ORIGINAL TO GENERAL FILES

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

OFFICE OF DESIGN POLICY & SUPPORT
INTERDEPARTMENTAL CORRESPONDENCE

FILE P.I. # 0010739
Bryan County
GDOT District 5 - Jesup
QUICK PROJECT: Safety Improvements – Roundabouts & Bypass Lanes on SR 144 at I-95 Ramps

OFFICE Design Policy & Support

DATE 2/5/2016

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:

Hiral Patel, Director of Engineering
Joe Carpenter, Director of P3/Program Delivery
Genetha Rice-Singleton, Assistant Director of P3/Program Delivery
Albert Shelby, State Program Delivery Engineer
Darryl VanMeter, State Innovative Delivery Engineer
Bobby Hilliard, Program Control Administrator
Cindy VanDyke, State Transportation Planning Administrator
Eric Duff, State Environmental Administrator
Andrew Heath, State Traffic Engineer
Angela Robinson, Financial Management Administrator
Lisa Myers, State Project Review Engineer
Charles "Chuck" Hasty, State Materials Engineer
Lee Upkins, State Utilities Engineer
Richard Cobb, Statewide Location Bureau Chief
Brad Saxon for District Engineer
Dallory Rozier, District Utilities Engineer
Cassius Edwards, Project Manager
BOARD MEMBER - 1st Congressional District

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
LIMITED SCOPE PROJECT CONCEPT REPORT

Project Type:	QUICK	P.I. Number:	0010739
GDOT District:	5	County:	Bryan
Federal Route Number:	I-95	State Route Number:	SR 144 / SR 405
		Project Number:	*N/A*

This project proposes safety improvements for the SR 144 at I-95 Interchange. The proposed improvements consist of constructing roundabouts on SR 144 at the I-95 ramps, adding a right turn bypass lanes for the I-95 NB Ramps, restriping SR 144 west of the interchange and adding pedestrian accommodations through the project limits.

Submitted for approval:

Rudolph Frampton, Heath & Lineback Engineers, Inc. — DATE 10/9/15

Albert Shelby BrA — State Program Delivery Engineer — DATE 10/27/15

Cassius Edwards — Cassius Edwards, GDOT Project Manager — DATE 10/13/15

Recommendation for approval:

* HIRAL PATEL — State Environmental Administrator — DATE 11/15/2015

* KEN WERHO — State Traffic Engineer — DATE 1/21/2016

☒ MPO Richmond Hill: This project is consistent with the MPO adopted Regional Transportation Plan (RTP)/Long Range Transportation Plan (LRTP).

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

* BILL DuVALL — STATE BRIDGE DESIGN ENGINEER — DATE 1/19/2016

* CYNTHINA L. VANDYKE — State Transportation Planning Administrator — DATE 11/13/2015

Approval:

Concur: Hiral Patel — GDOT Director of Engineering — DATE 01/26/2016

Approve: Margaret B. Pirkle — GDOT Chief Engineer — DATE 2.2.16

* RECOMMENDATION ON FILE –

PROJECT LOCATION

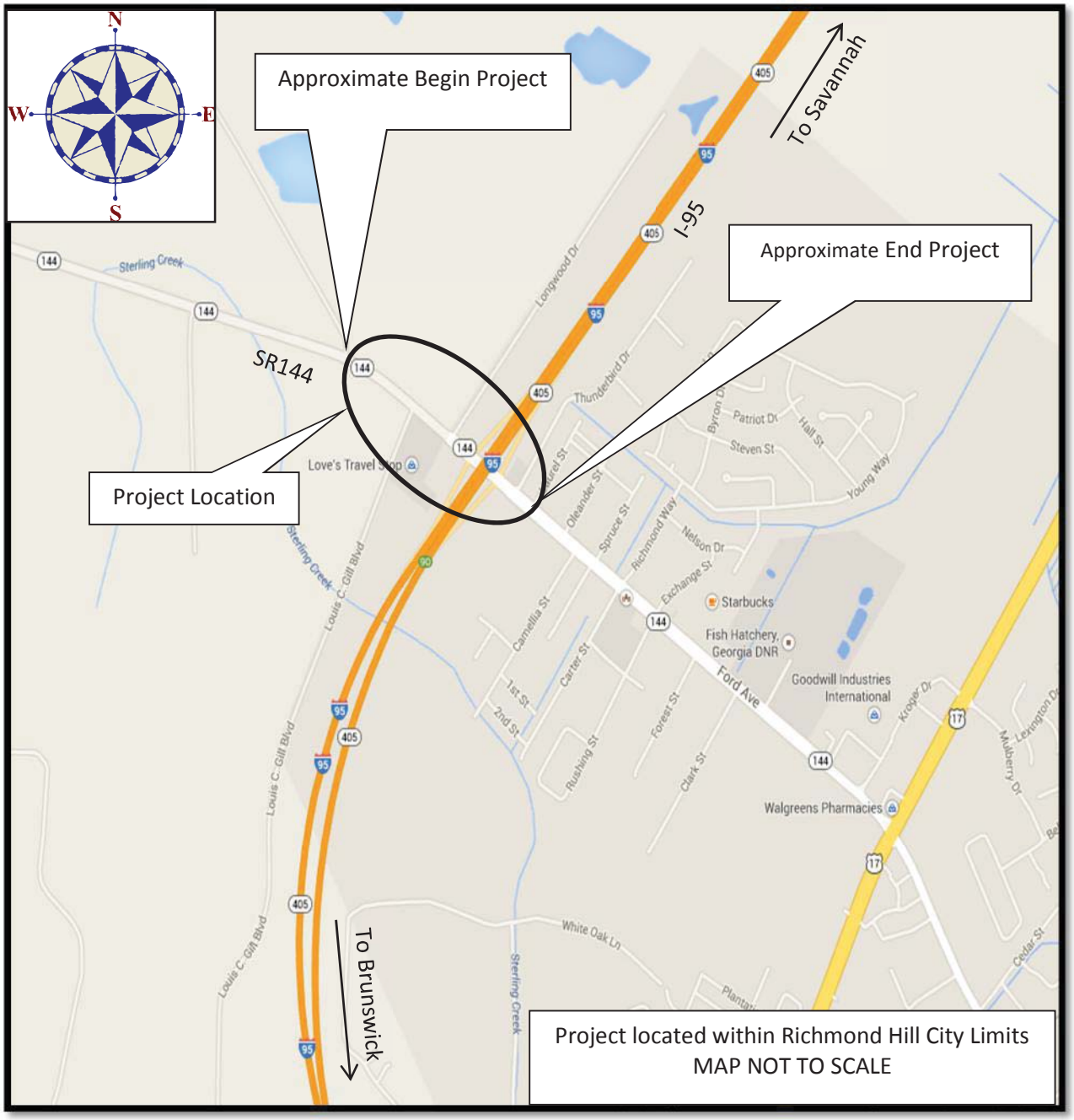


Figure 1 – Project Location Map

PI No. 0010739 – Bryan County
SR 144 at I-95 SB & NB Off Ramps

PLANNING & BACKGROUND DATA

Project Justification Statement:

In Georgia, nearly a third of fatal crashes occur at intersections. Therefore, intersection safety is a focus area for the Georgia Department of Transportation. Nationally intersection crashes account for 40% of all reported crashes and approximately 20% of traffic fatalities. Of those crashes, almost half are the result of angle collisions. Angle collisions are often high speed, high impact crashes which often result in serious injuries or fatalities. This proposed project will reduce crash frequency and severity on SR 144 at its intersections with the I-95 SB and NB ramps by installing roundabouts at both intersections. Roundabouts have been identified as one of nine proven safety countermeasures by the Federal Highway Administration (FHWA). They may decrease total crashes at an intersection by approximately 80% by reducing the speeds and conflict points of vehicles, only leaving the potential for lower impact, less severe crashes.

Existing conditions:

I-95 is a 70 mph urban interstate principal arterial that travels north and south through the Savannah and Brunswick Metro areas in eastern Georgia. At the interchange between the ramps, SR 144 is a two-lane divided roadway with 12-foot lanes, 14-foot paved shoulders and a 20-foot median. The 20-foot median between intersections consists of opposing short left turn lanes and a raised concrete median strip. Beyond the ramp intersections to the east and west, SR 144 is a four lane divided roadway. The I-95 southbound exit ramp at SR 144 is currently signalized as a two lane approach with a shared through-left lane and channelized right turn lane. The I-95 northbound exit ramp at SR 144 is currently stop-controlled with a shared lane that develops into a short right turn slip lane. The existing right-of-way (ROW) corridor along SR 144 varies from 100 feet to 110 feet. The ROW along the interchange ramps varies from 60 feet to 100 feet from the edge of the travel lane.

Other projects in the area:

In the proposed project vicinity and the Richmond Hill area, there are other Georgia Department of Transportation (GDOT) projects planned or under construction.

- SR 144 S from SR 25/US 17 to CSX RR, Bryan County – PI No.: 0008075
- SR 25; SR 26; & SR 204 – Signal Upgrades, Bryan/Chatham County – PI No.: 0012843
- I-95 from 0.8 Miles S of US 17 to Ogeechee River – 8 Lanes, Bryan County – Pi No.: 511025
- SR 144 from I-95 to SR 25/US 17, Bryan County – PI No.: M004865
- SR 25/US 17/Ocean Hwy at SR 144 Extend/Add left turn lanes, Bryan County – PI No.: M004689
- SR 144 EB from S of CR 100 to S of CR 154, Bryan County – PI No.: 532370

Description of the proposed project:

This project proposes two roundabouts on SR 144 at the I-95 Interchange ramps. The project limits along SR 144 are approximately 1900 feet west of the I-95 southbound ramp intersection and 600 feet east of the I-95 northbound ramp intersection. The project limits along the I-95 ramps will not exceed 850 feet from the center of SR 144.

The proposed typical section for SR 144 consists of one 12-foot travel lane in the westbound direction and two 12-foot travel lanes in the eastbound direction. Roundabouts are utilized at the two intersections with the I-95 ramps. SR 144 travel lanes will be separated by a 20-foot raised median or striped flush median outside the intersection and a 4-foot raised median between the ramps. SR 144 will have a dedicated right turn lane onto the I-95 northbound entrance ramp. The shoulders for SR 144 will be 10’-0” urban shoulders with curb, gutter and sidewalk from Longwood Drive to Laurel Street. Additionally, SR 144 will be restriped in the westbound direction for 1600-feet. Beginning at Longwood Drive, the short westbound existing 2 lane section and lane drop will be restriped to one lane to tie to the existing one lane section just west of the project.

The proposed typical section for the I-95 northbound exit ramp consists of one 16-foot left turn lane and a separate 16-foot right turn bypass lane. The I-95 northbound entrance ramp consists of one 16-foot travel lane. The proposed typical section for the I-95 southbound exit ramp consists of two 12-foot left turn lanes and a separate 16-foot right turn bypass lane. The I-95 southbound entrance ramp consists of one 16-foot

travel lane. No ramp work will extend past the existing converging or diverging points from the interstate and the interchange will remain a Diamond Interchange configuration.

The proposed typical section for the roundabouts consist of a 180-foot maximum Inscribed Diameter, with 16'-0" to 18'-0" interior lanes and 18'-0" exterior lanes. The roundabouts will be designed to accommodate off tracking from truck turning movement. The design allows a WB-67 and a passenger vehicle simultaneously within the roundabout and will include special accommodations for oversized "Low Boy" trucks used by Fort Stewart. Existing drainage structures within the intersection will be relocated and will tie to drainage structures required for the roundabouts. Crosswalks, curb cuts and sidewalks will be set to avoid conflicts. Landscaping and lighting will be installed as required. Right of way is anticipated for this project. No detour is anticipated for this project.

MPO: Savannah TMA **TIP #:** N/A

The City of Richmond Hill is part of the Savannah Metropolitan Planning Commission (MPC). The proposed project limits are not within any of the MPO's planned pedestrian or Bikeway improvements as listed in their Non-motorized Transportation Plan. However, the MPC plan does include a pedestrian project which proposes adding sidewalk at locations from Thunderbird Drive to Cedar Street, within the City of Richmond Hill. The MPC project is not included in the FY2015-2018 TIP. The proposed interchange improvement project ends just east of Thunderbird Drive on SR 144 and would tie to the MPO's planned pedestrian project.

TIA Regional Commission: Not a TIA Project

Congressional District(s): 1

Federal Oversight: ☒ Exempt ☐ State Funded ☐ Other

Projected Traffic: ADT SR 144 (Ford Avenue) 24 HR T: 7 %

Current Year (2012): 15,000 Open Year (2017): 16,800 Design Year (2037): 24,500
Traffic Projections Performed by: Grice Consulting Group
(Provided by GDOT, Approved on 12/09/2012))

Functional Classification (Mainline): Urban Minor Arterial Street

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

Warrants met: ☐ None ☐ Bicycle ☒ Pedestrian ☐ Transit

The proposed project meets the pedestrian warrants listed in the PDP. The Functional Classification of SR 144 (Ford Avenue) at the project location is an Urban Minor Arterial Street. The proposed typical section for SR 144 (Ford Avenue) adds curb and gutter throughout the project corridor. The urban classification and the addition of curb and gutter meet the warrant for pedestrian accommodations.

The proposed project does not meet bicycle warrants listed in the PDP. The proposed project is not part of a state or local bicycle route. Although J. F. Gregory City Park is located less than 3 miles east of the project, the area west of the project is undeveloped rural land belonging to the Ft. Stewart Military base. There are no destinations within the project area that are anticipated to generate bicycle traffic through the project corridor.

No transit exists within the project area.

Pavement Evaluation and Recommendations

Preliminary Pavement Evaluation Summary Report Required? ☐ No ☒ Yes
(To be completed during the Final Phase)
Preliminary Pavement Type Selection Report Required? ☐ No ☒ Yes
Feasible Pavement Alternatives: ☐ HMA ☐ PCC ☒ HMA & PCC

DESIGN AND STRUCTURAL

Description of Proposed Project:

Major Structures: I-95 Overpass Bridge (Bridge ID.: 029-0043-0, Sufficiency Rating: 72.80)
The proposed project does not modify or impact the I-95 bridge over SR 144.

Mainline Design Features: *SR 144 (Ford Avenue)*

Feature	Existing	Standard*	Proposed
Typical Section			
- **Number of Lanes**	**Varies 2 Lanes to 4 Lanes**	**4 Lanes**	**1 West Bound 2 East Bound**
- **Lane Width(s)**	**12'-0"**	**11'-0" – 12'-0"**	**12'-0"**
- **Median Width & Type**	**20'-0" median with 12'-0" turn lanes, 2'-0" paved shoulders and variable width concrete medians**	**20'-0"**	**Varies 4'-0" to 20'-0"**
- **Outside Shoulder or Border Area Width**	**Varies**	**10'-0" to 16'-0"**	**10'-0"**
- **Outside Shoulder Slope**	**Varies**	**2%**	**2%**
- **Sidewalks**	**None**	**5'-0"**	**5'-0"**
- **Auxiliary Lanes**	**None**	**n/a**	**None**
- **Bike Lanes**	**None**	**4'-0"**	**None**
- **Posted Speed**	**45 mph**		**45 mph**
Design Speed	**45 mph**	**45 mph**	**45 mph**
Min Horizontal Curve Radius	**n/a**	**711**	**711**
Maximum Superelevation Rate	**2%**	**4%**	**4%**
Maximum Grade	**1.7%**	**6%**	**2%**
Access Control	**Permitted/Full**	**Permitted/Full**	**Permitted/Full**
Design Vehicle	**-**	**WB-40 or BUS-40**	**WB-67****

*According to current GDOT design policy if applicable
**Modifications will be made for Fort Stewart oversized trucks (Low Boys).

Ramp Design Features: *I-95 Ramps*

Feature	Existing	Standard*	Proposed
Typical Section			
- **Number of Lanes**	**Varies 1 Lane to 2 Lanes**	**1 or more**	**Varies 1 Lane to 3 Lanes**
- **Lane Width(s)**	**16'-0" – 1 Lane 12'-0" – 2+ Lanes**	**16'-0" – 1 Lane 12'-0" – 2+ Lanes**	**16'-0" – 1 Lane 12'-0" – 2+ Lanes**
- **Outside Shoulder or Border Area Width**	**12'-0" Shoulders (10'-0" Paved)**	**12"-0" Shoulders (10'-0" Paved)**	**12'-0" Shoulders (10'-0" Paved)**
- **Shoulder Slope (Concrete)**	**2%**	**2%**	**2%**
- **Inside Shoulder Width**	**8'-0" Shoulders (4'-0" Paved)**	**8'-0" Shoulders (4'-0" Paved)**	**8'-0" Shoulders (4'-0" Paved)**
- **Auxiliary Lanes**	**None**	**n/a**	**None**
Posted Speed	**n/a**		**n/a**
Design Speed	**35 – 60 mph**	**35 - 60 mph**	**35 - 60 mph**
Min Horizontal Curve Radius	**n/a**	**n/a**	**n/a**
Maximum Superelevation Rate	**2%**	**8%**	**4%**
Maximum Grade	**3.3%**	**-4% and +8%**	**3.3%**
Access Control	**Full**	**Full**	**Full**
Design Vehicle	**-**	**WB-67**	**WB-67****

*According to current GDOT design policy if applicable

**Modifications will be made for Fort Stewart oversized trucks (Low Boys).

Major Interchanges/Intersections: SR 144 at I-95

Lighting required: ☐ No ☒ Yes
Existing interchange lighting is present on I-95 and is not impacted by the proposed construction.

Roundabout lighting will be required. The City of Richmond Hill will be responsible for the operation and maintenance of all required roundabout lighting. A letter documenting the lighting agreement between GDOT and the City of Richmond Hill has been included in the appendix of this concept.

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

Will Context Sensitive Solutions procedures be utilized? ☐ No ☒ Yes
Context sensitive design for the proposed project consist of installing two roundabouts at the intersections of SR 144 and the I-95 Interchange ramps. Roundabout design will eliminate substandard design features associated with a signal design alternate requiring design exceptions and variances. These substandard designs include failing to provide warranted pedestrian accommodations and substandard shoulder width through the project corridor. Roundabouts are being considered a Context Sensitive Design and Solution due to the unfamiliarity of roundabouts in the region. Public involvement was included to mitigate the public's concerns.

Design Exceptions to FHWA/AASHTO controlling criteria anticipated: NO

Design Variances to GDOT Standard Criteria anticipated: *YES*
A design variance will be required for encroachment of the Full Access Control area. GDOT requires 300 feet minimum of full access control along SR 144 beyond the interstate ramp radius returns. The proposed design will shift the I-95 ramps to the outside of their existing locations at their tie-in to SR 144 and reduce the length of the 300 foot Full Access Control boundary. This will result in existing side roads and driveways encroaching within the existing limited access area at the following locations:

- Longwood Drive.
- Parcel Driveway in southwest quadrant near I-95 SB Entrance Ramp.
- Thunderbird Drive.
- Gas Station Driveway in southeast quadrant near I-95 NB Exit Ramp.

A design variance is anticipated because of the existing substandard clearance under the I-95 overpass bridge and the limitations associated with providing positive drainage. The existing clearance under the overpass bridge is 16.34' which will be maintained in the proposed design. The minimum vertical clearance per the Bridge and Structures Design Manual is 16'-9" for State routes.

A design variance is anticipated for the I-95 NB exit ramp. The existing vertical curve on the ramp meets a 45 mph design speed and the required design speed is 50 mph at that location on the ramp. Proposed work consist of widening the exit ramp to add a right turn bypass lane.

UTILITY AND PROPERTY

Temporary State Route Needed: ☒ No ☐ Yes ☐ Undetermined

Railroad Involvement: No

Utility Involvements:

An initial utility submittal has been made to the utility companies through the District 5 Utilities Engineer. Known utilities within the area include:

- Georgia Power – Power
- Costal Electric Cooperative – Power
- Atlanta Gas Light – Gas
- City of Richmond Hill – Water and Sewer
- ITS Cameras – GDOT
- Telecommunications – Unknown

SUE Required: ☒ No ☐ Yes

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

Right-of-Way:

SR 144: Existing width: 115-120 ft Proposed width: 295 ft

Required Right-of-Way anticipated: ☐ No ☒ Yes ☐ Undetermined

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

Anticipated number of impacted parcels:		7
Displacements anticipated:	Total:	0
	Businesses:	0
	Residences:	0
	Other:	0

Impacts to USACE Property: ☒ No ☐ Yes ☐ Undetermined

Location and Design approval: ☐ Not Required ☒ Required

ROUNDABOUTS

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

The City of Richmond Hill will be responsible for the operation and maintenance of all lighting required for the proposed roundabouts. A letter documenting the lighting agreement between GDOT and The City of Richmond Hill has been included in the appendix of this concept.

Roundabout Planning Level Assessment:

A Planning Level Assessment is not required.

Roundabout Feasibility Study:

A Roundabout Feasibility was completed on 8/7/2015 and will be submitted for approval after conclusion of peer review comments. The study is included in the appendix.

Roundabout Peer Review Required: ☐ No ☐ Yes ☒ Completed – Date: 8/31/2015

A Roundabout Peer Review has been completed. The report was submitted for review and approval on 9/03/2015.

ENVIRONMENTAL AND PERMITS

Anticipated Environmental Document:

GEPA: ☐ **NEPA:** ☒ CE ☐ PCE

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

Environmental Permits, Variances, Commitments, and Coordination anticipated:
Environmental screening was performed based on the smaller footprint of a conceptual signalized intersection design, the findings are documented below. Additional environmental screening will be required for the larger project footprint of the roundabout concept.

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

(if any of the above are answered "Yes", additional analysis may be required)

NEPA/GEPA Comments & Information:
History: One historic property from a previous Department of Natural Resources (DNR) Survey appears to have been demolished. A site visit is needed to determine if SHPO concurrence is required.

Archeology: No archaeologic resources were identified and notification was sent out for review by the appropriate agencies.

Public Involvement: A public involvement plan is required for this project. A Public Information Open House (P.I.O.H.) was held September 29, 2015.

Ecology: Waters of the US are located within the project area. A Section 404 Permit or state buffer variance may be required for this project. No suitable habitat for federal or state protected species. No Section 7 consultation or Fish and Wildlife Coordination Act coordination would be required.

COORDINATION, ACTIVITIES, RESPONSIBILITIES, AND COSTS

Project Meetings:

Project Kick-off Team Meeting	06/02/2014
Environmental Team Meeting	07/10/2014
Concept Team Meeting	11/04/2014
Traffic Operations Meeting	11/17/2014
PIOH	9/29/2015

Project Activity	Party Responsible for Performing Task(s)
Concept Development	Heath & Lineback Engineers
Design	Heath & Lineback Engineers
Roundabout Peer Review	*Kittleson & Associates, Inc.*
Lighting Design	Heath & lineback Engineers Gresham, Smith and Partners
Right-of-Way Acquisition	GDOT
Utility Coordination/Relocation	Utility Owners
Letting to Contract	GDOT
Construction Supervision	GDOT / District 5
Providing Material Pits	Construction Contractor
Providing Detours	n/a
Environmental Studies, Documents, & Permits	Heath & Lineback Engineers Edwards-Pitman Environmentalist (Ecology) GDOT Office of Environmental Services (NEPA document and required Studies excluding ecology)
Environmental Mitigation	GDOT
Construction Inspection & Materials Testing	GDOT

Other coordination to date: *N/A.*

Project Cost Estimate and Funding Responsibilities:

	Breakdown of PE	ROW	Reimbursable Utility	CST*	Environmental Mitigation	Total Cost
Funded By	GDOT	N/A	N/A	GDOT	GDOT	
$ Amount	$375,000.00	$ 420,000	$ 0.00	$2,861,677.58	$ 0.00	$3,656,677.58
Date of Estimate	8/11/2011	10/7/2015	9/22/2015	10/8/2015	10/30/2014	

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

ALTERNATIVES DISCUSSION

Preferred Alternative: 180' I.D. Roundabout Alternate *This alternate adds: roundabouts on SR 144 at the intersections of the I-95 northbound and southbound ramps, an additional lane on SR 144 in the eastbound direction, right turn bypass lanes for the I-95 northbound Entrance and Exit Ramps, creates two left turn lanes on the I-95 southbound exit ramp, and provides 10'-0" urban shoulders with curb, gutter and sidewalk along SR 144. This alternate requires right of way acquisition.*

Estimated Property Impacts:	**7 Parcels**	**Estimated Total Cost:**	**$3,656,677.58**
Estimated ROW Cost:	**$69,000**	**Estimated CST Time:**	**18 months**

Rationale: *This alternate was selected because it meets the scope of the project while reducing congestion, providing operational improvements within the I-95 interchange and providing pedestrian accommodations along SR 144 throughout the project. Right of way acquisition from 6 commercial parcels would be required but is not anticipated to have any major impacts to the businesses.*

No-Build Alternative: *This alternate uses the existing lane configuration within the interchange on SR 144 and the I-95 exit ramps.*

Estimated Property Impacts:	**N/A**	**Estimated Total Cost:**	**N/A**
Estimated ROW Cost:	**N/A**	**Estimated CST Time:**	**N/A**

Rationale: *This alternate was not selected because it does not reduce congestion or provide improvements within the I-95 interchange and does not meet the scope of the project.*

Alternative 1: SR 144 3-Lane Signalized Alternate *This alternate adds: an additional through lane on SR 144 in the eastbound direction, an additional turn lane on SR 144 to provide separate left turn lanes for the I-95 northbound and southbound entrance ramps, a right turn lane on SR 144 eastbound for the I-95 southbound entrance ramp, and a 14''-0" outside paved shoulder on SR 144 westbound that could be used by pedestrians crossing through the interchange. This alternate also adds an additional lane to the I-95 southbound exit ramp to be used as a dedicated right turn lane for exiting westbound onto SR 144. The existing two lanes on the southbound exit ramp would become dedicated left turn lanes for exiting eastbound onto SR 144. This alternate does not require right of way acquisition.*

Estimated Property Impacts:	**None Anticipated**	**Estimated Total Cost:**	**N/A**
Estimated ROW Cost:	**N/A**	**Estimated CST Time:**	**6 Months**

Rationale: *This alternate was not selected because it does not meet the scope of the project.Providing the paved shoulders for pedestrian access would encourage unsafe crossing through the interchange.*

Alternative 2: <u>SR 144 4-Lane Signalized Alternate</u> *This alternate adds: an additional through lane on SR 144 in the eastbound and westbound direction, an additional turn lane on SR 144 to separate exclusive left turn lanes for the I-95 northbound and southbound entrance ramps, a right turn lane on SR 144 eastbound for the I-95 southbound entrance ramp, and an additional lane to the I-95 southbound exit ramp to be used as a dedicated right turn lane for exiting westbound onto SR 144. The existing two lanes on the southbound exit ramp will become dedicated left turn lanes for exiting eastbound onto SR 144. This alternate does not require right of way acquisition.*

Estimated Property Impacts:	**None Anticipated**	**Estimated Total Cost:**	**N/A**
Estimated ROW Cost:	**N/A**	**Estimated CST Time:**	**6 Months**

Rationale: This alternate was not selected due to its substandard design features and safety concerns. This alternate would have substandard: shoulder width, turn lane length, signal spacing and median opening spacing, and places through traffic within three feet of the existing bridge bents. Additionally, this alternate does not provide safe pedestrian access through the project.

Alternative 3: <u>SR 144 Shared Left Turn Lane Signalized Alternate</u> *This alternate would construct a shared left turn lane on SR 144 for traffic turning onto the I-95 northbound and southbound entrance ramps, and add a right turn lane on SR 144 eastbound for the I-95 southbound entrance ramp. There would be 7''-0" outside paved shoulders on SR 144. The paved shoulders could be used by pedestrians crossing through the interchange. This alternate also adds an additional lane to the I-95 southbound exit ramp to be used as a dedicated right turn lane for exiting westbound onto SR 144. The existing two lanes on the southbound exit ramp will become dedicated left turn lanes for exiting eastbound onto SR 144. This alternate does not require right of way acquisition.*

Estimated Property Impacts:	**None Anticipated**	**Estimated Total Cost:**	**N/A**
Estimated ROW Cost:	**N/A**	**Estimated CST Time:**	**6 Months**

Rationale: *This alternate was not selected because it does not reduce congestion and provide operational improvement during peak demand times within the I-95 interchange. The required storage, deceleration lengths and taper lengths for the left turn lanes on SR 144 would not be provided. The northbound turning movement would back up into the SR 144 eastbound through lanes thereby requiring westbound left turning movements to turn from the SR 144 westbound through lanes. Providing the paved shoulders for pedestrian access would encourage unsafe crossing through the interchange.*

Alternative 4: <u>160' I.D. Roundabout Alternate</u> *This alternate adds: roundabouts on SR 144 at the intersections of the I-95 northbound and southbound ramps, an additional lane on SR 144 in the eastbound direction, right turn bypass lanes from SR 144 onto the I-95 Entrance Ramps, an additional lane on the I-95 northbound and southbound entrance ramps, and creates two left turn lanes on the I-95 southbound exit ramp. A 10'-0" urban shoulder with curb, gutter and sidewalk along SR 144 would be provided. This alternate requires right of way acquisition.*

Estimated Property Impacts:	**3 Parcels**	**Estimated Total Cost:**	**N/A**
Estimated ROW Cost:	**N/A**	**Estimated CST Time:**	**18 Months**

Rationale: *This alternate was not selected because it does not meet the desired design requirements of allowing a WB-67 and a passenger car to use the roundabout simultaneously. This alternate will require right of way acquisition from 3 commercial parcels.*

Comments/Additional Information:

The project team studied the crash history at the site. The reported accidents for the last 3 years were higher than the state average for SR 144; however, only 1 accident has been recorded as occurring on one of the interchange ramps. Per the crash history as documented, there is no evidence of a significant crash rate on the interchange ramps. The proposed roundabouts will reduce the total number of conflict points between vehicles and provide lower travel speeds through the intersection. Therefore, it is expected that the installation of roundabouts will result in less sever crashes and a lower total number of crashes

LIST OF ATTACHMENTS/SUPPORTING DATA

1. Concept Layout & Typical Sections
2. Aerial Photograph of Existing Conditions
3. Cost Estimates
    a. Construction including Engineering and Inspection and Contingencies
    b. Completed Liquid AC Cost Adjustment forms
    c. CES Printout
    d. Right-of-Way
    e. Utilities
4. Crash summaries
5. Traffic diagrams & Approval Letter
6. Roundabout Data
    a. Roundabout feasibility study
    b. Lighting agreement or commitment letter
    c. Peer Review #1
    d. Peer Review #1 Responses
    e. Peer Review #2
    f. Peer Review #2 Responses
7. Minutes of Concept meeting
8. Meeting Minutes
    a. Project Kick Off Meeting Minutes - 06/02/2014
    b. OES Team Meeting Minutes – 07/10/2014
    c. Memorandum to Project Manager– 10/20/2014
    d. TMC Team Meeting Minutes – 11/17/2014
    e. PIOH Dry Run Meeting Minutes – 09/14/2015
9. Fort Steward Oversized Truck Specification
10. Bridge Inventory Data Listing
11. Pavement Evaluation Summary
12. Concept Report Review Comments and Responses

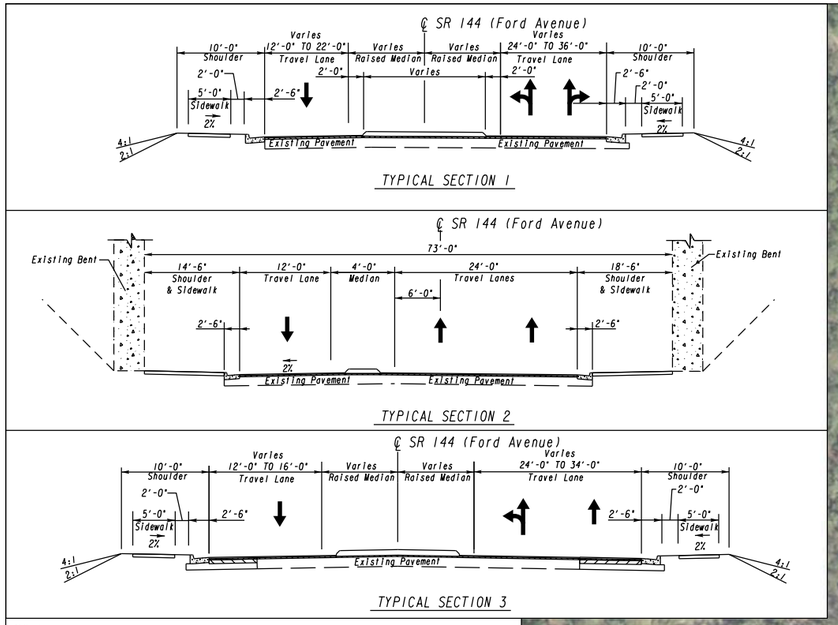
SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET
0 100 200 400

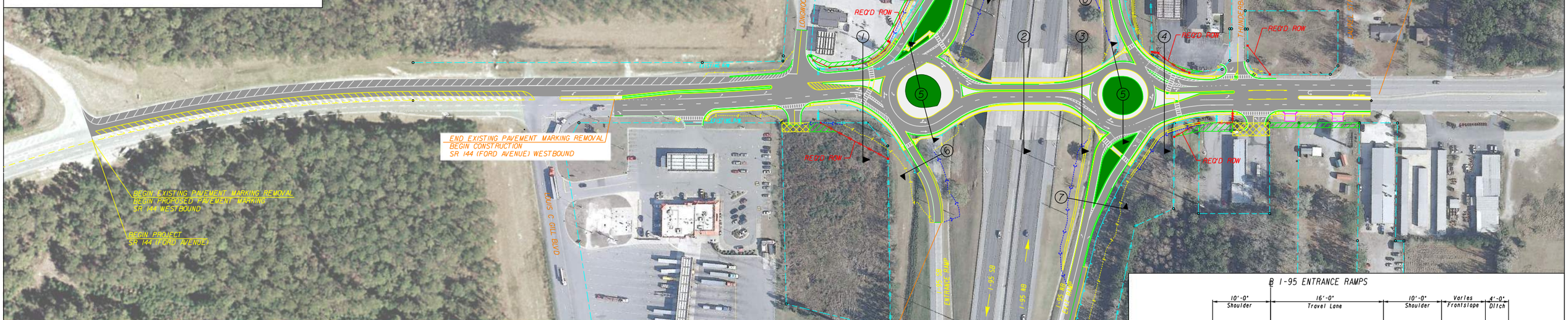
Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

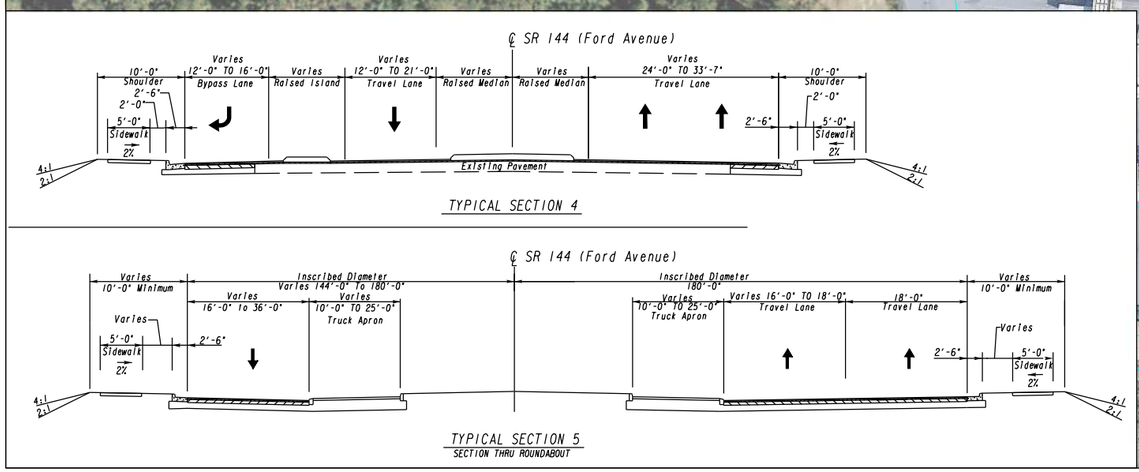
Georgia Department of Transportation

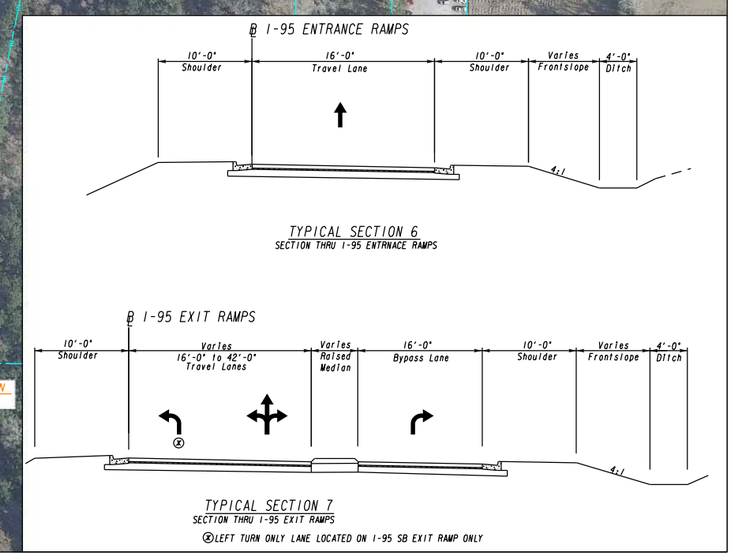
PROPOSED INTERSECTION IMPROVEMENTS



NOTE:
ADDITIONAL WORK SHOWN ON SR 144 WEST OF LONGWOOD DRIVE CONSISTS OF RESTRIPING THE EXISTING PAVEMENT IN THE WESTBOUND DIRECTION TO ONE LANE







SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET
0 60 120 240

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

Georgia Department of Transportation

EXISTING CONDITIONS

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE P.I. No. **10739**

OFFICE Program Delivery

PROJECT DESCRIPTION

SR 144 at I-95 SB & NB Off Ramps

DATE September 8, 2015

From: Albert V. Shelby III

To: Lisa L. Myers, State Project Review Engineer

Subject: REVISIONS TO PROGRAMMED COSTS

PROJECT MANAGER Cassius Edwards

MGMT LET DATE 2/2/2017

MGMT ROW DATE N/A

PROGRAMMED COSTS (TPro W/OUT INFLATION)			**LAST ESTIMATE UPDATE**	
CONSTRUCTION	$	1,024,578.62	DATE	10/21/2014
RIGHT OF WAY	$	0.00	DATE	N/A
UTILITIES	$	0.00	DATE	N/A

REVISED COST ESTIMATES

CONSTRUCTION*	$	2,861,677.58
RIGHT OF WAY	$	420,000.00
UTILITIES	$	0.00

*Cost Contains **15** % Contingency

REASONS FOR COST INCREASE AND CONTINGENCY JUSTIFICATION:

Construction cost have been updated per peer review comments of the concept design.

