APPENDIX A. GDOT ICE Stage 1 - Screening

Basic informational elements usually necessary or helpful to complete ICE Stage 1 include:

- Location, Context, Roadway Functional Classification, and Project Description
- Traffic Data (AADT, DHV, vehicle classification, percent trucks)
- Basic Roadway Characteristics (geometric elements, existing traffic control devices, pedestrian or bicycle features, unique conditions or constraints, etc.) obtained from roadway inventory or online mapping
- Pedestrian and bicycle information, such as activity, volumes, generators, etc. (when available)
- Existing Safety Performance
    - Long-term (minimum 5 years) crash history summary and diagram for intersection(s) under study
    - If available, findings and recommendations from a previously completed Road Safety Audit or other expressed safety concerns about the location(s), such as feedback from the local maintenance office or the general public
    - Connection to the emphasis areas, goals or strategies included in the latest Georgia Strategic Highway Safety Plan (SHSP). Specifically, describe how the project addresses the Serious Crash Type – Intersection Safety emphasis area

Much of the information listed above may be obtained from the GDOT Crash, Road & Traffic Data group at http://www.dot.ga.gov/DS/Data.

An explanation of various intersection control types can be found on the Intersection Descriptions tab of the GDOT ICE Spreadsheet Tool.

Exhibit 1-A provides a flow chart of the ICE Stage 1 process and Table 1-A provides a description for each step in the flow chart.

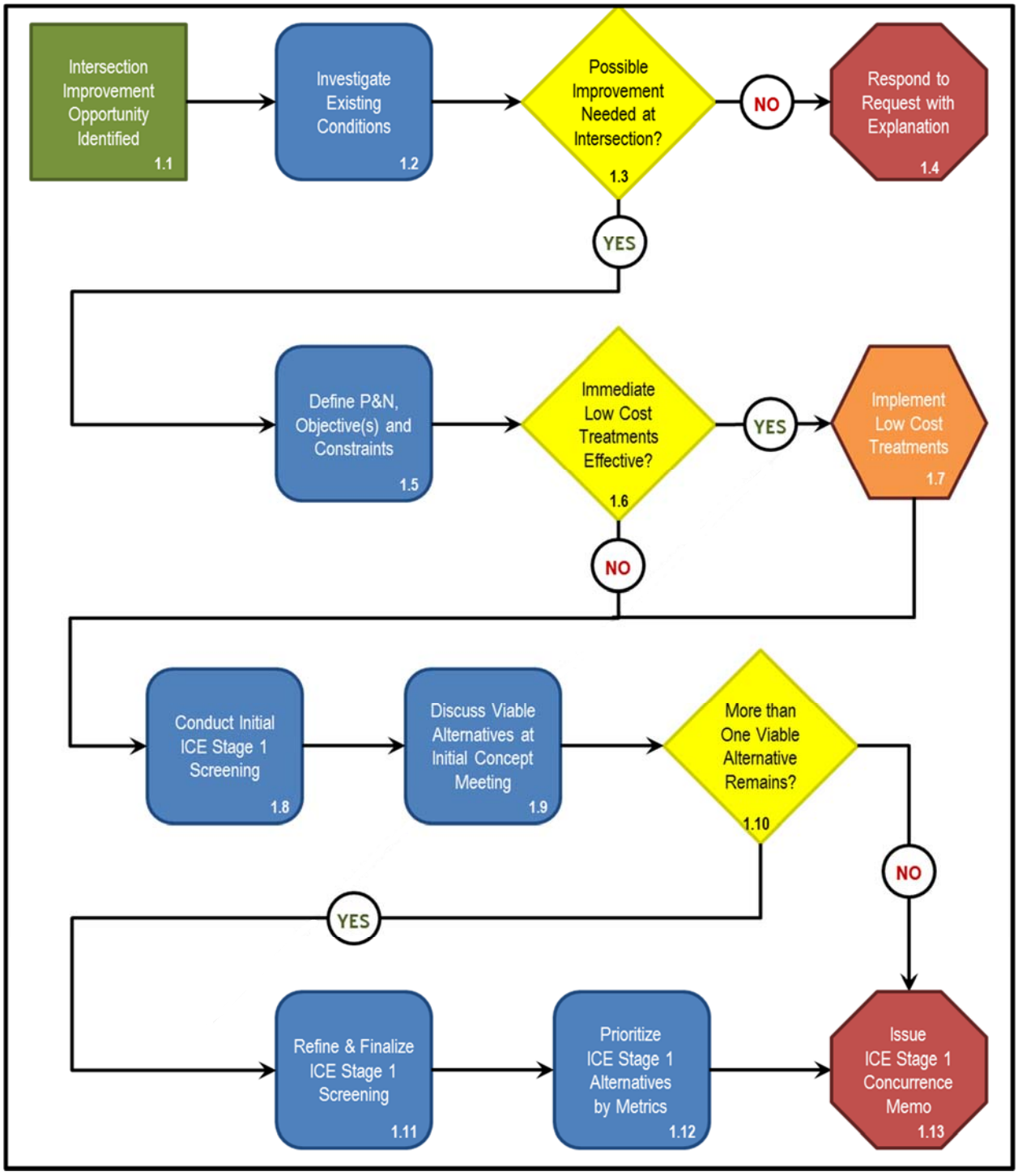


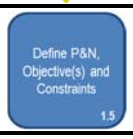
Exhibit 1-A. ICE Stage 1 Flow Chart

Procedural steps required to complete ICE Stage 1 (refer to Exhibit 1-A. ICE Stage 1 Flow Chart):

Step 1.1. The opportunity for an intersection improvement is identified, potentially for any number of reasons – as a candidate for HSIP, due to corridor widening or reconstruction, based on a petition for new highway access, or because a community requested a change in control. When the project involves more than one intersection, or a series of intersections along a corridor, the approach to ICE as a consolidated effort (all intersections together) or as separate efforts (one for each intersection) should be discussed in advance with the District Traffic Engineer or the State Traffic Engineer, as appropriate.

Step 1.2. Following the identification of an intersection improvement opportunity, it is necessary to collect certain minimum information about the existing conditions. This includes the location and description, traffic data, basic roadway characteristics, pedestrian and bicycle influences, and historic safety performance.

Step 1.3. The first decision point of an ICE is to determine whether or not an intersection improvement is needed. This determination is meant to screen out unreasonable requests for changes, mainly from external sources. If an intersection improvement is not needed, an explanation to the requestor should be sent (Step 1.4 on flow chart). For GDOT-sponsored projects, proceed to Step 1.5.



Step 1.5. Once a determination is made that a possible intersection improvement is needed, the Purpose and Need (P&N) of the project must be defined, and specific objectives and constraints for the intersection(s) identified. This will inform the initial and final screening that takes place in subsequent ICE steps.

Step 1.6. In some cases, it may be possible to improve safety and operations with "low cost" treatments, such as enhanced applications of or adjustments to traffic control devices (i.e., signing and pavement markings), re-timing existing signals, trimming vegetation – types of work often accomplished with in-house forces as part of routine maintenance activities. These low cost treatments should be implemented immediately if practical (Step 1.7 on flow chart), while the remaining steps of ICE proceed.

Step 1.8. The next step is to conduct the initial, high-level screening of the many different geometric and control alternatives. A corresponding ICE Stage 1 Screening Decision Record is provided (see **GDOT ICE Spreadsheet Tool**) for consistency of approach and documentation. The emphasis of this process is on eliminating non-competitive options and identifying which alternatives merit further consideration based on their practical feasibility.

- Each alternative should be evaluated for its appropriateness in meeting the project need in a balanced manner and in scale with the project.
- The safety performance of each alternative should be considered, with emphasis on the difference in severe crashes (i.e., those resulting in fatalities and injuries). Strongest consideration should be given to the alternatives associated with the largest expected reduction in or fewest expected number of severe crash outcomes.
- Suitability for pedestrians and bicycles should be assessed for each alternative (with emphasis on convenience and accessibility); refer to DPM Chapter 9 Complete Streets Design Policy. If available, the assessment should consider pedestrian and bicycle network information from local or community plans and planning documents.
- The operational assessment should consist of evaluating whether operations are preserved or improved for each alternative. Note that warrant analyses (for traffic signals or multiway stop) per the MUTCD remain applicable. Additionally, the motorized users assessment should consider suitability of each alternative for transit (if applicable) and freight or other large vehicle operation (refer to DPM Section 3.2 Design Vehicles for more information regarding selection of appropriate Design Vehicle).
- The final assessments should consist of evaluating each alternative against general site characteristics, constraints and context. Included in this category are right-of-way, type(s) of development and access, environmentally sensitive areas, and potential impacts to major utilities.

	Step 1.9. With results from the initial screening, the possible alternatives are discussed at the Initial Concept Meeting (consult GDOT PDP Manual for more information). Projects that may not always require an Initial Concept Meeting, such as some HSIP projects, may proceed to Step 1.10. However, in these cases, it is still advisable to solicit informal input on possible alternatives from other GDOT offices.
	Step 1.10. Based on the consensus from the Initial Concept Meeting, if only a single alternative is viable the process skips directly to the end of Stage 1 to Step 1.13; if more than a single alternative are viable, proceed to step 1.11.
	Step 1.11. Using the feedback from the Initial Concept Meeting, refine the alternatives, update the corresponding analyses and review the initial screening from Step 1.8. After incorporating new information and making any necessary adjustments, finalize the Stage 1 screening by updating the decision process.
	Step 1.12. Upon completing the decision process from Step 1.11, list the recommended alternatives, summarize based on the results of the high-level screening analyses.
	Step 1.13. Document the final ICE Stage 1 recommendations in the ICE Stage 1 Screening Decision Record. For corridor projects prepare a concurrence memo (may complete **Multi-File ICE Summary** and use as concurrence memo), and attach the output from the **GDOT ICE Spreadsheet Tool** and appropriate backup material. If ICE Stage 1 results in only one feasible alternative, then an ICE waiver may be submitted in lieu of completing ICE Stage 2. The waiver must clearly explain why there is no other feasible alternative. If a waiver is not submitted, then formal documentation of ICE Stage 2 is still required.

Table 1-A. ICE Stage 1 Procedural Steps

APPENDIX B. GDOT ICE Stage 2 – Alternative Selection

Elements required for Stage 2 (for each of the short listed Stage 1 alternatives):

- Prepare capital cost estimate and summarize lifecycle maintenance and operation costs
  - Preparation of high-level conceptual design/sketch not required, but may assist with cost estimate and determination of impacts
    - Summarize and compare any right-of-way impacts and extent/significance of land acquisition
    - Include the essential elements or treatments for pedestrians and bicyclists
    - Critical/turning movement analysis of design vehicle and check vehicle(s) (i.e. oversize permit load scenarios)
- Perform operational analysis to determine intersection delay and V/C ratio and therefore operational performance
- Perform safety analysis to determine expected reduction in number of crashes, with an emphasis on the difference in severe crashes (i.e. those resulting in fatalities or injuries)
- Identify significant environmental impacts (wetlands, parks, historic, etc.)
- Identify level of support from different stakeholders, including GDOT, local government and local citizens

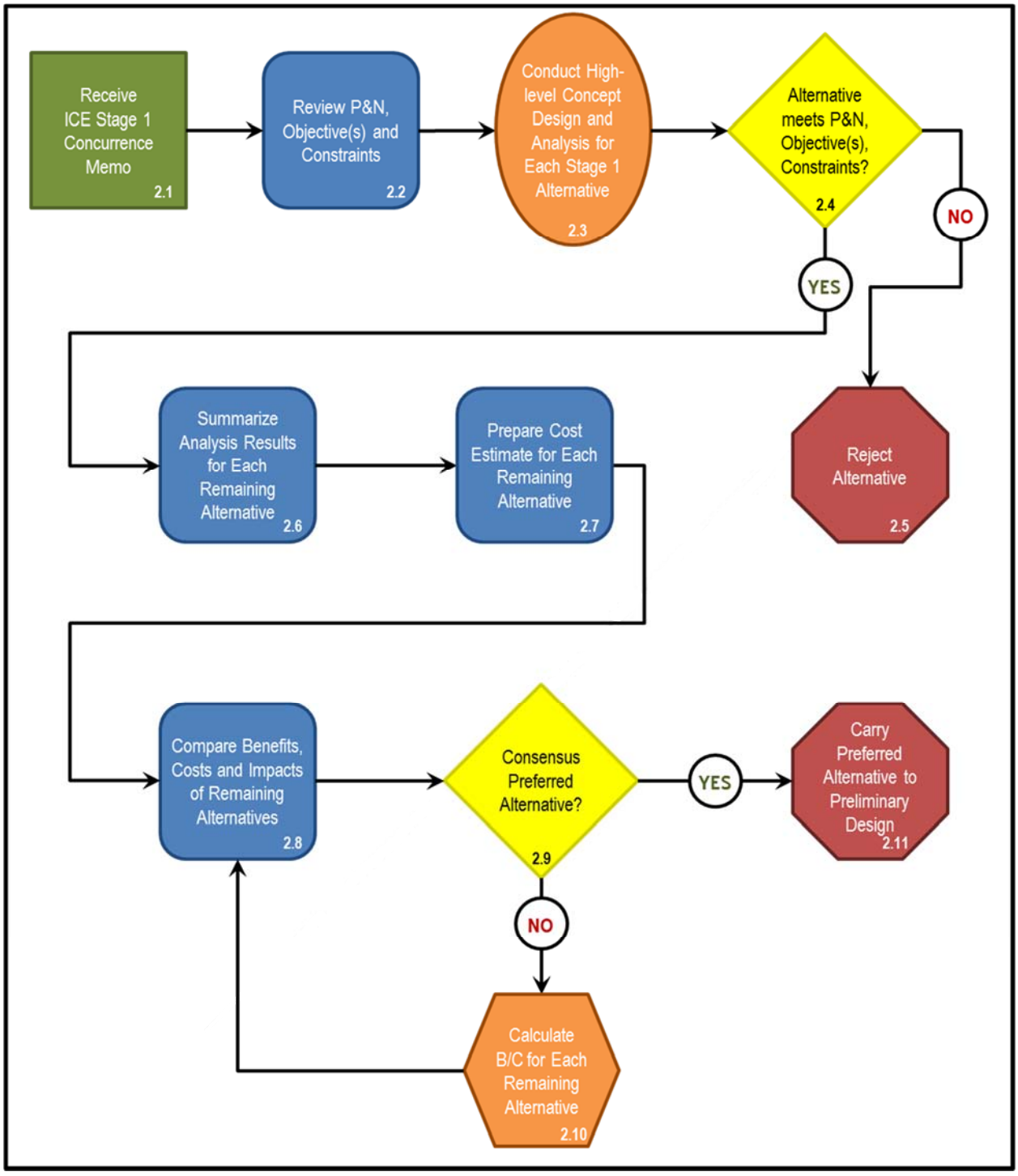
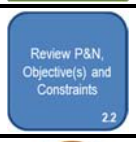


Exhibit 1-B. ICE Stage 2 Flow Chart

Procedural steps required to complete ICE Stage 2 (refer to Exhibit1-B. ICE Stage 2 Flow Chart):

Step 2.1. The ICE Stage 2 process begins with reviewing the output from ICE Stage 1, including the Concurrence Memo, the output from the GDOT ICE Spreadsheet Tool and supporting documents such as notes or minutes from the Initial Concept Meeting and other project records.



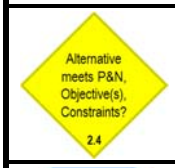
Step 2.2. The next step is to review the Purpose and Need (P&N) of the project and confirm the objectives and constraints remain unchanged. The recommendations outlined in the Concurrence Memo and ICE Stage 1 record should be consistent with the P&N, objectives and constraints.

Step 2.3. For each potential alternative recommended through ICE Stage 1, it is necessary to conduct safety and operational performance analyses in order to complete the ICE Decision Record for ICE Stage 2. Preparation of high-level conceptual designs/sketches is not required, but may assist in cost estimates and determination of impacts. These analyses are a combination of quantitative and qualitative. The quantitative analyses include:

- A complete safety performance analysis of each alternative using HSM models (SPFs, CMFs, severity distributions, etc.) and other safety models that are GDOT-approved.
  - Calculate expected safety performance in terms of reduction in crash frequencies and severities using HSM-based techniques.
  - Include non-motorized user safety assessment to the extent possible.
- A complete operational analysis using appropriate capacity and reliability analysis tools as approved by GDOT (incl. HCM/HCS, Synchro, Sidra, Vissim, GDOT Roundabout Analysis Tool etc.); as with Stage 1, focus on basic performance measures.
  - Summarize results of fundamental performance measures; may also include advanced measures of effectiveness such as travel times, throughput, reliability, etc.
  - Consider performing non-motorized and transit (if applicable) operational assessments using objective metrics, such as Multimodal Level of Service (MMLOS) or Level of Traffic Stress (LTS).
- Summary of stakeholder posture (Political Factors)
  - Degree of support by local elected/appointed officials (including emergency first responders when appropriate)
  - Degree of support by affected stakeholders (businesses, landowners, etc.)
  - Compatibility with regional, local or corridor transportation plans
- Impacts assessment (land acquisition, utility relocation, environmental mitigation) and cost estimates.

The qualitative analyses include:

- An assessment of the convenience and accessibility of pedestrian and bicycle features for each alternative.
- An assessment of construction staging.



Step 2.4. Once the performance analyses for each alternative are complete (and high-level concept designs when prepared), they must be re-checked against the project P&N, objectives and constraints. If any of the alternatives no longer address the need of the project adequately, they should be dropped from further consideration (Step 2.5 on flow chart).

Step 2.6. Summarize the performance analyses results for alternatives that remain under consideration following Step 2.4 in order to establish an initial priority order among the remaining alternatives. Also at this step, other project factors should be considered, such as the feedback/input received from project stakeholders.

Step 2.7. Cost estimates should be prepared for each remaining alternative. The cost estimates should consist of two parts: capital costs for construction (including the value of land acquisition, reimbursable utility and environmental costs, if any) and, if available, unique maintenance and operational costs associated with the alternative.

	Step 2.8. With the information summarized in Step 2.6 and the cost information from Step 2.7, a comparison of the remaining alternatives should be made. The GDOT ICE Spreadsheet Tool provides the format in which to input and summarize this information.
	Step 2.9. If there is a consensus preferred alternative based on the preceding steps, it should be identified in this step, and all other alternatives should be rejected.
	Step 2.10. If there is not yet an obvious preferred alternative following Steps 2.8 and 2.9, a benefit-cost (B/C) analysis may be conducted on the remaining alternatives to help identify the "best value" alternative. Consider calculating incremental benefit/cost ratios to further differentiate between alternatives.
	Step 2.11. Upon determining a preferred alternative, complete the ICE Decision Record, attach appropriate documentation from the analyses, and incorporate the output from Stage 1 and Stage 2 in to the completed Concept Report (or equivalent); carry preferred alternative in to preliminary design.

