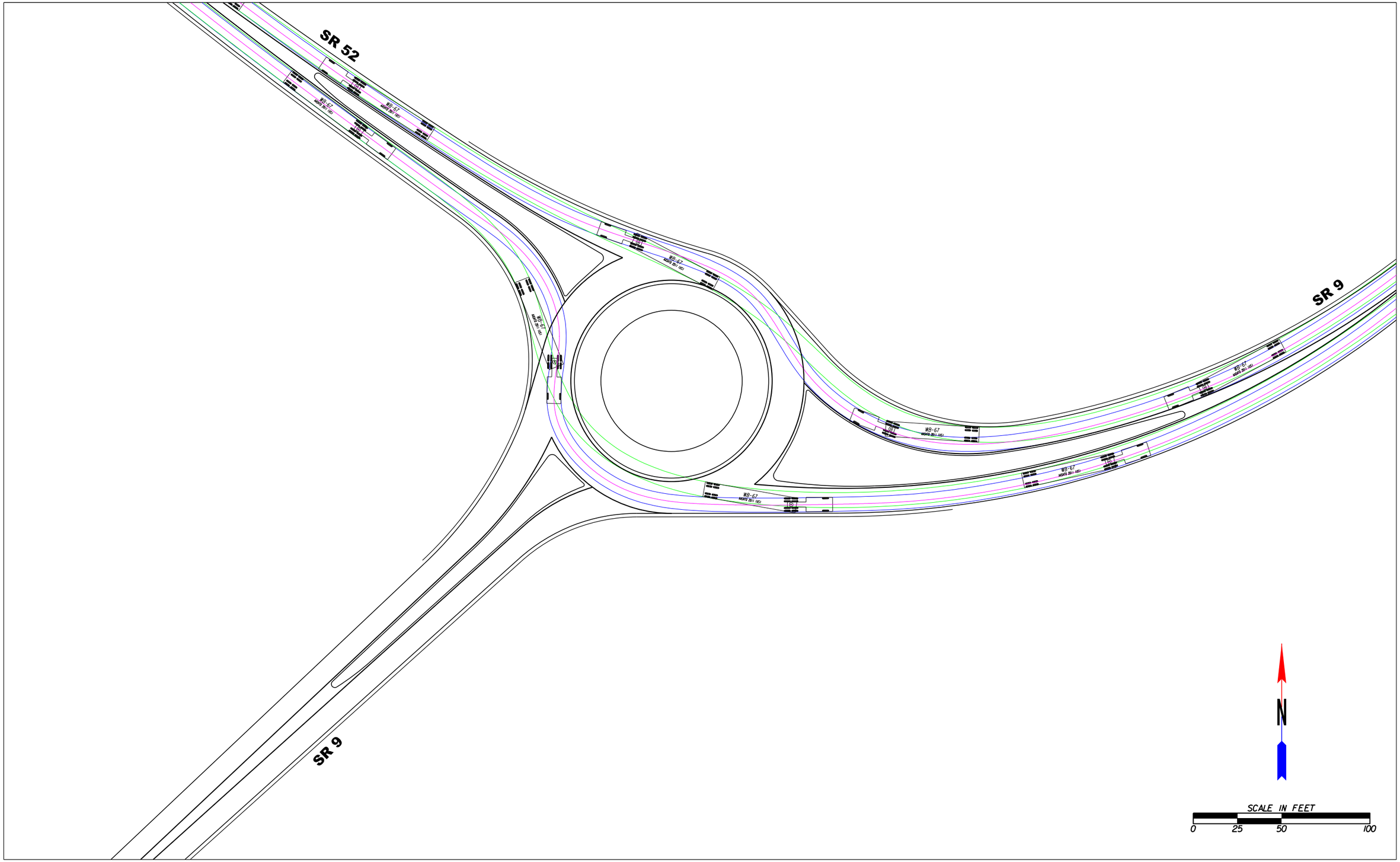
# WB-67 Truck Check Figures




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**WB-67 TRUCK CHECKS**

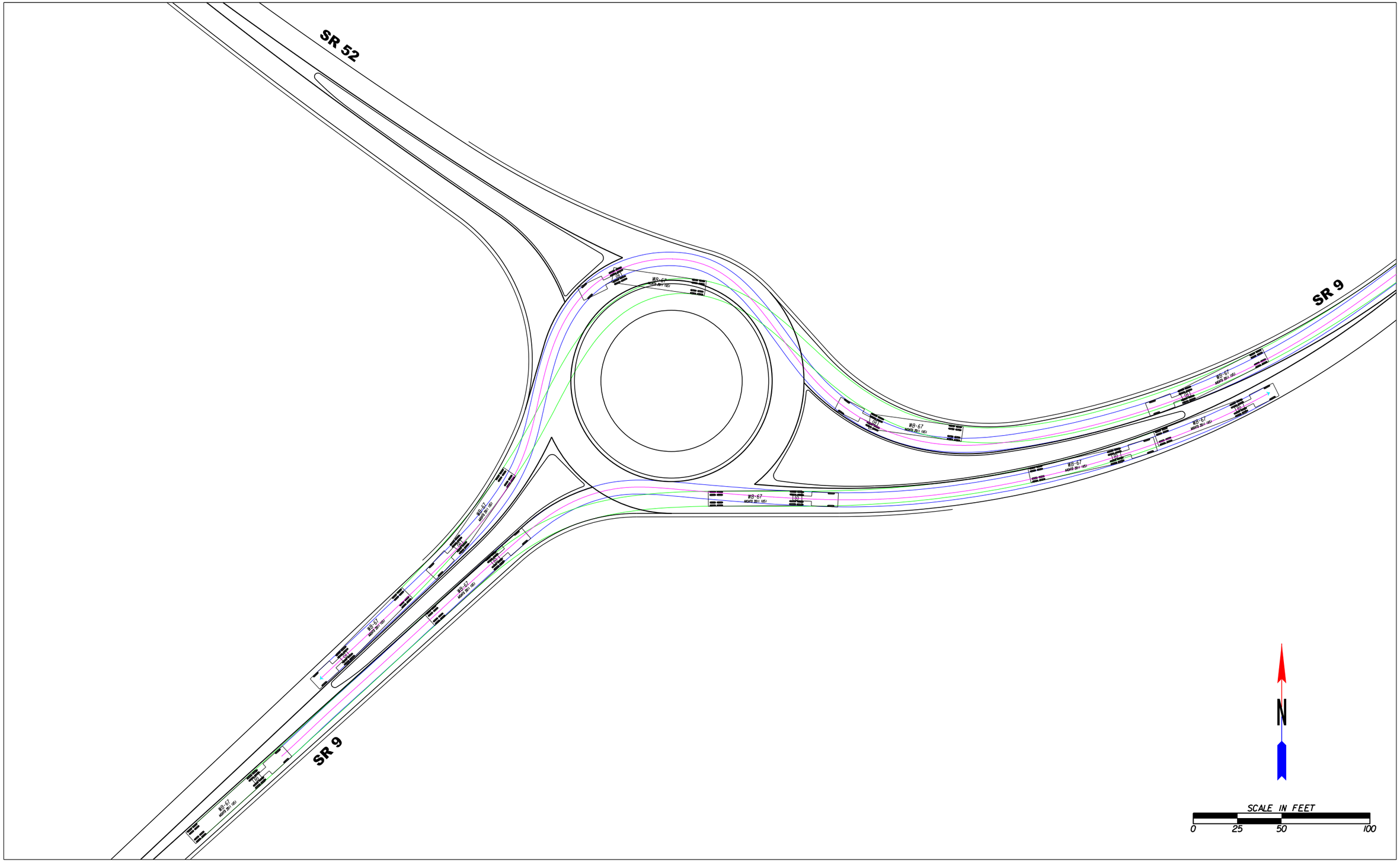
**November 5, 2014**




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**WB-67 TRUCK CHECKS**