CONTINGENCY SUMMARY

A.	CONSTRUCTION COST ESTIMATE:	$ 2,331,590.68	Base Estimate From CES		
B.	ENGINEERING AND INSPECTION (E & I):	$ 116,579.53	Base Estimate (A) x	5	%
C.	CONTINGENCY:	$ 367,225.53	Base Estimate (A) + E & I (B) x See % Table in "Risk Based Cost Estimation" Memo	15	%
D.	TOTAL LIQUID AC ADJUSTMENT:	$ 46,281.83	Total From Liquid AC Spreadsheet		
E.	CONSTRUCTION TOTAL:	$ 2,861,677.58	(A + B + C + D = E)		

REIMBURSABLE UTILTY COSTS

UTILITY OWNER	REIMBURSABLE COST
TOTAL	$ -

ATTACHMENTS:

Liquid AC Adjustment Spreadsheet

PROJ. NO.	TOOPDDES110124	CALL NO.	9/29/2009
P.I. NO.	0010739		
DATE	10/1/2015		

INDEX (TYPE)	**DATE**	**INDEX**
REG. UNLEADED	Jan-15	$ 2.155
DIESEL		$ 2.485
LIQUID AC		$ 429.00

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)				**44839.08**	**$ 44,839.08**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	686.40	
Monthly Asphalt Cement Price month project let (APL)			$	429.00	
Total Monthly Tonnage of asphalt cement (TMT)				174.2	

ASPHALT	**Tons**	**%AC**	**AC ton**
Leveling	827	5.0%	41.35
12.5 OGFC	0	5.0%	0
12.5 mm	1439	5.0%	71.95
9.5 mm SP	0	5.0%	0
25 mm SP	530	5.0%	26.5
19 mm SP	688	5.0%	34.4
	3484		**174.2**

BITUMINOUS TACK COAT

Price Adjustment (PA)			**$**	**1,442.75**	**$ 1,442.75**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	686.40	
Monthly Asphalt Cement Price month project let (APL)			$	429.00	
Total Monthly Tonnage of asphalt cement (TMT)				5.605106703	

Bitum Tack Gals	gals/ton	tons
1305	232.8234	5.6051067

BITUMINOUS TACK COAT (surface treatment)

Price Adjustment (PA)				**0**	**$ -**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	686.40	
Monthly Asphalt Cement Price month project let (APL)			$	429.00	
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 **$ 46,281.83**

STATE HIGHWAY AGENCY

DATE : 10/08/2015
PAGE : 1

JOB DETAIL ESTIMATE

JOB NUMBER : 0010739 SPEC YEAR: 13
DESCRIPTION: SR 144 AT I-95 SB & NB OFF RAMPS
INTERSECTION IMPROVEMENT

***** This job contains obsolete items *****

ITEMS FOR JOB 0010739

LINE	ITEM	ALT	UNITS	DESCRIPTION	QUANTITY	PRICE	AMOUNT
0005	310-1101		TN	GR AGGR BASE CRS, INCL MATL	4164.000	49.01	204078.64
0010	402-1812		TN	RECYL AC LEVELING,INC BM&HL	827.000	86.59	71616.41
0015	402-3121		TN	RECYL AC 25MM SP,GP1/2,BM&HL	530.000	90.42	47927.84
0020	402-3130		TN	RECYL AC 12.5MM SP,GP2,BM&HL	1439.000	91.59	131810.11
0025	402-3190		TN	RECYL AC 19 MM SP,GP 1 OR 2 ,INC BM&HL	688.000	91.90	63231.56
0030	413-1000		GL	BITUM TACK COAT	1305.000	3.25	4245.83
0035	430-0200		SY	PLN PC CONC PVMT/CL1C/ 10 TK	3842.000	38.25	146956.50
0040	432-5010		SY	MILL ASPH CONC PVMT,VARB DEPTH	15035.000	2.22	33465.65
0047	441-0748		SY	CONC MEDIAN, 6 IN	1901.000	46.02	87491.30
0048	441-0104		SY	CONC SIDEWALK, 4 IN	15575.000	31.17	485555.45
0049	441-4030		SY	CONC VALLEY GUTTER, 8 IN	130.000	50.19	6525.16
0050	441-6222		LF	CONC CURB & GUTTER/ 8X30TP2	5497.000	20.44	112364.51
0055	150-1000		LS	TRAFFIC CONTROL - 0010739	1.000	100000.00	100000.00
0060	210-0100		LS	GRADING COMPLETE - 0010739	1.000	200000.00	200000.00
0064	634-1200		EA	RIGHT OF WAY MARKERS	15.000	105.32	1579.84
0065	641-1200		LF	GUARDRAIL, TP W	2206.000	19.27	42521.47
0070	641-1100		LF	GUARDRAIL, TP T	62.000	71.05	4405.12
0075	641-5001		EA	GUARDRAIL ANCHORAGE, TP 1	5.000	830.95	4154.80
0080	641-5012		EA	GUARDRAIL ANCHORAGE, TP 12	4.000	2054.15	8216.60
0085	620-0100		LF	TEMP BARRIER, METHOD NO. 1	2000.000	27.54	55086.16
0090	648-1350		EA	IMPACT ATT UNIT, TP-P- 0010739	2.000	18353.65	36707.30
0100	550-1480		LF	STM DR PIPE 48,H 1-10	200.000	110.37	22075.98
0109	550-1240		LF	STM DR PIPE 24,H 1-10	371.000	54.67	20285.55
0110	550-1300		LF	STM DR PIPE 30,H 1-10	256.000	58.78	15049.62
0111	550-1360		LF	STM DR PIPE 36,H 1-10	405.000	73.51	29771.85
0115	550-3436		EA	SAFETY END SECTION 36,SD,4:1	1.000	1160.00	1160.00
0116	550-3430		EA	SAFETY END SECTION 30,SD,4:1	1.000		
0117	550-3448		EA	SAFETY END SECTION 48,SD,4:1	1.000		
0118	611-8020		EA	ADJUST DRAIN INLET TO GRADE	1.000		
0119	611-8050		EA	ADJUST MANHOLE TO GRADE	3.000	768.16	2304.50
0137	668-1100		EA	CATCH BASIN, GP 1	17.000	2277.80	38722.63
0138	550-1180		LF	STM DR PIPE 18,H 1-10	564.000	48.57	27393.75
0139	668-4300		EA	STORM SEW MANHOLE, TP 1	3.000	1990.13	5970.42
0140	653-1501		LF	THERMO SOLID TRAF ST 5 IN, WHI	3857.000	0.47	1848.78
0145	653-1502		LF	THERMO SOLID TRAF ST, 5 IN YEL	6481.000	0.49	3181.13
0150	653-6004		SY	THERM TRAF STRIPING, WHITE	3419.000	3.29	11270.49
0155	653-6006		SY	THERM TRAF STRIPING, YELLOW	363.000	3.72	1352.15
0158	653-3501		GLF	THERMO SKIP TRAF ST, 5 IN, WHI	2510.000	0.35	884.25

STATE HIGHWAY AGENCY

DATE : 10/08/2015
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JOB DETAIL ESTIMATE

0159	653-1804		LF	THERM SOLID TRAF STRIPE, 8,WH	2334.000	2.14	5012.10
0160	656-3600		SY	REM EX TRAF STRIPE,ALL KND/TYP	100.000	6.06	606.00
0165	656-0050		LF	REM EX SLD TRF STRIPE, 5,THER	6000.000	0.56	3360.00
0170	657-1085		LF	PRF PL SD PVT MKG,8,B/W,TP PB	3213.000	4.74	15256.54

0175	657-6085	LF	PRF PL SD PVMT MKG,8,B/Y,TPPB	2238.000	5.01	11221.13
0180	653-0110	EA	THERM PVMT MARK, ARROW, TP 1	3.000	72.30	216.92
0185	653-0120	EA	THERM PVMT MARK, ARROW, TP 2	20.000	79.85	1597.02
0189	653-0130	EA	THERM PVMT MARK, ARROW, TP 3	12.000	98.02	1176.24
0194	653-0170	EA	THERM PVMT MARK, ARROW, TP 7	2.000	96.24	192.48
0195	653-1704	LF	THERM SOLID TRAF STRIPE,24,WH	200.000	7.28	1456.33
0199	653-3502	GLF	THERMO SKIP TRAF ST, 5 IN, YEL	173.000	0.34	59.97
0200	654-1003	EA	RAISED PVMT MARKERS TP 3	924.000	3.20	2961.21
0205	657-5016	EA	PRF PL PVT MKG,ARW TP1,WH,TPPB	3.000	750.00	2250.00
0210	636-1033	SF	HWY SIGNS, TP1MAT,REFL SH TP 9	94.000	17.53	1648.44
0215	639-3003	EA	STEEL STRAIN POLE, TP III	4.000	7371.67	29486.68
0220	639-2002	LF	STEEL WIRE STRAND CABLE, 3/8	340.000	3.90	1326.91
0229	636-2070	LF	GALV STEEL POSTS, TP 7	188.000	6.54	1230.14
0230	171-0030	LF	TEMPORARY SILT FENCE, TYPE C	4000.000	3.37	13519.96
0235	165-0030	LF	MAINT OF TEMP SILT FENCE, TP C	2000.000	0.68	1378.12
0240	163-0240	TN	MULCH	36.000	255.86	9211.28
0245	700-8000	TN	FERTILIZER MIXED GRADE	1.000	617.98	617.99
0250	700-6910	AC	PERMANENT GRASSING	3.000	876.68	2630.04
0255	163-0232	AC	TEMPORARY GRASSING	1.000	199.75	199.76
0260	700-8100	LB	FERTILIZER NITROGEN CONTENT	125.000	3.26	408.01
0265	700-7000	TN	AGRICULTURAL LIME	8.000	71.66	573.35
0270	603-1012	SY	STN PLAIN RIP RAP, 12 IN	24.000	142.73	3425.52
0275	603-7000	SY	PLASTIC FILTER FABRIC	24.000	4.03	96.92
0280	163-0300	EA	CONSTRUCTION EXIT	2.000	1418.93	2837.87
0285	165-0101	EA	MAINT OF CONST EXIT	2.000	548.19	1096.39
0290	163-0520	LF	CONSTR AND REMOVE TEMP PIPE SLOPE DRAIN	240.000	21.63	5191.91
0295	163-0550	EA	CONS & REM INLET SEDIMENT TRAP	30.000	161.30	4839.01
0300	165-0105	EA	MAINT OF INLET SEDIMENT TRAP	15.000	44.39	665.90
0305	163-0527	EA	CNST/REM RIP RAP CKDM,STN P RIPRAP/SN BG	20.000	311.14	6222.93
0310	165-0041	LF	MAINT OF CHECK DAMS - ALL TYPES	200.000	1.45	291.47
0315	167-1000	EA	WATER QUALITY MONITORING AND SAMPLING	2.000	464.26	928.54
0320	167-1500	MO	WATER QUALITY INSPECTIONS	18.000	852.49	15344.90
0325	163-0503	EA	CONSTR AND REMOVE SILT CONTROL GATE,TP 3	7.000	473.25	3312.80
0330	716-2000	SY	EROSION CONTROL MATS, SLOPES	400.000	1.96	786.00
0335	210-0101	LS	LANDSCAPING	1.000	15000.00	15000.00
0340	681-3600	EA	LIGHTING STD, SPCL DES	2.000	75000.00	150000.00

ITEM TOTAL 2346848.15
INFLATED ITEM TOTAL 2346848.15

TOTALS FOR JOB 0010739

ESTIMATED COST: 2346848.13
CONTINGENCY PERCENT (15.0): 352027.22

STATE HIGHWAY AGENCY

DATE : 10/08/2015
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JOB DETAIL ESTIMATE

ESTIMATED TOTAL: 2698875.35

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

Department of Transportation

State of Georgia

Interdepartmental Correspondence

FILE	R/W Cost Estimate Update	**OFFICE**	Atlanta
		DATE	October 7, 2015
FROM	Phil Copeland, Right of Way Administrator LaShone Alexander, Right of Way Cost Estimator		
TO	Cassius Octavius, Project Manager		

SUBJECT **Preliminary Right of Way Cost Estimate**
Project: Bryan County
P.I. No.: 0010739
Description: SR 144 @ I-95 SB & NB

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

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

`

PC:LA
Attachments
c: File

GEORGIA DEPARTMENT OF TRANSPORTATION
PRELIMINARY ROW COST ESTIMATE SUMMARY

Date:	10/7/2015	Project:	0010739
Revised:		County:	Bryan
		PI:	0010739

Description: SR 144 @ I-95 SB &NB

Project Termini: SR 144 @ I-95 SB &NB

Existing ROW: Vary

Parcels: 6

Required ROW: Vary

Land and Improvements		$276,656.25
Proximity Damage	*$0.00*	
Consequential Damage	*$0.00*	
Cost to Cures	*$0.00*	
Trade Fixtures	*$0.00*	
Improvements	*$50,000.00*	
Valuation Services		$37,500.00
Legal Services		$41,550.00
Relocation		$12,000.00
Demolition		$0.00
Administrative		$52,000.00
TOTAL ESTIMATED COSTS		$419,706.25
TOTAL ESTIMATED COSTS (ROUNDED)		***$420,000.00***

Preparation Credits	Hours	Signature

Prepared By: Lashone Alexander CG#: 286999 10/07/2015 (DATE)

Approved By: Lashone Alexander CG#: 286999 10/07/2015 (DATE)

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

allsop

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE **PI No. 0010739, Bryan County** **DATE: 09-22-2015**
SR 144 @ I-95 SB & NB Ramps
FROM **Dallory Rozier, District Utilities Engineer**

TO **Cassius Edwards, Project Manager**

SUBJECT **UPDATED 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
Century Link	$51,600.00	$0.00	
Coastal EMC	$20,000.00	$0.00	
Comcast	$46,440.00	$0.00	
Atlanta Gas Light	$103,200.00	$0.00	
Georgia Power Distribution	$200,000.00	$0.00	
City of Richmond Hill	$167,700.00	$0.00	
Totals	$588,940.00	$0.00	
Total Reimbursement		$0.00	

CC: Lee Upkins, State Utilities Engineer
Kerry Gore, Assistant State Utilities Engineer
Jun Birnkammer, State Utilities Preconstruction Engineer
Yulanda Pride-Foster, Utilities Preconstruction Engineer
Merishia Robinson, Utilities Preconstruction Engineer
Vahid Munshi, Management Specialist
District Office File
Utilities Office File

AccidentNo	AgencyName	Date	Time	County	Route	IntersectingRoute	RampSection	DistanceFrom	DirectionFrom	Injuries	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent
3745457	Richmond Hill Police Deptartment	2/10/2009	17:27:00	BRYAN	GA 144		1	300	West	2	0	Angle	On Roadway	Motor Vehicle In Motion
172344	Richmond Hill Police Deptartment	2/11/2009	17:50:00	BRYAN	SR 144		0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
175745	Richmond Hill Police Deptartment	2/12/2009	11:52:00	BRYAN	SR 144	LONGWOOD DR	0	0		1	0	Angle	On Roadway	Motor Vehicle In Motion
172353	Richmond Hill Police Deptartment	2/12/2009	17:44:00	BRYAN	SR 144		0	0		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
184564	Richmond Hill Police Deptartment	3/3/2009	17:49:00	BRYAN	SR 144		0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
186262	Richmond Hill Police Deptartment	3/8/2009	7:36:00	BRYAN	FORD AVE		0	0		1	0	Not A Collision with Motor Vehicle	Off Roadway	Other - Fixed Object
184569	Richmond Hill Police Deptartment	3/13/2009	16:27:00	BRYAN	GA405 EXIT 90 RP	GA144	1	0		0	0	Rear End	Ramp	Motor Vehicle In Motion
188125	Richmond Hill Police Deptartment	3/16/2009	17:49:00	BRYAN	SR 144		0	0		0	0	Not A Collision with Motor Vehicle	On Shoulder	Median Barrier
206301	Richmond Hill Police Deptartment	3/19/2009	21:16:00	BRYAN	SR 144		0	0		0	0	Not A Collision with Motor Vehicle	Off Roadway	Culvert
206306	Richmond Hill Police Deptartment	3/31/2009	17:12:00	BRYAN	SR 144		0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
278660	Richmond Hill Police Deptartment	6/19/2009	17:31:00	BRYAN	SR 144		0	0		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
307428	Richmond Hill Police Deptartment	7/16/2009	15:29:00	BRYAN	SR 144		0	0		1	0	Rear End	On Roadway	Motor Vehicle In Motion
282001	Richmond Hill Police Deptartment	7/21/2009	17:38:00	BRYAN	G A144		0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
282660	Richmond Hill Police Deptartment	8/1/2009	17:37:00	BRYAN	G A144		0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
324133	Richmond Hill Police Deptartment	8/12/2009	17:20:00	BRYAN	SR 144	0602	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
357322	Richmond Hill Police Deptartment	9/24/2009	16:24:00	BRYAN	SR 144		0	0		1	0	Angle	On Roadway	Motor Vehicle In Motion
354314	Richmond Hill Police Deptartment	9/25/2009	13:29:00	BRYAN	SR 144	SR 405	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
378442	Richmond Hill Police Deptartment	10/17/2009	22:40:00	BRYAN	HWY 144	SR 405	0	0		1	0	Not A Collision with Motor Vehicle	On Roadway	Over Turn
391433	Richmond Hill Police Deptartment	10/29/2009	16:38:00	BRYAN	SR 144		0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3419455	Richmond Hill Police Deptartment	11/17/2009	8:16:00	BRYAN	SR 144	SR 405	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
1777755	Richmond Hill Police Deptartment	1/4/2010	17:09:00	BRYAN	SR 144	SR 405	0	400	West	1	0	Rear End	On Roadway	Motor Vehicle In Motion
1777759	Richmond Hill Police Deptartment	1/5/2010	17:27:00	BRYAN	SR 144	SR 405	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
1779174	Richmond Hill Police Deptartment	1/6/2010	14:27:00	BRYAN	SR 144	SR 405	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3425272	Richmond Hill Police Deptartment	1/23/2010	11:19:00	BRYAN	SR 144	SR 405	0	200	West	0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
3519914	Richmond Hill Police Deptartment	5/17/2010	15:51:00	BRYAN	SR 144		0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3519600	Richmond Hill Police Deptartment	5/18/2010	17:12:00	BRYAN	SR 144	SR 405	0	0		0	0	Not A Collision with Motor Vehicle	Ramp	Ditch
3541002	Richmond Hill Police Deptartment	5/31/2010	19:47:00	BRYAN	SR 144	SR 405	0	0		0	0	Not A Collision with Motor Vehicle	Off Roadway	Culvert
3539444	Richmond Hill Police Deptartment	6/2/2010	20:52:00	BRYAN	SR 144	SR 405	0	-1		0	0	Angle	On Roadway	Motor Vehicle In Motion
3582018	Richmond Hill Police Deptartment	6/4/2010	7:44:00	BRYAN	GA 144	GA 405	0	0		1	0	Rear End	On Roadway	Motor Vehicle In Motion
3584809	Richmond Hill Police Deptartment	6/9/2010	17:13:00	BRYAN	GA 144	GA 405	0	0		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
3628451	Richmond Hill Police Deptartment	7/14/2010	20:08:00	BRYAN	GA 144	OLEANDER STREET	0	0		0	0	Not A Collision with Motor Vehicle	Median	Highway Traffic Sign Post
3452861	Richmond Hill Police Deptartment	7/28/2010	7:12:00	BRYAN	SR 144	THUNDERBIRD DR	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3472737	Richmond Hill Police Deptartment	8/18/2010	17:06:00	BRYAN	SR 144	LOUS C GILL BLVD	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3522731	Richmond Hill Police Deptartment	8/18/2010	17:40:00	BRYAN	SR 144	LOUS C GILL BLVD	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3472736	Richmond Hill Police Deptartment	8/18/2010	12:31:00	BRYAN	SR 144	SR 405	0	0		2	0	Rear End	On Roadway	Motor Vehicle In Motion
3473769	Richmond Hill Police Deptartment	8/23/2010	14:19:00	BRYAN	SR 144	SR 405	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3562241	Richmond Hill Police Deptartment	9/2/2010	7:16:00	BRYAN	SR 144	SR 405	0	0		1	0	Angle	On Roadway	Motor Vehicle In Motion
3736562	Richmond Hill Police Deptartment	9/17/2010	16:25:00	BRYAN	SR 144	SR 405	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3594250	Richmond Hill Police Deptartment	11/1/2010	16:50:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3530391	Richmond Hill Police Deptartment	11/1/2010	16:50:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3545153	Richmond Hill Police Deptartment	11/5/2010	17:11:00	BRYAN	LONGWOOD DR	SR 144	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3565748	Richmond Hill Police Deptartment	12/7/2010	13:09:00	BRYAN	HWY 144	SR 405	0	0		1	0	Rear End	On Roadway	Parked Motor Vehicle
3566664	Richmond Hill Police Deptartment	12/13/2010	16:51:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0		2	0	Angle	On Roadway	Motor Vehicle In Motion
3566833	Richmond Hill Police Deptartment	12/15/2010	12:06:00	BRYAN	SR 144	SR 405	0	0		1	0	Not A Collision with Motor Vehicle	On Roadway	Over Turn
3597645	Richmond Hill Police Deptartment	1/19/2011	5:22:00	BRYAN	SR 144	SR 405	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3616346	Richmond Hill Police Deptartment	2/11/2011	6:48:00	BRYAN	SR 144	LONGWOOD DR	0	0		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
3646058	Richmond Hill Police Deptartment	3/8/2011	18:52:00	BRYAN	SR 144	SR 405	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3671215	Richmond Hill Police Deptartment	4/5/2011	18:00:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	-1		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
3787697	Richmond Hill Police Deptartment	6/3/2011	15:33:00	BRYAN	SR 144	LONGWOOD DR	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3796517	Richmond Hill Police Deptartment	6/13/2011	15:00:00	BRYAN	SR 144	LONGWOOD DR	0	0		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
3803720	Richmond Hill Police Deptartment	6/23/2011	16:17:00	BRYAN	SR 144	LOUIS GILL BLVD	0	500	East	1	0	Angle	On Roadway	Motor Vehicle In Motion
3806954	Richmond Hill Police Deptartment	6/30/2011	16:48:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	-1		0	0	Angle	On Roadway	Motor Vehicle In Motion
3808576	Richmond Hill Police Deptartment	7/1/2011	18:00:00	BRYAN	SR 144	SR 405	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3813764	Richmond Hill Police Deptartment	7/14/2011	15:55:00	BRYAN	SR 144	LEWIS GILL BLVD	0	0		0	0	Sideswipe-Opposite Direction	On Roadway	Motor Vehicle In Motion
3869384	Richmond Hill Police Deptartment	9/20/2011	5:50:00	BRYAN	SR 144	LONGWOOD DR	0	100	East	0	0	Angle	On Roadway	Motor Vehicle In Motion
3875502	Richmond Hill Police Deptartment	9/28/2011	18:12:00	BRYAN	SR 144	LONGWOOD DR	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3888354	Richmond Hill Police Deptartment	10/11/2011	17:17:00	BRYAN	SR 144	SR 405	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3890724	Richmond Hill Police Deptartment	10/13/2011	16:16:00	BRYAN	SR 144	LEWIS GILL DR	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
3893085	Richmond Hill Police Deptartment	10/19/2011	17:17:00	BRYAN	SR 144	LOUIS GILL BLVD	0	0		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
3913550	Richmond Hill Police Deptartment	11/9/2011	17:13:00	BRYAN	SR 144	LOUIS GILL BLVD	0	-1		1	0	Head On	On Roadway	Motor Vehicle In Motion
3921898	Richmond Hill Police Deptartment	11/16/2011	17:33:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0		1	0	Angle	On Roadway	Motor Vehicle In Motion
3966417	Richmond Hill Police Deptartment	1/9/2012	17:13:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
3987807	Richmond Hill Police Deptartment	1/30/2012	17:32:00	BRYAN	SR 144	LOUIS GILL RD	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
4000943	Richmond Hill Police Deptartment	2/9/2012	16:06:00	BRYAN	SR 144	LEWIS C GILL	0	0		5	0	Angle	On Roadway	Motor Vehicle In Motion
4036514	Richmond Hill Police Deptartment	3/20/2012	17:35:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion - In Other Roadway
4054858	Richmond Hill Police Deptartment	4/11/2012	13:00:00	BRYAN	SR 144	LAUREL ST	0	25	East	0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
4067879	Richmond Hill Police Deptartment	4/25/2012	16:34:00	BRYAN	SR 144	SR 405	0	0		0	0	Rear End	On Roadway	Motor Vehicle In Motion
4069466	Richmond Hill Police Deptartment	4/27/2012	10:52:00	BRYAN	SR 144	THUNDERBIRD DR	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion
4118979	Bryan County Sheriff's Office	5/17/2012	16:05:00	BRYAN	HWY 144	LONGWOOD DR	0	0	South	1	0	Rear End	On Roadway	Motor Vehicle In Motion
4105271	Richmond Hill Police Deptartment	5/29/2012	18:54:00	BRYAN	SR 144	LONGWOOD DR	0	0		2	0	Rear End	On Roadway	Motor Vehicle In Motion
4106045	Richmond Hill Police Deptartment	5/30/2012	17:51:00	BRYAN	SR 144	THUNDERBIRD DR	0	0		0	0	Angle	On Roadway	Motor Vehicle In Motion

4124895	Richmond Hill Police Deptartment	6/19/2012	7:28:00	BRYAN	SR 144	I 95	0	0	2	0	Rear End	Ramp	Motor Vehicle In Motion
4141239	Gsp Post 00	6/27/2012	13:50:00	BRYAN	SR 144	SR 405	0	0	0	0	Angle	On Roadway	Other Object (Not Fixed)
4189408	Gsp Post 00	8/28/2012	17:40:00	BRYAN	SR 144	LOUIS C GILL BLVD	0	0	2	0	Angle	On Roadway	Other Object (Not Fixed)
4208704	Bryan County Sheriff's Office	8/28/2012	18:19:00	BRYAN	SR 144	MILE POST 8	0	0	0	0	Rear End	On Roadway	Motor Vehicle In Motion
4303671	Bryan County Sheriff's Office	11/3/2012	11:49:00	BRYAN	HWY144	I 95	0	0	South	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion
4513375	Bryan County Sheriff's Office	5/29/2013	7:35:00	BRYAN	HWY 144	I 95	0	0	West	1	Head On	On Roadway	Motor Vehicle In Motion
4553085	Gsp Post 00	8/23/2013	18:08:00	BRYAN	SR 144	MM9	0	0	1	0	Rear End	On Roadway	Other Object (Not Fixed)

Light	Surface	DriverAge1	DriverSafetyEquip1	VehType1	DirVeh1	MnvrVeh1	MicrofilmNo	LatDecimal	LongDecimal	DriverAge2	DriverSafetyEquip2	VehType2	DirVeh2	MnvrVeh2
Daylight	Dry	73	Unknown	Passenger Car	Northeast	Turning Left	90440316	31.962128	-81.332537	36	Unknown	Utility Passenger Vehicle	East	Straight
Daylight	Dry	18	Lap and Shoulder Belt	Utility Passenger Vehicle	Southeast	Turning Left	90630197	0	0	24	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	39	Lap and Shoulder Belt	Tractor/Trailer	Northeast	Turning Left	90630198	31.960864	-81.330048	19	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	27	Lap and Shoulder Belt	Passenger Car	Southeast	Changing Lanes	90630209	31.960896	-81.330482	25	Lap and Shoulder Belt	Passenger Car	Southeast	Straight
Daylight	Dry	18	Unknown	Passenger Car	Southeast	Turning Left	90940070	31.962343	-81.332852	54	Unknown	Pickup Truck	East	Straight
Daylight	Dry	24	Lap and Shoulder Belt	Passenger Car	North	Straight	90940073	31.961752	-81.331985					
Daylight	Dry	33	Lap and Shoulder Belt	Pickup Truck	Northeast	Straight	90940076	31.961786	-81.327083	67	Lap and Shoulder Belt	Van	Northeast	Stopped
Daylight	Wet	49	Lap and Shoulder Belt	Pickup Truck	East	Turning Left	90940080	31.961786	-81.327083					
Dark-Not Lighted	Dry	37	Lap and Shoulder Belt	Utility Passenger Vehicle	North	Turning Right	91320165	31.957819	-81.33111					
Daylight	Dry	74	Lap and Shoulder Belt	Utility Passenger Vehicle	Southeast	Turning Left	91320172	0	0	24	Lap and Shoulder Belt	Pickup Truck	East	Straight
Daylight	Dry	16	Unknown	Passenger Car	East	Straight	92460473	31.962128	-81.332537	61	Unknown	Passenger Car	East	Changing Lanes
Daylight	Dry	46	Lap and Shoulder Belt	Van	North	Turning Left	93000002	31.962541	-81.326304	30	Lap and Shoulder Belt	Utility Passenger Vehicle	North	Turning Left
Daylight	Dry	32	Lap and Shoulder Belt	Passenger Car	North	Turning Left	93220300	31.962541	-81.326304	45	Lap and Shoulder Belt	Van	Southeast	Straight
Daylight	Wet	56	Lap and Shoulder Belt	Tractor/Trailer	East	Turning Right	93220309	0	0	21	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Wet	24	Lap and Shoulder Belt	Pickup Truck	Southeast	Making U-turn	93380430	31.960847	-81.330399	22	Lap and Shoulder Belt	Passenger Car	Southeast	Straight
Daylight	Dry	20	Lap and Shoulder Belt	Passenger Car	Southeast	Turning Left	94130041	-1	-1	25	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Straight
Daylight	Dry	27	Lap and Shoulder Belt	Passenger Car	North	Entering/Leaving Parking	94130037	-1	-1	25	Lap and Shoulder Belt	Passenger Car	Southeast	Straight
Dark-Lighted	Wet	37	Motorcycle Helmet	Motorcycle, Scooter, Minibike	Southeast	Straight	94580059	-1	-1					
Daylight	Dry	65	Unknown	Utility Passenger Vehicle	North	Turning Left	94780265	-1	-1	26	Unknown	Pickup Truck	East	Straight
Daylight	Dry	30	Lap and Shoulder Belt	Pickup Truck	Southeast	Straight	96070078	31.82965	-81.255101	50	Lap and Shoulder Belt	Van	North	Stopped
Daylight	Dry	42	Unknown	Passenger Car	East	Straight	A0140158	31.768813	-81.244489	21	Unknown	Pickup Truck	East	Straight
Dusk	Dry	63	Unknown	Pickup Truck	Southeast	Straight	A0140152	31.768813	-81.244489	58	Lap and Shoulder Belt	Passenger Car	Southeast	Turning Left
Daylight	Dry	80	Lap and Shoulder Belt	Passenger Car	East	Turning Right	A0140155	31.768813	-81.244489	45	Lap and Shoulder Belt	Single Unit Truck	East	Straight
Daylight	Dry	109	Unknown	Tractor/Trailer	East	Changing Lanes	A0490083	31.768813	-81.244489	33	Unknown	Passenger Car	East	Straight
Daylight	Wet	25	Lap and Shoulder Belt	Passenger Car	East	Straight	A1850068	31.768813	-81.244489	26	Lap and Shoulder Belt	Passenger Car	East	Stopped
Daylight	Dry	21	Lap and Shoulder Belt	Passenger Car	East	Turning Left	A1850066	31.82965	-81.255101					
Daylight	Wet	22	Unknown	Passenger Car	North	Turning Right	A2020469	31.9488	-81.311369					
Dark-Lighted	Dry	51	Lap and Shoulder Belt	Passenger Car	North	Turning Left	A2020468	31.82965	-81.2551	40	Lap and Shoulder Belt	Van	East	Stopped
Daylight	Dry	20	Lap and Shoulder Belt	Passenger Car	Southeast	Turning Right	A2150483	-1	-1	41	Lap and Shoulder Belt	Passenger Car	Southeast	Stopped
Daylight	Dry	25	Unknown	Passenger Car	East	Changing Lanes	A2150480	-1	-1	99	Unknown	Tractor/Trailer	Southeast	Straight
Daylight	Wet	43	Lap and Shoulder Belt	Tractor/Trailer	Southeast	Making U-turn	A2390150	31.958171	-81.325876					
Daylight	Dry	54	Lap and Shoulder Belt	Utility Passenger Vehicle	West	Straight		31.9488	-81.311369	23	Lap and Shoulder Belt	Pickup Truck	West	Straight
Daylight	Dry	33	Unknown	Tractor/Trailer	East	Turning Right		31.9488	-81.311369	46	Lap and Shoulder Belt	Logging Truck	East	Straight
Daylight	Dry	33	Unknown	Tractor/Trailer	East	Turning Right	A2760095	31.9488	-81.311369	38	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Straight
Daylight	Dry	37	Unknown	Panel Truck	East	Straight		31.82965	-81.255101	39	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Straight
Daylight	Dry	24	Unknown	Utility Passenger Vehicle	East	Turning Right		31.82965	-81.255101	47	Unknown	Passenger Car	East	Entering/Leaving Parking
Daylight	Dry	38	Lap and Shoulder Belt	Utility Passenger Vehicle	Southeast	Straight	A2830008	31.9488	-81.311369	20	Lap and Shoulder Belt	Van	East	Turning Left
Daylight	Dry	43	Lap and Shoulder Belt	Pickup Truck	East	Straight	A3750102	31.890278	-81.261735	50	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry			Tractor/Trailer	Southeast	Turning Left	A3150167	-1	-1			Passenger Car	East	Stopped
Daylight	Dry	49	Lap and Shoulder Belt	Tractor/Trailer	West	Turning Left		31.9488	-81.311369	53	Lap and Shoulder Belt	Passenger Car	East	Stopped
Daylight	Dry	24	Lap and Shoulder Belt	Utility Passenger Vehicle	South	Straight		31.960864	-81.330048	24	Lap and Shoulder Belt	Utility Passenger Vehicle	South	Stopped
Daylight	Dry	43	Lap and Shoulder Belt	Passenger Car	West	Straight		31.768813	-81.244489	23	Lap and Shoulder Belt		West	Stopped
Daylight	Dry	24	Lap and Shoulder Belt	Passenger Car	West	Turning Left		31.9488	-81.311369	22	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	40	Lap and Shoulder Belt	Other	West	Turning Right		31.82965	-81.255101					
Dark-Lighted	Wet	36	Lap and Shoulder Belt	Passenger Car	North	Turning Left		31.768813	-81.244489	29	Lap and Shoulder Belt	Pickup Truck	West	Straight
Dawn	Dry	33	Lap and Shoulder Belt	Passenger Car	West	Changing Lanes		31.960864	-81.330048	46	Lap and Shoulder Belt	Utility Passenger Vehicle	West	Straight
Dark-Lighted	Dry	47	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Turning Left		31.768813	-81.244489	36	Lap and Shoulder Belt	Utility Passenger Vehicle	West	
Daylight	Dry	22	Unknown	Passenger Car	East	Changing Lanes		31.9488	-81.311369	25	Unknown	Tractor/Trailer	East	Straight
Daylight	Dry	18	Lap and Shoulder Belt	Passenger Car	East	Straight		31.960864	-81.330048	49	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	64	Unknown	Motorized Recreational Vehicle	West	Making U-turn		31.960864	-81.330048	45	Unknown	Utility Passenger Vehicle	West	Straight
Daylight	Wet	25	Unknown	Passenger Car	North	Turning Right		31.9488	-81.311369	47	Motorcycle Helmet	Motorcycle, Scooter, Minibike	East	Straight
Daylight	Dry	62	Lap and Shoulder Belt	Passenger Car	West	Turning Left		31.9488	-81.311369	49	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	51	Lap and Shoulder Belt	Van	East	Turning Left		31.768813	-81.244489	40	Lap and Shoulder Belt	Van	East	Stopped
Daylight	Dry	31	Lap and Shoulder Belt	Passenger Car	West	Turning Left		31.9488	-81.311369	26	Lap and Shoulder Belt	Passenger Car	East	Straight
Dark-Not Lighted	Wet	26	Lap and Shoulder Belt	Pickup Truck	West	Changing Lanes		31.9488	-81.311369	26	Lap and Shoulder Belt	Pickup Truck	West	Straight
Daylight	Dry	35	Lap and Shoulder Belt	Tractor/Trailer	East	Straight		31.9488	-81.311369	24	Lap and Shoulder Belt	Passenger Car	East	Stopped
Daylight	Dry	25	Lap and Shoulder Belt	Pickup Truck	East	Turning Left		31.768813	-81.244489	65	Lap and Shoulder Belt	Passenger Car	West	Straight
Daylight	Dry	28	Unknown	Tractor/Trailer	South	Turning Left		31.9488	-81.311369	48	Unknown	Pickup Truck	East	Straight
Daylight	Dry	37	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Straight		31.9488	-81.311369	29	Lap and Shoulder Belt	Passenger Car	East	Straight
Dusk	Dry	43	Lap and Shoulder Belt	Tractor/Trailer	West	Turning Left		31.9488	-81.311369	28	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	37	Lap and Shoulder Belt	Van	West	Turning Left		31.9488	-81.311369	37	Motorcycle Helmet	Motorcycle, Scooter, Minibike	East	Straight
Daylight	Dry	25	Lap and Shoulder Belt	Passenger Car	East	Straight		31.76881	-81.244489	26	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Stopped
Daylight	Dry	-977	Lap and Shoulder Belt	Passenger Car	West	Turning Left		31.76881	-81.244489	31	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	24	Lap and Shoulder Belt	Pickup Truck	West	Turning Left		31.76881	-81.244489	18	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	55	Lap and Shoulder Belt	Passenger Car	South	Turning Left		31.76881	-81.244489	49	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Straight
Daylight	Dry	55	Lap and Shoulder Belt	Single Unit Truck	East	Turning Right		31.95905	-81.32711	19	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Straight
Daylight	Dry	18	Lap and Shoulder Belt	Passenger Car	East	Straight		31.76881	-81.244489	50	Lap and Shoulder Belt	Pickup Truck	East	Stopped
Daylight	Dry	18	Lap and Shoulder Belt	Passenger Car	South	Turning Left		31.95942	-81.32775	36	Lap and Shoulder Belt	Utility Passenger Vehicle	West	Straight
Daylight	Wet	25	Lap and Shoulder Belt	Passenger Car	East	Stopped	C1600148	-1	-1	43	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Wet	50	Unknown	Passenger Car	East	Making U-turn		31.96098	-81.33037	43	Unknown	Passenger Car	West	Straight
Daylight	Dry	22	Lap and Shoulder Belt	Van	West	Turning Right		31.95942	-81.32775	20	Lap and Shoulder Belt	Utility Passenger Vehicle	West	Turning Left

Daylight	Dry	32	Lap and Shoulder Belt	Pickup Truck	West	Turning Right		31.76881	-81.244489	54	Lap and Shoulder Belt	Pickup Truck	West	Stopped
Daylight	Dry	42	Lap and Shoulder Belt	Van	South	Turning Right		31.96035	-81.32929	32	Lap and Shoulder Belt	Van	East	Straight
Daylight	Wet	63	Lap and Shoulder Belt	Passenger Car	West	Turning Left		31.96191	-81.33193	33	Lap and Shoulder Belt	Pickup Truck	East	Straight
Daylight	Wet	27	Lap and Shoulder Belt	Passenger Car	East	Straight	C2540389	-1	-1	23	Lap and Shoulder Belt	Passenger Car	East	Straight
Daylight	Dry	23	Lap and Shoulder Belt	Passenger Car	West	Straight	C3480509	-1	-1	39	Lap and Shoulder Belt	Pickup Truck	West	Turning Left
Daylight	Dry	29	Lap and Shoulder Belt	Pickup Truck	East	Straight	D1760254	31.76881	-81.244489	53	Lap and Shoulder Belt	Passenger Car	West	Straight
Daylight	Dry	63	Lap and Shoulder Belt	Utility Passenger Vehicle	East	Turning Left		31.94969	-81.31185	36	Lap and Shoulder Belt	Passenger Car	East	Straight

Department of Transportation
State of Georgia

INTERDEPARTMENT CORRESPONDENCE

FILE Bryan County
P.I. # 0010739

OFFICE Planning

DATE December 3, 2012

FROM Cynthia L. VanDyke, State Transportation Planning Administrator

TO Genetha Rice-Singleton, State Program Delivery Engineer
Attention: Cassius Edwards

SUBJECT **Reviewed** Design Traffic for SR 144 @ I-95 SB & NB OFF RAMPS

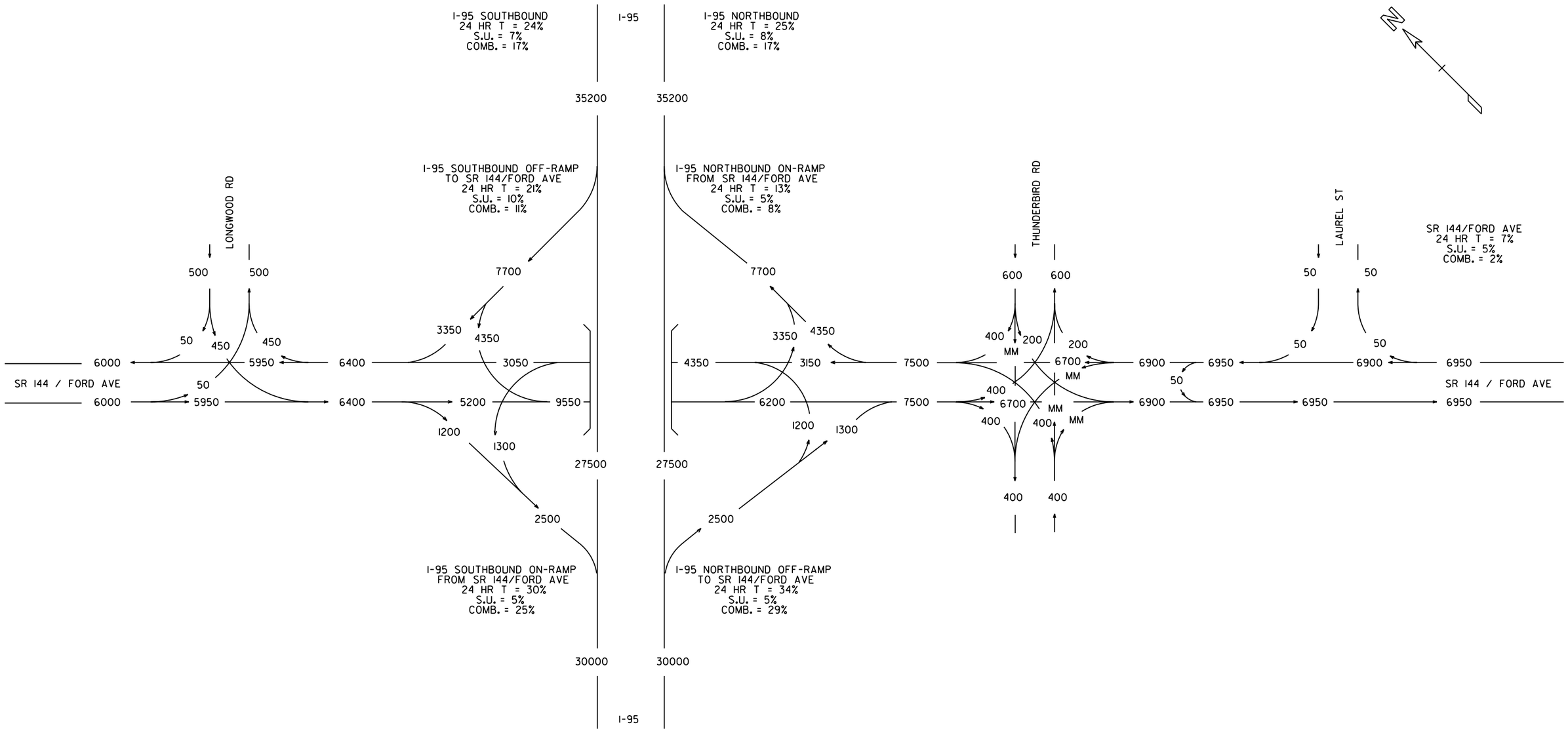
We have reviewed the consultant's design traffic data for the above project. Based on the information furnished, we find the Design Traffic to be satisfactory, and approve the Design Traffic volume.

If you have any questions concerning this information please contact Andre Washington at (404) 631-1925.

CLV/AMW

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING
GROUP

P.I.# 0010739
BRYAN COUNTY

SR 144 (FORD AVE)

SR 144 @ I-95
SB & NB RAMPS

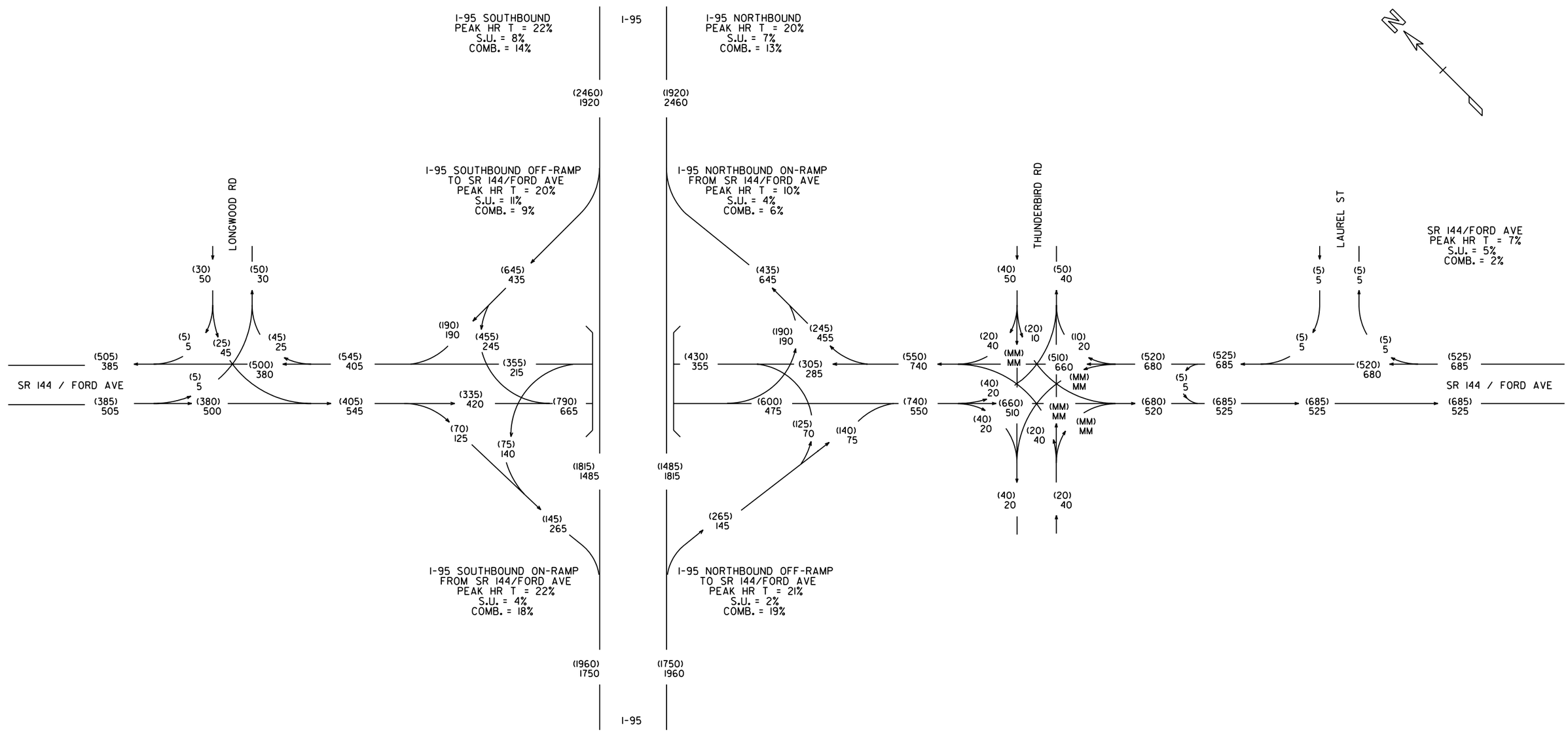
2012 ADT

HF
11/12

Sheet 1 of 5

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

P.I.# 0010739
BRYAN COUNTY

SR 144 (FORD AVE)

SR 144 @ I-95
SB & NB RAMPS

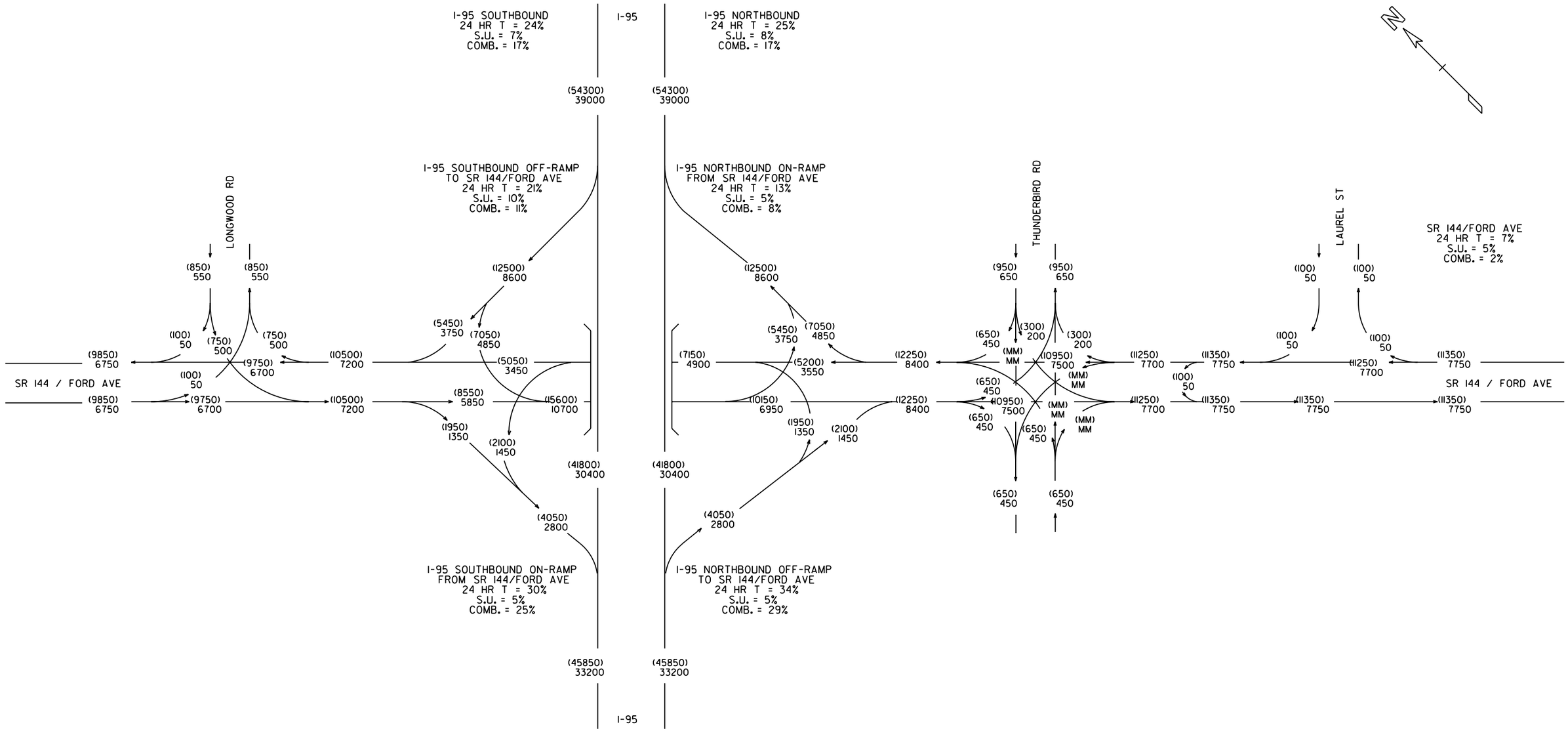
2012 PM DHV = (000)
2012 AM DHV = 000

HF
11/12

Sheet 2 of 5

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

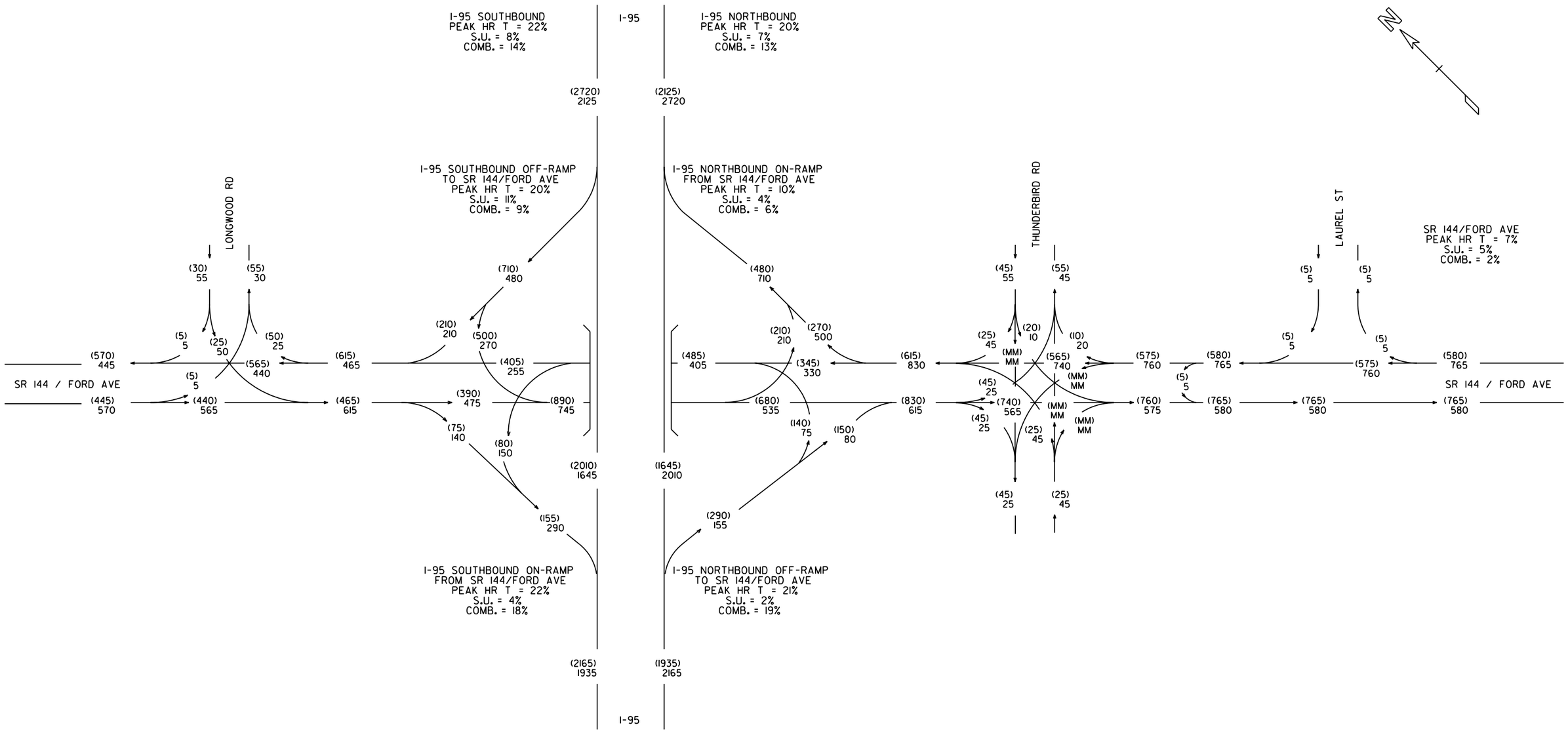
P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS

2037 BUILD/NO-BUILD ADT = (000)
2017 BUILD/NO-BUILD ADT = 000

HF
11/12

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING
GROUP

P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS

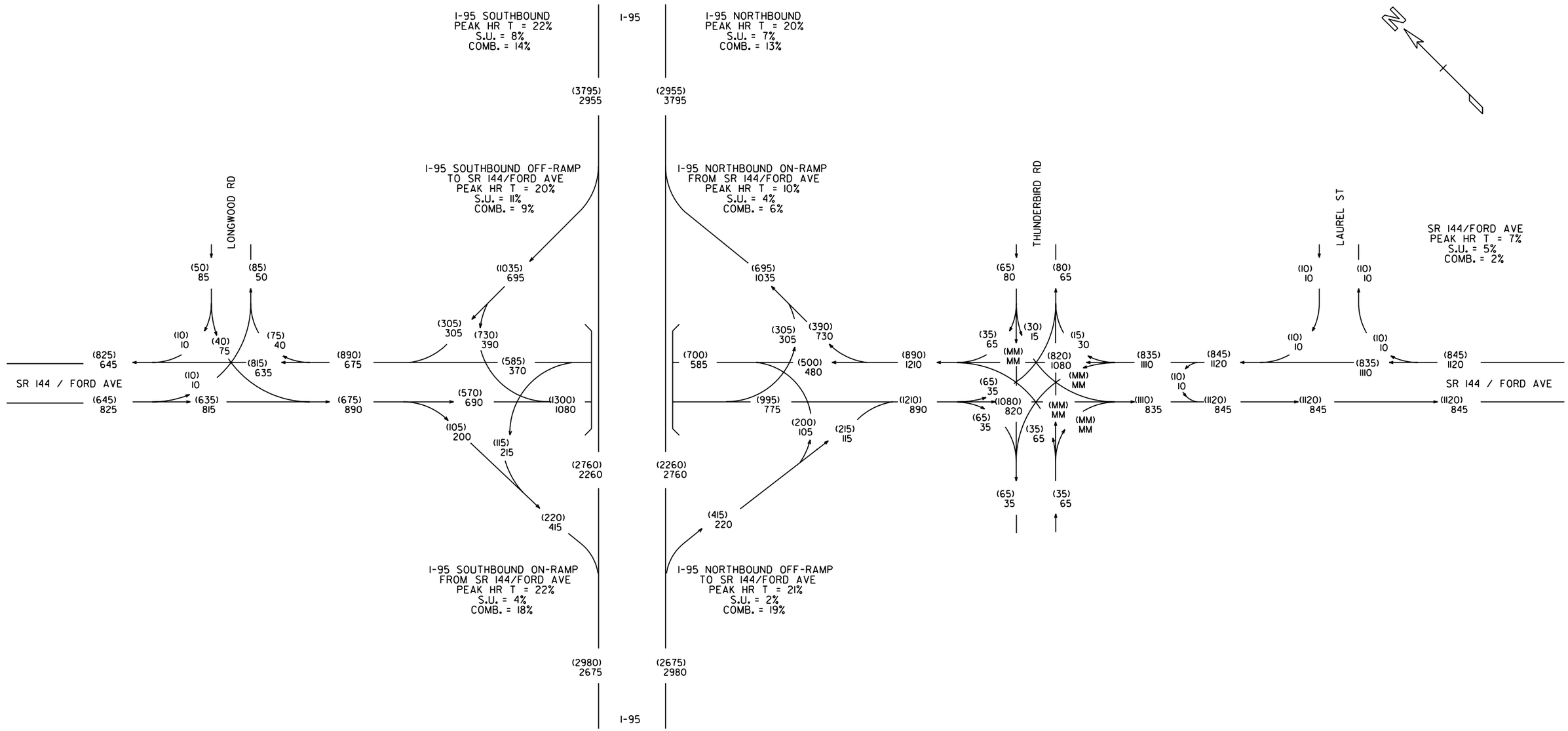
2017 BUILD/NO-BUILD PM DHV = (000)
2017 BUILD/NO-BUILD AM DHV = 000

HF
11/12

Sheet 4 of 5

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS
2037 BUILD/NO BUILD PM DHV = (000)
2037 BUILD/NO BUILD AM DHV = 000
HF
11/12

Sheet 5 of 5

Roundabout Feasibility Study

SR 144 (Ford Avenue) Improvements at I-95

City of Richmond Hill, Georgia

Report Prepared:

August 2015

Prepared for:

Georgia Department of Transportation

Prepared by:

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1.0 INTRODUCTION

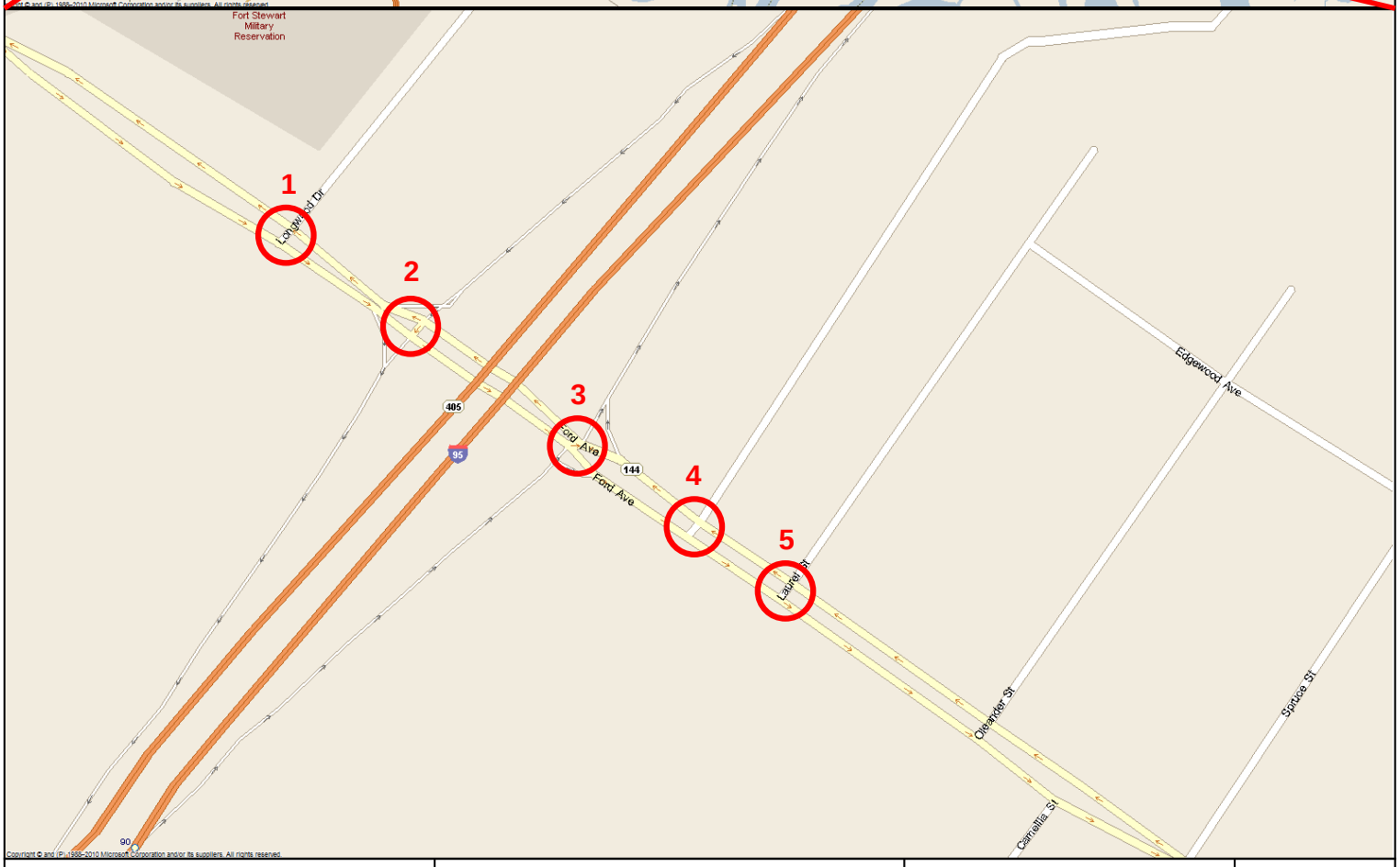
The segment of SR 144 (Ford Avenue) between Longwood Drive and Laurel Street in Bryan County, Georgia, has been identified for an operational analysis by the Georgia Department of Transportation (GDOT). This traffic engineering study was completed in an effort to determine what geometric, operational, and safety improvements could be made to improve traffic conditions along the studied roadway, particularly at the I-95 Southbound and Northbound Ramp intersections. Furthermore, the operations of the corridor were assessed for future traffic conditions, and recommendations were made to improve traffic flow.

Note: This report provides support for the recommended concept layout that includes proposed roundabouts at the I-95 Southbound and Northbound Ramp intersections. Additionally, this report includes information for an alternative concept that considered roadway widening, additional turn lanes, and signalization at these two intersections. It should be noted that this alternative concept is not recommended.

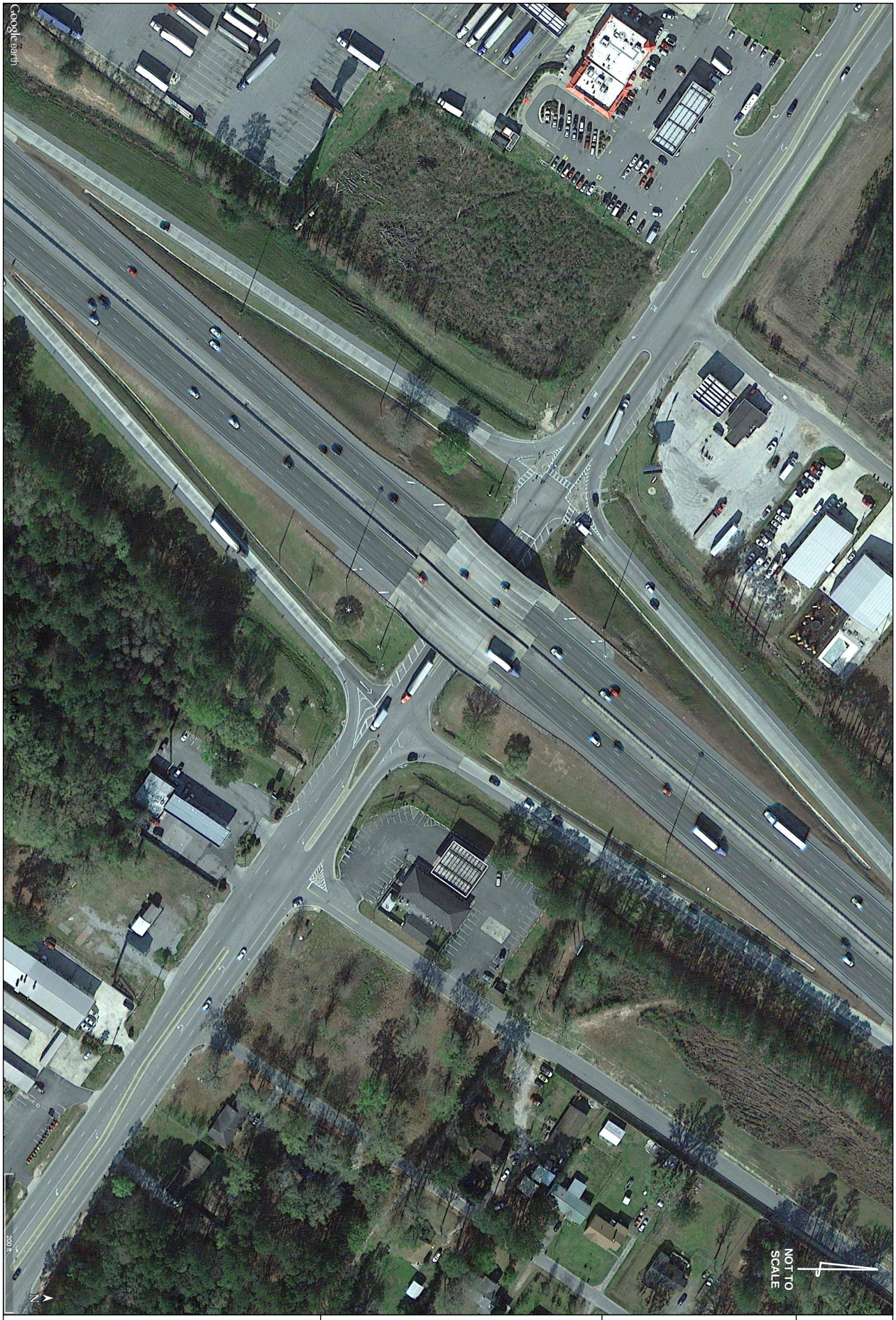
The entire SR 144 corridor is approximately 83.7 miles in total length, connecting Baxley, Georgia with southeastern Bryan County. SR 144 (Ford Avenue) intersects I-95 at the 68.3-mile mark, on the western side of Richmond Hill, Georgia. The 20-mile section of SR 144 from SR 119 in Hinesville, Georgia to I-95 is part of the National Highway System. SR 144 serves as a main corridor through Richmond Hill, providing access to many of the City's businesses and institutions.

The project limits along SR 144 are from the intersection with Longwood Drive to the intersection with Laurel Street and covers approximately 0.20 miles. The limits of construction along the I-95 NB and SB Ramps are illustrated on the concept layout. The proposed improvements are planned to be constructed and open to traffic by year 2017 (Base Year) with a 20-year design horizon of 2037 (Design Year).

This report summarizes the data collection, accident data, analysis of traffic conditions, and conclusions from the analysis of Existing Year 2012 Conditions, No-Build Base Year 2017 Conditions, No-Build Design Year 2037 Conditions, Build Base Year 2017 Conditions, and Build Design Year 2037 Conditions. A project location map showing the study area and intersections is depicted on **Figure 1**. Aerials of the study area are displayed on **Figure 2** and **Figure 3**. A concept layout illustrating the proposed roadway geometry for the recommended modern roundabouts is included in **Appendix A**. Photographs within the study area are provided in **Appendix D**.



Kimley»Horn	**SR 144 Widening at I-95 Traffic Engineering Study** F- 1 of 15	**Location of Study Area & Intersections**	**Figure 1**



Kimley»Horn	SR 144 Widening at I-95 Traffic Engineering Study	Study Area Aerial	Figure 2

Kimley»Horn	SR 144 Widening at I-95 Traffic Engineering Study	Study Area Aerial	Figure 3

2.0 EXISTING CONDITIONS

2.1 STUDY AREA

The study area of SR 144 was identified to include the five (5) intersections listed below in **Table 1**.

Table 1
Study Intersections

Intersection ID	Intersection Name	Existing Control
1	SR 144 at Longwood Drive	Unsignalized
2	SR 144 at I-95 SB Ramp	Signalized
3	SR 144 at I-95 NB Ramp	Unsignalized
4	SR 144 at Thunderbird Drive	Unsignalized
5	SR 144 at Laurel Street	Unsignalized

2.2 ROADWAY CONDITIONS & TRAFFIC CONTROL

Currently, SR 144 is classified as an urban minor arterial with a posted speed limit of 45 MPH within the study area. SR 144 is a four-lane divided facility (two eastbound and two westbound through travel lanes) to the west of the I-95 Southbound Ramps and to the east of the I-95 Northbound Ramps. SR 144 is a two-lane divided facility (one eastbound and one westbound through travel lane) through and in between the two I-95 Ramp intersections. SR 144 is divided with varying raised medians within the study area. Curb and gutter exists along SR 144 everywhere within the study area except between the two I-95 Ramp intersections. For the purposes of this study, the SR 144 corridor will be considered an east-west oriented roadway.

Longwood Drive, Thunderbird Drive, and Laurel Street are classified as local roads and are all two-lane facilities within vicinity of SR 144. Laurel Street is limited to right-in/right-out access only, and has a posted speed limit of 25 MPH. Longwood Drive and Thunderbird Drive have no posted speed limit, but relatively low speeds were assumed for the purposes of the analyses contained in this study. For the purposes of this study, Longwood Drive, Thunderbird Drive, Laurel Street, and the two I-95 Ramps will be considered north-south oriented roadways.

The intersection of SR 144 at I-95 Southbound Ramp is the only study intersection that is currently controlled by a traffic signal. The other four study intersections are unsignalized with stop control on the side street only.

Table 2 gives a summary of the geometry and control type by approach for each study intersection. The existing laneage along the SR 85 corridor, as well as the existing year 2012 traffic volumes (approved by GDOT), are illustrated on **Figure 10**.

Table 2
Study Intersections: Geometry and Signalization

ID	Intersection Name	Mainline Exclusive Turn Lanes	Side Street Approach Geometry	Intersection Control Type & Phasing
1	SR 144 at Longwood Drive	EB: shared U/left-turn lane	SB: shared left/right lane	Unsignalized SB Stop
2	SR 144 at I-95 SB Ramp	EB: channelized yield right-turn lane WB: left-turn lane	SB: shared through/left-turn lane and channelized free-flow right-turn lane	Signalized EB: Permissive WB: Protected/Permissive SB: Permissive/Split
3	SR 144 at I-95 NB Ramp	EB: left-turn lane WB: channelized yield right-turn lane	NB: shared left-turn/through/right-turn lane with a channelized free-flow right-turn	Unsignalized NB Stop
4	SR 144 at Thunderbird Drive	EB: left-turn lane WB: shared U/left-turn lane	NB: shared left-turn/through/right-turn lane SB: shared left-turn/through/right-turn lane with a channelized yield right-turn	Unsignalized NB Stop SB Stop
5	SR 144 at Laurel Street	None	SB: right-turn lane (right-in/right-out)	Unsignalized SB Stop

2.3 VEHICULAR SPEEDS

The posted speed limit on SR 144 is 45 MPH within the study area. The posted speed limit on Laurel Street is 25 MPH. Longwood Drive and Thunderbird Drive have no posted speed limit, but relatively low speeds were assumed for the purposes of this study. The posted speed limit on I-95 is 70 MPH within the vicinity of the interchange with SR 144.

2.4 PEDESTRIAN MOVEMENTS

Pedestrian volume counts were not performed within the study area.

Sidewalks are present along the north side of SR 144 between Thunderbird Drive and Laurel Street, and along the north side of SR 144 east of Laurel Street. No other sidewalks are present within the study area.

Signalized crosswalks are present at the signalized intersection of SR 144 at I-95 Southbound Ramp, crossing the northern leg, western leg, and southern leg of the intersection. No other crosswalks are present within the study area.

2.5 DELAY STUDY

A delay study was not performed as a part of this roundabout feasibility study.

2.6 PARKING

No on-street parking is provided along SR 144 within the study area. No parking is provided or expected at any of the five study intersections.

2.7 ADJACENT SIGNALIZED INTERSECTIONS

The nearest signalized intersection to the study area is SR 144 at Exchange Street / Rushing Street, and is located approximately 2,820 feet east of the signalized intersection of SR 144 at I-95 Southbound Ramp. There are no relatively close signalized intersections to the west of the study area.

The intersection of SR 144 at I-95 Northbound Ramp is considered for future signalization (studied under separate report cover). The distance between the I-95 Southbound Ramp and I-95 Northbound Ramp is approximately 370 feet.

2.8 ACCIDENT HISTORY

Accident data for the SR 144 study corridor was obtained from the Georgia Department of Transportation for years 2009-2013. Data covering the segment of SR 144 from Louis C. Gill Boulevard (just west of study area) to Oleander Street (just east of study area) was obtained. Note that while all crashes included in these totals occurred on SR 144, some crashes included in these totals may not have occurred within the study area due to incomplete location data logged. **Table 3** summarizes the number of accidents, injuries, fatalities, and number by type of accident.

Table 3
Five-Year Accident History
2009 – 2013

Year	Total Crashes	Injuries	Fatalities	Angle	Head-On	Rear-End	Sideswipe Same Direction	Sideswipe Opposite Direction	Other
2009	20	7	0	11	0	3	2	0	4
2010	18	7	0	4	0	9	2	0	3
2011	9	0	0	4	0	3	2	0	0
2012	10	5	0	3	0	5	2	0	0
2013	2	2	0	0	1	1	0	0	0

During the five-year period, the majority of crashes reported in the study area was of either angle crash type or rear-end crash type. The most recent three years (2011-2013) had fewer crashes than years 2009-2010. Rear-end crashes and angle crashes may be reduced with the installation of either a traffic signal or a modern roundabout. Also, with a modern roundabout, the severity of crashes is typically less due to slower travel speeds.

3.0 EXISTING TRAFFIC

Vehicle turning movement counts were collected on Thursday, August 23, 2012 by Traffic Data Services and provided by Grice Consulting Group. The weekday counts were performed during the AM peak period (7:00-9:00) and the PM peak period (4:00-6:00) at three of the study intersections: SR 144 at I-95 SB Ramp, SR 144 at I-95 NB Ramp, and SR 144 at Thunderbird Drive. The raw turning movement counts are included in **Appendix F**.

Twenty 24-hour weekday tube counts were collected during August 2012 by Traffic Data Services and provided by Grice Consulting Group. The tube counts were performed to gather the Average Daily Traffic (ADT) along SR 144, I-95 near SR 144, I-95 Ramps and the study intersection side-streets. Seven of the tube counts were automatic classification tube counts for heavy vehicle percentage data. The raw tube count data is included in **Appendix G**.

It should be noted that Grice Consulting Group created Traffic Flow Diagrams in November 2012 which documents balanced Design Hour Volumes (DHV) and balanced Average Daily Traffic (ADT) volumes for the Existing Year 2012, Base Year 2017, and Design Year 2037 scenarios. These Traffic Flow Diagrams also document peak hour truck percentages and 24-hour truck percentages along SR 144, I-95, and the I-95 Ramps. For Base Year 2017 and Design Year 2037, there is no difference between No-Build volumes and Build volumes. These Traffic Flow Diagrams have been approved by GDOT, thus, the diagrams' traffic volumes and truck percentages were used for all analysis scenarios in this study. The GDOT-approved Traffic Flow Diagrams are included in **Appendix E**.

Table 4 summarizes the balanced 2012 ADT volumes at a select few locations within the study area. These ADT volumes are from the Traffic Flow Diagrams, which have been approved by GDOT.

Table 4
Year 2012 Average Daily Traffic (ADT)
Source: Approved Traffic Flow Diagrams

ADT Location	Volume Direction	ADT (2012)
SR 144 west of I-95 SB Ramp	Two-Way Total	12,800
SR 144 east of I-95 NB Ramp	Two-Way Total	15,000
SR 144 between I-95 Ramps (under bridge)	Two-Way Total	13,900 (9,550 EB / 4,350 WB)
I-95 SB Exit Ramp & I-95 NB Entrance Ramp	One-Way	7,700
I-95 NB Exit Ramp & I-95 SB Entrance Ramp	One-Way	2,500
I-95 north of SR 144 Interchange	Two-Way Total	70,400

Graphs depicting the directional and 2-way total volumes by hour from 6 select tube counts within the study area are illustrated as **Figure 4**, **Figure 5**, **Figure 6**, **Figure 7**, **Figure 8**, and **Figure 9**.

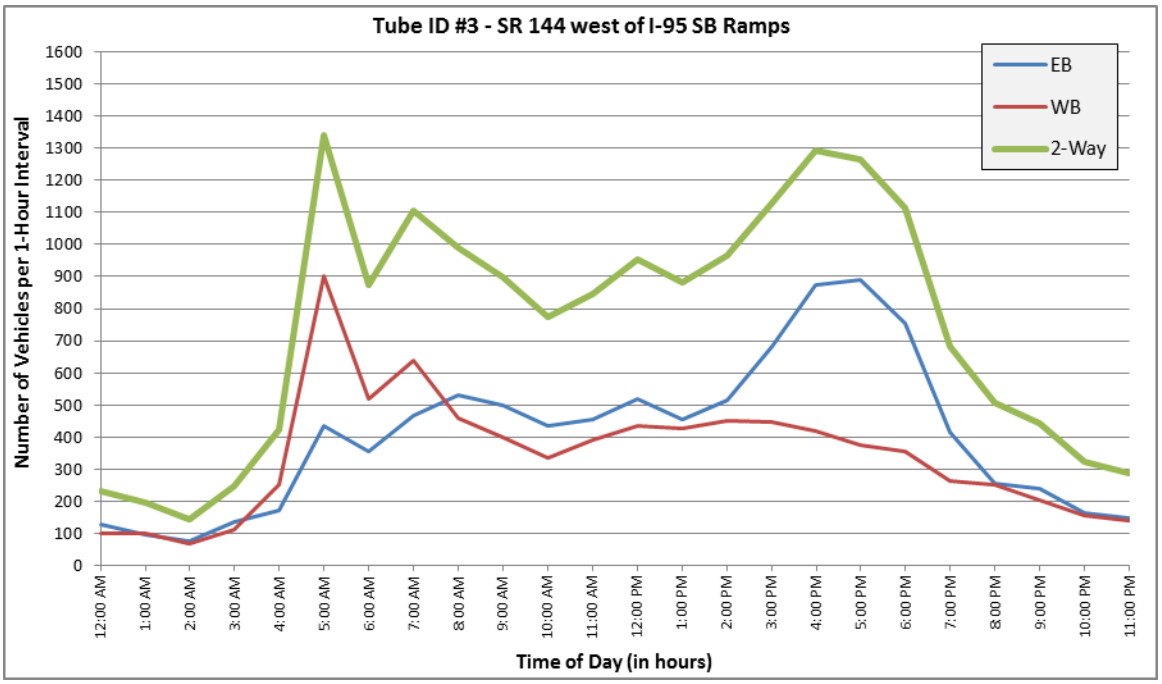


Figure 4: VPH Graph along SR 144 west of I-95 SB Ramps

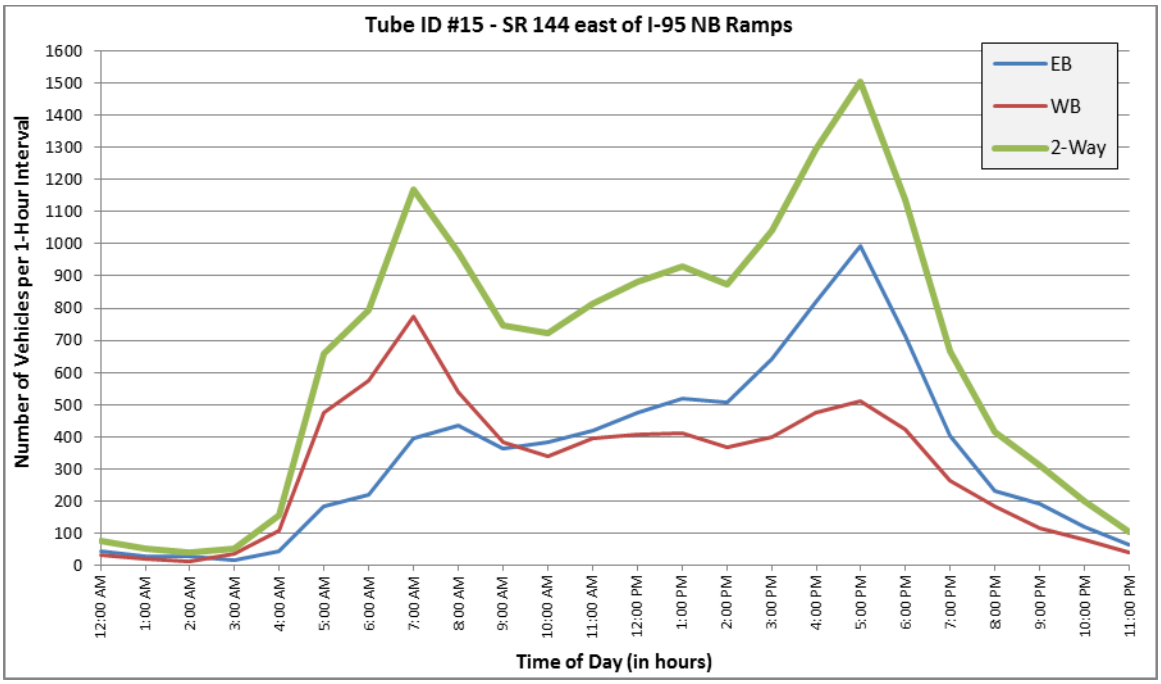


Figure 5: VPH Graph along SR 144 east of I-95 NB Ramps

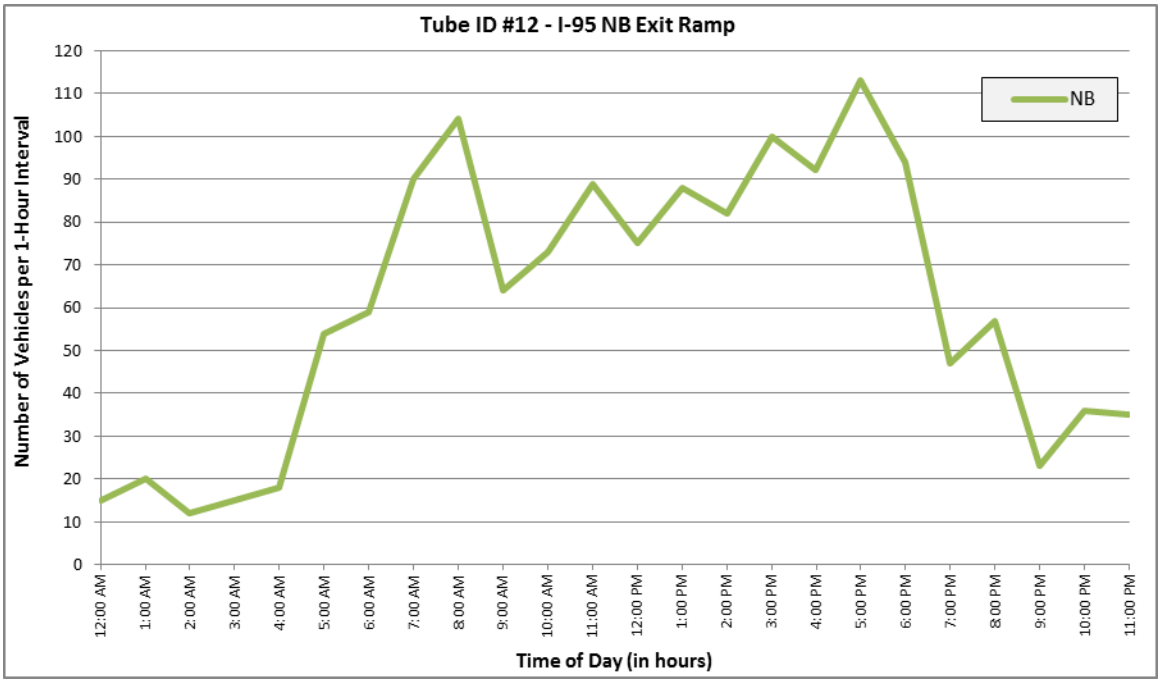


Figure 6: VPH Graph along the I-95 NB Exit Ramp

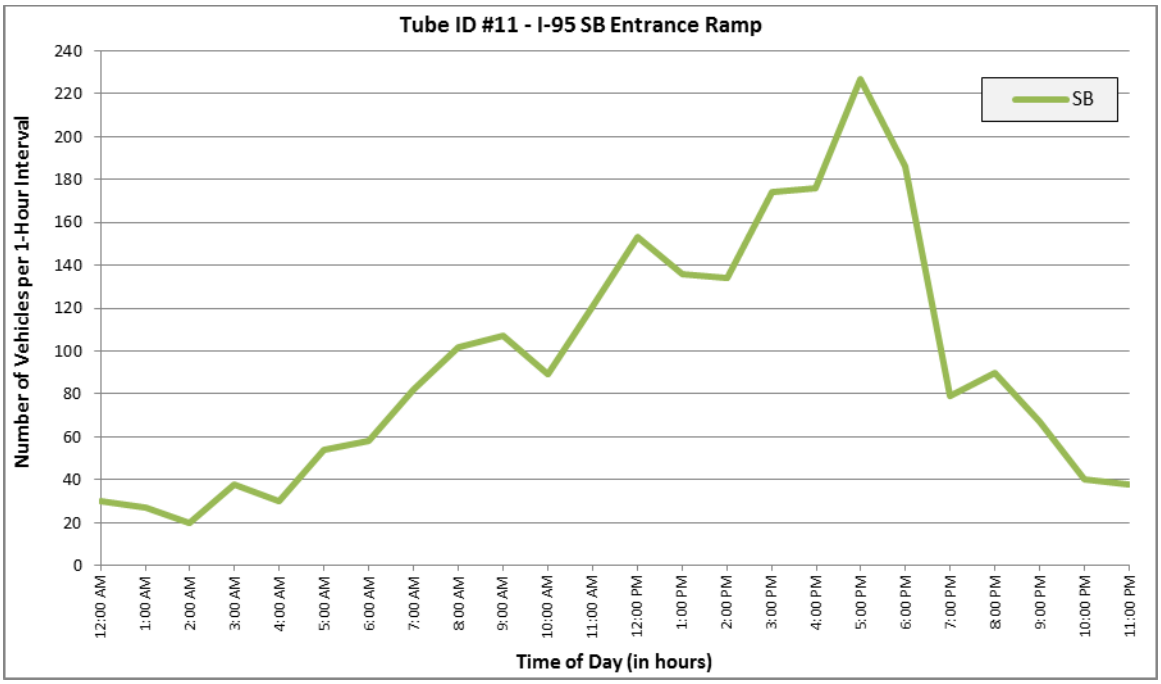


Figure 7: VPH Graph along the I-95 SB Entrance Ramp

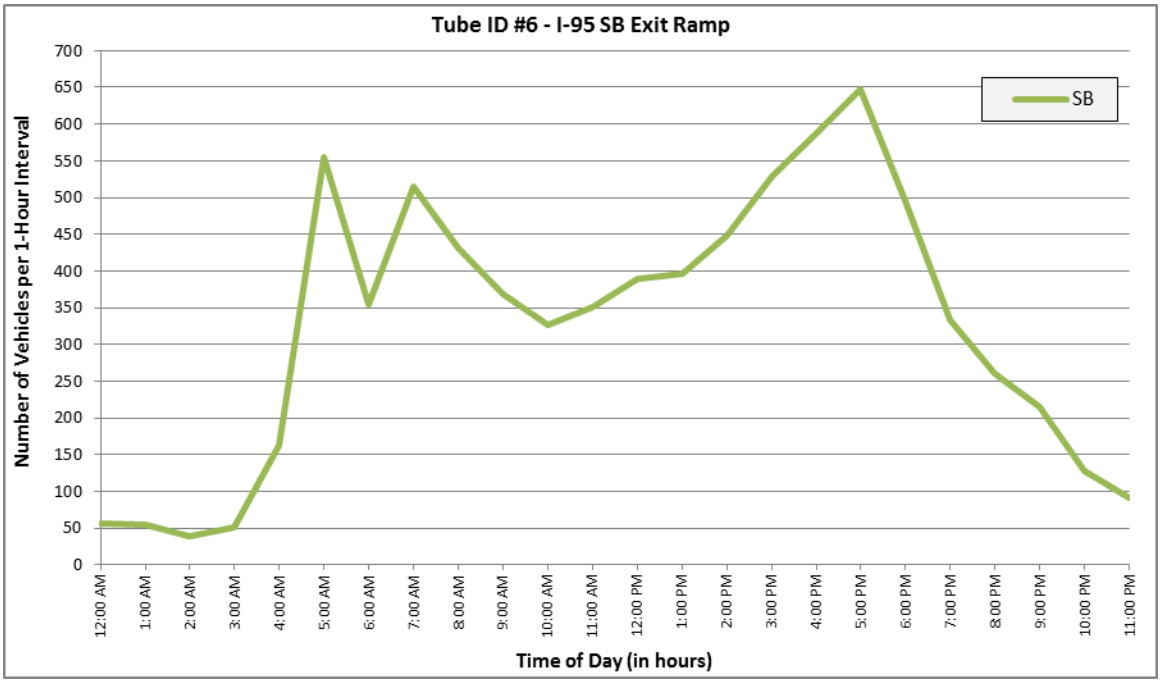


Figure 8: VPH Graph along the I-95 SB Exit Ramp

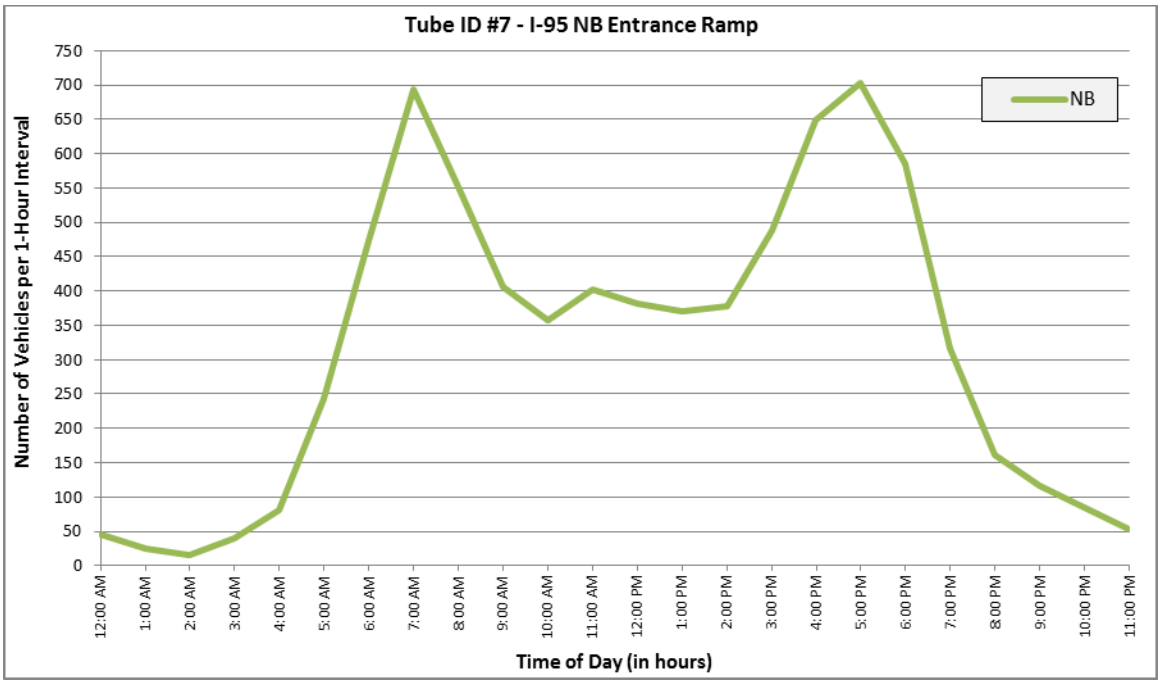


Figure 9: VPH Graph along the I-95 NB Entrance Ramp

Table 5 summarizes the peak hour and 24-hour truck percentages within the study area. These truck percentages are from the Traffic Flow Diagrams (see Appendix E), which have been approved by GDOT.

Table 5
Truck Percentages
Source: Traffic Flow Diagrams

Roadway	Time Period	Single-Unit (SU)	Multi-Unit (MU)	Total Trucks
SR 144	Peak Hour	5%	2%	7%
	24-Hour	5%	2%	7%
I-95	Peak Hour	7.5%	13.5%	21%
	24-Hour	7.5%	17%	24.5%

Table 6 summarizes historical Annual Average Daily Traffic (AADT) volumes as published by GDOT in their Traffic Count Database System at four GDOT count station locations.

Table 6
GDOT Historical Annual Average Daily Traffic (AADT)
Source: GDOT's Traffic Count Database System

Year	SR 144 east of Laurel Street (#0290178)	SR 144 west of Longwood Drive (#0290181)	I-95 north of SR 144 (#0290198)	I-95 south of SR 144 (#0290196)
2007	11,180	4,650	71,970	60,040
2008	11,060	5,020	69,780	57,230
2009	11,750	5,060	69,380	56,090
2010	12,370	6,490	71,060	59,460
2011	12,660	6,360	67,920	57,530
2012	13,100	6,990	67,950	58,440

4.0 FUTURE VOLUME DEVELOPMENT

Intersection traffic growth projections were determined by Grice Consulting Group and incorporated into their future traffic volume development. Their chosen background traffic growth rate(s) were used to develop DHVs and ADT volumes for the Base Year 2017 and Design Year 2037 scenarios, which are included in **Appendix E**.

For informational purposes, Kimley-Horn backward-calculated the approved future traffic volumes to approximate the growth rates used in their development. Along the SR 144 corridor, an approximate growth rate of 2.30% per year for 5 years was applied to the Existing Year 2012 traffic volumes to determine the Base Year 2017 traffic volumes, and an approximate growth rate of 1.90% per year for 20 years was applied to the Base Year 2017 traffic volumes to determine the Design Year 2037 traffic volumes. Along I-95, an approximate growth rate of 2.05% per year for 5 years was applied to the Existing Year 2012 traffic volumes to determine the Base Year 2017 traffic volumes, and an approximate growth rate of 1.65% per year for 20 years was applied to the Base Year 2017 traffic volumes to determine the Design Year 2037 traffic volumes.

5.0 OPERATIONAL ANALYSIS

5.1 INTRODUCTION

Capacity is defined as the maximum number of vehicles that can pass over a particular road segment or through a particular intersection within a specified period under prevailing roadway, traffic, and control conditions. Level-of-service (LOS) is used to describe the operating characteristics of a road segment or intersection in relation to its capacity. LOS is defined as a qualitative measure that describes operational conditions and motorists' perceptions within a traffic stream. The *Highway Capacity Manual* (HCM) defines six levels-of-service, LOS A through LOS F, with A being the best and F the worst. Intersection analyses were performed using *Synchro, Version 8* (signalization optimization and intersection analysis program) and *SIDRA INTERSECTION 6* (roundabout analysis program).

LOS at intersections can be defined as a function of the average overall wait time for a vehicle to pass through the intersection. This way, LOS can be quantitatively measured at any intersection. Shown below are the LOS criteria as defined by the HCM.

Signalized Intersections		Unsignalized Intersections	
A	≤10 sec	A	≤10 sec
B	10-20 sec	B	10-15 sec
C	20-35 sec	C	15-25 sec
D	35-55 sec	D	25-35 sec
E	55-80 sec	E	35-50 sec
F	≥80 sec	F	≥50 sec

LOS for signalized intersections is reported for individual movements as well as for the intersection as a whole. One or more movements at an intersection may experience a low LOS, while the intersection as a whole may operate acceptably. An overall signalized intersection LOS of D or better is generally the desirable threshold for operating conditions.