Table 1-B. ICE Stage 2 Procedural Steps

APPENDIX C. ICE RELATED TOOLS AND RESOURCES

- Spreadsheets for HSM Part C Calculations
  Excel spreadsheet-based calculators to aid the conduct of HSM analyses

- Crash Modification Factor (CMF) Clearinghouse
  Inventory and quality ratings of crash modification factors derived using HSM statistical models

- Interactive Highway Safety Design Model (IHSDM)
  Decision-support tool that provides estimates of expected safety and operational performance

- GDOT Roundabout Analysis Tool
  Excel spreadsheet-based capacity calculator for roundabouts

- Safety Performance for Intersection Control Evaluation (SPICE) Tool *[**Placeholder**]*
  Excel spreadsheet-based safety performance screening tool

- NCHRP Intersection Lifecycle Cost Analysis (LCCA) Tool
  Excel spreadsheet-based economic evaluation tool []

APPENDIX D. Example TE Study with Intersection Control Evaluation

Exhibit D-1: SR 101 @ Old Draketown Trail, Carroll County

Exhibit D-2: SR 140 @ Avery Road, Cherokee County

Exhibit D-1:

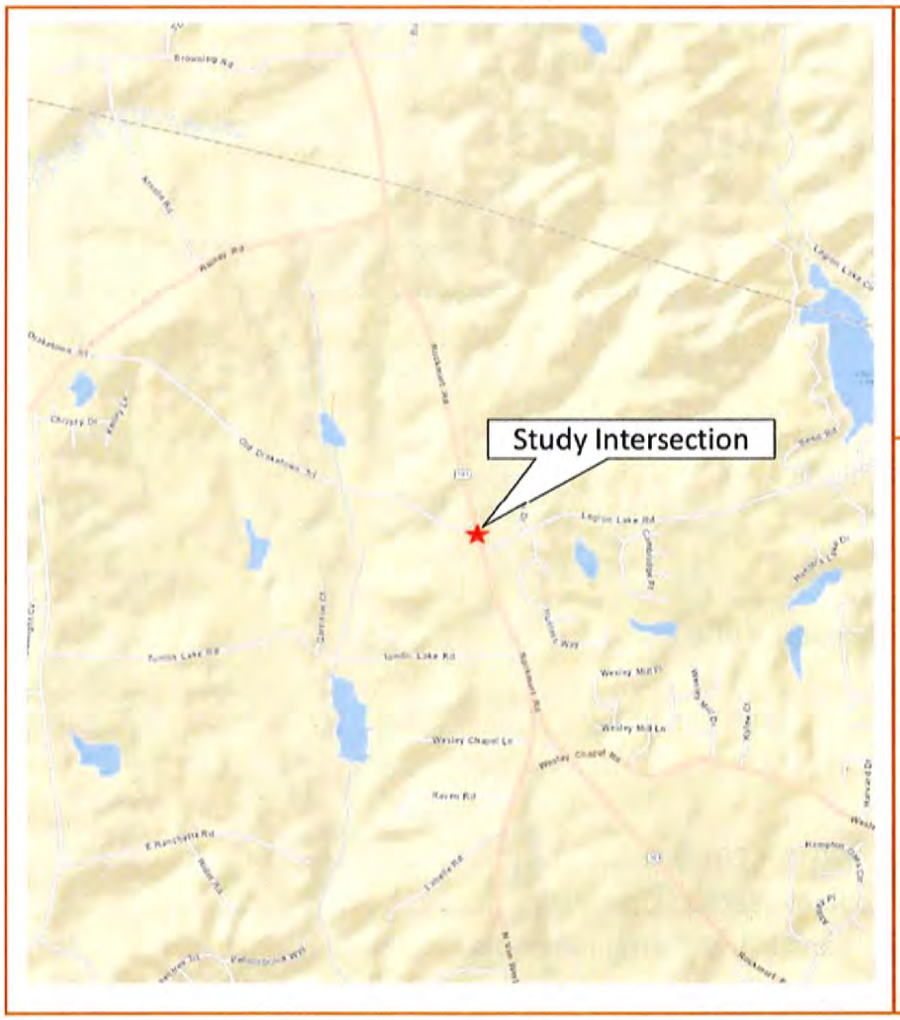
SR 101 @ Old Draketown Trail, Carroll County

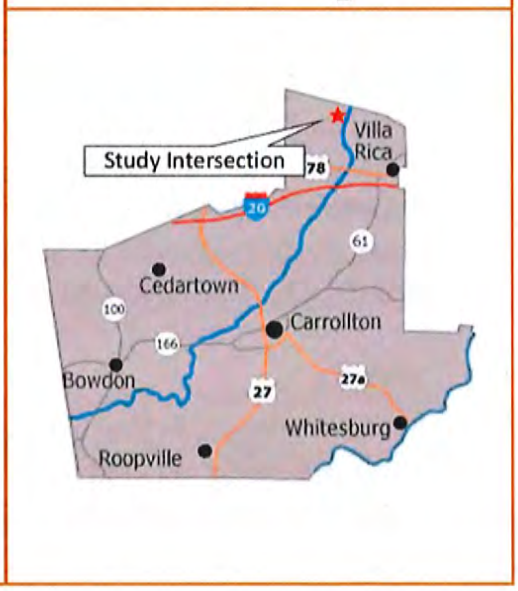
DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

TRAFFIC ENGINEERING STUDY

May 2017





PRIMARY ROUTE: SR 101 (Rockmart Road)

SECONDARY ROUTE: Old Draketown Trail

MILEPOINT: 5.27

GDOT DISTRICT: 6

CONGRESSIONAL DISTRICT 3

COUNTY: Carroll

CITY: Temple

PREPARED BY: ARCADIS

TABLE OF CONTENTS

TABLES

STUDY REQUEST: This study was requested by GDOT District 6 Traffic Operations (Grant Waldrop)

REASON FOR INVESTIGATION: SR 101 at Old Draketown Trail intersection has experienced 2.3 crashes per year from 2013-2015. Per the Highway Safety Manual (1) methodology, intersections with similar characteristics typically experience 2.1 crashes per year. Also, this intersection has experienced severe crashes resulting in multiple injuries and a fatality.

PROJECT LOCATION: SR 101 is a two-lane road with a posted speed of 55 MPH. It is classified as an Urban Minor Arterial that connects northern Carroll County and western Paulding County to I-20. There are few signalized intersections along this roadway, with the nearest signal to this intersection being 5 miles to the south. Old Draketown Trail is a two-lane local road with a posted speed of 45 MPH that connects Rainey Road to SR 101. There are no signalized intersections on Old Draketown Trail. **Figure 1** provides aerial view of the intersection geometrics.

Figure 1:Aerial Map of Study Intersection

FIELD VISIT

A field visit was conducted on Tuesday, November 15, 2016. The site visit observed the current site conditions as well as identifying and documenting conditions that could effect safety and operations. Field visit observations included:

- Intersection control: Currently SR 101 is free flow, and Old Draketown Trail is stop controlled. The pavement shows signs of wearing and cracking. Other Modes of Transportation: No other modes of transportation were noticed in the project vicinity.
- Horizontal/Vertical Grades: There is a steep gradient on the east side Old Draketown Trial approaching SR 101 inside of the clear zone. There is no guardrail at this location or at any location near the intersection. Old Draketown Trail intersects SR 101 at a 55-degree skew that can make turning more difficult.
- Intersection Delay / Queuing: There was no major delay or queuing issues at the intersection. The absences of a northbound left turn lane caused some vehicles to stop in the through travel lane to await a gap to turn left. This causes minor delay for northbound vehicles, and leads to a greater risk of rear-end crashes.

- Sight Distance / Vegetation Concerns: There is an adequate sight-triangle of vision for all approaches. There is a vertical crest on SR 101 just south of this intersection that impacts the visibility of northbound vehicles. There is no vegetation that could obstruct views.
- Pavement/Signs/Striping Conditions: The pavement and marking appeared adequate with only normal wear. There is a standard stop sign on the Old Draketown approach in good condition but a portion of the stop bar has worn off.
- Pedestrian Accommodations: There are no pedestrian accommodations provided at the intersection nor signs of significant pedestrian activity (no beaten path). There were two pedestrians observed during the site visit crossing the Old Draketown Trail approach. No other pedestrians were observed during the 12-hour traffic count.
- Lighting: There is no street lighting at the intersection.
- Parking: There is no on-street parking accommodations near the intersection.
- Potential Environmental Impacts: There is no appearance of any environmental concerns at this intersection.
- Other Modes of Transportation: There are no bus stops near this rural intersection

CRASH ANALYSIS

Crash data for over the most recent three-year period for which data is available was collected from GEARS. The number and types of crashes are provided in tabular form in **Appendix A** and **Table 1** below presents a comparison of crash rates, injury rates, and fatality rates along the study area. A crash diagram of all crashes occurring at this intersection is included in **Appendix B**.

Table 1: Intersection Crash History [2011 – 2013]

Collision Type	Year			
	2013	2014	2015	Total
Angle	-	-	-	-
Head On	-	-	-	-
Rear End	1	2	2	5
Sideswipe	-	-	-	-
Not a Collision with Motor Vehicle	-	-	2	2
Unknown	-	-	-	-
Total Crashes	1	2	4	7
Total Non-Fatal Injuries	-	-	-	-
Total Fatalities	-	-	-	-
Average Crashes (per year)				2.3
HSM Predicted Crashes (per year)				2.1
Average Daily Traffic (ADT)	9,350	9,350	9,350	
Crash Rate (per 100 MEV)	29	59	117	
Non-Fatality Injury Rate (per 100 MEV)	-	-	-	
Fatality Rate (per 100 MEV)	-	-	-	

ADT = average daily traffic; MEV = million entering vehicles

In the past five years, there have been seven crashes reported at SR 101 and Old Draketown Trail. Five of the crashes were rear end collisions and two involved running off roadway (attempting to avoid rear ending another vehicle). There were no injuries, nor fatalities involved in the reported crashes.

The study intersection has had an average of 2.3 crashes per year from 2013-2015. According to Highway Safety Manual (HSM) methodology, intersections with similar geometric, traffic control, and traffic volume characteristics typically experience 2.1 crashes per year.

OPERATIONAL ANALYSIS

Traffic Volume Counts:

A 12-hour intersection turning movement count was collected on Thursday, September 29, 2016. All cars, trucks or other motorized vehicles passing through the intersection were counted between the hours of 6:30AM and 6:30PM, broken into 15-minute intervals to determine peak morning, mid-day and afternoon peak hours. The percentage of trucks on each intersection leg was also reported. As a permanent count station is not available near of the intersection, the 12-hour data was used to project Average Daily Traffic (ADT) for each of the approach roadways. Queue length observations were made for critical movements during the AM and PM peak periods. The traffic volume counts collected and ADT reports and/or projections are included in **Appendix C**.

Existing Operations:

The intersection geometries, volumes and control specifics were inputs to a Synchro 9 model analysis of existing conditions that was calibrated to observed queuing conditions. The Synchro model reports for existing intersection conditions are include in **Appendix D** and the results are summarized in **Table 2** below.

Table 2: Existing AM / PM Peak Hour Intersection Operations

Intersection	Peak Period	Overall Delay/LOS	V/C Ratio	Eastbound		Westbound		Northbound		Southbound		ICU (%/LOS)
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	
SR 101 at Old Draketown Trail	AM	11.2 / B	0.24	11.2	B	N/A	N/A	1.4	A	0.00	A	0.44 / A
	PM	10.6 / B	0.24	10.6	B	N/A	N/A	2.5	A	0.0	A	0.54 / A

Note: LOS for unsignalized intersection is based on maximum side street approach delay

Signal Warrant Analysis:

The Manual of Uniform Traffic Control Devices 2009 Edition (MUTCD) is the established source for evaluating warrants for installing a traffic signal. The MUTCD established nine traffic signal warrants that define minimum conditions under which signal installations may be justified. Installation of a traffic signal can improve the overall safety and/or operation of an intersection but should be considered only when deemed necessary by analysis combined with engineering judgement, and less restrictive solutions have been considered.

A signal warrant analysis was evaluated based on the existing 12-hour turning movement counts that were used as inputs into the analysis model. The full warrants report is included in **Appendix E** and the results summarized in **Table 3** below.

Table 3: Summary of Current Conditions Signal Warrant Analysis

Intersection	Warrant 1a	Warrant 1b	Warrant 2	Warrant 3	Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Warrant 9
SR 101 at Old Draketown Trial	No	No	No	No	n/a	n/a	n/a	n/a	n/a	n/a

Based on the warrant analysis conducted combined with good engineering judgement, a signal is not warranted for this intersection.

INTERSECTION CONTROL EVALUATION (ICE)

GDOT's Intersection Control Evaluation (ICE) policies were developed to further leverage safety advancements as part of intersection improvements. The ICE process consists of 2 distinct stages. A Stage 1 evaluation identifies potential Intersection Control Types that may provide safety benefits. Stage 2 further evaluates those alternatives inclusive of safety, operations, cost, environmental

impacts and project support. The Stage 1 screening and Stage 2 ranking results are documented in **Appendix F.** Sketches of each Stage 2 alternative are included in **Appendix G**.

1. **Conventional (Minor Route Stop):** Old Draketown Trail is currently an offset tee pair with Legion Lake Road. Installing A northbound left turn lane would reduce the total amount of crashes as well as the occurrences of crashes that lead to injuries. As the left turn taper would extend to the SR 101 / Legion Lake Road intersection, it is recommended that the left turn lane should be extended through the Legion Lake Road intersection (providing back-to-back left turns) so that southbound left turns onto Legion Lake Road can be moved out of the southbound SR101 travel lane. The ICE level two screening showed that this was the best option when looking at cost, safety, operations, environmental, and political implications.

   A realignment of Legion Lake Road to intersect with Old Draketown Road would reduce the number of conflict points on SR101. However, the cost and impacts of the realignment would be considerable and the safety gain would not be more than the provision of a left turn bay as previously identified. Lastly, The addition of guardrail at the intersection would improve safety for vehicles running off the roadway.

2. **Single Lane Roundabout:** A single lane roundabout was analyzed using GDOT's Roundabout Analysis Tool spreadsheet with and without a northbound bypass lane. With such low right turn volume bypass lanes were determined not to be needed at this intersection.

3. **Conventional Signalized:** Intersection volumes do not meet signal warrants and thus a signalized intersection is not recommended.

Crash Reduction Factors

The Crash Reduction Factors used in the ICE Stage 2 analysis were determined from the FHWA's CMF Clearinghouse website (http://www.cmfclearinghouse.org/) and are provided in **Table 4** below:

Table 4: Crash Reduction Factors

Safety Countermeasure	PDO	Injury/Fatal
Turn Lane Improvements	49%	55%
Intersection Realignment	13%	N/A
Single Lane Roundabout	71%	87%
New guardrail embankment	3%*	55%*

**Running off road only crashes.*

EXPECTED OPERATIONAL RESULTS

For all alternatives considered in the Stage 2 analysis, the intersection delay and LOS was determined with the intersection control improvements made and the results are summarized in **Table 5.** All of the alternatives considered provide equal or improved intersection operating conditions compared to existing conditions.

Table 5: Operational Analysis Results

	Existing Stop Control		Turn Lane Improvements		Roadway Realignment		Single Lane Roundabout	
Approach	AM	PM	AM	PM	AM	PM	AM	PM
EB	11.2 - B	10.6 - A	11.2 - B	10.6 - A	11.2 - B	10.6 - A	5 - A	4 - A
WB	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NB	1.4 - A	2.5 – A	1.2 - A	1.8 – A	1.4 - A	2.5 – A	4 - A	6 - A
SB	0.0 - A	0.0 - A	0.0 - A	0.0 - A	0.0 - A	0.0 - A	5 - A	5 - A
Overall	11.2 - B	10.6 - A	11.2 - B	10.6 - A	11.2 - B	10.6 - A	-	-

Note: LOS for unsignalized intersection is based on maximum side street approach delay

BENEFIT-COST ANALYSIS

A summary of the Safety Benefit / Cost of the studied alternatives are presented in **Table 6**. The Turn Lane Improvements and Intersection Realignment alternatives are shown because the two projects will be combined and was analyzed to have the highest ICE Stage 2 score, as shown in **Appendix F.** A summary of the cost estimate development details is included in **Appendix H.**

Table 6: Benefit / Cost Ratio Analysis Results

Safety Countermeasure	Project Cost	B/C Ratio
Turn Lane Improvements	$435,673	18.38
Intersection Realignment	$195,097	0.17

CONCLUSION

The intersection of SR 101 and Old Draketown Trail experiences more crashes than the HSM methodology predicts, and there has been one intersection fatality. Potential solutions including the installation of a northbound left turn lane, replacing the intersection with a roundabout, and other minor intersection modifications showed a possible reduction in expected crashes.

Recommendations

A list of short, mid-term and long-term safety project recommendations are identified in **Table 7**. The result of the long-term project is expected to reduce the number of overall crashes to 1.0 crashes per year, and to have a 55 percent reduction of injury crashes. If the skew cannot be reasonably corrected, the northbound turn lane should be still be installed, resulting in a projected decrease of 1.2 crashes per year.

Table 7: Intersection Safety Improvement Recommendations

Short Term	Mid Term	Long Term
• Refresh paint or provide thermoplastic on the Old Draketown Road stop bar • Install additional intersection warning signs	• Install guardrail to reduce crashes involving vehicles running off the roadway	• Install a northbound turn lane (extending back-to-back with a southbound left turn lane at Legion Lake Road) • Correcting the Old Draketown Trail intersection skew (by teeing into SR 101 at or close to 90-degrees)

RECOMMENDED BY: _____ **DATE** 6-1-17

Jonathan Reid, PE, PTOE
Consultant Project Manager

RECOMMENDED BY: _____ **DATE** 6-8-17

Grant Waldrop, PE
District Traffic Engineer

Appendix A: Crash Data

AccidentNo	Agency Name	Date	Time	County	Route	Injuries	Fatalities	Manner Of Collision	First Harmful Event	Light	Surface	VehType1	VehType2	MnvrVeh1	MnvrVeh2	Number Of Vehicles	LatDecimal	LongDecimal	Serious Injuries	Visible Injuries	Complaint Injuries	U1Factors	U2Factors
4318573	Gsp Post 00	1/7/2013	13:45:00	CARROLL	GA 101 NEAR OLD DRAKETOWN RD SR 101 RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	Passenger Car	Passenger Car	Straight	Stopped	2	33.784465	-84.96716	0	0	0	No Contributing Factors	No Contributing Factors
4723036	Gsp Post 00	1/31/2014	17:40:00	CARROLL	LEGION LAKE RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	Pickup Truck	Utility Passenger Vehicle	Straight	Stopped	2	33.783103	-84.96662	0	0	0	No Contributing Factors	No Contributing Factors
5109944	Gsp Post 00	12/28/2014	1:05:00	CARROLL	GA 101 S OF LEGION LAKE RD	0	0	Not A Collision with Motor Vehicle	Ditch	Dark Not Lighted	Wet	Passenger Car		Turning Left		1	33.78309	-84.96677	0	0	0	No Contributing Factors	
5117725	Gsp Post 00	1/2/2015	10:10:00	CARROLL	GA-101	0	0	Rear End	Motor Vehicle In Motion	Daylight	Wet	Passenger Car	Passenger Car	Straight	Stopped	2	33.783767	-84.967025	0	0	0	No Contributing Factors	No Contributing Factors
5387516	Gsp Post 00	8/11/2015	16:12:00	CARROLL	LEGION LAKE RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	Pickup Truck	Pickup Truck	Straight	Stopped	2	33.78313	-84.96668	0	0	0	No Contributing Factors	No Contributing Factors
5510093	Gsp Post 00	11/8/2015	4:07:00	CARROLL	GA 101	0	0	Not A Collision with Motor Vehicle	Ditch	Dark Not Lighted	Wet	Passenger Car		Turning Right		1	33.78389	-84.96702	0	0	0	No Contributing Factors	

Appendix B: Intersection Crash Diagram

LOCATION: SR 101 @ Old Draketown Trail
CRASH PERIOD: 2013 to 2015

①

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality?	Pavement Condition
4318573	Rear End	01/07/13	Monday	1:45 PM	---	Dry
5117725	Rear End	01/02/15	Friday	10:10 AM	---	Wet

②

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality?	Pavement Condition
5109944	Single Vehicle	12/28/14	Sunday	1:05 AM	---	Wet