**November 5, 2014**



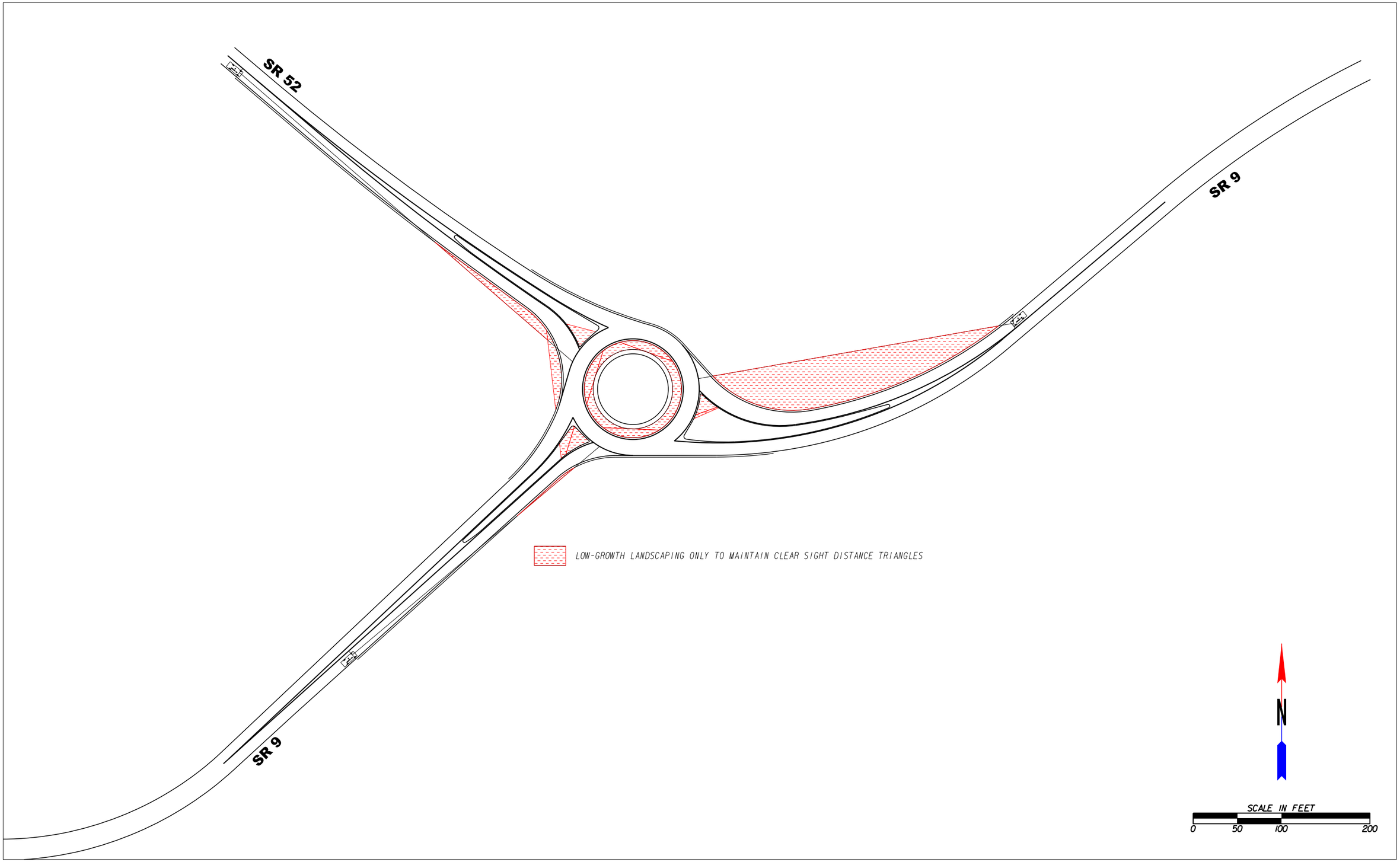

**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**WB-67 TRUCK CHECKS**

**November 5, 2014**

# Appendix F

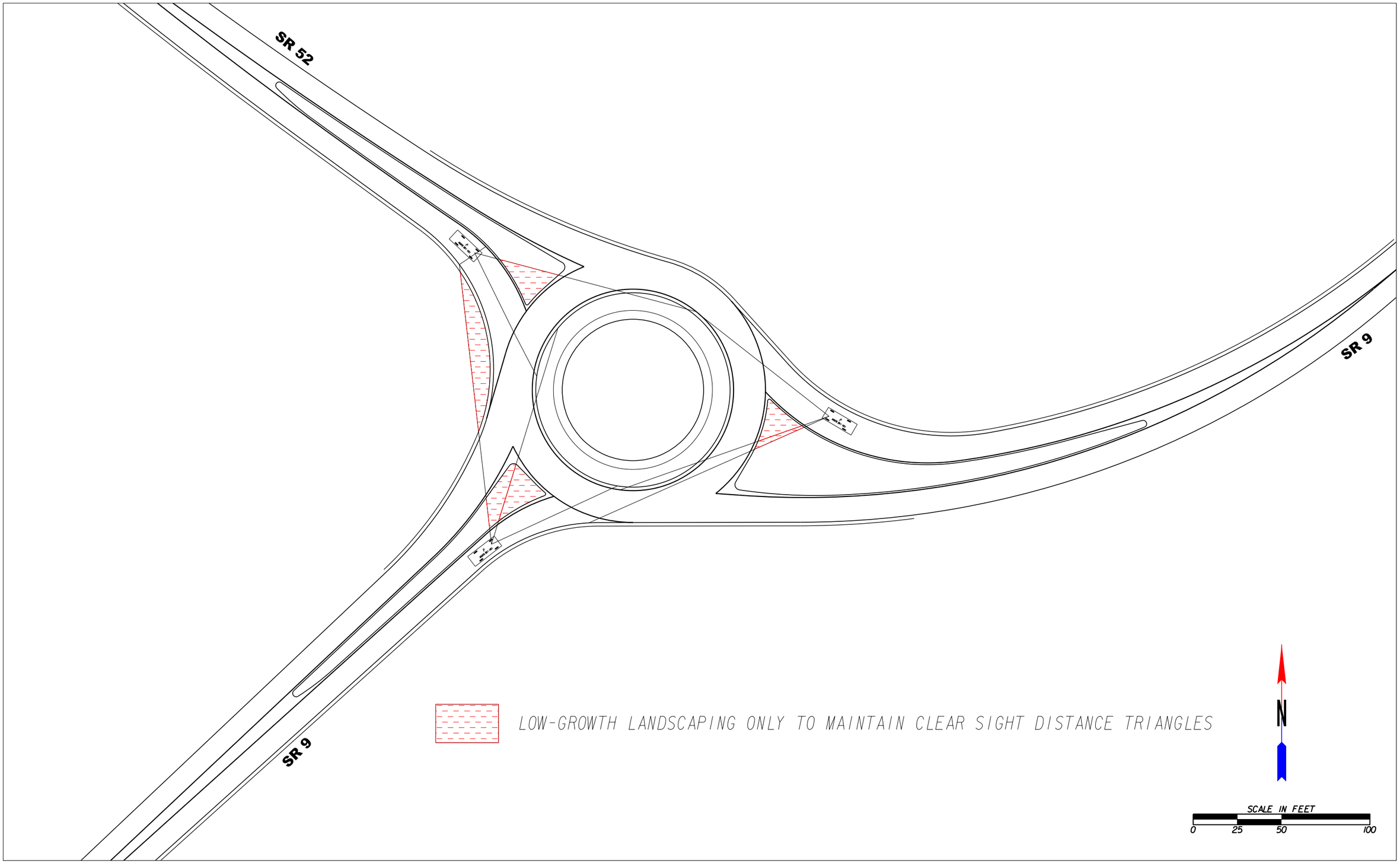
# Sight Distance Figures




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**COMBINED SIGHT DISTANCE DIAGRAM**