LOS for unsignalized intersections, with stop control on the minor street only, is reported for the side street approaches. Low and failing levels-of-service for side street approaches are not uncommon, as vehicles may experience significant delay in turning onto a major roadway. An unsignalized side street approach LOS of E or better is generally the accepted minimum threshold for operating conditions.

LOS for modern roundabouts is reported for individual movements as well as for the roundabout as a whole. One or more movements at an intersection may experience a low LOS, while the roundabout as a whole may operate acceptably. An overall roundabout LOS of D or better is generally the desirable threshold for operating conditions.

AM peak hour and PM peak hour Level-of-Service analyses (described and reported in *Section 5.3 – Intersection Level-of-Service Analysis*) were performed for Existing Year 2012 Conditions, No-Build Base Year 2017 Conditions, No-Build Design Year 2037 Conditions, Build Base Year 2017 Conditions, and Build Design Year 2037 Conditions. Queuing analyses were also performed for these scenarios, which are described and reported in *Section 5.4 – Queue Length Analysis*.

5.2 GDOT ROUNDABOUT POLICY

According to GDOT's Design Policy Manual, "a roundabout shall be considered in the following situations:

- For any intersection being designed on new location or to be reconstructed;
- For any existing intersection that has been identified as needing major safety or operational improvement (or where improvements are otherwise planned); and
- For all intersections where a request for a traffic signal has been made."

For single-lane roundabouts, the total design year ADT entering the intersection should be less than 25,000 veh/day. For two-lane roundabouts, the total design year ADT entering the intersection should be less than 45,000 veh/day. From the traffic flow diagrams, the approximate Existing Year 2012 ADT entering the I-95 SB Ramp and I-95 NB Ramp intersections is 18,450 veh/day and 19,550 veh/day, respectively. Therefore, the total ADT requirement for single-lane roundabouts under Existing Year 2012 conditions is satisfied for each of the two I-95 Ramp intersections. From the traffic flow diagrams, the approximate Design Year 2037 ADT entering the I-95 SB Ramp and I-95 NB Ramp intersections is 30,150 veh/day and 31,900 veh/day, respectively. The total ADT requirement for single-lane roundabouts under projected Design Year 2037 conditions is <u>not</u> satisfied for each of the two I-95 Ramp intersections; however, the total ADT requirement for dual-lane roundabouts is satisfied. Therefore, each of the two I-95 Ramp intersections should be considered for dual-lane roundabouts.

For single-lane roundabouts and two-lane (dual-lane) roundabouts, the percentage of total traffic along the major road should be less than 90%. From the traffic flow diagrams, the approximate percentage of total traffic along the major road (SR 144) for the I-95 SB Ramp and I-95 NB Ramp intersections is 72% and 74%, respectively. Therefore, the major road percentage of total traffic requirement is satisfied for each of the two I-95 Ramp intersections.

5.3 INTERSECTION LEVEL-OF-SERVICE ANALYSIS

Intersection Level-of-Service (LOS) analyses were performed for the study intersections for Existing Year 2012 Conditions, No-Build Base Year 2017 Conditions, No-Build Design Year 2037 Conditions, Build Base Year 2017 Conditions, and Build Design Year 2037 Conditions.

Analysis for Existing Year 2012 Conditions assumed the existing roadway geometry (intersection laneage), existing control types, and Existing Year 2012 traffic volumes used for this analysis, as shown on **Figure 10**.

The Base Year 2017 traffic volumes and Design Year 2037 traffic volumes are shown on **Figure 11** and **Figure 12**, respectively. For Base Year 2017 and Design Year 2037, there is no difference between No-Build volumes and Build volumes. Analysis for No-Build Base Year 2017 Conditions and No-Build Design Year 2037 Conditions assume existing roadway geometry (intersection laneage) and existing control types as shown on **Figure 10**. Analysis for Build Base Year 2017 Conditions and Build Design Year 2037 Conditions assume proposed roadway geometry (intersection laneage) and projected volumes as shown on **Figure 11** and **Figure 12**, respectively.

The proposed roadway geometry (intersection laneage) is described in *Section 7.1 – Recommendations*, and is illustrated on the concept layout in **Appendix A**. Geometric analyses for fastest vehicular path and WB-67 truck turning templates are included in **Appendix C**.

Table 7 summarizes the level-of-service and average delay per vehicle (in seconds) for each of the study intersections for each of the aforementioned scenarios during the AM peak hour and PM peak hour. The *Synchro* level-of-service analysis results are included in **Appendix H**. The *SIDRA* level-of-service analysis results are included in **Appendix I**.

LEGEND

- Existing Roadway Laneage
- Existing Traffic Signal
- STOP Existing STOP Control
- XX AM Peak Hour Traffic Volumes
- (XX) PM Peak Hour Traffic Volumes
- [XX] Two-Way Daily Traffic Volumes
- (X) Intersection Reference Number

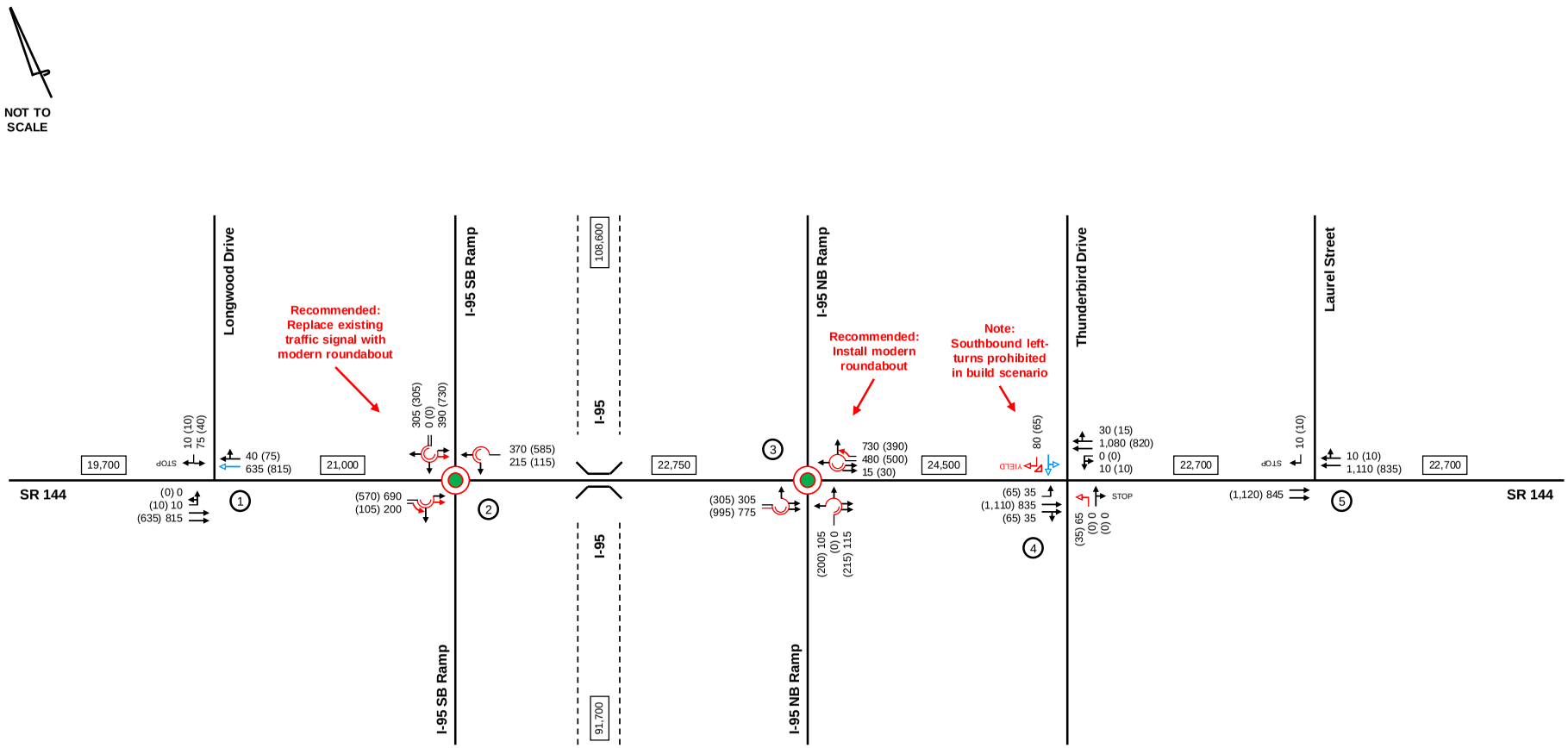
Kimley»Horn	SR 144 Widening at I-95 Traffic Engineering Study	Existing 2012 Laneage & Volumes	Figure 10

LEGEND

- Existing Roadway Laneage
- Build Roadway Laneage
- Removed Roadway Laneage
- Proposed Roundabout
- STOP Existing STOP Control
- XX AM Peak Hour Traffic Volumes
- (XX) PM Peak Hour Traffic Volumes
- [XX] Two-Way Daily Traffic Volumes
- (X) Intersection Reference Number

Note: Base Year 2017 traffic volumes are the same for both the No-Build and Build scenarios.

Kimley»Horn	SR 144 Widening at I-95 Traffic Engineering Study	Recommended Base Year 2017 (Build) Laneage & Volumes	Figure 11



LEGEND

- Existing Roadway Laneage
- Build Roadway Laneage
- Removed Roadway Laneage
- Proposed Roundabout
- STOP — Existing STOP Control
- XX — AM Peak Hour Traffic Volumes
- (XX) — PM Peak Hour Traffic Volumes
- [XX] — Two-Way Daily Traffic Volumes
- (X) — Intersection Reference Number

Note: Design Year 2037 traffic volumes are the same for both the No-Build and Build scenarios.

Kimley»Horn

SR 144 Widening at I-95
Traffic Engineering Study

Recommended
Design Year 2037 (Build)
Laneage & Volumes

Figure
12

Table 7
Intersection Level-of-Service Summary
AM Peak Hour and PM Peak Hour
LOS (average delay per vehicle in seconds)

ID	Intersection Name	Control	Existing 2012	No-Build Base 2017	No-Build Design 2037	Build Base 2017	Build Design 2037
AM Peak Hour							
1	SR 144 at Longwood Drive	SB Stop	C (16.9)	C (19.8)	E (46.8)	C (20.1)	E (48.9)
2	SR 144 at I-95 SB Ramp*	Signal	C (21.4)	C (23.4)	E (59.9)	---	---
		Roundabout*	---	---	---	A (9.7)	B (14.5)
3	SR 144 at I-95 NB Ramp*	NB Stop	F (111)	F (259)	F(**)	---	---
		EB Left Yield	A (8.7)	A (9.1)	B (10.7)	---	---
		Roundabout*	---	---	---	A (7.3)	A (8.9)
4	SR 144 at Thunderbird Drive	NB Stop	D (34.4)	E (48.8)	F (447)	F (51.8)	F (513)
		SB Stop	C (16.0)	C (17.9)	F (50.0)	B (12.2)	C (16.0)
5	SR 144 at Laurel Street (RI/RO)	SB Stop	B (11.0)	B (11.5)	B (13.9)	B (11.5)	B (13.9)
PM Peak Hour							
1	SR 144 at Longwood Drive	SB Stop	C (16.7)	C (18.9)	E (37.3)	C (19.7)	E (40.5)
2	SR 144 at I-95 SB Ramp*	Signal	C (25.0)	C (28.6)	F (89.0)	---	---
		Roundabout*	---	---	---	B (11.7)	C (24.3)
3	SR 144 at I-95 NB Ramp*	NB Stop	F (563)	F (**)	F (**)	---	---
		EB Left Yield	A (8.8)	A (9.1)	B (10.7)	---	---
		Roundabout*	---	---	---	A (8.8)	C (16.9)
4	SR 144 at Thunderbird Drive	NB Stop	E (35.1)	E (48.3)	F (306)	F (52.9)	F (380)
		SB Stop	C (20.4)	C (22.9)	F (87.4)	B (10.8)	B (12.7)
5	SR 144 at Laurel Street (RI/RO)	SB Stop	B (10.2)	B (10.5)	B (11.9)	B (10.5)	B (11.9)

* A modern roundabout is recommended at this intersection. This intersection was analyzed with both existing geometry (existing and no-build) and proposed roundabout geometry (build; as shown on the concept layout in Appendix A).

** Long delays (cannot calculate – outside Synchro limitations) due to stop control on minor street only with heavy major street volume.

Legend: RI/RO = Right-In/Right-Out Only, NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

Under No-Build Design Year 2037 Conditions, the currently-signalized intersection of SR 144 at I-95 SB Ramp (Intersection #2) is projected to operate at LOS E and LOS F during the AM peak hour and PM peak hour, respectively. With the implementation of a modern roundabout with the proposed roadway geometry (refer to Figure 11, Figure 12, and Appendix A), this intersection (Intersection #2) is projected to improve to LOS B and LOS C during the AM peak hour and PM peak hour, respectively, under Build Design Year 2037 Conditions.

Under Existing Year 2012 Conditions, the stop-controlled side-street movement at the intersection of SR 144 at I-95 NB Ramp (Intersection #3) currently operates at LOS F during the AM and PM peak hours, and vehicular delays are projected to increase in the future year scenarios. With the implementation of a modern roundabout with the proposed roadway geometry (refer to Figure 11, Figure 12, and Appendix A), this intersection (Intersection #3) is projected to improve to an overall LOS A and LOS C during the AM peak hour and PM peak hour, respectively, under Build Design Year 2037 Conditions.

Under Build Design Year 2037 Conditions, the stop-controlled side-street movements at the intersections of SR 144 at Longwood Drive (Intersection #1) and SR 144 at Laurel Street (Intersection #5) are projected to operate at LOS E and LOS B, respectively, during the AM and PM peak hours. The stop-controlled side-street movements at the intersection of SR 144 at Thunderbird Drive (Intersection #4) are projected to operate at LOS F/F (NB approach, AM/PM peak hour) and LOS C/B (SB approach, proposed right-in/right-out configuration, AM/PM peak hour) under Build Design Year 2037 Conditions. As discussed above, it is typical for unsignalized intersections to show extreme delay for the side-street stop-controlled movements along a multi-lane facility such as SR 144.

5.4 QUEUE LENGTH ANALYSIS

Queuing analyses were performed for the study intersections for Build Design Year 2037 Conditions. The queuing analysis focused on the I-95 exit ramps and major street left-turn lanes. For the purposes of this queue length analysis, the proposed roadway geometry (intersection laneage) for the recommended modern roundabouts was assumed.

The proposed roadway geometry (intersection laneage) is described in *Section 7.1 – Recommendations*, and is illustrated on the concept layout in **Appendix A**.

Table 8 summarizes the 95th percentile queue lengths (in feet) for each of the study intersections for Build Design Year 2037 Conditions during the AM peak hour and PM peak hour. The *Synchro* queue length analysis results are included in **Appendix H**. The *SIDRA* queue length analysis results are included in **Appendix I**.

Table 8 Queue Length Summary Build Design Year 2037 Conditions – AM Peak Hour and PM Peak Hour 95th Percentile Queues (in feet) and Existing/Proposed Storage (in feet)							
ID	**Intersection Name**	**Movement**	**Control**	**Existing Storage**	**Proposed Storage**	**AM Peak Queue**	**PM Peak Queue**
1	SR 144 at Longwood Drive	EB Left	Yield	220	*	5	5
2	SR 144 at I-95 SB Ramp *(Roundabout)*	Southbound	Yield	940 / 650	*	120	515
3	SR 144 at I-95 NB Ramp *(Roundabout)*	Northbound	Yield	1,040	*	65	290
4	SR 144 at Thunderbird Drive	EB Left	Yield	105	100	10	10

* No roadway geometry changes are proposed to affect the storage length of this movement.

Under Build Design Year 2037 Conditions (refer to Figure 11, Figure 12, and Appendix A), the 95th percentile queue lengths for the I-95 exit ramps and major street left-turn lanes in the study area do not appear to be problematic.

6.0 TRAFFIC SIGNAL ALTERNATIVE – NOT RECOMMENDED

A complete traffic signal warrant analysis for the currently unsignalized intersection of SR 144 at I-95 NB Ramp (Intersection #3) was performed, and is provided under a separate report cover. Since the completion of referenced traffic signal warrant analysis, a traffic signal is no longer recommended; instead, a modern roundabout is recommended per this roundabout feasibility study.

Note that this section is provided for informational purposes only.

As an alternative to installing modern roundabouts at the two I-95 ramp intersections with SR 144, consideration was given to installing a traffic signal at the intersection of SR 144 at I-95 NB Ramp (Intersection #3). Along with installing a traffic signal at the NB Ramp intersection, the SB Ramp intersection would remain signalized and roadway geometry improvements would be implemented, as part of this traffic signal alternative.

Similar to the analyses performed and described in *Section 5* of this report, Intersection Level-of-Service (LOS) analyses were performed for the I-95 Ramp intersections (Intersections #2 and #3) for Build Base Year 2017 Conditions and Build Design Year 2037 Conditions.

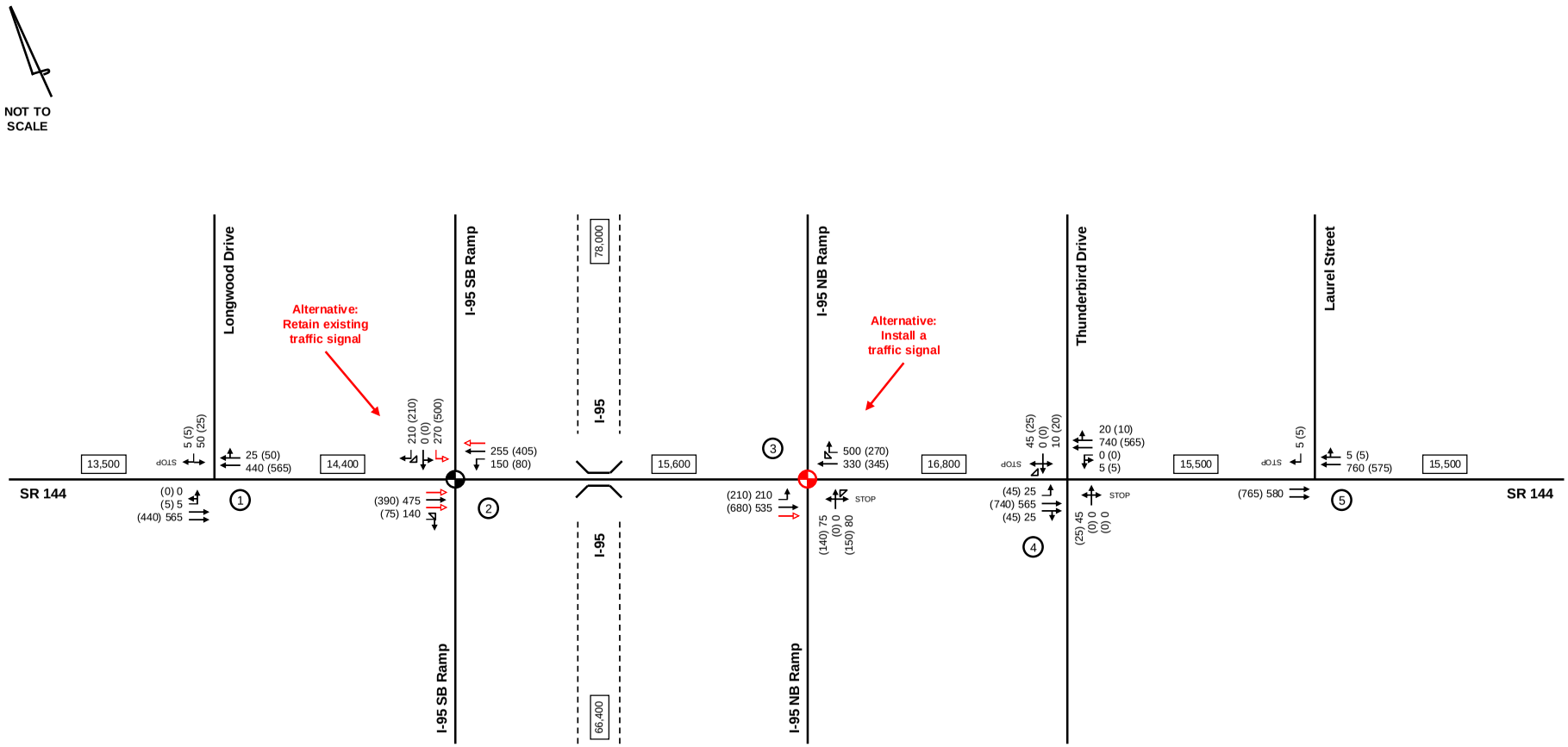
Analysis for this traffic signal alternative assume proposed roadway geometry (intersection laneage) and projected volumes as shown on **Figure 13** and **Figure 14**. The roadway geometry for this traffic signal alternative is illustrated on the alternative concept layout in **Appendix B**.

Table 9 summarizes the level-of-service and average delay per vehicle (in seconds) for the two I-95 Ramp intersections for each of the aforementioned scenarios during the AM peak hour and PM peak hour. The *Synchro* level-of-service analysis results are included in **Appendix H**.

Table 9
Traffic Signal Alternative: Intersection Level-of-Service Summary
AM Peak Hour and PM Peak Hour
LOS (average delay per vehicle in seconds)

ID	Intersection Name	Control	Build Base 2017	Build Design 2037
AM Peak Hour				
2	SR 144 at I-95 SB Ramp	Signal	B (18.0)	B (19.7)
3	SR 144 at I-95 NB Ramp	Signal	A (9.8)	C (21.6)
PM Peak Hour				
2	SR 144 at I-95 SB Ramp	Signal	B (19.6)	C (21.7)
3	SR 144 at I-95 NB Ramp	Signal	B (18.1)	C (34.5)

From the results shown in Table 9, implementing this traffic signal alternative (which includes the proposed roadway widening and turn lanes as illustrated in the concept layout in Appendix B) would result in an acceptable LOS for each of the two I-95 Ramp intersections under projected Build Design Year 2037 Conditions. In comparison, installing modern roundabouts at each of the two I-95 Ramp intersections (per the concept layout in Appendix A) is projected to operate with less vehicular delay during the AM Peak Hour and PM Peak Hour (with the one exception of the SB Ramp during the PM Peak Hour under projected 2037 conditions), with less roadway widening, compared to this traffic signal alternative (refer to Table 7 for comparison).



Note: Base Year 2017 traffic volumes are the same for both the No-Build and Build scenarios.

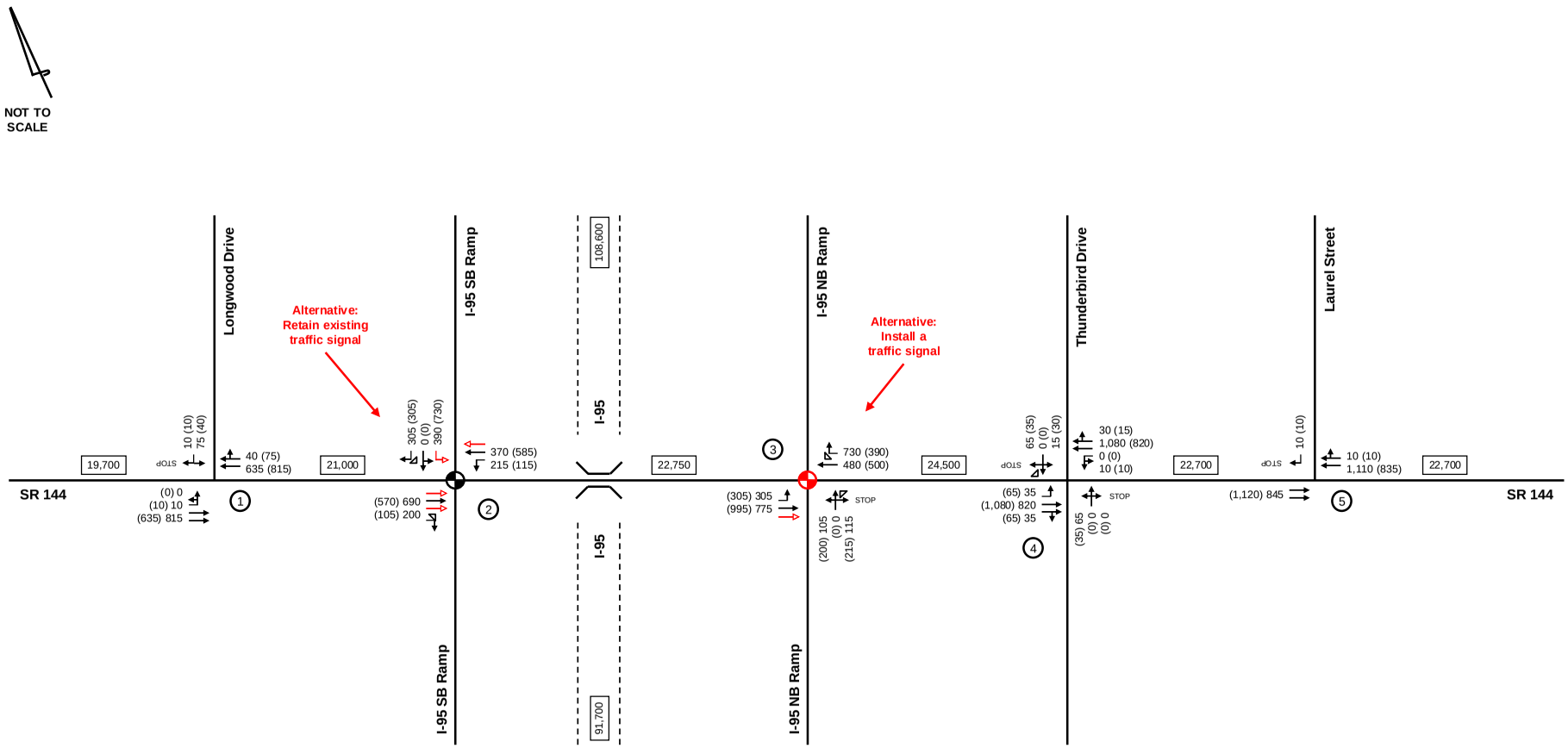
Note: This alternative concept is not recommended; included for informational purposes only.

Kimley»Horn

SR 144 Widening at I-95
Traffic Engineering Study

Alternative
Base Year 2017 (Build)
Laneage & Volumes

Figure 13



LEGEND

- Existing Roadway Laneage
- Build Roadway Laneage
- Existing Traffic Signal
- Proposed Traffic Signal (under consideration)
- STOP Existing STOP Control
- XX AM Peak Hour Traffic Volumes
- (XX) PM Peak Hour Traffic Volumes
- XX Two-Way Daily Traffic Volumes
- X Intersection Reference Number

Note: Design Year 2037 traffic volumes are the same for both the No-Build and Build scenarios.

Note: This alternative concept is not recommended; included for informational purposes only.

Kimley»Horn

SR 144 Widening at I-95
Traffic Engineering Study

Alternative
Design Year 2037 (Build)
Laneage & Volumes

Figure 14

7.0 CONCLUSION

The segment of SR 144 (Ford Avenue) between Longwood Drive and Laurel Street in Bryan County, Georgia, has been identified for an operational analysis by GDOT. This traffic engineering study was completed in an effort to determine what geometric and operational improvements could be made to improve traffic operations and safety along the studied roadway, particularly at the I-95 Southbound and Northbound Ramp intersections.

SR 144 serves as a main corridor through Richmond Hill, providing access to many of the City's businesses and institutions. SR 144 (Ford Avenue) intersects I-95 at the 68.3-mile mark, on the western side of Richmond Hill, Georgia. The project limits along SR 144 are from the intersection with Longwood Drive to the intersection with Laurel Street and covers approximately 0.20 miles.

The proposed improvements are planned to be constructed and open to traffic by year 2017 (Base Year) with a 20-year design horizon of 2037 (Design Year). This report summarized the data collection, accident data, analysis of traffic conditions, and conclusions from the analysis of Existing Year 2012 Conditions, No-Build Base Year 2017 Conditions, No-Build Design Year 2037 Conditions, Build Base Year 2017 Conditions, and Build Design Year 2037 Conditions.

Based on the results of the analyses contained within this roundabout feasibility study, the installation of modern roundabouts at each of the I-95 Ramp intersections at SR 144 is recommended, per the proposed roadway geometry illustrated on the concept layout in **Appendix A**. The recommended improvements and proposed roadway geometry are further described in *Section 7.1 – Recommendations*.

7.1 RECOMMENDATIONS

Based on the projected Base Year 2017 Conditions and the projected Design Year 2037 Conditions, we offer the following (please refer to the recommended concept layout in **Appendix A**):

SR 144 (Ford Avenue) at I-95 Southbound Ramp (Intersection #2)

- Install a modern roundabout.
  - Provide two circulating lanes from the northern leg to the eastern leg.
  - Provide one circulating lane from the eastern leg to the northern leg.
- Provide dual southbound approach lanes along the I-95 Southbound Exit Ramp.
  - Both southbound approach lanes enter the roundabout.
- Provide dual eastbound approach lanes along SR 144.
  - The inside eastbound approach lane enters the roundabout.
  - The outside eastbound approach lane bypasses the roundabout and intersects with the southern leg without an acceleration lane (yield control).
- Provide a single westbound approach lane along SR 144.
- Provide a single westbound exiting lane along SR 144.
- Provide dual eastbound exiting lanes along SR 144, resulting in two eastbound travel lanes under the I-95 overpass.

SR 144 (Ford Avenue) at I-95 Northbound Ramp (Intersection #3)

- Install a modern roundabout.
  - Provide two circulating lanes from the western leg to the eastern leg.
  - Provide one circulating lane from the eastern leg to the western leg.
- Provide a single northbound approach lane along the I-95 Northbound Exit Ramp.
- Provide dual eastbound approach lanes along SR 144.
  - Both eastbound approach lanes enter the roundabout.
- Provide dual westbound approach lanes along SR 144.
  - The inside westbound approach lane enters the roundabout.
  - The outside westbound approach lane bypasses the roundabout and intersects with the northern leg without an acceleration lane (yield control).
- Provide dual eastbound exiting lanes along SR 144.
- Provide a single westbound exiting lane along SR 144, resulting in one westbound travel lane under the I-95 overpass.

SR 144 (Ford Avenue) at Thunderbird Drive (Intersection #4)

- Convert the southbound approach from full-movement to channelized right-turn only.
  - Retain the existing eastbound left-turn and westbound right-turn movements from SR 144 onto Thunderbird Drive.
  - Provide one circulating lane from the eastern leg to the western leg.
- Reconstruct the gas station access (southern leg) to be a single driveway with one ingress lane and two egress lanes.

APPENDIX A

Recommended Concept Layout (Modern Roundabouts)

SR 144 at I-95 SB & NB Ramps

PI NO.: 0010739

SCALE IN FEET
0 50 100 200

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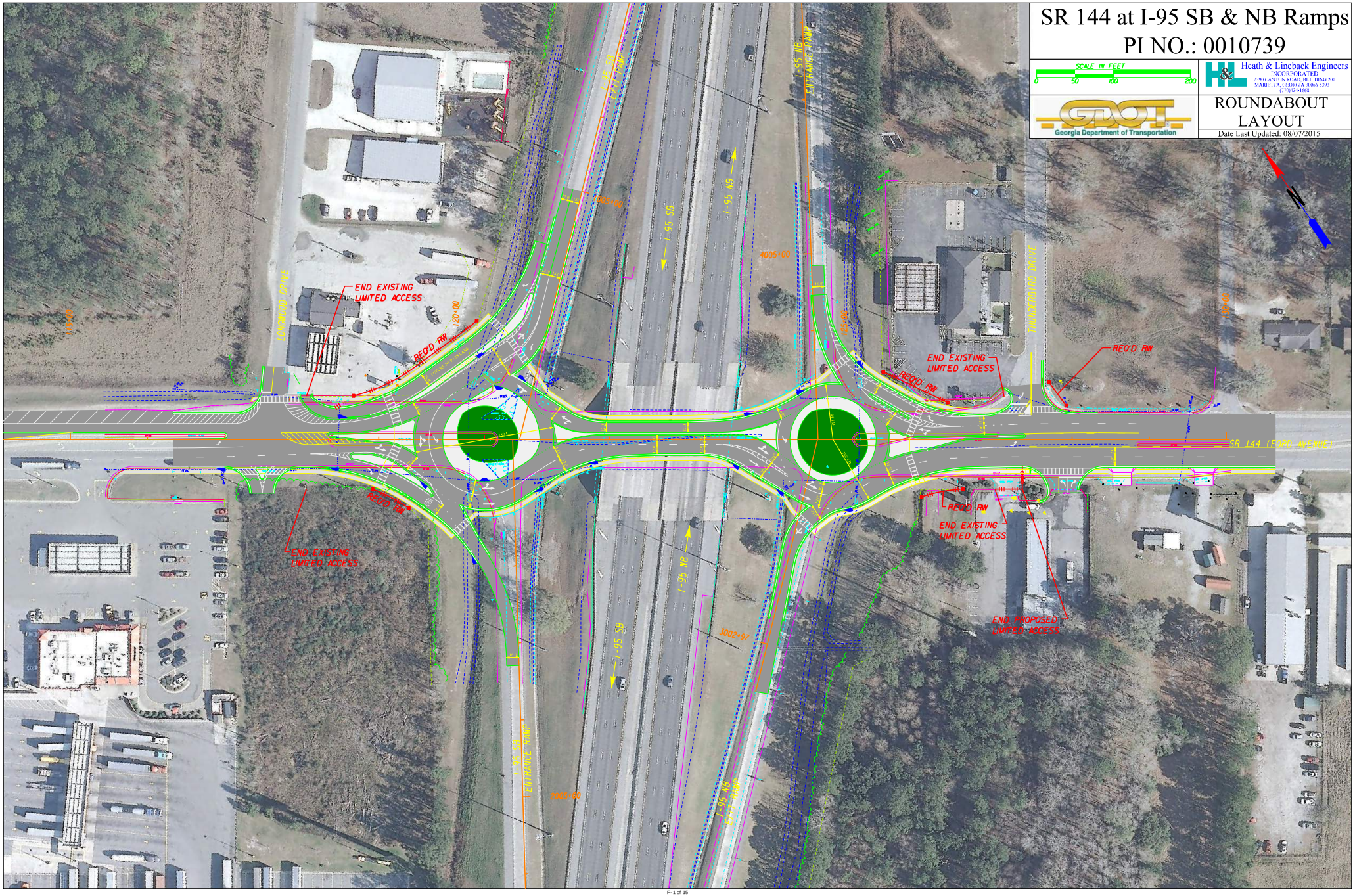
Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET
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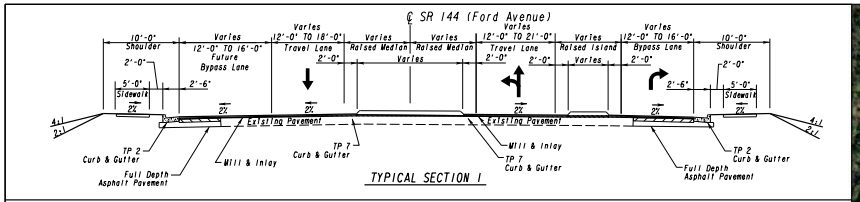
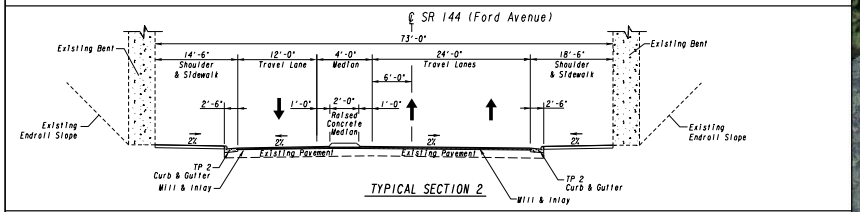
Date Last Updated: 08/07/2015



TYPICAL SECTION 1



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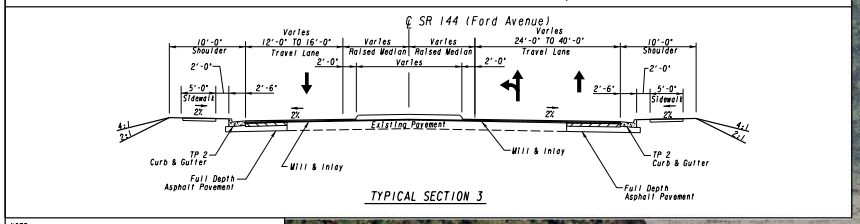
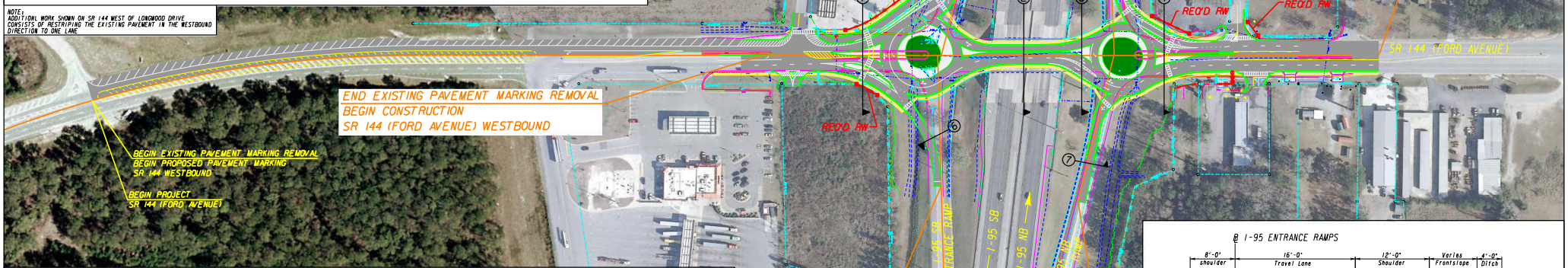
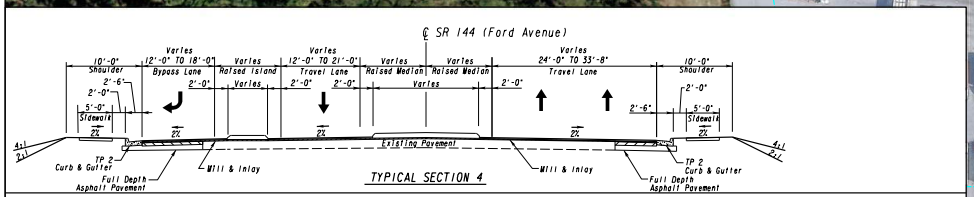


TYPICAL SECTION 3

NOTE:
ADDITIONL WORK SHOWN ON SR 144 WEST OF LONGWOOD DRIVE CONSISTS OF RESTRIPING THE EXISTING PAVEMENT IN THE WESTBOUND DIRECTION TO ONE LANE





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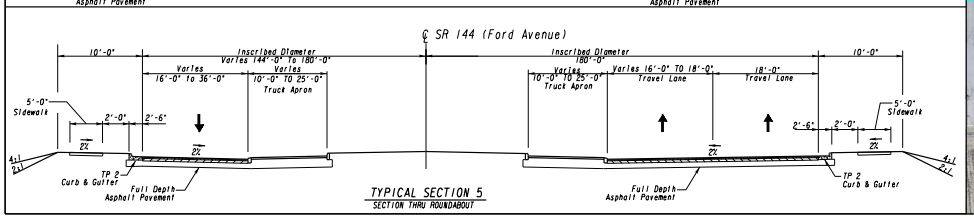
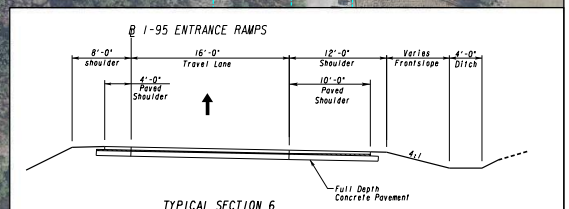
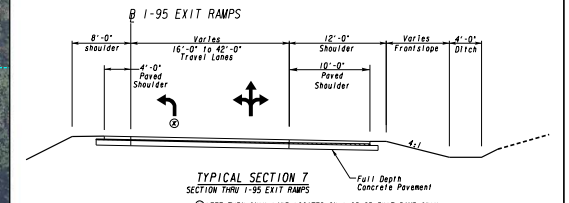


TYPICAL SECTION 5
SECTION THRU ROUNDABOUT



TYPICAL SECTION 6
SECTION THRU I-95 ENTRANCE RAMPS



TYPICAL SECTION 7
SECTION THRU I-95 EXIT RAMPS

(8) LEFT TURN ONLY LANE LOCATED ON I-95 SB EXIT RAMP ONLY

APPENDIX B

Alternative Concept Layout (Traffic Signals and Widening)

Note: For informational purposes only; this concept not recommended.

