ORIGINAL TO GENERAL FILES

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

OFFICE OF DESIGN POLICY & SUPPORT
INTERDEPARTMENTAL CORRESPONDENCE

FILE P.I. # 0012722
Chatham County
GDOT District 5 - Jesup
I-95@ SR 21 Diverging Diamond Interchange

OFFICE Design Policy & Support

DATE December 15, 2014

FROM for Brent Story, State Design Policy Engineer

TO SEE DISTRIBUTION

SUBJECT **APPROVED CONCEPT REPORT**

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

Attachment

DISTRIBUTION:

Glenn Bowman, Director of Engineering
Joe Carpenter, Director of P3/Program Delivery
Genetha Rice-Singleton, Assistant Director of P3/Program Delivery
Albert Shelby, State Program Delivery Engineer
Bobby Hilliard, Program Control Administrator
Cindy VanDyke, State Transportation Planning Administrator
Hiral Patel, State Environmental Administrator
Ben Rabun, State Bridge Engineer
Kathy Zahul, State Traffic Engineer
Angela Robinson, Financial Management Administrator
Lisa Myers, State Project Review Engineer
Charles "Chuck" Hasty, State Materials Engineer
Mike Bolden, State Utilities Engineer
Richard Cobb, Statewide Location Bureau Chief
Karon Ivery, District Engineer
Will Murphy, District Preconstruction Engineer
Dallory Rozier, District Utilities Engineer
Andrew Hoenig, Project Manager
BOARD MEMBER - 1st Congressional District

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
PROJECT CONCEPT REPORT

Project Type:	Interchange Reconstruction	P.I. Number:	0012722
GDOT District:	5	County:	Chatham
Federal Route Number:	I-95	State Route Number:	SR 21
		Project Number:	

Reconstruction of existing interchange at I-95 at SR 21 to a diverging diamond interchange

Submitted for approval:

Doug Tilt, PE	ARCADIS U.S., Inc.	10/27/14 Date
Darryl D. VanMeter, PE	Office of Innovative Delivery	10/31/14 Date
Andrew Hoenig	GDOT Project Manager	10/31/2014 Date

* Recommendation on file

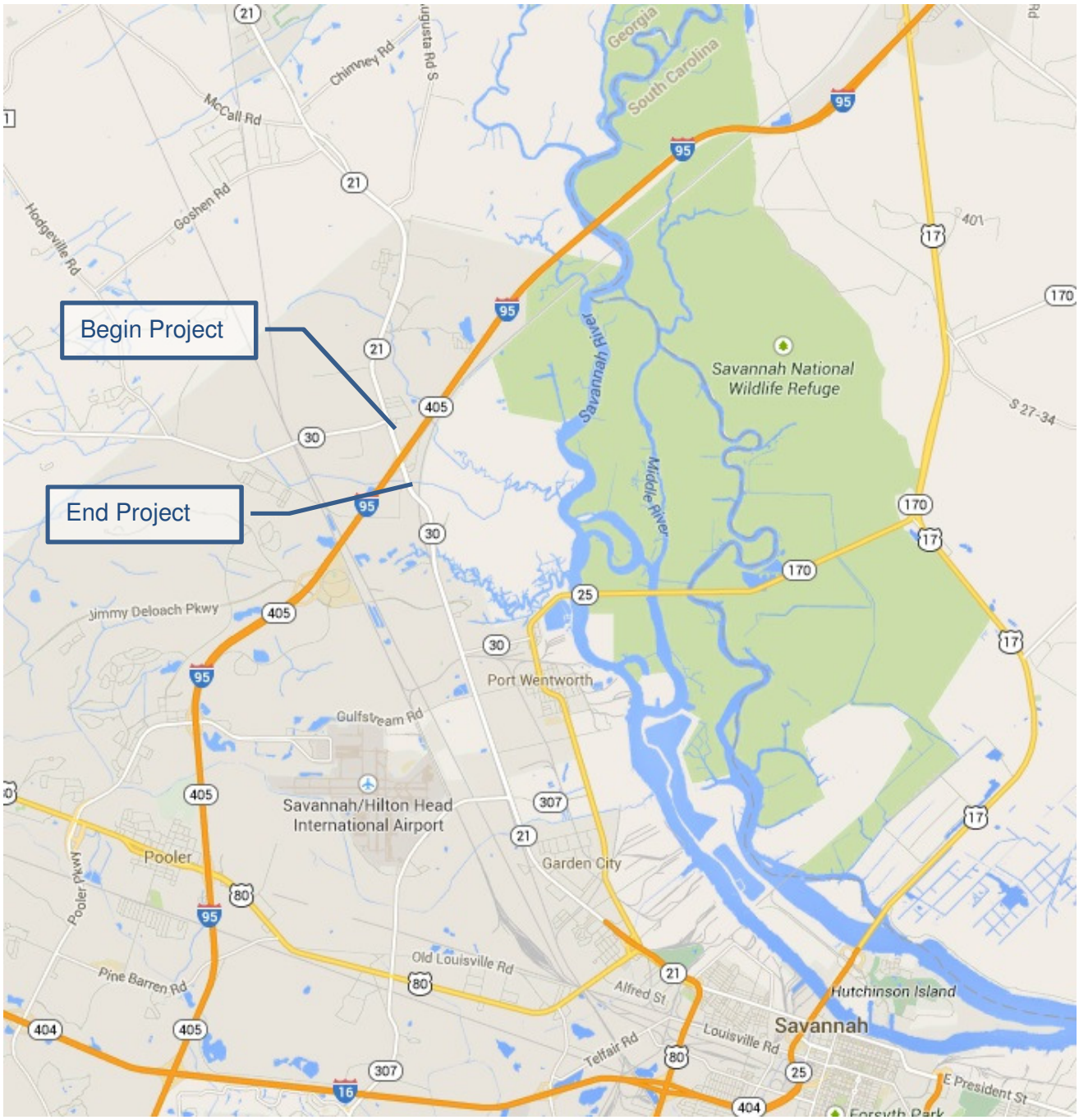
Recommendation for approval:

Program Control Administrator	Date
* Hiral Patel /KLP	10-6-14
State Environmental Administrator	Date
* Kathy Zahul /KLP	9-25-14
State Traffic Engineer	Date
* Lisa Myers/KLP	9-25-14
Project Review Engineer	Date
* Jun Birnkammer/KLP	9-30-14
State Utilities Engineer	Date
* Karon Ivery/KLP	10-3-14
District Engineer	Date
* Ben Rabun /KLP	11-7-14
State Bridge Engineer	Date
State Transportation Financial Management Administrator	Date

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

* Cynthia VanDyke	9-25-14
State Transportation Planning Administrator	Date

PROJECT LOCATION MAP



PLANNING AND BACKGROUND

Project Justification Statement:

State Route 21 in Chatham County was identified for corridor improvements and minor interchange improvements. This proposed project was presented to and approved by the Operational Improvement Committee. In the interest of accelerated and efficient delivery, the project was approved for Design-Build delivery on January 28, 2014.

SR 21 is an urban principal arterial that connects downtown Savannah to the northern suburban areas in Effingham County. Currently, SR 21 consists of two through lanes and one right turn auxiliary lane each direction with a grass median. The SR 21/I-95 interchange is a conventional diamond interchange with two through travel lanes and one turn lane in each direction on the arterial mainline and dual left turns and a right turn lane on the ramp terminals. The exit ramp intersections are controlled by traffic signals that are coordinated with the intersection of SR 30 to the north.

The Office of Traffic Operations performed an engineering study of the interchange to determine if a diverging diamond interchange (DDI) configuration would improve operations along SR 21. The proposed DDI consists of three through lanes and one turn lane in each direction of SR 21 under the I-95 overpass. The additional lane from the SR 21 at the interchange will terminate as a left turn only lane at SR 30 to the north and a right turn only lane at Hendley Road to the south. The project will use the existing grass median/shoulder to connect the lanes from the DDI on the north and south side of the interchange. A capacity analysis concluded that the DDI reconfiguration will improve operations at the interchange in the short term over a 10 year project life, reducing the intersection delay and travel times from the ramps and along the SR 21 mainline. (see charts below) These improvements will also increase the operational efficiency of the intersection, by reducing the potential for queuing on the I-95 mainline.

Figure 1: Overall Intersection Delay (seconds) and Level of Service for 2025 Design Year

	AM Peak		PM Peak	
	No Build	DDI	No Build	DDI
SR 21 @ NB Ramp	147 (F)	20 (B)	108 (F)	79 (E)
SR 21 @ SB Ramp	72 (E)	20 (B)	55 (E)	19 (B)

Figure 2: Travel Time Estimates for 2025 Design Year

	AM Peak		PM Peak	
	No Build	DDI	No Build	DDI
SR 21 Southbound from SR 30 to Hendley Road	1.4 min	1.3 min (-7%)	1.4 min	1.2 min (-14%)
SR 21 Northbound from Hendley Road to SR 30	1.3 min	1.2 min (-8%)	2.6 min	3.0 min (+15%)
I-95 Northbound Exit Ramp to SR 21 @ SR 30	10.5 min	2.8 min (-73%)	4.9 min	3.9 min (-20%)

Due to the minor project scope, the right-of-way constraints, existing intersection features (existing roadway width and signal operations) and the scope approved by the Operational Improvement Committee, a roundabout was not recommended for this location.

Existing conditions: SR 21 is primarily two lanes in each direction with right and left turn lanes at intersections. Shoulders are paved and grassed shoulders inside the median and outside of travel lanes. Commercial driveways and side roads radii are curb and gutter. Existing conditions are observed that the NB off-ramp traffic from I-95 to SR 21 backs up on I-95 mainline creating blocking on I-95 in the NB direction.

Other projects in the area:

PI 0008480, I-95 From Jimmy Deloach Pkwy To SR 21
PI M004603, I-95 NB Exit Ramp @ SR 21; Inc SR 21 @ I-95 NB Right Turn Ln
PI M003685, Chatham SR 21 Intersection Improvements
PI 511165, I-95 From N of I-16 Chatham Thru Effingham To SC State Line - 8 Lanes
PI 0011743, SR 21 From I-516 to Effingham County Line-Corridor Study

As part of evaluation with project PI#0008480, an analysis was performed to improve the current capacity for the NB off-ramp which could include triple lefts going NB into Effingham County. A request was made to evaluate a diverging diamond interchange as an alternate to improve the operational conditions of the interchange.

MPO: Savannah TMA **TIP #:** 2015-GDOT-01

TIA Regional Commission: Coastal Georgia RC RC Project ID:

Congressional District(s): 1

Federal Oversight: ☐ FOS/PoDI ☒ Exempt ☐ State Funded ☐ Other

Projected Traffic: ADT
Current Year (2014): 45,790 vpd; Open Year (2015): 46,770 vpd; Design Year (2035): 63,055 vpd
Traffic Projections Performed by: ARCADIS

Functional Classification (Mainline): Urban Principal Arterial

Complete Streets - Bicycle, Pedestrian, and/or Transit Warrants:
Warrants met: ☒ None ☐ Bicycle ☐ Pedestrian ☐ Transit

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

Pavement Evaluation and Recommendations
Preliminary Pavement Evaluation Summary Report Required? ☐ No ☒ Yes
Preliminary Pavement Type Selection Report Required? ☒ No ☐ Yes
Feasible Pavement Alternatives: ☒ HMA ☐ PCC ☐ HMA & PCC

DESIGN AND STRUCTURAL

Description of the proposed project: Interchange reconstruction of I-95 and SR 21 / SR 30 from a diamond to a diverging diamond interchange. The three through lanes will be carried through the interchange northbound and southbound, and the northbound right turn lanes at multiple driveways will

be converted to a right turn auxiliary lane on SR 21. Additional lane added in each direction on SR 21 from SR 30 to Hendley Rd. PI #0012722 is located in Chatham County approximately 4 miles NW of Port Wentworth and 10 miles NW of Savannah. Total length of project is approximately 1 mile.

Major Structures:

Structure	Existing	Proposed
ID # 051-0125-0 And 051-0126-0 I-95 over SR 21	I-95 bridges over SR 21 existing NBL and SBL structures are 323' in length, 79' in deck width, and 64' roadway bridge width. NBL shoulder widths are 12' LT/RT and SBL shoulder widths are 11.167'/10' LT and 13'/12' RT. Current Sufficiency Rating = 92.25 NBL & SBL.	Existing bridge to be maintained and not altered for this project.
Retaining walls (not including gravity walls)	No existing retaining walls.	No proposed retaining walls.
Other	None.	None.

Mainline Design Features:

Feature	Existing	Standard*	Proposed
Typical Section			
- **Number of Lanes – SR 21**	**4**	**4**	**6**
- **Lane Width(s) – SR 21**	**12'**	**12'**	**12'**
- **Lane Width(s) - Ramps**	**12'-20'**	**12'-20'**	**12'-20'**
- **Median Width & Type**	**10'-64', TP B**	**8'-20', TP B**	**8'-40', TP B**
- **Outside Shoulder or Border Area Width**	**5'-10'**	**6.5' paved, 3.5' grassed**	**6.5' paved, 3.5' grassed**
- **Outside Shoulder Slope**	**4%-6%**	**6%**	**6%**
- **Inside Shoulder Width**	**5'-10'**	**2' paved, 4' grassed**	**4' paved, 4' grassed**
- **Sidewalks**	**None**	**None**	**None**
- **Auxiliary Lanes**	**12'**	**12'**	**12'**
Bike Lanes	**None**	**None**	**None**
Posted Speed	**45**		**45 (30 within DDI)**
Design Speed	**45**	**N/A**	**45**
Min Horizontal Curve Radius	**None**	**711'**	**300'**
Maximum Superelevation Rate	**N/A**	**6%-8%**	**6%**
Maximum Grade	**2.2%**	**5%**	**Match Existing**
Access Control	**None**	**By Permit**	**By Permit**
Design Vehicle	**WB-40**	**WB-40 or WB-62**	**WB-67**
Pavement Type	**Asphalt**	**Asphalt**	**Asphalt**

*According to current GDOT design policy if applicable

Major Interchanges/Intersections: SR 21 at I-95 Interchange

Major intersections include SR 21 intersections with I-95 ramp terminals.

Lighting required: ☐ No ☒ Yes
In accordance with GDOT Design Manual, underpass lighting is being considered. Currently, coordination with City of Port Wentworth is ongoing with regards to approval of a lighting agreement.

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

Transportation Management Plan [TMP] Required: ☐ No ☒ Yes
If Yes: Project classified as: ☐ Non-Significant ☒ Significant
TMP Components Anticipated: ☒ TTC ☒ TO ☒ PI

Design Exceptions to FHWA/AASHTO controlling criteria anticipated:

FHWA/AASHTO Controlling Criteria	No	Undeter-mined	Yes	Appvl Date (if applicable)
1. Design Speed	☒	☐	☐	
2. Lane Width	☒	☐	☐	
3. Shoulder Width	☒	☐	☐	
4. Bridge Width	☒	☐	☐	
5. Horizontal Alignment	☐	☐	☒	10/1/2014
6. Superelevation	☒	☐	☐	
7. Vertical Alignment	☒	☐	☐	
8. Grade	☒	☐	☐	
9. Stopping Sight Distance	☒	☐	☐	
10. Cross Slope	☒	☐	☐	
11. Vertical Clearance	☒	☐	☐	
12. Lateral Offset to Obstruction	☒	☐	☐	
13. Bridge Structural Capacity	☒	☐	☐	

A design exception for minimum curve radius has been approved for the crossover movements of the Diverging Diamond Interchange.

Design Variances to GDOT Standard Criteria anticipated:

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

13. GDOT Bridge & Structural Manual	Bridges	☒	☐	☐	

Complete Streets: Sidewalk is not included along SR 21 to avoid any impacts to nearby properties and ecological resources including wetlands and streams. The need for a design variance for pedestrian accommodation will be evaluated during preliminary plans stage.

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

UTILITY AND PROPERTY

Temporary State Route needed: ☒ No ☐ Yes ☐ Undetermined

Railroad Involvement: N/A

Utility Involvements:
Sanitary Sewer – City of Port Wentworth
Water – City of Port Wentworth
Telephone– Southern Bell
Gas – Atlanta Gas Light Co.

SUE Required: ☐ No ☒ Yes ☐ Undetermined

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

Right-of-Way (ROW): Existing width: 300 ft Proposed width: 300 ft
Required Right-of-Way anticipated: ☒None ☐Yes ☐Undetermined
Easements anticipated: ☒None ☐Temporary ☐Permanent ☐Utility ☐Other

Anticipated total number of impacted parcels:		0
Displacements anticipated:	Businesses:	0
	Residences:	0
	Other:	0
	Total Displacements:	0

Location and Design approval: ☒ Not Required ☐ Required

CONTEXT SENSITIVE SOLUTIONS

Issues of Concern:
Ecological Resources
Many ecological resources, including wetland and streams, are present along SR 21 and the ramps at I-95. The project corridor is mostly used for commuting to and from the City of Savannah.

Pedestrian Accommodations
The existing typical section of SR 21 is rural without sidewalks.

Driver Expectancy
The Diverging Diamond Interchange is still a relatively new concept which hasn't been widely implemented in Georgia. As a result, drivers along this corridor may not have encountered this type of interchange configuration before. To improve driver expectancy and minimize confusion within the interchange, the following mitigation strategies are recommended to combat several design elements along the roadway

which may not meet driver expectancy for this corridor. The design speed along SR 21, functionally classified as an Urban Principal Arterial, is 45mph. The proposed project will reconstruct the existing conventional diamond interchange to a Diverging Diamond Interchange. The major controlling element of a DDI is the design speed of the horizontal alignment (e.g. crossover movements). The crossover movements associated with the proposed project have been designed to meet a 30 mph speed design. The placement of the crossovers is largely dependent on the spacing and location of the Interstate Interchange Ramps (i.e. intersections spaced closely together will result in lower horizontal curve radii).

Context Sensitive Solutions Proposed:

Ecological Resources

The design has been adjusted to not impact the ecological resources. High commuter use along the project suggests that a PIOH will be useful.

Pedestrian Accommodations

The existing shoulder will be retained when possible and no pedestrian improvements will be implemented so to avoid any impacts to the nearby properties and ecological resources.

Driver Expectancy

The horizontal alignment of the DDI consists of three main interacting elements: 1) crossing angle; 2) tangent length approaching and following the crossover; and 3) curve radii approaching and following the crossover.

1. Crossing Angle
    a. Potential mitigation strategies:
        i. Additional signage indicating “no right turn” or “no left turn” at crossover intersections to clarify permitted movements
        ii. Enhanced pavement markings, such as directional arrows on opposite sides of the intersections to guide traffic to the appropriate lanes.
        iii. Enhanced pavement markings, such as RPMs and “mini-skips” across intersections as guidance.
        iv. Additional intersection lighting for clarity during night-time operations.
        v. Upward-oriented “green arrow” on signal installations to indicates straight ahead movements.
2. Tangent Length
    a. Potential mitigation strategies:
        i. Additional signage indicating reverse curves.
        ii. Enhanced pavement markings such as RPMs for guidance
        iii. Select curve radii such that normal crown can be maintained throughout based on design speed and low-speed super elevation criteria.
3. Curve Radii
    a. Potential mitigation strategies:
        i. Install speed reduction zone through the interchange to incrementally step the travel speed along SR 21 from 45 mph to 30 mph prior to traffic reaching the crossover movements at each ramp terminal.
        ii. Additional signage indicating reverse curves.
        iii. Enhanced pavement markings such as RPMs for guidance
        iv. Select curve radii such that normal crown can be maintained throughout based on design speed and low-speed super elevation criteria.

ENVIRONMENTAL & PERMITS

Anticipated Environmental Document:

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

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

The project is located in Chatham County, which is within the MS4 boundary of the state. The project disturbs more than 1 acre of land, therefore compliance with post-construction storm water treatment requirement of the MS4 permit is required. These requirements include

- Removal of 80 % of the average annual TSS load from pavement runoff by treating the first 1.2 inch rainfall.
- Stream channel protection by detaining 1 year 24 hour rainfall for 24 hours.
- Provide overbank protection by not increasing the post-developed compared to pre-developed flows for the 25 year 24 hour rainfall event.
- Provide extreme flood protection by controlling the 100 year 24 hour flood and routing through the BMP.

Use of post-construction best management practices (BMPs) including detention ponds and enhanced swales are being evaluated. A summary of the conceptual hydrology study is attached to report with site specific discussions on these BMPs.

Environmental Permits/Variances/Commitments/Coordination anticipated:

Permit/Variance/Commitment/Coordination Anticipated	No	Yes	Remarks
1. U.S. Coast Guard Permit	☒	☐	
2. Forest Service/Corps Land	☒	☐	
3. CWA Section 404 Permit	☒	☐	
4. Tennessee Valley Authority Permit	☒	☐	
5. Buffer Variance	☒	☐	
6. Coastal Zone Management Coordination	☒	☐	
7. NPDES	☐	☒	
8. FEMA	☒	☐	
9. Cemetery Permit	☒	☐	
10. Other Permits	☒	☐	
11. Other Commitments	☒	☐	

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

Environmental Comments and Information:

NEPA/GEPA: Project is proposed as a CE. The change in access along SR 21 with the addition of a median precludes this from being a PCE.

Ecology: Waters of the U.S. are present in the project area. Preliminary design indicates no impacts to all resources.

A Phase I ecology survey has been prepared. A phase II report will be prepared to state no effect to waters of the US. No protected species have been identified in the project limits.

History: None present along the project area.

Archeology: None present along the project area.

Air Quality:

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

Noise Effects: Project qualifies for a Type III noise analysis. No modeling or barrier analysis to be completed.

Public Involvement: A Public Information Open House was held on August 12, 2014.

Major stakeholders: Traveling public, Georgia Tech Savannah is 2 miles from project site. Chatham County, Savannah MPO, Georgia DOT board member.

CONSTRUCTION

Issues potentially affecting constructability/construction schedule: High peak hour traffic will require off-hour construction for the areas outside of the interchange. Temporary weekend lane closures with temporary on-site detours will be utilized for the interchange.

Early Completion Incentives recommended for consideration: ☒ No ☐ Yes

COORDINATION, ACTIVITIES, RESPONSIBILITIES, AND COSTS

Initial Concept Meeting: April 29, 2014 – See minutes in attachments.

Concept Meeting: GDOT PM suggests there may not be a need for a concept meeting.

Other coordination to date:

Project Activity	Party Responsible for Performing Task(s)
Concept Development	ARCADIS
Design	Design Build Team
Right-of-Way Acquisition	Design Build Team
Utility Relocation	Design Build Team/Utility Owner
Letting to Contract	GDOT
Construction Supervision	GDOT
Providing Material Pits	Design Build Team
Providing Detours	Design Build Team
Environmental Studies & Documents	ARCADIS
Environmental Permits & Mitigation	Design Build Team
Construction Inspection & Materials Testing	GDOT

Project Cost Estimate Summary and Funding Responsibilities:

	Breakdown of PE	ROW	Utility*	CST**	Mitigation	Total Cost
Funded By	GDOT	GDOT	GDOT	GDOT	GDOT	
$ Amount	$691,882	$0	Included in D/B Contract	$6,803,069	$0	$7,494,951
Date of Estimate	7/30/2014	7/30/2014	11/18/2014	10/27/2014	7/30/2014	

*Reimbursable Utility Costs only
**CST Cost includes: Utilities, Design, Construction, Contingency, Engineering and Inspection, and Liquid AC Cost Adjustment.
See the attached Cost Estimates.

ALTERNATIVES DISCUSSION

Alternative selection:

Preferred Alternative: Diverging diamond interchange with three through lanes and one turn-lane in each direction underneath I-95 bridge over SR-21. SR-21 underneath I-95 bridge currently has 48 feet of pavement in both directions. Widening is required to accommodate the fourth lane in both directions on SR-21. Additional northbound lane widening ends at intersection with SR-30 in the north side and with Hendley Road in the south side. In addition to that, this concept assumes triple lefts from I-95 off-ramp going NB into Effingham county. Also, dual rights are assumed for I-95 SB traffic on SR-21 going EB into City of Savannah. Existing shoulders are used as often as possible in order to reduce right of way and easement acquisition.