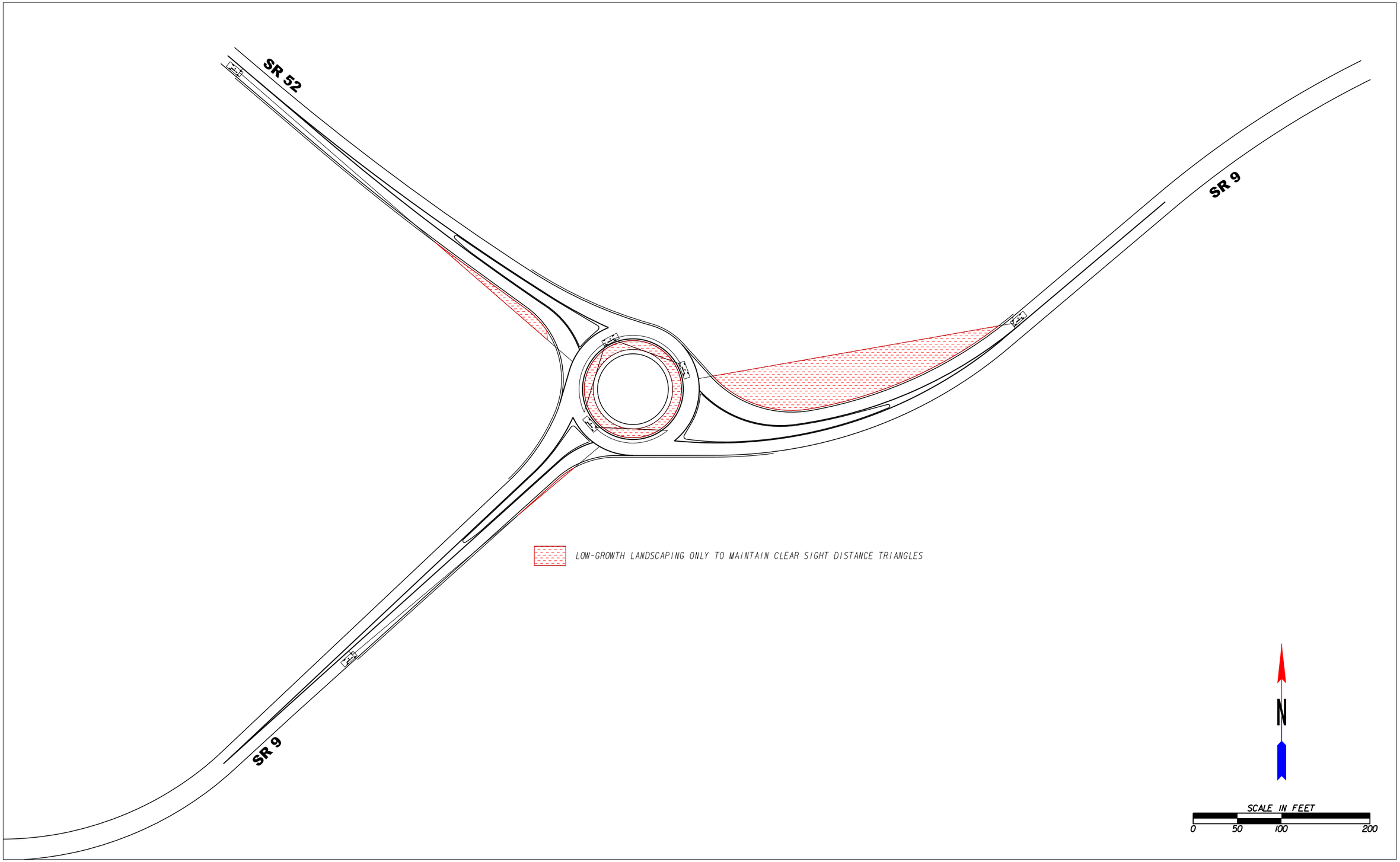
**November 5, 2014**




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**INTERSECTION SIGHT DISTANCES**

**November 5, 2014**




**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**STOPPING SIGHT DISTANCES**

**November 5, 2014**

# Attachment #6

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
225 E Robinson Street, Suite 450, Orlando, FL 32801 P 407.540.0555 F 407.540.0550

# TECHNICAL MEMORANDUM

**SR 9 at SR 52 Roundabout Peer Review**

---

Date: December 31, 2014 Project #: 17477

To: Adolfo Guzman, P.E., Clark Patterson Lee

From: Justin Bansen, P.E.

---

Kittelson & Associates, Inc. (KAI) is providing ongoing peer review support to the Clark Patterson Lee (CPL) team in the evaluation of a roundabout at the intersection of SR 9 at SR 52 in Lumpkin County Georgia. KAI activities to date have included:

- Provided comments on October 8th, 2014 (along with a team conference call) to discuss possible issues with WB-67 truck accommodation for the right-turn movements as well as to identify the need for longer splitter islands. As a result of this feedback, CPL refined the design and resubmitted to KAI for review. A draft traffic study report was provided at this time, but was missing the appendix materials that prevented a full review of the analysis. Enough information was present to confirm that a single-lane roundabout would be sufficient in terms of needed roundabout lane configurations.
- KAI re-reviewed CPL's updated concept on October 14th, 2014 which incorporated a wider outside shoulder to accommodate WB-67 design vehicle right-turn movements. KAI held another conference call with CPL to discuss possible fastest path speed control issues with the use of a shoulder instead of raised curb along the outside of the roundabout.
- KAI prepared another roundabout concept that further refined the CPL preferred alternative to slightly shift the roundabout position and approach alignments to both accommodate the WB-67 design vehicle while also meeting speed control objectives. The updated roundabout design concept was provided to CPL on 10/15/2014. KAI prepared figures illustrating fastest path speeds, WB-67 design vehicle paths, and sight-distance triangles for the revised roundabout concept prepared by KAI.
- KAI has been supporting the CPL team to date in compiling available information from the various team members into a roundabout feasibility study report.

This technical memorandum provides roundabout peer review comments on items that have not previously been addressed, as noted above. This includes:

- Draft vertical profiles and possible detour options for the roundabout concept
- Review comments for the complete Traffic Study report by Wilburn Engineering, LLC

Our review has been conducted in general accordance with the guidance provided in NCHRP Report 672, *Roundabouts: An Informational Guide, Second Edition* and our experience with peer reviews of this type.

## OPERATIONS ANALYSIS

The following comments pertain to the draft Traffic Study report prepared by Wilburn Engineering, dated August 13, 2014. In general, the comments below are not anticipated to change the conclusions of the analysis. The comments are also not expected to impact the lane configurations identified in the Traffic Study for the roundabout alternatives.

1. **Truck Factors, Page 5** - No information is provided in the report regarding truck per on SR 52. Page 5 of the report and the GDOT traffic diagrams simply identi percentages for SR 9 (no information is provided for SR 52). The operational worksheets in the appendix assumed 0% trucks on SR 52.
   a. Based upon the 4% trucks identified along SR 9 (to both the east and west of the study intersection) and the fact that a substantial portion of the traffic east of the study intersection travels to/from SR 52, it seems likely that SR 52 carries a similar truck percentage as SR 9. However, further verification is needed. The analysis sho updated to reflect the trucks on the stop controlled SR 52 approaches.

1a.Traffic volumes and truck percentages were provided by GDOT, no additional data was provided.