③

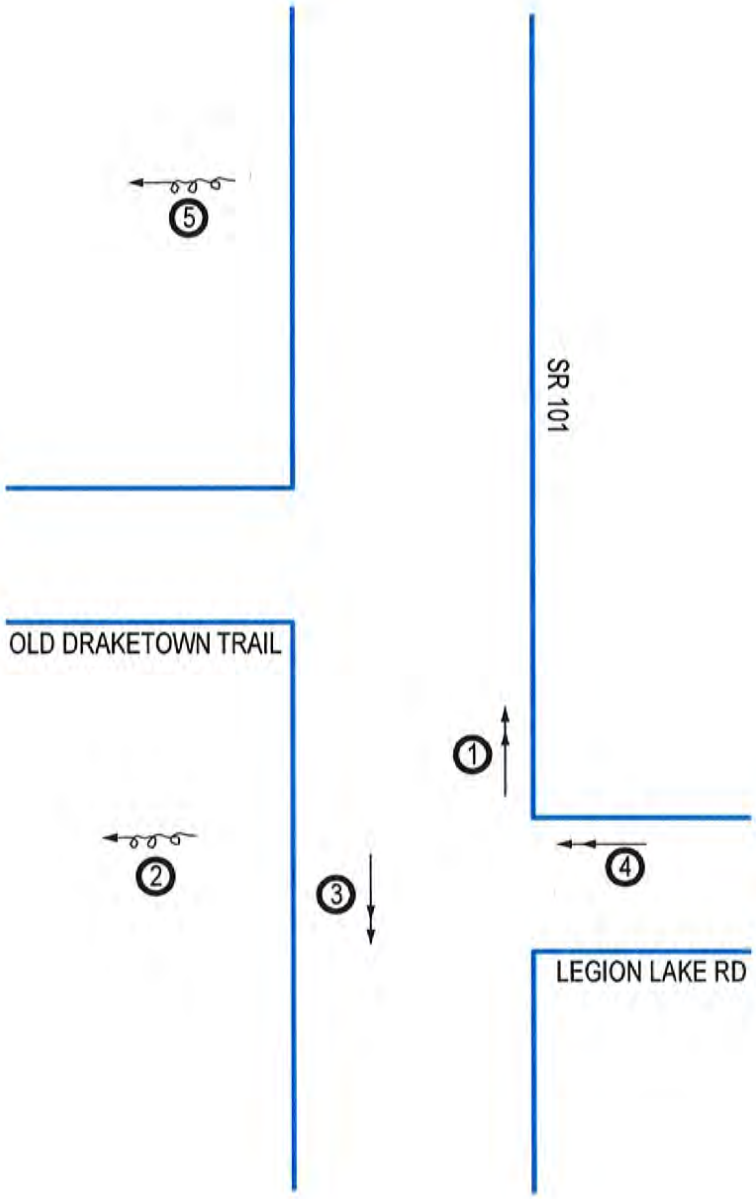
Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality?	Pavement Condition
3676514	Rear End	04/11/14	Friday	8:21 PM	Injury	Dry

④

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality?	Pavement Condition
4723036	Rear End	01/31/14	Friday	5:40 PM	---	Dry
5387516	Rear End	08/11/15	Tuesday	4:12 PM	---	Dry

⑤

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality?	Pavement Condition
5510093	Single Vehicle	11/08/15	Sunday	4:07 AM	---	Wet



SYMBOLS	TYPES OF CRASHES
Moving Vehicle	Rear End
Backing Vehicle	Head On
Non-Involved Vehicle	Side Swipe
Pedestrian	Out of Control
Parked Vehicle	Left Turn
Fixed Object	Right Angle

Appendix C: Traffic Data

All Traffic Data Services

1 SR 101 & Old Draketown Trail AM
Thursday, September 29, 2016

Peak Hour
05:00 PM - 06:00 PM
Peak 15-Minutes
05:15 PM - 05:30 PM

Traffic Counts - All Vehicles

	Old Draketown Trail										SR 101					SR 101						
	Eastbound					Westbound					Northbound					Southbound						Rolling
Time	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	Total	Hour
6:30 AM	0	1	0	22	0	0	0	0	0	0	0	4	35	0	0	0	0	82	0	0	144	605
6:45 AM	0	0	0	28	0	0	0	0	0	0	0	8	38	0	0	0	0	78	0	0	152	616
7:00 AM	0	0	0	22	0	0	0	0	0	0	0	5	37	0	0	0	0	74	0	0	138	624
7:15 AM	0	0	0	20	0	0	0	0	0	0	0	14	42	0	0	0	0	95	0	0	171	616
7:30 AM	0	1	0	17	0	0	0	0	0	0	0	4	37	0	0	0	0	96	0	0	155	578
7:45 AM	0	0	0	21	0	0	0	0	0	0	0	6	49	0	0	0	0	84	0	0	160	517
8:00 AM	0	0	0	15	0	0	0	0	0	0	0	2	38	0	0	0	0	75	0	0	130	453
8:15 AM	0	0	0	21	0	0	0	0	0	0	0	9	33	0	0	0	0	69	1	0	133	407
8:30 AM	0	0	0	15	0	0	0	0	0	0	0	8	30	0	0	0	0	39	2	0	94	377
8:45 AM	0	0	0	10	0	0	0	0	0	0	0	6	31	0	0	0	0	49	0	0	96	362
9:00 AM	0	0	0	15	0	0	0	0	0	0	0	4	23	0	0	0	0	42	0	0	84	373
9:15 AM	0	1	0	14	0	0	0	0	0	0	0	9	24	0	0	0	0	55	0	0	103	390
9:30 AM	0	0	0	9	0	0	0	0	0	0	0	4	35	0	0	0	0	31	0	0	79	374
9:45 AM	0	0	0	8	0	0	0	0	0	0	0	4	30	0	0	0	0	64	1	0	107	404
10:00 AM	0	0	0	12	0	0	0	0	0	0	0	12	28	0	0	0	0	49	0	0	101	382
10:15 AM	0	0	0	8	0	0	0	0	0	0	0	6	35	0	0	0	0	36	2	0	87	370
10:30 AM	0	0	0	13	0	0	0	0	0	0	0	7	41	0	0	0	0	48	0	0	109	388
10:45 AM	0	1	0	9	0	0	0	0	0	0	0	8	25	0	0	0	0	39	3	0	85	368
11:00 AM	0	1	0	6	0	0	0	0	0	0	0	6	33	0	0	0	0	42	1	0	89	395
11:15 AM	0	2	0	12	0	0	0	0	0	0	0	5	38	0	0	0	0	44	4	0	105	409
11:30 AM	0	0	0	9	0	0	0	0	0	0	0	12	37	0	0	0	0	31	0	0	89	403
11:45 AM	0	3	0	8	0	0	0	0	0	0	0	12	47	0	0	0	0	41	1	0	112	412
12:00 PM	0	1	0	9	0	0	0	0	0	0	0	4	49	0	0	0	0	40	0	0	103	391
12:15 PM	0	0	0	6	0	0	0	0	0	0	0	6	46	0	0	0	0	39	2	0	99	374
12:30 PM	0	0	0	8	0	0	0	0	0	0	0	13	29	0	0	0	0	47	1	0	98	400
12:45 PM	0	0	0	5	0	0	0	0	0	0	0	5	49	0	0	0	0	32	0	0	91	410
1:00 PM	0	0	0	12	0	0	0	0	0	0	0	5	40	0	0	0	0	29	0	0	86	448
1:15 PM	0	0	0	15	0	0	0	0	0	0	0	13	44	0	0	0	0	53	0	0	125	453
1:30 PM	0	0	0	15	0	0	0	0	0	0	0	8	36	0	0	0	0	47	2	0	108	460
1:45 PM	0	0	0	8	0	0	0	0	0	0	0	14	55	0	0	0	0	51	1	0	129	481
2:00 PM	0	0	0	11	0	0	0	0	0	0	0	5	38	0	0	0	0	37	0	0	91	489
2:15 PM	0	1	0	7	0	0	0	0	0	0	0	6	51	0	0	0	0	65	2	0	132	516
2:30 PM	0	2	0	9	0	0	0	0	0	0	0	13	55	0	0	0	0	48	2	0	129	531
2:45 PM	0	0	0	11	0	0	0	0	0	0	0	17	51	0	0	0	0	57	1	0	137	550
3:00 PM	0	2	0	12	0	0	0	0	0	0	0	17	46	0	0	0	0	39	2	0	118	576
3:15 PM	0	1	0	9	0	0	0	0	0	0	0	15	67	0	0	0	0	53	2	0	147	620
3:30 PM	0	2	0	10	0	0	0	0	0	0	0	20	64	0	0	0	0	52	0	0	148	643
3:45 PM	0	3	0	14	0	0	0	0	0	0	0	15	75	0	0	0	0	53	3	0	163	672

4:00 PM	0	0	0	10	0	0	0	0	0	0	0	12	83	0	0	0	0	56	1	0	162	694
4:15 PM	0	2	0	8	0	0	0	0	0	0	0	20	80	0	0	0	0	60	0	0	170	725
4:30 PM	0	2	0	9	0	0	0	0	0	0	0	17	95	0	0	0	0	53	1	0	177	766
4:45 PM	0	1	0	15	0	0	0	0	0	0	0	11	87	0	0	0	0	68	3	0	185	800
5:00 PM	0	1	0	17	0	0	0	0	0	0	0	16	92	0	0	0	0	66	1	0	193	819
5:15 PM	0	0	0	14	0	0	0	0	0	0	0	21	101	0	0	0	0	73	2	0	211	790
5:30 PM	0	0	0	14	0	0	0	0	0	0	0	21	97	0	0	0	0	74	5	0	211	774
5:45 PM	0	0	0	10	0	0	0	0	0	0	0	28	100	0	0	0	0	66	0	0	204	0
6:00 PM	0	0	0	20	0	0	0	0	0	0	0	19	74	0	0	0	0	51	0	0	164	0
6:15 PM	0	0	0	13	0	0	0	0	0	0	0	19	98	0	0	0	0	65	0	0	195	0
12-Hour Summary	0	28	0	605	0	0	0	0	0	0	0	515	2,468	0	0	0	0	2,637	46	0	6,299	23,205

Peak Rolling Hour Flow Rates

	Eastbound					Westbound					Northbound					Southbound					
Vehicle Type	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	Total
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	2	0	0	8
Lights	0	1	0	54	0	0	0	0	0	0	0	84	378	0	0	0	0	274	8	0	799
Mediums	0	0	0	1	0	0	0	0	0	0	0	2	6	0	0	0	0	3	0	0	12
Total	0	1	0	55	0	0	0	0	0	0	0	86	390	0	0	0	0	279	8	0	819
Bicycles on Crosswalk			0				0						0					0			0
Heavy Vehicle Percentage			1.8%										2.9%					1.7%			2.4%
Heavy Vehicle Percentage	0.0%	0.0%	0.0%	1.8%	0.0%						0.0%	2.3%	3.1%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	2.4%
Peak Hour Factor (PHF)			0.83										0.93					0.91			0.97
Peak Hour Factor (PHF)	0.00	0.67	0.00	0.82	0.00						0.00	0.79	0.97	0.00	0.00	0.00	0.00	0.91	0.55	0.00	0.97

Traffic Counts by Vehicle Type

	Eastbound					Westbound					Northbound					Southbound					
Time	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	Total
Articulated Trucks																					
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4	0	0	6
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	6	0	0	9
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	5
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	4	0	0	7
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	5
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	0	0	6

12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0	0	5
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	5
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	4
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	5
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	4
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	2	0	0	5
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
12-Hour Summary	0	0	0	0	0	0	0	0	0	0	0	2	74	0	0	0	0	65	0	0	141
Lights																					
6:30 AM	0	0	0	21	0	0	0	0	0	0	0	3	35	0	0	0	0	77	0	0	136
6:45 AM	0	0	0	28	0	0	0	0	0	0	0	8	37	0	0	0	0	73	0	0	146
7:00 AM	0	0	0	22	0	0	0	0	0	0	0	5	34	0	0	0	0	73	0	0	134
7:15 AM	0	0	0	20	0	0	0	0	0	0	0	14	41	0	0	0	0	89	0	0	164
7:30 AM	0	1	0	17	0	0	0	0	0	0	0	4	35	0	0	0	0	93	0	0	150
7:45 AM	0	0	0	21	0	0	0	0	0	0	0	6	43	0	0	0	0	77	0	0	147
8:00 AM	0	0	0	15	0	0	0	0	0	0	0	2	34	0	0	0	0	68	0	0	119
8:15 AM	0	0	0	21	0	0	0	0	0	0	0	8	33	0	0	0	0	66	1	0	129
8:30 AM	0	0	0	14	0	0	0	0	0	0	0	8	29	0	0	0	0	36	2	0	89
8:45 AM	0	0	0	9	0	0	0	0	0	0	0	6	26	0	0	0	0	48	0	0	89
9:00 AM	0	0	0	14	0	0	0	0	0	0	0	4	17	0	0	0	0	38	0	0	73
9:15 AM	0	1	0	14	0	0	0	0	0	0	0	9	20	0	0	0	0	53	0	0	97
9:30 AM	0	0	0	9	0	0	0	0	0	0	0	4	27	0	0	0	0	31	0	0	71
9:45 AM	0	0	0	8	0	0	0	0	0	0	0	4	26	0	0	0	0	62	1	0	101
10:00 AM	0	0	0	12	0	0	0	0	0	0	0	12	24	0	0	0	0	49	0	0	97
10:15 AM	0	0	0	8	0	0	0	0	0	0	0	5	30	0	0	0	0	35	2	0	80
10:30 AM	0	0	0	13	0	0	0	0	0	0	0	7	36	0	0	0	0	42	0	0	98
10:45 AM	0	1	0	9	0	0	0	0	0	0	0	8	24	0	0	0	0	37	3	0	82
11:00 AM	0	1	0	6	0	0	0	0	0	0	0	6	32	0	0	0	0	40	1	0	86
11:15 AM	0	2	0	12	0	0	0	0	0	0	0	5	35	0	0	0	0	40	4	0	98
11:30 AM	0	0	0	8	0	0	0	0	0	0	0	12	36	0	0	0	0	30	0	0	86
11:45 AM	0	3	0	8	0	0	0	0	0	0	0	11	44	0	0	0	0	36	1	0	103
12:00 PM	0	1	0	8	0	0	0	0	0	0	0	4	46	0	0	0	0	39	0	0	98
12:15 PM	0	0	0	6	0	0	0	0	0	0	0	6	45	0	0	0	0	35	2	0	94
12:30 PM	0	0	0	8	0	0	0	0	0	0	0	12	28	0	0	0	0	42	1	0	91
12:45 PM	0	0	0	5	0	0	0	0	0	0	0	5	45	0	0	0	0	30	0	0	85
1:00 PM	0	0	0	12	0	0	0	0	0	0	0	5	38	0	0	0	0	27	0	0	82

1:15 PM	0	0	0	15	0	0	0	0	0	0	0	11	39	0	0	0	0	49	0	0	114
1:30 PM	0	0	0	15	0	0	0	0	0	0	0	8	35	0	0	0	0	45	2	0	105
1:45 PM	0	0	0	8	0	0	0	0	0	0	0	12	51	0	0	0	0	45	1	0	117
2:00 PM	0	0	0	11	0	0	0	0	0	0	0	5	33	0	0	0	0	35	0	0	84
2:15 PM	0	1	0	7	0	0	0	0	0	0	0	6	44	0	0	0	0	61	2	0	121
2:30 PM	0	2	0	9	0	0	0	0	0	0	0	13	54	0	0	0	0	46	2	0	126
2:45 PM	0	0	0	11	0	0	0	0	0	0	0	17	49	0	0	0	0	52	1	0	130
3:00 PM	0	1	0	12	0	0	0	0	0	0	0	17	45	0	0	0	0	37	2	0	114
3:15 PM	0	1	0	9	0	0	0	0	0	0	0	14	63	0	0	0	0	51	2	0	140
3:30 PM	0	2	0	10	0	0	0	0	0	0	0	19	61	0	0	0	0	48	0	0	140
3:45 PM	0	2	0	13	0	0	0	0	0	0	0	14	71	0	0	0	0	49	2	0	151
4:00 PM	0	0	0	10	0	0	0	0	0	0	0	11	79	0	0	0	0	53	1	0	154
4:15 PM	0	2	0	8	0	0	0	0	0	0	0	19	78	0	0	0	0	57	0	0	164
4:30 PM	0	2	0	9	0	0	0	0	0	0	0	14	91	0	0	0	0	48	1	0	165
4:45 PM	0	1	0	15	0	0	0	0	0	0	0	11	85	0	0	0	0	66	3	0	181
5:00 PM	0	1	0	16	0	0	0	0	0	0	0	16	87	0	0	0	0	65	1	0	186
5:15 PM	0	0	0	14	0	0	0	0	0	0	0	21	101	0	0	0	0	71	2	0	209
5:30 PM	0	0	0	14	0	0	0	0	0	0	0	20	93	0	0	0	0	74	5	0	206
5:45 PM	0	0	0	10	0	0	0	0	0	0	0	27	97	0	0	0	0	64	0	0	198
6:00 PM	0	0	0	20	0	0	0	0	0	0	0	19	74	0	0	0	0	51	0	0	164
6:15 PM	0	0	0	13	0	0	0	0	0	0	0	19	97	0	0	0	0	64	0	0	193
12-Hour Summary	0	25	0	597	0	0	0	0	0	0	0	496	2,327	0	0	0	0	2,497	45	0	5,987
Mediums																					
6:30 AM	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0	0	7
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	3	0	0	7
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
8:30 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3
8:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	6
9:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	6
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	7
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	1	0	0	5
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
11:30 AM	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3
12:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	4	0	0	6
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	4
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	4	0	0	7
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4	0	0	8
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0	0	5

2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
3:00 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	2	0	0	5
3:45 PM	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	3	1	0	8
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	1	0	0	6
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	0	0	4
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	3	0	0	7
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
5:00 PM	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	5
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	3
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
12-Hour Summary	0	3	0	8	0	0	0	0	0	0	0	17	67	0	0	0	0	75	1	0	171

Bicycles on Crosswalk

	Eastbound			Westbound			Northbound			Southbound		
Time	CCW	CW	Total	CCW	CW	Total	CCW	CW	Total	CCW	CW	Total
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0

2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
12-Hour Summary	0	0	0	0	0	0	0	0	0	0	0	0

Pedestrians

	Eastbound			Westbound			Northbound			Southbound		
Time	CCW	CW	Total	CCW	CW	Total	CCW	CW	Total	CCW	CW	Total
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	1	1	2	0	0	0	0	0	0	0	1	1
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0

3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
12-Hour Summary	1	1	2	0	0	0	0	0	0	0	1	1

Appendix D: Traffic Analysis

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	80	29	165	349	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	87	32	179	379	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	621	379	379	0	-	0
Stage 1	379	-	-	-	-	-
Stage 2	242	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	451	668	1179	-	-	-
Stage 1	692	-	-	-	-	-
Stage 2	798	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	437	668	1179	-	-	-
Mov Cap-2 Maneuver	437	-	-	-	-	-
Stage 1	692	-	-	-	-	-
Stage 2	774	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.2	1.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1179	-	664	-	-
HCM Lane V/C Ratio	0.027	-	0.133	-	-
HCM Control Delay (s)	8.1	0	11.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.5	-	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	55	86	390	279	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	110	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	67	82	79	97	91	55
Heavy Vehicles, %	2	2	3	3	2	2
Mvmt Flow	1	67	109	402	307	15

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	934	314	321	0	-	0
Stage 1	314	-	-	-	-	-
Stage 2	620	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.13	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.227	-	-	-
Pot Cap-1 Maneuver	295	726	1233	-	-	-
Stage 1	741	-	-	-	-	-
Stage 2	536	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	269	726	1233	-	-	-
Mov Cap-2 Maneuver	269	-	-	-	-	-
Stage 1	741	-	-	-	-	-
Stage 2	489	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.7	1.7	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1233	-	700	-	-
HCM Lane V/C Ratio	0.088	-	0.098	-	-
HCM Control Delay (s)	8.2	-	10.7	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.3	-	0.3	-	-

Georgia Department of Transportation

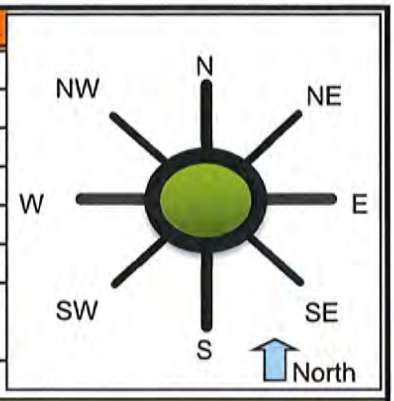
Roundabout Analysis Tool
Single Lane

5/26/2017
Version 4.1

General & Site Information

v 4.1

Analyst:	Selma Hasancevic
Agency/Co:	Arcadis
Date:	
Project or PI#:	
Year, Peak Hour:	2016, 7 AM
County/District:	Carroll
Intersection Name:	SR 101 at Old Draketown Trail



Volumes		Entry Legs (FROM) N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
	N (1), vph					165		1	
Exit	NE (2), vph								
Legs	E (3), vph								
(TO)	SE (4), vph								
	S (5), vph	349						80	
	SW (6), vph								
	W (7), vph					29			
	NW (8), vph								
Output	Total Vehicles	349	0	0	0	194	0	81	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98.3%	100.0%	100.0%	100.0%	97.1%	100.0%	98.2%	100.0%
% Heavy Vehicles	1.7%	0.0%	0.0%	0.0%	2.9%	0.0%	1.8%	0.0%
% Bicycle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	*0.91*	*0.95*	*0.95*	*0.95*	*0.93*	*0.95*	*0.83*	*0.95*
F_{HV}	0.983	1.000	1.000	1.000	0.972	1.000	0.982	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	0	0	183	0	1	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	0	0	0	0	0	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	390	0	0	0	0	0	98	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	32	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	390	0	0	0	215	0	99	0
Conflicting flow, pcu/h	32	0	0	0	1	0	390	0