SR 144 at I-95 SB & NB Ramps

SCALE IN FEET
0 50 100 200

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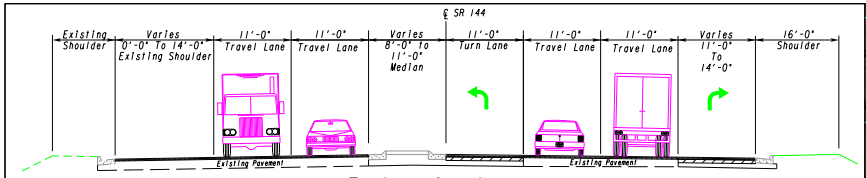
Draft Concept Layout



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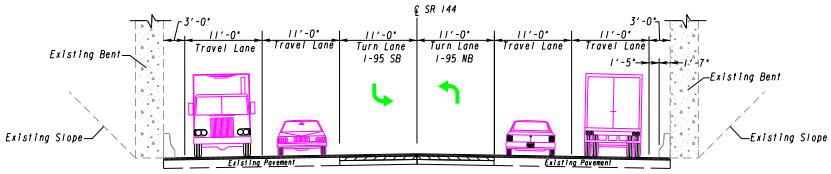
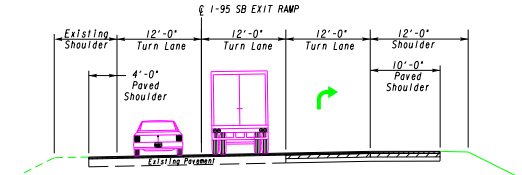


Typical Section 2



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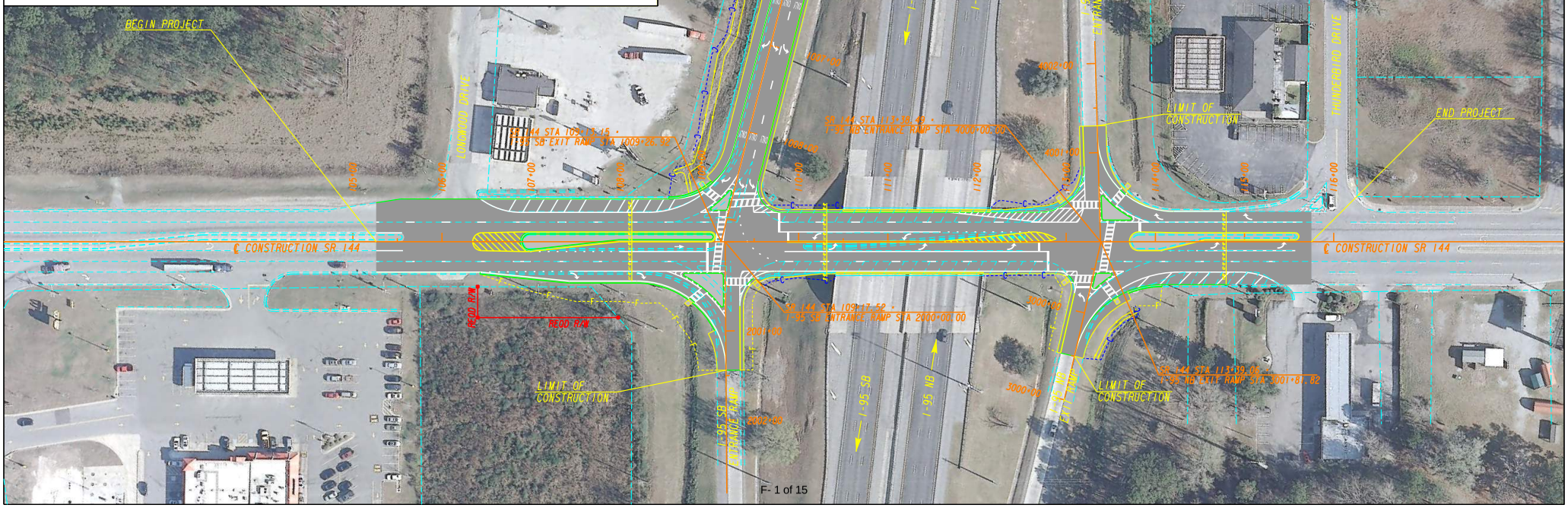

APPENDIX C

Vehicular Paths:

Fastest Path

WB-67 Truck Turning Templates

COMP. BY	W.D.	DATE	8/7/2015			SHEET 1	OF 4
CHKD. BY		DATE		Heath & Lineback Engineers INCORPORATED		JOB NO. 2011.006.020	
						PROJECT NO. 10739	
PROJECT	SR 144 at I-95 Intersection Improvements			STRUCTURE	Fastest Path Calculations		

SR 144 Eastbound Fastest Path Calculations:

Radius Number:	Radius Value:		V= (S.E.)	Estimated Vehicle Speed:
R1 =	188	so:	V (0%) =	24.8
R2 =	148	so:	V (+2%) =	23.7
R3 =	157	so:	V (0%) =	23.2
R4 =	158	so:	V (+2%) =	24.3
R5 =	273	so:	V (-2%) =	27.2
R6 =	61	so:	V (+2%) =	16.8
R7 =	61	so:	V (+2%) =	16.8

Note: Speeds at 0% SE were assumed as the average of the (+2%) & (-2%) calculated speeds

SR 144 Westbound Fastest Path Calculations:

Radius Number:	Radius Value:		V= (S.E.)	Estimated Vehicle Speed:
R1 =	153	so:	V (0%) =	22.98
R2 =	90	so:	V (+2%) =	19.56
R3 =	172	so:	V (0%) =	24.02
R4 =	410	so:	V (0%) =	33.33
R5 =	147	so:	V (0%) =	22.64
R6 =	96	so:	V (+2%) =	20.05
R7 =	187	so:	V (0%) =	24.79
R8 =	77	so:	V (+2%) =	18.41
R9 =	77	so:	V (+2%) =	18.41

Note: Speeds at 0% SE were assumed as the average of the (+2%) & (-2%) calculated speeds

I-95 Southbound Ramps Fastest Path Calculations:

Radius Number:	Radius Value:		V= (S.E.)	Estimated Vehicle Speed:
R1 =	255	so:	V (0%) =	27.9
R2 =	117	so:	V (+2%) =	21.6
R3 =	116	so:	V (0%) =	20.7
R4 =	60	so:	V (+2%) =	16.7
R5 =	319	so:	V (-2%) =	28.8
R6 =	176	so:	V (+2%) =	25.3
R7 =	256	so:	V (0%) =	27.9

Note: Speeds at 0% SE were assumed as the average of the (+2%) & (-2%) calculated speeds

I-95 Northbound Ramps Fastest Path Calculations

Radius Number:	Radius Value:		V= (S.E.)	Estimated Vehicle Speed:
R1 =	110	so:	V (0%) =	20.3
R2 =	78	so:	V (+2%) =	18.5
R3 =	168	so:	V (0%) =	23.8
R4 =	61	so:	V (+2%) =	16.8
R5 =	197	so:	V (-2%) =	24.1

Note: Speeds at 0% SE were assumed as the average of the (+2%) & (-2%) calculated speeds

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

NOT TO SCALE

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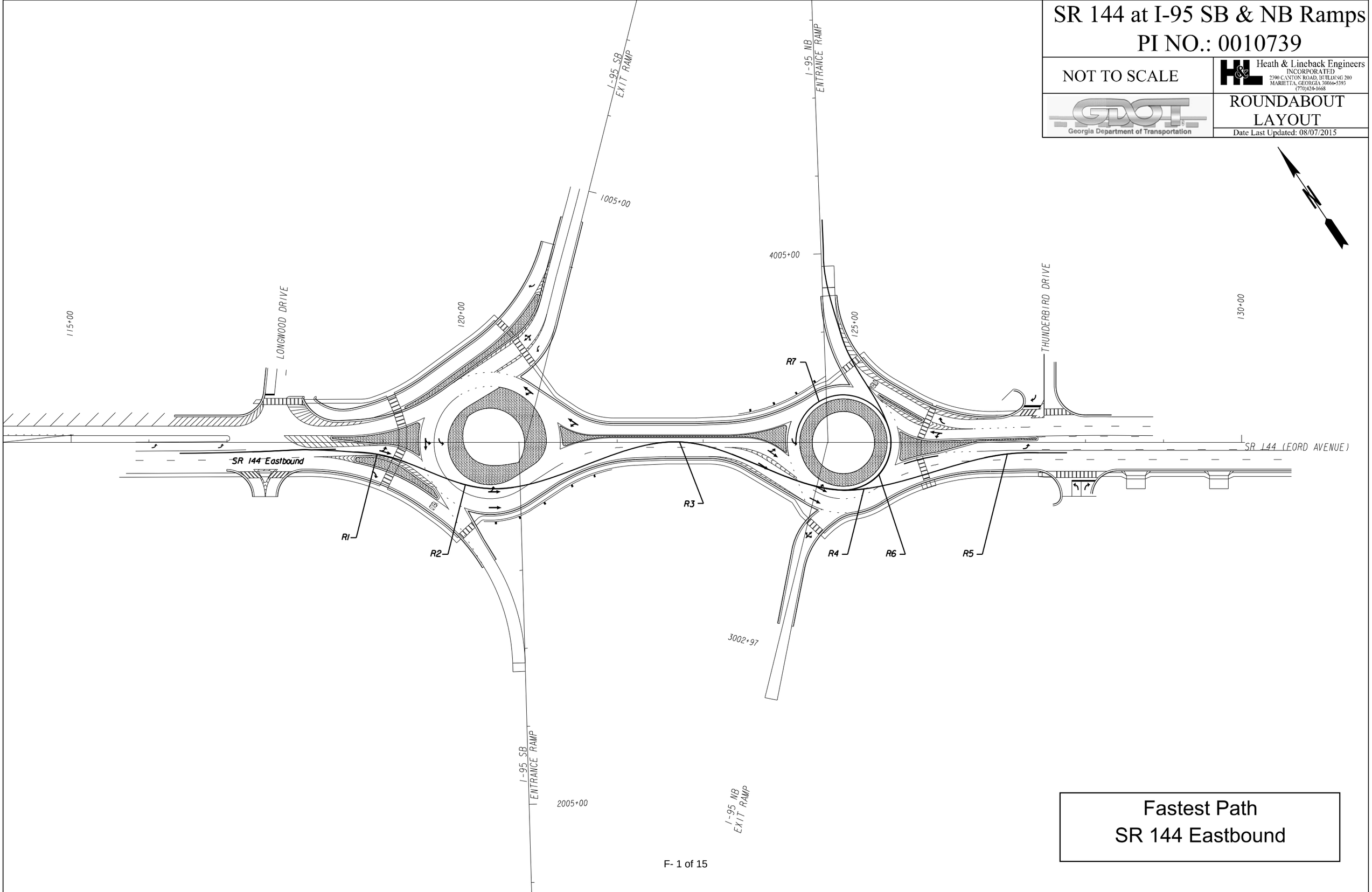
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



Fastest Path
SR 144 Eastbound

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

NOT TO SCALE

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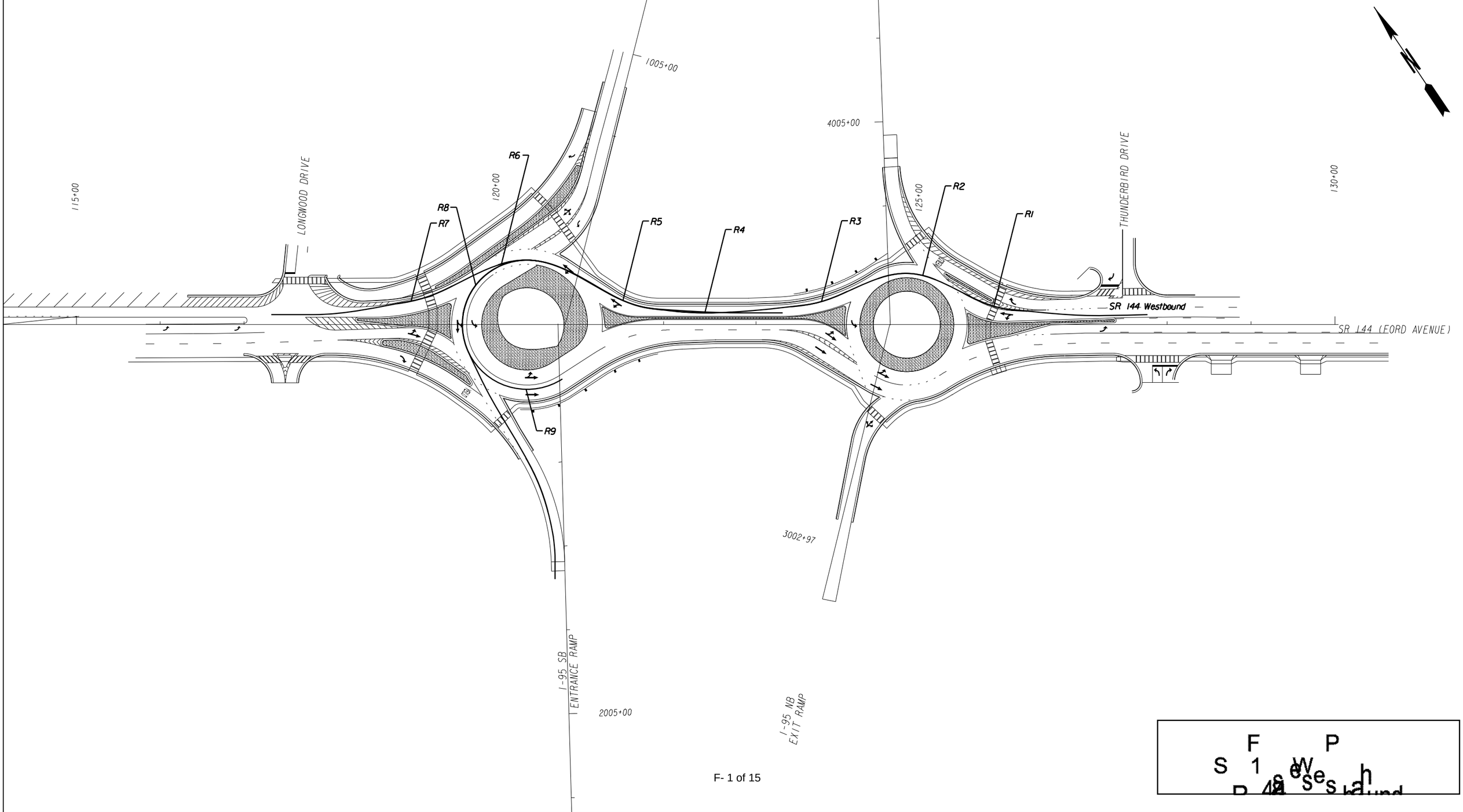

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

NOT TO SCALE

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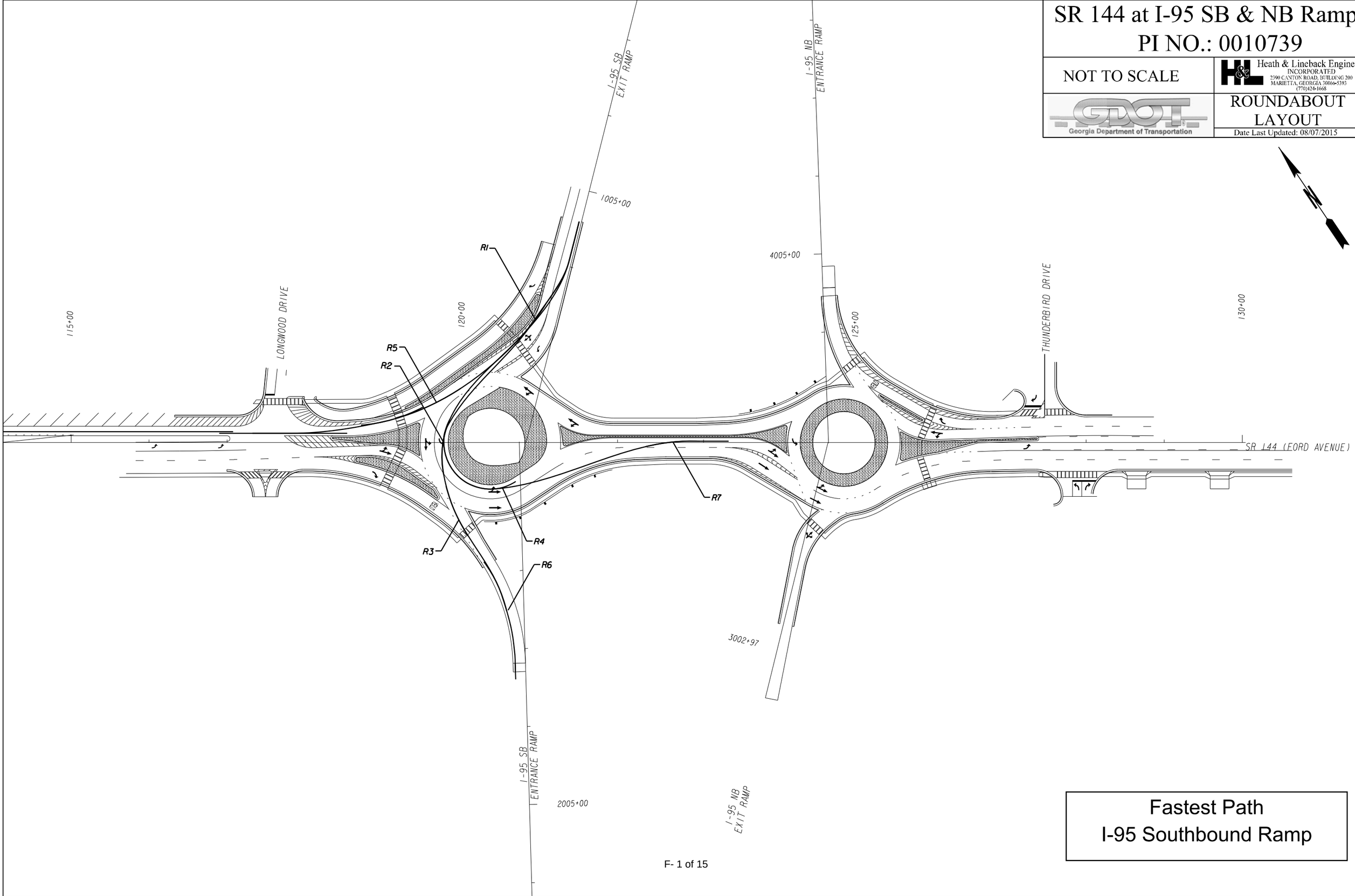
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



Fastest Path
I-95 Southbound Ramp

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

NOT TO SCALE

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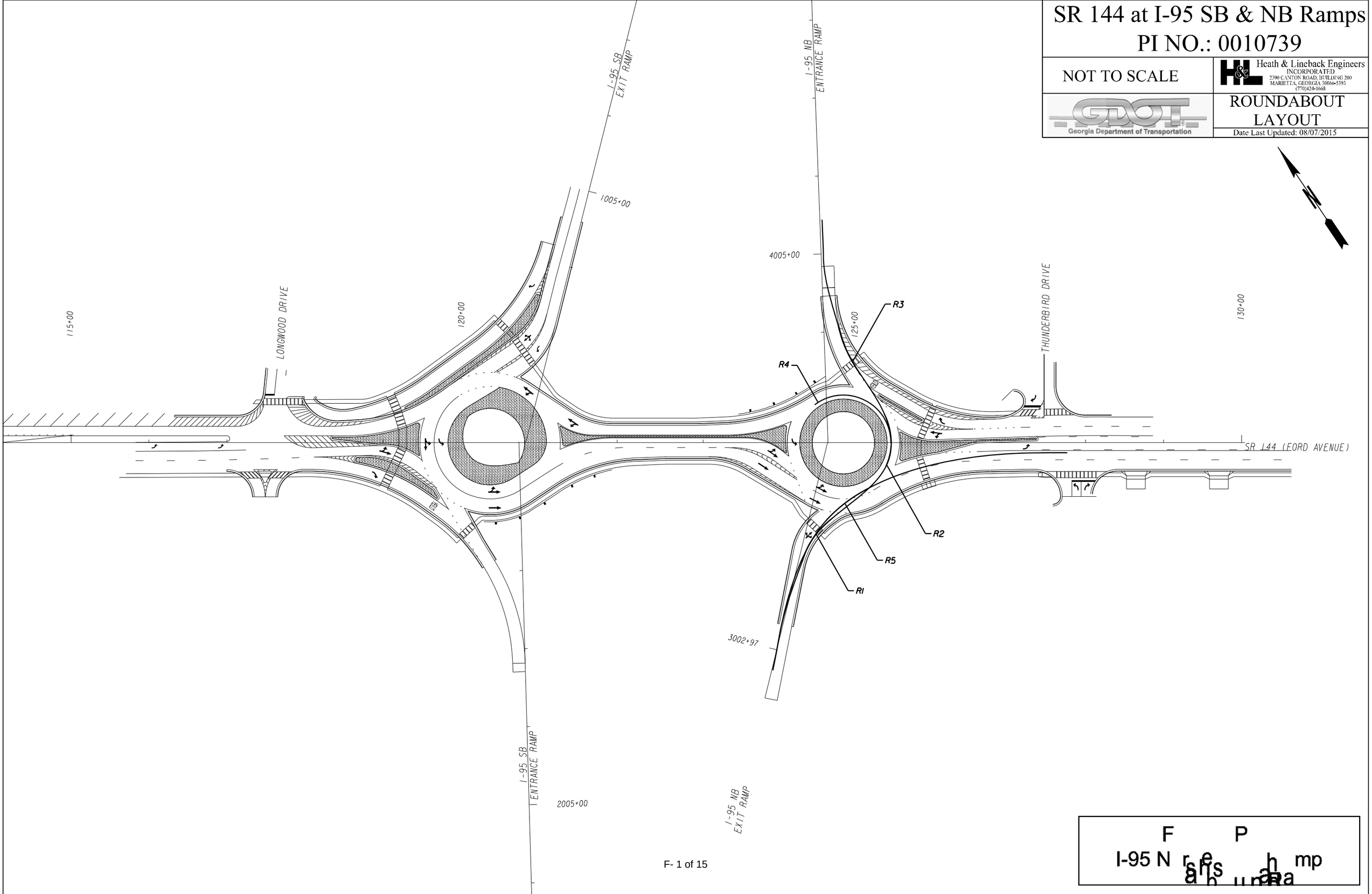
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



F P
I-95 N r e h mp
s s
a h a

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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2390 CANTON ROAD, BUILDING 200
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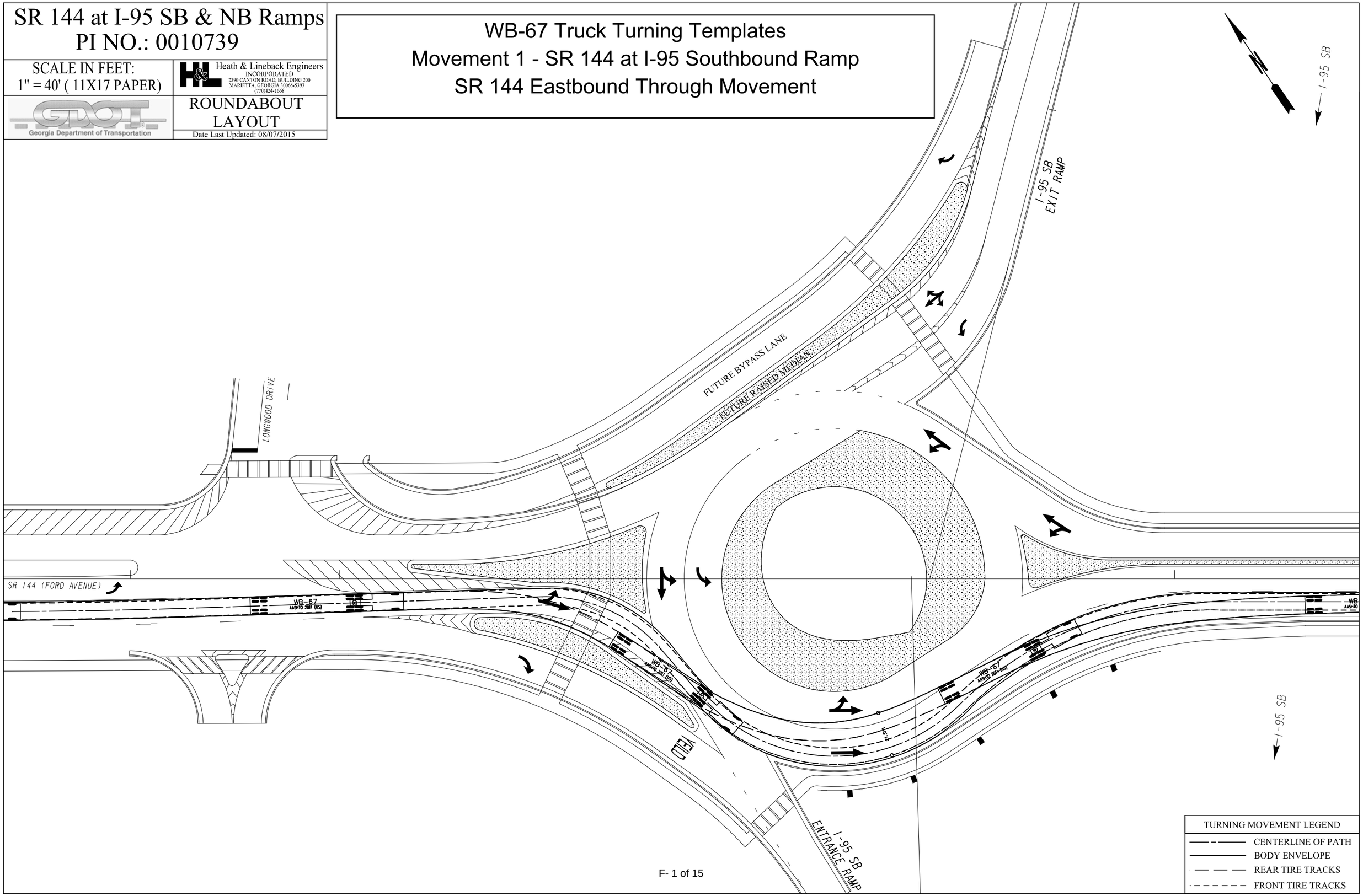
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 1 - SR 144 at I-95 Southbound Ramp
SR 144 Eastbound Through Movement



WB-67 Truck Turning Templates
Movement 2 - SR 144 at I-95 Northbound Ramp
SR 144 Eastbound Through Movement

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

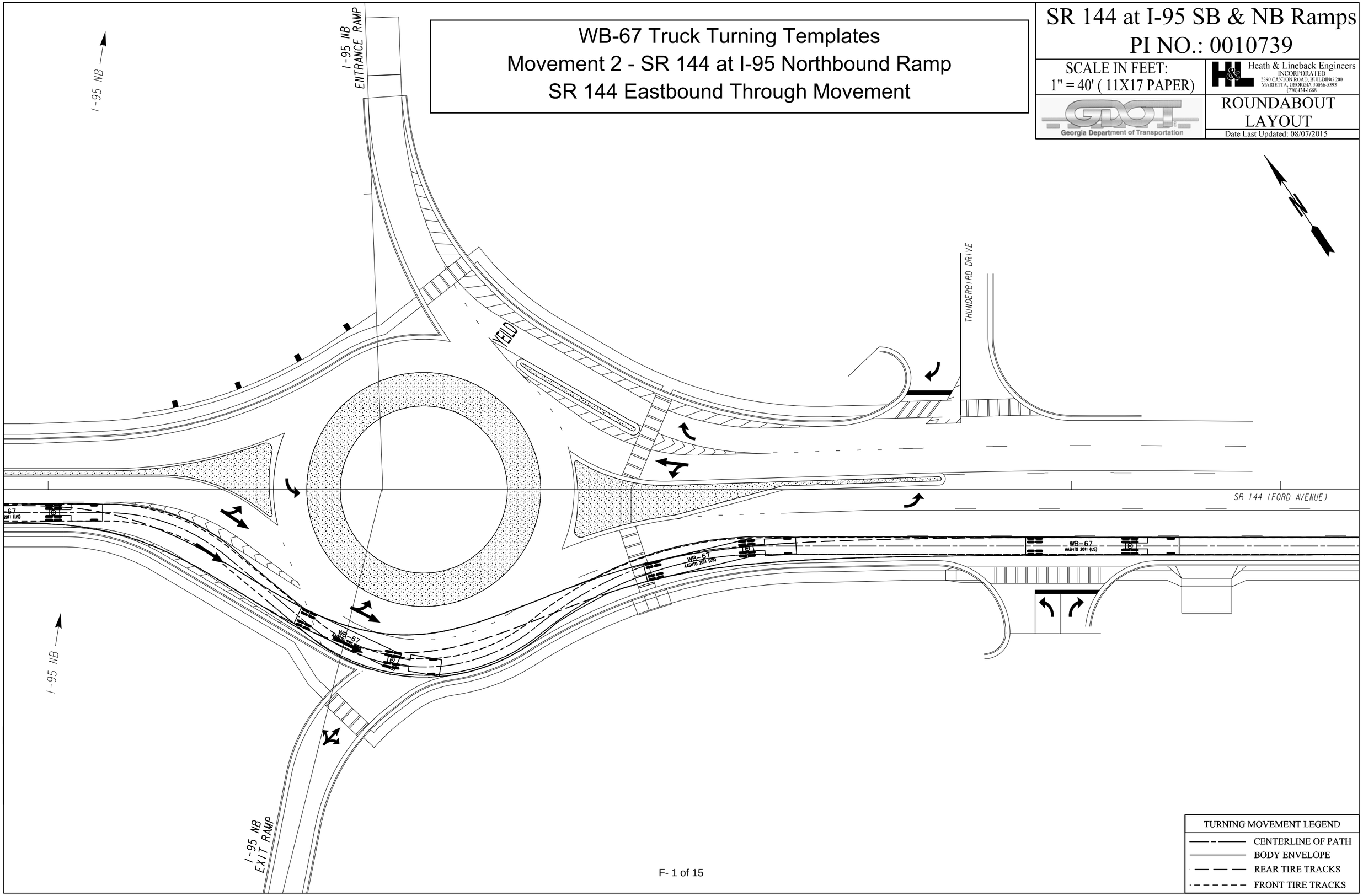
SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



TURNING MOVEMENT LEGEND

- CENTERLINE OF PATH
- BODY ENVELOPE
- REAR TIRE TRACKS
- FRONT TIRE TRACKS

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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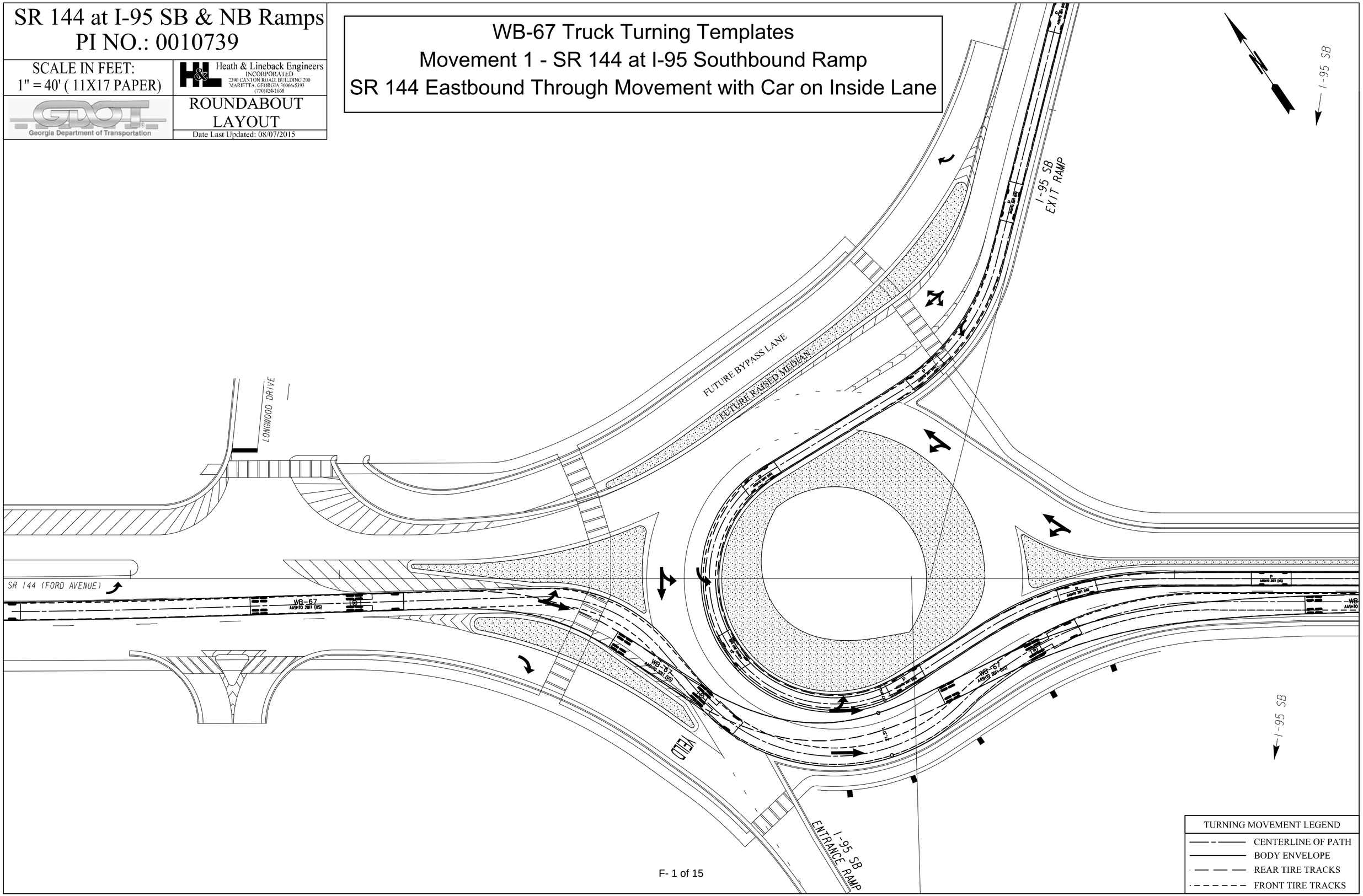
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 1 - SR 144 at I-95 Southbound Ramp
SR 144 Eastbound Through Movement with Car on Inside Lane



WB-67 Truck Turning Templates
Movement 2 - SR 144 at I-95 Northbound Ramp
SR 144 Eastbound Through Movement with Car on Inside Lane

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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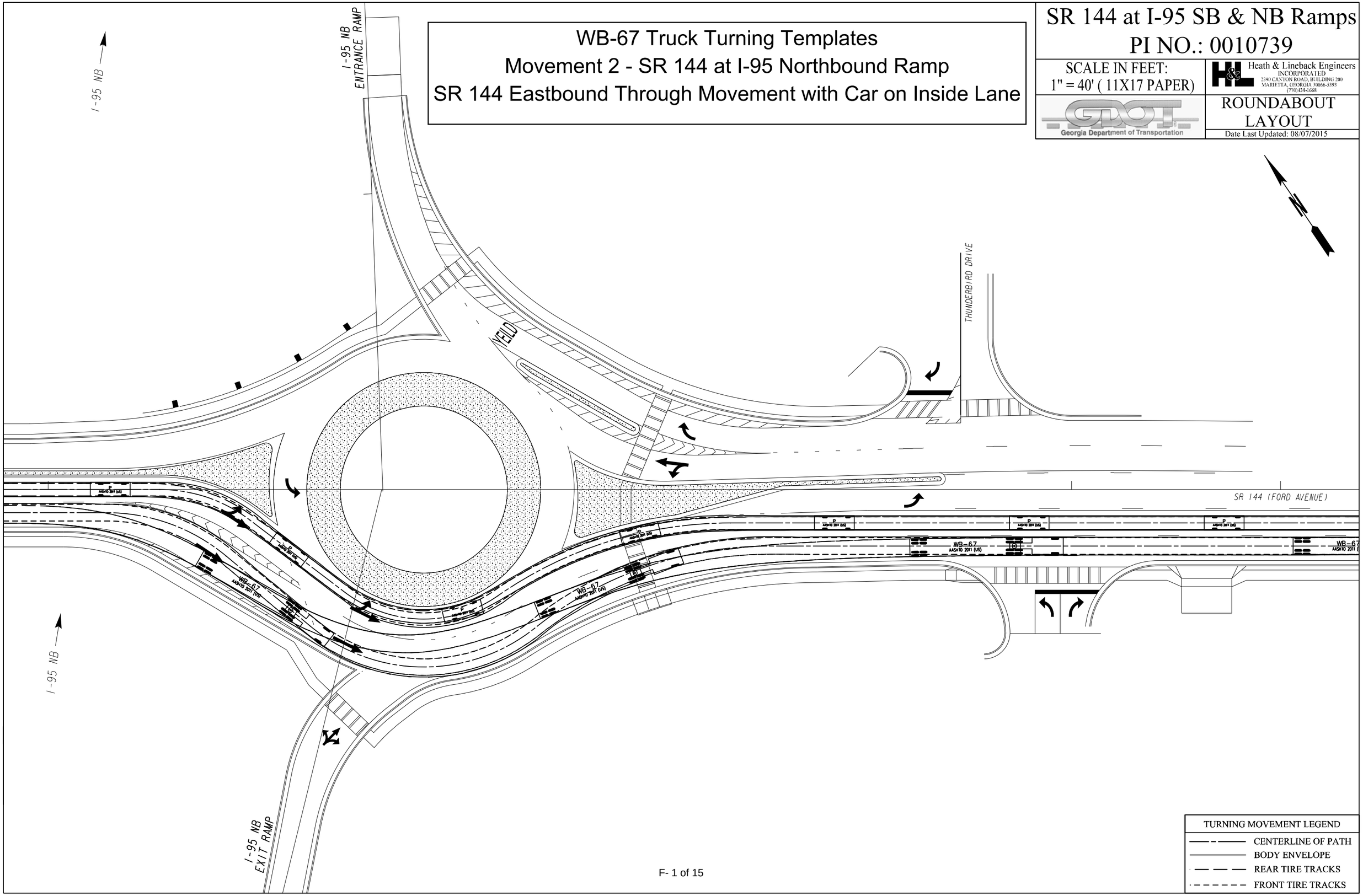
Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
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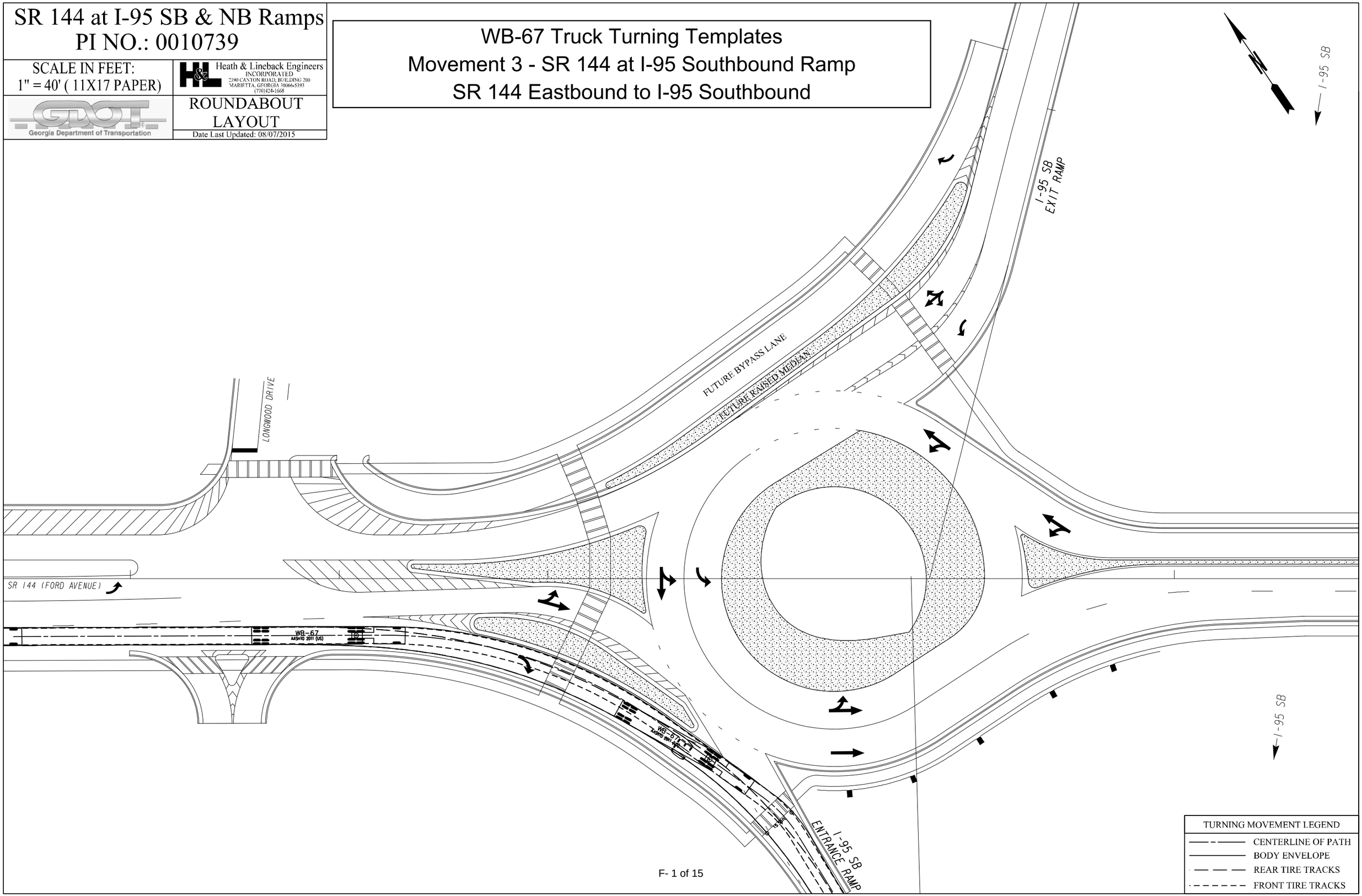
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 3 - SR 144 at I-95 Southbound Ramp
SR 144 Eastbound to I-95 Southbound



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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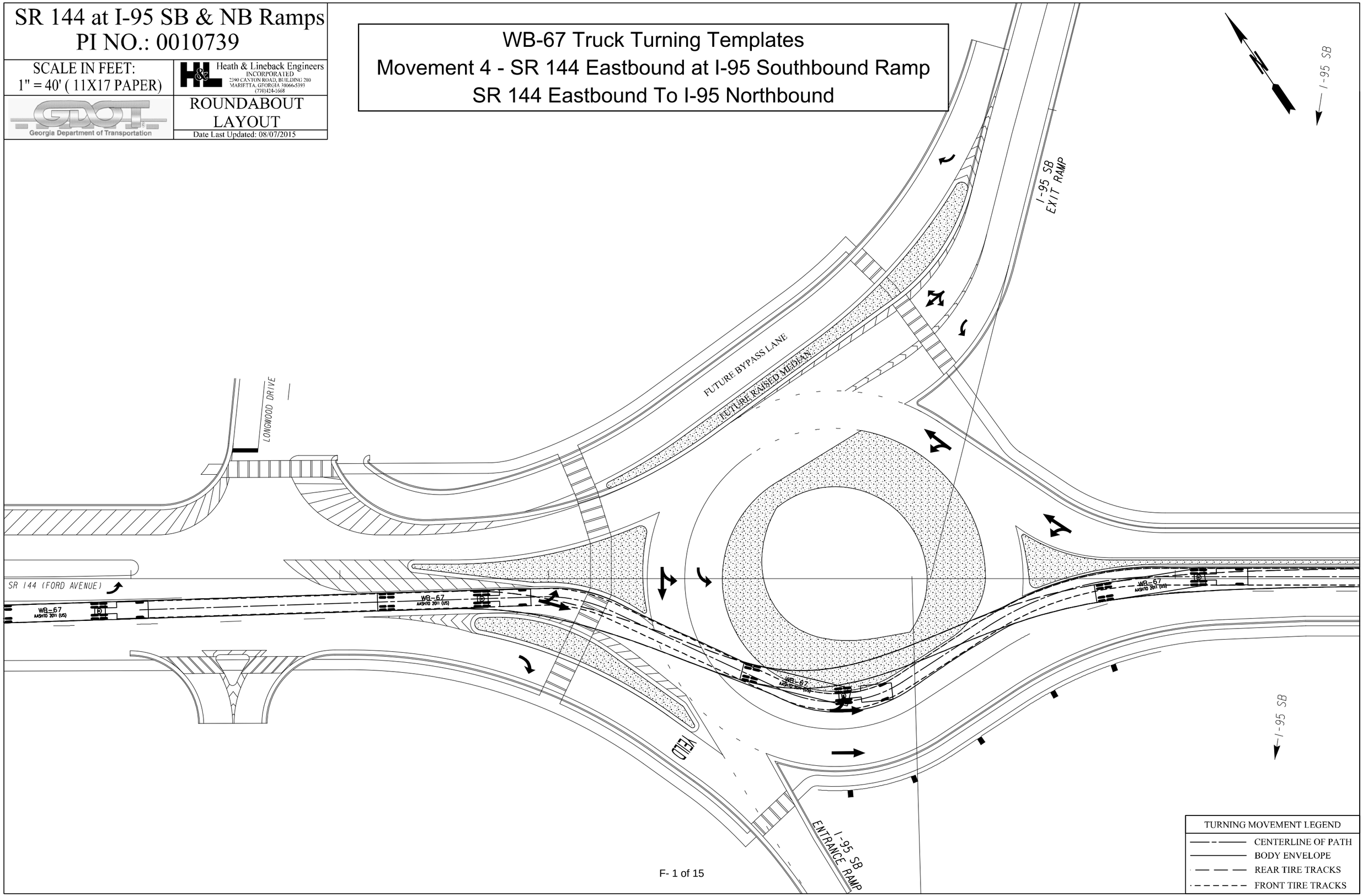
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 4 - SR 144 Eastbound at I-95 Southbound Ramp
SR 144 Eastbound To I-95 Northbound



WB-67 Truck Turning Templates
Movement 5 - SR 144 at I-95 Northbound Ramp
SR 144 Eastbound to I-95 Northbound

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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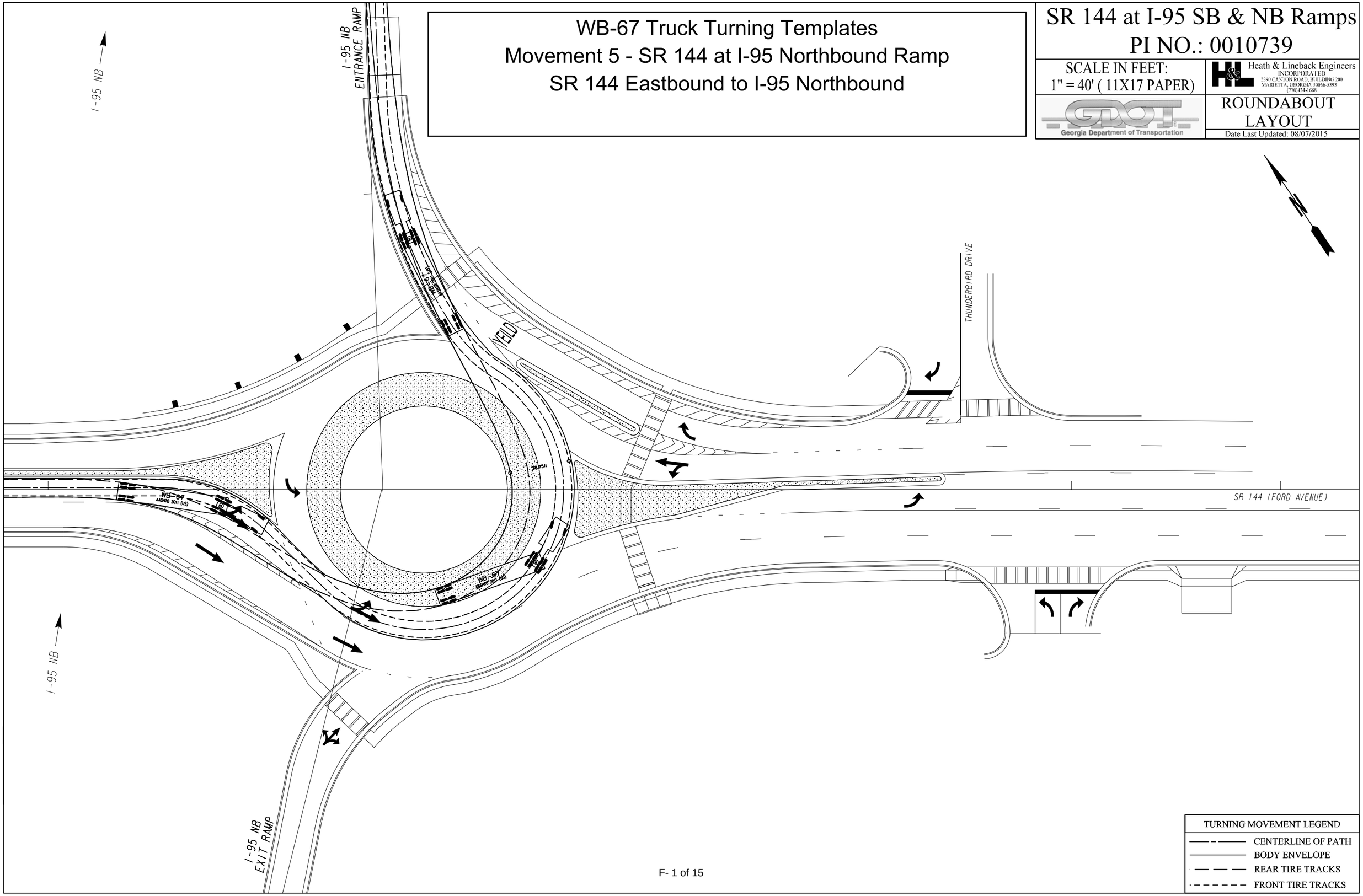
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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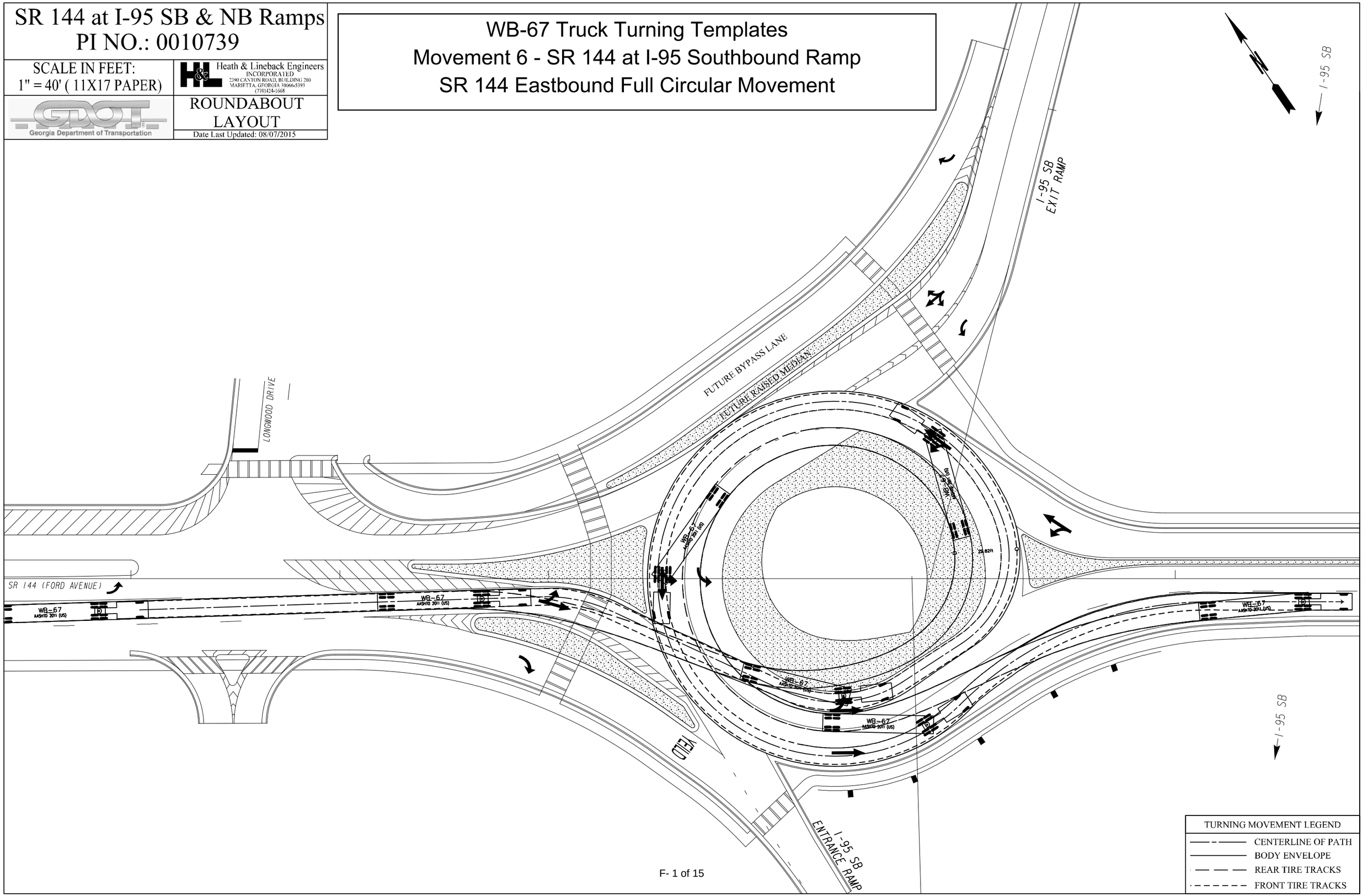
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 6 - SR 144 at I-95 Southbound Ramp
SR 144 Eastbound Full Circular Movement