2. **Crash History, Page 8** – The table identifies the single-vehicle crashes as "Vehicle C with Animal or Structure". 6 of the 10 crashes fall into this category. However, the crash summaries simply identify these crashes as "Not a Collision with Motor Ve Therefore, it is unclear whether any of these involved animals versus other run-off-th type crashes. Further understanding the cause and locations of these crashes wo helpful in being able to identify needed improvements as well as possible benefits that be expected from the proposed alternatives. Is it possible to get a copy of the actua reports for these crashes and to create a crash diagram illustrating their locations?

2.There were 6 crashes of this type over a four year period...they were all dissimilar, less than 1.5 per year...did not warrant further investigation. If needed.

3. **Capacity Analysis, Page 13** – The text in the first paragraph references that Synchro 8 the procedures from the Highway Capacity Manual, Special Report 209 (HCM 2000). However, Synchro 8 actually implements some procedures from the HCM 2010 and others from the HCM 2000. The two-way stop control procedures still reflect the HCM 2000. However, the roundabout procedures reflect the HCM 2010.

3. Corrected. Synchro incorporates methods of 2000 and 2010 HCM.

4. **No-Build Alternative, Page 14** – Table 4 identifies the "EB Left" movement at the West Intersection. However, the results shown in the table reflect the SB Right-Turn movement, which is the critical movement at the west intersection. Please update the label in the table.

4. Corrected. Table 4 is updated showing the SBR for the west intersection.

5. **Turn Lane Criteria, Page 15** – Tables 5 and 6 have a column titled "Daily Volume" whic includes the actual volume (1075) for the study intersection. Including the actual volume i these tables is confusing since they are titled "Left Turn Lane Criteria" and "Right Turn Lan Criteria". We suggest removing the "Daily Volume" column so that Table's 5 and 6 simpl show the criteria and Table 7 shows the evaluation. This does not impact the results; it simply reduces potential confusion for the reader.

5. Corrected, daily volumes removed.

6. **Roundabout Analysis, Page 16** – For the opening year analysis, the HCM 2010 capacity model results should be used from the GDOT spreadsheet. The results in Table 10 reflect the "calibrated model" from the spreadsheet. Please provide a footnote under the table to specify the capacity model that was utilized for the analysis.

6. We have been instructed by GDOT in the past to use the "future" model when recording projected conditions?

7. **Roundabout Analysis, Page 17** – For the 2038 Design Year analysis, GDOT allows the use of the "calibrated model" from their spreadsheet to account for possible increases in capacity over time. However, given that the roundabout is not expected to be near capacity, we suggest also using the HCM 2010 results from the spreadsheet for the 2038 Design Year

7. same as #6.

8. Corrected. Revised volumes.

conditions to avoid potential confusion with multiple roundabout models being applied. This will not change the conclusions of the analysis since LOS on all approaches remains at an "A".

8. **Roundabout Analysis, Page 17** – The 2038 PM Peak Hour results shown in Table 11 require updating. KAI noted errors in the volume entries for the 2038 PM peak hour analysis worksheet. Update Table 11 to reflect the corrected analysis results. This is not anticipated to impact the conclusions of the analysis.

9. Corrected, LOS revised from 'C' to 'B'. The comparison of the small differences in delay is no longer necessary.

9. **Summary of Findings, Page 18** – The comparison of alternatives focuses on level-of-service only. The no-build condition is identified as having an LOS 'C', however, this only applies to the SB left-turn movement during the 2038 AM Peak Hour and this movement only exceeds the LOS 'B' threshold by 0.1 seconds of delay. All other movements are at an LOS 'B'. Comparing on the basis of delay would allow for the reader to get a better sense for the relatively small differences in delay between the various alternatives.

10. Corrected. Appendix updated.

10. **Appendix E and F** – the analysis worksheets for the north intersection (under no-build conditions) were not included. Please add them to the appendices.

11. **General Analysis Notes**:

11a. Corrected. Same PHF used through out report.

a. **Peak Hour Factor** – Please use a consistent PHF for analysis of the various alternatives. A PHF of 0.85 was used for the no-build and traditional T-Intersection results. Meanwhile a PHF of 0.88 was used for the roundabout analysis.

11b. Grade has no impact on the results.

b. **Grade adjustment** – No grade adjustment was included for the stop-control analyses (doesn't apply to the roundabout analysis). Adjusting for the downgrade on the SR 52 approach is expected to have a relatively small impact on the results, resulting in a slight improvement to the reported delays. Therefore, it isn't required to go back and make this adjustment. However, if other refinements to the analysis are being made, consider also updating the grade adjustment at the same time.

11c. GDOT provided all traffic data. We made an assumption of 2% for the other movements.

c. **Truck Factors –** As identified previously, include truck factors for the SR 52 approaches in all analyses. Truck percentages are not indicated on the Synchro outputs, so we are not able to verify whether or not heavy vehicles were considered in the stop-control analyses.

12. Corrected. Volumes updated.

12. **Appendix H, 2038 PM Peak Analysis -** The incorrect volumes for the westbound through and right-turn movements were used in the analysis.

## ROUNDABOUT CONCEPTUAL DESIGN COMMENTS

The following comments reflect review of the vertical profiles, cross-sections, and detour routes provided to KAI by CPL on October 24, 2014. The vertical information is based upon the refined horizontal roundabout concept prepared by KAI and provided to CPL. All fastest path, design vehicle, and sight-distance checks are included under the feasibility study report.

### Lane Configurations for Traditional T-Intersection (Concept D)

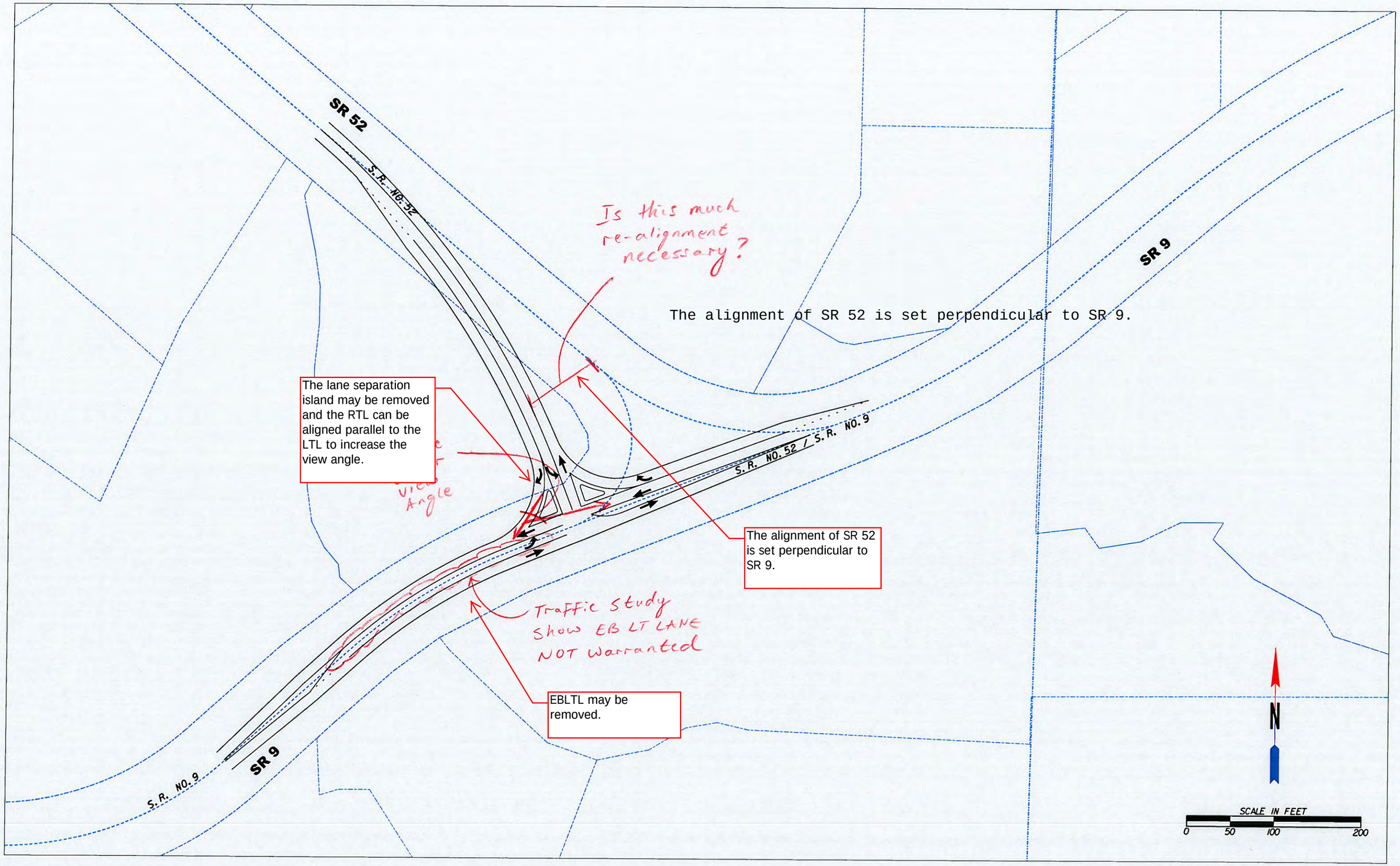
13. The geometric layout for Concept D includes an eastbound left-turn lane. However, the Traffic Study prepared by Wilburn Engineering shows that the eastbound left-turn lane is not warranted. Zero AM Peak Hour vehicles are anticipated to make the eastbound left and only five are expected during the PM peak. If the turn lane is being provided for alternative reasons (safety, etc. due to the back to the horizontal curves along SR 9), then it may be appropriate to amend the Traffic Study to include justification for including the additional turn lane in the design.