Results: Approach Measures of Effectiveness

HCM 6th Edition	N	NE	E	SE	S	SW	W	NW
Entry Capacity, vph	1313	NA	NA	NA	1339	NA	911	NA
Entry Flow Rates, vph	384	NA	NA	NA	209	NA	98	NA
V/C ratio	**0.29**				**0.16**		**0.11**	
Control Delay, sec/pcu	**5**				**4**		**5**	
LOS	A				A		A	
95th % Queue (ft)	**31**				**14**		**9**	

Notes: v 4.0

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

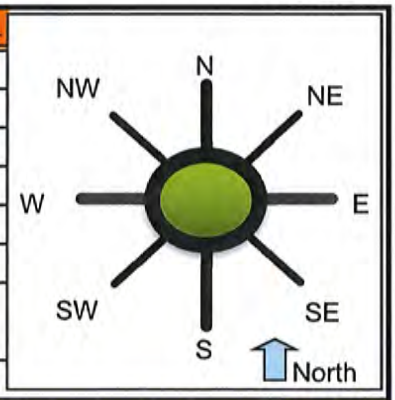
Bypass Lane Merge Point Analysis (if applicable)

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 6th Edition)						
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

v 4.1

Analyst:	Selma Hasancevic
Agency/Co:	Arcadis
Date:	
Project or PI#:	
Year, Peak Hour:	2016, 3 PM
County/District:	Carroll
Intersection Name:	SR 101 at Old Draketown Trail



Volumes		Entry Legs (FROM) N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
	N (1), vph					390		1	
Exit	NE (2), vph								
Legs	E (3), vph								
(TO)	SE (4), vph								
	S (5), vph	279						55	
	SW (6), vph								
	W (7), vph	8				86			
	NW (8), vph								
Output	Total Vehicles	287	0	0	0	476	0	56	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98.3%	100.0%	100.0%	100.0%	97.1%	100.0%	98.2%	100.0%
% Heavy Vehicles	1.7%	0.0%	0.0%	0.0%	2.9%	0.0%	1.8%	0.0%
% Bicycle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
# of Pedestrians **(ped/hr)**	0	0	0	0	0	0	0	0
PHF	*0.91*	*0.95*	*0.95*	*0.95*	*0.93*	*0.95*	*0.83*	*0.95*
F_{HV}	0.983	1.000	1.000	1.000	0.972	1.000	0.982	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	0	0	432	0	1	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	0	0	0	0	0	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	312	0	0	0	0	0	67	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	9	0	0	0	95	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	321	0	0	0	527	0	69	0
Conflicting flow, pcu/h	95	0	0	0	1	0	312	0

Results: Approach Measures of Effectiveness

HCM 6th Edition	N	NE	E	SE	S	SW	W	NW
Entry Capacity, vph	1231	NA	NA	NA	1339	NA	986	NA
Entry Flow Rates, vph	315	NA	NA	NA	512	NA	67	NA
V/C ratio	**0.26**				**0.38**		**0.07**	
Control Delay, sec/pcu	**5**				**6**		**4**	
LOS	A				A		A	
95th % Queue (ft)	**26**				**47**		**6**	

Notes: v 4.0

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 6th Edition)						
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 E: Signal Warrant Analysis

Warrants Summary

Information			
Analyst		Intersection	SR 101 @ Old Draketown Trail
Agency/Co	Carroll County	Jurisdiction	GDOT
Date Performed	11/8/2016	Units	U.S. Customary
Project ID		Time Period Analyzed	PM
East/West Street	Old Draketown Trail	North/South Street	SR 101
File Name	Warrants Analysis	Major Street	North-South

Project Description

General				Roadway Network	
Major Street Speed (mph)	55	☑	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	0	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	3	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	1	0	0	0	0	0	0	1	0	0	1	0
Lane usage	L	LR						LT			TR	
Vehicle Volume Averages (vph)	2	0	43	0	0	0	38	185	0	0	198	3
Peds (ped/h) / Gaps (gaps/h)	--	/	--	--	/	--	--	/	--	--	/	--
Delay (s/veh) / (veh-hr)	--	/	--	--	/	--	--	/	--	--	/	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☐
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 3: Peak Hour	☐
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 4: Pedestrian Volume	☐
4 A. Pedestrian Volumes (Four hours --or-- one hour) --and--	☐
4 B. Gaps Same Period (Four hours --or-- one hour)	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐

7 C. 80% Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐

Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐

Appendix F: Intersection Control Evaluation (ICE)

INTERSECTION CONTROL EVALUATION (ICE) TOOL

Version 1.8
Revised 4/14/2017

GDOT PI # (or N/A)	N/A	County:	Carroll	Requested By:	District Engineer	Date:	4/19/2017
Major (State) Route:	SR 101			GDOT District:	6 - Cartersville	Area Type:	Rural
Crossing Route:	Old Draketown Trail			Prepared By:	Arcadis	Analyst:	T. Galloway
Project Purpose:	Improve intersection safety					Project ID:	3005

Introduction In 2005, SAFETEA-LU established the Highway Safety Improvement Program (HSIP) and mandated that each State prepare a Strategic Highway Safety Plan (SHSP) by which to prioritize safety funding investments. Intersections quickly became a common component of a majority of States' SHSP emphasis areas and HSIP project lists, including in Georgia's SHSP. Intersection Control Evaluation (ICE) policies and procedures represent a traceable and transparent procedure to streamline the evaluation of intersection control alternatives, and to further leverage the safety advancements noted above for intersection improvements beyond just the safety program. As approximately one-third of all traffic fatalities and roughly 75% of all traffic crashes in Georgia occur at or adjacent to intersections, the Georgia SHSP includes an emphasis on enhancing intersection safety in order to advance toward the Toward Zero Deaths vision embraced by the Georgia Governor's Office of Highway Safety. This ICE tool was developed to support the ICE policy and help ensure that intersection investments across the entire Georgia highway system are selected, prioritized and implemented with defensible benefits for safety toward those ends.

Tool Goal The goal of this ICE tool is to provide a simplified and consistent way of using traffic, safety, cost, environmental impact and political support data to assess and quantify intersection control improvement benefits and aid decision making by the Department in a manor that provides traceability, transparency, consistency and accountability when identifying and selecting an intersection control solution that both meets the project purpose and reflects the overall best value in terms of specific performance-based criteria.

Requirements An ICE is **required** for any intersection improvement (e.g., a new intersection, an intersection modification, widening/reconstruction or corridor project, or work accomplished through a driveway or encroachment permit that affects an intersection) where **1)** the intersection includes at least one roadway designated as a State Route (State Highway System) or as part of the National Highway System; and/or **2)** the intersection will be designed or constructed using State or Federal funding. In certain circumstances where an ICE would otherwise be required, the requirement **may** be waived based on appropriate evidence presented with a written request. Please see the "Waiver" tab to understand the criteria that may make a project waiver eligible and learn how to submit a waiver request to the Department. An ICE is **not required** when the proposed work involved does not include any major changes to an intersection that would substantially alter the character of the intersection; for instance, a project limited only to "mill and fill" pavement resurfacing with no change to intersection geometry or control, or routine traffic signal timing (not to include adding a phase) and equipment maintenance.

Two-Stage Process A complete ICE process consists of two (2) distinct stages, and it is expected that the respective level of effort for completing both stages of ICE will correspond to the magnitude and complexity of the intersection. The Stage 1 and Stage 2 ICE forms are designed to keep data inputs at a minimum, requiring limited data entry and drop-down menu fields. All fields shaded in grey have drop down menu choices and all fields shaded in blue require a text response. All other cells in the worksheet are locked to prohibit the entering or editing of data.

Stage 1: Screening Decision Record Stage 1 is conducted as early in the project development process as possible and is intended to inform which alternatives are worthy of further evaluation in Stage 2. A Stage 1 evaluation normally requires sufficient analysis or subject matter expertise to estimate the preliminary footprint of the intersection to determine whether or not an alternative is practical to implement. Users should use good engineering judgement in responding to seven policy questions by selecting "Yes" or "No" in the drop-down boxes and alternatives should not be summarily eliminating without due consideration. Reasons for eliminating or advancing an alternative should be documented in the rightmost column with heading: "Screening Decision Justification".

Stage 2: Alternative Selection Decision Record Stage 2 involves a more detailed and familiar evaluation of alternatives identified in Stage 1 in order to support the selection of a preferred alternative that may be advanced to detailed design. Based on the Concept Development Process outlined by the PDP Manual, Stage 2 would begin after the Initial Concept Meeting for corridor improvements and projects consisting of multiple intersections. The data entry is similar in process to Stage 1 but is more robust, requiring separate analysis of each alternative to determine cost, impacts, operations, safety and project support. A separate "Instructions" tab is provided to provide guidance to the user on data entry values and parameters. Once all the data is entered, a score and ranking of each alternative is calculated and reported on the bottom line of the worksheet to inform on the best intersection treatment to select as the preferred alternative.

Documentation A complete ICE document consists of the combination of the outputs from both Stage 1 and Stage 2 along with supporting documentation, to be included in the approved project Concept Report (or equivalent) or as a stand-alone document.

GDOT ICE STAGE 1: SCREENING DECISION RECORD

GDOT PI #	N/A
Major Route:	SR 101
Minor Route:	Old Draketown Trail
Prepared by:	Arcadis
Analyst:	T. Galloway
Date Completed:	4/19/2017

Answer "Yes" or "No" to each policy question for each control type to identify which alternatives should be evaluated in the Stage 2 Decision Record. Enter justification in the rightmost column.
Note: *No more than 5 alternatives may selected and evaluated in Stage 2.*

Version 1.8
Revised 4/14/2017

	Intersection Alternative:	1 Does alternative address the project need in a balanced manner and in scale with the project?	2 Does alternative improve safety performance in terms of reducing severe crashes?	3 Does alternative incorporate convenience and accessibility for pedestrians and /or bicyclists?	4 Does alternative improve (or preserve) traffic operations (congestion, delay, reliability, etc.)?	5 Does alternative appear feasible given the site characteristics, constrains and location context?	6 Does alternative appear feasible with respect to other project factors?	7 Overall feasible alternative (select alternative for further evaluation in Stage 2)?	Screening Decision Justification:
Unsignalized	Conventional (Minor Stop)	No	No	No	**Yes**	**Yes**	**Yes**	No	Existing Condition
	Conventional (All-Way Stop)	No	**Yes**	No	**Yes**	No	No	No	Low side street volume
	Mini Roundabout	No	**Yes**	No	No	No	No	No	High speed mainline
	Single Lane Roundabout	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**Potential solution to evaluate**
	Multilane Roundabout	No	No	No	No	No	No	No	All single lane approaches
	RCUT (unsignalized)	No	No	No	No	No	No	No	Signigicant impacts to improve from undivided to divided roadway
	RIRO w/downstream U-Turn	No	No	No	No	No	No	No	Significant thru volumes / insufficient ROW on mainline
	Unsignalized High-T	No	No	No	No	No	No	No	Low volume
	Offset-Tee Pair	No	No	No	No	No	No	No	No thru vehicles
	Other Unsignalized (provide description):	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Fix Intersection skew**
	Other Unsignalized (provide description):	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Add Left Turn Lane**
Signalized Intersections	Traffic Signal	No	No	No	No	No	No	No	Does not meet signal warrants
	Median U-Turn (Indirect Left)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	RCUT (signalized)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Displaced Left Turn (CFI)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Continuous Green-Tee (Hight-T)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Jughandle (Any Corner)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Quadrant Roadway (Any Corner)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Diverging Diamond (Ramp Terminals)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Single Point Interch (Ramp Terminals)	No	No	No	No	No	No	No	N/A - Not an interchange
	Other Signalized (provide description):	No	No	No	No	No	No	No	N/A - Not an interchange
	Other Signalized (provide description):	No	No	No	No	No	No	No	Write in control type / improvements

☐ = Intersection type selected for more detailed analysis in Stage 2 Alternative Selection Decision Record

GDOT ICE STAGE 2: ALTERNATIVE SELECTION DECISION RECORD

Version 1.8
Revised 4/14/2017

Project Information

GDOT PI # (or N/A): N/A
GDOT District: 6 - Cartersville
Date: 4/19/2017
County: Carroll
Area Type: Rural
Agency/Firm: Arcadis
Project Location: SR 101 @ Old Draketown Trail
Analyst: T. Galloway

Existing Intersection Control: Conventional (Minor Stop)
Type of Analysis: Safety Funded Project

Existing Conditions

Intersection meets Signal warrants?	No
Intersection meets AWSC warrants?	No
Traffic Analysis Software	Synchro 9
Existing Pk Hr Intersection Delay*	2.2
Existing Intersection V/C ratio*	0.19
Design Year	2017
Design Year Intersection Delay*	2.2
Design Year V/C Ratio*	0.19

* = worst case AM/PM results

Crash Data:

Crash Type	3 most recent years of intersection crash data	Crash Severity: PDO	Injuries	Fatalities
	Angle	0	0	0
	Head-On	0	0	0
	Rear End	4	0	0
	Sideswipe - same	0	0	0
	Sideswipe - opposite	0	0	0
	Not Collision w/Motor Veh	2	0	0
	TOTALS:	6	0	0

Alternatives Analysis

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Proposed Control Type/Improvement	Single Lane Roundabout	Fix Intersection skew	Add Left Turn Lane	N/A	N/A
Project Cost					
Construction Cost	$644,002	$113,542	$338,325		
ROW Cost	$32,200	$10,191	$12,766		
Environmental Cost	$0	$0	$0		
Reimbursable Utility	$19,161	$5,677	$16,916		
PE+Contingency Cost (30%)	$208,609	$38,823	$110,402		
Total Cost	$903,972	$168,233	$478,409		
Traffic Operations					
Design Yr Intersection Delay	5.5	2.2	1.8		
Design Yr V/C Ratio	0.31	0.19	0.24		
Traffic Analysis Software	GDOT RND Tool 4.0	Synchro 9	Synchro 9		
Safety Analysis					
Predefined CRF: PDO	71%	0%	0%		
Predefined CRF: Fatal/Inj	87%	0%	0%		
User Defined CRF: PDO		13%	49%		
User Defined CRF: Fatal/Inj		0%	55%		
User Defined CRF Source (if applicable):		CMF Clearinghouse # 5188	CMF Clearinghouse #s 4703 / 4704 / 5188		
Environmental Impacts					
Historic District/Property	None	None	None	None	
Archaeology Resources	None	None	None	None	
Graveyard	None	None	None	None	
Stream	None	None	None	None	
Underground Tank/Hazmat	None	None	None	None	
Park Land	None	None	None	None	
Environmental Justice Community	None	None	None	None	
Wooded Area	None	None	None	None	
Wetland	None	None	None	None	
Political Factors	*If environmental impact is highlighted **RED**, provide justification impact won't jeopardize project delivery on ENV worksheet tab.*				
Local Citizen Support	Neutral	Neutral	Supportive	Neutral	
Local Government Support	Neutral	Neutral	Strong	Neutral	
GDOT District Office Support	Neutral	Neutral	Supportive	Neutral	
GDOT Central Office Support	Neutral	Neutral	Supportive	Neutral	
Final ICE Stage 2 Score	7.4	6.5	7.8	-	-
Rank of Control Type Alternatives:	2	3	1	-	-

Note: Stage 2 score is not shown (shown as "-") if signal or AWS is selected as control type but signal or AWS warrants are not met

Provide any additional general comments or explain analysis inputs (as necessary):

No comments.

Appendix G: Alternative Sketches

GDOT

ARCADIS

SCALE IN FEET

0 75 150

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

SR 101 AT
OLD DRAKETOWN TRAIL
EXISTING CONDITIONS

PAGE
1 OF 3

GDOT

ARCADIS

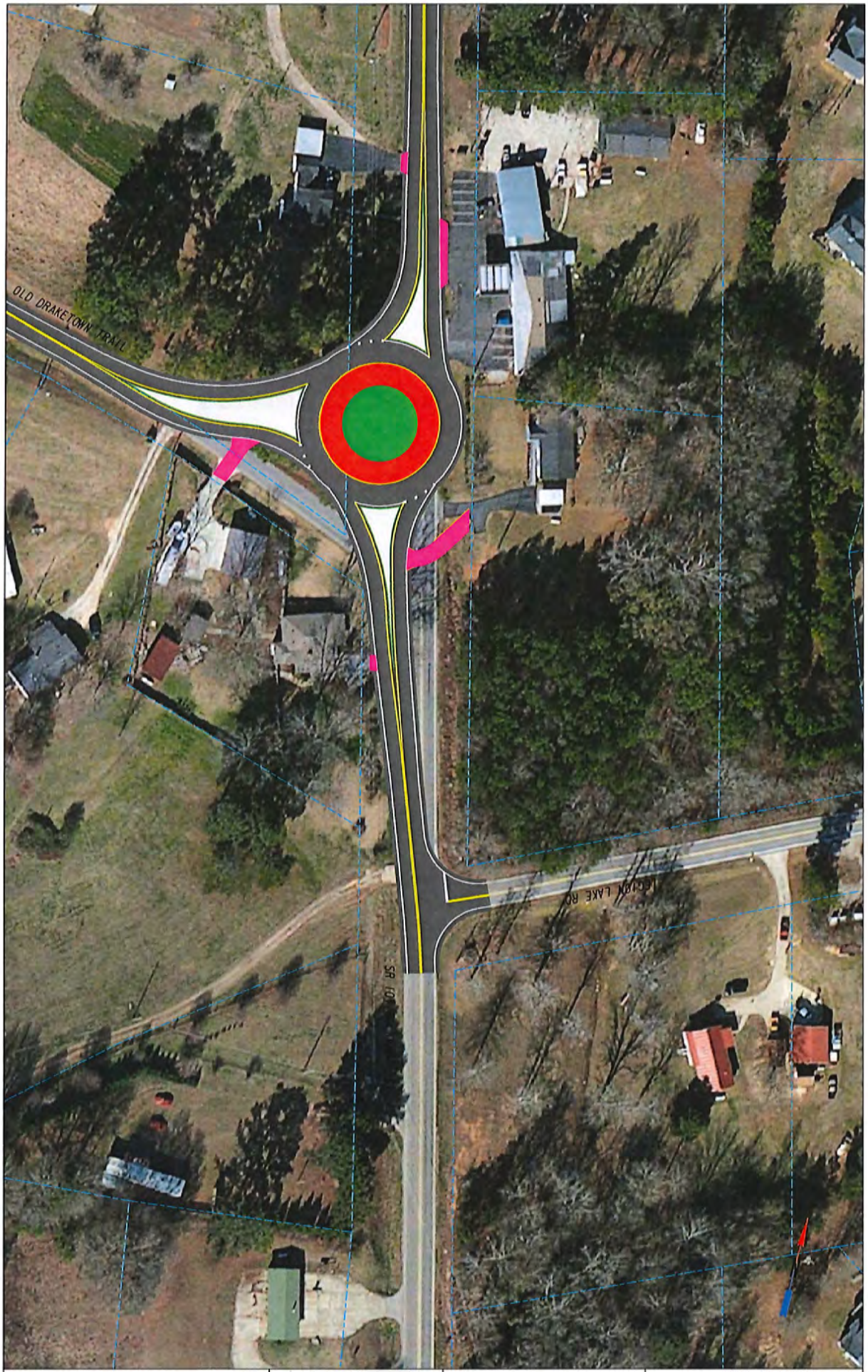
SCALE IN FEET

0 75 150

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

SR 101 AT
OLD DRAKETOWN TRAIL
PROPOSED IMPROVEMENTS

PAGE
3 OF 3



GDOT
ARCADIS

SCALE IN FEET
0 75 150

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

SR 101 AT
OLD DRAKETOWN TRAIL
ROUNDABOUT

Appendix H: Cost Estimates

Planning Level Project Cost Estimation

Project Identification SR 101 @ Old Draketown Trail Safety

Description	Add Left Turn Lane		Proj. Type	
From/To Limit			District	3
Notes				
SR 101	0.15 miles			
Old Draktown Trail	0.03 miles	total	0.18	