WB-67 Truck Turning Templates
Movement 7 - SR 144 at I-95 Northbound Ramp
SR 144 Westbound Through Movement

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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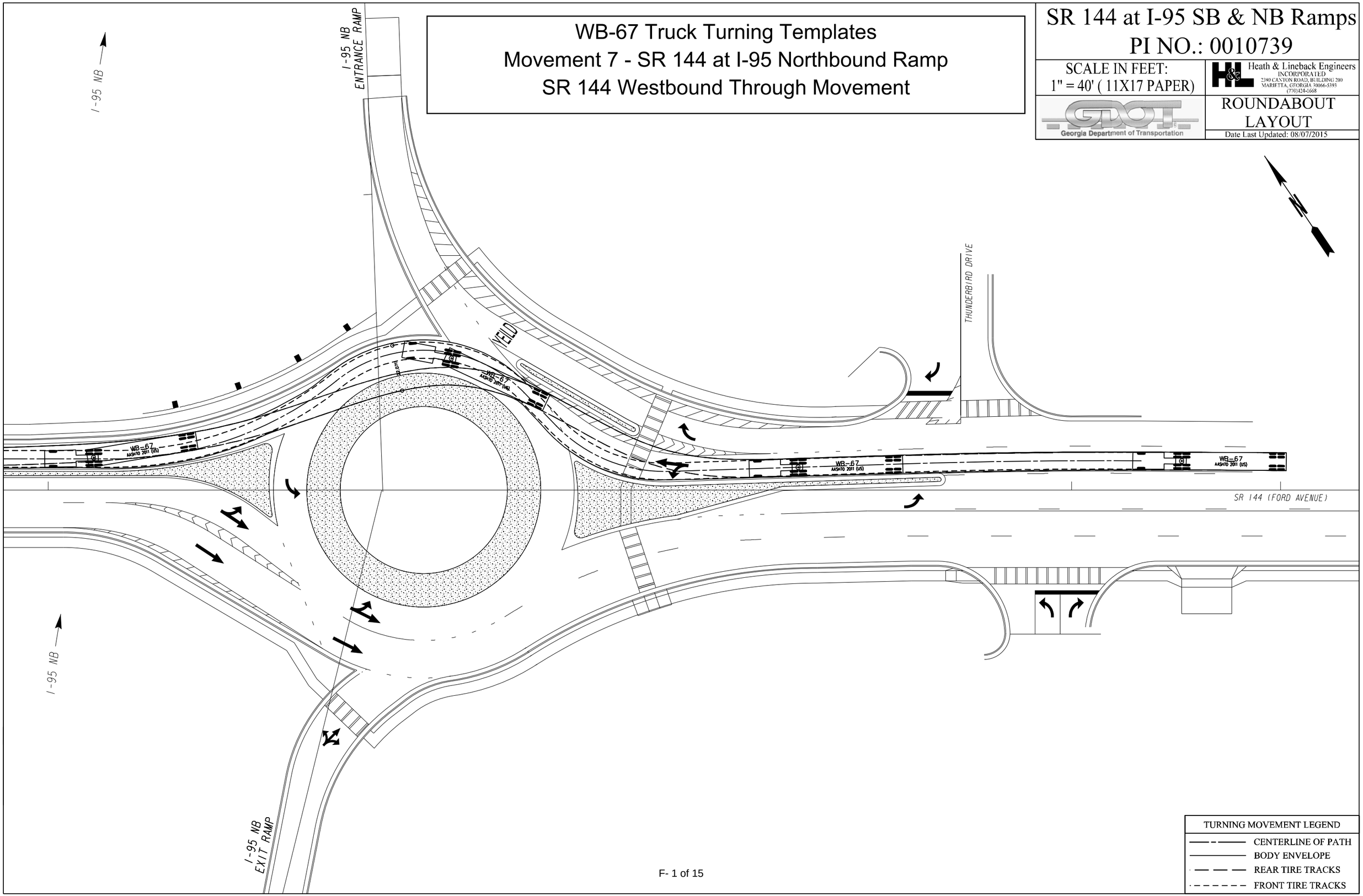
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



TURNING MOVEMENT LEGEND

- CENTERLINE OF PATH
- BODY ENVELOPE
- REAR TIRE TRACKS
- FRONT TIRE TRACKS

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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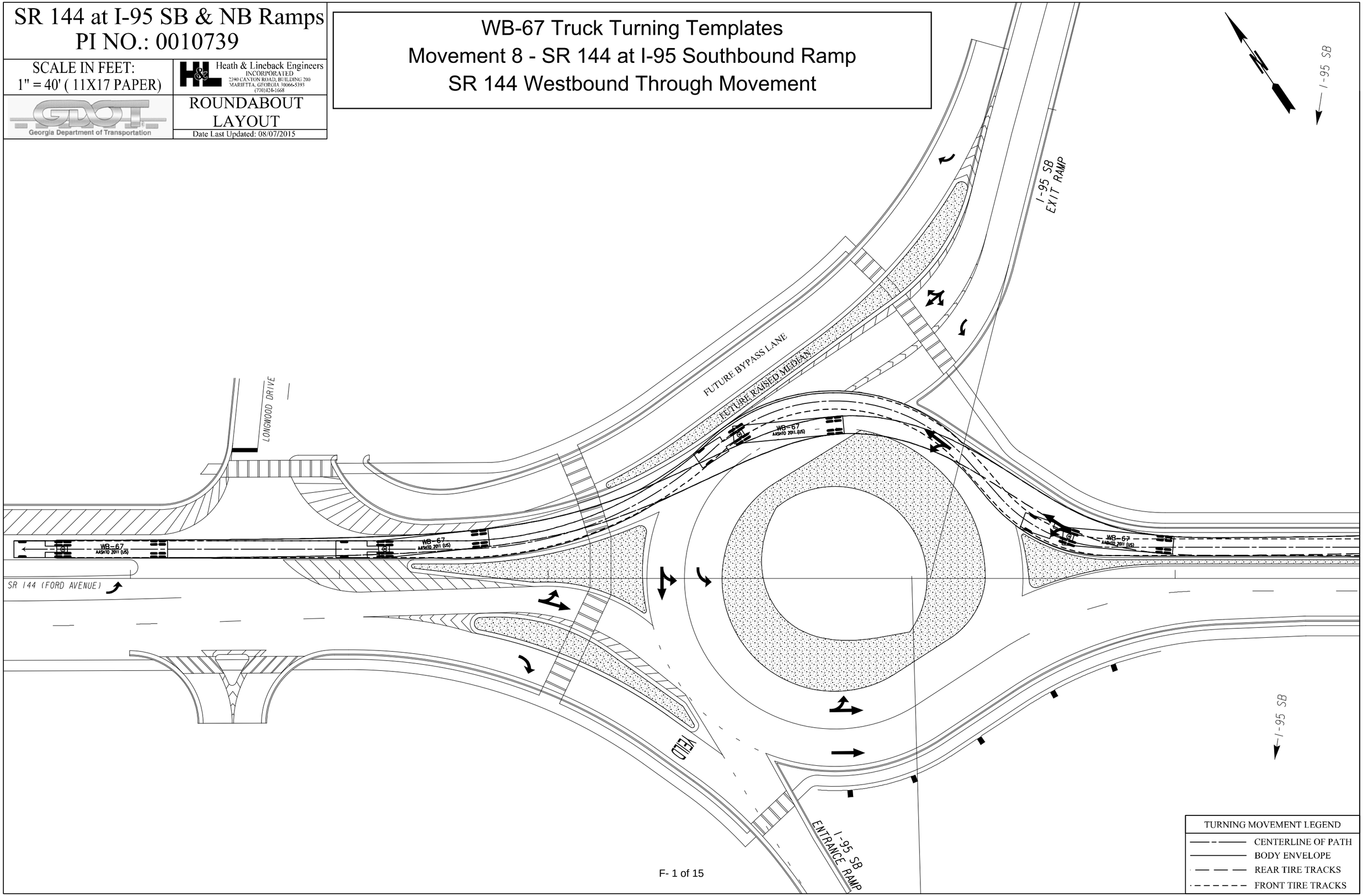
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 8 - SR 144 at I-95 Southbound Ramp
SR 144 Westbound Through Movement



WB-67 Truck Turning Templates
Movement 9 - SR 144 at I-95 Northbound Ramp
SR 144 Westbound to I-95 Northbound

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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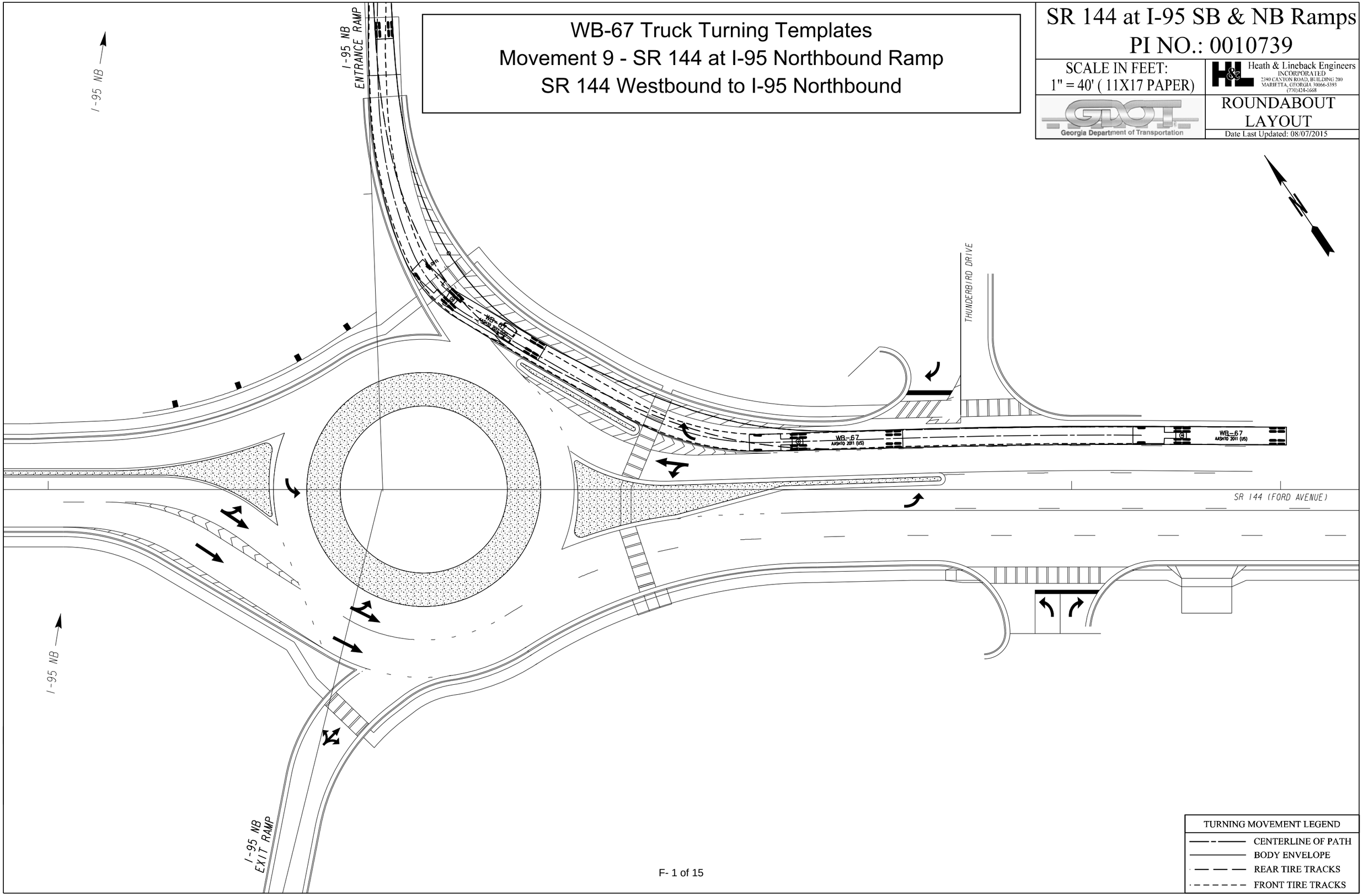
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



TURNING MOVEMENT LEGEND

- CENTERLINE OF PATH
- BODY ENVELOPE
- REAR TIRE TRACKS
- FRONT TIRE TRACKS

WB-67 Truck Turning Templates
Movement 10 - SR 144 at I-95 Northbound Ramp
SR 144 Westbound Full Circular Movement

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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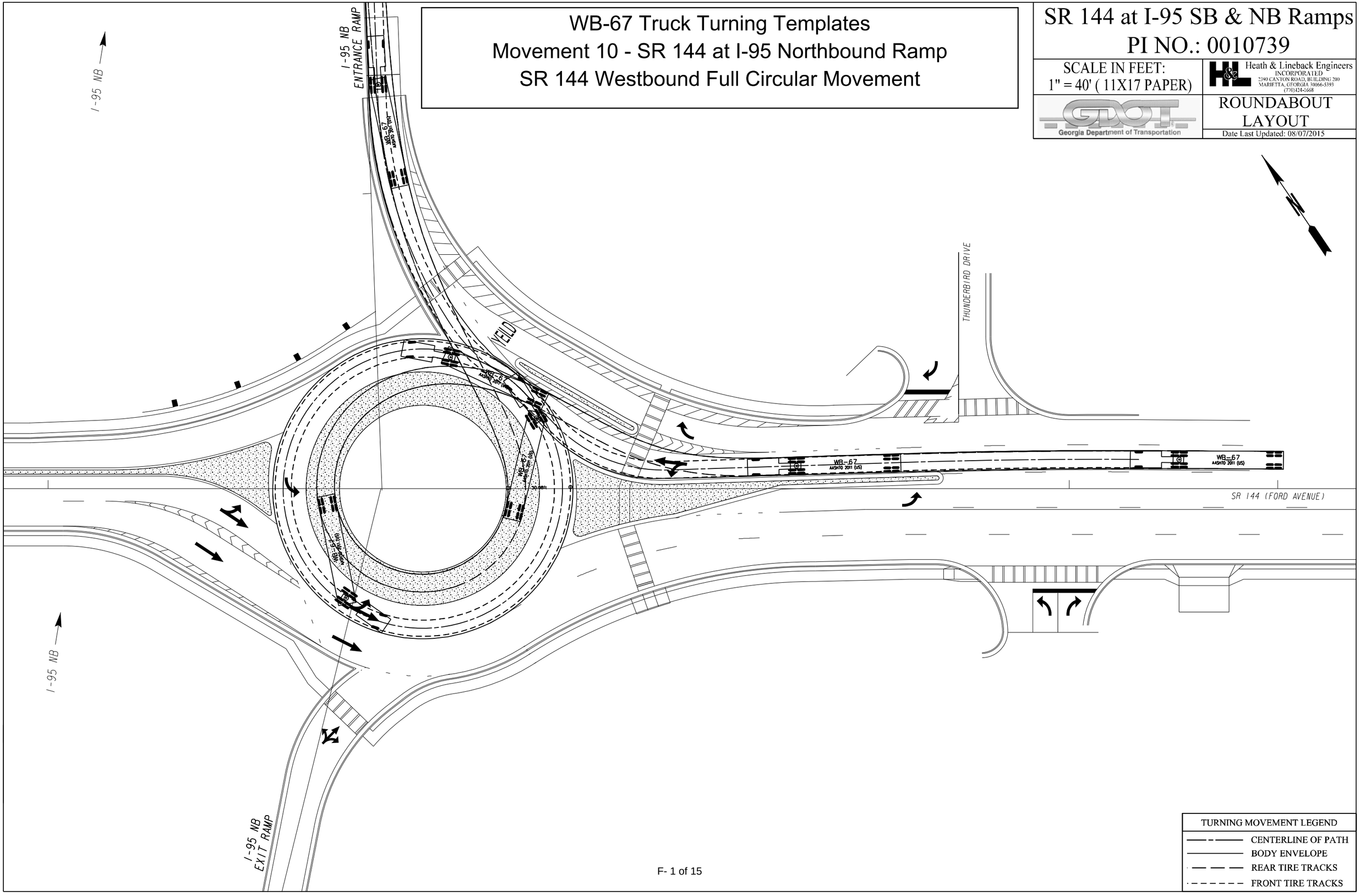
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



TURNING MOVEMENT LEGEND

- CENTERLINE OF PATH
- BODY ENVELOPE
- REAR TIRE TRACKS
- FRONT TIRE TRACKS

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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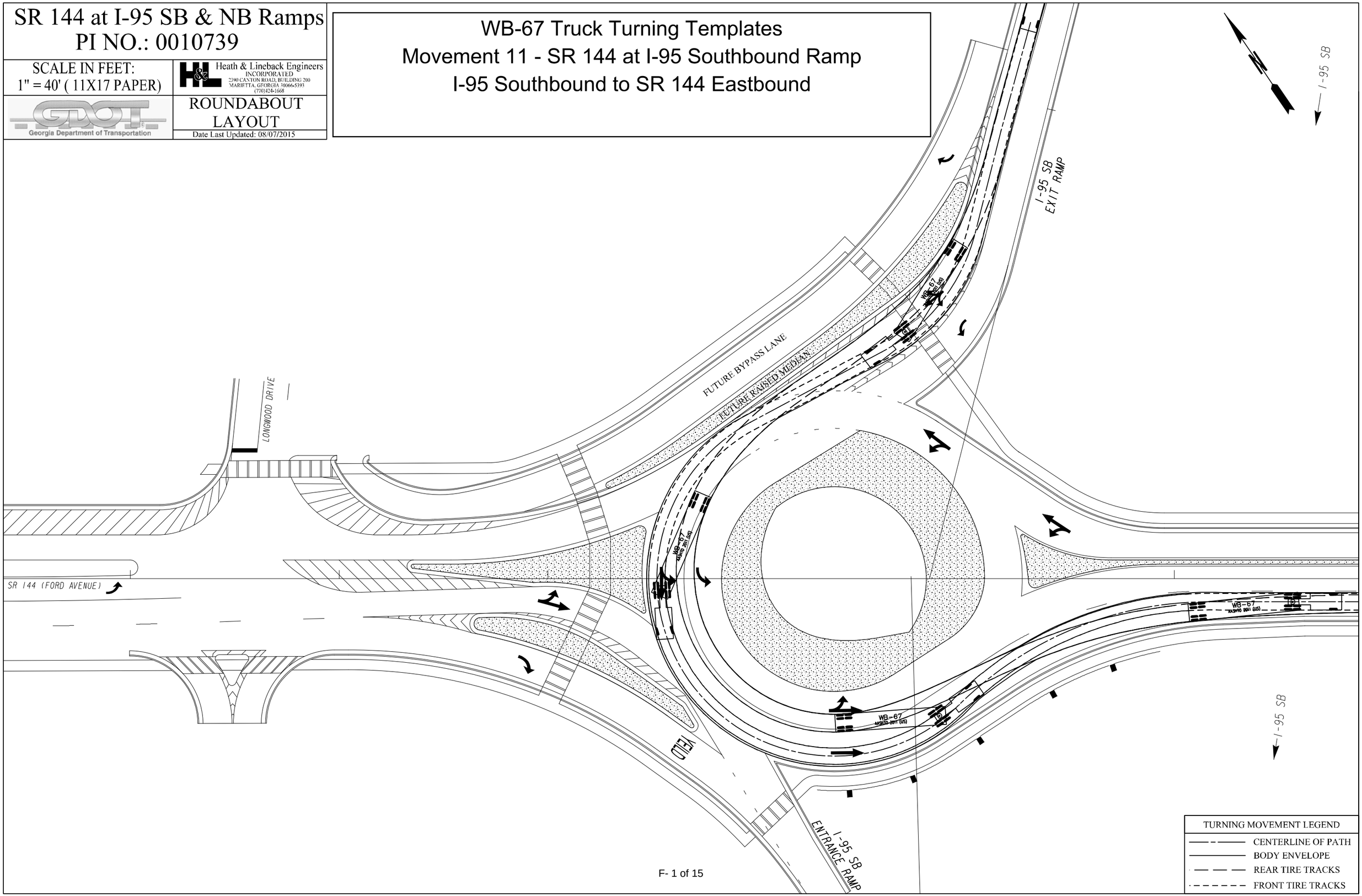
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 11 - SR 144 at I-95 Southbound Ramp
I-95 Southbound to SR 144 Eastbound



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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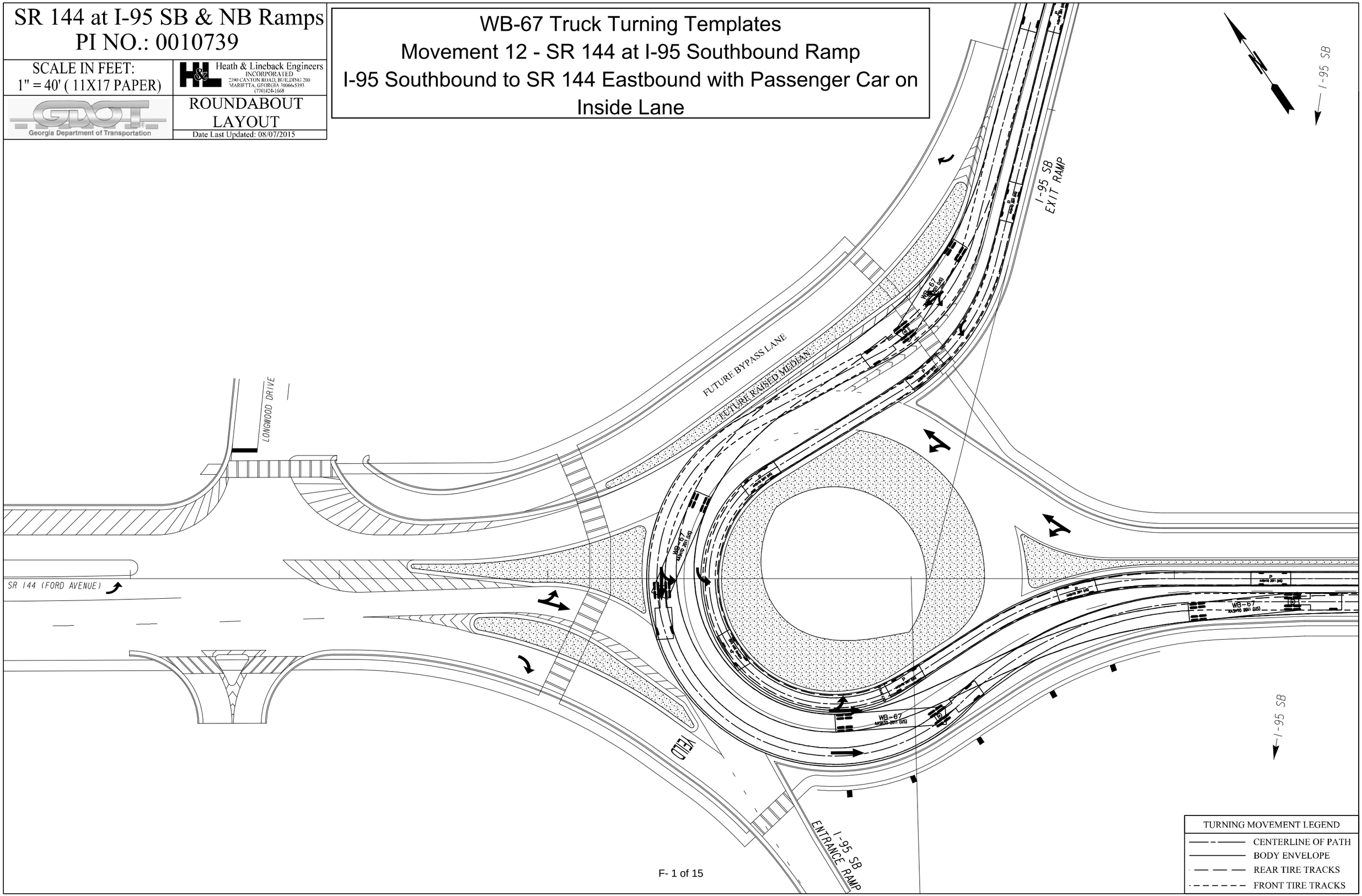
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 12 - SR 144 at I-95 Southbound Ramp
I-95 Southbound to SR 144 Eastbound with Passenger Car on Inside Lane



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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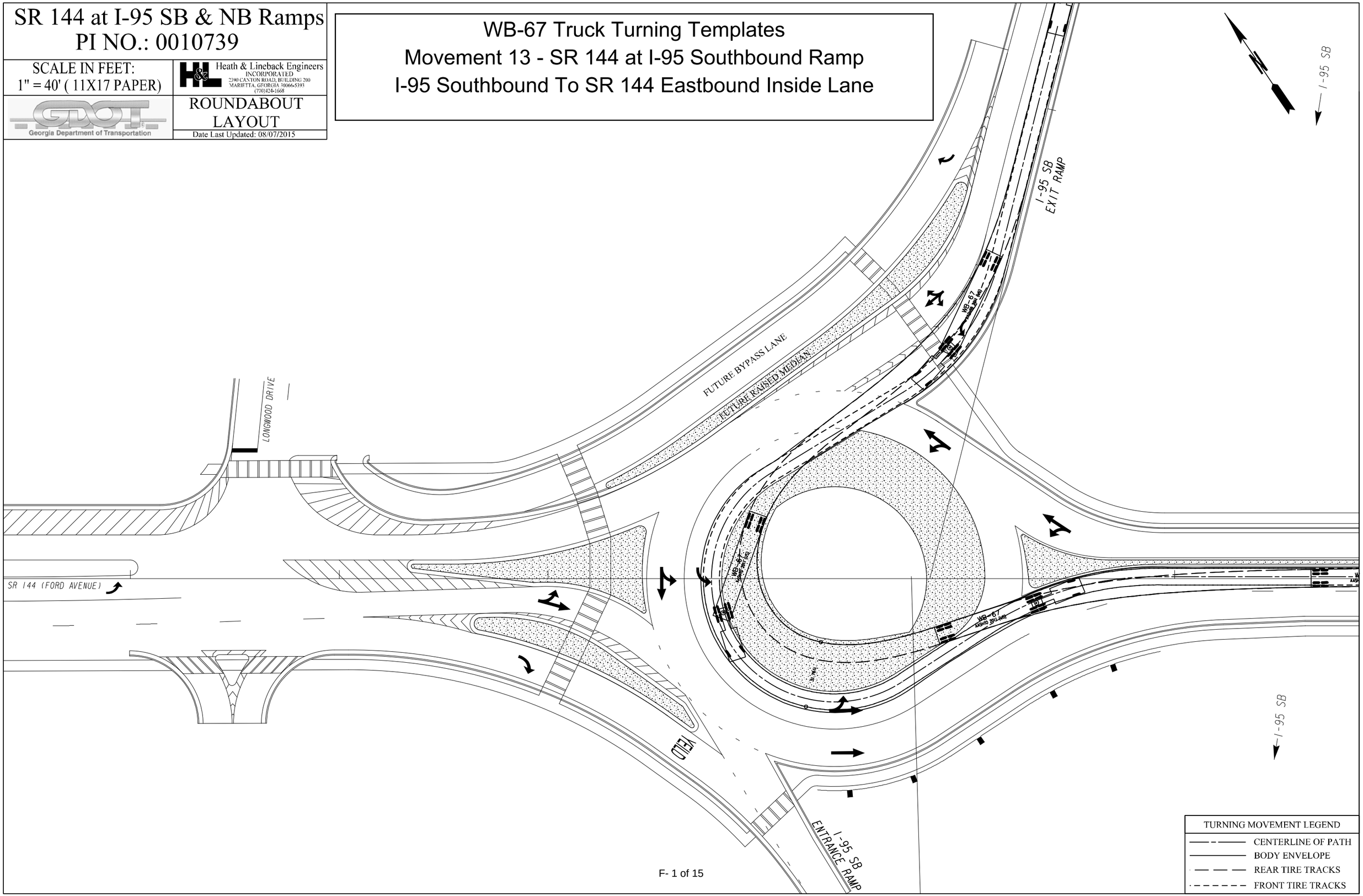
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 13 - SR 144 at I-95 Southbound Ramp
I-95 Southbound To SR 144 Eastbound Inside Lane



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
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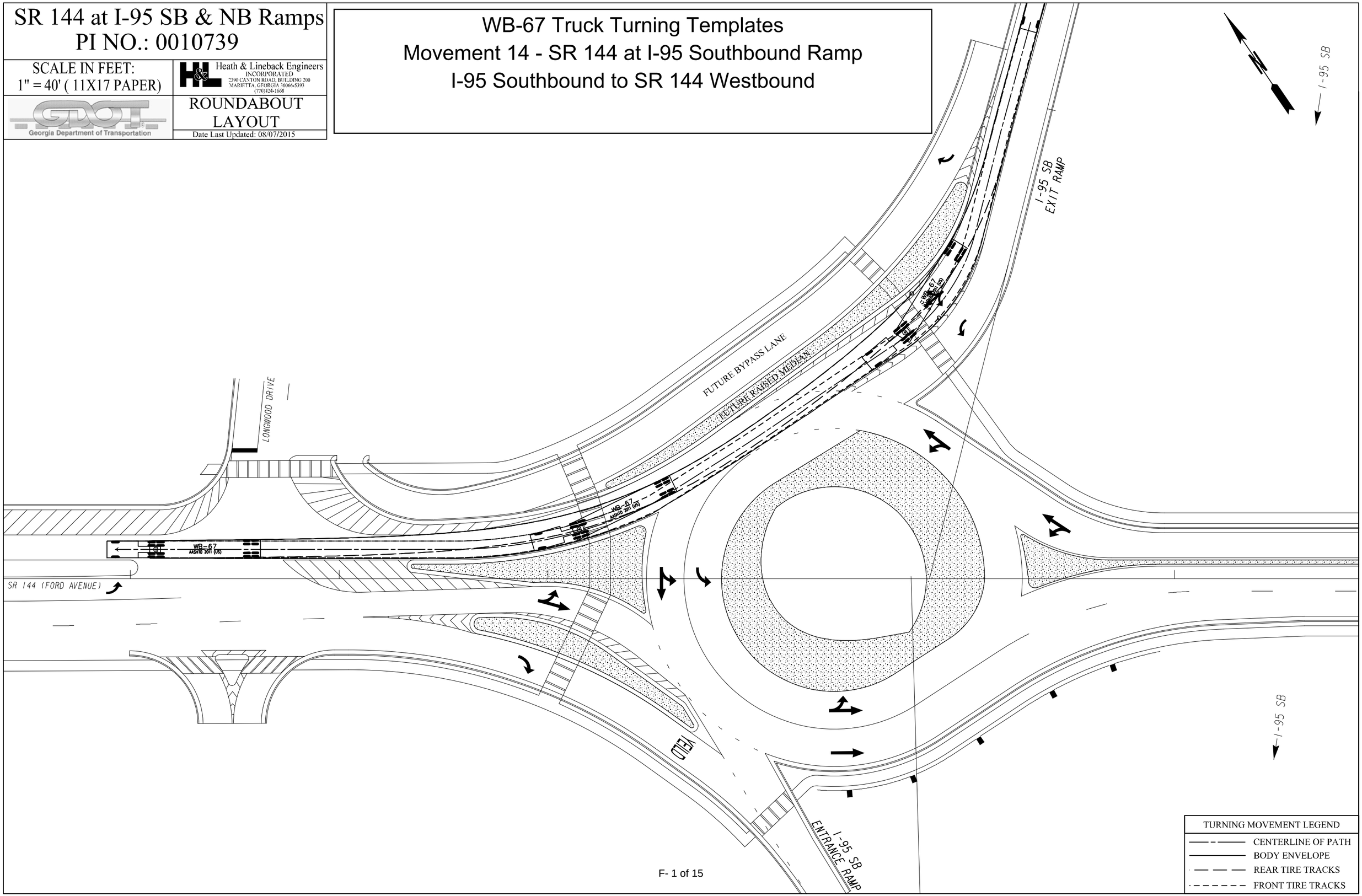
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 14 - SR 144 at I-95 Southbound Ramp
I-95 Southbound to SR 144 Westbound



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
INCORPORATED
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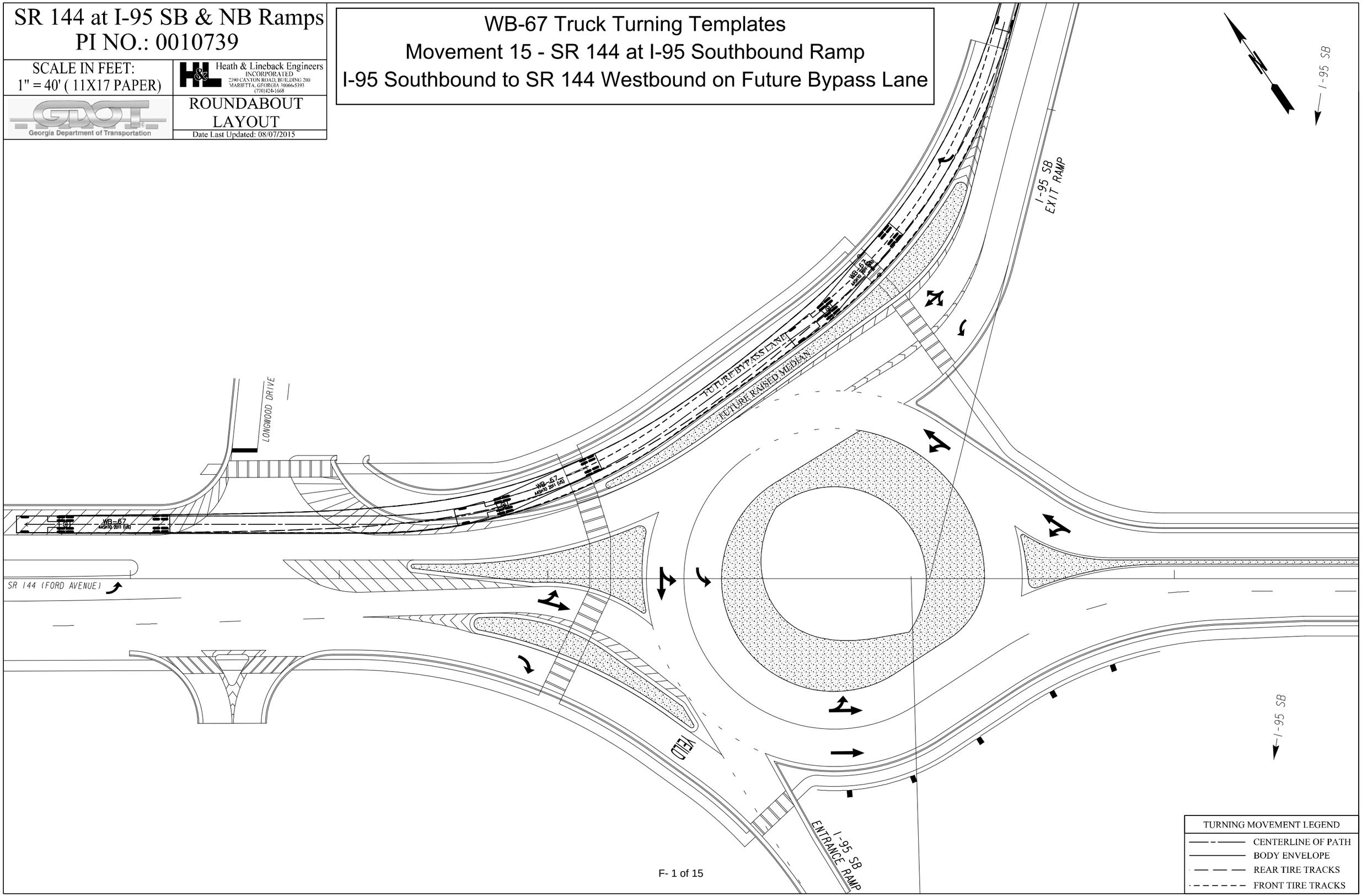
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 15 - SR 144 at I-95 Southbound Ramp
I-95 Southbound to SR 144 Westbound on Future Bypass Lane



TURNING MOVEMENT LEGEND

- CENTERLINE OF PATH
- BODY ENVELOPE
- REAR TIRE TRACKS
- FRONT TIRE TRACKS

WB-67 Truck Turning Templates
Movement 16 - SR 144 at I-95 Northbound Ramp
I-95 Northbound to SR 144 Eastbound

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

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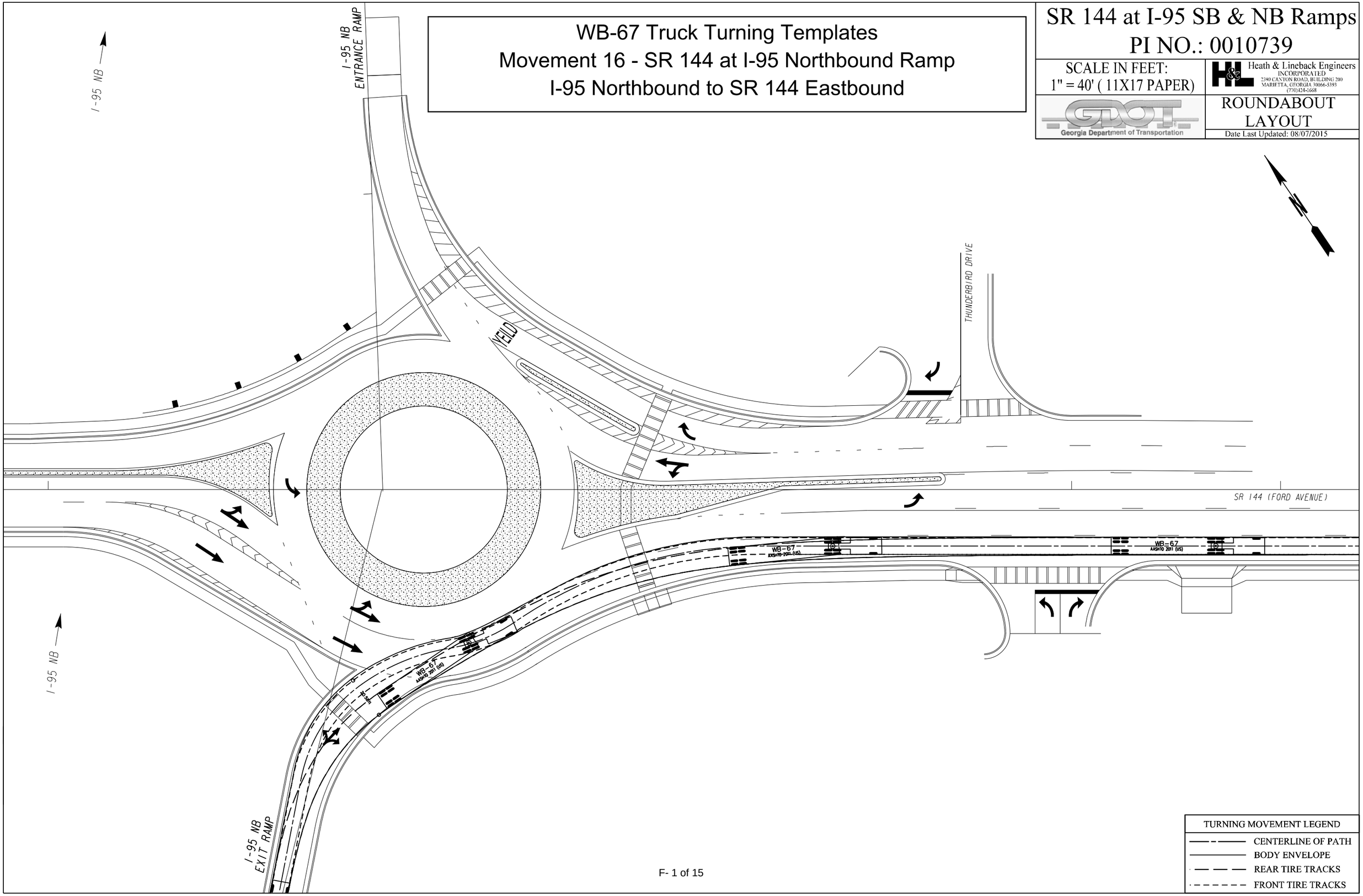
Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



WB-67 Truck Turning Templates
Movement 17 - SR 144 at I-95 Northbound Ramp
I-95 Northbound to SR 144 Westbound

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
INCORPORATED
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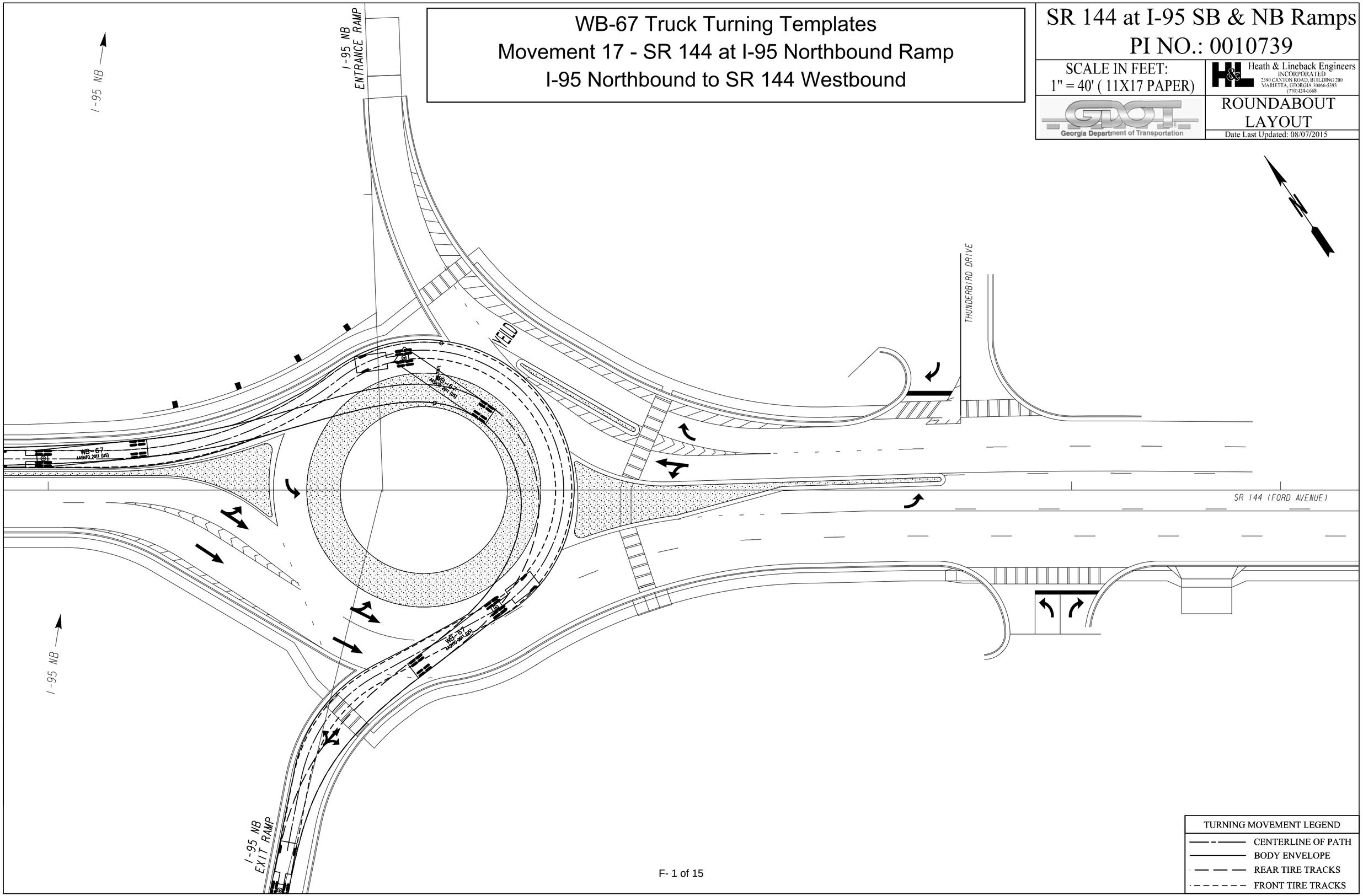
ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



APPENDIX D

Study Area Photographs

Kimley»Horn

Richmond Hill, Georgia

Photograph Sheet

KHA Job No.: 015905015

Date: September 2014

Page: 1 of 9

SR 144 (Ford Avenue) at I-95

Photo No. 1

Comments: SR 144 from western end of study network. Photo looking to the east.