## Detour Routes and Construction Staging

14. Consider adjusting the alignment of Detour B to push is slightly towards the east to allow for the entire central island to be built in one stage. As currently shown, a small portion of the central island and truck apron lies under the southbound lanes for the Detour B route, which would require traffic to be shifted under a separate stage to allow for the remaining portion of the central island curbing and truck apron to be completed.
15. Based upon the cross-sections shown for Detour A, west of the roundabout, a portion of the slope for the final roundabout approach encroaches into the detour route. Please clarify the intended construction staging since it appears that the westbound lanes of SR 9 will need to be shifted over the new roundabout alignment in order to construct the eastbound lanes of SR 9.

## Vertical Considerations

16. As the project proceeds into design, we recommend that a profile be drawn around the outside of the circulatory roadway and around the central island. These profiles can be helpful in verifying that a smooth vertical geometry is provided for vehicles navigating around the circulatory roadway.
17. As part of the final design, consideration for vertical elements within the central island should acknowledge that the surrounding area is wooded. Therefore, using similar species of trees or plants may actually cause the central island to blend into the background landscaping instead of stand out. Selection of the plant materials should help to provide vertical elements that stand out from adjacent vegetation to improve visibility of the roundabout to drivers approaching on the upgrade from the west (traveling eastbound).
18. An additional alternative that could be considered is to slope the entire roundabout towards the south in order to minimize the amount of cut along SR 52. Currently, the conceptual profiles bench the roundabout resulting in a -4% grade approaching the roundabout (existing grade is approximately 2%). While benching the roundabout (as currently shown in the conceptual profiles) is preferred, placing the roundabout on a sloping plane may also be acceptable (provided that the grade through the roundabout is kept below approximately 3% (see NCHRP Report 672 for additional information). This would potentially allow for reduced cost by reducing the amount of profile adjustment needed along SR 52.




November 10, 2014

**SR 9 AT SR 52 ROUNDABOUT CONCEPT**

**CONCEPT D**

Detour B can be shifted away from the central island in order to construct it (central island) in one stage.

CAN DETOUR B BE SHIFTED EAST TO ALLOW FOR CENTRAL ISLAND TO BE CONSTRUCTED IN 1 STAGE?