Estimated Property Impacts:	**None**	**Estimated Total Cost:**	**$7,494,951**
Estimated ROW Cost:	**None**	**Estimated CST Time:**	**24 months**

Rationale: This alternate is anticipated to reduce the expected number of accidents and keeps a minimum footprint for the project in order to keep right of way and easement acquisition to a minimum. Also this alternate provides a dramatic reduction in delay times for the primary movements which are the Northbound off ramp in the afternoon and the Southbound on ramp in the morning.

No-Build Alternative: Existing interchange with 2 through lanes and 1 left turn lane each direction

Estimated Property Impacts:	**None**	**Estimated Total Cost:**	**None**
Estimated ROW Cost:	**None**	**Estimated CST Time:**	**None**

Rationale: This alternative does not address the problem at hand, volume that exceeds the capacity of the roadway.

Alternative 1: Interchange improvement with triple lefts from I-95 off-ramp going NB into Effingham county. Also, dual rights are assumed for I-95 SB traffic on SR-21 going EB into City of Savannah. Widening is required to accommodate the fourth lane in northbound direction on SR-21. Additional northbound lane widening ends at intersection with SR-30 in the north side and with Hendley Road in the south side.

Estimated Property Impacts:	**None**	**Estimated Total Cost:**	**$2,276,420**
Estimated ROW Cost:	**None**	**Estimated CST Time:**	**24 months**

Rationale: This alternate does not address the problem of lengthy travel times. It does not reduce delay as much as the preferred alternative. See the attachment for a comparison of travel times.

Comments:

LIST OF ATTACHMENTS/SUPPORTING DATA

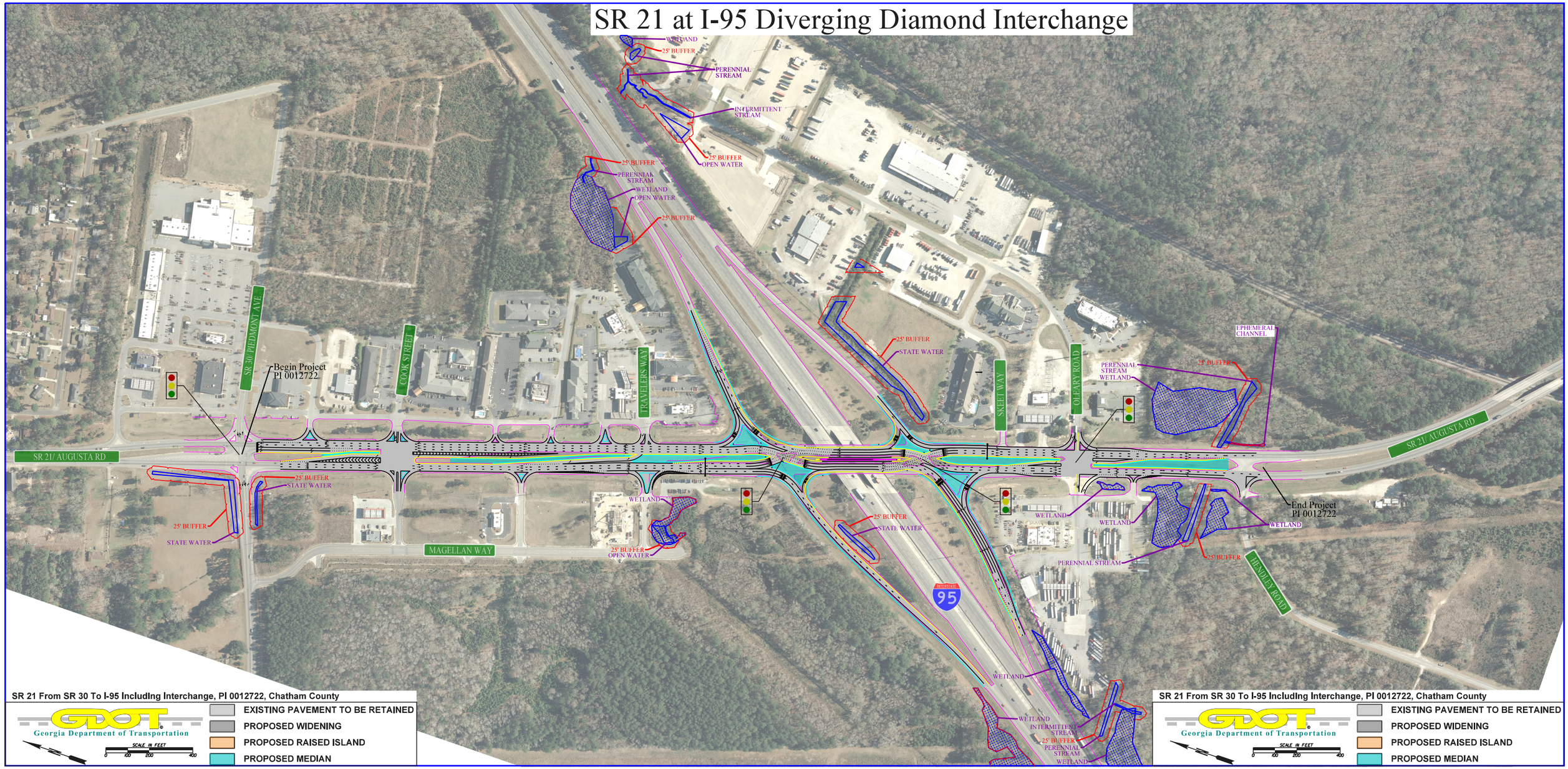
1. Concept Layout
2. Typical sections
3. Detailed Cost Estimates:
    a. Summary
    b. Utility
    c. CES
    d. Liquid AC Cost Adjustment
4. Alternates Anticipated Benefits Table
5. Traffic diagrams
6. Capacity analysis summary
7. S I & A Report(s)
8. Concept Level Hydrology Study for MS4 Permit
9. Pavement Design
10. Highway Safety Manual Crash Reduction Factor Calculations
11. Minutes of Concept Meetings
12. Transportation Management Plan

APPROVALS

Concur: _____
Director of Engineering

Approve: _____ 12-4-14
Chief Engineer Date

SR 21 at I-95 Diverging Diamond Interchange



SR 21 From SR 30 To I-95 Including Interchange, PI 0012722, Chatham County

Georgia Department of Transportation

SCALE IN FEET 0 100 200 400

- EXISTING PAVEMENT TO BE RETAINED
- PROPOSED WIDENING
- PROPOSED RAISED ISLAND
- PROPOSED MEDIAN

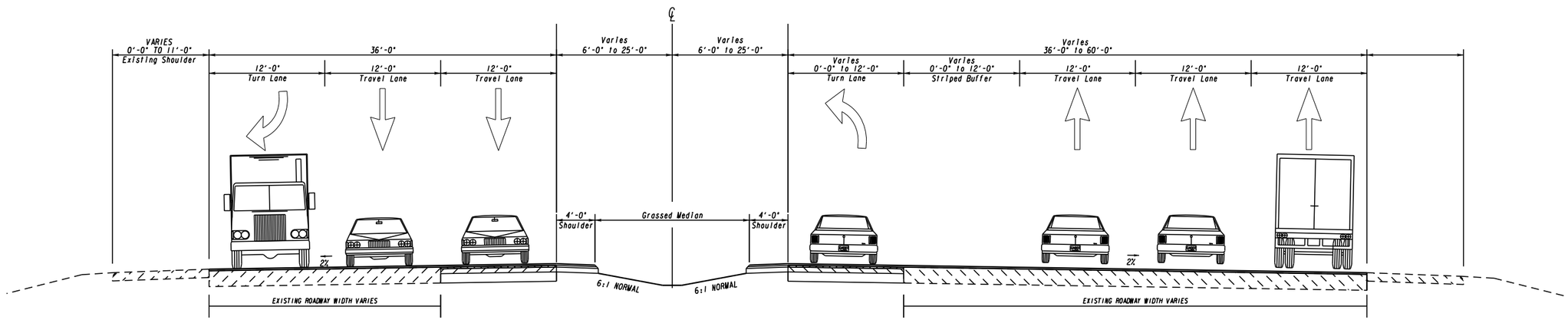
SR 21 From SR 30 To I-95 Including Interchange, PI 0012722, Chatham County

Georgia Department of Transportation

SCALE IN FEET 0 100 200 400

EXISTING PAVEMENT TO BE RETAINED
PROPOSED WIDENING
PROPOSED RAISED ISLAND
PROPOSED MEDIAN

DATE$$$	TIME$$$	$PRF8$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA			



TYPICAL SECTION 1
BEGIN PROJECT TO OLEARY ROAD

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES		

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

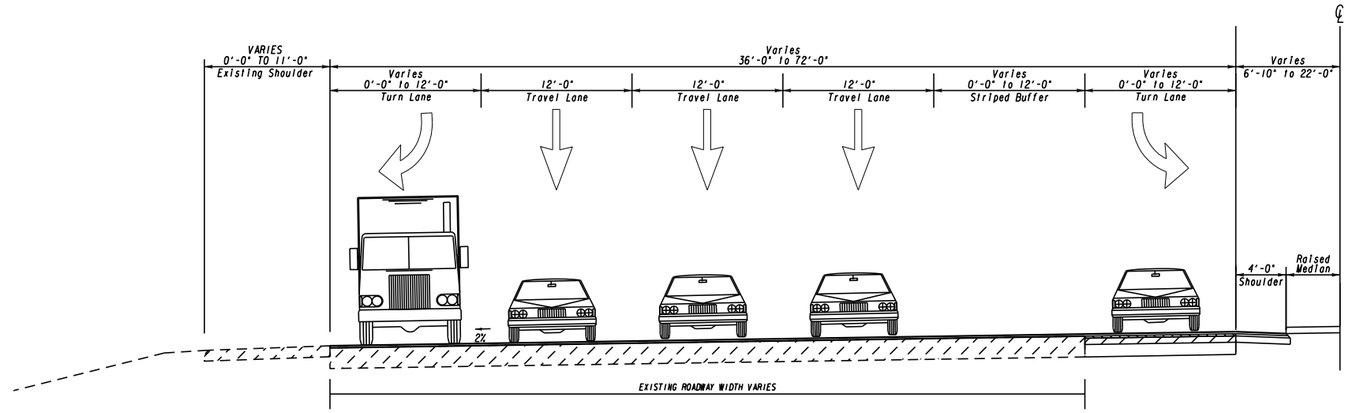
OFFICE:

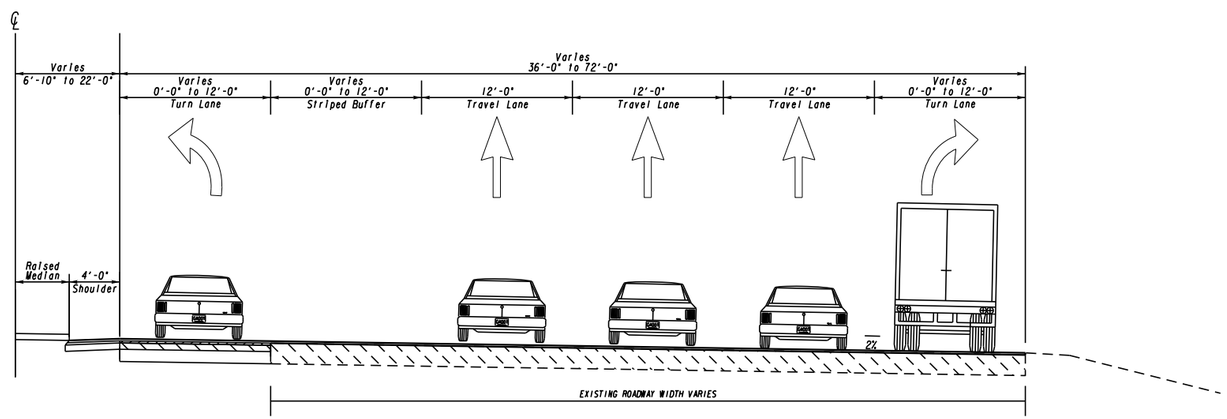
TYPICAL SECTIONS

DRAWING No.
05-001

12/14/2012 GPLN

DATE$$$	TIME$$$	$PRF8$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA			





TYPICAL SECTION 2
OLEARY ROAD TO BEGIN OF DDI

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES		

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

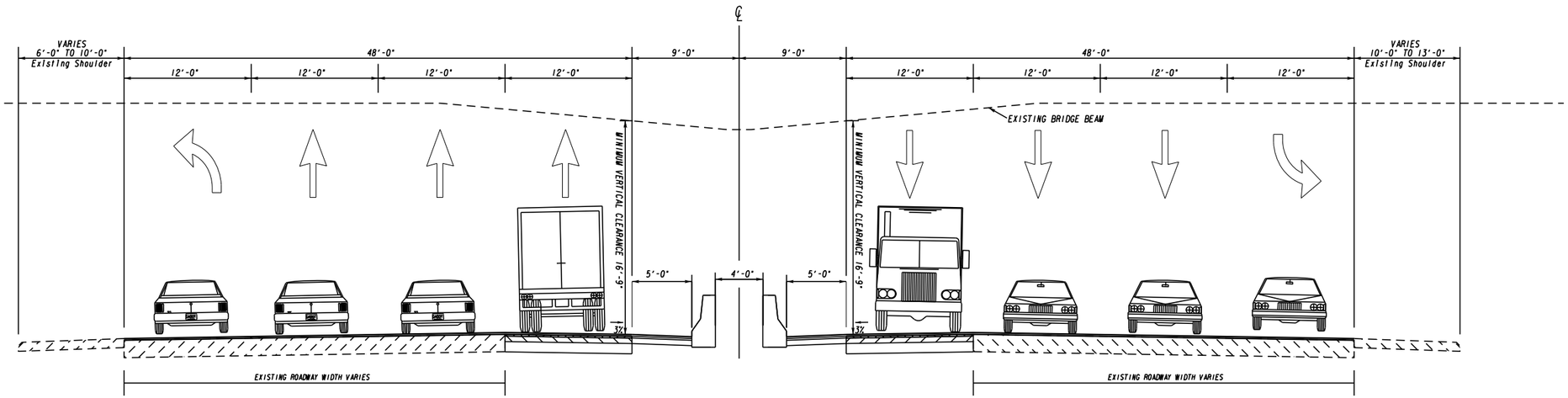
OFFICE:

TYPICAL SECTIONS

DRAWING No.
05-002

12/14/2012 GPLN

DATE$$$	TIME$$$	$PRF8$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA			



TYPICAL SECTION 3
UNDER I-95 BRIDGE

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES		

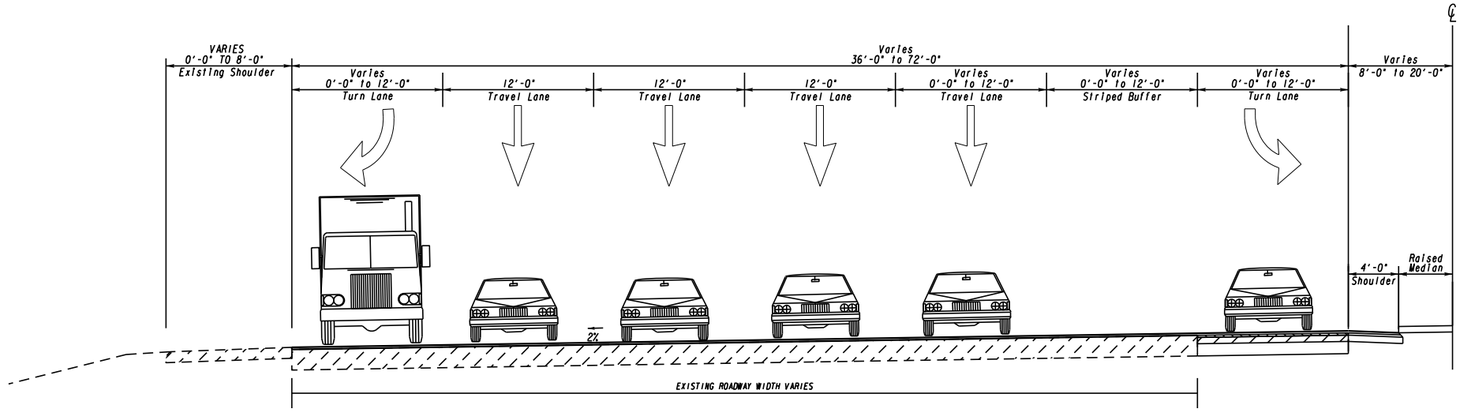
STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

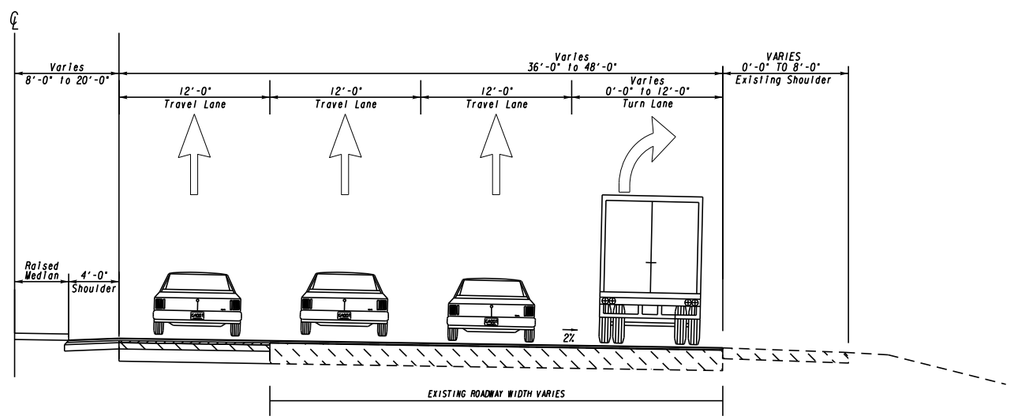
OFFICE:

TYPICAL SECTIONS

DRAWING No.
05-003

12/14/2012 GPLN





TYPICAL SECTION 4
END OF DDI TO TRAVELERS WAY

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES		

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

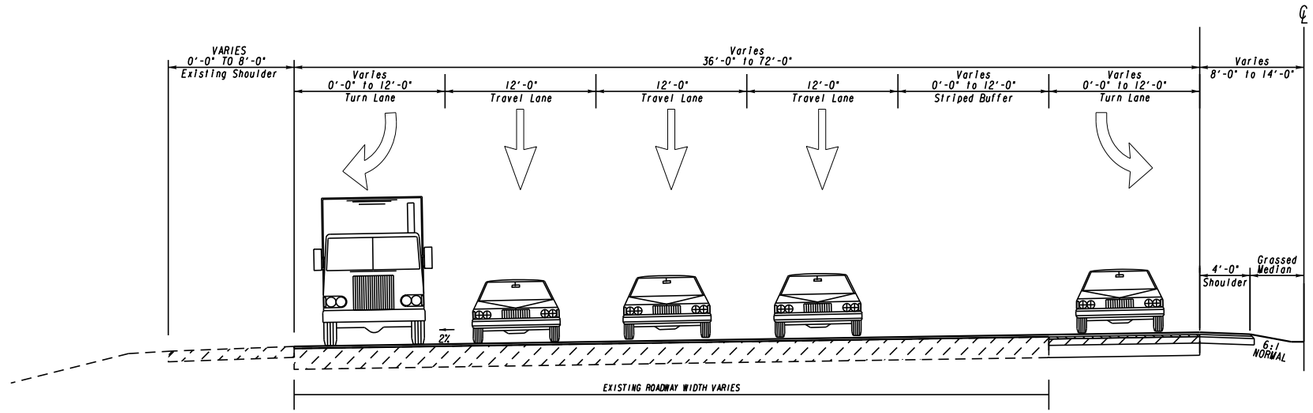
OFFICE:

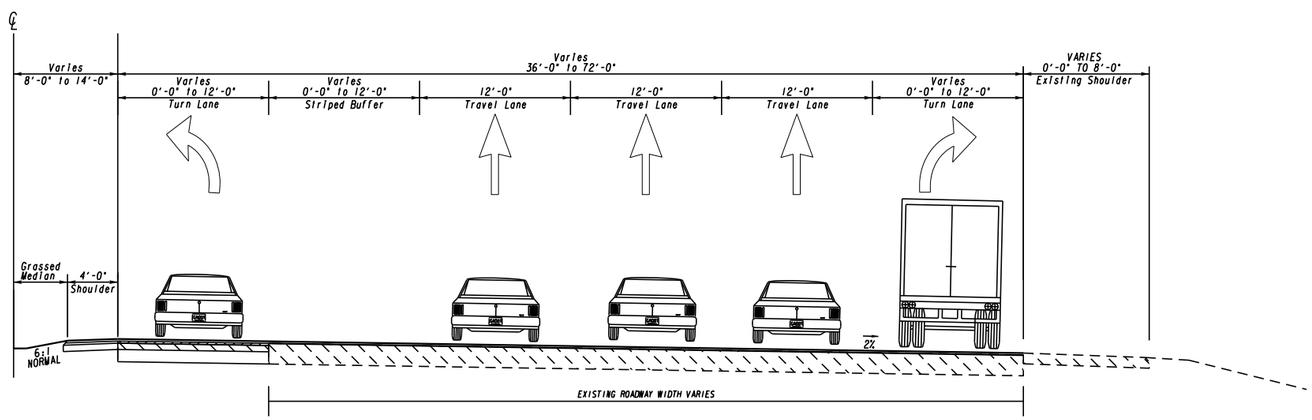
TYPICAL SECTIONS

DRAWING No.
05-004

12/14/2012 GPLN

DATE$$$	TIME$$$	$PRF8$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA			





TYPICAL SECTION 5
TRAVELERS WAY TO COOK STREET

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES		

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

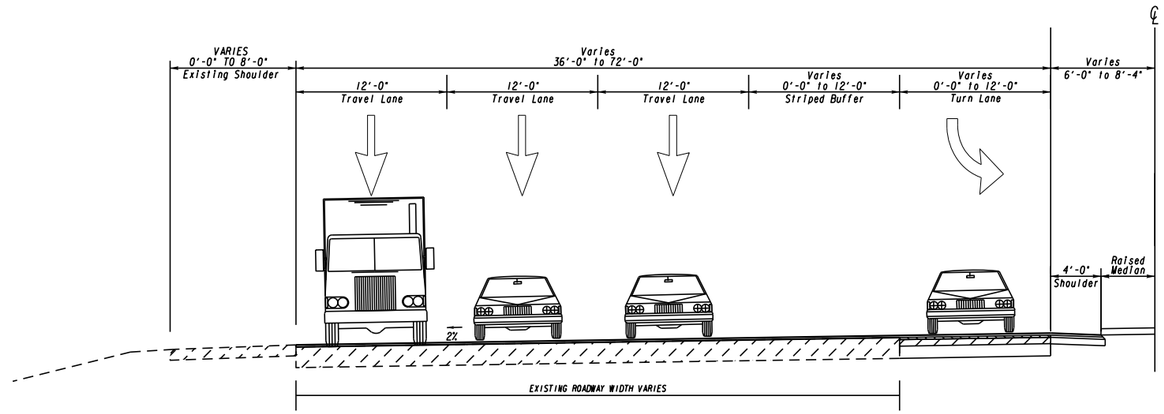
OFFICE:

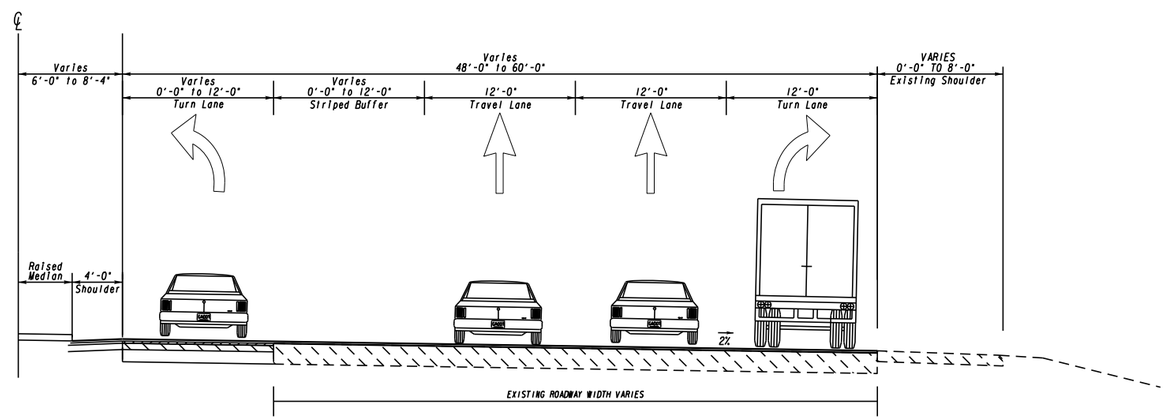
TYPICAL SECTIONS

DRAWING No.
05-005

12/14/2012 GPLN

DATE$$$	TIME$$$	$PRF8$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA			





TYPICAL SECTION 6
COOK STREET TO SR 30

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

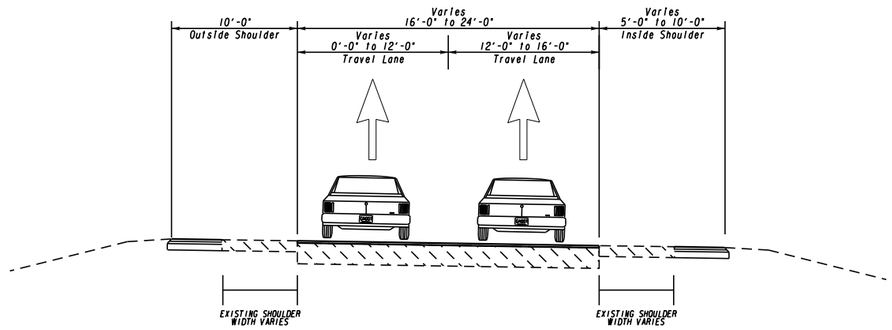
OFFICE:

TYPICAL SECTIONS

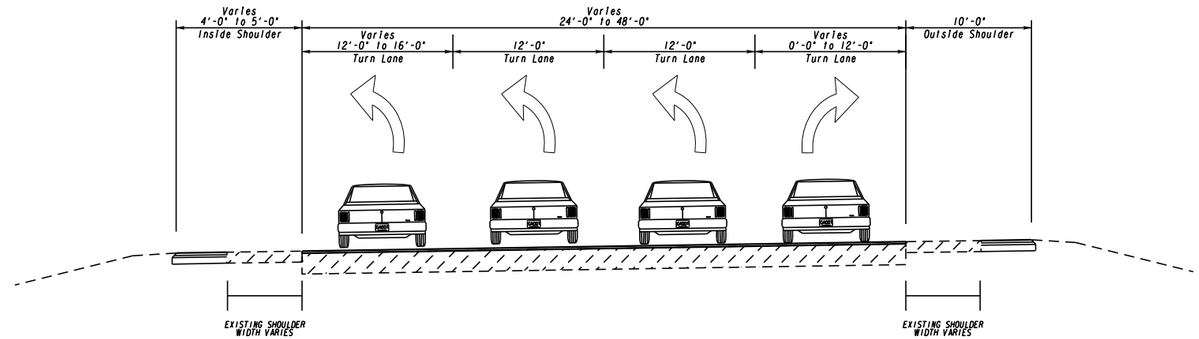
DRAWING No.
05-006

12/14/2012 GPLN

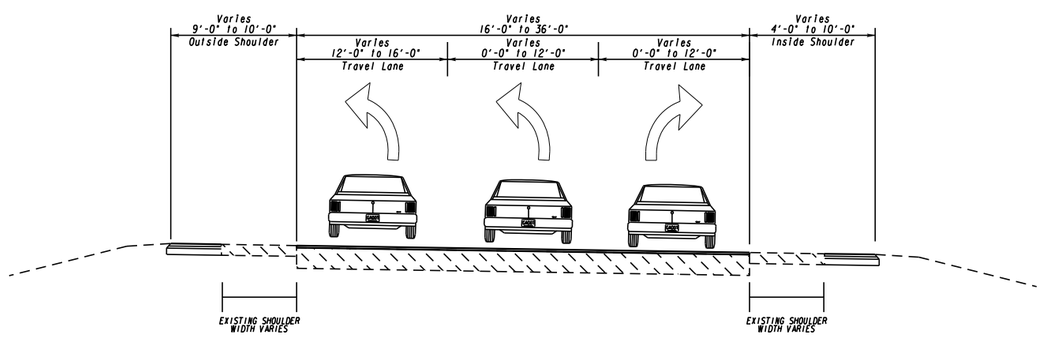
DATE$$$	TIME$$$	$PRF8$	DGN	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$$PENTABLE$$		GA			



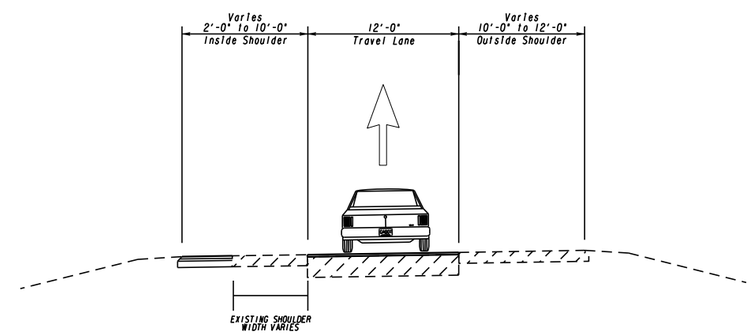
TYPICAL SECTION 7
I-95 SB Entrance Ramp



TYPICAL SECTION 9
I-95 NB Exit Ramp



TYPICAL SECTION 8
I-95 SB Exit Ramp



TYPICAL SECTION 10
I-95 NB Entrance Ramp

ARCADIS
Infrastructure · Water · Environment · Buildings

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

OFFICE:

TYPICAL SECTIONS

DRAWING No.
05-007

12/14/2012 GPLN

CONSTRUCTION COST ESTIMATE

Project: SR 21 from SR 30 to I-95 including DDI
Project No.: 0012722
County: Chatham

Prepared by: ARCADIS
Last Modified: October 29, 2014

Construction Line Items from CES	**$**	**4,389,407.77**
Design Complete 8%	$	351,153.00
Reimbursable Utilities	$	120,000.00
Subtotal Construction Cost from CES	**$**	**4,860,560.77**
Design Build Contingency 15%	$	729,084.12
Total Design Build Cost	**$**	**5,589,644.89**
Liquid AC	$	374,977.84
E&I 5%	$	279,482.24
Concept Contingency 10%	$	558,964.49
Right-of-way	$	-
Grand Total Project CST Cost	**$**	**6,803,069.46**

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE Design-Build SR 21 @ I-95 OFFICE District 5, Jesup

P.I. # 0012722 DATE November 18, 2014

FROM Dallory Rozier, District Utilities Engineer

TO Andrew Hoenig, Project Manager

SUBJECT PRELIMINARY UTILITY COST (ESTIMATE)

As requested by your office, we are furnishing you with an Updated Preliminary Utility Cost Estimate of each utility with facilities potentially located within the above project limits.

Facility Owner	Non-Reimbursable	Reimbursable	Comments
AGL Resources	$0.00	$20,500.00	
AT&T	$0.00	$15,500.00	
Carolina Gas Transmission	$0.00	$0.00	
Comcast	$0.00	$0.00	
Century Link Telecom	$0.00	$0.00	
City of Port Wentworth - Water	$0.00	$44,500.00	
City of Port Wentworth - Sewer	$0.00	$39,500.00	
Georgia Power - Distribution	$0.00	$0.00	
Totals	$0.00		
Total Reimbursement		$120,000.00	

CC: Jun Birnkammer, State Utilities Preconstruction Engineer
Nicholas Fields, Utilities Preconstruction Engineer
Yulanda Pride-Foster, Utilities Preconstruction Engineer
Vahid Munshi, Management Specialist
District Office File
Utilities Office File

DATE : 10/29/2014
PAGE : 1

JOB ESTIMATE REPORT

JOB NUMBER : 0012722 SPEC YEAR: 13
DESCRIPTION: SR 21 FROM SR 30 TO I-95 INCLUDING DDI

ITEMS FOR JOB 0012722

LINE	ITEM	ALT	UNITS	DESCRIPTION	QUANTITY	PRICE	AMOUNT
0005	150-1000		LS	TRAFFIC CONTROL - P.I. 0012722	1.000	200000.00	200000.00
0010	201-1500		LS	CLEARING & GRUBBING - P.I. 0012722	1.000	60000.00	60000.00
0015	210-0100		LS	GRADING COMPLETE - P.I. 0012722	1.000	200000.00	200000.00
0020	310-1101		TN	GR AGGR BASE CRS, INCL MATL	8400.000	26.36	221430.05
0025	310-5060		SY	GR AGGR BS CRS 6IN INCL MATL	880.000	13.08	11513.58
0030	402-1802		TN	RECYL AC PATCHING, INCL BM&HL	820.000	109.18	89527.81
0035	402-1812		TN	RECYL AC LEVELING,INC BM&HL	4400.000	82.30	362120.04
0040	402-3121		TN	RECYL AC 25MM SP,GP1/2,BM&HL	4000.000	78.94	315789.12
0045	402-3600		TN	RECY AC 12.5,SMA,GP2 ON,INCLP-,BM&HL	9700.000	131.00	1270700.00
0050	402-3190		TN	RECYL AC 19 MM SP,GP 1 OR 2 ,INC BM&HL	1700.000	87.02	147935.94
0055	413-1000		GL	BITUM TACK COAT	6100.000	2.26	13797.90
0060	432-5010		SY	MILL ASPH CONC PVMT,VARB DEPTH	73900.000	1.80	133181.84
0065	441-0748		SY	CONC MEDIAN, 6 IN	8800.000	34.09	300008.19
0070	441-6022		LF	CONC CURB & GUTTER, 6X30TP2	8400.000	13.90	116837.03
0075	500-9999		CY	CL B CONC,BASE OR PVMT WIDEN	80.000	217.72	17418.38
0080	621-4070		LF	CONCRETE SIDE BARRIER, TY 7C	760.000	150.00	114000.00
0085	648-1350		EA	IMPACT ATT UNIT, TP-P- P.I. 0012722	2.000	16060.90	32121.82
0095	550-1180		LF	STM DR PIPE 18,H 1-10	200.000	44.32	8865.62
0100	550-1240		LF	STM DR PIPE 24,H 1-10	50.000	57.33	2866.67
0105	550-4218		EA	FLARED END SECT 18 IN, ST DR	10.000	538.55	5385.51
0110	550-4224		EA	FLARED END SECT 24 IN, ST DR	1.000	735.18	735.19
0115	603-2182		SY	STN DUMPED RIP RAP, TP 3, 24	100.000	50.62	5062.05
0120	603-7000		SY	PLASTIC FILTER FABRIC	100.000	4.35	435.90
0125	611-3000		EA	RECONSTR CATCH BASIN, GROUP 1	1.000	2079.45	2079.45
0130	611-3010		EA	RECONSTR DROP INLET, GROUP 1	1.000	2023.25	2023.25
0140	611-8000		EA	ADJUST CATCH BASIN TO GRADE	3.000	1301.00	3903.00
0145	668-1100		EA	CATCH BASIN, GP 1	4.000	2239.40	8957.60
0150	668-1110		LF	CATCH BASIN, GP 1, ADDL DEPTH	10.000	155.47	1554.71
0155	668-2100		EA	DROP INLET, GP 1	4.000	2056.70	8226.80
0160	668-2110		LF	DROP INLET, GP 1, ADDL DEPTH	10.000	234.48	2344.87
0175	231-1250		EA	MISC CONSTR, UNPAVED RDS, STS AND DRWAYS - ENHANCED SWALES	7.000	11000.00	77000.00
0180	163-0232		AC	TEMPORARY GRASSING	2.000	498.12	996.24
0185	163-0240		TN	MULCH	48.000	244.39	11730.77
0190	163-0300		EA	CONSTRUCTION EXIT	4.000	1458.93	5835.72
0195	163-0503		EA	CONSTR AND REMOVE SILT CONTROL GATE,TP 3	5.000	455.65	2278.27
0200	163-0527		EA	CNST/REM RIP RAP CKDM,STN P RIPRAP/SN BG	10.000	373.57	3735.74
0205	163-0550		EA	CONS & REM INLET SEDIMENT TRAP	20.000	174.59	3492.00
0210	165-0030		LF	MAINT OF TEMP SILT FENCE, TP C	5287.000	0.57	3050.33
0213	165-0041		LF	MAINT OF CHECK DAMS - ALL TYPES	10.000	3.20	32.02
0215	165-0087		EA	MAINT OF SILT CONTROL GATE, TP 3	5.000	139.40	697.00

DATE : 10/29/2014
PAGE : 2

JOB ESTIMATE REPORT

0220	165-0101	EA	MAINT OF CONST EXIT	4.000	595.61	2382.48
0225	165-0105	EA	MAINT OF INLET SEDIMENT TRAP	20.000	36.14	722.90
0230	167-1000	EA	WATER QUALITY MONITORING AND SAMPLING	6.000	319.40	1916.41
0235	167-1500	MO	WATER QUALITY INSPECTIONS	24.000	502.31	12055.51
0240	171-0030	LF	TEMPORARY SILT FENCE, TYPE C	10573.000	3.05	32266.89
0245	643-8200	LF	BARRIER FENCE (ORANGE), 4 FT	1175.000	1.62	1908.02
0250	700-6910	AC	PERMANENT GRASSING	4.000	975.19	3900.78
0255	700-7000	TN	AGRICULTURAL LIME	12.000	72.10	865.26
0260	700-8000	TN	FERTILIZER MIXED GRADE	4.000	585.56	2342.27
0265	700-8100	LB	FERTILIZER NITROGEN CONTENT	200.000	3.25	651.71
0270	716-2000	SY	EROSION CONTROL MATS, SLOPES	6000.000	1.34	8061.96
0275	636-1020	SF	HWY SGN,TP1MAT,REFL SH TP3	100.000	14.25	1425.48
0280	636-1033	SF	HWY SIGNS, TP1MAT,REFL SH TP 9	100.000	17.60	1760.36
0285	636-1041	SF	HWY SIGNS,TP 2MAT,REFL SH TP 9	60.000	35.55	2133.30
0290	636-2070	LF	GALV STEEL POSTS, TP 7	300.000	6.01	1803.29
0295	639-3004	EA	STEEL STRAIN POLE, TP IV	8.000	11140.82	89126.58
0300	647-1000	LS	TRAF SIGNAL INSTALLATION NO - 1	1.000	95000.00	95000.00
0305	647-1000	LS	TRAF SIGNAL INSTALLATION NO - 2	1.000	95000.00	95000.00
0310	653-0110	EA	THERM PVMT MARK, ARROW, TP 1	12.000	68.86	826.38
0315	653-0120	EA	THERM PVMT MARK, ARROW, TP 2	23.000	87.07	2002.76
0320	653-1501	LF	THERMO SOLID TRAF ST 5 IN, WHI	12050.000	0.46	5630.84
0325	653-1502	LF	THERMO SOLID TRAF ST, 5 IN YEL	10500.000	0.46	4907.49
0330	653-1704	LF	THERM SOLID TRAF STRIPE,24,WH	34.000	6.90	234.93
0335	653-1804	LF	THERM SOLID TRAF STRIPE, 8,WH	144.000	3.02	436.18
0340	653-3501	GLF	THERMO SKIP TRAF ST, 5 IN, WHI	21120.000	0.26	5527.53
0345	653-6004	SY	THERM TRAF STRIPING, WHITE	500.000	4.22	2113.31
0350	653-6006	SY	THERM TRAF STRIPING, YELLOW	150.000	4.15	624.00
0355	654-1001	EA	RAISED PVMT MARKERS TP 1	264.000	3.94	1042.56
0360	682-6233	LF	CONDUIT, NONMETL, TP 3, 2 IN	2128.000	3.70	7873.60
0365	935-1114	LF	OUT PLNT FBR OPT CBL,LOOSE TB,SM,36 FBR	5280.000	2.80	14784.00
0370	935-1511	LF	OUT PLNT FBR OPT CBL,DROP,SM,6 FBR	420.000	2.30	966.00
0375	935-3104	EA	FIBER OPTIC CLOSURE,UNDRGRD,36 FIBER	2.000	700.00	1400.00
0380	935-3501	EA	FBR OPTIC CLOSURE,FDC(WALL MTD),6 FBR	2.000	325.00	650.00
0385	935-4010	EA	FIBER OPTIC SPLICE, FUSION	80.000	42.55	3404.23
0390	935-5050	EA	FIBER OPTIC PATCH CORD, SM	2.000	125.00	250.00
0395	936-1001	EA	CCTV SYSTEM,TYPE B	2.000	5575.00	11150.00
0400	939-2305	EA	FIELD SWITCH, TYPE C	2.000	2044.00	4088.00
0405	939-4040	EA	TYPE D CABINET	2.000	4094.00	8188.00
0407	682-9030	LS	LIGHTING SYSTEM - UNDERPASS LIGHTING	1.000	40000.00	40000.00
0410	150-9011	HR	TR CT-WORKZONE LAW ENF-CTR BIDS	3000.000	49.97	149914.35
0415	158-1000	HR	TRAINING HOURS	3000.000	0.80	2400.00
0420	999-2010	LS	DESIGN COMPLETE - 8%	1.000	351153.00	351153.00
0425	001-5000	*	UTILITY CONTINGENCY	1.000	120000.00	120000.00

ITEM TOTAL 4860560.79
INFLATED ITEM TOTAL 4860560.79

TOTALS FOR JOB 0012722

ESTIMATED COST: 4860560.77
CONTINGENCY PERCENT (0.0): 0.00
ESTIMATED TOTAL: 4860560.77

NOTE: The item totals include all alternate items. The estimated totals include only the low cost alternate items.

PROJ. NO.		CALL NO.
P.I. NO.	0012722	
DATE	10/29/2014	

INDEX (TYPE)	**DATE**	**INDEX**
REG. UNLEADED	Oct-14	$ 3.312
DIESEL		$ 3.718
LIQUID AC		$ 615.00

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

LIQUID AC ADJUSTMENTS

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

Asphalt

Price Adjustment (PA)				**365310**	**$**	**365,310.00**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	984.00		
Monthly Asphalt Cement Price month project let (APL)			$	615.00		
Total Monthly Tonnage of asphalt cement (TMT)				990		

ASPHALT	**Tons**	**%AC**	**AC ton**
Leveling	4400	5.0%	220
12.5 OGFC		5.0%	0
12.5 mm	9700	5.0%	485
9.5 mm SP		5.0%	0
25 mm SP	4000	5.0%	200
19 mm SP	1700	5.0%	85
	19800		**990**

BITUMINOUS TACK COAT

Price Adjustment (PA)			**$**	**9,667.84**	**$**	**9,667.84**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	984.00		
Monthly Asphalt Cement Price month project let (APL)			$	615.00		
Total Monthly Tonnage of asphalt cement (TMT)				26.20011562		

Bitum Tack Gals	gals/ton	tons
6100	232.8234	26.2001156

PROJ. NO.		CALL NO.	
P.I. NO.	0012722		
DATE	10/29/2014		

BITUMINOUS TACK COAT (surface treatment)

Price Adjustment (PA)				**0**	**$ -**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	984.00	
Monthly Asphalt Cement Price month project let (APL)			$	615.00	
Total Monthly Tonnage of asphalt cement (TMT)				0	

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

TOTAL LIQUID AC ADJUSTMENT	**$**	**374,977.84**

Alternates Anticipated Benefits Table:
(LOS, Delay Reduction, Modeling output, etc.)

Travel Time

Segment	AM Peak Hour			PM Peak Hour		
	Travel Time (min)			Travel Time (min)		
	No-Build (2025)	Preferred Alt (2025)	Alt 1 (2025)	No-Build (2025)	Preferred Alt (2025)	Alt 1 (2025)
I-II	1.4	2.1 (50%)	1.4 (0%)	1.4	1.2 (-14%)	1.4 (0%)
II-I	1.3	1.2 (-8%)	1.4 (8%)	2.6	3.1 (19%)	2.3 (-12%)
III-I	10.5	2.8 (-73%)	10.5 (0%)	4.9	4.4 (-10%)	4.4 (-10%)

Note: Percent reduction in travel time as compared to no-build scenario is listed in parenthesis next to the actual travel time. For segment locations, refer to image below.