Cost Summary Incl. Contingency	
Preliminary Engineering	$ 67,665
Reimbursable Utility	$ 16,916
Right-of-Way	$ 12,766
Construction	$ 338,325
Total	$ 435,673

Construction Costs

Average Per Lane-Mile Components	Unit Cost	Miles	Add Lanes	Lane-Miles	Cost
Surface Str. New Cst. base & pave	$410,000	0.03	2.00	0.06	$24,600
SR or High volume Rd widening	$500,000	0.10	1.00	0.1	$50,000
Surface Street Overlay	$64,000	0.18	2.00	0.36	$23,040
Concrete Widening (Ramps)	$843,744			0	$0
Cross Streets widening	$307,500			0	$0
Cross Street Overlay	$20,000				$0
Traffic Control	$150,000	0.18	1.00		$27,000
Typical Driveways	$75,000	0.01	3.00		$2,250
Typical E & S Control Temp&Perm	$150,000	0.18	2.00		$54,000
Typical Earthwork	$500,000	0.15	0.50		$37,500
Typical Drainage - Urban Section	$255,000				$0
Curb & Gutter both sides (mile)	$264,000				$0
Typical Drainage - Rural Section	$150,000	0.18	1.00		$27,000
Signing & Marking	$50,000	0.18	2.00		$18,000
Typical Clear & Grub-120 ft wide	$109,091				$0
Typical Guardrail Type W	$212,000				$0
20ft. Raised median +C&G (mile)	$968,000				$0
Median landscaping	$100,000				$0
Sidewalks 5 ft. ea.side (mile)	$294,000				$0
ADA Ramps	$1,500				$0
					$0
				Subtotal	**$263,390**

Additional Per Mile Components	Unit Cost	Length	factor		Cost
Add'l Major Earthwork (mile)	$350,000				$0
Add'l Major Drainage (mile)	$150,000				$0
Add'l Major Grade changes (mile)	$350,000				$0
Major alignment corrections (mile)	$750,000	0.03	2.00		$45,000
Maint of Traffic difficulty (mile)	$200,000				$0
Temporary Barrier	$30				$0
Concrete Island + C&G (SY)	$60				$0
Add'l guardrail Type T (mile)	$423,000				$0
Paved Shoulders, 4 ft, 2 sides(mile)	$100,000				$0
blank	$0				$0
blank	$0				$0
Bikeway, 4 feet, both side (mile)	$333,333				$0
Add'l driveways (mile)	$75,000				$0
Cl. B Conc. Base or pvmt widening	$792,000				$0
Special E&S control	$300,000				$0
				Subtotal	**$45,000**

Individual Components	Unit Cost	Length (ft)	Width (ft)	Ht (ft)	Cost
Truck Apron	$506,880				$0
Conc Header Crub, TP 7 both sides (r	$126,720				$0
Conc Header Crub, TP 9 both sides (r	$147,840				$0
Retaining Walls - Gravity 0 - 5' (LF)	$60	0			$0
Retaining Walls-Gravity 5'-max (LF)	$120	0			$0
Retaining Walls-Special Design(SF)	$60	0		0	$0
Bridges - widen (SF)	$100	0	0		$0
Bridges - widen (SF)	$100	0	0		$0
Bridges - replace (SF)	$120	0	0		$0
Bridges - replace (SF)	$120	0	0		$0
Bridges - detour (SF)	$60	0	0		$0
Bridge Removal (SF)	$25	0	0		$0
Cofferdams (ea)	$20,000	0			$0
Box Culverts (SF)	$95	0	0		$0
Box Culverts (SF)	$95	0	0		$0
Large cross drains (LF)	$80	0			$0
Replace cross drains (LF)	$120	0			$0
Sediment/ detention ponds (ea)	$30,000	0			$0
Pavement patching (Sq yd)	$30	0	1.00		$0
Bus Stop Relocation	$50,000	0			$0
Traffic Signalization / Upgrade (ea)	$125,000				$0
				Subtotal	**$0**
			Total Construction Cost		**$308,390**
			Percent of Total		*78%*

Right-of-Way Costs

Area Type		Unit cost/ac	Miles	Width (ft)	Acres	Cost
Urban						
Residential Property		$800,000	0	0	0.00	$0
Residential Easement		$240,000	0	0	0.00	$0
Commercial Property		$1,200,000	0		0.00	$0
Commercial Easment		$360,000	0	0	0.00	$0
Suburban/Rural						
Residential Property		$20,000	0.1	30	0.36	$7,273
Residential Easement		$180,000	0	0	0.00	$0
Commercial Property		$800,000	0	0	0.00	$0
Commercial Easment		$240,000	0	0	0.00	$0
			Number	factor		
Displacements	Residential	$250,000	0	1.00		$0
	Commercial	$1,000,000	0	0		$0
	Damages	$0	0	1.00		$0
					ROW multiplier	1.6
				Total Right-of-Way Cost		**$11,636**
						3%

Reimbursable Utility Costs

	5%	**Total Reimbursable Utility Cost**	$ 15,420
			3.88%

Preliminary Engineering Costs

PE %	20%	**Total Preliminary Engineering Cost**	**$61,678**
			15.53%

Contingency Costs

Contingency %	10%	**Total Contingency Cost**	**$38,549**
		Total (PE+Util.+ROW+CST)	**$397,124**
		Grand Total	**$435,673**

Safety Benefits

Recommendation	CMF ID	Ek	R	r	Rp	rp
Left turn lane	253	0.135	0.55	0.45	0.49	0.51
Skew	5188	0.087	0.00	1.00	0.13	0.87

Description	Symbol	Value
Reduction Factor (F, I)	R	0.55
Reduction Factor (PDO)	Rp	0.5563
Capital Recovery Factor	Ek	0.135
Initial Improvement Cost	Ci	$ 435,672

Accident Data	Symbol	Value
PDO	P	1.8
Fatalities	F	0.2
Injuries	I	0.8

Weighted cost of fatal and injury collisions

Q = $ 2,584,400

Annual Benefit: $ 1,448,757

Annual Cost: $ 78,816

Annual B/C Ratio: **18.38**

Design Life Benefit

B = $ 6,908,658

Design Life Cost

C = $ 375,847

Design Life Benefit/Cost Ratio

B/C = **18.38**

Planning Level Project Cost Estimation

Project Identification SR 101 @ Old Draketown Trail Safety

Description	Fix Skew Only		Proj. Type	
From/To Limit			District	3
Notes				
SR 101	0.00 miles			
Old Draktown Trail	0.03 miles	total	0.03	

Cost Summary Incl. Contingency	
Preliminary Engineering	$ 65,687
Reimbursable Utility	$ 5,677
Right-of-Way	$ 10,191
Construction	$ 113,542
Total	$ 195,097

Construction Costs

Average Per Lane-Mile Components	Unit Cost	Miles	Add Lanes	Lane-Miles	Cost
Surface Str. New Cst. base & pave	$410,000	0.03	2.00	0.06	$24,600
SR or High volume Rd widening	$500,000			0	$0
Surface Street Overlay	$64,000	0.03	2.00	0.06	$3,840
Concrete Widening (Ramps)	$843,744			0	$0
Cross Streets widening	$307,500			0	$0
Cross Street Overlay	$20,000				$0
Traffic Control	$150,000	0.03	1.00		$4,500
Typical Driveways	$75,000				$0
Typical E & S Control Temp&Perm	$150,000	0.03	2.00		$9,000
Typical Earthwork	$500,000	0.03	2.00		$30,000
Typical Drainage - Urban Section	$255,000				$0
Curb & Gutter both sides (mile)	$264,000				$0
Typical Drainage - Rural Section	$150,000	0.03	1.00		$4,500
Signing & Marking	$50,000	0.03	1.00		$1,500
Typical Clear & Grub-120 ft wide	$109,091	0.03	1.00		$3,273
Typical Guardrail Type W	$212,000				$0
20ft. Raised median +C&G (mile)	$968,000				$0
Median landscaping	$100,000				$0
Sidewalks 5 ft. ea.side (mile)	$294,000				$0
ADA Ramps	$1,500				$0
					$0
				Subtotal	**$81,213**

Additional Per Mile Components	Unit Cost	Length	factor	Cost
Add'l Major Earthwork (mile)	$350,000			$0
Add'l Major Drainage (mile)	$150,000			$0
Add'l Major Grade changes (mile)	$350,000			$0
Major alignment corrections (mile)	$750,000	0.03	1.00	$22,500
Maint of Traffic difficulty (mile)	$200,000			$0
Temporary Barrier	$30			$0
Concrete Island + C&G (SY)	$60			$0
Add'l guardrail Type T (mile)	$423,000			$0
Paved Shoulders, 4 ft, 2 sides(mile)	$100,000			$0
blank	$0			$0
blank	$0			$0
Bikeway, 4 feet, both side (mile)	$333,333			$0
Add'l driveways (mile)	$75,000			$0
Cl. B Conc. Base or pvmt widening	$792,000			$0
Special E&S control	$300,000			$0
			Subtotal	**$22,500**

Individual Components	Unit Cost	Length (ft)	Width (ft)	Ht (ft)	Cost
Truck Apron	$506,880				$0
Conc Header Crub, TP 7 both sides (r	$126,720				$0
Conc Header Crub, TP 9 both sides (r	$147,840				$0
Retaining Walls - Gravity 0 - 5' (LF)	$60	0			$0
Retaining Walls-Gravity 5'-max (LF)	$120	0			$0
Retaining Walls-Special Design(SF)	$60	0		0	$0
Bridges - widen (SF)	$100	0	0		$0
Bridges - widen (SF)	$100	0	0		$0
Bridges - replace (SF)	$120	0	0		$0
Bridges - replace (SF)	$120	0	0		$0
Bridges - detour (SF)	$60	0	0		$0
Bridge Removal (SF)	$25	0	0		$0
Cofferdams (ea)	$20,000	0			$0
Box Culverts (SF)	$95	0	0		$0
Box Culverts (SF)	$95	0	0		$0
Large cross drains (LF)	$80	0			$0
Replace cross drains (LF)	$120	0			$0
Sediment/ detention ponds (ea)	$30,000	0			$0
Pavement patching (Sq yd)	$30	0			$0
Bus Stop Relocation	$50,000	0			$0
Traffic Signalization / Upgrade (ea)	$125,000				$0
				Subtotal	**$0**
			Total Construction Cost		**$103,713**
			Percent of Total		*58%*

Right-of-Way Costs

Area Type		Unit cost/ac	Miles	Width (ft)	Acres	Cost
Urban						
Residential Property		$800,000	0	0	0.00	$0
Residential Easement		$240,000	0	0	0.00	$0
Commercial Property		$1,200,000	0		0.00	$0
Commercial Easment		$360,000	0	0	0.00	$0
Suburban/Rural						
Residential Property		$20,000	0.08	30	0.29	$5,818
Residential Easement		$180,000	0	0	0.00	$0
Commercial Property		$800,000	0	0	0.00	$0
Commercial Easment		$240,000	0	0	0.00	$0
Displacements			Number	factor		
	Residential	$250,000	0	1.00		$0
	Commercial	$1,000,000	0	0		$0
	Damages	$0	0	1.00		$0
					ROW multiplier	1.6
				Total Right-of-Way Cost		**$9,309**
						5%

Reimbursable Utility Costs

	5%	**Total Reimbursable Utility Cost**	$ 5,186
			2.91%

Preliminary Engineering Costs

PE %	20%	**Total Preliminary Engineering Cost**	**$60,000**
			33.67%

Contingency Costs

Contingency %	10%	**Total Contingency Cost**	**$16,890**
		Total (PE+Util.+ROW+CST)	**$178,207**
		Grand Total	**$195,097**

Safety Benefits

Recommendation	CMF ID	Ek	R	r	Rp	rp
Skew	5188	0.087	0.00	1.00	0.13	0.87

Description	Symbol	Value
Reduction Factor (F, I)	R	0
Reduction Factor (PDO)	Rp	0.13
Capital Recovery Factor	Ek	0.087
Initial Improvement Cost	Ci	$ 195,097

Accident Data	Symbol	Value
PDO	P	1.8
Fatalities	F	0.2
Injuries	I	0.8

Weighted cost of fatal and injury collisions

Q = $ 2,584,400

Annual Benefit: $ 6,388

Annual Cost: $ 36,973

Annual B/C Ratio: **0.17**

Design Life Benefit

B = $ 30,463

Design Life Cost

C = $ 176,315

Design Life Benefit/Cost Ratio

B/C = **0.17**

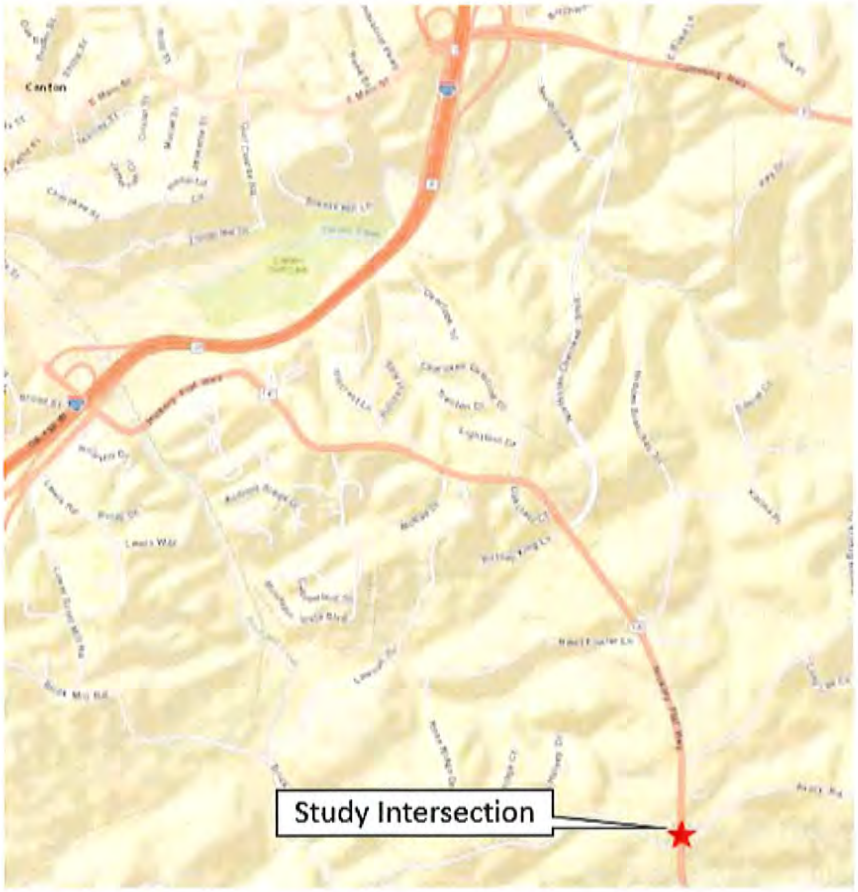
Exhibit D-2:

SR 140 @ Avery Road, Cherokee County

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

TRAFFIC ENGINEERING STUDY

May 2017



PRIMARY ROUTE: SR 140
SECONDARY ROUTE: Avery Road
MILEPOINT: 18.99
GDOT DISTRICT: 6
CONGRESSIONAL DISTRICT 11
COUNTY: Cherokee
CITY: Canton
PREPARED BY: ARCADIS

TABLE OF CONTENTS

TABLES

STUDY REQUEST: This study was requested by GDOT District 6 Traffic Operations (Grant Waldrop)

REASON FOR INVESTIGATION: SR 140 @ Avery Road intersection has experienced 5.3 crashes per year from 2013-2015 resulting. Per the Highway Safety Manual (1) methodology, intersections with similar characteristics typically experience 3.2 crashes per year. Also, this intersection has experienced severe crashes resulting in nine injuries and a fatality.

PROJECT LOCATION: SR 140 is a two-lane road with a posted speed of 50 MPH. It is classified as an Urban Minor Arterial that connects Canton with North Fulton County. The nearest signal to this intersection 800 feet to the north at Scott Road. Avery Road is a two-lane local road with a posted speed of 30 MPH. There are no signalized intersections on Avery Road. **Figure 1** provides aerial view of the intersection geometrics.

Figure 1:Aerial Map of Study Intersection

FIELD VISIT

A field visit was conducted on Tuesday, February 14, 2017. The site visit observed the current site conditions as well as identifying and documenting conditions that could affect safety and operations. Field visit observations included:

- Intersection control: Currently SR 140 is free flow, and Avery Road is stop controlled. The pavement shows signs of wearing and cracking. Other Modes of Transportation: No other modes of transportation were noticed in the project vicinity.
- Horizontal/Vertical Grades: SR 140 has vertical crest just south of the intersection with Avery Road. SR 140 also has a slight vertical crest just to the north of the intersection with Avery Road. Avery Road has a sharp horizontal curve leading up to the intersection, and sits lower than the SR 140 roadway.
- Intersection Delay / Queuing: There was no major delay or queuing issues at the intersection. The absences of a southbound left turn lane caused some vehicles to stop in the through

travel lane to await a gap to turn left. This causes minor delay for southbound vehicles, and leads to a greater risk of rear-end crashes.

- Sight Distance / Vegetation Concerns: Avery Road has sight distance issue due to the vertical crest curves, and sitting lower than SR 140. When driving on SR 140 Avery Road is hard to see due to these issues as well.
- Pavement/Signs/Striping Conditions: The pavement and marking appeared adequate with only normal wear. There is a standard stop sign on the Avery Road approach in good condition.
- Pedestrian Accommodations: There are no pedestrian accommodations provided at the intersection nor signs of significant pedestrian activity (no beaten path). No pedestrians were observed during the 12-hour traffic count.
- Lighting: There is no street lighting at the intersection.
- Parking: There is no on-street parking accommodations near the intersection.
- Potential Environmental Impacts: There is no appearance of any environmental concerns at this intersection.
- Other Modes of Transportation: There are no bus stops near this rural intersection

CRASH ANALYSIS

Crash data for over the most recent five-year period for which data is available was collected from GEARS. The number and types of crashes are provided in tabular form in **Appendix A** and **Table 1** below presents a comparison of crash rates, injury rates, and fatality rates along the study area. A crash diagram of all crashes occurring at this intersection is included in **Appendix B**.

Table 1: Intersection Crash History [2013 – 2015]

Collision Type	Year			
	2013	2014	2015	Total
Angle	-	-	2	2
Head On	1	-	(1)	2
Rear End	5	4	3	12
Sideswipe	-	-	-	-
Not a Collision with Motor Vehicle	-	-	-	-
Unknown	-	-	-	-
Total Crashes	6	4	6	16
Total Non-Fatal Injuries	2	2	5	9
Total Fatalities	-	-	1	1
Average Crashes (per year)				5.3
HSM Predicted Crashes (per year)				3.2
Average Daily Traffic (ADT)	15,000	15,000	15,000	
Crash Rate (per 100 MEV)	110	73	110	
Non-Fatality Injury Rate (per 100 MEV)	36	36	91	
Fatality Rate (per 100 MEV)	-	-	18	

ADT = average daily traffic; MEV = million entering vehicles; (x) = fatality

In the past three years, there have been sixteen crashes reported at SR 140 and Avery Road. Twelve of the crashes were rear end collisions, two were head on collisions (attempting to avoid rear ending another vehicle), and two angle crashes. Only one fatality was reported in 2015 in a head-on collision. Most of the crashes were due to southbound vehicles blocking southbound traffic in an attempt to turn left onto Avery Road. When driving southbound on SR 140 Avery Road sits lower than the roadway, and is hard to see until you are at the intersection. This leads to many vehicles braking without notice, and getting rear-ended by vehicles behind them.

The study intersection has had an average of 5.3 crashes per year from 2013-2015. Per the Highway Safety Manual (HSM) methodology, intersections with similar geometric, traffic control, and traffic volume characteristics typically experience 3.2 crashes per year.

OPERATIONAL ANALYSIS

Traffic Volume Counts:

A 12-hour intersection turning movement count was collected on Thursday, September 29, 2016. All cars, trucks or other motorized vehicles passing through the intersection were counted between the hours of 6:30AM and 6:30PM, broken into 15-minute intervals to determine peak morning, mid-day and afternoon peak hours. The percentage of trucks on each intersection leg was also reported. As a permanent count station is not available near of the intersection, the 12-hour data was used to project Average Daily Traffic (ADT) for each of the approach roadways. Queue length observations were made for critical movements during the AM and PM peak periods. The traffic volume counts collected and ADT reports and/or projections are included in **Appendix C**.