Photo No. 2

Comments: SR 144 from eastern end of study network. Photo looking to the west.

SR 144 (Ford Avenue) at I-95

Photo No. 3

Comments: Longwood Drive from across SR 144. Photo looking to the north.

Photo No. 4

Comments: Longwood Drive approach to SR 144. Photo looking to the south.

SR 144 (Ford Avenue) at I-95

Photo No. 5

Comments: Eastbound approach to the I-95 Southbound Ramp. Photo looking to the east.

Photo No. 6

Comments: Southbound approach along the I-95 Southbound Ramp to SR 144. Photo looking to the south.

SR 144 (Ford Avenue) at I-95

Photo No. 7

Comments: Westbound approach to the I-95 Southbound Ramp. Photo looking to the east from SB Ramp.

Photo No. 8

Comments: Northbound approach along the I-95 Northbound Ramp to SR 144. Photo looking to the north.

SR 144 (Ford Avenue) at I-95

Photo No. 9

Comments: Eastbound approach to the I-95 Northbound Ramp. Photo looking to the west from NB Ramp.

Photo No. 10

Comments: Westbound approach to the I-95 Northbound Ramp. Photo looking to the west.

SR 144 (Ford Avenue) at I-95

Photo No. 11

Comments: I-95 Northbound Ramp intersection. Photo looking to the southwest.

Photo No. 12

Comments: Thunderbird Drive from across SR 144. Photo looking to the north.

SR 144 (Ford Avenue) at I-95

Photo No. 13

Comments: Thunderbird Drive approach to SR 144. Photo looking to the south.

Photo No. 14

Comments: Westbound approach to Thunderbird Drive. Photo looking to the east from Thunderbird Drive.

SR 144 (Ford Avenue) at I-95

Photo No. 15

Comments: Laurel Street from across SR 144. Photo looking to the north.

Photo No. 16

Comments: Laurel Street approach to SR 144. Photo looking to the south.

SR 144 (Ford Avenue) at I-95

Photo No. 17

Comments: Westbound approach to Laurel Street. Photo looking to the east from Laurel Street.

Photo No. 18

Comments: Westbound departure from Laurel Street. Photo looking to the west from Laurel Street.

APPENDIX E

Traffic Flow Diagrams (GDOT-Approved)

Department of Transportation
State of Georgia

INTERDEPARTMENT CORRESPONDENCE

FILE Bryan County
P.I. # 0010739

OFFICE Planning

DATE December 3, 2012

FROM Cynthia L. VanDyke, State Transportation Planning Administrator

TO Genetha Rice-Singleton, State Program Delivery Engineer
Attention: Cassius Edwards

SUBJECT **Reviewed** Design Traffic for SR 144 @ I-95 SB & NB OFF RAMPS

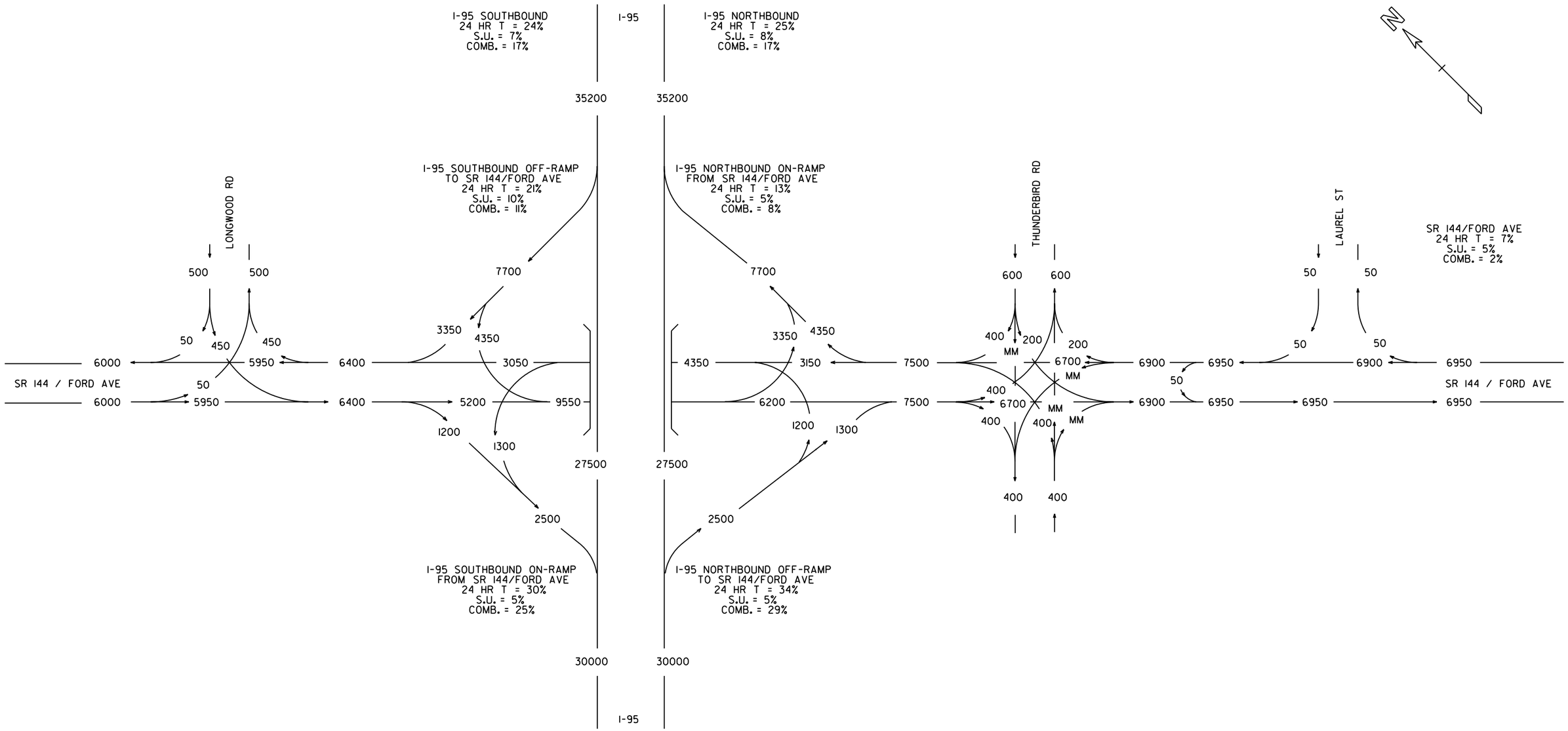
We have reviewed the consultant's design traffic data for the above project. Based on the information furnished, we find the Design Traffic to be satisfactory, and approve the Design Traffic volume.

If you have any questions concerning this information please contact Andre Washington at (404) 631-1925.

CLV/AMW

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING
GROUP

P.I.# 0010739
BRYAN COUNTY

SR 144 (FORD AVE)

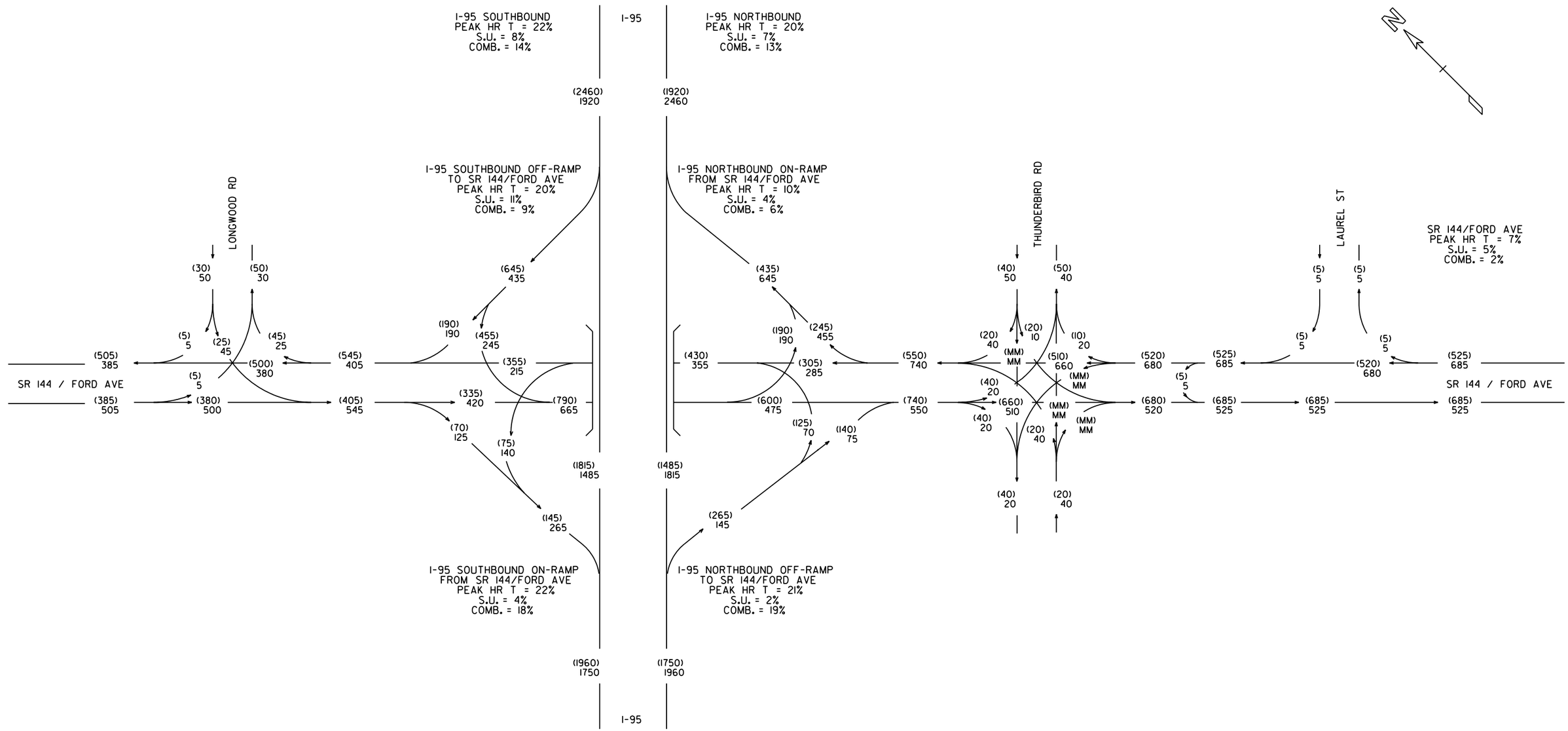
SR 144 @ I-95
SB & NB RAMPS

2012 ADT

HF
11/12

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

P.I.# 0010739
BRYAN COUNTY

SR 144 (FORD AVE)

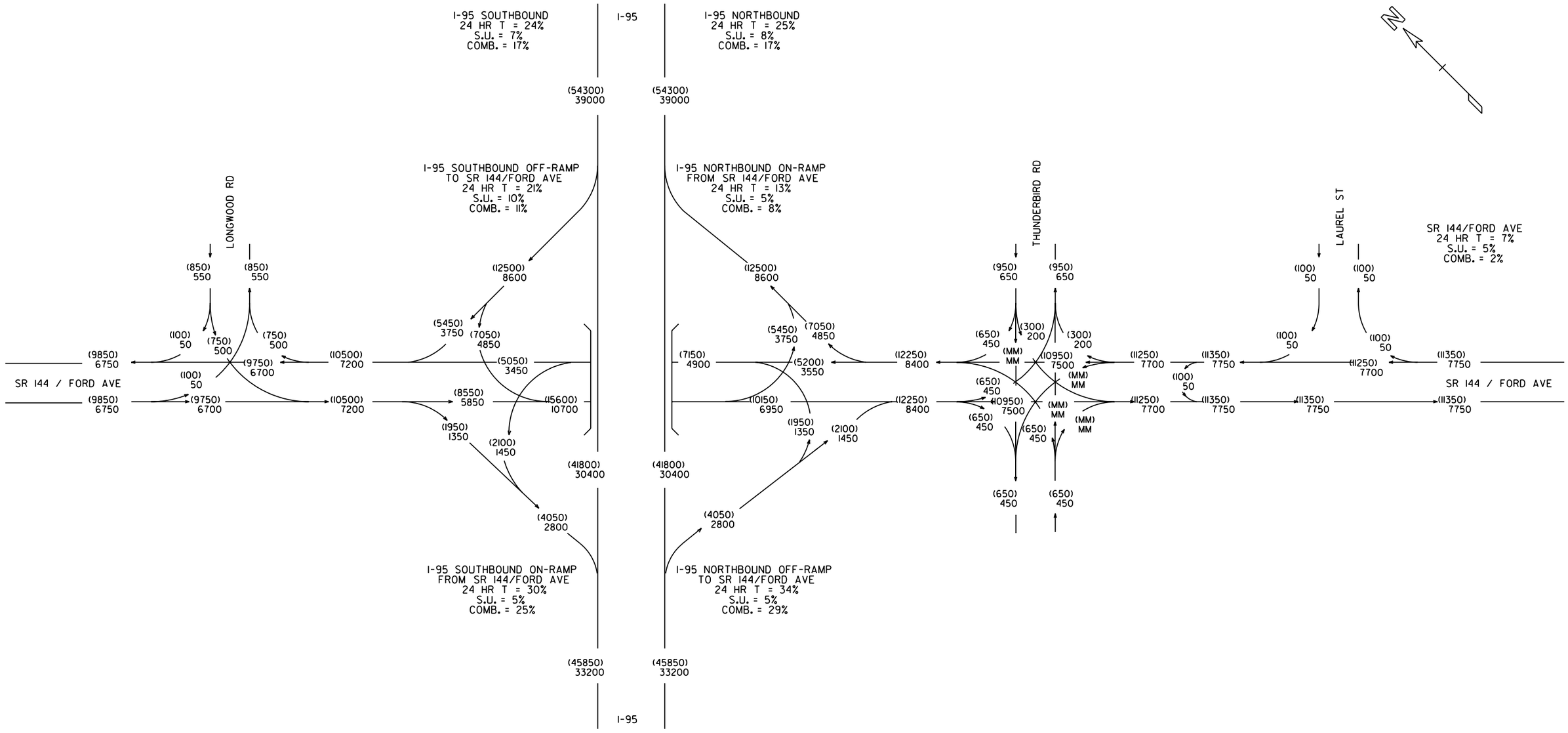
SR 144 @ I-95
SB & NB RAMPS

2012 PM DHV = (000)
2012 AM DHV = 000

HF
11/12

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

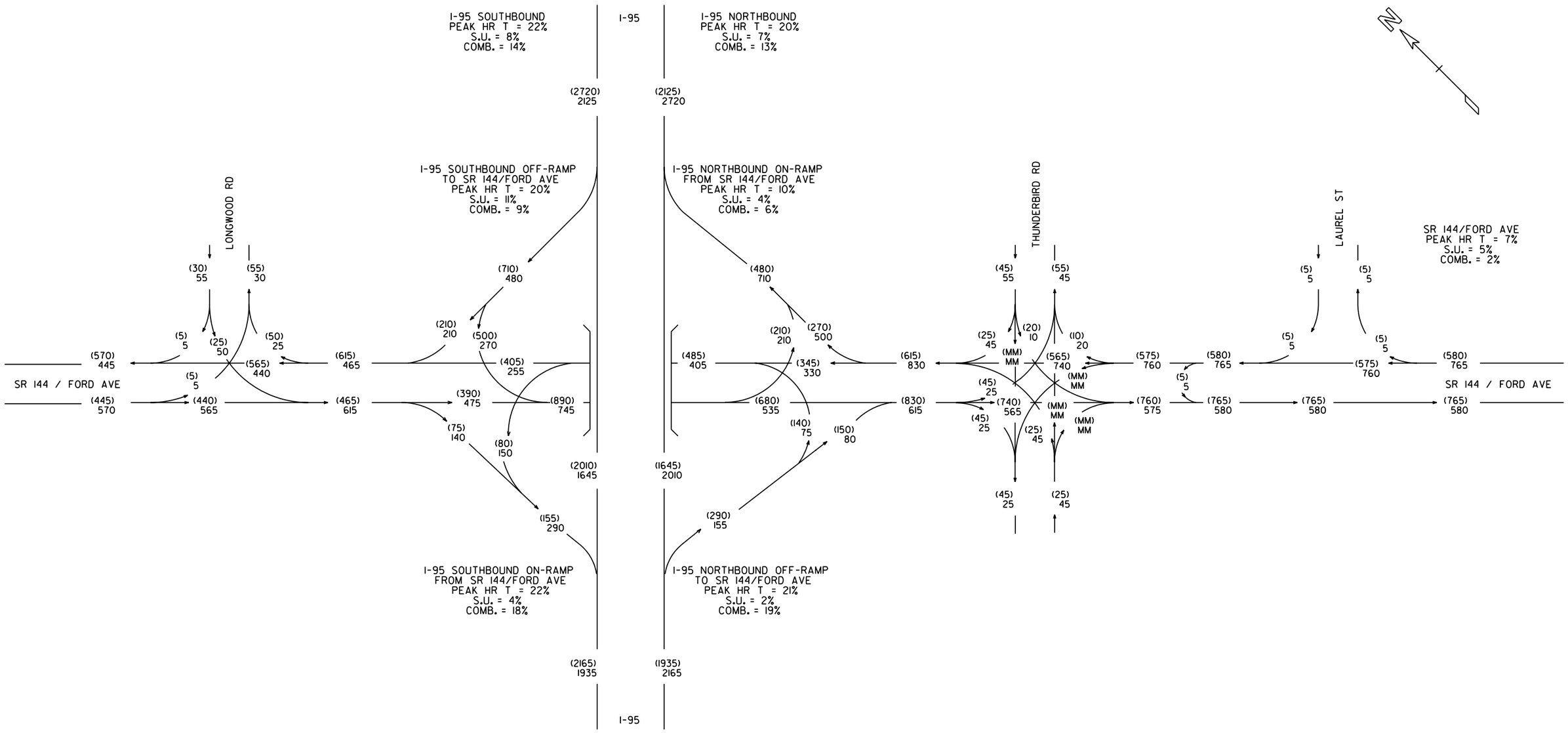
P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS

2037 BUILD/NO-BUILD ADT = (000)
2017 BUILD/NO-BUILD ADT = 000

HF
11/12

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING
GROUP

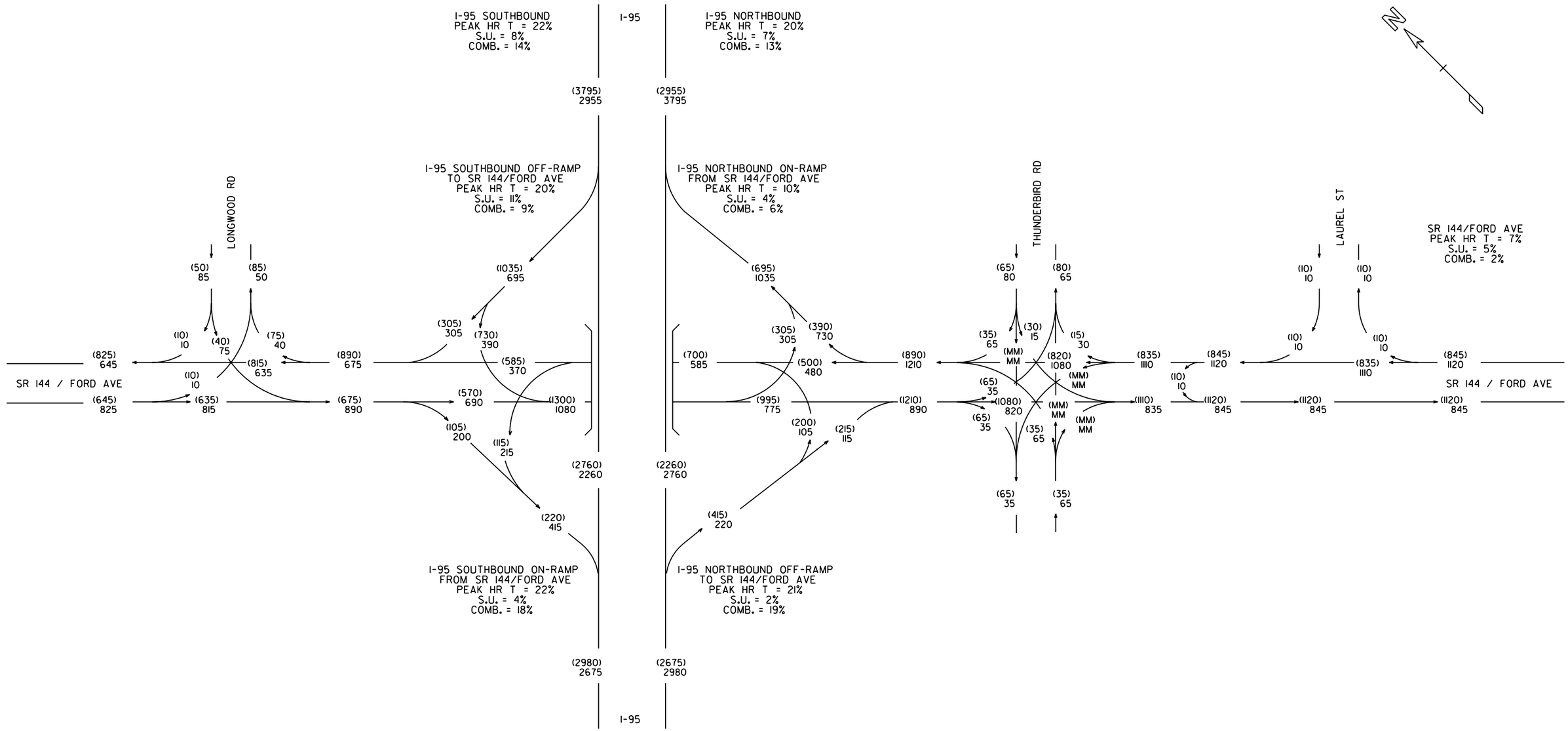
P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS

2017 BUILD/NO-BUILD PM DHV = (000)
2017 BUILD/NO-BUILD AM DHV = 000

HF
11/12

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS
2037 BUILD/NO BUILD PM DHV = (000)
2037 BUILD/NO BUILD AM DHV = 000
HF
11/12

APPENDIX F

Turning Movement Count Data

TRAFFIC DATA SERVICES

Phone: (678) 687-8266 Fax: (404) 294-6122

INTERSECTION TURNING MOVEMENT COUNT SUMMARY

CLIENT: GRICE CONSULTING GROUP
PROJECT: P.I. #0010739 BRYAN COUNTY
DATE: THURSDAY, AUGUST 23RD 2012
PERIODS: 7:00 AM TO 9:00 AM AND 4:00 PM TO 6:00 PM
INTERSECTION: N/S I-95 SB RAMPS
E/W SR 144/FORD AVENUE

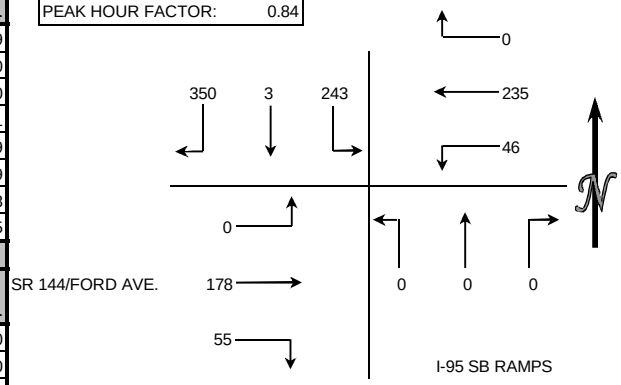
15 MIN COUNTS — 7:00 AM TO 9:00 AM

PERIOD	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
700-715	138	1	65	0	73	10	0	0	0	10	32	0	329
715-730	88	0	52	0	67	11	0	0	0	20	42	0	280
730-745	68	1	51	0	47	13	0	0	0	10	50	0	240
745-800	56	1	75	0	48	12	0	0	0	15	54	0	261
800-815	72	0	66	0	59	10	0	0	0	14	38	0	259
815-830	70	0	72	0	46	12	0	0	0	22	77	0	299
830-845	47	0	45	0	54	14	0	0	0	12	76	0	248
845-900	46	0	57	0	44	8	0	0	0	10	60	0	225

HOUR TOTALS

TIME	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
700-800	350	3	243	0	235	46	0	0	0	55	178	0	1110
715-815	284	2	244	0	221	46	0	0	0	59	184	0	1040
730-830	266	2	264	0	200	47	0	0	0	61	219	0	1059
745-845	245	1	258	0	207	48	0	0	0	63	245	0	1067
800-900	235	0	240	0	203	44	0	0	0	58	251	0	1031

AM PEAK HOUR: 700-800
PEAK HOUR FACTOR: 0.84



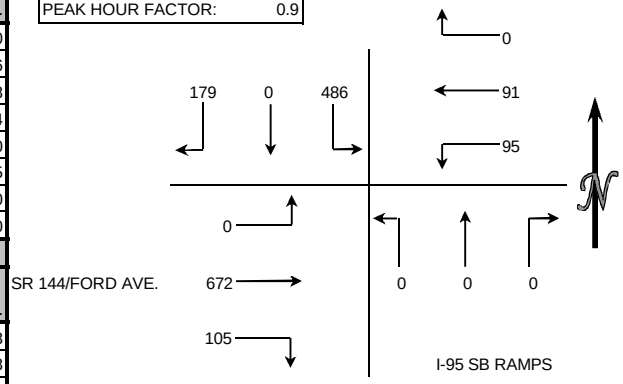
15 MIN COUNTS — 4:00 PM TO 6:00 PM

PERIOD	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
400-415	50	11	101	0	35	18	0	0	0	26	149	0	390
415-430	48	0	103	0	26	16	0	0	0	35	188	0	416
430-445	44	0	123	0	28	24	0	0	0	18	171	0	408
445-500	44	0	112	0	13	27	0	0	0	23	135	0	354
500-515	43	0	148	0	24	28	0	0	0	29	178	0	450
515-530	54	1	161	0	28	29	0	0	0	33	109	0	415
530-545	36	2	178	0	17	20	0	0	0	15	102	0	370
545-600	40	0	138	0	20	28	0	0	0	18	126	0	370

HOUR TOTALS

TIME	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
400-500	186	11	439	0	102	85	0	0	0	102	643	0	1568
415-515	179	0	486	0	91	95	0	0	0	105	672	0	1628
430-530	185	1	544	0	93	108	0	0	0	103	593	0	1627
445-545	177	3	599	0	82	104	0	0	0	100	524	0	1589
500-600	173	3	625	0	89	105	0	0	0	95	515	0	1605

PM PEAK HOUR: 415-515
PEAK HOUR FACTOR: 0.9



TRAFFIC DATA SERVICES

Phone: (678) 687-8266 Fax: (404) 294-6122

INTERSECTION TURNING MOVEMENT COUNT SUMMARY

CLIENT: GRICE CONSULTING GROUP
PROJECT: P.I. #0010739 BRYAN COUNTY
DATE: THURSDAY, AUGUST 23RD 2012
PERIODS: 7:00 AM TO 9:00 AM AND 4:00 PM TO 6:00 PM
INTERSECTION: N/S I-95 NB RAMPS
E/W SR 144/FORD AVENUE

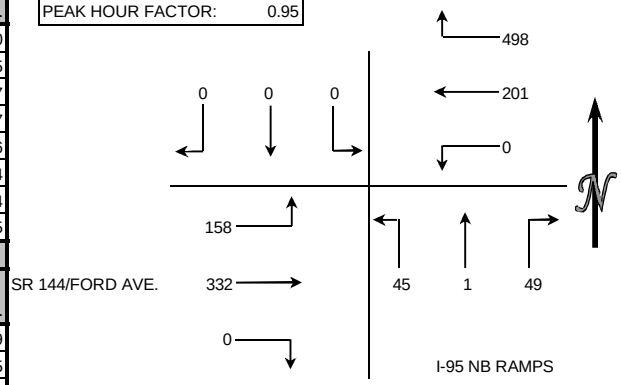
15 MIN COUNTS — 7:00 AM TO 9:00 AM

PERIOD	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
700-715	0	0	0	96	66	0	11	0	11	0	77	29	290
715-730	0	0	0	126	63	0	15	1	10	0	57	33	305
730-745	0	0	0	145	48	0	14	1	13	0	73	43	337
745-800	0	0	0	122	50	0	12	0	11	0	86	36	317
800-815	0	0	0	130	49	0	13	0	11	0	81	32	316
815-830	0	0	0	101	54	0	10	0	10	0	92	47	314
830-845	0	0	0	106	43	0	29	0	15	0	74	47	314
845-900	0	0	0	65	39	0	12	0	15	0	73	41	245

HOUR TOTALS

TIME	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
700-800	0	0	0	489	227	0	52	2	45	0	293	141	1249
715-815	0	0	0	523	210	0	54	2	45	0	297	144	1275
730-830	0	0	0	498	201	0	49	1	45	0	332	158	1284
745-845	0	0	0	459	196	0	64	0	47	0	333	162	1261
800-900	0	0	0	402	185	0	64	0	51	0	320	167	1189

AM PEAK HOUR: 730-830
PEAK HOUR FACTOR: 0.95



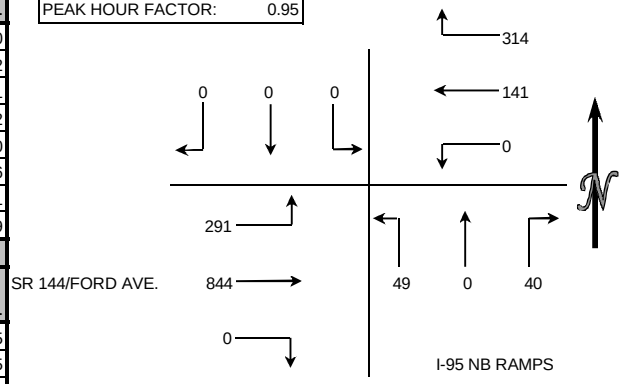
15 MIN COUNTS — 4:00 PM TO 6:00 PM

PERIOD	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
400-415	0	0	0	83	28	0	13	0	11	0	213	62	410
415-430	0	0	0	79	21	0	13	0	10	0	155	54	332
430-445	0	0	0	74	28	0	12	0	12	0	208	77	411
445-500	0	0	0	74	30	0	11	0	12	0	226	59	412
500-515	0	0	0	87	45	0	9	0	12	0	207	80	440
515-530	0	0	0	79	38	0	8	0	13	0	203	75	416
530-545	0	0	0	67	17	0	7	0	10	0	203	77	381
545-600	0	0	0	81	20	0	5	0	7	0	221	75	409

HOUR TOTALS

TIME	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
400-500	0	0	0	310	107	0	49	0	45	0	802	252	1565
415-515	0	0	0	314	124	0	45	0	46	0	796	270	1595
430-530	0	0	0	314	141	0	40	0	49	0	844	291	1679
445-545	0	0	0	307	130	0	35	0	47	0	839	291	1649
500-600	0	0	0	314	120	0	29	0	42	0	834	307	1646

PM PEAK HOUR: 430-530
PEAK HOUR FACTOR: 0.95



TRAFFIC DATA SERVICES

Phone: (678) 687-8266 Fax: (404) 294-6122

INTERSECTION TURNING MOVEMENT COUNT SUMMARY

CLIENT: GRICE CONSULTING GROUP
PROJECT: P.I. #0010739 BRYAN COUNTY
DATE: THURSDAY, AUGUST 23RD 2012
PERIODS: 7:00 AM TO 9:00 AM AND 4:00 PM TO 6:00 PM
INTERSECTION: N/S THUNDERBIRD ROAD
E/W SR 144/FORD AVENUE

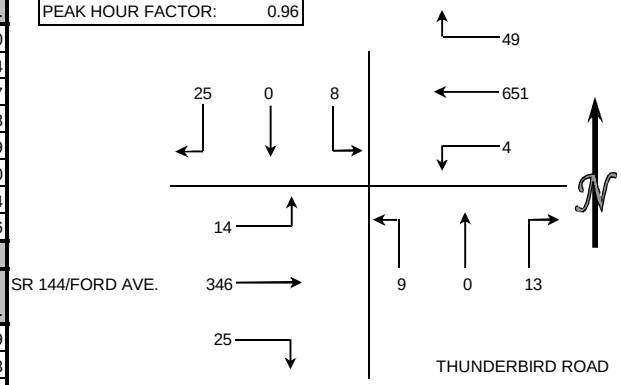
15 MIN COUNTS — 7:00 AM TO 9:00 AM

PERIOD	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
700-715	6	0	0	3	155	1	0	0	2	7	65	1	240
715-730	4	0	6	9	177	1	0	0	7	7	70	3	284
730-745	5	0	0	2	191	2	4	0	5	2	76	0	287
745-800	2	0	4	12	170	1	2	0	0	7	96	4	298
800-815	10	0	2	11	153	0	4	0	1	4	82	2	269
815-830	8	0	2	24	137	1	3	0	3	12	92	8	290
830-845	10	0	7	12	138	1	2	0	5	6	82	11	274
845-900	5	0	2	17	94	1	1	0	3	6	82	5	216

HOUR TOTALS

TIME	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
700-800	17	0	10	26	693	5	6	0	14	23	307	8	1109
715-815	21	0	12	34	691	4	10	0	13	20	324	9	1138
730-830	25	0	8	49	651	4	13	0	9	25	346	14	1144
745-845	30	0	15	59	598	3	11	0	9	29	352	25	1131
800-900	33	0	13	64	522	3	10	0	12	28	338	26	1049

AM PEAK HOUR: 730-830
PEAK HOUR FACTOR: 0.96



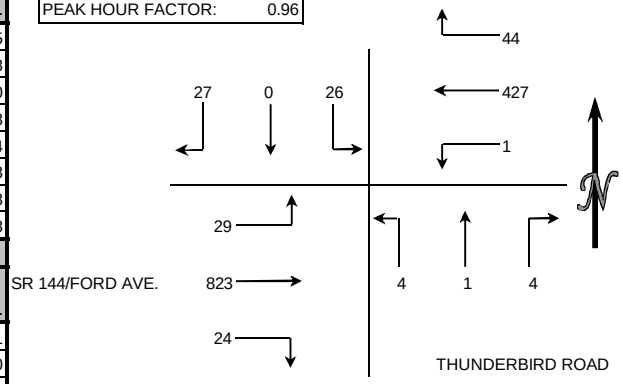
15 MIN COUNTS — 4:00 PM TO 6:00 PM

PERIOD	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
400-415	11	0	14	15	88	1	1	0	1	4	195	5	335
415-430	5	0	4	12	91	0	5	0	1	4	202	4	328
430-445	10	0	3	12	111	0	0	0	1	5	203	5	350
445-500	4	0	5	8	101	1	3	0	2	7	208	9	348
500-515	2	0	9	9	108	0	1	1	0	5	203	6	344
515-530	11	0	9	15	107	0	0	0	1	7	209	9	368
530-545	3	0	9	9	93	0	3	0	2	7	206	6	338
545-600	12	0	5	14	99	0	2	0	1	6	184	15	338

HOUR TOTALS

TIME	1 SBRT	2 SBTH	3 SBLT	4 WBRT	5 WBTH	6 WBLT	7 NBRT	8 NBTH	9 NBLT	10 EBRT	11 EBTH	12 EBLT	TOTAL
400-500	30	0	26	47	391	2	9	0	5	20	808	23	1361
415-515	21	0	21	41	411	1	9	1	4	21	816	24	1370
430-530	27	0	26	44	427	1	4	1	4	24	823	29	1410
445-545	20	0	32	41	409	1	7	1	5	26	826	30	1398
500-600	28	0	32	47	407	0	6	1	4	25	802	36	1388

PM PEAK HOUR: 430-530
PEAK HOUR FACTOR: 0.96



APPENDIX G

ADT Tube Count Data

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: SR 144-Ford Ave. West of
Title2: Longwood Dr.
Title3:

Site: #9001
Date: 8/14/2012
Tuesday

Daily Volume

Begin	EB		WB		Combined		Begin	EB		WB		Combined	
12:00 AM	33	105	41	95	74	200	12:00 PM	110	443	106	398	216	841
12:15 AM	27		16		43		12:15 PM	117		100		217	
12:30 AM	26		14		40		12:30 PM	115		102		217	
12:45 AM	19		24		43		12:45 PM	101		90		191	
1:00 AM	13	71	18	101	31	172	1:00 PM	99	391	114	377	213	768
1:15 AM	8		25		33		1:15 PM	100		77		177	
1:30 AM	28		32		60		1:30 PM	99		84		183	
1:45 AM	22		26		48		1:45 PM	93		102		195	
2:00 AM	8	69	15	69	23	138	2:00 PM	133	477	106	411	239	888
2:15 AM	21		23		44		2:15 PM	114		118		232	
2:30 AM	21		15		36		2:30 PM	104		108		212	
2:45 AM	19		16		35		2:45 PM	126		79		205	
3:00 AM	12	101	25	110	37	211	3:00 PM	125	596	89	399	214	995
3:15 AM	16		40		56		3:15 PM	135		127		262	
3:30 AM	46		26		72		3:30 PM	165		95		260	
3:45 AM	27		19		46		3:45 PM	171		88		259	
4:00 AM	38	131	34	253	72	384	4:00 PM	155	773	102	388	257	1161
4:15 AM	28		46		74		4:15 PM	197		101		298	
4:30 AM	21		72		93		4:30 PM	192		85		277	
4:45 AM	44		101		145		4:45 PM	229		100		329	
5:00 AM	36	186	179	898	215	1084	5:00 PM	208	792	100	357	308	1149
5:15 AM	60		254		314		5:15 PM	204		97		301	
5:30 AM	34		289		323		5:30 PM	163		76		239	
5:45 AM	56		176		232		5:45 PM	217		84		301	
6:00 AM	37	237	104	485	141	722	6:00 PM	234	650	112	336	346	986
6:15 AM	66		80		146		6:15 PM	175		61		236	
6:30 AM	72		118		190		6:30 PM	138		80		218	
6:45 AM	62		183		245		6:45 PM	103		83		186	
7:00 AM	99	351	193	560	292	911	7:00 PM	89	343	72	238	161	581
7:15 AM	77		117		194		7:15 PM	107		53		160	
7:30 AM	98		137		235		7:30 PM	82		52		134	
7:45 AM	77		113		190		7:45 PM	65		61		126	
8:00 AM	101	398	108	411	209	809	8:00 PM	77	200	46	243	123	443
8:15 AM	108		119		227		8:15 PM	36		68		104	
8:30 AM	104		94		198		8:30 PM	51		60		111	
8:45 AM	85		90		175		8:45 PM	36		69		105	
9:00 AM	108	405	106	348	214	753	9:00 PM	55	164	54	193	109	357
9:15 AM	109		88		197		9:15 PM	42		50		92	
9:30 AM	101		96		197		9:30 PM	34		46		80	
9:45 AM	87		58		145		9:45 PM	33		43		76	
10:00 AM	117	372	88	287	205	659	10:00 PM	29	133	38	156	67	289
10:15 AM	78		62		140		10:15 PM	35		33		68	
10:30 AM	94		67		161		10:30 PM	33		42		75	
10:45 AM	83		70		153		10:45 PM	36		43		79	
11:00 AM	108	422	77	358	185	780	11:00 PM	29	114	48	136	77	250
11:15 AM	91		81		172		11:15 PM	37		27		64	
11:30 AM	106		101		207		11:30 PM	9		28		37	
11:45 AM	117		99		216		11:45 PM	39		33		72	

	EB	WB	Combined
24 Hour Volume	7924 (51.0%)	7607 (49.0%)	15531

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	EB	WB	Combined	EB	WB	Combined
Count	2848	3975	6823	5076	3632	8708
	41.7 %	58.3 %		58.3 %	41.7 %	
Peak Hour	11:00 AM	5:00 AM	5:00 AM	4:30 PM	1:45 PM	4:30 PM
Volume	422	898	1084	833	434	1215
Factor	0.90	0.78	0.84	0.91	0.92	0.92

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Longwood Rd. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9002
Date: 8/14/2012
Tuesday

Daily Volume

Begin	SB		NB		Combined		Begin	SB		NB		Combined	
12:00 AM	1	2	1	3	2	5	12:00 PM	13	49	10	39	23	88
12:15 AM	1		1		2		12:15 PM	13		13		26	
12:30 AM	0		0		0		12:30 PM	11		7		18	
12:45 AM	0		1		1		12:45 PM	12		9		21	
1:00 AM	1	1	0	0	1	1	1:00 PM	9	39	14	42	23	81
1:15 AM	0		0		0		1:15 PM	12		10		22	
1:30 AM	0		0		0		1:30 PM	10		12		22	
1:45 AM	0		0		0		1:45 PM	8		6		14	
2:00 AM	0	0	0	0	0	0	2:00 PM	8	21	9	30	17	51
2:15 AM	0		0		0		2:15 PM	3		3		6	
2:30 AM	0		0		0		2:30 PM	5		8		13	
2:45 AM	0		0		0		2:45 PM	5		10		15	
3:00 AM	0	1	0	0	0	1	3:00 PM	9	33	12	39	21	72
3:15 AM	0		0		0		3:15 PM	8		7		15	
3:30 AM	1		0		1		3:30 PM	11		6		17	
3:45 AM	0		0		0		3:45 PM	5		14		19	
4:00 AM	0	0	0	1	0	1	4:00 PM	9	47	8	25	17	72
4:15 AM	0		0		0		4:15 PM	15		2		17	
4:30 AM	0		0		0		4:30 PM	9		8		17	
4:45 AM	0		1		1		4:45 PM	14		7		21	
5:00 AM	0	0	0	2	0	2	5:00 PM	13	45	8	14	21	59
5:15 AM	0		1		1		5:15 PM	9		2		11	
5:30 AM	0		0		0		5:30 PM	16		3		19	
5:45 AM	0		1		1		5:45 PM	7		1		8	
6:00 AM	0	5	2	26	2	31	6:00 PM	8	28	4	20	12	48
6:15 AM	1		6		7		6:15 PM	5		2		7	
6:30 AM	3		9		12		6:30 PM	5		7		12	
6:45 AM	1		9		10		6:45 PM	10		7		17	
7:00 AM	6	22	17	72	23	94	7:00 PM	11	16	8	21	19	37
7:15 AM	4		11		15		7:15 PM	2		4		6	
7:30 AM	2		19		21		7:30 PM	1		3		4	
7:45 AM	10		25		35		7:45 PM	2		6		8	
8:00 AM	3	29	15	38	18	67	8:00 PM	2	10	0	4	2	14
8:15 AM	8		10		18		8:15 PM	1		2		3	
8:30 AM	9		5		14		8:30 PM	4		2		6	
8:45 AM	9		8		17		8:45 PM	3		0		3	
9:00 AM	10	28	11	38	21	66	9:00 PM	3	19	2	4	5	23
9:15 AM	5		7		12		9:15 PM	6		0		6	
9:30 AM	7		8		15		9:30 PM	3		0		3	
9:45 AM	6		12		18		9:45 PM	7		2		9	
10:00 AM	9	46	12	46	21	92	10:00 PM	0	1	0	1	0	2
10:15 AM	13		17		30		10:15 PM	0		0		0	
10:30 AM	10		12		22		10:30 PM	1		1		2	
10:45 AM	14		5		19		10:45 PM	0		0		0	
11:00 AM	9	46	14	40	23	86	11:00 PM	0	1	0	2	0	3
11:15 AM	13		8		21		11:15 PM	1		0		1	
11:30 AM	11		11		22		11:30 PM	0		0		0	
11:45 AM	13		7		20		11:45 PM	0		2		2	