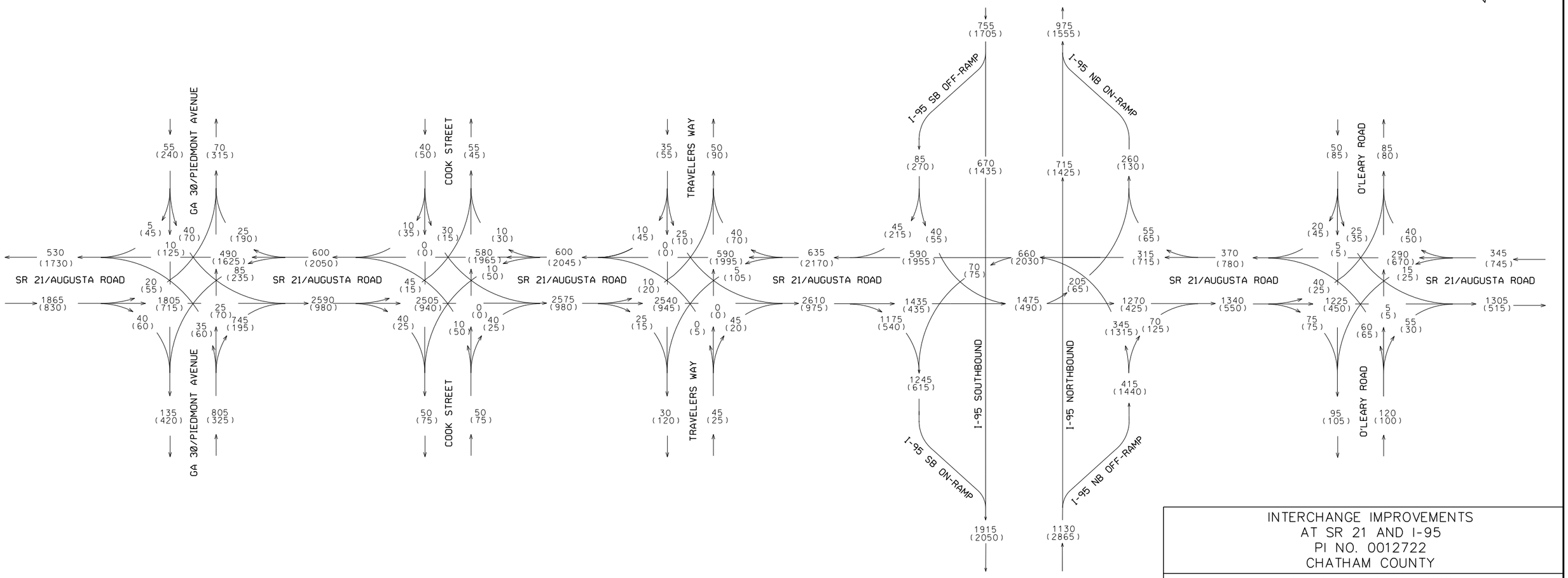
Overall **Intersection Delay** and **Level of Service (LOS)**

Intersection	AM Peak Hour			PM Peak Hour		
	Intersection Delay (sec/veh) and LOS			Intersection Delay (sec/veh) and LOS		
	No-Build (2025)	Preferred Alt (2025)	Alt 1 (2025)	No-Build (2025)	Preferred Alt (2025)	Alt 1 (2025)
NB ramp	147 (F)	21 (C)	149 (F)	108 (F)	87 (F)	73 (E)
SB ramp	72 (E)	90 (F)	79 (E)	55 (E)	23 (C)	54 (D)

95 Percentile Queue Length

Segment	AM Peak Hour			PM Peak Hour		
	95 Percentile Queue Length (ft)			95 Percentile Queue Length (ft)		
	No-Build (2025)	Preferred Alt (2025)	Alt 1 (2025)	No-Build (2025)	Preferred Alt (2025)	Alt 1 (2025)
III-I	1,659	1,670	1,660	1,643	911	729

EXISTING (2014) DHV



INTERCHANGE IMPROVEMENTS
AT SR 21 AND I-95
PI NO. 0012722
CHATHAM COUNTY

AM PEAK HOUR = 000
PM PEAK HOUR = (000)

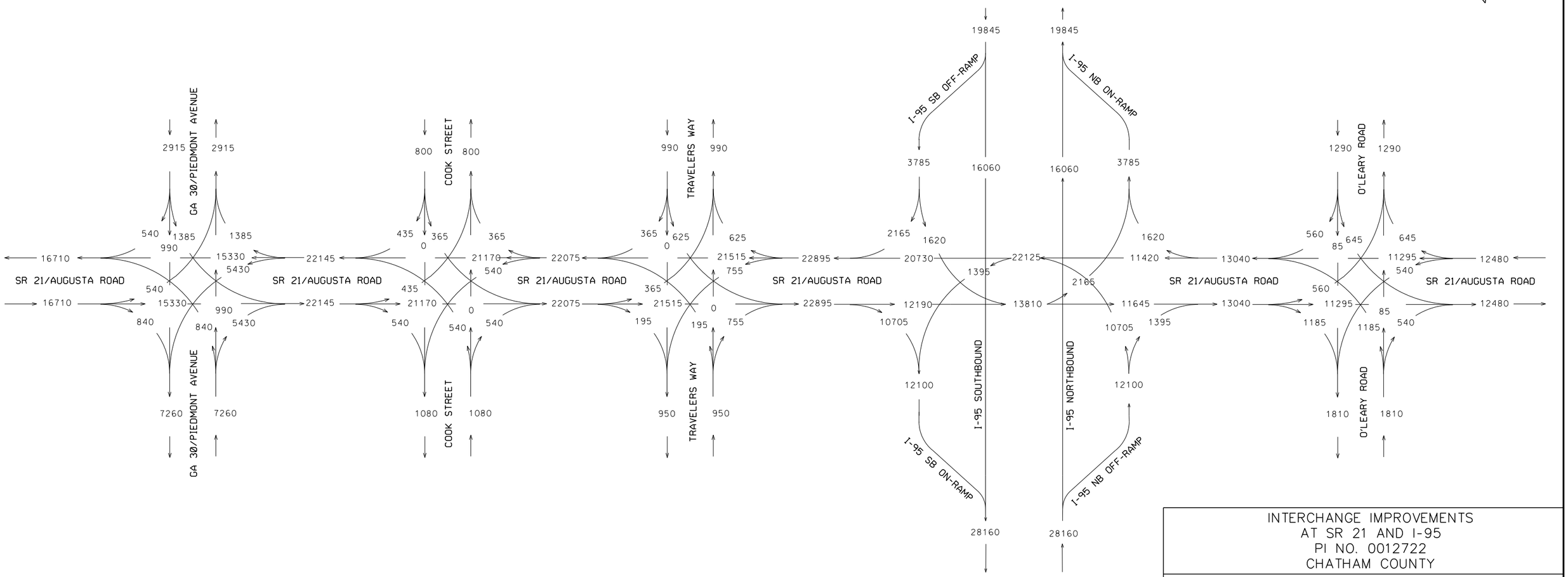
TRUCK PERCENTAGES:

LOCATION	PK HR T%	S.U. %	COMB %
SR 21	12%	7%	5%
I-95	24%	5%	19%
I-95 RAMPS (N. OF SR 21)	8%	4%	4%
I-95 RAMPS (S. OF SR 21)	12%	3%	9%

COMPLETED BY: KC
CHECKED BY: JP
DATE: 6/16/2014

ARCADIS
Infrastructure, Water, Environment, Buildings

EXISTING (2014) ADT



INTERCHANGE IMPROVEMENTS
AT SR 21 AND I-95
PI NO. 0012722
CHATHAM COUNTY

AVERAGE DAILY TRAFFIC
(ADT) = 000

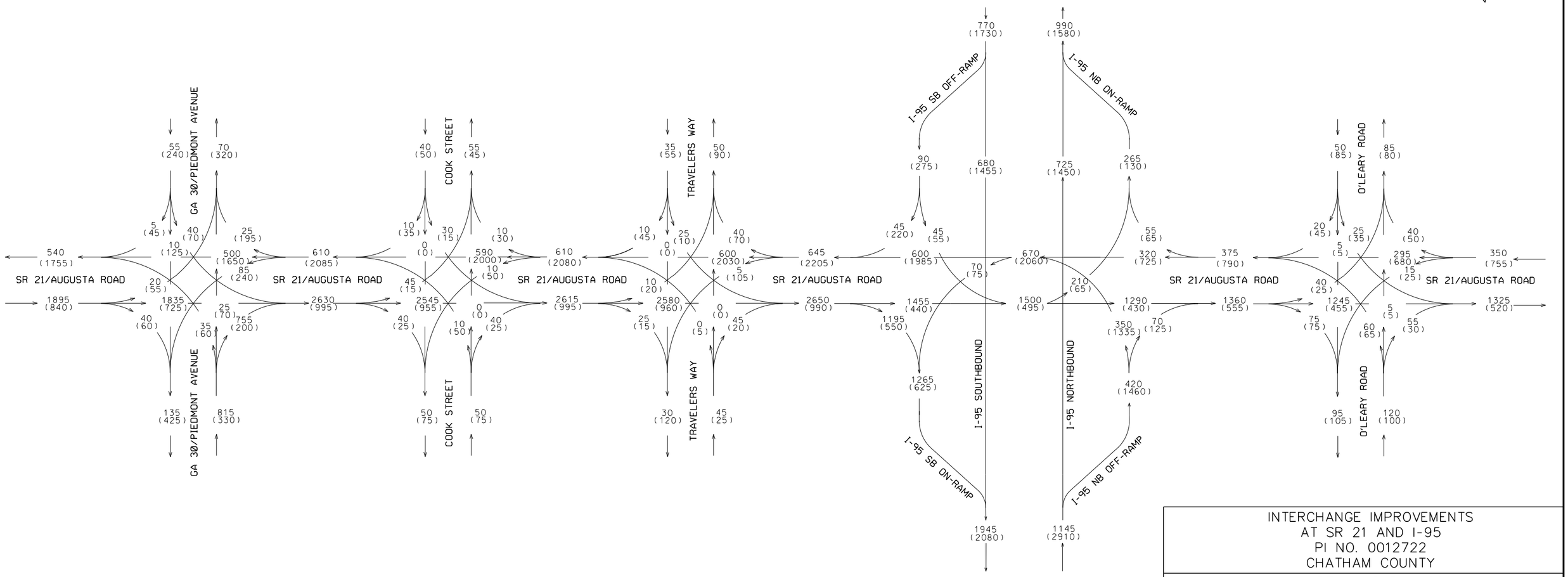
TRUCK PERCENTAGES:

LOCATION	24 HR T%	S.U. %	COMB %
SR 21	15%	9%	6%
I-95	29%	5%	24%
I-95 RAMPS (N. OF SR 21)	11%	4%	7%
I-95 RAMPS (S. OF SR 21)	13%	3%	10%

COMPLETED BY: KC
CHECKED BY: JP
DATE: 6/16/2014

ARCADIS
Infrastructure, Water, Environment, Buildings

OPEN (2015) DHV
NO-BUILD



INTERCHANGE IMPROVEMENTS
AT SR 21 AND I-95
PI NO. 0012722
CHATHAM COUNTY

AM PEAK HOUR = 000
PM PEAK HOUR = (000)

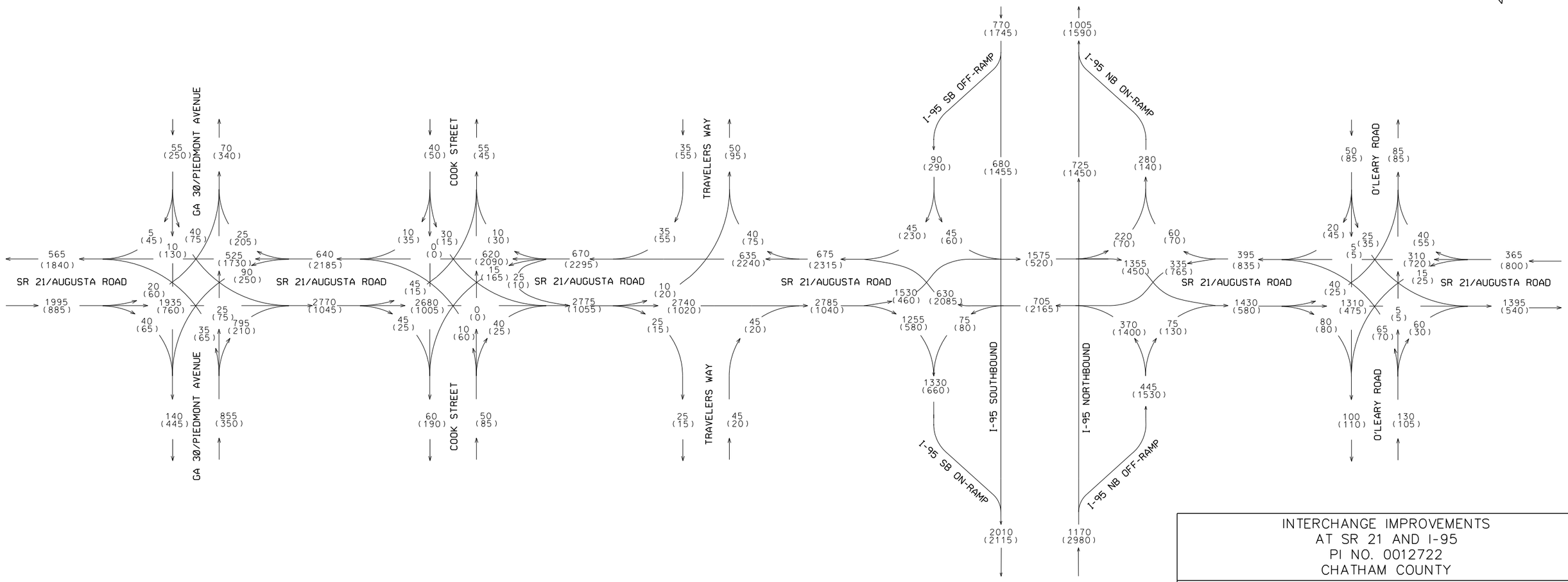
TRUCK PERCENTAGES:

LOCATION	PK HR T%	S.U. %	COMB %
SR 21	12%	7%	5%
I-95	24%	5%	19%
I-95 RAMPS (N. OF SR 21)	8%	4%	4%
I-95 RAMPS (S. OF SR 21)	12%	3%	9%

COMPLETED BY: KC
CHECKED BY: JP
DATE: 6/16/2014

ARCADIS
Infrastructure, Water, Environment, Buildings

OPEN (2015) DHV
BUILD



INTERCHANGE IMPROVEMENTS
AT SR 21 AND I-95
PI NO. 0012722
CHATHAM COUNTY

AM PEAK HOUR = 000
PM PEAK HOUR = (000)

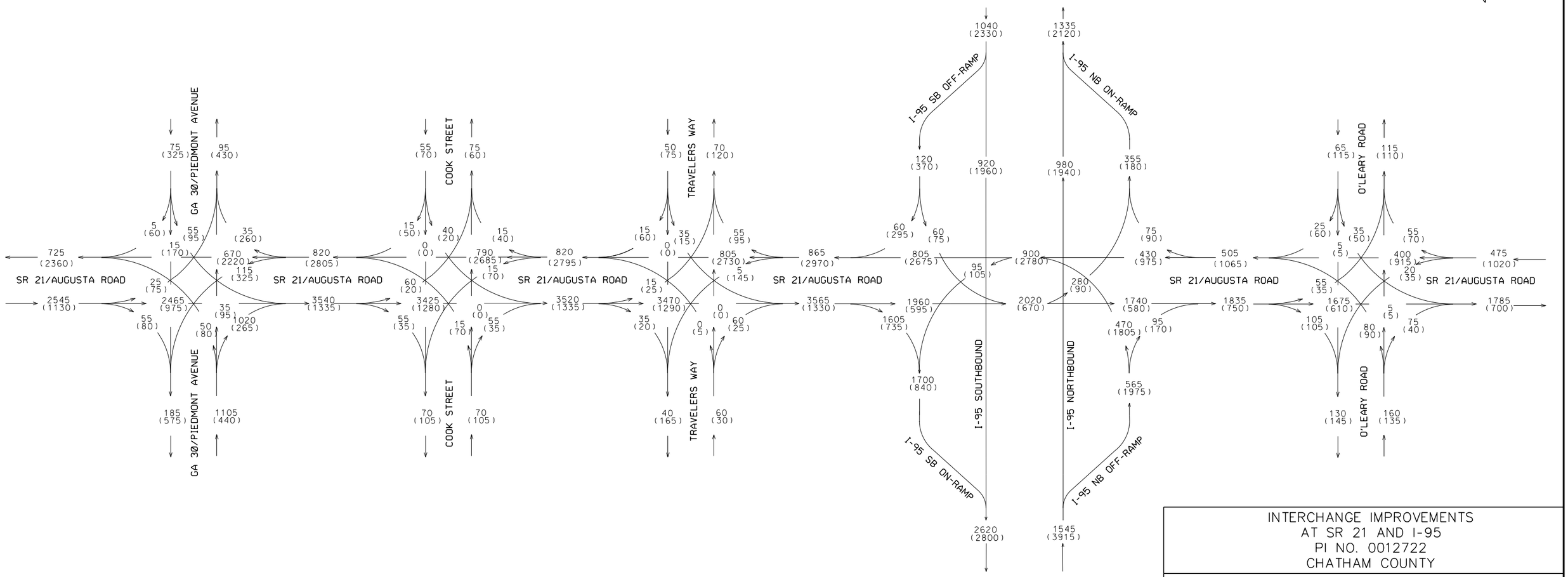
TRUCK PERCENTAGES:

LOCATION	PK HR T%	S.U. %	COMB %
SR 21	12%	7%	5%
I-95	24%	5%	19%
I-95 RAMPS (N. OF SR 21)	8%	4%	4%
I-95 RAMPS (S. OF SR 21)	12%	3%	9%

COMPLETED BY: KC
CHECKED BY: JP
DATE: 6/16/2014

ARCADIS
Infrastructure, Water, Environment, Buildings

DESIGN (2035) DHV
NO-BUILD



INTERCHANGE IMPROVEMENTS
AT SR 21 AND I-95
PI NO. 0012722
CHATHAM COUNTY

AM PEAK HOUR = 000
PM PEAK HOUR = (000)

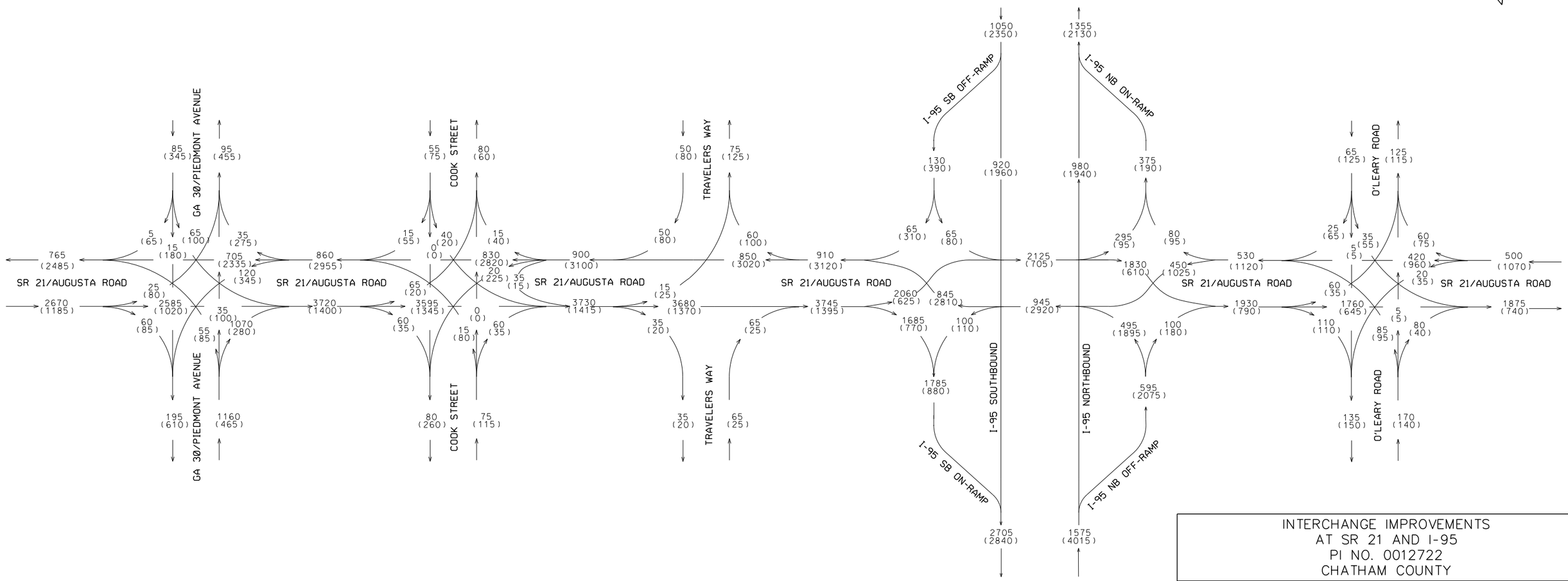
TRUCK PERCENTAGES:

LOCATION	PK HR T%	S.U. %	COMB %
SR 21	12%	7%	5%
I-95	24%	5%	19%
I-95 RAMPS (N. OF SR 21)	8%	4%	4%
I-95 RAMPS (S. OF SR 21)	12%	3%	9%

COMPLETED BY: KC
CHECKED BY: JP
DATE: 6/16/2014

ARCADIS
Infrastructure, Water, Environment, Buildings

DESIGN (2035) DHV
BUILD



INTERCHANGE IMPROVEMENTS
AT SR 21 AND I-95
PI NO. 0012722
CHATHAM COUNTY

AM PEAK HOUR = 000
PM PEAK HOUR = (000)

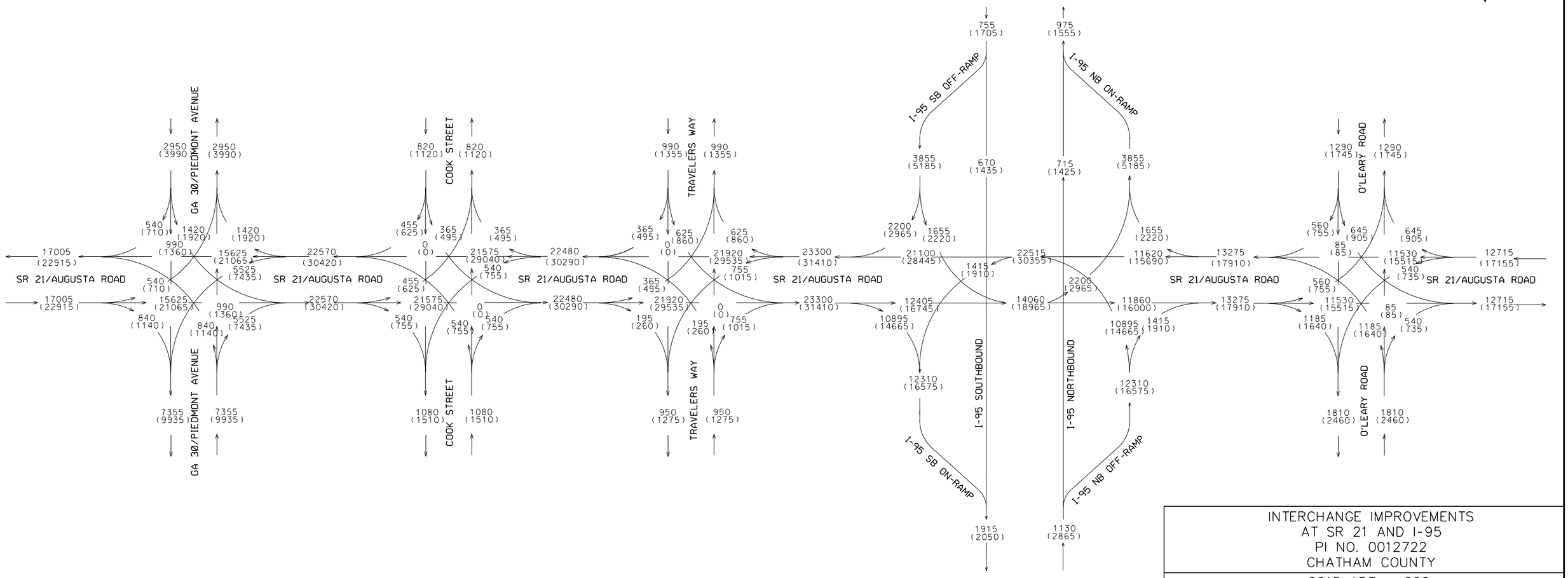
TRUCK PERCENTAGES:

LOCATION	PK HR T%	S.U. %	COMB %
SR 21	12%	7%	5%
I-95	24%	5%	19%
I-95 RAMPS (N. OF SR 21)	8%	4%	4%
I-95 RAMPS (S. OF SR 21)	12%	3%	9%

COMPLETED BY: KC
CHECKED BY: JP
DATE: 6/16/2014

ARCADIS
Infrastructure, Water, Environment, Buildings

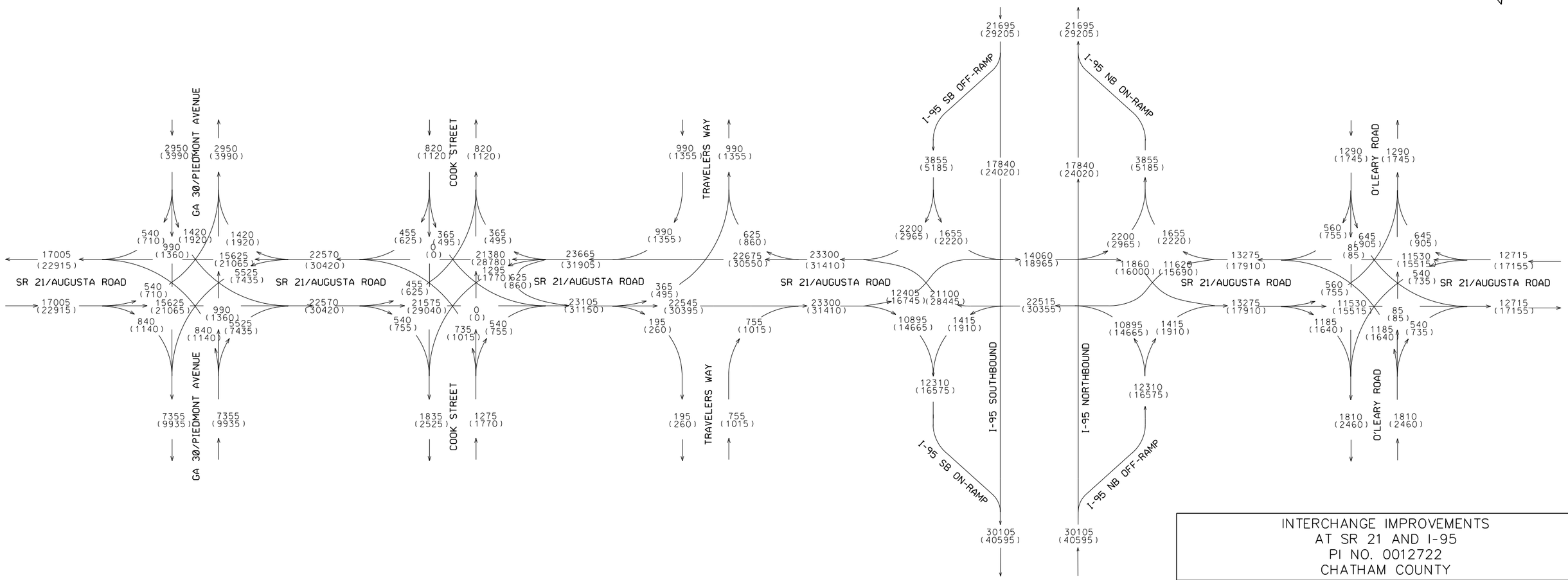
OPEN (2015)/DESIGN (2035) ADT
NO-BUILD



INTERCHANGE IMPROVEMENTS AT SR 21 AND I-95 PI NO. 0012722 CHATHAM COUNTY			
2015 ADT = 000 2035 ADT = (000)			
TRUCK PERCENTAGES:			
LOCATION	24 HR T%	S.U. %	COMB %
SR 21	15%	9%	6%
I-95	29%	5%	24%
I-95 RAMPS (N. OF SR 21)	11%	4%	7%
I-95 RAMPS (S. OF SR 21)	13%	3%	10%
COMPLETED BY: KC CHECKED BY: JP DATE: 6/16/2014			

ARCADIS
Infrastructure, Water, Environment, Buildings

OPEN (2015)/DESIGN (2035) ADT
BUILD



INTERCHANGE IMPROVEMENTS AT SR 21 AND I-95 PI NO. 0012722 CHATHAM COUNTY			
2015 ADT = 000 2035 ADT = (000)			
TRUCK PERCENTAGES:			
LOCATION	24 HR T%	S.U. %	COMB %
SR 21	15%	9%	6%
I-95	29%	5%	24%
I-95 RAMPS (N. OF SR 21)	11%	4%	7%
I-95 RAMPS (S. OF SR 21)	13%	3%	10%
COMPLETED BY: KC CHECKED BY: JP DATE: 6/16/2014			

ARCADIS
Infrastructure, Water, Environment, Buildings

1. Traffic Analysis

A detailed traffic analysis was completed for existing, no-build, and build conditions using Synchro 8 and VISSIM 6 modeling software tools. Synchro was used to develop the signal timings using existing field timings for existing and no-build conditions and to optimize timings for build conditions. Synchro is not able to easily evaluate overall network performance for innovative designs such as diverging diamond interchanges; therefore, VISSIM was used to analyze interchange operations under build conditions.