Existing Operations:

The intersection geometries, volumes and control specifics were inputs to a Synchro 9 model analysis of existing conditions that was calibrated to observed queuing conditions. The Synchro model reports for existing intersection conditions are include in **Appendix D** and the results are summarized in **Table 2** below.

Table 2: Existing AM / PM Peak Hour Intersection Operations

Intersection	Peak Period	Overall Delay/LOS	V/C Ratio	Eastbound		Westbound		Northbound		Southbound		ICU (%/LOS)
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	
SR 140 @ Avery Road	AM	1.8 / A	0.47	N/A	N/A	28.2	D	0.0	A	1.8	A	0.88 / E
	PM	3.7 / A	0.62	N/A	N/A	50.3	F	0.0	A	3.1	A	1.06 / G

Note: LOS for unsignalized intersection is based on maximum side street approach delay

Signal Warrant Analysis:

The Manual of Uniform Traffic Control Devices 2009 Edition (MUTCD) is the established source for evaluating warrants for installing a traffic signal. The MUTCD established nine traffic signal warrants that define minimum conditions under which signal installations may be justified. Installation of a traffic signal can improve the overall safety and/or operation of an intersection but should be considered only when deemed necessary by analysis combined with engineering judgement, and less restrictive solutions have been considered.

A signal warrant analysis was evaluated based on the existing 12-hour turning movement counts that were used as inputs into the analysis model. A 100% right turn reduction was applied to complete the signal warrant. The full warrants report is included in **Appendix E** and the results summarized in **Table 3** below.

Table 3: Summary of Current Conditions Signal Warrant Analysis

Intersection	Warrant 1a	Warrant 1b	Warrant 2	Warrant 3	Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Warrant 9
SR 140 @ Avery Road	No	No	No	No	n/a	n/a	n/a	n/a	n/a	n/a

Based on the warrant analysis conducted combined with good engineering judgement, a signal is not warranted for this intersection.

INTERSECTION CONTROL EVALUATION (ICE)

GDOT's Intersection Control Evaluation (ICE) policies were developed to further leverage safety advancements as part of intersection improvements. The ICE process consists of 2 distinct stages. A Stage 1 evaluation identifies potential Intersection Control Types that may provide safety benefits.

Stage 2 further evaluates those alternatives inclusive of safety, operations, cost, environmental impacts and project support. The Stage 1 screening and Stage 2 ranking results are documented in **Appendix F.** Sketches of each Stage 2 alternative are included in **Appendix G.**

1. **Conventional (Minor Route Stop):** Installing a southbound left turn lane would reduce the total amount of crashes as well as the occurrences of crashes that lead to injuries. In addition, install intersection ahead warning signs on both southbound and northbound approaches.
2. **Single Lane Roundabout:** A single lane roundabout was analyzed using GDOT's Roundabout Analysis Tool spreadsheet with and without a northbound bypass lane. With such low right turn volume bypass lanes were determined not to be needed at this intersection.
3. **Conventional Signalized:** Intersection volumes do not meet signal warrants and thus a signalized intersection is not recommended.

Crash Reduction Factors

The Crash Reduction Factors used in the ICE Stage 2 analysis were determined from the FHWA's CMF Clearinghouse website (http://www.cmfclearinghouse.org/) and are provided in **Table 4** below:

Table 4: Crash Reduction Factors

Safety Countermeasure	PDO	Injury/Fatal
Turn Lane Improvements	44%	55%
Single Lane Roundabout	71%	87%

EXPECTED OPERATIONAL RESULTS

For all alternatives considered in the Stage 2 analysis, the intersection delay and LOS was determined with the intersection control improvements made and the results are summarized in **Table 5.** All of the alternatives considered provide equal or improved intersection operating conditions compared to existing conditions.

Table 5: Operational Analysis Results

	Existing Stop Control		Turn Lane Improvements		Single Lane Roundabout	
Approach	AM	PM	AM	PM	AM	PM
WB	28.2 - D	50.3 – F	28.2 - D	50.3 – F	7 - A	10 - A
NB	0.0 - A	0.0 – A	0.0 - A	0.0 – A	8 - A	13 – B
SB	1.8 - A	3.1 - A	0.8 - A	1.0 - A	10 - A	13 - B
Overall	3.1 - B	4.4 - A	2.7 - B	3.5 - A	-	-

BENEFIT-COST ANALYSIS

A summary of the Safety Benefit / Cost of the studied alternatives are presented in **Table 6.** Only the Turn Lane Improvements alternative is shown because this alternative was analyzed to have a higher ICE Stage 2 score than the Roundabout, as shown in **Appendix F.** A summary of the cost estimate development details is included in **Appendix H.**

Table 6: Benefit / Cost Ratio Analysis Results

Safety Countermeasure	Project Cost	B/C Ratio
Turn Lane Improvements	$288,254	55.75

CONCLUSION

The intersection of SR 140 @ Avery Road experiences more crashes than the HSM methodology predicts, and there has been one intersection fatality. Potential solutions including the installation of a northbound left turn lane, replacing the intersection with a roundabout, and other minor intersection modifications showed a possible reduction in expected crashes.

Recommendations

A list of short, mid-term and long-term safety project recommendations are identified in **Table 7**. The result of the long-term project is expected to reduce the number of overall crashes by 44% a year, and to have a 55 percent reduction of injury/fatal crashes. Intersection ahead signs should be installed because of sight distance issue due to crest hills near the intersection.

Table 7: Intersection Safety Improvement Recommendations

Short Term	Long Term
• Install additional intersection warning signs	• Install a southbound left turn lane

RECOMMENDED BY: _____ **DATE** 6-1-17

Jonathan Reid, PE, PTOE
Consultant Project Manager

RECOMMENDED BY: _____ **DATE** 6-8-17

Grant Waldrop, PE
District Traffic Engineer

Appendix A: Crash Data

AccidentNo	Agency Name	Date	Time	County	Route	Milelog	Intersecting Route	Injuries	Fatalities	Manner Of Collision	First Harmful Event	Light	Surface	Driver Age 1	Driver Age 2	Veh Type 1	Veh Type 2	MnvrVeh1	MnvrVeh2	Number Of Vehicles	LatDecimal	LongDecimal	Serious Injuries	Visible Injuries	Complaint Injuries	U1 Factors	U2 Factors
4359711	Cherokee Co Sheriff's Office	2/18/2013	18:53:00	CHEROKEE	HICKORY FLAT HWY	18.95	AVERY RD	1	0	Rear End	Motor Vehicle In Motion	DarkNot Lighted	Dry	47	24	Utility Passenger Vehicle	Passenger Car	Straight	Stopped	2	34.20673	-84.455252	0	0	1	Following too Close,Cell Phone	No Contributing Factors
4364037	Cherokee Co Sheriff's Office	2/22/2013	16:35:00	CHEROKEE	HICKORY FLAT HWY	18.94	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Wet	24	64	Utility Passenger Vehicle	Pickup Truck	Straight	Straight	2	34.20695	-84.455248	0	0	0	Weather Conditions	No Contributing Factors
4424987	Gsp Post 00	4/22/2013	11:30:00	CHEROKEE	SR-140	18.99		1	0	Head On	Motor Vehicle In Motion	Daylight	Dry	41	42	Passenger Car	Single Unit Truck	Straight	Straight	2	34.206207	-84.455246	1	0	0	No Contributing Factors	No Contributing Factors
4508363	Cherokee Co Sheriff's Office	7/19/2013	17:39:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	19	30	Passenger Car	Passenger Car	Straight	Straight	2	34.20663	-84.455253	0	0	0	Following too Close	No Contributing Factors
4597385	Cherokee Co Sheriff's Office	10/4/2013	14:11:00	CHEROKEE	HICKORY FLAT HWY	18.93	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	18	39	Pickup Truck	Van	Straight	Stopped	2	34.207039	-84.455247	0	0	0	No Contributing Factors	No Contributing Factors
4641174	Gsp Post 00	11/14/2013	7:25:00	CHEROKEE	GA 140		AVERY ROAD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	35	22	Passenger Car	Pickup Truck	Straight	Turning Left	2	34.20652	-84.455246	0	0	0	No Contributing Factors	No Contributing Factors
4897156	Cherokee Co Sheriff's Office	7/3/2014	15:27:00	CHEROKEE	HICKORY FLAT HWY	18.95	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	16	51	Pickup Truck	Pickup Truck	Straight	Straight	2	34.206688	-84.455304	0	0	0	Following too Close	No Contributing Factors
5013429	Cherokee Co Sheriff's Office	10/10/2014	15:08:00	CHEROKEE	HICKORY FLAT HWY	18.95	AVERY RD	2	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	26	30	Passenger Car	Passenger Car	Straight	Stopped	3	34.206706	-84.455257	0	1	1	Following too Close,Distracted	No Contributing Factors
5034165	Cherokee Co Sheriff's Office	10/29/2014	17:15:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	24	37	Pickup Truck	Pickup Truck	Straight	Stopped	2	34.206683	-84.455298	0	0	0	Following too Close,Inattentive	No Contributing Factors
5058049	Cherokee Co Sheriff's Office	11/20/2014	14:20:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	Daylight	Dry	33	19	Passenger Car	Passenger Car	Straight	Stopped	2	34.206481	-84.455239	0	0	0	Following too Close,Inattentive	No Contributing Factors
5248595	Cherokee Co Sheriff's Office	4/10/2015	7:54:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	1	0	Rear End	Motor Vehicle In Motion	Daylight	Wet	16	55	Utility Passenger Vehicle	Passenger Car	Straight	Stopped	2	34.20663	-84.455253	0	0	1	Following too Close,Distracted	No Contributing Factors
5368882	Cherokee Co Sheriff's Office	7/24/2015	15:48:00	CHEROKEE	HICKORY FLAT HWY		AVERY RD	0	0	Angle	Motor Vehicle In Motion	Daylight	Dry	20	53	Passenger Car	Pickup Truck	Turning Left	Straight	2	34.206576	-84.455228	0	0	0	Failed to Yield	No Contributing Factors
5412868	Cherokee Co Sheriff's Office	9/2/2015	0:00:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	2	0	Angle	Motor Vehicle In Motion	DarkLighte d	Dry	16	58	Utility Passenger Vehicle	Passenger Car	Turning Left	Straight	2	34.206563	-84.455226	0	0	2	Failed to Yield	No Contributing Factors
5448822	Gsp Post 00	9/28/2015	12:16:00	CHEROKEE	GA 140	18.94	AVERY ROAD	2	1	Sideswipe-Same Direction	Motor Vehicle In Motion	Daylight	Wet	39	17	Pickup Truck	Passenger Car	Straight	Stopped	3	34.206772	-84.45526	1	1	0	No Contributing Factors	No Contributing Factors
5470268	Cherokee Co Sheriff's Office	10/15/2015	21:30:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	0	0	Rear End	Motor Vehicle In Motion	DarkNot Lighted	Dry	28	40	Passenger Car	Pickup Truck	Straight	Straight	2	34.206745	-84.455232	0	0	0	Following too Close	No Contributing Factors
5515496	Cherokee Co Sheriff's Office	11/18/2015	8:00:00	CHEROKEE	HICKORY FLAT HWY	18.96	AVERY RD	0	0	Angle	Motor Vehicle In Motion	Daylight	Wet	16	51	Pickup Truck	Passenger Car	Straight	Stopped	2	34.206713	-84.455252	0	0	0	Inattentive	No Contributing Factors

Appendix B: intersection Crash Diagram

LOCATION: SR 140 @ Avery Road
CRASH PERIOD: 2013 to 2015

①

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality	Pavement Condition
4359711	Rear End	2/18/2013	Monday	6:53 PM	Injury	Dry
4364037	Rear End	2/22/2013	Friday	4:35 PM	---	Wet
4641174	Rear End	11/14/2013	Thursday	7:25 AM	---	Dry
4597385	Rear End	10/4/2013	Friday	2:11 PM	---	Dry
4897156	Rear End	7/3/2014	Thursday	3:27 PM	---	Dry
5013429	Rear End	10/10/2014	Friday	3:08 AM	Injury	Dry
5034165	Rear End	10/29/2014	Wednesday	5:15 PM	---	Dry
5248595	Rear End	4/10/2015	Friday	7:54 AM	Injury	Wet
5470268	Rear End	10/15/2015	Thursday	9:30 PM	---	Dry
5515496	Rear End	11/18/2015	Wednesday	8:00 AM	---	Wet

②

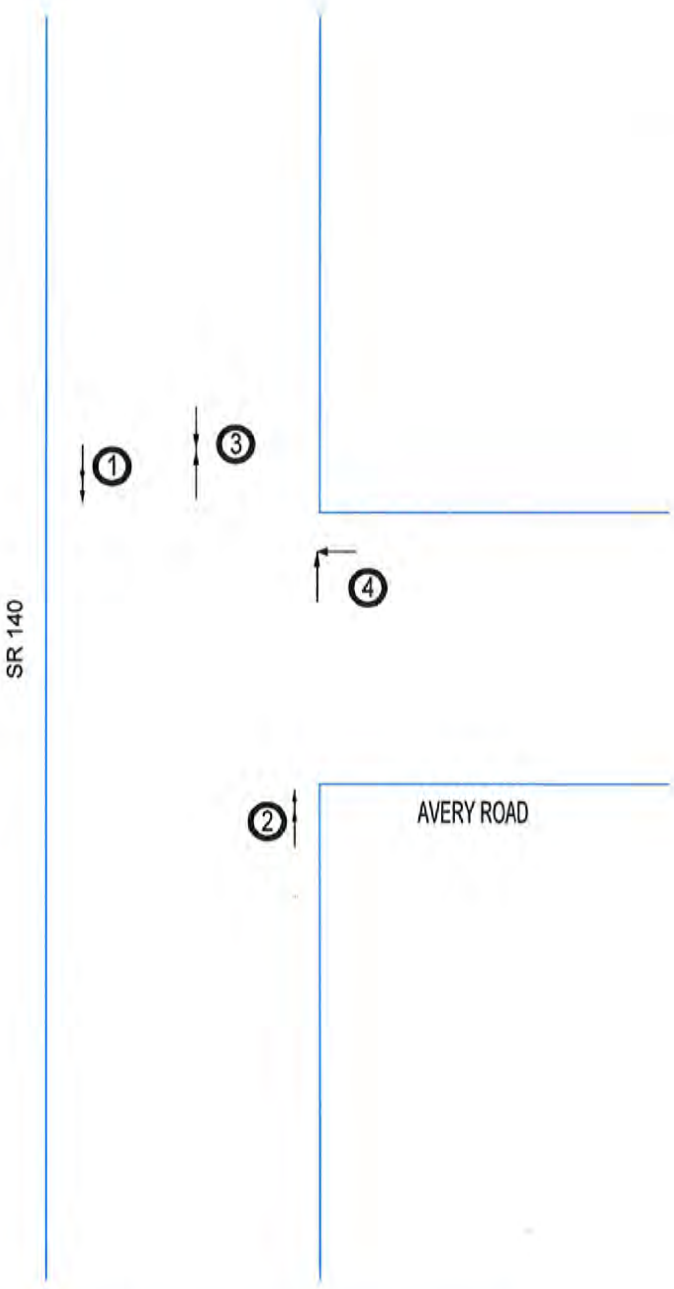
Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality	Pavement Condition
4508363	Rear End	7/19/2013	Friday	5:39 PM	---	Dry
5058049	Rear End	11/20/2014	Thursday	2:20 PM	---	Dry

③

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality	Pavement Condition
4424987	Head On	4/22/2013	Monday	11:30 AM	Injury	Dry
5448822	Head On	9/28/2015	Monday	12:16 PM	Fatality	Wet

④

Crash Number	Crash Type	Date	Day of Week	Time of Day	Injury or Fatality	Pavement Condition
5368882	Angle	7/24/2015	Friday	3:52 PM	---	Dry
5412868	Angle	9/2/2015	Wednesday	9:20 PM	Injury	Dry



SYMBOLS

- Moving Vehicle
- Backing Vehicle
- Non-Involved Vehicle
- Pedestrian
- Parked Vehicle
- Fixed Object

TYPES OF CRASHES

- Rear End
- Head On
- Side Swipe
- Out of Control
- Angle

Appendix C: Traffic Data

All Traffic Data Services

1 SR 140 & Avery Rd AM
Wednesday, September 28, 2016

Peak Hour
04:45 PM - 05:45 PM
Peak 15-Minutes
05:00 PM - 05:15 PM

Traffic Counts - All Vehicles

						Avery Rd					SR 140					SR 140						
	Eastbound					Westbound					Northbound					Southbound						Rolling
Time	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	Total	Hour
6:30 AM	0	0	0	0	0	0	2	0	10	0	0	0	86	4	0	0	9	127	0	0	238	1,141
6:45 AM	0	0	0	0	0	0	3	0	9	0	0	0	93	7	0	0	5	166	0	0	283	1,332
7:00 AM	0	0	0	0	0	0	8	0	13	0	0	0	103	6	0	0	15	132	0	0	277	1,448
7:15 AM	0	0	0	0	0	0	6	0	27	0	0	0	119	9	0	0	14	168	0	0	343	1,494
7:30 AM	0	0	0	0	0	0	7	0	17	0	0	0	193	10	0	0	17	185	0	0	429	1,457
7:45 AM	0	0	0	0	0	0	7	0	33	0	0	0	199	10	0	0	13	137	0	0	399	1,345
8:00 AM	0	0	0	0	0	0	9	0	15	0	0	0	145	5	0	0	9	140	0	0	323	1,238
8:15 AM	0	0	0	0	0	0	5	0	15	0	0	0	132	10	0	0	9	135	0	0	306	1,233
8:30 AM	0	0	0	0	0	0	5	0	20	0	0	0	130	8	0	0	11	143	0	0	317	1,192
8:45 AM	0	0	0	0	0	0	5	0	20	0	0	0	133	2	0	0	5	127	0	0	292	1,113
9:00 AM	0	0	0	0	0	0	6	0	10	0	0	0	159	7	0	0	11	125	0	0	318	1,084
9:15 AM	0	0	0	0	0	0	4	0	14	0	0	0	130	2	0	0	6	109	0	0	265	1,015
9:30 AM	0	0	0	0	0	0	5	0	11	0	0	0	125	3	0	0	6	88	0	0	238	1,011
9:45 AM	0	0	0	0	0	0	1	0	9	0	0	0	116	4	0	0	7	126	0	0	263	1,039
10:00 AM	0	0	0	0	0	0	3	0	9	0	0	0	121	7	0	0	5	104	0	0	249	1,043
10:15 AM	0	0	0	0	0	0	5	0	7	0	0	0	135	4	0	0	7	103	0	0	261	1,025
10:30 AM	0	0	0	0	0	0	4	0	7	0	0	0	120	3	0	0	4	128	0	0	266	992
10:45 AM	0	0	0	0	0	0	3	0	8	0	0	0	124	5	0	0	4	123	0	0	267	1,000
11:00 AM	0	0	0	0	0	0	0	0	4	0	0	0	111	3	0	0	7	106	0	0	231	1,010
11:15 AM	0	0	0	0	0	0	2	0	8	0	0	0	110	0	0	0	6	102	0	0	228	1,073
11:30 AM	0	0	0	0	0	0	6	0	7	0	0	0	119	1	0	0	4	137	0	0	274	1,113
11:45 AM	0	0	0	0	0	0	2	0	7	0	0	0	130	3	0	0	6	129	0	0	277	1,124
12:00 PM	0	0	0	0	0	0	8	0	8	0	0	0	126	3	0	0	6	143	0	0	294	1,132
12:15 PM	0	0	0	0	0	0	0	0	2	0	0	0	136	3	0	0	3	124	0	0	268	1,134
12:30 PM	0	0	0	0	0	0	2	0	7	0	0	0	131	4	0	0	5	136	0	0	285	1,153
12:45 PM	0	0	0	0	0	0	4	0	6	0	0	0	131	8	0	0	5	131	0	0	285	1,154
1:00 PM	0	0	0	0	0	0	4	0	6	0	0	0	145	3	0	0	5	133	0	0	296	1,175
1:15 PM	0	0	0	0	0	0	1	0	11	0	0	0	128	7	0	0	10	130	0	0	287	1,210
1:30 PM	0	0	0	0	0	0	3	0	9	0	0	0	100	7	0	0	6	161	0	0	286	1,245
1:45 PM	0	0	0	0	0	0	4	0	15	0	0	0	120	3	0	0	3	161	0	0	306	1,286
2:00 PM	0	0	0	0	0	0	5	0	11	0	0	0	143	6	0	0	16	150	0	0	331	1,311
2:15 PM	0	0	0	0	0	0	1	0	8	0	0	0	131	5	0	0	8	169	0	0	322	1,297
2:30 PM	0	0	0	0	0	0	9	0	7	0	0	0	142	5	0	0	6	158	0	0	327	1,302
2:45 PM	0	0	0	0	0	0	6	0	13	0	0	0	145	4	0	0	8	155	0	0	331	1,356
3:00 PM	0	0	0	0	0	0	2	0	6	0	0	0	154	5	0	0	17	133	0	0	317	1,381
3:15 PM	0	0	0	0	0	0	2	0	10	0	0	0	147	9	0	0	10	149	0	0	327	1,437
3:30 PM	0	0	0	0	0	0	3	0	12	0	0	0	187	12	0	0	17	150	0	0	381	1,520
3:45 PM	0	0	0	0	0	0	7	0	11	0	0	0	139	6	0	0	12	181	0	0	356	1,551
4:00 PM	0	0	0	0	0	0	6	0	9	0	0	0	199	9	0	0	10	140	0	0	373	1,626
4:15 PM	0	0	0	0	0	0	14	0	15	0	0	0	195	7	0	0	11	168	0	0	410	1,742
4:30 PM	0	0	0	0	0	0	5	0	18	0	0	0	199	9	0	0	15	166	0	0	412	1,785
4:45 PM	0	0	0	0	0	0	6	0	23	0	0	0	214	13	0	0	19	156	0	0	431	1,838
5:00 PM	0	0	0	0	0	0	5	0	19	0	0	0	215	10	0	0	19	221	0	0	489	1,807
5:15 PM	0	0	0	0	0	0	2	0	18	0	0	0	212	11	0	0	18	192	0	0	453	1,721
5:30 PM	0	0	0	0	0	0	7	0	30	0	0	0	221	7	0	0	22	178	0	0	465	1,651
5:45 PM	0	0	0	0	0	0	5	0	21	0	0	0	193	6	0	0	18	157	0	0	400	0
6:00 PM	0	0	0	0	0	0	5	0	22	0	0	0	198	10	0	0	20	148	0	0	403	0
6:15 PM	0	0	0	0	0	0	3	0	21	0	0	0	183	6	0	0	14	156	0	0	383	0
12-Hour Summary	0	0	0	0	0	0	217	0	618	0	0	0	7,067	291	0	0	483	6,886	0	0	15,562	58,336