S.R. NO. 52

S.R. NO. 52

DETOUR B

DETOUR A

S.R. NO. 9/S.R. NO. 52

S.R. NO. 9/S.R. NO. 52

S.R. NO. 9

S.R. NO. 9

P.I. 358+26.57

P.I. 354+50.59

P.C. 356+90.34

P.I. 352+72.37

P.I. 350+00.00

P.C. 350+54.00

P.T. 144+30.93

P.C. 141+19.84

POB 140+12.76

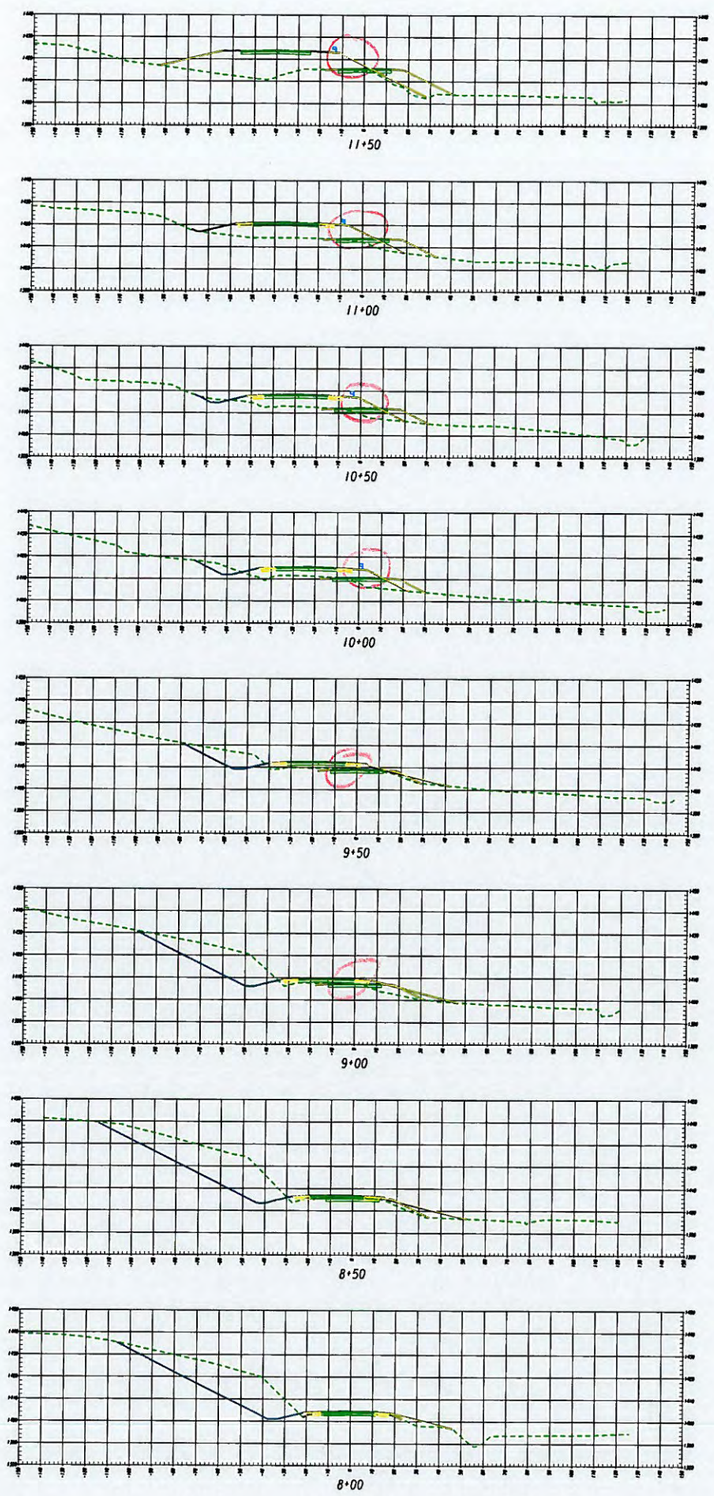
SCALE IN FEET

0 50 100 200

S.R. 52 AT S.R. 9
INTERSECTION
PROJECT #0009949
LUMPKIN COUNTY
OCTOBER 22, 2014

Clark Patterson Lee
DESIGN PROFESSIONALS

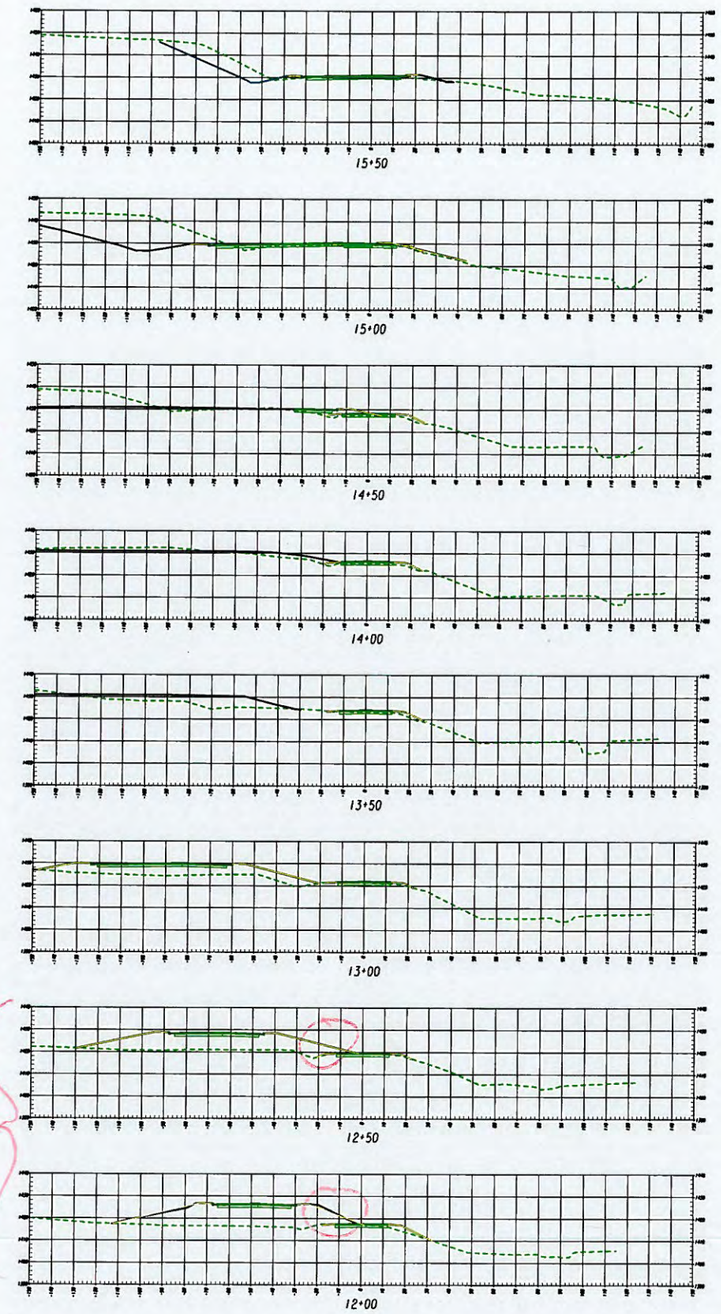
350 TOWN CENTER AVE, SUITE 201
SUWANEE, GEORGIA 30024
TEL: (800) 274-9000
FAX: (770) 831-9243
www.clarkpatterson.com>>




DETOUR A (S.R. NO. 9)

What is the expected phasing plan?

1. Construct temp Detour A and switch traffic to it.
2. Construct SR9 (including roundabout and all islands) except for RT shoulder. Use 1:1 slope between Detour A and SR9 and protect with temp jersey barriers. Possible use of LT paved shoulder to achieve 2-way traffic.
3. Remove Detour A and construct the remaining portion of SR 9 LT shoulder.
Note: The phasing will be properly presented on the staging plans.




DETOUR A (S.R. NO. 9)

# Attachment #7

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

# INDICATION OF ROUNDABOUT SUPPORT

To the Georgia Department of Transportation:

Attn: State Traffic Engineer
934 E. Confederate Ave., Building 24
Atlanta, GA 30316

## Location

The **COMMISSIONER** of **LUMPKIN** County supports the consideration of a roundabout at the location specified below.

State/County Route Numbers: **SR 9** at **SR 52**

## Associated Conditions

The undersigned agrees to participate in the following maintenance of the intersection in the event that the roundabout is selected as the preferred concept alternative:

- The full and entire cost of the electric energy used for any lighting installed and the maintenance thereof (if needed)
- Any maintenance costs associated with the landscaping as approved by the local government and the Georgia Department of Transportation (after construction is complete)

We agree to participate in a formal Local Government Lighting Project Agreement during the preliminary design phase. This indication of support is submitted and all of the conditions are hereby agreed to. The undersigned are duly authorized to execute this agreement.

This is the 7th day of May, 2014

By: _____

Title: CHAIRMAN, LUMPKIN COUNTY BOARD OF COMMISSIONERS

Attest:

Kathleen C Walker
Clerk

**Keith Golden, P.E.,** Commissioner

**DEPARTMENT OF TRANSPORTATION**

One Georgia Center, 600 West Peachtree Street, NW
Atlanta, Georgia 30308

April 18, 2014

Lumpkin County Board of Commissioners
Attn: Mr. Chris Dockery, Chairman
99 Courthouse Hill, Suite H
Dahlonega, GA 30533

**SUBJECT:** PI No: 0009949
Roundabout Support for SR 9/Dawsonville Highway @ SR 52
Lumpkin County

Dear Chairman Dockery:

In an effort to finalize the process necessary for the consideration of the installation of a roundabout at the above location, please complete the enclosed "Indication of Roundabout Support" form with the appropriate signatures and return to this office at the following address:

Georgia Department of Transportation
Attention: Traffic Operations
P.O. Box 1057
Gainesville, GA 30503

The completion of this document does not guarantee the installation of a roundabout.

Please feel free to contact me at 770-532-5532 if you have any questions.

Sincerely,

David W. Olson, P.E.
District Traffic Engineer

RECEIVED
APR 28 2014
BY: KCW

DWO:kms

*Georgia Department of Transportation, District One, Traffic Operations, PO Box 1057, Gainesville, GA 30503*
*Office Phone: 770-532-5532 Fax: 770-532-5581*

# Attachment #8

**MEETING MINUTES**

PROJECT: PI# 0009949 S.R. 52 at S.R. 9, Lumpkin County
TIME & LOCATION: GDOT District Office #1, 10:00 AM
CPL PROJECT NO.: 13197.00

DATE: September 17, 2014

ATTENDEES:
Dylan Curtis – GDOT
Aaron Burgess – GDOT
Vickie Simmons – GDOT
Doug Fadool – GDOT
Kim Coley – GDOT
William Hunter – GDOT
Davis Olson – GDOT
Justin Lott – GDOT
Brent Cook – GDOT
Bobby Dollar – GDOT
Joe Garland – Clark Patterson Lee
Adolfo Guzman - Clark Patterson Lee
Mark Hanson - Clark Patterson Lee
Ben Morden - Clark Patterson Lee
Speedy Boutwell – Wilburn Engineering
Josh Earhart – Edwards-Pitman Environmental
Charles Trammell – Lumpkin County
Larry Reiter – Lumpkin County
Ted Almond – Amicalola EMC
Ray Roberts – Amicalola EMC

**INTRODUCTIONS:**

- Project Manager commenced meeting by having each attendee introduce themselves
- Consultant introduced themselves and proceeded to begin the review of alternates designs considered to date.