The following sections describe the results of the capacity, off-ramp queue, travel time, and throughput analyses.

1.1 Capacity Analysis

Using VISSIM 6, a network capacity analysis was completed to analyze how the diverging diamond interchange design will operate as well as to compare between no-build and build conditions. The existing year VISSIM networks were calibrated to existing conditions using turning movement volumes and simulation visualization. Future year networks were based on the calibrated existing networks, with the diverging diamond interchange design added to the build scenario models.

VISSIM records the delay experienced by each vehicle as it approaches an intersection during the simulation. The approach delay results were used to calculate overall intersection delay based on guidance provided by the Highway Capacity Manual (HCM). Intersection delay from the HCM can be associated with a level of service (LOS) or a grade assigned to an intersection based on its capacity operations. Table 1 shows the average delay associated with each LOS for signalized intersections.

Table 1 Signalized Intersection Level of Service

Level of Service (LOS)	Average Delay per Vehicle (Seconds/Vehicle)
A	Less than 10
B	10 – 20
C	20.1 – 35
D	35.1 – 55
E	55.1 – 80
F	Greater than 80

The results of the VISSIM capacity analysis are presented in Table 2, which shows the delay and LOS at each of the study area intersections under the various scenarios.

Table 2 Intersection Delay (sec/veh) and Level of Service

Intersection	A.M. Peak Period					P.M. Peak Period				
	Existing Year (2014)	Open Year (2015)		Design Year (2035)		Existing Year (2014)	Open Year (2015)		Design Year (2035)	
		No-Build	Build	No-Build	Build		No-Build	Build	No-Build	Build
SR 30	99.4 (LOS F)	144.6 (LOS F)	11.8 (LOS B)	231.3 (LOS F)	142.2 (LOS F)	33.0 (LOS C)	33.2 (LOS C)	50.6 (LOS D)	76.1 (LOS E)	64.4 (LOS E)
Cook Street	44.7 (LOS D)	44.8 (LOS D)	8.3 (LOS A)	59.4 (LOS E)	34.0 (LOS C)	26.1 (LOS C)	25.2 (LOS C)	39.1 (LOS D)	35.9 (LOS D)	57.1 (LOS E)
Traveler's Way	51.2 (LOS D)	42.8 (LOS D)	24.5 (LOS C)	62.6 (LOS E)	15.5 (LOS B)	8.0 (LOS A)	8.4 (LOS A)	11.2 (LOS B)	18.5 (LOS B)	16.4 (LOS B)
I-95 SB Ramps	18.3 (LOS B)	18.8 (LOS B)	45.6 (LOS D)	25.0 (LOS C)	32.0 (LOS C)	36.0 (LOS D)	39.6 (LOS C)	30.5 (LOS C)	126.5 (LOS F)	48.5 (LOS D)
I-95 NB Ramps	35.4 (LOS D)	38.1 (LOS D)	40.7 (LOS D)	57.8 (LOS E)	24.5 (LOS C)	282.7 (LOS F)	315.3 (LOS F)	134.2 (LOS F)	337.8 (LOS F)	424.8 (LOS F)
O'Leary Road	9.3 (LOS A)	8.4 (LOS A)	9.3 (LOS A)	10.0 (LOS B)	11.1 (LOS B)	153.6 (LOS F)	170.6 (LOS F)	168.6 (LOS F)	837.9 (LOS F)	465.2 (LOS F)

A.M. Peak Period Summary

- Under existing conditions, the SR 30 intersection currently operates at an LOS F, the Cook Street, Traveler's Way, and I-95 northbound ramps intersections currently operate at an LOS D, and the I-95 southbound ramps and O'Leary Road intersections currently operate at an LOS A or B.

- Under no-build conditions, the SR 30 intersection will remain at an LOS F and the Cook Street, Traveler's Way, and I-95 northbound ramps intersections will decrease to an LOS E by the design year 2035. The I-95 southbound ramps and the O'Leary Road intersections are expected to remain at an acceptable LOS through the design year 2035.

- Under open year build conditions, the LOS becomes worse than in no-build conditions for the two I-95 ramp intersections. This is due to the fact that vehicular throughput is significantly increased under build conditions, which is described in section 1.4. By the design year, the build conditions show a significant improvement in delay and LOS for almost all of the study area intersections. The

delay at the I-95 southbound ramps intersection is increased slightly from no-build to build conditions due to the increased throughput.

P.M. Peak Period Summary

- Under existing conditions, the I-95 northbound ramps and the O'Leary Road intersections currently operate at an LOS F during the p.m. peak period. The I-95 southbound ramps intersection currently operates at an LOS D and the northern most three study intersections currently operate at an LOS C or better.

- Under no-build conditions, the I-95 northbound ramps and the O'Leary Road intersections are expected to remain at an LOS F and the I-95 southbound ramps intersection is expected to also decrease to an LOS F by the design year 2035. By the design year 2035, the Traveler's Way intersection is expected to be at LOS B, the Cook Street intersection is expected to be at LOS D, and the SR 30 intersection is expected to be at LOS E.

- Under open year build conditions, the delay and LOS is improved significantly at the I-95 northbound ramps intersection from no-build conditions. The delay gets slightly worse at the SR 30, Cook Street, and Traveler's Way intersections under build conditions due to the increased vehicular throughput at the interchange. In the design year build conditions, the existing capacity at the SR 30 intersection is no longer sufficient for the increased traffic volumes and this intersection acts as a bottleneck for the heavy northbound traffic traveling throughout the study corridor.

1.2 Off-Ramp Queue Analysis

In addition to intersection performance, ramp queues were analyzed to evaluate the impact the ramp intersections might have on the mainline freeway traffic. Table 3 shows the maximum ramp queue results from VISSIM for each of the I-95 off-ramps.

Table 3 Maximum Ramp Queue Lengths (feet)

Ramp	A.M. Peak Period					P.M. Peak Period				
	Existing Year (2014)	Open Year (2015)		Design Year (2035)		Existing Year (2014)	Open Year (2015)		Design Year (2035)	
		No-Build	Build	No-Build	Build		No-Build	Build	No-Build	Build
I-95 Southbound Off-Ramp (~1,740 feet)*	145’	245’	105’	165’	125’	510’	490’	85’	6,350’	110’
I-95 Northbound Off-Ramp (~1,675 feet)*	585’	680’	210’	750’	200’	10,015’	10,075’	6,165’	10,075’	8,360’

I-95 Southbound Off-ramp Summary

- Maximum queues on this ramp are currently well within the ramp length of approximately 1,700 feet.
- Under no-build conditions, the maximum ramp queue is expected to remain about the same during the a.m. peak period, but is expected to exceed the ramp length during the p.m. peak period by the design year 2035.
- Under build conditions the southbound off-ramp maximum queue is expected to be decreased significantly particularly due to the free right turn movement added with the build condition.

I-95 Northbound Off-ramp Summary

- In existing conditions, maximum queues on this ramp are minimal during the a.m. peak period but are currently exceeding the ramp length during the p.m. peak period.
- Under no-build conditions, the maximum queue on this ramp is expected to remain minimal during the a.m. peak period but will continue to exceed the ramp length during the p.m. peak period.
- Under build conditions, the northbound off-ramp maximum queue is expected to decrease substantially, but is still expected to exceed the available ramp storage length.

1.3 Travel Time Analysis

To better evaluate the overall operations of the interchange, a travel time analysis was completed for key movements using VISSIM. Travel times for both peak periods were determined for vehicles traveling to I-95 southbound and from SR 21 north of SR 30 as well as for vehicles traveling to SR 21 north of SR 30 from I-95 northbound. The p.m. peak travel time segment from I-95 northbound to SR 21 north of SR 30 was extended farther down I-95 northbound than during the a.m. peak period in order to capture all of the congestion that is expected to be present by the design year 2035.

The a.m. and p.m. travel time segment results are summarized below and on Figures 1 and 2 respectively:

- The results show that travel times are reduced from no-build to build conditions for both travel time routes in all scenarios.

- Travel times are expected to improve the most significantly for vehicles traveling to I-95 southbound from SR 21 north of SR 30 during the a.m. peak period.

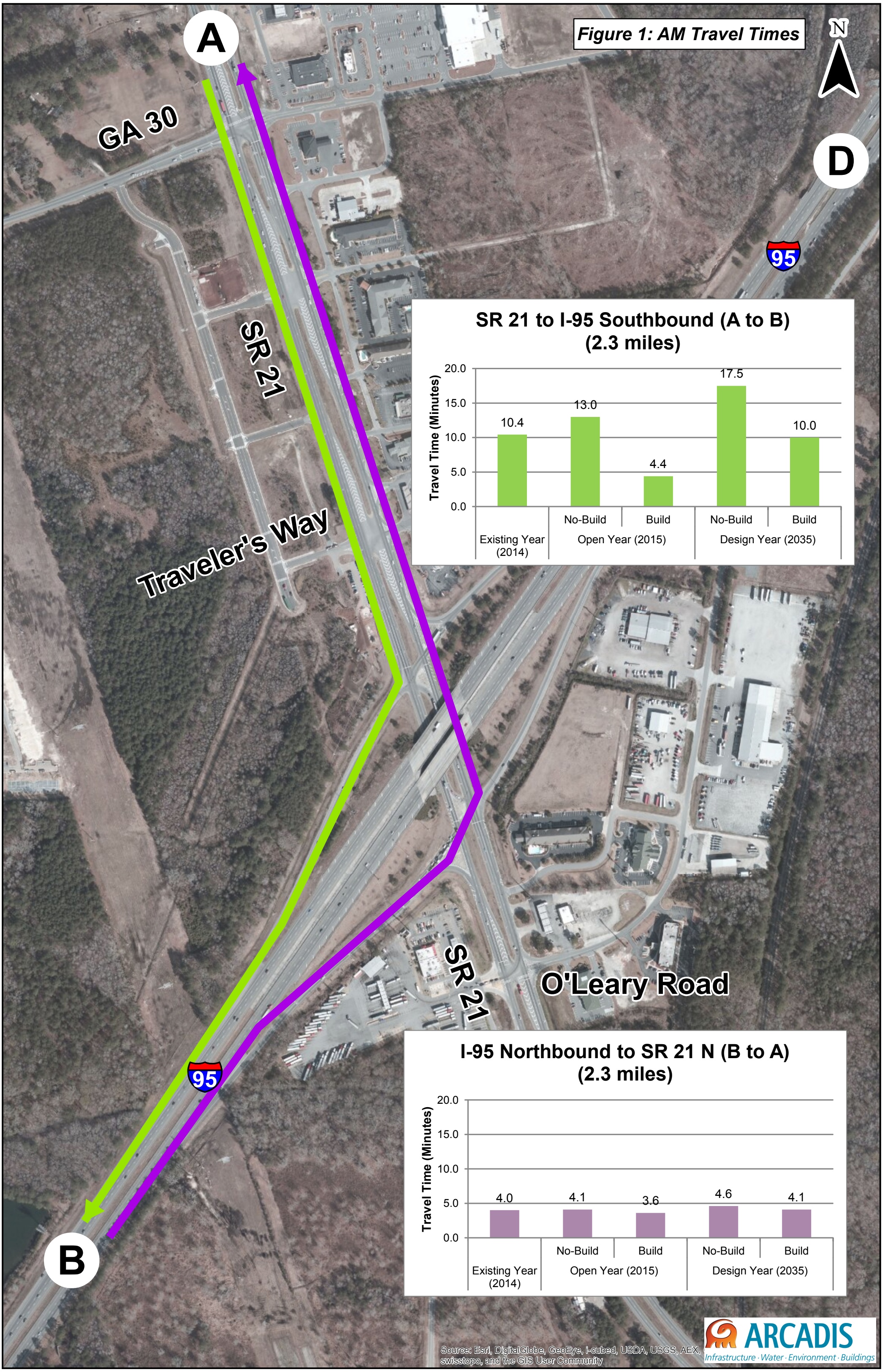


Figure 1: AM Travel Times
N
A
B
D
GA 30
SR 21
Traveler's Way
SR 21
O'Leary Road
95
95
SR 21 to I-95 Southbound (A to B)
(2.3 miles)
Travel Time (Minutes)
20.0
15.0
10.0
5.0
0.0
10.4
13.0
4.4
17.5
10.0
No-Build
Build
No-Build
Build
Existing Year (2014)
Open Year (2015)
Design Year (2035)
I-95 Northbound to SR 21 N (B to A)
(2.3 miles)
Travel Time (Minutes)
20.0
15.0
10.0
5.0
0.0
4.0
4.1
3.6
4.6
4.1
No-Build
Build
No-Build
Build
Existing Year (2014)
Open Year (2015)
Design Year (2035)
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, swisstopo, and the GIS User Community
ARCADIS
Infrastructure · Water · Environment · Buildings

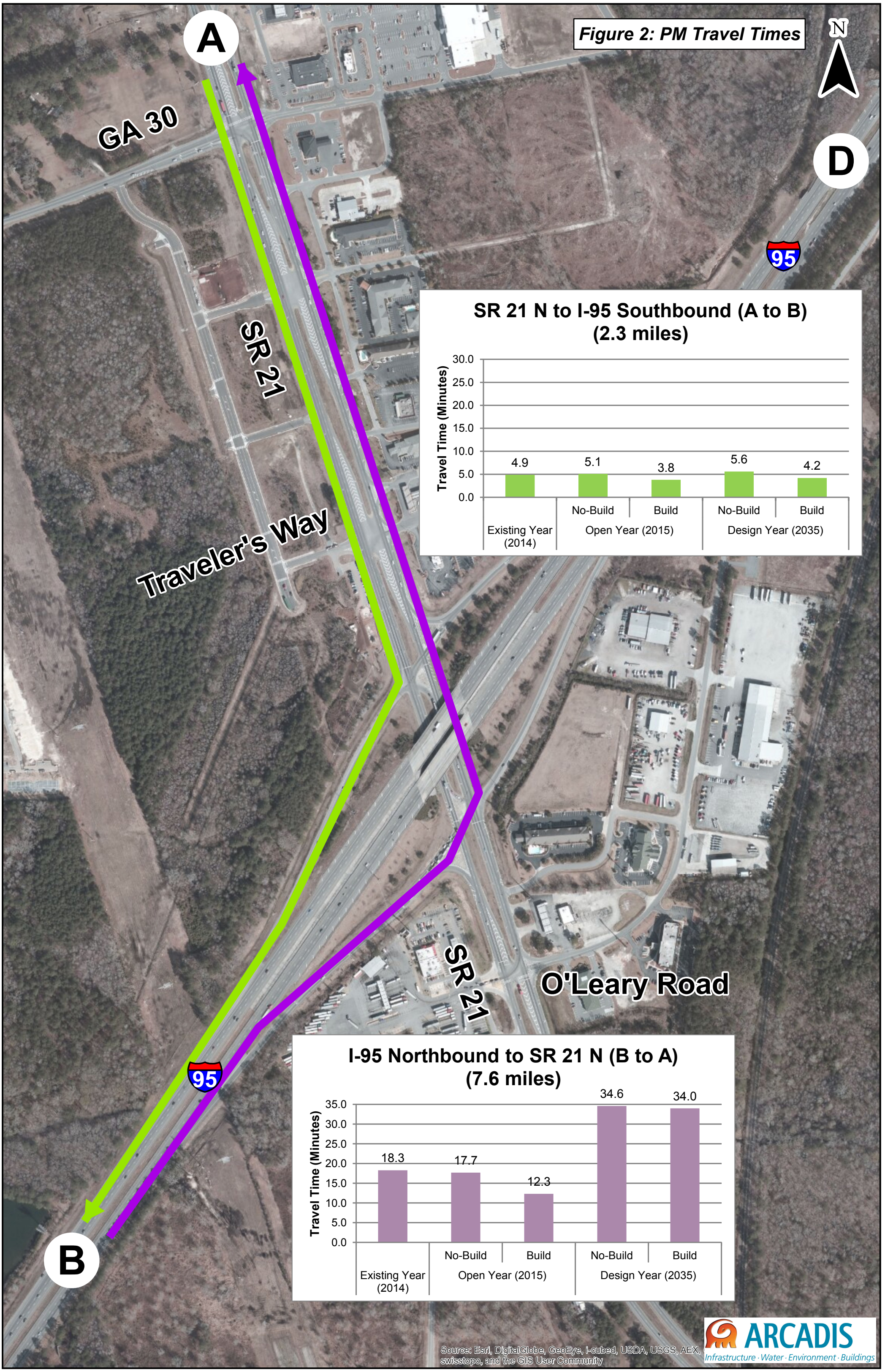


Figure 2: PM Travel Times
N
A
B
D
GA 30
SR 21
Traveler's Way
SR 21
O'Leary Road
95
95
SR 21 N to I-95 Southbound (A to B)
(2.3 miles)
Travel Time (Minutes)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
4.9
5.1
3.8
5.6
4.2
Existing Year (2014)
No-Build
Build
Open Year (2015)
No-Build
Build
Design Year (2035)
I-95 Northbound to SR 21 N (B to A)
(7.6 miles)
Travel Time (Minutes)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
18.3
17.7
12.3
34.6
34.0
Existing Year (2014)
No-Build
Build
Open Year (2015)
No-Build
Build
Design Year (2035)
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, swisstopo, and the GIS User Community
ARCADIS
Infrastructure · Water · Environment · Buildings

1.4 Vehicular Throughput

In addition to improving safety and reducing delays, providing better access to the interstate is a key indicator of the benefits of a project and is often quantified by vehicle throughput. The VISSIM results show that the a.m. peak period vehicular throughput is expected to increase by 8 percent in the open year and by 23 percent in the design year from no-build to build conditions. In the p.m. peak period, vehicular throughput is expected to increase by 12 percent in the open year and by 10 percent in the design year from no-build to build conditions. Table 4 shows the total throughput for each analysis scenario.

Table 4 Interchange Throughput

Scenario			Total Vehicles in Network	Percent Change
A.M. Peak	Existing Year (2014)		3,314	N/A
	Open Year (2015)	No-Build	3,337	N/A
		Build	3,598	8%
	Design Year (2035)	No-Build	3,542	N/A
		Build	4,371	23%
P.M. Peak	Existing Year (2014)		3,810	N/A
	Open Year (2015)	No-Build	3,786	N/A
		Build	4,302	12%
	Design Year (2035)	No-Build	3,843	N/A
		Build	4,293	10%

Processed Date:6/17/2014

Parameters: Bridge Serial Num

Bridge Inventory Data Listing

Structure ID:051-0125-0 | **Chatham** | **SUFF. RATING:** 92.25

Location & Geography

Structure ID:	051-0125-0
200 Brdge Information:	06
*6A Feature Int:	SR 21
*6B Critical Bridge:	0
*7A Route No Carried:	SR00405
*7B Facility Carried:	I-95 (NBL)
9 Location:	INT I-95 & SR 21
2 Dot District:	5
207 Year Photo:	2012
*91 Inspection Frequency:	24 Date: 07/18/2012
92A Fract Crit Insp Freq:	0 Date: 02/01/1901
92B Underwater Insp Freq:	0 Date: 02/01/1901
92C Other Spc. Insp Freq:	0 Date: 02/01/1901
* 4 Place Code:	00000
*5 Inventory Route(O/U):	1
Type:	1
Designation:	1
Number:	00095
Direction:	0
*16 Latitude:	32 - 11.4602 HMMS Prefix:SR
*17 Longtitude:	81 - 11.6853 HMMS Suffix:00
	MP: 108.51
98 Border Bridge:	000 % Shared:00
99 ID Number:	000000000000000
*100 STRAHNET:	1
12 Base Highway Network:	1
13A LRS Inventory Route:	511040500
13B Sub Inventory Route:	1
*101 Parallel Structure:	R
*102 Direction of Traffic:	1
*264 Road Inventory Mile Post:	016.69
*208 Inspection Area:	05 Initials: KAS
Engineer's Initials:	bcn
* Location ID No:	051-00405D-108.52N

*104 Highway System:	1
*26 Functional Classification:	11
*204 Federal Route Type:	I No: 00951
105 Federal Lands Highway:	0
*110 Truck Route:	0
206 School Bus Route:	0
217 Benchmark Elevation:	0000.00
218 Datum:	0
*19 Bypass Length:	01
*20 Toll:	3
*21 Maintanance:	01
*22 Owner:	01
*31 Design Load:	6
37 Historical Significance:	5
205 Congressional District:	12
27 Year Constructed:	1976
106 Year Reconsrtucted:	1995
33 Bridge Median	1
34 Skew:	36
35 Structure Flared:	0
38 Navigation Control:	N
213 Special Steel Design:	0
267 Type of Paint:	2
*42 Type of Service On:	1
Type of Service Under:	1
214 Movable Bridge:	0
203 Type Bridge:	D - O - M - O
259 Pile Encasement	3
*43 Structure Type Main:	4 02
45 No.Spans Main:	004
44 Structure Type Appr:	0 00
46 No Spans Appr:	0000
226 Bridge Curve Horz	0 Vert: 0.00
111 Pier Protection	0
107 Deck Structure Type:	1
108 Wearing Structure Type:	1
Membrane Type:	8
Deck Protection:	8

Signs & Attachments

225 Expansion Joint Type:	03
242 Deck Drains:	0
243 Parapet Location:	0
Height:	0.00
Width:	0.00
238 Curb Height:	0
Curb Material:	0
239 Handrail	9 9
*240 Median Barrier Rail:	0
241 Bridge Median Height:	0
* Bridge Median Width:	0
230 Guardrail Loc. Dir. Rear:	6
Fwrd:	6
Oppo. Dir. Rear:	0
Oppo. Fwrd:	0
244 Aproach Slab	3
224 Retaining Wall:	0
233Posted Speed Limit:	65
236 Warning Sign:	0.00
234 Delineator:	1.00
235 Hazard Boards:	0
237 Utilities Gas:	00
Water:	00
Electric:	00
Telephone:	00
Sewer:	00
247 Lighting Street:	1
Navigation:	0
Aerial:	0
*248 County Continuity No.:	00

"The Information contained in this File/Report is the property of GDOT and may not be released to any other party without the written consent of the Data Custodian. Please dispose of this information by shredding or other confidential method."