Peak Rolling Hour Flow Rates

	Eastbound					Westbound					Northbound					Southbound					
Vehicle Type	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	Total
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
Lights	0	0	0	0	0	0	20	0	89	0	0	0	857	40	0	0	78	738	0	0	1,822
Mediums	0	0	0	0	0	0	0	0	1	0	0	0	3	1	0	0	0	7	0	0	12
Total	0	0	0	0	0	0	20	0	90	0	0	0	862	41	0	0	78	747	0	0	1,838
Bicycles on Crosswalk			0					0					0					0			0
Heavy Vehicle Percentage								0.9%					0.7%					1.1%			0.9%
Heavy Vehicle Percentage						0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.6%	2.4%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	0.9%
Peak Hour Factor (PHF)								0.76					0.99					0.86			0.94
Peak Hour Factor (PHF)						0.00	0.57	0.00	0.78	0.00	0.00	0.00	0.98	0.83	0.00	0.00	0.89	0.85	0.00	0.00	0.94

Traffic Counts by Vehicle Type

	Eastbound					Westbound					Northbound					Southbound					
Time	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	U-Turn	Left	Thru	Right	RTOR	Total
Articulated Trucks																					
6:30 AM	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	3
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	4
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
8:30 AM	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	5
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
10:00 AM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	4
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	0	6

11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
12:00 PM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	4
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
12-Hour Summary	0	0	0	0	0	0	1	0	3	0	0	0	52	1	0	0	1	56	0	0	114
Lights																					
6:30 AM	0	0	0	0	0	0	2	0	9	0	0	0	80	3	0	0	9	127	0	0	230
6:45 AM	0	0	0	0	0	0	3	0	9	0	0	0	87	7	0	0	5	164	0	0	275
7:00 AM	0	0	0	0	0	0	8	0	12	0	0	0	95	6	0	0	15	125	0	0	261
7:15 AM	0	0	0	0	0	0	6	0	26	0	0	0	111	7	0	0	14	164	0	0	328
7:30 AM	0	0	0	0	0	0	7	0	15	0	0	0	189	10	0	0	17	174	0	0	412
7:45 AM	0	0	0	0	0	0	7	0	33	0	0	0	194	10	0	0	12	123	0	0	379
8:00 AM	0	0	0	0	0	0	9	0	15	0	0	0	135	3	0	0	9	135	0	0	306
8:15 AM	0	0	0	0	0	0	5	0	15	0	0	0	125	10	0	0	9	122	0	0	286
8:30 AM	0	0	0	0	0	0	4	0	20	0	0	0	126	8	0	0	11	138	0	0	307
8:45 AM	0	0	0	0	0	0	5	0	20	0	0	0	127	2	0	0	5	126	0	0	285
9:00 AM	0	0	0	0	0	0	6	0	10	0	0	0	156	7	0	0	11	125	0	0	315
9:15 AM	0	0	0	0	0	0	4	0	14	0	0	0	123	2	0	0	6	109	0	0	258
9:30 AM	0	0	0	0	0	0	5	0	11	0	0	0	116	3	0	0	6	85	0	0	226
9:45 AM	0	0	0	0	0	0	1	0	9	0	0	0	109	4	0	0	7	115	0	0	245
10:00 AM	0	0	0	0	0	0	3	0	8	0	0	0	117	6	0	0	5	100	0	0	239
10:15 AM	0	0	0	0	0	0	5	0	7	0	0	0	130	4	0	0	7	99	0	0	252
10:30 AM	0	0	0	0	0	0	4	0	7	0	0	0	115	3	0	0	4	124	0	0	257
10:45 AM	0	0	0	0	0	0	3	0	8	0	0	0	118	5	0	0	3	120	0	0	257
11:00 AM	0	0	0	0	0	0	0	0	4	0	0	0	108	3	0	0	7	102	0	0	224
11:15 AM	0	0	0	0	0	0	2	0	8	0	0	0	106	0	0	0	6	101	0	0	223
11:30 AM	0	0	0	0	0	0	6	0	7	0	0	0	115	0	0	0	4	132	0	0	264
11:45 AM	0	0	0	0	0	0	2	0	6	0	0	0	127	2	0	0	6	125	0	0	268
12:00 PM	0	0	0	0	0	0	7	0	7	0	0	0	124	3	0	0	6	137	0	0	284
12:15 PM	0	0	0	0	0	0	0	0	2	0	0	0	132	3	0	0	3	117	0	0	257
12:30 PM	0	0	0	0	0	0	2	0	7	0	0	0	129	4	0	0	5	129	0	0	276
12:45 PM	0	0	0	0	0	0	4	0	6	0	0	0	128	8	0	0	5	129	0	0	280
1:00 PM	0	0	0	0	0	0	4	0	6	0	0	0	140	3	0	0	5	131	0	0	289
1:15 PM	0	0	0	0	0	0	1	0	10	0	0	0	125	6	0	0	10	122	0	0	274
1:30 PM	0	0	0	0	0	0	3	0	9	0	0	0	100	7	0	0	6	159	0	0	284
1:45 PM	0	0	0	0	0	0	4	0	15	0	0	0	117	2	0	0	3	155	0	0	296
2:00 PM	0	0	0	0	0	0	5	0	11	0	0	0	139	5	0	0	15	149	0	0	324
2:15 PM	0	0	0	0	0	0	1	0	8	0	0	0	127	4	0	0	8	164	0	0	312
2:30 PM	0	0	0	0	0	0	8	0	6	0	0	0	138	4	0	0	6	151	0	0	313
2:45 PM	0	0	0	0	0	0	5	0	13	0	0	0	140	3	0	0	8	147	0	0	316
3:00 PM	0	0	0	0	0	0	2	0	6	0	0	0	152	4	0	0	17	128	0	0	309
3:15 PM	0	0	0	0	0	0	2	0	10	0	0	0	144	8	0	0	10	144	0	0	318
3:30 PM	0	0	0	0	0	0	3	0	11	0	0	0	181	11	0	0	17	146	0	0	369
3:45 PM	0	0	0	0	0	0	7	0	11	0	0	0	136	6	0	0	12	175	0	0	347
4:00 PM	0	0	0	0	0	0	6	0	9	0	0	0	199	8	0	0	10	138	0	0	370
4:15 PM	0	0	0	0	0	0	13	0	15	0	0	0	185	6	0	0	11	165	0	0	395
4:30 PM	0	0	0	0	0	0	5	0	17	0	0	0	199	9	0	0	15	160	0	0	405
4:45 PM	0	0	0	0	0	0	6	0	23	0	0	0	211	13	0	0	19	152	0	0	424
5:00 PM	0	0	0	0	0	0	5	0	19	0	0	0	215	10	0	0	19	218	0	0	486
5:15 PM	0	0	0	0	0	0	2	0	18	0	0	0	212	10	0	0	18	192	0	0	452
5:30 PM	0	0	0	0	0	0	7	0	29	0	0	0	219	7	0	0	22	176	0	0	460
5:45 PM	0	0	0	0	0	0	5	0	20	0	0	0	191	6	0	0	18	154	0	0	394
6:00 PM	0	0	0	0	0	0	5	0	22	0	0	0	196	10	0	0	20	146	0	0	399
6:15 PM	0	0	0	0	0	0	3	0	21	0	0	0	182	6	0	0	12	151	0	0	375
12-Hour Summary	0	0	0	0	0	0	212	0	604	0	0	0	6,870	271	0	0	478	6,670	0	0	15,105
Mediums																					
6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	2	0	0	7
7:00 AM	0	0	0	0	0	0	0	0	1	0	0	0	5	0	0	0	0	6	0	0	12
7:15 AM	0	0	0	0	0	0	0	0	1	0	0	0	7	2	0	0	0	3	0	0	13
7:30 AM	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0	0	7	0	0	13
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	8	0	0	14
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	9	2	0	0	0	3	0	0	14
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	13	0	0	19
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	5	0	0	8
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	5
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	1	0	0	7
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	10	0	0	16
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	4	0	0	9
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	5
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	6
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	4
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	5
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	4	0	0	7

11:45 AM	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	2	0	0	6
12:00 PM	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	3	0	0	6
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	5	0	0	9
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
1:15 PM	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	6	0	0	9
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	6	0	0	10
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	5
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	3	0	0	8
2:30 PM	0	0	0	0	0	0	1	0	1	0	0	0	2	1	0	0	0	6	0	0	11
2:45 PM	0	0	0	0	0	0	1	0	0	0	0	0	3	1	0	0	0	6	0	0	11
3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	3	0	0	6
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	2	0	0	6
3:30 PM	0	0	0	0	0	0	0	0	1	0	0	0	4	1	0	0	0	4	0	0	10
3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	6	0	0	8
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	3
4:15 PM	0	0	0	0	0	0	1	0	0	0	0	0	7	1	0	0	0	3	0	0	12
4:30 PM	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0	5
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	5
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
5:30 PM	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0	4
5:45 PM	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	2	0	0	5
6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3
6:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	3	0	0	6
12-Hour Summary	0	0	0	0	0	0	4	0	11	0	0	0	145	19	0	0	4	160	0	0	343

	Avery Rd				SR 140			SR 140			
	Westbound				Northbound			Southbound			
Time	U-Turn	Left	Thru	Right	U-Turn	Thru	Right	U-Turn	Left	Thru	Total
7:00AM		28	0	90	0	614	35	0	59	622	1,448
8:00AM		24	0	70	0	540	25	0	34	545	1,238
9:00AM		16	0	44	0	530	16	0	30	448	1,084
10:00AM		15	0	31	0	500	19	0	20	458	1,043
11:00AM		10	0	26	0	470	7	0	23	474	1,010
12:00PM		14	0	23	0	524	18	0	19	534	1,132
1:00PM		12	0	41	0	493	20	0	24	585	1,175
2:00PM		21	0	39	0	561	20	0	38	632	1,311
3:00PM		14	0	39	0	627	32	0	56	613	1,381
4:00PM		31	0	65	0	807	38	0	55	630	1,626
5:00PM		19	0	88	0	841	34	0	77	748	1,807

Appendix D: Traffic Analysis

Intersection	
Int Delay, s/veh	2.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	28	90	614	35	59	622
Future Vol, veh/h	28	90	614	35	59	622
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	30	98	667	38	64	676

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1490	686	0	0	705	0
Stage 1	686	-	-	-	-	-
Stage 2	804	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	136	447	-	-	893	-
Stage 1	500	-	-	-	-	-
Stage 2	440	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	120	447	-	-	893	-
Mov Cap-2 Maneuver	120	-	-	-	-	-
Stage 1	500	-	-	-	-	-
Stage 2	389	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	29.7	0	0.8
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	271	893	-
HCM Lane V/C Ratio	-	-	0.473	0.072	-
HCM Control Delay (s)	-	-	29.7	9.3	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	2.4	0.2	-

Intersection	
Int Delay, s/veh	3.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	19	88	841	34	77	748
Future Vol, veh/h	19	88	841	34	77	748
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	96	914	37	84	813

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1913	933	0	0	951	0
Stage 1	933	-	-	-	-	-
Stage 2	980	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	75	323	-	-	722	-
Stage 1	383	-	-	-	-	-
Stage 2	364	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	59	323	-	-	722	-
Mov Cap-2 Maneuver	59	-	-	-	-	-
Stage 1	383	-	-	-	-	-
Stage 2	287	-	-	-	-	-

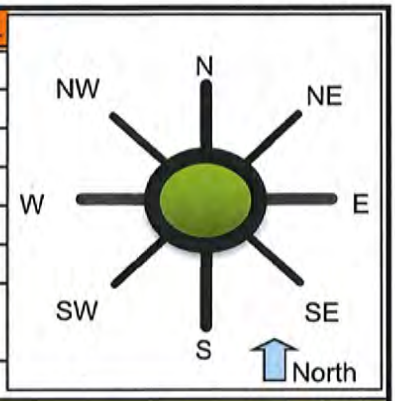
Approach	WB	NB	SB
HCM Control Delay, s	55.6	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	180	722	-
HCM Lane V/C Ratio	-	-	0.646	0.116	-
HCM Control Delay (s)	-	-	55.6	10.6	0
HCM Lane LOS	-	-	F	B	A
HCM 95th %tile Q(veh)	-	-	3.7	0.4	-

General & Site Information

v 4.1

Analyst:	Selma Hasancevic
Agency/Co:	Arcadis
Date:	
Project or PI#:	
Year, Peak Hour:	
County/District:	Cherokee/11
Intersection Name:	SR 140 at Avery Road



Volumes		Entry Legs (FROM) N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
	N (1), vph			90		614			
Exit	NE (2), vph								
Legs	E (3), vph	59				35			
(TO)	SE (4), vph								
	S (5), vph	622		28					
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Output	Total Vehicles	681	0	118	0	649	0	0	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98.9%	100.0%	99.1%	100.0%	99.3%	100.0%	100.0%	100.0%
% Heavy Vehicles	1.1%	0.0%	0.9%	0.0%	0.7%	0.0%	0.0%	0.0%
% Bicycle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	*0.86*	*0.95*	*0.76*	*0.95*	*0.99*	*0.95*	*0.95*	*0.95*
F_{HV}	0.989	1.000	0.991	1.000	0.993	1.000	1.000	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	119	0	625	0	0	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	69	0	0	0	36	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	731	0	37	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	0	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	801	0	157	0	660	0	0	0
Conflicting flow, pcu/h	37	0	625	0	69	0	0	0

Results: Approach Measures of Effectiveness

HCM 6th Edition	N	NE	E	SE	S	SW	W	NW
Entry Capacity, vph	1314	NA	723	NA	1277	NA	NA	NA
Entry Flow Rates, vph	792	NA	155	NA	656	NA	NA	NA
V/C ratio	**0.60**		**0.21**		**0.51**			
Control Delay, sec/pcu	**10**		**7**		**8**			
LOS	A		A		A			
95th % Queue (ft)	**108**		**20**		**77**			

Notes: v 4.0

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

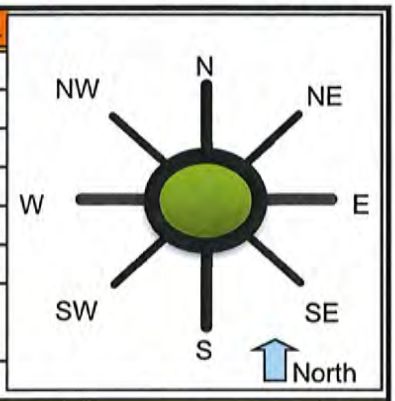
Bypass Lane Merge Point Analysis (if applicable)

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 6th Edition)						
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

v 4.1

Analyst:	Selma Hasancevic
Agency/Co:	Arcadis
Date:	
Project or PI#:	
Year, Peak Hour:	
County/District:	Cherokee, 11
Intersection Name:	SR 140 at Avery Rd



Volumes		Entry Legs (FROM) N (1)	NE (2)	E (3)	SE (4)	S (5)	SW (6)	W (7)	NW (8)
	N (1), vph			88		841			
Exit	NE (2), vph								
Legs	E (3), vph	77				34			
(TO)	SE (4), vph								
	S (5), vph	748		19					
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Output	Total Vehicles	825	0	107	0	875	0	0	0

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	98.9%	100.0%	99.1%	100.0%	99.3%	100.0%	100.0%	100.0%
% Heavy Vehicles	1.1%	0.0%	0.9%	0.0%	0.7%	0.0%	0.0%	0.0%
% Bicycle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	*0.86*	*0.95*	*0.76*	*0.95*	*0.99*	*0.95*	*0.95*	*0.95*
F_{HV}	0.989	1.000	0.991	1.000	0.993	1.000	1.000	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	117	0	855	0	0	0
NE (2), pcu/h	0	0	0	0	0	0	0	0
E (3), pcu/h	91	0	0	0	35	0	0	0
SE (4), pcu/h	0	0	0	0	0	0	0	0
S (5), pcu/h	879	0	25	0	0	0	0	0
SW (6), pcu/h	0	0	0	0	0	0	0	0
W (7), pcu/h	0	0	0	0	0	0	0	0
NW (8), pcu/h	0	0	0	0	0	0	0	0
Entry flow, pcu/h	970	0	142	0	890	0	0	0
Conflicting flow, pcu/h	25	0	855	0	91	0	0	0

Results: Approach Measures of Effectiveness

HCM 6th Edition	N	NE	E	SE	S	SW	W	NW
Entry Capacity, vph	1330	NA	572	NA	1250	NA	NA	NA
Entry Flow Rates, vph	959	NA	141	NA	884	NA	NA	NA
V/C ratio	**0.72**		**0.25**		**0.71**			
Control Delay, sec/pcu	**13**		**10**		**13**			
LOS	B		A		B			
95th % Queue (ft)	**171**		**24**		**160**			

Notes: v 4.0

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 6th Edition)						
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 E: Signal Warrant Analysis

HCS+: MUTCD Signal Warrants Release 5.3

Analyst: Arcadis
Agency: Arcadis
Date: 2/8/2017
Project ID: Safetyr
EW Street: Avery Road

Intersection: SR 140 @ Avery Road
Jurisdiction: GDOT
Units: U.S. Customary
Analysis Year: 2016
NS Street: SR 140

General Information

Major St. Speed (mph): 50
Nearest Signal (ft): 800
Crashes per Yr: 5

Population: Less than 10000
Coordinated Signal System: N

School Crossing

Students in Highest Hour: 0
Adequate Gaps in Period: 0
Minutes in Period: 0

Roadway Network

Two Major Routes: 0
Weekend Count: 0
5-yr Growth Factor: 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	0	0	0	1	0	0	1	0
LaneUsage					LR			TR			LT	