**DISCUSSION:**

A field review of the project on location with the GDOT Project Manager, Consultants and District One Traffic Operations personnel was held on July 15, 2014.

**Evaluate the Project Justification**

The intersection of SR 9 @ SR 52 is planned to be improved and is identified in the State Transportation Improvement Plan (STIP). The project (PI 0009949) is scheduled to be LET for construction in 2018 and anticipated to be open by the end of 2018.

**Project Location**

The project is located approximately 3.5 miles west of Dahlonega, in Lumpkin County.

**Safety concerns.**
The current geometrics of the existing Y configuration is operating as three separate intersections.

**Review alternates considered to date**

ROUNDABOUT

*Concept A*

*Concept B*

*Concept C*

*Concept D* (T- INTERSECTION)

**Preliminary design traffic ("Build Alternative" and "No-Build Alternatives").**

**Accident data for the previous three years.**

- 10 accidents total, 2 Injury, 0 fatalities, 6 collisions with animal/structure.

**Location of potential roundabouts or traffic signals.**

- Left offset approaches are desirable for traffic calming effect leading into the roundabout.

**Traffic Engineering Study**

- Capacity analysis was studied for year 2038 projections for No Build, T-Intersection with traffic signal, and roundabout alternatives.
- No Build – LOS C (2038)
- T-Intersection, unsignalized – LOS B (2038)
- Roundabout – LOS A (2038)

**Staging and traffic control**.
-Work zone safety and mobility requirements.
-Traffic calming techniques to be implemented.

- T-intersection will require detour for the staging.
- Roundabout must include vertical elements within center isle to increase visibility.

**Maintenance problems, including drainage and pavement problems.**

-Roundabout will require lighting

**Proposed design criteria including speed design.**

-SR 9 is classified as a Rural Minor Arterial and SR 52 is classified as a Rural Minor Collector.

-SR 9 is posted 45 MPH

-SR 52 is posted 55 MPH

-Bicycle signs are posted along SR 9

**Proposed type of access control**.

-Approved by permit.

**District information on public contacts and concerns to date**.

-Lumpkin County proposed fire station site

**Evaluate the extent of public outreach efforts and coordination needed**.

- Community outreach will be needed for roundabout.

-Coordination with FHWA, FTA, GRTA, and other non-environmental Federal, state and local agencies and/or governments.

**Proximity to (< 200' of existing crossing) and impacts to railroads and railroad right-of-ways**. N/A

**Proximity to and impacts to airports**. N/A

**Existing structures and their condition**.

-15"PVC SR 52

-18"CMP SR 9 West of the intersection

-15" RCP SR 9 Ease leg of the intersection

**Environmental concerns:**

-History

- Nothing eligible as of now.

-Potential for Archaeology

- Study yet to be started. Need better determinate of construction limits.

-Neighborhoods

-Special interest groups

- Church on S.R. 52 is outside of current construction limits.

-Context Sensitive Design

-Cemeteries

- Cemetery on S.R. 52 is outside of current construction limits.

-Parks and recreation

- No parks or recreation areas within project limits.

-Need for a Practical Alternatives Report (PAR)

- No need for a PAR report. ?(Parks and Recreation Report)?

-Wetlands and streams, open waters, buffers, floodplains

- Assessment in progress and ecologist will determine "streams".

-Endangered species

-Erosion and Sedimentation Control

-Air Quality

- Air Quality assessment in progress. Not expected to be a problem.

-Potential for noise impacts

- Impacts will be dependent upon which alternate is ultimately selected.

**Possible permits required:**

-U. S. Army Corps of Engineers Section 404 Permit

-Tennessee Valley Authority (TVA)

-U. S. Coast Guard (USCG)

-Stream Buffer Variance

- Buffer variance will likely be required based on which alternate is selected.

Opportunities to accommodate other modes of transportation.

Coordination with other GDOT and local projects.

**Existing right-of-way.**

- Impacts of Right-of-Way will be determined once closer to selected alternate.

General location, size of utilities, and the need to employ an Overhead/Subsurface Utility Engineering (SUE) investigation (Quality Level D-records research only) to be used for further concept development.

**Determine if the Public Interest Determination Policy and Procedure should be used for the Project**.

Concurrence to proposed project schedule.

The outcome of the Initial Concept Meeting should be a better understanding of the project scope, identification of information that is available and what is needed, and the next steps to be accomplished in the concept development. The participants should agree on assignments and schedules for detailed concept development.

The Project Manager will update the project management system and provide meeting notes to the participants within 15 working days of the Initial Concept Meeting.

**ADDITIONAL DISCUSSION:**

-Utilities

- Noted that pole existed in middle of triangle at center of intersection. Pole belongs to Amicalola EMC.
- Involved utilities will require a PDF or DGN of existing to insert existing utilities.
- Concept 'B' was preferred due to the minimal impacts of Right of Way.
- Windstream has underground utilities within area.
- All electric utilities are overhead.
- Will be evaluated whether lighting for intersection will be attached to existing poles or will require separate structures.

-Lumpkin County

- Main concern relates to the proposed Fire Station.
- Lumpkin County on board and has agreed to lighting of intersection.
- County has no issue with roundabout placement next to proposed fire station.
- Spring of 2017 is possible for the begin construction date of the fire station.

-Additional Items

- The limits of construction are not expected to encroach on the curve west of the intersection on S.R. 9.
- T-intersection is preferred if cost is 10% or less of roundabout.
- Target dates of December 2nd or 4th for PIOH.
    - Worksheet is needed as soon as possible and will be done by GDOT.
    - Location will be needed soon for PIOH.

- Concept 'B' seems to be preferred alternate.
    - Concept 'B' incorporated the most existing Right of Way
- Noted that T-intersection will promote high speeds in front of the proposed fire station.
- Not certain yet whether fire station will be open before construction of the intersection project begins.

**ACTION ITEMS:**

1. Involved utilities will need PDFs or DGNs of existing base map to place in existing utility locations.
2. Target dates of December 2nd or 4th for PIOH.
    - PIOH Worksheet is needed as soon as possible.
    - Location will be needed for PIOH.
3. Identify detour construction limits for environmental field survey.

The foregoing constitutes our understanding of matters discussed and conclusions reached. If there are any errors or omissions in the basic discussion, please notify the Author in writing within seven days.

Cc: All Attendees
File

F:\GDOT SR 52 at SR 9 Task Order # 20\Minutes & Agendas\PI0009949-Initial Concept Meeting Minutes-09-17-2014.doc

# Attachment # 9

1

**Georgia Department of Transportation** | Public Information Open House Handout
PI#: 0009949, County: Lumpkin

## Comment Card

*Please print responses.*

Name MIKE PIERCE

Address 821 SAM DAVIS RD.
DAHLONEGA, GA. 30533

Do you support the project? (check your response)

☐ *For* ☐ *Against* ☐ *Conditional* ☑ *Uncommitted*

General Comments BIGGEST CONCERN IS PEOPLE FAILING TO YIELD TO TRAFFIC IN ROUNDABOUT, MOST I HAVE SEEN PEOPLE DON'T SLOW TO A YIELD AND ACKNOWLEDGE ANYBODY ALREADY IN THE ROUNDABOUT HAVING THE RIGHT OF WAY. SOME TYPE OF T INTERSECTION COULD POSSIBLY WORK. I'M NOT AGAINST ROUNDABOUTS IS PEOPLE'S IGNORANCE TOWARDS THEM.