Bridge Inventory Data Listing

Structure ID:051-0125-0

Programming Data

201 Project No:	I-95-1 (35) 99
202 Plans Available:	4
249 Prop Proj No:	00000000000000000000000000
250 Approval Status:	0000
251 PI Number:	0000000
252 Contract Date:	02/01/1901
260 Seismic No:	00000
75 Type Work:	00 0
94 Bridge Imp: Cost:	$1,606
95 Roadway Imp. Cost:	$161
96 Total Imp Cost:	$2409
76 Imp Length:	000000
97 Imp Year:	2013
114 Furure ADT:	068610 Year:2031

Hydralic Data

215Waterway Data:	
High Water Elev:	0000.0 Year:1900
Flood Elev:	0000.0 Freq:00
Avg Streambed Elev:	0000.0
Drainage Area:	00000
Area of Opening:	000000
113 Scour Critical	N
216 Water Depth:	00.0 Br.Height:00.0
222 Slope Protection:	4
221Spur Dikes Rear	0 Fwd:0
219 Fender System	0
220 Dolphin:	0
223 Culvert Cover:	000
Type:	0
No. Barrels:	0
Width:	0.00 Height:0.00
Length:	0 Apron:0
*265 U/W Insp. Area	0 Diver:ZZZ
*Location ID No:	051-00405D-108.52N

Measurements:

*29 ADT	045740 Year:2011
109 %Trucks:	20
* 28 Lanes On:	03 Under:06
210 No. Tracks On:	00 Under:00
* 48 Max. Span Length	0109
* 49 Structure Length:	323
51 Br. Rwdy. Width	64.00
52 Deck Width:	79.00
* 47 Tot. Horiz. Cl:	64
50 Curb / Sidewalk Width	0.00 / 0.00
32 Approach Rdwy. Width	060
*229 Shoulder Width:	
Rear Lt:	12.0(Type:2 Rt:12.00
Fwd. Lt:	12.00Type:2 Rt:12.00
Pavement Width:	
Rear:	35.60 Type: 2
	36.00 Type: 2
Intersaction Rear:	0 Fwd: 0
36Safety Features Br. Rail:	1
Transition:	1
App. G. Rail:	1
App. Rail End:	1
53 Minimum Cl. Over:	99' 99 "
Under: H	17' 00"
*228 Minimum Vertical Cl	
Act. Odm Dir::	99' 99"
Oppo. Dir:	99' 99"
Posted Odm. Dir:	00' 00"
Oppo. Dir:	00' 00"
55 Lateral Undercl. Rt:	H 29.60
56 Lateral Undercl. Lt:	15.20
*10 Max Min Vert Cl:	99' 99" Dir:0
39 Nav Vert Cl:	000 Horiz:0000
116 Nav Vert Cl Closed:	000
245 Deck Thickness Main	8.00
Deck Thick Approach:	0.00
246 Overlay Thickness:	0.00
212 Year Last Painted:	Sup:1995 Sub:0000

65 Inventory Rating Mathod:	1
63 Operating Rating Method:	1
66 Inventory Type:	2 Rating: 32
64 Operating Type:	2 Rating: 54
231Calculated Loads:	
H-Modified:	21 0
HS-Modified:	30 0
Type 3:	33 0
Type 3s2:	40 0
Timber:	37 0
Piggyback:	40 0
261 H Inventory Rating:	30
262 H Operating Rating	50
67 Structural Evaluation:	7
58 Deck Condition:	7
59 Superstructure Condition:	8
* 227 Collision Damage:	0
60A Substructure Condition:	7
60B Scour Condition:	N
60C Underwater Condition	N
71 Waterway Adequacy:	N
61 Channel Protection Cond.:	N
68 Deck Geometry:	9
69 UnderClr. Horz/Vert:	7
72 Appr. Alignment:	8
62 Culvert:	N

Posting Data

70 Bridge Posting Required	5
41 Struct Open, Posted, CL:	A
* 103 Temporary Structure:	0
232 Posted Loads	
H-Modified:	00
HS-Modified:	00
Type 3:	00
Type 3s2:	00
Timber:	00
Piggyback	00
253 Notification Date:	02/01/1901
258 Fed Notify Date:	02/01/1901

"The Information contained in this File/Report is the property of GDOT and may not be released to any other party without the written consent of the Data Custodian. Please dispose of this information by shredding or other confidential method."

Processed Date:6/17/2014

Parameters: Bridge Serial Num

Bridge Inventory Data Listing

Structure ID:051-0126-0 | **Chatham** | **SUFF. RATING:** 92.25

Location & Geography

Structure ID:	051-0126-0
200 Brdge Information:	06
*6A Feature Int:	SR 21
*6B Critical Bridge:	0
*7A Route No Carried:	SR00405
*7B Facility Carried:	I-95 (SBL)
9 Location:	INT I-95 & SR 21
2 Dot District:	5
207 Year Photo:	2012
*91 Inspection Frequency:	24 Date: 07/18/2012
92A Fract Crit Insp Freq:	0 Date: 02/01/1901
92B Underwater Insp Freq:	0 Date: 02/01/1901
92C Other Spc. Insp Freq:	0 Date: 02/01/1901
* 4 Place Code:	00000
*5 Inventory Route(O/U):	1
Type:	1
Designation:	1
Number:	00095
Direction:	0
*16 Latitude:	32 - 11.4892 HMMS Prefix:SR
*17 Longtitude:	81 - 11.6842 HMMS Suffix:00
	MP: 108.51
98 Border Bridge:	000 % Shared:00
99 ID Number:	000000000000000
*100 STRAHNET:	1
12 Base Highway Network:	1
13A LRS Inventory Route:	511040500
13B Sub Inventory Route:	1
*101 Parallel Structure:	L
*102 Direction of Traffic:	1
*264 Road Inventory Mile Post:	016.70
*208 Inspection Area:	05 Initials: KAS
Engineer's Initials:	bcn
* Location ID No:	051-00405D-108.53N

*104 Highway System:	1
*26 Functional Classification:	11
*204 Federal Route Type:	I No: 00951
105 Federal Lands Highway:	0
*110 Truck Route:	0
206 School Bus Route:	0
217 Benchmark Elevation:	0000.00
218 Datum:	0
*19 Bypass Length:	01
*20 Toll:	3
*21 Maintanance:	01
*22 Owner:	01
*31 Design Load:	6
37 Historical Significance:	5
205 Congressional District:	12
27 Year Constructed:	1976
106 Year Reconsrtucted:	1995
33 Bridge Median	1
34 Skew:	36
35 Structure Flared:	0
38 Navigation Control:	N
213 Special Steel Design:	0
267 Type of Paint:	2
*42 Type of Service On:	1
Type of Service Under:	1
214 Movable Bridge:	0
203 Type Bridge:	D - O - M - O
259 Pile Encasement	3
*43 Structure Type Main:	4 02
45 No.Spans Main:	004
44 Structure Type Appr:	0 00
46 No Spans Appr:	0000
226 Bridge Curve Horz	0 Vert: 0.00
111 Pier Protection	0
107 Deck Structure Type:	1
108 Wearing Structure Type:	1
Membrane Type:	8
Deck Protection:	8

Signs & Attachments

225 Expansion Joint Type:	03
242 Deck Drains:	0
243 Parapet Location:	0
Height:	0.00
Width:	0.00
238 Curb Height:	0
Curb Material:	0
239 Handrail	9 9
*240 Median Barrier Rail:	0
241 Bridge Median Height:	0
* Bridge Median Width:	0
230 Guardrail Loc. Dir. Rear:	6
Fwrd:	6
Oppo. Dir. Rear:	0
Oppo. Fwrd:	0
244 Aproach Slab	3
224 Retaining Wall:	0
233Posted Speed Limit:	65
236 Warning Sign:	0.00
234 Delineator:	1.00
235 Hazard Boards:	0
237 Utilities Gas:	00
Water:	00
Electric:	00
Telephone:	00
Sewer:	00
247 Lighting Street:	1
Navigation:	0
Aerial:	0
*248 County Continuity No.:	00

"The Information contained in this File/Report is the property of GDOT and may not be released to any other party without the written consent of the Data Custodian. Please dispose of this information by shredding or other confidential method."

Bridge Inventory Data Listing

Structure ID:051-0126-0

Programming Data

201 Project No:	I-95-1 (35) 99
202 Plans Available:	4
249 Prop Proj No:	00000000000000000000000000
250 Approval Status:	0000
251 PI Number:	0000000
252 Contract Date:	02/01/1901
260 Seismic No:	00000
75 Type Work:	00 0
94 Bridge Imp: Cost:	$1,606
95 Roadway Imp. Cost:	$161
96 Total Imp Cost:	$2409
76 Imp Length:	000000
97 Imp Year:	2013
114 Furure ADT:	068610 Year:2031

Hydralic Data

215Waterway Data:	
High Water Elev:	0000.0 Year:1900
Flood Elev:	0000.0 Freq:00
Avg Streambed Elev:	0000.0
Drainage Area:	00000
Area of Opening:	000000
113 Scour Critical	N
216 Water Depth:	00.0 Br.Height:00.0
222 Slope Protection:	4
221Spur Dikes Rear	0 Fwd:0
219 Fender System	0
220 Dolphin:	0
223 Culvert Cover:	000
Type:	0
No. Barrels:	0
Width:	0.00 Height:0.00
Length:	0 Apron:0
*265 U/W Insp. Area	0 Diver:ZZZ
*Location ID No:	051-00405D-108.53N

Measurements:

*29 ADT	045740 Year:2011
109 %Trucks:	20
* 28 Lanes On:	03 Under:06
210 No. Tracks On:	00 Under:00
* 48 Max. Span Length	0109
* 49 Structure Length:	323
51 Br. Rwdy. Width	64.60
52 Deck Width:	79.00
* 47 Tot. Horiz. Cl:	65
50 Curb / Sidewalk Width	0.00 / 0.00
32 Approach Rdwy. Width	058
*229 Shoulder Width:	
Rear Lt:	11.2(Type:2 Rt:13.00
Fwd. Lt:	10.00Type:2 Rt:12.00
Pavement Width:	
Rear:	36.00 Type: 2
	36.00 Type: 2
Intersaction Rear:	0 Fwd: 0
36Safety Features Br. Rail:	1
Transition:	1
App. G. Rail:	1
App. Rail End:	1
53 Minimum Cl. Over:	99' 99 "
Under: H	17' 00"
*228 Minimum Vertical Cl	
Act. Odm Dir::	99' 99"
Oppo. Dir:	99' 99"
Posted Odm. Dir:	00' 00"
Oppo. Dir:	00' 00"
55 Lateral Undercl. Rt:	H 29.60
56 Lateral Undercl. Lt:	29.80
*10 Max Min Vert Cl:	99' 99" Dir:0
39 Nav Vert Cl:	000 Horiz:0000
116 Nav Vert Cl Closed:	000
245 Deck Thickness Main	8.00
Deck Thick Approach:	0.00
246 Overlay Thickness:	0.00
212 Year Last Painted:	Sup:1995 Sub:0000

65 Inventory Rating Mathod:	1
63 Operating Rating Method:	1
66 Inventory Type:	2 Rating: 32
64 Operating Type:	2 Rating: 54
231Calculated Loads:	
H-Modified:	21 0
HS-Modified:	30 0
Type 3:	33 0
Type 3s2:	40 0
Timber:	37 0
Piggyback:	40 0
261 H Inventory Rating:	30
262 H Operating Rating	50
67 Structural Evaluation:	7
58 Deck Condition:	7
59 Superstructure Condition:	7
* 227 Collision Damage:	0
60A Substructure Condition:	7
60B Scour Condition:	N
60C Underwater Condition	N
71 Waterway Adequacy:	N
61 Channel Protection Cond.:	N
68 Deck Geometry:	9
69 UnderClr. Horz/Vert:	7
72 Appr. Alignment:	8
62 Culvert:	N

Posting Data

70 Bridge Posting Required	5
41 Struct Open, Posted, CL:	A
* 103 Temporary Structure:	0
232 Posted Loads	
H-Modified:	00
HS-Modified:	00
Type 3:	00
Type 3s2:	00
Timber:	00
Piggyback	00
253 Notification Date:	02/01/1901
258 Fed Notify Date:	02/01/1901

"The Information contained in this File/Report is the property of GDOT and may not be released to any other party without the written consent of the Data Custodian. Please dispose of this information by shredding or other confidential method."

PI: 0012722
SR 21 from SR 30 to I-95
Including Diamond Interchange
Conceptual Hydraulics Analysis for
Post-construction BMP (July 2014)

Study Purpose: To evaluate the proposed design and assessment of post construction stormwater management measures (BMPs) and MS4 permit compliance for the project.

Introduction: In January 2012 the Environmental Protection Division of the Georgia Department of Natural Resources (EPD) issued the Georgia Department of Transportation (GDOT) first Municipal Separate Storm Sewer System (MS4) Permit (General NPDES Permit No. GAR041000 (Permit).

The Permit regulates new and existing point source discharges of stormwater from roadways owned and operated by GDOT to waters of the State of Georgia. The Riverside at I-285 project (Project) must meet the requirements of the Permit which includes the incorporating permanent water quality control and detention measures (BMPs) into the design where appropriate and where those BMPs have not been determined to be infeasible based on the infeasibility criteria identified in Section 1.4 of the GDOT Guidelines for Design of Post-Construction BMPs (GDOT Guidelines) issued August 23, 2013

Design Criteria: To the extent feasible, the BMPs were designed in accordance with the Permit requirements, the GDOT Guidelines, and the Georgia Stormwater Management Manual (GSMM). A summary of the standard design criteria from the GDOT Guidelines is as follows:

- **Stormwater runoff quality and reduction** – demonstrate 80% of the total suspended solids (TSS) from runoff generated by a 1.2-inch rainfall event. The GSMM refers to this design criteria as the Water Quality Sizing Criteria.

- **Stream channel protection** – detain the 1-year 24-hour rainfall event. The GSMM refers to this design criteria as the Channel Protection Sizing Criteria.

- **Overbank protection** – calculated post-construction peak discharge rate that is less than or equal to pre-construction rates, for the 25-year 24-hour rainfall event. The GSMM refers to this design criteria as the Overbank Flood Protection Sizing Criteria.

- **Extreme flood protection** – control the 100-year 24-hour flood such that flooding is not exacerbated. The GSMM refers to this design criteria as the Extreme Flood Protection Sizing Criteria.

Hydraulic Analysis: Study of the existing drainage pattern indicates that there are multiple outfalls from the project area. WB SR 21 west of I-95 and SB I-95 north of SR 21 drains to an existing 36” RCP. EB SR 21 west of I-95, the I-95 SB on ramp, the I-95 NB off ramp, and I-95 south of SR 21 drain south into roadside ditches. The I-95 NB on ramp and SR 21 east of I-95 drains to a double 5’x5’ culvert into Little Hurst branch. Tables 1-5 summarize the existing and proposed hydraulic conditions within the project limits.

Table 1: Conceptual Drainage Area 1 Summary

Description	Existing		Proposed	
	Area (ac)	CN	Area (ac)	CN
Total Area	7.06	82	7.06	83
Impervious Area	3.29	95	3.39	95
Pervious Area	3.78	70	3.67	70

Table 2: Conceptual Drainage Area 2 Summary

Description	Existing		Proposed	
	Area (ac)	CN	Area (ac)	CN
Total Area	20.38	83	20.38	85
Impervious Area	10.84	95	11.95	95
Pervious Area	9.53	70	8.43	70

Table 3: Conceptual Drainage Area 3 Summary

Description	Existing		Proposed	
	Area (ac)	CN	Area (ac)	CN
Total Area	6.17	84	6.17	85
Impervious Area	3.43	95	3.71	95
Pervious Area	2.75	70	2.46	70

Table 4: Conceptual Drainage Area 4 Summary

Description	Existing		Proposed	
	Area (ac)	CN	Area (ac)	CN
Total Area	7.65	83	7.65	84
Impervious Area	3.87	95	4.25	95
Pervious Area	3.79	70	3.41	70

Table 5: Conceptual Drainage Area 5 Summary

Description	Existing		Proposed	
	Area (ac)	CN	Area (ac)	CN
Total Area	20.53	80	20.53	81
Impervious Area	8.52	95	9.37	95
Pervious Area	12.00	70	11.16	70

Table 6 summarizes the stormwater treatment requirement. It is anticipated that a detention pond can meet the MS4 requirements. Detention pond details and location will be further evaluated during the design-build phase of the project. Attempts should be made to by-pass as much of the existing drainage area especially any on-site and off-site impervious areas to minimize the size of the post-construction BMP.

Table 6: Conceptual Post-Construction Stormwater Treatment Requirement

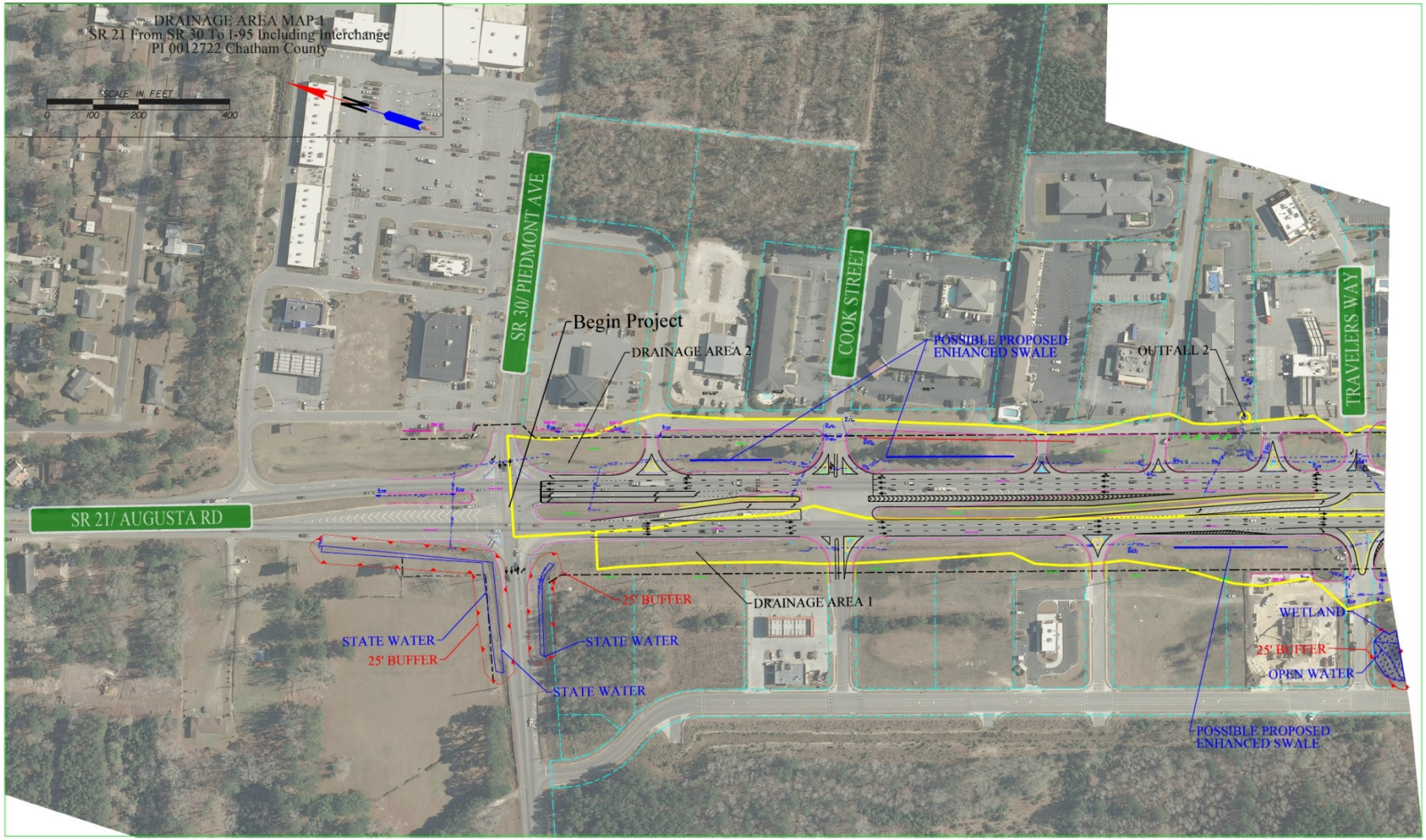
Description	Area 1	Area 2	Area 3	Area 4	Area 5
	cubic feet	cubic feet	cubic feet	cubic feet	cubic feet
Water Quality Volume	449	4,814	1,232	1,648	3,678
Channel Protection Volume	640	3,803	513	570	1,779
Overbank Protection	1,234	7,314	993	1,101	3,439

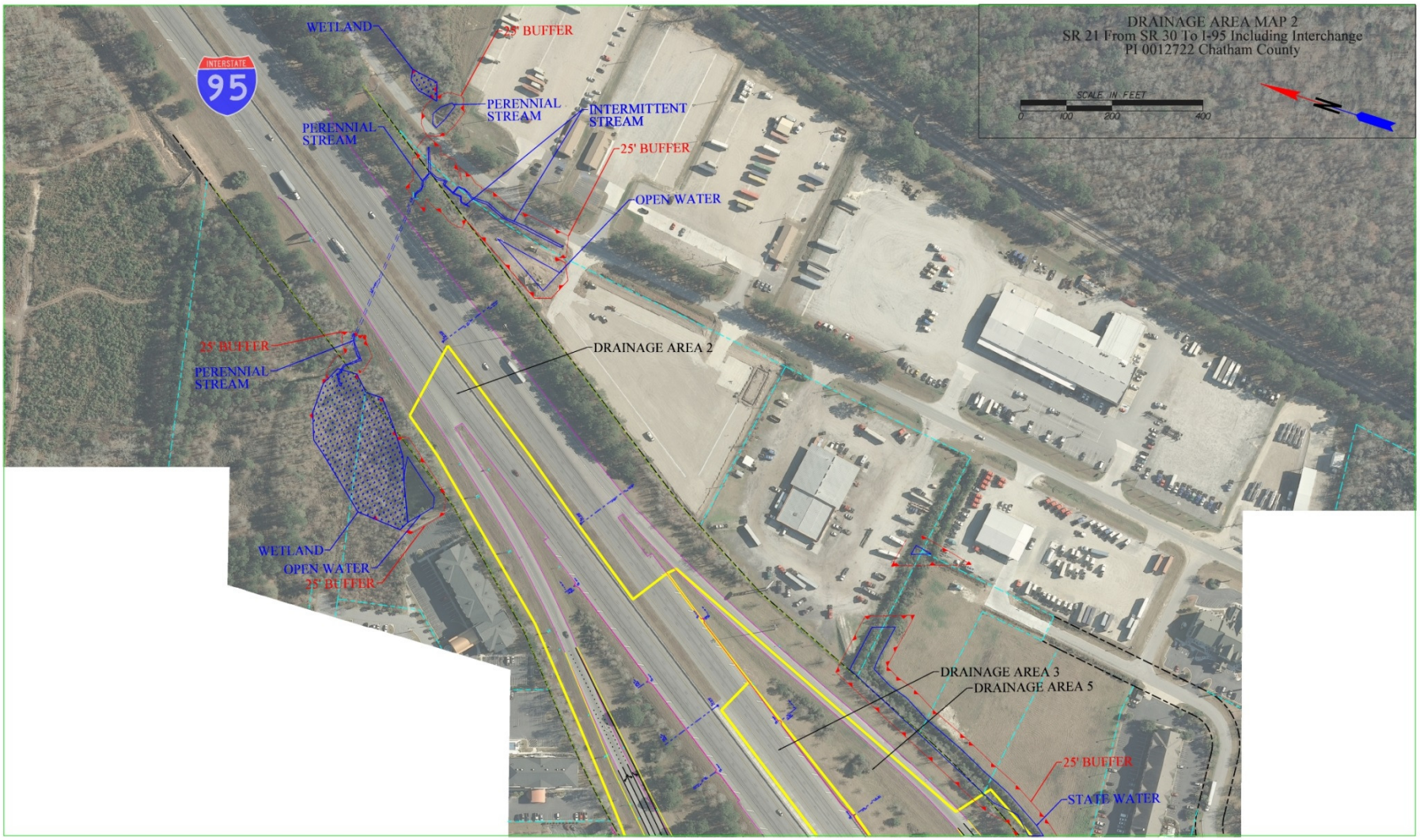
BMP Placement: Stormwater ponds are infeasible due to site topography, and filter strips are infeasible due to the compacted soil that is on site. Therefore, the most useful stormwater BMP for this project is the enhanced swale. Table 7 summarizes the location of possible enhanced swales for each drainage area.