Results

Warrant 1: Eight-Hour Vehicular Volume	[ ]
1 A. Minimum Vehicular Volumes	[ ]
1 B. Interruption of Continuous Traffic	[ ]
1 80% Vehicular --and-- Interruption Volumes	[ ]
Warrant 2: Four-Hour Vehicular Volume	
2 A. Four-Hour Vehicular Volumes	[ ]
Warrant 3: Peak Hour	[ ]
3 A. Peak-Hour Conditions	[ ]
3 B. Peak-Hour Vehicular Volume Hours Met	[ ]
Warrant 4: Pedestrian Volume	[ ]
4 A. Pedestrian Volumes	[ ]
4 B. Gaps Same Period	[ ]
Warrant 5: School Crossing	[ ]
5 A. Student Volumes	[ ]
5 B. Gaps Same Period	[ ]
Warrant 6: Coordinated Signal System	
6 Degree of Platooning	[ ]
Warrant 7: Crash Experience	[ ]
7 A. Adequate trials of alternatives	[ ]

7 B. Reported crashes [X]
7 80% Volumes for Warrants 1A, 1B --or-- 4 [ ]

Warrant 8: Roadway Network [ ]
8 A. Weekday Volume [ ]
8 B. Weekend Volume [ ]

Summary

Hours	Major Volume	Minor Volume	Total Volume	Delay (Veh-hr)	1A 70%	1A 56%	1B 70%	1B 56%	2 70%	3A 70%	3B 70%
07-08	1295	28	1323	0.0	No	No	No	No	No	No	No
08-09	1119	24	1143	0.0	No	No	No	No	No	No	No
09-10	1008	16	1024	0.0	No	No	No	No	No	No	No
10-11	978	15	993	0.0	No	No	No	No	No	No	No
11-12	967	10	977	0.0	No	No	No	No	No	No	No
12-13	1077	14	1091	0.0	No	No	No	No	No	No	No
13-14	1102	12	1114	0.0	No	No	No	No	No	No	No
14-15	1231	21	1252	0.0	No	No	No	No	No	No	No
15-16	1296	14	1310	0.0	No	No	No	No	No	No	No
16-17	1492	31	1523	0.0	No	No	No	No	No	No	No
17-18	1666	19	1685	0.0	No	No	No	No	No	No	No
18-19	0	0	0	0.0	No	No	No	No	No	No	No
Total	13231	204	13435		0	0	0	0	0	0	0

Traffic Volumes (vph)

Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
0	0	0	28	0	0	0	614	0	59	622	0
0	0	0	24	0	0	0	540	0	34	545	0
0	0	0	16	0	0	0	530	0	30	448	0
0	0	0	15	0	0	0	500	0	20	458	0
0	0	0	10	0	0	0	470	0	23	474	0
0	0	0	14	0	0	0	524	0	19	534	0
0	0	0	12	0	0	0	493	0	24	585	0
0	0	0	21	0	0	0	561	0	38	632	0
0	0	0	14	0	0	0	627	0	56	613	0
0	0	0	31	0	0	0	807	0	55	630	0
0	0	0	19	0	0	0	841	0	77	748	0
0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian Volumes and Gaps (Per Hour)

Volume	Gap	Volume	Gap	Volume	Gap	Volume	Gap
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Delay	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F: Intersection Control Evaluation (ICE)

INTERSECTION CONTROL EVALUATION (ICE) TOOL

Version 1.8
Revised 4/14/2017

GDOT PI # (or N/A)	N/A	County: Carroll	Requested By: District Engineer		Date: 4/19/2017
Major (State) Route:	SR 140		GDOT District: 6 - Cartersville	Area Type:	Rural
Crossing Route:	Avery Road		Prepared By: Arcadis	Analyst:	T. Galloway
Project Purpose:	Improve intersection safety			Project ID:	3006

Introduction In 2005, SAFETEA-LU established the Highway Safety Improvement Program (HSIP) and mandated that each State prepare a Strategic Highway Safety Plan (SHSP) by which to prioritize safety funding investments. Intersections quickly became a common component of a majority of States' SHSP emphasis areas and HSIP project lists, including in Georgia's SHSP. Intersection Control Evaluation (ICE) policies and procedures represent a traceable and transparent procedure to streamline the evaluation of intersection control alternatives, and to further leverage the safety advancements noted above for intersection improvements beyond just the safety program. As approximately one-third of all traffic fatalities and roughly 75% of all traffic crashes in Georgia occur at or adjacent to intersections, the Georgia SHSP includes an emphasis on enhancing intersection safety in order to advance toward the Toward Zero Deaths vision embraced by the Georgia Governor's Office of Highway Safety. This ICE tool was developed to support the ICE policy and help ensure that intersection investments across the entire Georgia highway system are selected, prioritized and implemented with defensible benefits for safety toward those ends.

Tool Goal The goal of this ICE tool is to provide a simplified and consistent way of using traffic, safety, cost, environmental impact and political support data to assess and quantify intersection control improvement benefits and aid decision making by the Department in a manor that provides traceability, transparency, consistency and accountability when identifying and selecting an intersection control solution that both meets the project purpose and reflects the overall best value in terms of specific performance-based criteria.

Requirements An ICE is **required** for any intersection improvement (e.g., a new intersection, an intersection modification, widening/reconstruction or corridor project, or work accomplished through a driveway or encroachment permit that affects an intersection) where **1)** the intersection includes at least one roadway designated as a State Route (State Highway System) or as part of the National Highway System; and/or **2)** the intersection will be designed or constructed using State or Federal funding. In certain circumstances where an ICE would otherwise be required, the requirement **may** be waived based on appropriate evidence presented with a written request. Please see the "Waiver" tab to understand the criteria that may make a project waiver eligible and learn how to submit a waiver request to the Department. An ICE is **not required** when the proposed work involved does not include any major changes to an intersection that would substantially alter the character of the intersection; for instance, a project limited only to "mill and fill" pavement resurfacing with no change to intersection geometry or control, or routine traffic signal timing (not to include adding a phase) and equipment maintenance.

Two-Stage Process A complete ICE process consists of two (2) distinct stages, and it is expected that the respective level of effort for completing both stages of ICE will correspond to the magnitude and complexity of the intersection. The Stage 1 and Stage 2 ICE forms are designed to keep data inputs at a minimum, requiring limited data entry and drop-down menu fields. All fields shaded in grey have drop down menu choices and all fields shaded in blue require a text response. All other cells in the worksheet are locked to prohibit the entering or editing of data.

Stage 1: Screening Decision Record Stage 1 is conducted as early in the project development process as possible and is intended to inform which alternatives are worthy of further evaluation in Stage 2. A Stage 1 evaluation normally requires sufficient analysis or subject matter expertise to estimate the preliminary footprint of the intersection to determine whether or not an alternative is practical to implement. Users should use good engineering judgement in responding to seven policy questions by selecting "Yes" or "No" in the drop-down boxes and alternatives should not be summarily eliminating without due consideration. Reasons for eliminating or advancing an alternative should be documented in the rightmost column with heading: "Screening Decision Justification".

Stage 2: Alternative Selection Decision Record Stage 2 involves a more detailed and familiar evaluation of alternatives identified in Stage 1 in order to support the selection of a preferred alternative that may be advanced to detailed design. Based on the Concept Development Process outlined by the PDP Manual, Stage 2 would begin after the Initial Concept Meeting for corridor improvements and projects consisting of multiple intersections. The data entry is similar in process to Stage 1 but is more robust, requiring separate analysis of each alternative to determine cost, impacts, operations, safety and project support. A separate "Instructions" tab is provided to provide guidance to the user on data entry values and parameters. Once all the data is entered, a score and ranking of each alternative is calculated and reported on the bottom line of the worksheet to inform on the best intersection treatment to select as the preferred alternative.

Documentation A complete ICE document consists of the combination of the outputs from both Stage 1 and Stage 2 along with supporting documentation, to be included in the approved project Concept Report (or equivalent) or as a stand-alone document.

GDOT ICE STAGE 1: SCREENING DECISION RECORD

GDOT PI #	N/A
Major Route:	SR 140
Minor Route:	Avery Road
Prepared by:	Arcadis
Analyst:	T. Galloway
Date Completed:	4/19/2017

Answer "Yes" or "No" to each policy question for each control type to identify which alternatives should be evaluated in the Stage 2 Decision Record. Enter justification in the rightmost column.
Note: *No more than 5 alternatives may selected and evaluated in Stage 2.*

Version 1.8
Revised 4/14/2017

	Intersection Alternative:	1 Does alternative address the project need in a balanced manner and in scale with the project?	2 Does alternative improve safety performance in terms of reducing severe crashes?	3 Does alternative incorporate convenience and accessibility for pedestrians and /or bicyclists?	4 Does alternative improve (or preserve) traffic operations (congestion, delay, reliability, etc.)?	5 Does alternative appear feasible given the site characteristics, constrains and location context?	6 Does alternative appear feasible with respect to other project factors?	7 Overall feasible alternative (select alternative for further evaluation in Stage 2)?	Screening Decision Justification:
Unsignalized	**Conventional (Minor Stop)**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Addition of left turn lane**
	Conventional (All-Way Stop)	No	**Yes**	No	No	**Yes**	No	No	Low side street volume
	Mini Roundabout	No	No	No	No	No	No	No	High speed mainline
	Single Lane Roundabout	**Yes**	**Yes**	**No**	**No**	**Yes**	**No**	**Yes**	**Potential solution to evaluate**
	Multilane Roundabout	No	No	No	No	No	No	No	All single lane approaches
	RCUT (unsignalized)	No	No	No	No	No	No	No	Signigicant impacts to improve from undivided to divided roadway
	RIRO w/downstream U-Turn	No	No	No	No	No	No	No	Significant thru volumes / insufficient ROW on mainline
	Unsignalized High-T	No	No	No	No	No	No	No	Low volume
	Offset-Tee Pair	No	No	No	No	No	No	No	No thru vehicles
	Other Unsignalized (provide description):	No	No	No	No	No	No	No	
	Other Unsignalized (provide description):	No	No	No	No	No	No	No	
Signalized Intersections	Traffic Signal	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Median U-Turn (Indirect Left)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	RCUT (signalized)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Displaced Left Turn (CFI)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Continuous Green-Tee (Hight-T)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Jughandle (Any Corner)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Quadrant Roadway (Any Corner)	No	No	No	No	No	No	No	N/A - Does not meet signal warrants
	Diverging Diamond (Ramp Terminals)	No	No	No	No	No	No	No	N/A - Not an interchange
	Single Point Interch (Ramp Terminals)	No	No	No	No	No	No	No	N/A - Not an interchange
	Other Signalized (provide description):	No	No	No	No	No	No	No	Write in control type / improvements
	Other Signalized (provide description):	No	No	No	No	No	No	No	Write in control type / improvements

= Intersection type selected for more detailed analysis in Stage 2 Alternative Selection Decision Record

GDOT ICE STAGE 2: ALTERNATIVE SELECTION DECISION RECORD

Version 1.8
Revised 4/14/2017

Project Information

GDOT PI # (or N/A): N/A
County: Carroll
Project Location: SR 140 @ Avery Road
GDOT District: 6 - Cartersville
Area Type: Rural
Date: 4/19/2017
Agency/Firm: Arcadis
Analyst: T. Galloway
Existing Intersection Control: Conventional (Minor Stop)
Type of Analysis: Safety Funded Project

Existing Conditions

Intersection meets Signal warrants?	No
Intersection meets AWSC warrants?	No
Traffic Analysis Software	Synchro 9
Existing Pk Hr Intersection Delay*	2.2
Existing Intersection V/C ratio*	0.19
Design Year	2017
Design Year Intersection Delay*	2.2
Design Year V/C Ratio*	0.19

* = worst case AM/PM results

Crash Data:

Crash Type (3 most recent years of intersection crash data)	Crash Severity: PDO	Injuries	Fatalities
Angle	1	1	0
Head-On	0	1	1
Rear End	9	3	0
Sideswipe - same	0	0	0
Sideswipe - opposite	0	0	0
Not Collision w/Motor Veh	0	0	0
TOTALS:	10	5	1

All TWLT Lane

Alternatives Analysis

Proposed Control Type/Improvement	Alternative 1: Conventional (Minor Stop)	Alternative 2: Single Lane Roundabout	Alternative 3: N/A	Alternative 4: N/A	Alternative 5: N/A
Project Cost					
Construction Cost	$200,966	$587,770			
ROW Cost	$11,478	$22,979			
Environmental Cost	$0	$0			
Reimbursable Utility	$10,048	$33,731			
PE+Contingency Cost (30%)	$66,748	$193,344			
Total Cost	$289,240	$837,824			
Traffic Operations					
Design Yr Intersection Delay	3.5	12.8			
Design Yr V/C Ratio	0.67	0.68			
Traffic Analysis Software	Synchro 9	GDOT RND Tool 4.0			
Safety Analysis					
Predefined CRF: PDO	0%	71%			
Predefined CRF: Fatal/Inj	0%	87%			
User Defined CRF: PDO	44%				
User Defined CRF: Fatal/Inj	55%				
User Defined CRF Source (if applicable):	CMF Clearinghouse #s 4703 / 4704				
Environmental Impacts					
Historic District/Property	None	None	None	None	
Archaeology Resources	None	None	None	None	
Graveyard	None	None	None	None	
Stream	None	None	None	None	
Underground Tank/Hazmat	None	None	None	None	
Park Land	None	None	None	None	
Environmental Justice Community	None	None	None	None	
Wooded Area	None	None	None	None	
Wetland	None	None	None	None	
Political Factors	*If environmental impact is highlighted **RED**, provide justification impact won't jeopardize project delivery on ENV worksheet tab.*				
Local Citizen Support	Neutral	Neutral	Neutral	Neutral	
Local Government Support	Neutral	Neutral	Neutral	Neutral	
GDOT District Office Support	Neutral	Neutral	Neutral	Neutral	
GDOT Central Office Support	Neutral	Neutral	Neutral	Neutral	
Final ICE Stage 2 Score	7.4	7.3	-	-	-
Rank of Control Type Alternatives:	1	2	-	-	-

Note: Stage 2 score is not shown (shown as "-") if signal or AWS is selected as control type but signal or AWS warrants are not met

Provide any additional general comments or explain analysis inputs (as necessary): No comments.

Appendix G: Alternative Sketches

GDOT

ARCADIS

NOT TO SCALE

0 75 150

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

SR 140 @ Avery Road
Turn Lane Addition

PAGE
1 OF 3

GDOT

ARCADIS

NOT TO SCALE

0 75 150

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

SR 140 @ Avery Road Roundabout

Appendix H: Cost Estimates

Planning Level Project Cost Estimation

Project Identification

	SR 140 @ Avery Road		
Description	Add Left Turn Lane	Proj. Type	
From/To Limit		District	3
Notes			
SR 140	0.12 miles		
	miles total		0.12

Cost Summary Incl. Contingency	
Preliminary Engineering	$ 65,761
Reimbursable Utility	$ 10,048
Right-of-Way	$ 11,478
Construction	$ 200,966
Total	$ 288,254

Construction Costs

Average Per Lane-Mile Components	Unit Cost	Miles	Add Lanes	Lane-Miles	Cost
Surface Str. New Cst. base & pave	$410,000			0	$0
SR or High volume Rd widening	$500,000	0.12	0.75	0.09	$45,000
Surface Street Overlay	$64,000	0.12	2.00	0.24	$15,360
Concrete Widening (Ramps)	$843,744			0	$0
Cross Streets widening	$307,500			0	$0
Cross Street Overlay	$20,000				$0
Traffic Control	$150,000	0.12	1.00		$18,000
Typical Driveways	$75,000				$0
Typical E & S Control Temp&Perm	$150,000	0.12	1.00		$18,000
Typical Earthwork	$500,000	0.12	1.00		$60,000
Typical Drainage - Urban Section	$255,000				$0
Curb & Gutter both sides (mile)	$264,000				$0
Typical Drainage - Rural Section	$150,000	0.12	1.00		$18,000
Signing & Marking	$50,000	0.12	1.50		$9,000
Typical Clear & Grub-120 ft wide	$109,091				$0
Typical Guardrail Type W	$212,000				$0
20ft. Raised median +C&G (mile)	$968,000				$0
Median landscaping	$100,000				$0
Sidewalks 5 ft. ea.side (mile)	$294,000				$0
ADA Ramps	$1,500				$0
					$0
				Subtotal	$183,360

Additional Per Mile Components	Unit Cost	Length	factor		Cost
Add'l Major Earthwork (mile)	$350,000				$0
Add'l Major Drainage (mile)	$150,000				$0
Add'l Major Grade changes (mile)	$350,000				$0
Major alignment corrections (mile)	$750,000				$0
Maint of Traffic difficulty (mile)	$200,000				$0
Temporary Barrier	$30				$0
Concrete Island + C&G (SY)	$60				$0
Add'l guardrail Type T (mile)	$423,000				$0
Paved Shoulders, 4 ft, 2 sides(mile)	$100,000				$0
blank	$0				$0
blank	$0				$0
Bikeway, 4 feet, both side (mile)	$333,333				$0
Add'l driveways (mile)	$75,000				$0
Cl. B Conc. Base or pvmt widening	$792,000				$0
Special E&S control	$300,000				$0
				Subtotal	$0

Individual Components	Unit Cost	Length (ft)	Width (ft)	Ht (ft)	Cost
Truck Apron	$506,880				$0
Conc Header Crub, TP 7 both sides (r	$126,720				$0
Conc Header Crub, TP 9 both sides (r	$147,840				$0
Retaining Walls - Gravity 0 - 5' (LF)	$60				$0
Retaining Walls-Gravity 5'-max (LF)	$120				$0
Retaining Walls-Special Design(SF)	$60				$0
Bridges - widen (SF)	$100				$0
Bridges - widen (SF)	$100				$0
Bridges - replace (SF)	$120				$0
Bridges - replace (SF)	$120				$0
Bridges - detour (SF)	$60				$0
Bridge Removal (SF)	$25				$0
Cofferdams (ea)	$20,000				$0
Box Culverts (SF)	$95				$0
Box Culverts (SF)	$95				$0
Large cross drains (LF)	$80				$0
Replace cross drains (LF)	$120				$0
Sediment/ detention ponds (ea)	$30,000				$0
Pavement patching (Sq yd)	$30				$0
Bus Stop Relocation	$50,000				$0
Traffic Signalization / Upgrade (ea)	$125,000				$0
				Subtotal	$0
			Total Construction Cost		$183,360
			Percent of Total		*70%*

Right-of-Way Costs

Area Type		Unit cost/ac	Miles	Width (ft)	Acres	Cost
Urban						
Residential Property		$800,000	0	0	0.00	$0
Residential Easement		$240,000	0	0	0.00	$0
Commercial Property		$1,200,000	0		0.00	$0
Commercial Easment		$360,000	0	0	0.00	$0
Suburban/Rural						
Residential Property		$30,000	0.07	15	0.13	$3,818
Residential Easement		$15,000	0.1	15	0.18	$2,727
Commercial Property		$800,000	0	0	0.00	$0
Commercial Easment		$240,000	0	0	0.00	$0
Displacements			Number	factor		
	Residential	$250,000	0	1.00		$0
	Commercial	$1,000,000	0	0		$0
	Damages	$0	0	1.00		$0
					ROW multiplier	1.6
				Total Right-of-Way Cost		$10,473
						4%

Reimbursable Utility Costs

	5%	Total Reimbursable Utility Cost	$ 9,168
			3.49%

Preliminary Engineering Costs

PE %	20%	Total Preliminary Engineering Cost	$60,000
			22.81%

Contingency Costs

Contingency %	10%	Total Contingency Cost	$25,253
		Total (PE+Util.+ROW+CST)	$263,001
		Grand Total	$288,254

Safety Benefits

Recommendation	Ek	R	r	Rp	rp
Left turn lane	0.135	0.55	0.45	0.44	0.56

Description	Symbol	Value
Reduction Factor (F, I)	R	0.55
Reduction Factor (PDO)	Rp	0.44
Capital Recovery Factor	Ek	0.135
Initial Improvement Cost	Ci	$ 288,254

Accident Data	Symbol	Value
PDO	P	3.3
Fatalities	F	0.3
Injuries	I	3.0

Weighted cost of fatal and injury collisions

Q = $ 1,769,877

Annual Benefit: $ 3,284,381

Annual Cost: $ 58,914

Annual B/C Ratio: **55.75**

Design Life Benefit

B = $ 15,662,167

Design Life Cost

C = $ 280,943

Design Life Benefit/Cost Ratio

B/C = **55.75**