How did you hear about this Open House? (check) ☐ *Radio* ☐ *Newspaper* ☑ *Signs* ☐ *Word of Mouth*

☐ *Other* _____

Was the location of the Open House convenient for you to attend? ☑ Yes ☐ No

If no, please suggest a general location that is more convenient to your community.

Was the time of the meeting convenient for you to attend? ☑ Yes ☐ No

If no, please suggest a time frame that is more convenient for you.

Were your questions answered by GDOT personnel? ☑ Yes ☐ No

Do you understand the project after attending this meeting? ☑ Yes ☐ No

Please share your suggestions on improving the ways GDOT conducts Open Houses:

HAVING A SCALED MODEL WITH THE ROAD, ROUNDABOUT AND SOME VEHICLES TO LET PEOPLE ACTUALLY SEE IT LAYED OUT AND CAN MOVE THE VEHICLES ALONG IT THE ROADS & SEE HOW THE FLOW SHOULD BE.

Mail to:
*Ms. Hiral Patel, P.E., State Environmental Administrator*
*Georgia Department of Transportation*
*600 West Peachtree Street, NW – 16th Floor*
*Atlanta, Georgia 30308*

2

**Georgia Department of Transportation** | Public Information Open House Handout
PI#: 0009949, County: Lumpkin

## Comment Card

*Please print responses.*

Name Teresa Sapp

Address 2493 Dawsonville Hwy
Dahlonega GA 30533

Do you support the project? (check your response)

☒ ***For*** ☐ ***Against*** ☒ ***Conditional*** ☐ ***Uncommitted***

General Comments Parcel 046 026 - owner would like to reduce the right of way as much as possible especially around P.I. 17+60.35 and to preserve the Black Walnut tree next to the out building that is proposed to be torn down. Also some concerns about headlights shining into the house from cars in the roundabout.

How did you hear about this Open House? (check) ☐ ***Radio*** ☒ ***Newspaper*** ☒ ***Signs*** ☐ ***Word of Mouth***

☐ ***Other*** _____

Was the location of the Open House convenient for you to attend? ☒ **Yes** ☐ **No**

If no, please suggest a general location that is more convenient to your community.

Was the time of the meeting convenient for you to attend? ☒ **Yes** ☐ **No**

If no, please suggest a time frame that is more convenient for you.

Were your questions answered by GDOT personnel? ☒ **Yes** ☐ **No**

Do you understand the project after attending this meeting? ☒ **Yes** ☐ **No**

Please share your suggestions on improving the ways GDOT conducts Open Houses:

More advance notice.

Mail to:
*Ms. Hiral Patel, P.E., State Environmental Administrator*
*Georgia Department of Transportation*
*600 West Peachtree Street, NW – 16th Floor*
*Atlanta, Georgia 30308*

3

Office of Environmental Services

**Georgia Department of Transportation** | Public Information Open House Handout
PI#: 0009949, County: Lumpkin

## Comment Card

*Please print responses.*

Name Ruby Davis
Address 2432 Dawsonville Hwy
Dahlonega, GA 30533

**Primary P1 #** 0009949
**Add'l P1 Nos.**
**NEPA analyst:** A. Burgess
**Recipient:**
**Copies: OH** ____ **Asst. OH** ____
**NEPA** ____ **A/N** ____ **Arch** ____
**Eco** ____ **Hist** ____
**ORIGINAL TO GEN. FILES**

Do you support the project? (check your response)

☐ *For* ☑ *Against* ☐ *Conditional* ☐ *Uncommitted*

General Comments

I'm not against But there's one thing you will Be taken my Son's Septic and ½ of his trailer and this is why I'm against this. He is Disable.

How did you hear about this Open House? (check) ☐ *Radio* ☐ *Newspaper* ☐ *Signs* ☐ *Word of Mouth* ☑ *Other*

Was the location of the Open House convenient for you to attend? ☑ Yes ☐ No

If no, please suggest a general location that is more convenient to your community.

Was the time of the meeting convenient for you to attend? ☑ Yes ☐ No

If no, please suggest a time frame that is more convenient for you.

Were your questions answered by GDOT personnel? ☐ Yes ☑ No

Do you understand the project after attending this meeting? ☑ Yes ☐ No

Please share your suggestions on improving the ways GDOT conducts Open Houses:

Mail to:
*Ms. Hiral Patel, P.E., State Environmental Administrator*
*Georgia Department of Transportation*
*600 West Peachtree Street, NW – 16th Floor*
*Atlanta, Georgia 30308*

# PUBLIC INFORMATION OPE N HOUSE
# PROPOSED INTERSECTION IMPROVE MENTS TO SR 52
# AT SR 9 WEST OF DAHL ONEGA
# P.I. NO. 000994 9

LUMPKIN COUNTY COMMUNIT Y CENTER

365 RILEY ROAD

DAHLONEGA, GEORG IA

DECEMBER 4, 201 4

4

1 J.W. Fields
2 115 Fields Farm Road
3 Dahlonega, Georgia
4
5 It's been a bad intersection down there for a long
6 time. I know back when I was a teenager or little boy
7 we used to hear a lot of wrecks down there. Well,
8 there's nothing between there and my house except
9 woods, you know, going down that hollow, branches. It
10 needs something there to prevent, you know, accidents.
11 Accident prone place really. That's about all I got to
12 say about it.
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1 C E R T I F I C A T E

2

3 G E O R G I A:
HALL COUNTY

4

5 I hereby certify that the foregoing Public
6 Information Open House was reported as stated in the
7 caption and the comments were reduced to the written
8 page under my direction; that the foregoing Pages 1
9 through 3 represent a true, complete and correct
10 transcript of the comments given.
11 I further certify that I am not in the regular
12 employ of counsel for any of said parties, nor am I in
13 anyway financially interested in the result of the
14 proposed project.
15 This, the 5th day of December, 2014.
16
17
18 _____
19 Randy A. Slane, CCR-B-2281
20
21
22
23
24
25

## Burgess, Aaron T

**From:** Burgess, Aaron T
**Sent:** Friday, December 05, 2014 9:19 AM
**To:** McMurry, Russell; Bowman, Glenn; Patel, Hiral; Duff, Eric; Curtis, Dylan K; Pope, Teri; Cook, Brent; Coley, Kim; Josh (jearhart@edwards-pitman.com)
**Cc:** Dollar, Robert (Bobby)
**Subject:** PI 0009948 , Lumpkin County -- Public Information Open House

Hi everyone,

Below please find below a brief synopsis of last night's Open House. Please let me know if you have questions or concerns.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Brief Project Description* | Construction of a roundabout at SR 9 Dawsonville Highway at SR 52 | | | | | | |
| *Date of Open House* | December 4, 2014 | | | *End of Comment Period* | December 18, 2014 | | |
| *Number in Attendance* | 12 | | | | | | |
| *Officials in Attendance (list name and title)* | Charles Trammell – Lumpkin County<br>Doug Sherrill – Lumpkin County Commissioner, District 1 | | | | | | |
| *Comment Breakdown (for comments provided at the Open House)* | | | | | | | |
| *For* | 1 | *Conditional* | | *Uncommitted* | 1 | *Against* | |
| *Major concerns:* | Reduce the amount of ROW required from a property owner; if possible save a large black walnut within the ROW to be acquired on our property; concern about headlights shining into home from the roundabout; drivers concerned about maneuvering through roundabouts | | | | | | |
| *Prepared by (include firm's name if applicable):* | Josh Earhart, Edwards-Pitman Environmental, Inc. | | | | | | |
| | | | | | | | |

Aaron T. Burgess
Transportation Environmental Planner (NEPA)
GDOT Office of Environmental Services
600 West Peachtree Street, 16th floor
Atlanta, GA 30308
404-631-1159 office