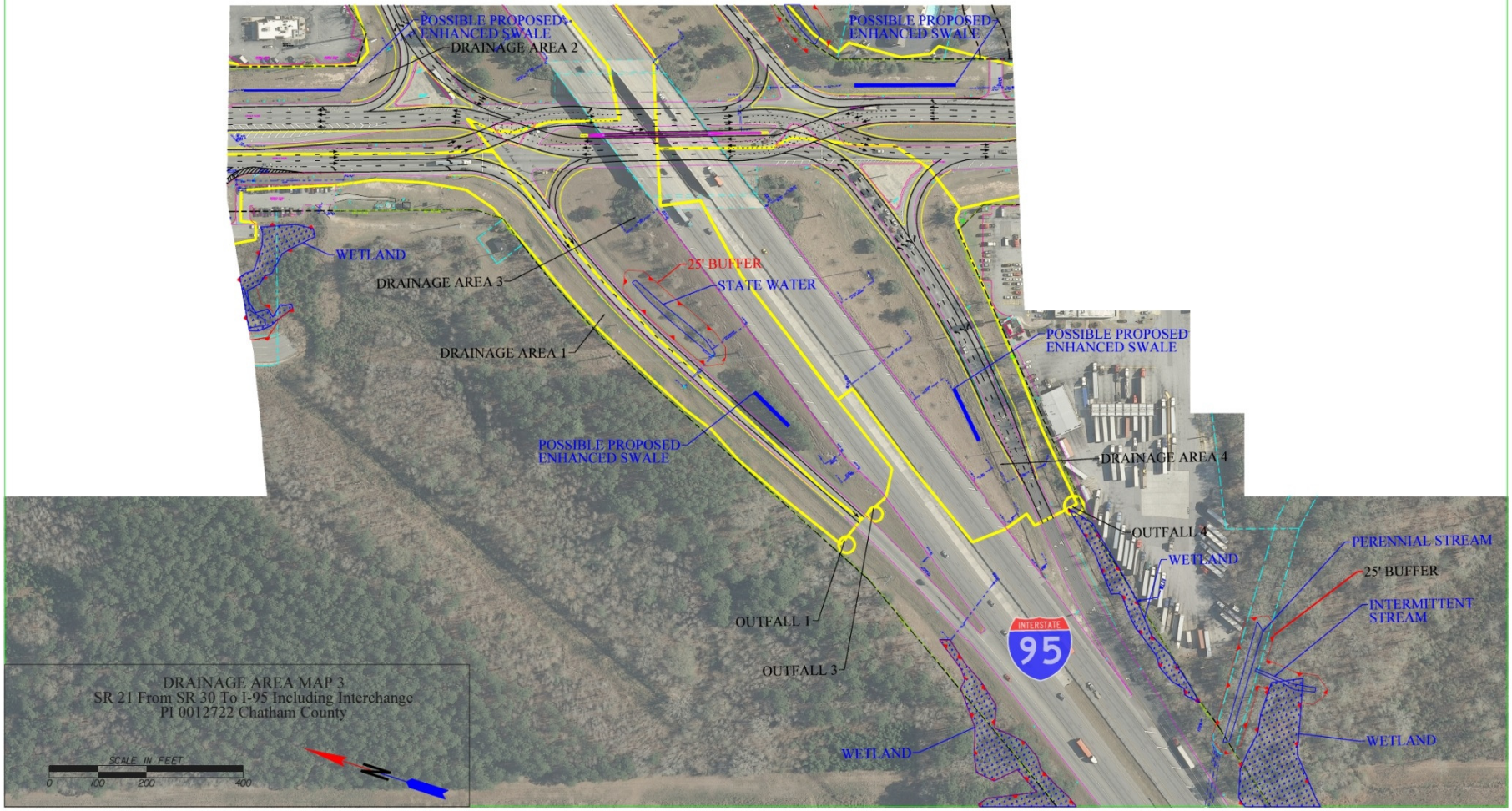
Table 7: Enhanced Swale Locations

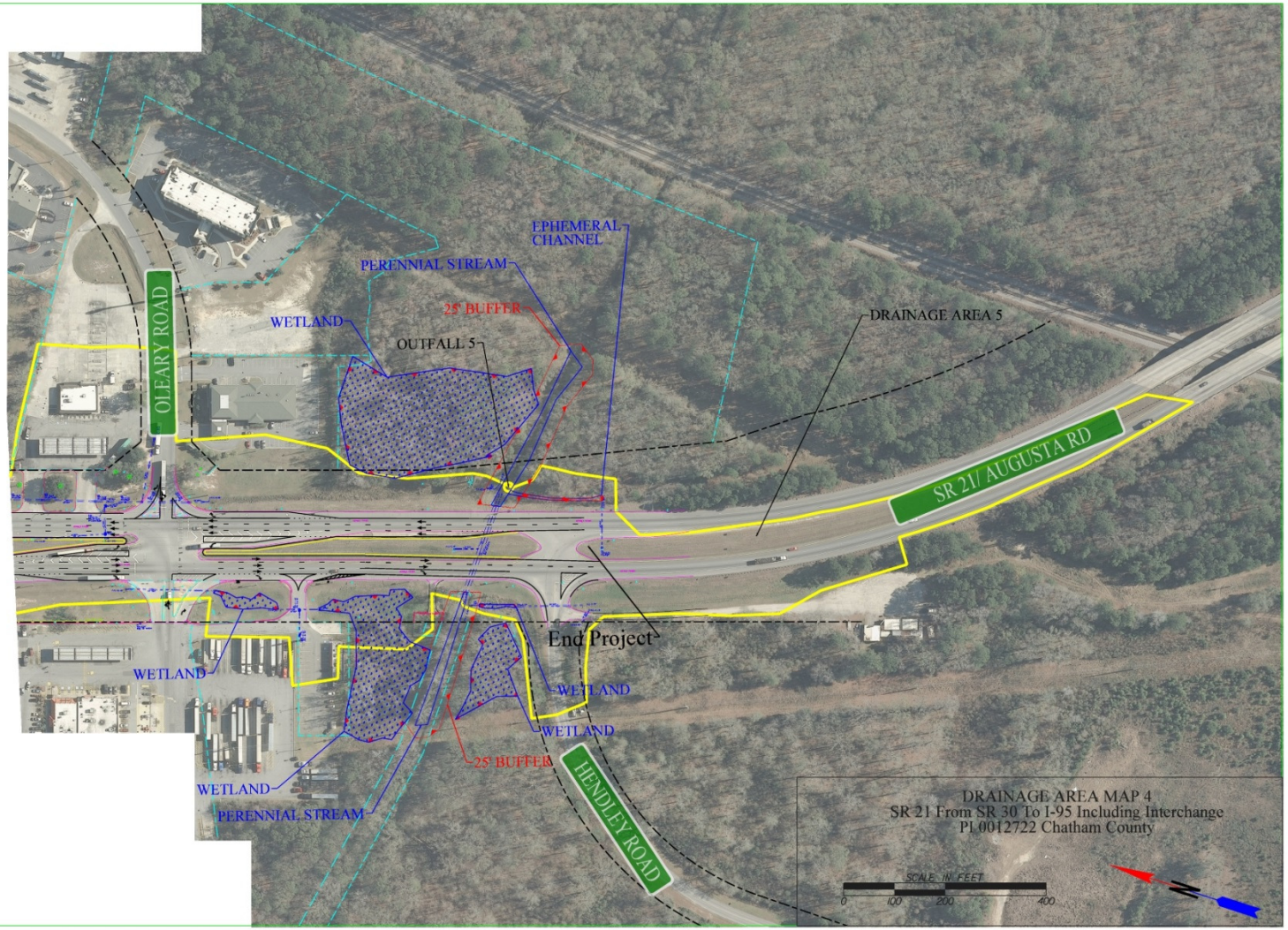
Area	Length	Width	Location
1	250	4.00	EB SR 21, North of park and ride lot
2	180	4.00	WB SR 21, at Quality Inn
2	280	4.00	WB SR 21, at Holiday Inn Express
2	200	4.00	WB SR 21 at I-95 SB off ramp
3	100	8.00	Gore of I-95 SB on ramp
4	120	8.00	Gore of I-95 NB off ramp
5	210	8.00	WB SR 21, at I-95 NB on ramp

Drainage Area Maps: Attached drainage area maps show the project area and possible proposed enhanced swale locations.


DRAINAGE AREA MAP-1
SR 21 From SR 30 To I-95 Including Interchange
PI 0012722 Chatham County
SCALE IN FEET
0
100
200
400
SR 30/ PIEDMONT AVE
COOK STREET
TRAVELERS WAY
SR 21/ AUGUSTA RD
Begin Project
DRAINAGE AREA 2
POSSIBLE PROPOSED ENHANCED SWALE
OUTFALL 2
DRAINAGE AREA 1
25' BUFFER
STATE WATER
25' BUFFER
STATE WATER
STATE WATER
WETLAND
25' BUFFER
OPEN WATER
POSSIBLE PROPOSED ENHANCED SWALE


DRAINAGE AREA MAP 2
SR 21 From SR 30 To I-95 Including Interchange
PI 0012722 Chatham County
SCALE IN FEET
0
100
200
400
INTERSTATE
95
WETLAND
25' BUFFER
PERENNIAL STREAM
INTERMITTENT STREAM
PERENNIAL STREAM
25' BUFFER
OPEN WATER
DRAINAGE AREA 2
25' BUFFER
PERENNIAL STREAM
WETLAND
OPEN WATER
25' BUFFER
DRAINAGE AREA 3
DRAINAGE AREA 5
25' BUFFER
STATE WATER


POSSIBLE PROPOSED ENHANCED SWALE
DRAINAGE AREA 2
POSSIBLE PROPOSED ENHANCED SWALE
WETLAND
DRAINAGE AREA 3
25' BUFFER
STATE WATER
DRAINAGE AREA 1
POSSIBLE PROPOSED ENHANCED SWALE
POSSIBLE PROPOSED ENHANCED SWALE
DRAINAGE AREA 4
OUTFALL 4
WETLAND
PERENNIAL STREAM
25' BUFFER
INTERMITTENT STREAM
OUTFALL 1
OUTFALL 3
INTERSTATE
95
WETLAND
WETLAND
DRAINAGE AREA MAP 3
SR 21 From SR 30 To I-95 Including Interchange
PI 0012722 Chatham County
SCALE IN FEET
0
100
200
400



DRAINAGE AREA MAP 4
SR 21 From SR 30 To I-95 Including Interchange
PI 0012722 Chatham County

Flexible Pavement Design Analysis

PI Number	0012722	**County(s)**	Chatham
Project Number	PI 0012722	**Design Name**	SR 21 Full Depth
Project Description	SR 21 From SR 30 to I-95 Including Diverging Diamond Interchange		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2015	**Initial AADT, VPD**	23,665	**24 Hour Truck %**	15.00	**Lanes in one direction**	3
Final Design Year	2035	**Final AADT, VPD**	31,905	**SU Truck %**	9.00	**Curb & Gutter/Barrier**	No
		Mean AADT, VPD	27,785	**MU Truck %**	6.00		

Design Data					
Lane Distribution Factor (%)	70.00	**Soil Support Value**	4.00	**Single Unit ESAL**	0.40
Terminal Serviceability Index	2.50	**Regional Factor**	1.70	**Multiple Unit ESAL**	1.50
		User Defined 18-KIP ESAL	0.00	**Calculated 18-KIP ESAL**	0.84
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
27,785	70.00	Single Unit Truck	9.00	0.40	701
		Multi Unit Truck	6.00	1.50	1,751
				Total Daily ESALs	2,452
				Total Design Period ESALs	17,899,600

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave, Polymer Modified	2.00	0.4400	0.88
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	0.50	0.4400	0.22
		4.50	0.3000	1.35
Course 4	Graded Aggregate Base	12.00	0.1600	1.92

Required SN	5.74	**Proposed pavement is 8.58% Underdesigned**	**Proposed SN**	5.25

Design Remarks	

Prepared By 7/11/2014 8:59 AM

Tyler Denning, PE - Project Engineer **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Filename: G:\Trf\TM130034_I95DDI\RDY\Pavement Design\GDOT Pavement Design Tool v2.0.xlsm

GDOT Pavement Design Tool - Version 2.0

Flexible Pavement Design Analysis

PI Number	0012722	**County(s)**	Chatham
Project Number	PI 0012722	**Design Name**	Ramps Full Depth
Project Description	SR 21 From SR 30 to I-95 Including Diverging Diamond Interchange		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2015	**Initial AADT, VPD**	12,310	**24 Hour Truck %**	13.00	**Lanes in one direction**	2
Final Design Year	2035	**Final AADT, VPD**	16,575	**SU Truck %**	3.00	**Curb & Gutter/Barrier**	No
		Mean AADT, VPD	14,443	**MU Truck %**	10.00		

Design Data					
Lane Distribution Factor (%)	70.00	**Soil Support Value**	4.00	**Single Unit ESAL**	0.40
Terminal Serviceability Index	2.50	**Regional Factor**	1.70	**Multiple Unit ESAL**	1.50
		User Defined 18-KIP ESAL	0.00	**Calculated 18-KIP ESAL**	1.25
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
14,443	70.00	Single Unit Truck	3.00	0.40	122
		Multi Unit Truck	10.00	1.50	1,517
				Total Daily ESALs	1,639
				Total Design Period ESALs	11,964,700

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave, Polymer Modified	2.00	0.4400	0.88
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	0.50	0.4400	0.22
		4.50	0.3000	1.35
Course 4	Graded Aggregate Base	10.00	0.1600	1.60

Required SN	5.44	**Proposed pavement is 9.34% Underdesigned**	**Proposed SN**	4.93

Design Remarks	

Prepared By 7/11/2014 8:59 AM

Tyler Denning, PE - Project Engineer **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Filename: G:\Trf\TM130034_I95DDI\RDY\Pavement Design\GDOT Pavement Design Tool v2.0.xlsm

GDOT Pavement Design Tool - Version 2.0

1. Safety Analysis

Safety is an important aspect related to development of the SR 21 and I-95 interchange. Traffic incidents (crashes) cause congestion, economic loss, and the potential for injuries or loss of life.

When analyzing crash data, it is important to note that there are usually multiple underlying reasons for each crash. These include roadway geometry, weather conditions, driver behavior, traffic operations, on-road or roadside hazards, and construction activity. In most cases, no single factor causes a crash. This report focuses on identifying the underlying causes of crashes to determine where motorist safety may be improved by means of upgrading roadway geometry, installing safety-related features, and/or improving traffic conditions.

1.1 Historical Crash Analysis

The latest five years of available crash data were collected from GDOT and analyzed to quantify the frequency, severity, and type of crashes occurring at the intersections of SR 21 with SR 30, Traveler's Way, I-95, and O'Leary Road. The latest crash data available for the five intersections were for the years 2009 to 2013. The following sections describe the crash rate, crash type, and crash severity analysis of the five years of historical crash data.

1.1.1 Crash Rate Analysis

The GDOT crash data were analyzed to determine the number of crashes that occurred at each study intersection each year. Table 1 presents a comparison between the number of study intersection crashes and the historical statewide average number of crashes that occurred at comparable intersections. Statewide average intersection crash rates were obtained from GDOT.

The results presented in the table show that the SR 30 intersection, the I-95 interchange, and the O'Leary Road intersection have all exceeded the statewide average total crash rate in one or more years between 2009 and 2013. The SR 30 intersection and the I-95 interchange have also exceeded the statewide average injury crash rate between 2009 and 2013. Additionally, the I-95 interchange exceeded the statewide average fatal crash rate in 2012 with one fatal crash. No fatal crashes occurred at the other study intersections during the five years of data. The Traveler's Way intersection did not exceed the statewide average crash rate for total, fatality, injury, or property damage only (PDO) crashes during the period from 2009-2013.

Table 1 Study Area Intersection Crash Rates vs. Statewide Average Intersection Crash Rates

SR 21		Statewide Average Crashes	2009 Actual Crashes	2010 Actual Crashes	2011 Actual Crashes	2012 Actual Crashes	2013 Actual Crashes
SR 30	Total	12.714	9	12	19	21	20
	Fatality	0.010	0	0	0	0	0
	Injury	2.674	3	6	1	5	5
	PDO	10.030	6	6	18	16	15
Traveler's Way	Total	12.868	3	2	1	3	3
	Fatality	0.011	0	0	0	0	0
	Injury	2.724	1	1	0	0	2
	PDO	10.133	2	1	1	3	1
I-95 Interchange	Total	25.428	24	34	36	60	69
	Fatality	0.020	0	0	0	1	0
	Injury	5.348	6	7	7	10	14
	PDO	20.060	18	27	29	49	55
O'Leary Road	Total	9.446	2	11	7	7	9
	Fatality	0.009	0	0	0	0	0
	Injury	2.215	2	2	1	2	0
	PDO	7.223	0	9	6	5	9

Source: GDOT Crash Database (2009 – 2013)

Red boxes indicate actual crash rates greater than statewide average crash rates.

1.1.2 Crash Type Analysis

The GDOT crash data were also analyzed to determine the frequency of each crash type that occurred at each of the five study intersections. With the exception of one type, “not a collision with a motor vehicle,” the crash types focus on the manner in which the vehicles collided. A crash categorized as “not a collision with a motor vehicle” occurs when a vehicle strikes a fixed object (utility pole, guardrail, curb, structure, etc.), a bicyclist, or a pedestrian, or when the vehicle leaves the roadway. Figures 1 through 4 illustrate the total number and percentage of each type of crash that occurred at the SR 21 and SR 30, SR 21 and Traveler’s Way, SR 21 and I-95, and SR 21 and O’Leary Road, respectively.

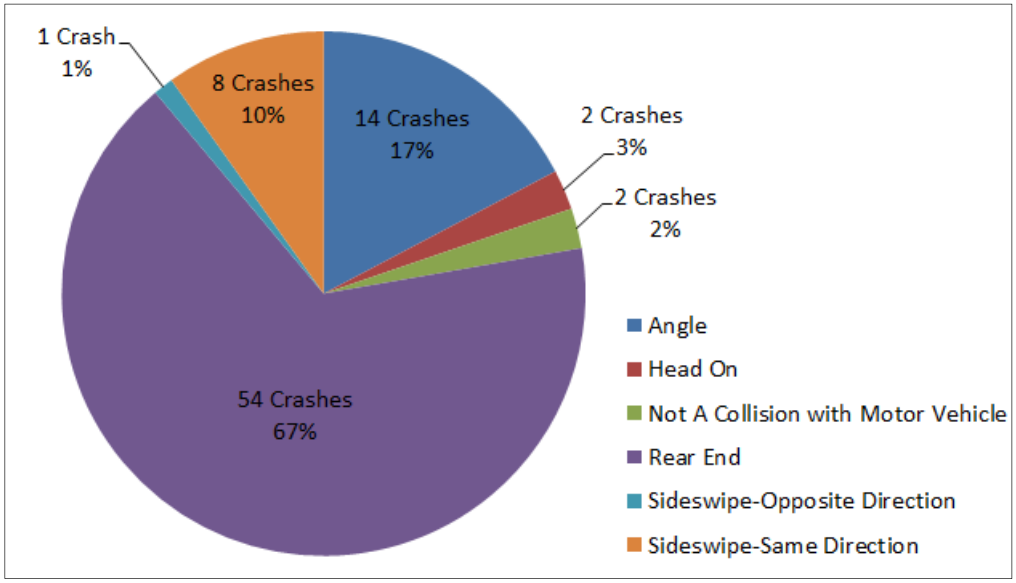


Figure 1 SR 30 Intersection Crash Frequency by Crash Type (2009 - 2013)

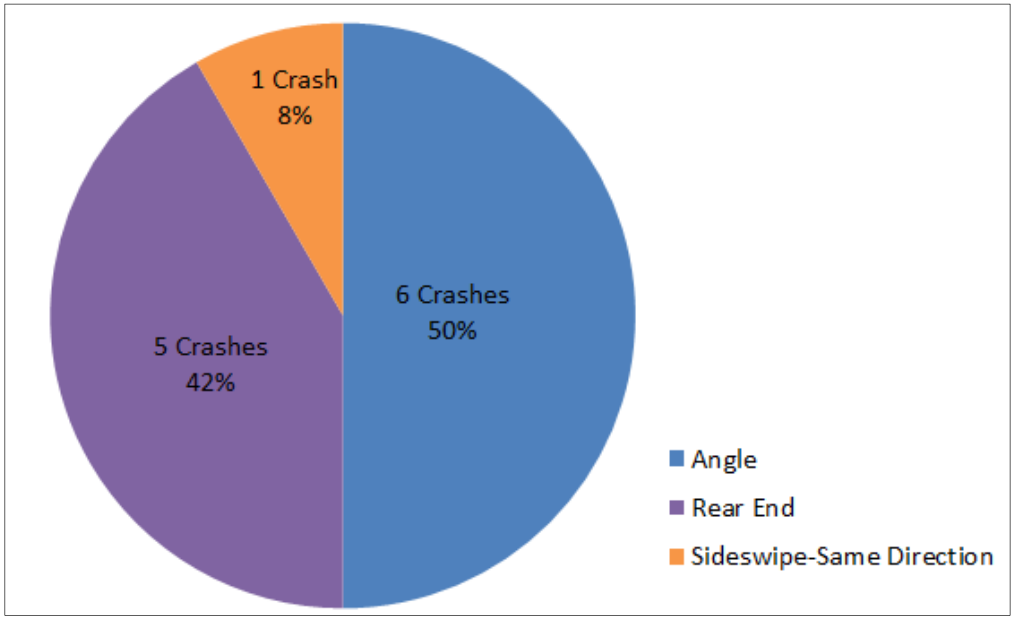


Figure 2 Traveler's Way Intersection Crash Frequency by Crash Type (2009-2013)

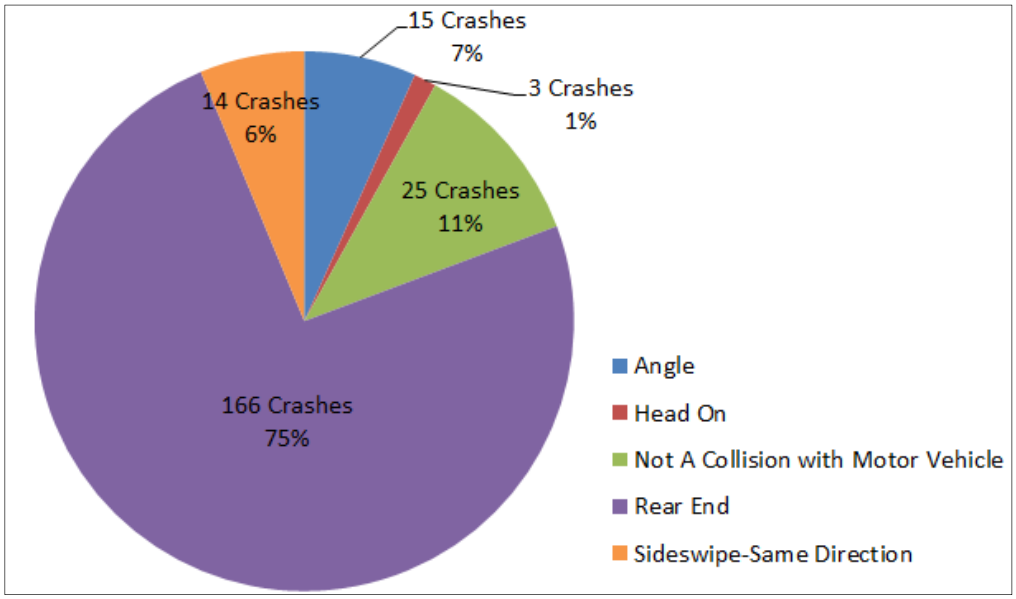


Figure 3 I-95 Interchange Crash Frequency by Crash Type (2009-2013)

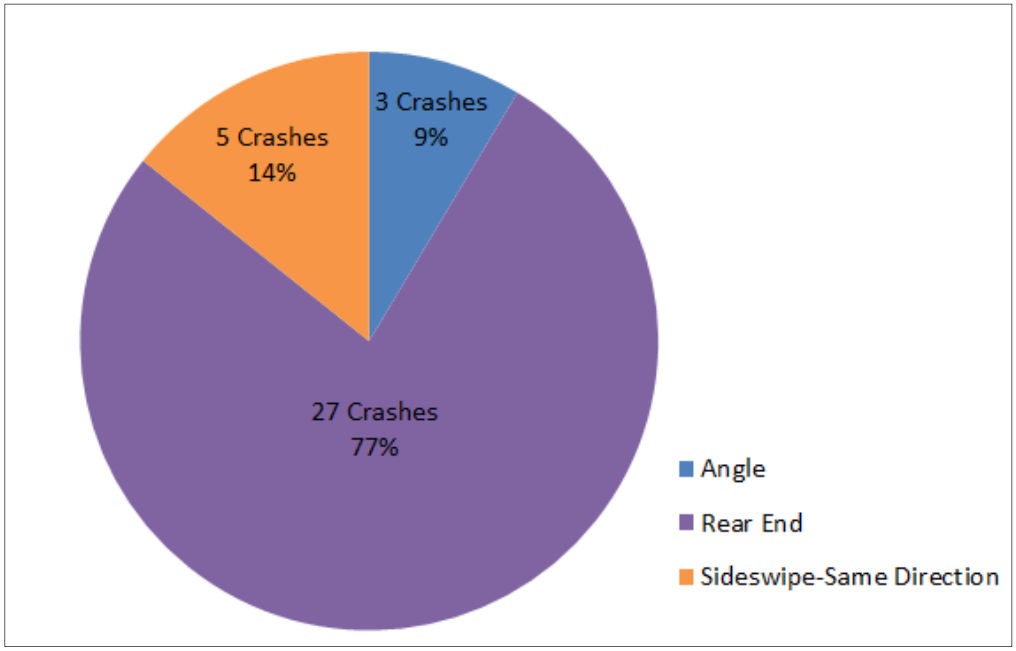


Figure 4 O'Leary Road Crash Frequency by Crash Type (2009-2013)

Figures 3 through 6 show that rear-end crashes and angle crashes are among the top three most prevalent crash types at all of the intersections along the study corridor. These two types of crashes represent approximately 84 percent of the total crashes that occurred at the SR 30 intersection, approximately 92 percent of the total crashes that occurred at the Traveler's Way intersection, approximately 82 percent of the total crashes that occurred at the I-95 interchange, and approximately 86 percent of the total crashes that occurred at the O'Leary Road intersection. In general, these two crash types are the most prevalent at signalized intersections.

Sideswipe same direction crashes were also prevalent at all of the study area intersections accounting for approximately 10 percent of the crashes at the SR 30 intersection, approximately 8 percent of the crashes at the Traveler's Way intersection, approximately 6 percent of the crashes at the I-95 interchange, and approximately 14 percent of the crashes at the O'Leary Road intersection. Sideswipe same direction crashes are common in locations where traffic must weave across lanes to access adjacent land uses. Additionally, accidents resulting from collisions with fixed objects accounted for 11 percent of the crashes that occurred at the I-95 interchange.

1.1.3 Crash Severity Analysis

The severity of the crashes was analyzed by calculating the percentage of each type of crash that involved injuries or fatalities. During the five years of study, one crash involving a fatality occurred in 2012 at the I-95 interchange resulting from a collision with a tree. Because only one fatal crash occurred along the study corridor during the five-year period, this information is not included in the following tables. Tables 2 through 5 show the injury rates for each crash type for the study area intersections. At the study intersections, injuries are common for angle crashes, rear-end crashes, head on crashes, and crashes not with a motor vehicle. Overall, 25 percent of the crashes at the SR 30 intersection involved injuries, 31 percent of the crashes at the Traveler's Way intersection involved injuries, 20 percent of the crashes at the I-95 interchange involved injuries, and 19 percent of the crashes at the O'Leary Road intersection involved injuries.

Table 2 SR 30 Intersection Crash Severity (2009–2013)

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Angle	14	5	36%
Head On	2	2	100%
Not a Collision With a Motor Vehicle	2	0	0%
Rear End	54	13	24%
Sideswipe - Opposite Direction	1	0	0%
Sideswipe - Same Direction	8	0	0%
Total	81	20	25%

Table 3 Traveler's Way Intersection Crash Severity (2009–2013)

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Angle	6	2	33%
Rear End	5	2	40%
Sideswipe - Same Direction	1	0	0%
Total	12	4	31%

Table 4 I-95 Interchange Crash Severity (2009–2013)

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Angle	15	3	20%
Head On	3	1	33%
Not a Collision With a Motor Vehicle	25	9	36%
Rear End	166	31	19%
Sideswipe - Same Direction	14	0	0%
Total	223	44	20%

Table 5 O'Leary Road Intersection Crash Severity (2009–2013)

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Angle	3	1	33%
Rear End	27	6	22%
Sideswipe - Opposite Direction	1	0	0%
Sideswipe - Same Direction	5	0	0%
Total	36	7	19%

1.2 Predictive Crash Analysis

To predict the reduction in crash rates that may occur in the study area after the conversion of the existing diamond interchange at the junction of I-95 and SR-21 to a diverging diamond interchange, the FHWA's Crash Modification Factors (CMF) Clearinghouse data and the Predictive Method for Urban and Suburban Arterials outlined in Chapter 12 of the 2010 Highway Safety Manual (HSM) were utilized.

The HSM provides safety performance function (SPF) formulas for standard intersection types that use site-specific annual average daily traffic (AADT) values as an input. The predicted crashes from the SPFs are further modified to site-specific conditions using CMFs for certain geometric design and traffic control features such as the addition of left-turn lanes or prohibition of left turns. Finally, a calibration factor, that

is equal to the number of observed crashes divided by the number of predicted crashes, is applied to the predicted number of crashes to obtain the final number of predicted crashes.

The HSM does not provide a CMF for the conversion of diamond interchange to a diverging diamond interchange. Therefore, the CMFs for this type of improvement were obtained from FHWA's CMF Clearinghouse.

The build condition adds a left turn lane to the northbound approach of the intersection of SR 21 with SR 30, and closes the Traveler's Way left-turn using directional median opening at its intersection with SR 21. The HSM methodology was followed to predict the number of multi-vehicle and single-vehicle crashes (separated further into injury/fatality crashes and PDO crashes) that are expected to occur at these intersections in the 2015 open year and the 2035 design year under no-build and build conditions. The HSM methodology predicts the number of fatality and injury crashes that will occur as a combined number. However, because no fatalities occurred at these intersections during the five years of available crash data, the fatality/injury crash prediction for these intersections is shown as a prediction for injury crashes only.

1.2.1 Crash Reduction

Based on a February 2011 study titled *Diverging Diamond Interchange Performance Evaluation by Chilukuri et.al*., converting a diamond interchange to a diverging diamond interchange on an urban divided arterial reduces all severity crashes by 46 percent, minor injury crashes by 72 percent, property damage only crashes by 37 percent, and rear-end crashes by 29 percent. These safety improvements are mainly due to 14 crossing-path conflicts at DDI compared with 26 crossing-path conflicts in a typical diamond interchange. The reverse curvature preceding the crossover intersections are another factor in the enhancement of safety. These curves lead to reduced speeds at the location of the crossing-path conflict points and are expected to lead to fewer crashes. Therefore, the conversion of the existing diamond interchange at the junction of I-95 and SR-21 to a diverging diamond interchange is expected to improve traffic safety.

Chapter 12 of the HSM provides crash modification factors to be used to predict the reduction in crash rates expected to accompany addition of left turn lane at an intersection. To calculate the expected number of crashes at the intersection of SR 21 with SR 30 for the build conditions, the no-build expected crash rates from the HSM methodology were multiplied by the appropriate crash modification factor from the

HSM. The results of the HSM predictive method, shown in Table 6, indicate an approximate crash reduction of 25 percent for total crashes, 56 percent for injury crashes, and 10 percent for PDO crashes at this intersection in 2035.

Table 6 SR 21 and SR 30 Intersection Predicted Crash Rates and Percentage of Crash Reduction

Crash Type	Open Year (2015)			Design Year (2035)		
	No-Build	Build	Percent Reduction	No-Build	Build	Percent Reduction
Total Predicted Crashes	17.47	13.24	-24%	25.54	19.26	-25%
Predicted Injury Crashes	5.41	2.38	-56%	8.09	3.56	-56%
Predicted PDO Crashes	12.06	10.85	-10%	17.45	15.70	-10%

The improvement at the intersection of SR 21 and Traveler's Way forms a T-intersection with a closed median, eliminating direct left-turn from Traveler's Way onto SR 21, and forces drivers to turn right and then perform a U-turn at a downstream intersection. It is intuitive and generally accepted that reducing the number of access points within the functional areas of intersections reduces conflict between through and turning traffic. This reduction in conflicts may lead to reductions in rear-end crashes related to speed changes near the intersections, and angle crashes related to turning vehicles. Chapter 12 of the HSM provides crash modification factors to be used to predict the reduction in crash rates expected to accompany replacement of direct left turns with right turn/U-turn combination. To calculate the expected number of crashes at the intersection of SR 21 with Traveler's Way for the build conditions, the no-build expected crash rates from the HSM methodology were multiplied by the appropriate crash modification factor from the HSM. The results of the HSM predictive method, shown in Table 7, indicate an approximate crash reduction of 31 percent for total crashes, 46 percent for injury crashes, and 20 percent for PDO crashes at this intersection in 2035.

Table 7 SR 21 and Traveler's Way Intersection Predicted Crash Rates and Percentage of Crash Reduction

Crash Type	Open Year (2015)			Design Year (2035)		
	No-Build	Build	Percent Reduction	No-Build	Build	Percent Reduction
Total Predicted Crashes	15.89	11.04	-31%	21.58	14.90	-31%
Predicted Injury Crashes	6.44	3.48	-46%	9.10	4.91	-46%
Predicted PDO Crashes	9.46	7.57	-20%	12.49	9.99	-20%

ARCADIS U.S., Inc.
2410 Paces Ferry Road
#400
Atlanta
Georgia 30339
Tel 770 431 8666
Fax 770 435 2666

MEETING REPORT

Subject:
I-95 @ SR 21 DDI, PI #0012722
Chatham County
Initial Concept Team Meeting

Date of Meeting:
4/29/2014

ARCADIS Project No.:
TM130034

Place of Meeting:
Georgia DOT, Area Office

Minutes by:
Doug Tilt

Issue Date:
3/25/2014

Participants:
See Attached Sign In Sheet

Copies:
Paul Dennard
Tyler Denning
Kate Colberg

Summary of Discussion

1. ARCADIS presented initial concept of I-95 at SR 21 DDI
    a. Comments regarding traffic projections and use of 1.5% growth rate:
        i. With the plan of the Gulfstream facility and Pooler Parkway, ARCADIS indicated that they followed GDOT's traffic projection guidelines which use a regional growth rather than specific generators.
    b. Comments regarding traffic operations
        i. A concern was raised regarding the car/truck mix, specifically on SR 21 NB eart the I-95 NB ramp. It was agreed that ARCADIS would evaluate and extend all turn lanes for both on and off ramps to maximum extent possible – up to the point to avoid ecology impacts as well as to the point to properly sign merges and turn lanes.
        ii. A suggestion was raised to provide a free flow lane for the SR 21 left turn lane onto the SB I-95 ramp. ARCADIS will review the ability to provide the necessary lane reduction from 3 lanes, to 2 lanes, to 1 lane and still avoid ecology impacts and the need for an Interchange Modification Report.
        iii. It was requested to document the SB queues at SR 21/I-95 intersections

iv. ARCADIS will update Vissim video and provide to attendees

c. Utilities
   i. It was noted that a 4" high-pressure gas line is along SR 21.

d. Environmental
   i. It was noted that no historic or archeological sites are present along the project area.
   ii. Ecological sites where presented. It was noted that impacts to ecological sites will be avoided during the design stage it practical. It was agreed that this would be a Programmatic Categorical Exclusion, but ARCADIS and the PM will meet with OES to confirm.

e. Design Comments
   i. It was noted that this is an MS4 area and design will take this into account
   ii. It was requested that signals should be interconnected with fiber
   iii. It was requested that video detection be provided at traffic signal locations
   iv. It was requested that mast arms be provided at traffic signal locations
   v. It was request that CCTV surveillance be provided at the interchange
   vi. It was requested that SR 21 be resurfaced within project limits. ARCADIS will provide estimate of cost and Project manager will determine if project budget permits.
   vii. It was suggested that the median openings north of I-95 be closed. The concern was raised regarding potential opposition to this. ARCADIS will present closing the southernmost opening at the PIOH but retaining the northern opening for U-turn and site access.
   viii. It was requested that the intersection of SR 30 at SR 21 be included in this project. It was agreed that signal improvements could be provided, but additional pavement or intersection modifications needs would be programmed as a separate project.

f. Schedule
   i. Project Manager suggest there may not be a need for concept team meeting
   ii. It was noted that any and all efforts will be made to expedite schedule

Summary of Action Items

1. ARCADIS to examine potential options to maximize capacity of all four ramps.
2. ARCADIS to provide SB SR 21 queue lengths in final traffic study
3. ARCADIS and Andrew Hoenig to meet with OES to confirm PCE

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

Office of Innovative Program Delivery

TRANSPORTATION MANAGEMENT PLAN

P. I. Number: 0012722
Chatham County

Design-Build project for
SR 21 From SR 30 to I-95 Including Interchange

July 7, 2014

Disclaimer

The purpose of this document is to establish a framework for the Transportation Management Plan (TMP) in advance of this project being awarded as a Design Build Contract. The successful Design Build Team will be responsible for completing this document, and obtaining approval from the Georgia Department of Transportation (GDOT) and Federal Highway Administration's (FHWA) Georgia Division prior to the start of land disturbing activities. This is an operations project with minimal impacts to the travelling public during construction.

Project Description

State Route 21 in Chatham County was identified for corridor improvements and minor interchange improvements. The proposed project is to be included in the GDOT Operational Improvement Lump Sum Program from the Office of Traffic Operations. This proposed project was presented to and approved by the Operational Improvement Committee, and will be recommended as a QUICK project.

SR 21 is an urban principal arterial that connects downtown Savannah to the northern suburban areas in Effingham County. Currently, SR 21 consists of two through lanes and one right turn auxiliary lane each direction with a grass median. The SR 21/I-95 interchange is a conventional diamond interchange with two through travel lanes and one turn lane in each direction on the arterial mainline and dual left turns and a right turn lane on the ramp terminals. The exit ramp intersections are controlled by traffic signals that are coordinated with the intersection of SR 30 to the north.

The Office of Traffic Operations performed an engineering study of the interchange to determine if a diverging diamond interchange (DDI) configuration would improve operations along SR 21. The proposed DDI consists of three through lanes and one turn lane in each direction of SR 21 under the I-95 overpass. The additional lane from the SR 21 at the interchange will terminate as a left turn only lane at SR 30 to the north and a right turn only lane at Hendley Road to the south. The project will use the existing grass median/shoulder to connect the lanes from the DDI on the north and south side of the interchange. A capacity analysis concluded that the DDI reconfiguration will improve operations at the interchange in the short term over a 10 year project life, reducing the intersection delay and travel times from the ramps and along the SR 21 mainline. (see charts below) These improvements will also increase the operational efficiency of the intersection, by reducing the potential for queuing on the I-95 mainline.

Figure 1: Overall Intersection Delay (seconds) and Level of Service for 2025 Design Year

	AM Peak		PM Peak	
	No Build	DDI	No Build	DDI
SR 21 @ NB Ramp	147 (F)	20 (B)	108 (F)	79 (E)
SR 21 @ SB Ramp	72 (E)	20 (B)	55 (E)	19 (B)

Figure 2: Travel Time Estimates for 2025 Design Year

	AM Peak		PM Peak	
	No Build	DDI	No Build	DDI
SR 21 Southbound from SR 30 to Hendley Road	1.4 min	1.3 min (-7%)	1.4 min	1.2 min (-14%)
SR 21 Northbound from Hendley Road to SR 30	1.3 min	1.2 min (-8%)	2.6 min	3.0 min (+15%)
I-95 Northbound Exit Ramp to SR 21 @ SR 30	10.5 min	2.8 min (-73%)	4.9 min	3.9 min (-20%)

Due to the minor project scope, the right-of-way constraints, existing intersection features (existing roadway width and signal operations) and the scope approved by the Operational Improvement Committee, a roundabout was not recommended for this location.

Project Traffic Control Plan

This section will discuss, in general, how the Department will address traffic control issues which will be part of the interchange reconstruction and widening of SR 21. This project will require lane closures when overlaying and widening the pavement. However, off peak work hours have been established to minimize travel disruption at peak time traffic periods. A project specific Special Provision 150.11 will be submitted as part of the PS&E package that details the working hours available to the Contractor, the times when lane closures will be permitted and the work restrictions that will be placed on the Contractor. If required, the Contractor will develop a specific traffic control plan.

The Department, as well as the Contractor, will have Project management staff on site to monitor traffic control activities. The DOT's Project Manager will have the authority to ensure the traffic control plan and the safety aspects of the Contract are effectively administered.

Project Staging

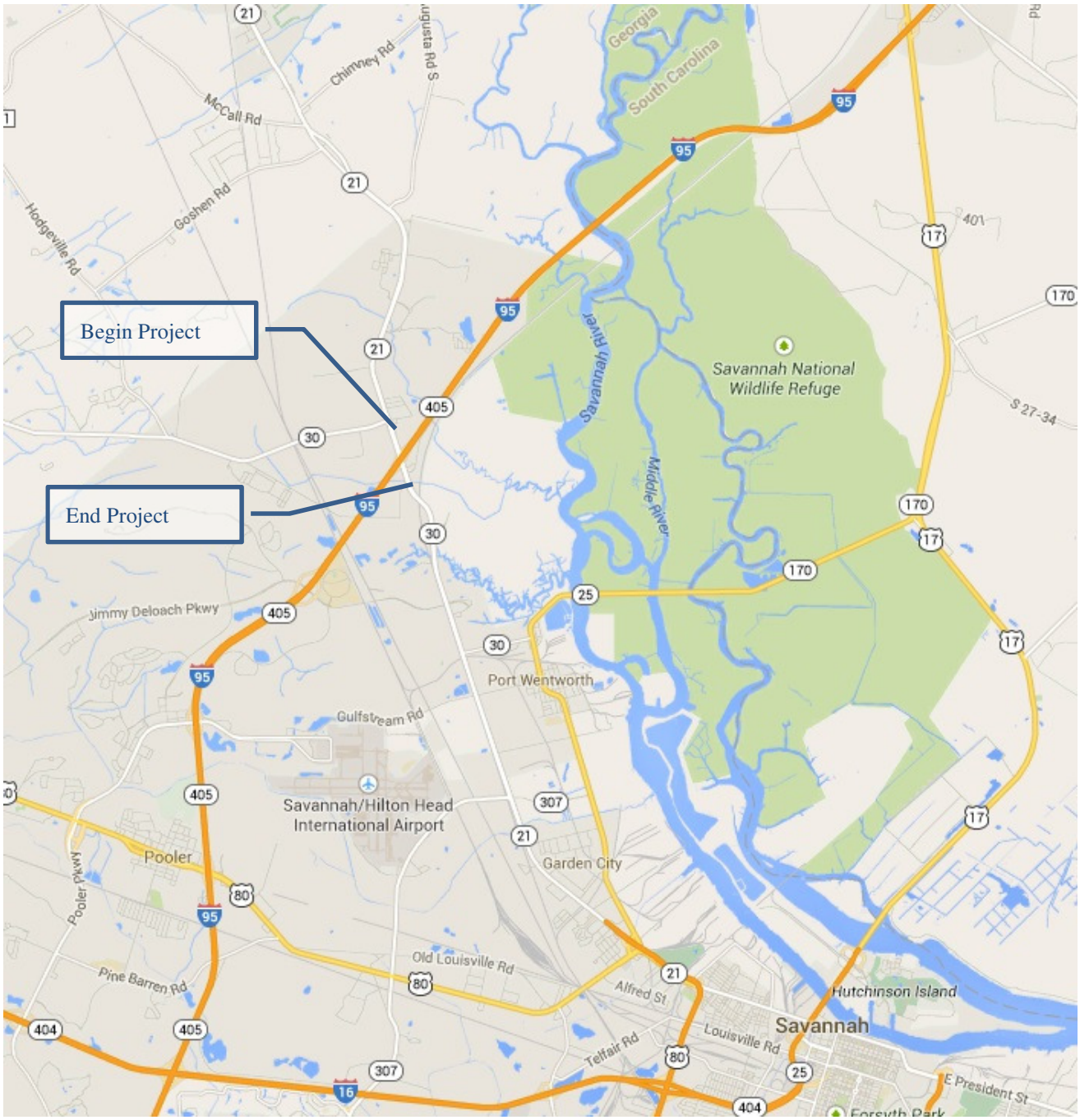
On site staging will be required including lane shifts and temporary lane closures during off-peak work hours.

Project Communications

Making the traveling public aware of critical activities, lane closures, anticipated delays and other traffic related information is vital to minimizing their frustration with the construction of this project. The Department of Transportation will establish lines of communication to disseminate timely traffic information to the traveling public. To ensure timely and accurate information is provided to the public, the Georgia Department of Transportation's Office of Communications will be utilized to issue various press releases regarding critical project activities and lane closures.

A PIOH has been scheduled and will be held in August 2014. Recommendations from this meeting will be incorporated into the project if necessary.

Project Location



Stakeholder/Review Committee
[*To be supplemented by the awarded Design Build Team*]
Georgia Department of Transportation and Federal Highway Administration

General Schedule and Timeline
[*To be completed by the awarded Design Build Team*]
- Time to complete final construction plans: ___Months. (Design-Build Contract)
- Time to completion construction: ____Months.
- Time to completion of Design Build contract: _____Months

TMP Implementation and Monitoring Contacts
[*To be supplemented by the awarded Design Build Team*]
Assistant District Construction Engineer
Area Engineer
Project Engineer
Andrew Hoenig, Project Manager GDOT

Safety
[*To be completed by Design Build Team*]

TMP Monitoring
[*To be completed by Design Build Team*]

Temporary Traffic Control (TCC) Strategies
[*To be completed by Design Build Team*]

Summary
This project will not generate a high level of sustained work zone impacts. This project should not increase sustained work zone impacts greater than considered tolerable for this type roadway project. The Design-Build contractor will be responsible for providing adequate safety measures as part of their traffic control. GDOT will ensure that adequate traffic control measures will be provided to ensure a safe project work zone and cause minimal impact to the traveling public.

If additional information is needed, please contact Andrew Hoenig at 404-631-1757.