	SB	NB	Combined
24 Hour Volume	489 (49.1%)	507 (50.9%)	996

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	SB	NB	Combined	SB	NB	Combined
Count	180	266	446	309	241	550
	40.4 %	59.6 %		56.2 %	43.8 %	
Peak Hour	10:45 AM	7:00 AM	7:00 AM	4:45 PM	12:45 PM	12:00 PM
Volume	47	72	94	52	45	88
Factor	0.84	0.72	0.67	0.81	0.80	0.85

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: SR 144-Ford Ave. East of
Title2: Longwood Rd
Title3:

Site: #9003
Date: 8/14/2012
Tuesday

Daily Volume

Begin	EB		WB		Combined		Begin	EB		WB		Combined	
12:00 AM	41	130	42	101	83	231	12:00 PM	135	518	119	437	254	955
12:15 AM	38		18		56		12:15 PM	135		110		245	
12:30 AM	30		14		44		12:30 PM	118		106		224	
12:45 AM	21		27		48		12:45 PM	130		102		232	
1:00 AM	19	95	18	102	37	197	1:00 PM	115	455	139	428	254	883
1:15 AM	13		24		37		1:15 PM	113		92		205	
1:30 AM	34		33		67		1:30 PM	114		93		207	
1:45 AM	29		27		56		1:45 PM	113		104		217	
2:00 AM	11	78	15	68	26	146	2:00 PM	132	516	119	450	251	966
2:15 AM	22		23		45		2:15 PM	119		126		245	
2:30 AM	21		15		36		2:30 PM	122		114		236	
2:45 AM	24		15		39		2:45 PM	143		91		234	
3:00 AM	23	135	25	113	48	248	3:00 PM	132	681	97	446	229	1127
3:15 AM	28		41		69		3:15 PM	161		133		294	
3:30 AM	52		27		79		3:30 PM	196		111		307	
3:45 AM	32		20		52		3:45 PM	192		105		297	
4:00 AM	46	174	38	251	84	425	4:00 PM	183	872	113	420	296	1292
4:15 AM	36		43		79		4:15 PM	217		106		323	
4:30 AM	35		75		110		4:30 PM	229		96		325	
4:45 AM	57		95		152		4:45 PM	243		105		348	
5:00 AM	85	437	176	903	261	1340	5:00 PM	234	888	108	376	342	1264
5:15 AM	126		263		389		5:15 PM	224		100		324	
5:30 AM	122		292		414		5:30 PM	194		80		274	
5:45 AM	104		172		276		5:45 PM	236		88		324	
6:00 AM	64	354	111	519	175	873	6:00 PM	246	756	114	357	360	1113
6:15 AM	81		87		168		6:15 PM	201		65		266	
6:30 AM	106		126		232		6:30 PM	179		90		269	
6:45 AM	103		195		298		6:45 PM	130		88		218	
7:00 AM	122	467	213	639	335	1106	7:00 PM	121	417	83	265	204	682
7:15 AM	120		132		252		7:15 PM	123		59		182	
7:30 AM	118		148		266		7:30 PM	95		57		152	
7:45 AM	107		146		253		7:45 PM	78		66		144	
8:00 AM	134	530	129	459	263	989	8:00 PM	91	256	48	253	139	509
8:15 AM	140		133		273		8:15 PM	54		71		125	
8:30 AM	133		96		229		8:30 PM	61		64		125	
8:45 AM	123		101		224		8:45 PM	50		70		120	
9:00 AM	135	501	114	398	249	899	9:00 PM	78	242	59	203	137	445
9:15 AM	136		97		233		9:15 PM	69		50		119	
9:30 AM	122		108		230		9:30 PM	41		49		90	
9:45 AM	108		79		187		9:45 PM	54		45		99	
10:00 AM	130	436	99	337	229	773	10:00 PM	40	164	39	158	79	322
10:15 AM	98		79		177		10:15 PM	40		36		76	
10:30 AM	106		78		184		10:30 PM	34		42		76	
10:45 AM	102		81		183		10:45 PM	50		41		91	
11:00 AM	120	456	91	391	211	847	11:00 PM	46	148	51	140	97	288
11:15 AM	105		95		200		11:15 PM	41		26		67	
11:30 AM	105		104		209		11:30 PM	18		30		48	
11:45 AM	126		101		227		11:45 PM	43		33		76	

	EB	WB	Combined
24 Hour Volume	9706 (54.2%)	8214 (45.8%)	17920

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	EB	WB	Combined	EB	WB	Combined
Count	3793	4281	8074	5913	3933	9846
	47.0 %	53.0 %		60.1 %	39.9 %	
Peak Hour	8:15 AM	5:00 AM	5:00 AM	4:30 PM	1:45 PM	4:30 PM
Volume	531	903	1340	930	463	1339
Factor	0.95	0.77	0.81	0.96	0.92	0.96

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1: I-95 North of SB OFF Ramp to
Title2: SR 144-Ford Ave.
Title3:

Site: #9004
Date: 8/23/2012
Thursday

Daily Vehicle Classification
Channel: SB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	314	1	154	26	6	7	2	0	35	72	0	4	3	4
1:00 AM	247	0	119	18	6	7	2	0	20	60	1	9	3	2
2:00 AM	274	1	109	26	7	10	1	0	24	78	0	7	6	5
3:00 AM	86	1	36	12	5	3	0	0	6	20	0	3	0	0
4:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:00 AM	183	1	108	29	4	4	1	0	16	17	0	2	0	1
7:00 AM	1462	6	891	251	31	69	7	0	70	119	2	7	7	2
8:00 AM	1502	13	863	260	38	78	13	0	87	129	2	10	2	7
9:00 AM	1360	9	780	207	48	56	12	1	107	116	0	11	4	9
10:00 AM	1570	15	897	259	33	68	15	0	106	151	6	13	4	3
11:00 AM	1551	9	919	213	54	69	13	0	108	136	5	13	3	9
12:00 PM	1576	14	930	239	45	52	12	0	111	148	2	10	4	9
1:00 PM	1758	13	1076	281	46	62	28	1	92	127	3	15	3	11
2:00 PM	1803	9	1088	280	53	62	23	0	117	137	0	15	3	16
3:00 PM	1995	19	1252	318	33	62	21	0	88	160	7	21	4	10
4:00 PM	2154	19	1320	335	81	69	23	2	102	171	5	17	4	6
5:00 PM	2244	19	1453	340	56	60	18	2	123	144	2	16	5	6
6:00 PM	1806	5	1170	253	37	57	9	1	84	156	8	14	1	11
7:00 PM	1221	6	764	167	26	36	13	1	64	129	3	10	0	2
8:00 PM	1069	4	628	146	25	31	10	0	63	140	6	7	2	7
9:00 PM	869	7	538	100	17	23	7	1	46	109	2	14	5	0
10:00 PM	689	6	390	77	13	17	2	0	42	128	0	9	3	2
11:00 PM	478	2	259	48	15	8	3	0	30	95	4	3	8	3
Total	26211	179	15744	3885	679	910	235	9	1541	2542	58	230	74	125
%		0.7	60.1	14.8	2.6	3.5	0.9	0.0	5.9	9.7	0.2	0.9	0.3	0.5

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1:	I-95 North of SB OFF Ramp to	Site:	#9004
Title2:	SR 144-Ford Ave.	Date:	8/23/2012
Title3:			Thursday

Daily Volume, per Channel

Channel: SB

Interval Begin			Interval Begin		
12:00 AM	66	314	12:00 PM	381	1576
12:15 AM	92		12:15 PM	387	
12:30 AM	89		12:30 PM	380	
12:45 AM	67		12:45 PM	428	
1:00 AM	57	247	1:00 PM	417	1758
1:15 AM	71		1:15 PM	428	
1:30 AM	62		1:30 PM	476	
1:45 AM	57		1:45 PM	437	
2:00 AM	60	274	2:00 PM	449	1803
2:15 AM	71		2:15 PM	462	
2:30 AM	76		2:30 PM	457	
2:45 AM	67		2:45 PM	435	
3:00 AM	71	86	3:00 PM	511	1995
3:15 AM	15		3:15 PM	479	
3:30 AM	0		3:30 PM	483	
3:45 AM	0		3:45 PM	522	
4:00 AM	0	0	4:00 PM	489	2154
4:15 AM	0		4:15 PM	543	
4:30 AM	0		4:30 PM	566	
4:45 AM	0		4:45 PM	556	
5:00 AM	0	0	5:00 PM	564	2244
5:15 AM	0		5:15 PM	589	
5:30 AM	0		5:30 PM	559	
5:45 AM	0		5:45 PM	532	
6:00 AM	0	183	6:00 PM	541	1806
6:15 AM	0		6:15 PM	447	
6:30 AM	0		6:30 PM	436	
6:45 AM	183		6:45 PM	382	
7:00 AM	402	1462	7:00 PM	294	1221
7:15 AM	356		7:15 PM	327	
7:30 AM	339		7:30 PM	314	
7:45 AM	365		7:45 PM	286	
8:00 AM	397	1502	8:00 PM	272	1069
8:15 AM	367		8:15 PM	290	
8:30 AM	372		8:30 PM	269	
8:45 AM	366		8:45 PM	238	
9:00 AM	304	1360	9:00 PM	236	869
9:15 AM	353		9:15 PM	226	
9:30 AM	366		9:30 PM	212	
9:45 AM	337		9:45 PM	195	
10:00 AM	389	1570	10:00 PM	216	689
10:15 AM	398		10:15 PM	185	
10:30 AM	394		10:30 PM	153	
10:45 AM	389		10:45 PM	135	
11:00 AM	396	1551	11:00 PM	124	478
11:15 AM	391		11:15 PM	130	
11:30 AM	393		11:30 PM	115	
11:45 AM	371		11:45 PM	109	

	SB
24 Hour Volume	26211

12:00 AM - 12:00 PM	SB	**12:00 PM - 12:00 AM** SB
Count	8549	17662
Peak Hour	10:15 AM	4:30 PM
Volume	1577	2275
Factor	0.99	0.97

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1: I-95 North of

Title2: SR 144-Ford Ave NB ON Ramp

Title3:

Site: #9005

Date: 8/23/2012

Thursday

Daily Vehicle Classification

Channel: NB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	342	1	161	60	8	5	1	0	23	72	0	6	3	2
1:00 AM	231	2	101	35	5	9	1	0	18	53	0	5	2	0
2:00 AM	231	1	104	29	2	6	1	0	20	54	0	10	2	2
3:00 AM	269	1	122	34	2	8	3	0	21	65	1	9	3	0
4:00 AM	427	4	220	70	11	15	5	0	17	71	1	9	4	0
5:00 AM	842	5	443	203	18	26	4	0	40	82	0	11	9	1
6:00 AM	1429	11	797	323	27	61	12	1	66	112	2	9	5	3
7:00 AM	1906	18	1143	383	33	92	10	1	81	116	2	22	0	5
8:00 AM	1651	12	1003	274	30	84	17	0	86	111	1	20	5	8
9:00 AM	1568	14	834	311	46	73	17	1	92	150	3	16	5	6
10:00 AM	1701	25	924	317	60	60	13	3	98	154	9	23	9	6
11:00 AM	1849	26	1029	328	60	81	22	1	116	139	1	32	6	8
12:00 PM	1876	25	1078	328	59	75	23	0	93	147	10	21	8	9
1:00 PM	1814	18	1006	329	62	84	13	1	92	168	6	16	7	12
2:00 PM	1913	15	1047	383	50	84	17	2	106	169	9	20	4	7
3:00 PM	2079	19	1216	384	55	90	12	1	112	148	9	18	5	10
4:00 PM	2032	16	1250	341	51	91	13	2	106	130	5	11	5	11
5:00 PM	1851	18	1131	354	45	80	10	1	76	109	3	9	5	10
6:00 PM	1499	10	850	286	39	72	8	1	78	132	2	12	3	6
7:00 PM	1130	7	577	214	48	48	4	0	78	131	6	12	1	4
8:00 PM	808	3	436	131	16	32	1	0	57	118	5	7	0	2
9:00 PM	708	9	378	119	21	24	4	0	47	92	5	5	1	3
10:00 PM	589	3	313	85	8	18	2	0	39	105	3	11	1	1
11:00 PM	462	6	212	89	7	13	4	0	31	80	0	9	8	3
Total	29207	269	16375	5410	763	1231	217	15	1593	2708	83	323	101	119
%		0.9	56.1	18.5	2.6	4.2	0.7	0.1	5.5	9.3	0.3	1.1	0.3	0.4

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1:	I-95 North of	Site:	#9005
Title2:	SR 144-Ford Ave NB ON Ramp	Date:	8/23/2012
Title3:			Thursday

Daily Volume, per Channel

Channel: NB

Interval Begin			Interval Begin		
12:00 AM	92	342	12:00 PM	473	1876
12:15 AM	86		12:15 PM	467	
12:30 AM	83		12:30 PM	479	
12:45 AM	81		12:45 PM	457	
1:00 AM	62	231	1:00 PM	463	1814
1:15 AM	63		1:15 PM	443	
1:30 AM	52		1:30 PM	451	
1:45 AM	54		1:45 PM	457	
2:00 AM	58	231	2:00 PM	452	1913
2:15 AM	69		2:15 PM	477	
2:30 AM	60		2:30 PM	452	
2:45 AM	44		2:45 PM	532	
3:00 AM	54	269	3:00 PM	546	2079
3:15 AM	72		3:15 PM	548	
3:30 AM	80		3:30 PM	485	
3:45 AM	63		3:45 PM	500	
4:00 AM	86	427	4:00 PM	492	2032
4:15 AM	90		4:15 PM	528	
4:30 AM	134		4:30 PM	523	
4:45 AM	117		4:45 PM	489	
5:00 AM	151	842	5:00 PM	476	1851
5:15 AM	211		5:15 PM	480	
5:30 AM	248		5:30 PM	450	
5:45 AM	232		5:45 PM	445	
6:00 AM	267	1429	6:00 PM	393	1499
6:15 AM	341		6:15 PM	382	
6:30 AM	414		6:30 PM	389	
6:45 AM	407		6:45 PM	335	
7:00 AM	434	1906	7:00 PM	303	1130
7:15 AM	506		7:15 PM	290	
7:30 AM	528		7:30 PM	261	
7:45 AM	438		7:45 PM	276	
8:00 AM	452	1651	8:00 PM	202	808
8:15 AM	420		8:15 PM	204	
8:30 AM	406		8:30 PM	206	
8:45 AM	373		8:45 PM	196	
9:00 AM	374	1568	9:00 PM	174	708
9:15 AM	396		9:15 PM	181	
9:30 AM	395		9:30 PM	185	
9:45 AM	403		9:45 PM	168	
10:00 AM	375	1701	10:00 PM	166	589
10:15 AM	448		10:15 PM	150	
10:30 AM	418		10:30 PM	139	
10:45 AM	460		10:45 PM	134	
11:00 AM	422	1849	11:00 PM	125	462
11:15 AM	466		11:15 PM	115	
11:30 AM	473		11:30 PM	125	
11:45 AM	488		11:45 PM	97	

	NB
24 Hour Volume	29207

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	NB	NB
Count	12446	16761
Peak Hour	7:15 AM	2:45 PM
Volume	1924	2111
Factor	0.91	0.96

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: I-95 at SR 144 Ford Ave.
Title2: SB off Ramps
Title3:

Site: #9006
Date: 8/14/2012
Tuesday

Daily Vehicle Classification
Channel: SB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	57	0	25	11	0	3	0	0	2	16	0	0	0	0
1:00 AM	55	1	28	9	1	1	1	0	1	12	0	1	0	0
2:00 AM	38	0	15	7	0	3	0	0	1	12	0	0	0	0
3:00 AM	51	0	19	9	1	4	0	0	0	16	0	2	0	0
4:00 AM	162	1	99	28	3	6	1	0	2	22	0	0	0	0
5:00 AM	555	5	377	99	7	41	1	0	8	16	0	0	1	0
6:00 AM	354	5	201	80	5	30	2	0	7	23	0	0	1	0
7:00 AM	515	4	293	111	9	56	1	0	11	29	0	0	0	1
8:00 AM	431	2	229	108	8	47	2	0	13	21	1	0	0	0
9:00 AM	369	4	170	103	6	35	4	0	15	28	2	0	0	2
10:00 AM	327	2	154	84	8	39	3	0	8	26	0	2	0	1
11:00 AM	351	1	183	82	2	32	3	0	9	37	1	1	0	0
12:00 PM	389	5	209	70	11	35	1	0	13	44	0	0	1	0
1:00 PM	396	2	201	90	12	36	5	0	10	35	1	3	1	0
2:00 PM	449	3	224	120	11	29	3	0	14	38	2	2	2	1
3:00 PM	529	2	268	140	18	35	2	0	27	34	0	2	0	1
4:00 PM	587	4	324	140	12	47	2	0	23	32	2	1	0	0
5:00 PM	648	6	384	144	21	33	0	0	35	16	0	4	1	4
6:00 PM	495	2	281	114	9	41	0	0	19	22	3	1	1	2
7:00 PM	334	4	197	77	9	11	1	0	5	27	0	1	0	2
8:00 PM	260	2	156	48	1	21	4	0	4	22	0	2	0	0
9:00 PM	215	3	111	51	2	15	3	0	2	27	1	0	0	0
10:00 PM	128	0	75	20	1	10	0	0	1	20	0	0	0	1
11:00 PM	91	2	51	15	1	3	0	0	2	13	1	2	1	0
Total	7786	60	4274	1760	158	613	39	0	232	588	14	24	9	15
%		0.8	54.9	22.6	2.0	7.9	0.5	0.0	3.0	7.6	0.2	0.3	0.1	0.2

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	I-95 at SR 144 Ford Ave.	Site:	#9006
Title2:	SB off Ramps	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: SB

Interval Begin			Interval Begin		
12:00 AM	18	57	12:00 PM	93	389
12:15 AM	16		12:15 PM	99	
12:30 AM	7		12:30 PM	116	
12:45 AM	16		12:45 PM	81	
1:00 AM	9	55	1:00 PM	106	396
1:15 AM	16		1:15 PM	101	
1:30 AM	17		1:30 PM	87	
1:45 AM	13		1:45 PM	102	
2:00 AM	6	38	2:00 PM	97	449
2:15 AM	17		2:15 PM	125	
2:30 AM	8		2:30 PM	113	
2:45 AM	7		2:45 PM	114	
3:00 AM	11	51	3:00 PM	106	529
3:15 AM	21		3:15 PM	152	
3:30 AM	12		3:30 PM	133	
3:45 AM	7		3:45 PM	138	
4:00 AM	17	162	4:00 PM	135	587
4:15 AM	19		4:15 PM	128	
4:30 AM	44		4:30 PM	151	
4:45 AM	82		4:45 PM	173	
5:00 AM	113	555	5:00 PM	160	648
5:15 AM	151		5:15 PM	163	
5:30 AM	178		5:30 PM	164	
5:45 AM	113		5:45 PM	161	
6:00 AM	65	354	6:00 PM	144	495
6:15 AM	73		6:15 PM	120	
6:30 AM	82		6:30 PM	114	
6:45 AM	134		6:45 PM	117	
7:00 AM	153	515	7:00 PM	89	334
7:15 AM	112		7:15 PM	80	
7:30 AM	123		7:30 PM	79	
7:45 AM	127		7:45 PM	86	
8:00 AM	121	431	8:00 PM	60	260
8:15 AM	111		8:15 PM	63	
8:30 AM	101		8:30 PM	74	
8:45 AM	98		8:45 PM	63	
9:00 AM	95	369	9:00 PM	55	215
9:15 AM	87		9:15 PM	59	
9:30 AM	97		9:30 PM	60	
9:45 AM	90		9:45 PM	41	
10:00 AM	74	327	10:00 PM	31	128
10:15 AM	79		10:15 PM	33	
10:30 AM	85		10:30 PM	31	
10:45 AM	89		10:45 PM	33	
11:00 AM	81	351	11:00 PM	29	91
11:15 AM	88		11:15 PM	20	
11:30 AM	89		11:30 PM	19	
11:45 AM	93		11:45 PM	23	

	SB
24 Hour Volume	7786

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	SB	SB
Count	3265	4521
Peak Hour	5:00 AM	4:45 PM
Volume	555	660
Factor	0.78	0.95

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: I-985 at SR 144 Ford Ave.
Title2: NB on Namps
Title3:

Site: #9007
Date: 8/14/2012
Tuesday

Daily Vehicle Classification
Channel: NB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	45	0	21	7	0	3	1	0	3	9	0	1	0	0
1:00 AM	25	0	12	2	0	0	1	0	3	6	0	1	0	0
2:00 AM	16	0	4	2	0	1	0	0	0	7	0	2	0	0
3:00 AM	40	0	19	4	0	0	0	0	3	12	0	1	1	0
4:00 AM	81	0	43	17	1	1	3	0	3	12	0	0	1	0
5:00 AM	243	1	146	64	0	6	0	0	5	18	0	3	0	0
6:00 AM	473	1	292	123	0	18	4	0	5	29	1	0	0	0
7:00 AM	694	3	467	148	5	16	6	0	11	33	2	1	0	2
8:00 AM	552	4	388	98	4	18	3	0	3	31	0	1	0	2
9:00 AM	406	1	249	87	11	15	4	0	5	32	2	0	0	0
10:00 AM	357	1	212	83	5	14	2	0	5	33	0	1	1	0
11:00 AM	402	3	259	85	1	24	3	0	5	18	2	2	0	0
12:00 PM	381	2	233	82	1	27	2	0	4	28	1	0	1	0
1:00 PM	371	1	222	78	4	24	6	0	8	26	0	1	0	1
2:00 PM	377	3	224	80	2	23	4	0	6	33	0	1	1	0
3:00 PM	489	2	323	104	5	17	1	0	6	27	3	0	1	0
4:00 PM	649	3	435	159	3	15	3	0	5	26	0	0	0	0
5:00 PM	702	7	503	141	3	15	4	0	9	20	0	0	0	0
6:00 PM	586	7	415	119	3	13	1	0	3	24	0	0	0	1
7:00 PM	317	1	225	51	2	14	1	0	1	21	0	1	0	0
8:00 PM	162	0	113	28	1	5	0	0	1	10	4	0	0	0
9:00 PM	117	2	82	14	0	3	0	0	0	16	0	0	0	0
10:00 PM	85	0	59	7	0	3	1	0	2	13	0	0	0	0
11:00 PM	52	1	28	10	0	1	0	0	1	11	0	0	0	0
Total	7622	43	4974	1593	51	276	50	0	97	495	15	16	6	6
%		0.6	65.3	20.9	0.7	3.6	0.7	0.0	1.3	6.5	0.2	0.2	0.1	0.1

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	I-985 at SR 144 Ford Ave.	Site:	#9007
Title2:	NB on Namps	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: NB

Interval Begin			Interval Begin		
12:00 AM	13	45	12:00 PM	102	381
12:15 AM	12		12:15 PM	87	
12:30 AM	9		12:30 PM	93	
12:45 AM	11		12:45 PM	99	
1:00 AM	10	25	1:00 PM	102	371
1:15 AM	4		1:15 PM	91	
1:30 AM	10		1:30 PM	88	
1:45 AM	1		1:45 PM	90	
2:00 AM	1	16	2:00 PM	89	377
2:15 AM	2		2:15 PM	99	
2:30 AM	4		2:30 PM	101	
2:45 AM	9		2:45 PM	88	
3:00 AM	7	40	3:00 PM	102	489
3:15 AM	5		3:15 PM	123	
3:30 AM	19		3:30 PM	133	
3:45 AM	9		3:45 PM	131	
4:00 AM	13	81	4:00 PM	142	649
4:15 AM	20		4:15 PM	147	
4:30 AM	19		4:30 PM	196	
4:45 AM	29		4:45 PM	164	
5:00 AM	43	243	5:00 PM	182	702
5:15 AM	59		5:15 PM	174	
5:30 AM	67		5:30 PM	150	
5:45 AM	74		5:45 PM	196	
6:00 AM	72	473	6:00 PM	165	586
6:15 AM	113		6:15 PM	181	
6:30 AM	140		6:30 PM	122	
6:45 AM	148		6:45 PM	118	
7:00 AM	164	694	7:00 PM	102	317
7:15 AM	178		7:15 PM	90	
7:30 AM	196		7:30 PM	69	
7:45 AM	156		7:45 PM	56	
8:00 AM	144	552	8:00 PM	42	162
8:15 AM	164		8:15 PM	37	
8:30 AM	124		8:30 PM	46	
8:45 AM	120		8:45 PM	37	
9:00 AM	100	406	9:00 PM	37	117
9:15 AM	100		9:15 PM	34	
9:30 AM	106		9:30 PM	24	
9:45 AM	100		9:45 PM	22	
10:00 AM	88	357	10:00 PM	18	85
10:15 AM	83		10:15 PM	14	
10:30 AM	112		10:30 PM	30	
10:45 AM	74		10:45 PM	23	
11:00 AM	95	402	11:00 PM	13	52
11:15 AM	95		11:15 PM	17	
11:30 AM	113		11:30 PM	8	
11:45 AM	99		11:45 PM	14	

	NB
24 Hour Volume	7622

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	NB	NB
Count	3334	4288
Peak Hour	7:00 AM	4:30 PM
Volume	694	716
Factor	0.89	0.91

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: SR 144-Ford Ave. Btwn I-95
Title2: NB Ramps and SB Ramps
Title3:

Site: #9008
Date: 8/14/2012
Tuesday

Daily Volume

Begin	EB		WB		Combined		Begin	EB		WB		Combined	
12:00 AM	22	86	19	56	41	142	12:00 PM	140	559	57	242	197	801
12:15 AM	29		15		44		12:15 PM	135		67		202	
12:30 AM	17		6		23		12:30 PM	151		52		203	
12:45 AM	18		16		34		12:45 PM	133		66		199	
1:00 AM	17	50	7	46	24	96	1:00 PM	137	581	72	265	209	846
1:15 AM	13		12		25		1:15 PM	152		50		202	
1:30 AM	12		9		21		1:30 PM	153		81		234	
1:45 AM	8		18		26		1:45 PM	139		62		201	
2:00 AM	7	47	6	30	13	77	2:00 PM	161	642	79	233	240	875
2:15 AM	14		7		21		2:15 PM	157		54		211	
2:30 AM	16		5		21		2:30 PM	156		50		206	
2:45 AM	10		12		22		2:45 PM	168		50		218	
3:00 AM	6	55	10	47	16	102	3:00 PM	151	832	66	232	217	1064
3:15 AM	13		17		30		3:15 PM	220		55		275	
3:30 AM	27		13		40		3:30 PM	218		51		269	
3:45 AM	9		7		16		3:45 PM	243		60		303	
4:00 AM	22	86	10	87	32	173	4:00 PM	237	1175	66	265	303	1440
4:15 AM	12		27		39		4:15 PM	288		63		351	
4:30 AM	13		22		35		4:30 PM	308		71		379	
4:45 AM	39		28		67		4:45 PM	342		65		407	
5:00 AM	20	157	78	357	98	514	5:00 PM	327	1311	59	281	386	1592
5:15 AM	47		105		152		5:15 PM	345		64		409	
5:30 AM	35		116		151		5:30 PM	295		77		372	
5:45 AM	55		58		113		5:45 PM	344		81		425	
6:00 AM	30	325	40	253	70	578	6:00 PM	337	1016	68	255	405	1271
6:15 AM	89		43		132		6:15 PM	278		68		346	
6:30 AM	91		69		160		6:30 PM	226		58		284	
6:45 AM	115		101		216		6:45 PM	175		61		236	
7:00 AM	156	582	102	310	258	892	7:00 PM	145	529	41	150	186	679
7:15 AM	130		59		189		7:15 PM	147		44		191	
7:30 AM	168		66		234		7:30 PM	120		32		152	
7:45 AM	128		83		211		7:45 PM	117		33		150	
8:00 AM	149	596	70	233	219	829	8:00 PM	80	295	39	156	119	451
8:15 AM	159		60		219		8:15 PM	68		37		105	
8:30 AM	141		51		192		8:30 PM	83		42		125	
8:45 AM	147		52		199		8:45 PM	64		38		102	
9:00 AM	135	520	61	186	196	706	9:00 PM	73	249	33	97	106	346
9:15 AM	121		42		163		9:15 PM	71		19		90	
9:30 AM	146		49		195		9:30 PM	52		24		76	
9:45 AM	118		34		152		9:45 PM	53		21		74	
10:00 AM	135	537	67	183	202	720	10:00 PM	32	142	19	89	51	231
10:15 AM	132		35		167		10:15 PM	37		19		56	
10:30 AM	133		49		182		10:30 PM	30		27		57	
10:45 AM	137		32		169		10:45 PM	43		24		67	
11:00 AM	120	503	55	235	175	738	11:00 PM	29	112	31	84	60	196
11:15 AM	110		56		166		11:15 PM	34		19		53	
11:30 AM	127		54		181		11:30 PM	11		13		24	
11:45 AM	146		70		216		11:45 PM	38		21		59	

	EB	WB	Combined
24 Hour Volume	10987 (71.5%)	4372 (28.5%)	15359

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	EB	WB	Combined	EB	WB	Combined
Count	3544	2023	5567	7443	2349	9792
	63.7 %	36.3 %		76.0 %	24.0 %	
Peak Hour	7:30 AM	5:00 AM	6:45 AM	4:30 PM	5:30 PM	5:15 PM
Volume	604	357	897	1322	294	1611
Factor	0.90	0.77	0.87	0.96	0.91	0.95

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1:	I-95 Btwn SR 144-Ford Ave. and	Site:	#9009
Title2:	I-95 SB ON Ramp	Date:	8/23/2012
Title3:			Thursday

Daily Volume, per Channel

Channel: SB

Interval Begin			Interval Begin		
12:00 AM	82	446	12:00 PM	388	1694
12:15 AM	134		12:15 PM	427	
12:30 AM	138		12:30 PM	440	
12:45 AM	92		12:45 PM	439	
1:00 AM	57	309	1:00 PM	417	1842
1:15 AM	98		1:15 PM	443	
1:30 AM	86		1:30 PM	533	
1:45 AM	68		1:45 PM	449	
2:00 AM	105	393	2:00 PM	516	1998
2:15 AM	87		2:15 PM	491	
2:30 AM	101		2:30 PM	520	
2:45 AM	100		2:45 PM	471	
3:00 AM	109	415	3:00 PM	529	2054
3:15 AM	119		3:15 PM	511	
3:30 AM	105		3:30 PM	501	
3:45 AM	82		3:45 PM	513	
4:00 AM	105	482	4:00 PM	535	2212
4:15 AM	112		4:15 PM	554	
4:30 AM	143		4:30 PM	578	
4:45 AM	122		4:45 PM	545	
5:00 AM	121	659	5:00 PM	581	2229
5:15 AM	146		5:15 PM	582	
5:30 AM	185		5:30 PM	566	
5:45 AM	207		5:45 PM	500	
6:00 AM	161	882	6:00 PM	499	1786
6:15 AM	224		6:15 PM	438	
6:30 AM	211		6:30 PM	438	
6:45 AM	286		6:45 PM	411	
7:00 AM	298	1217	7:00 PM	288	1238
7:15 AM	304		7:15 PM	339	
7:30 AM	284		7:30 PM	333	
7:45 AM	331		7:45 PM	278	
8:00 AM	375	1453	8:00 PM	301	1183
8:15 AM	319		8:15 PM	324	
8:30 AM	354		8:30 PM	297	
8:45 AM	405		8:45 PM	261	
9:00 AM	319	1469	9:00 PM	239	911
9:15 AM	359		9:15 PM	233	
9:30 AM	412		9:30 PM	227	
9:45 AM	379		9:45 PM	212	
10:00 AM	441	1665	10:00 PM	265	801
10:15 AM	406		10:15 PM	205	
10:30 AM	409		10:30 PM	174	
10:45 AM	409		10:45 PM	157	
11:00 AM	420	1635	11:00 PM	146	574
11:15 AM	414		11:15 PM	166	
11:30 AM	395		11:30 PM	135	
11:45 AM	406		11:45 PM	127	

	SB
24 Hour Volume	29547

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	SB	SB
Count	11025	18522
Peak Hour	10:00 AM	4:30 PM
Volume	1665	2286
Factor	0.94	0.98

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1:	I-95 Btwn SR 144-Ford Ave. and	Site:	#9010
Title2:	I-95 NB OFF Ramp	Date:	8/23/2012
Title3:			Thursday

Daily Volume, per Channel

Channel: NB

Interval Begin			Interval Begin		
12:00 AM	119	443	12:00 PM	495	1997
12:15 AM	99		12:15 PM	496	
12:30 AM	126		12:30 PM	500	
12:45 AM	99		12:45 PM	506	
1:00 AM	86	296	1:00 PM	524	1958
1:15 AM	92		1:15 PM	495	
1:30 AM	59		1:30 PM	431	
1:45 AM	59		1:45 PM	508	
2:00 AM	76	314	2:00 PM	496	1976
2:15 AM	95		2:15 PM	482	
2:30 AM	85		2:30 PM	517	
2:45 AM	58		2:45 PM	481	
3:00 AM	72	344	3:00 PM	562	1988
3:15 AM	86		3:15 PM	532	
3:30 AM	102		3:30 PM	449	
3:45 AM	84		3:45 PM	445	
4:00 AM	92	434	4:00 PM	474	1877
4:15 AM	101		4:15 PM	464	
4:30 AM	118		4:30 PM	487	
4:45 AM	123		4:45 PM	452	
5:00 AM	149	776	5:00 PM	432	1728
5:15 AM	189		5:15 PM	452	
5:30 AM	219		5:30 PM	424	
5:45 AM	219		5:45 PM	420	
6:00 AM	253	1233	6:00 PM	369	1443
6:15 AM	299		6:15 PM	359	
6:30 AM	353		6:30 PM	388	
6:45 AM	328		6:45 PM	327	
7:00 AM	409	1692	7:00 PM	337	1258
7:15 AM	446		7:15 PM	310	
7:30 AM	457		7:30 PM	283	
7:45 AM	380		7:45 PM	328	
8:00 AM	386	1453	8:00 PM	235	930
8:15 AM	367		8:15 PM	260	
8:30 AM	355		8:30 PM	230	
8:45 AM	345		8:45 PM	205	
9:00 AM	369	1541	9:00 PM	205	820
9:15 AM	385		9:15 PM	233	
9:30 AM	389		9:30 PM	209	
9:45 AM	398		9:45 PM	173	
10:00 AM	385	1753	10:00 PM	202	724
10:15 AM	440		10:15 PM	200	
10:30 AM	413		10:30 PM	182	
10:45 AM	515		10:45 PM	140	
11:00 AM	484	1946	11:00 PM	148	574
11:15 AM	465		11:15 PM	159	
11:30 AM	497		11:30 PM	142	
11:45 AM	500		11:45 PM	125	

	NB
24 Hour Volume	29498

12:00 AM - 12:00 PM	NB	**12:00 PM - 12:00 AM** NB
Count	12225	17273
Peak Hour	10:45 AM	2:30 PM
Volume	1961	2092
Factor	0.95	0.93

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: I-95 at SR 144-Ford Ave.
Title2: SB on Ramp
Title3:

Site: #9011
Date: 8/14/2012
Tuesday

Daily Vehicle Classification
Channel: SB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	30	0	11	2	0	1	0	0	1	14	0	0	1	0
1:00 AM	27	0	12	3	1	0	1	0	2	8	0	0	0	0
2:00 AM	20	0	8	2	0	0	0	0	1	8	0	1	0	0
3:00 AM	38	0	13	4	1	4	0	0	0	15	0	1	0	0
4:00 AM	30	0	3	3	0	1	0	0	0	23	0	0	0	0
5:00 AM	54	0	17	6	0	4	1	0	1	25	0	0	0	0
6:00 AM	58	0	22	7	2	2	0	0	3	21	0	1	0	0
7:00 AM	82	1	44	11	0	3	0	0	3	20	0	0	0	0
8:00 AM	102	0	52	19	1	3	0	0	0	26	1	0	0	0
9:00 AM	107	0	54	22	2	5	1	0	7	16	0	0	0	0
10:00 AM	89	1	47	14	1	1	1	0	3	20	0	1	0	0
11:00 AM	121	1	61	16	1	6	0	0	4	28	1	2	0	1
12:00 PM	153	0	83	20	1	8	1	0	5	35	0	0	0	0
1:00 PM	136	0	80	23	4	3	1	0	0	23	0	1	1	0
2:00 PM	134	0	72	22	3	2	1	0	4	28	1	1	0	0
3:00 PM	174	0	86	46	3	3	1	0	2	31	1	0	1	0
4:00 PM	176	0	96	39	1	9	1	0	2	24	1	1	0	2
5:00 PM	227	3	150	44	2	4	1	0	1	20	2	0	0	0
6:00 PM	186	0	117	43	1	2	0	0	2	19	0	0	2	0
7:00 PM	79	0	44	16	0	3	0	0	2	14	0	0	0	0
8:00 PM	90	0	52	12	0	3	2	0	3	17	0	1	0	0
9:00 PM	67	0	36	9	1	0	0	0	2	19	0	0	0	0
10:00 PM	40	0	17	3	0	0	1	0	0	19	0	0	0	0
11:00 PM	38	0	18	1	2	0	0	0	0	15	0	1	1	0
Total	2258	6	1195	387	27	67	13	0	48	488	7	11	6	3
%		0.3	52.9	17.1	1.2	3.0	0.6	0.0	2.1	21.6	0.3	0.5	0.3	0.1

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	I-95 at SR 144-Ford Ave.	Site:	#9011
Title2:	SB on Ramp	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: SB

Interval Begin			Interval Begin		
12:00 AM	8	30	12:00 PM	36	153
12:15 AM	10		12:15 PM	40	
12:30 AM	5		12:30 PM	36	
12:45 AM	7		12:45 PM	41	
1:00 AM	2	27	1:00 PM	29	136
1:15 AM	2		1:15 PM	39	
1:30 AM	10		1:30 PM	33	
1:45 AM	13		1:45 PM	35	
2:00 AM	2	20	2:00 PM	39	134
2:15 AM	6		2:15 PM	33	
2:30 AM	7		2:30 PM	30	
2:45 AM	5		2:45 PM	32	
3:00 AM	5	38	3:00 PM	46	174
3:15 AM	7		3:15 PM	43	
3:30 AM	15		3:30 PM	43	
3:45 AM	11		3:45 PM	42	
4:00 AM	11	30	4:00 PM	53	176
4:15 AM	6		4:15 PM	45	
4:30 AM	7		4:30 PM	37	
4:45 AM	6		4:45 PM	41	
5:00 AM	18	54	5:00 PM	44	227
5:15 AM	15		5:15 PM	62	
5:30 AM	11		5:30 PM	48	
5:45 AM	10		5:45 PM	73	
6:00 AM	10	58	6:00 PM	66	186
6:15 AM	12		6:15 PM	51	
6:30 AM	23		6:30 PM	38	
6:45 AM	13		6:45 PM	31	
7:00 AM	24	82	7:00 PM	21	79
7:15 AM	18		7:15 PM	27	
7:30 AM	17		7:30 PM	16	
7:45 AM	23		7:45 PM	15	
8:00 AM	32	102	8:00 PM	31	90
8:15 AM	27		8:15 PM	25	
8:30 AM	15		8:30 PM	23	
8:45 AM	28		8:45 PM	11	
9:00 AM	29	107	9:00 PM	17	67
9:15 AM	25		9:15 PM	16	
9:30 AM	32		9:30 PM	13	
9:45 AM	21		9:45 PM	21	
10:00 AM	25	89	10:00 PM	9	40
10:15 AM	22		10:15 PM	12	
10:30 AM	18		10:30 PM	7	
10:45 AM	24		10:45 PM	12	
11:00 AM	34	121	11:00 PM	14	38
11:15 AM	25		11:15 PM	8	
11:30 AM	19		11:30 PM	6	
11:45 AM	43		11:45 PM	10	

	SB
24 Hour Volume	2258

12:00 AM - 12:00 PM	SB	**12:00 PM - 12:00 AM** SB
Count	758	1500
Peak Hour	11:00 AM	5:15 PM
Volume	121	249
Factor	0.70	0.85

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: I-95 at SR 144-Ford Ave.
Title2: NB off Ramp
Title3:

Site: #9012
Date: 8/14/2012
Tuesday

Daily Vehicle Classification
Channel: NB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	15	0	3	0	0	0	1	0	1	9	0	1	0	0
1:00 AM	20	0	6	0	0	0	0	0	1	11	0	1	1	0
2:00 AM	12	0	4	1	1	0	1	0	0	5	0	0	0	0
3:00 AM	15	0	1	1	0	0	1	0	0	10	0	1	1	0
4:00 AM	18	0	3	3	0	4	1	0	1	5	0	0	1	0
5:00 AM	54	0	29	10	1	0	0	0	1	11	0	2	0	0
6:00 AM	59	0	23	13	1	3	0	0	0	18	0	1	0	0
7:00 AM	90	2	39	28	0	2	0	0	1	18	0	0	0	0
8:00 AM	104	1	59	23	0	2	0	0	2	15	1	1	0	0
9:00 AM	64	0	32	10	2	5	1	0	1	12	1	0	0	0
10:00 AM	73	0	37	9	4	3	1	0	3	13	1	1	1	0
11:00 AM	89	0	40	20	4	3	0	0	2	19	0	1	0	0
12:00 PM	75	0	38	18	0	0	0	0	2	16	0	0	1	0
1:00 PM	88	0	42	21	5	2	1	0	1	16	0	0	0	0
2:00 PM	82	0	43	12	1	1	1	0	0	23	1	0	0	0
3:00 PM	100	0	57	19	1	1	0	0	2	19	0	1	0	0
4:00 PM	92	0	49	12	4	2	1	0	3	21	0	0	0	0
5:00 PM	113	4	68	16	2	0	1	0	0	22	0	0	0	0
6:00 PM	94	2	41	15	1	3	0	0	3	27	1	1	0	0
7:00 PM	47	0	24	5	1	4	0	0	1	12	0	0	0	0
8:00 PM	57	0	30	6	0	0	0	0	1	19	1	0	0	0
9:00 PM	23	0	8	1	0	0	0	0	0	14	0	0	0	0
10:00 PM	36	0	14	4	0	0	0	0	0	18	0	0	0	0
11:00 PM	35	0	12	4	0	0	0	0	0	19	0	0	0	0
Total	1455	9	702	251	28	35	10	0	26	372	6	11	5	0
%		0.6	48.2	17.3	1.9	2.4	0.7	0.0	1.8	25.6	0.4	0.8	0.3	0.0

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: I-95 at SR 144-Ford Ave.
Title2: NB off Ramp
Title3:

Site: #9012
Date: 8/14/2012
Tuesday

Daily Volume, per Channel

Channel: NB

Interval Begin			Interval Begin		
12:00 AM	6	15	12:00 PM	12	75
12:15 AM	2		12:15 PM	21	
12:30 AM	2		12:30 PM	18	
12:45 AM	5		12:45 PM	24	
1:00 AM	6	20	1:00 PM	20	88
1:15 AM	6		1:15 PM	24	
1:30 AM	2		1:30 PM	18	
1:45 AM	6		1:45 PM	26	
2:00 AM	3	12	2:00 PM	23	82
2:15 AM	1		2:15 PM	19	
2:30 AM	3		2:30 PM	21	
2:45 AM	5		2:45 PM	19	
3:00 AM	4	15	3:00 PM	28	100
3:15 AM	5		3:15 PM	26	
3:30 AM	3		3:30 PM	22	
3:45 AM	3		3:45 PM	24	
4:00 AM	2	18	4:00 PM	16	92
4:15 AM	6		4:15 PM	26	
4:30 AM	9		4:30 PM	24	
4:45 AM	1		4:45 PM	26	
5:00 AM	13	54	5:00 PM	26	113
5:15 AM	17		5:15 PM	26	
5:30 AM	16		5:30 PM	33	
5:45 AM	8		5:45 PM	28	
6:00 AM	12	59	6:00 PM	27	94
6:15 AM	10		6:15 PM	20	
6:30 AM	19		6:30 PM	28	
6:45 AM	18		6:45 PM	19	
7:00 AM	25	90	7:00 PM	15	47
7:15 AM	24		7:15 PM	12	
7:30 AM	15		7:30 PM	13	
7:45 AM	26		7:45 PM	7	
8:00 AM	32	104	8:00 PM	10	57
8:15 AM	28		8:15 PM	14	
8:30 AM	18		8:30 PM	14	
8:45 AM	26		8:45 PM	19	
9:00 AM	17	64	9:00 PM	7	23
9:15 AM	14		9:15 PM	5	
9:30 AM	18		9:30 PM	6	
9:45 AM	15		9:45 PM	5	
10:00 AM	18	73	10:00 PM	10	36
10:15 AM	13		10:15 PM	6	
10:30 AM	24		10:30 PM	9	
10:45 AM	18		10:45 PM	11	
11:00 AM	13	89	11:00 PM	11	35
11:15 AM	24		11:15 PM	6	
11:30 AM	28		11:30 PM	10	
11:45 AM	24		11:45 PM	8	

	NB
24 Hour Volume	1455

12:00 AM - 12:00 PM	NB	**12:00 PM - 12:00 AM** NB
Count	613	842
Peak Hour	7:45 AM	5:15 PM
Volume	104	114
Factor	0.81	0.86

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1:	I-95 South of	Site:	#9013
Title2:	SR 144-Ford Ave. SB Ramp	Date:	8/23/2012
Title3:			Thursday

Daily Volume, per Channel

Channel: SB

Interval Begin			Interval Begin		
12:00 AM	95	499	12:00 PM	421	1881
12:15 AM	146		12:15 PM	493	
12:30 AM	159		12:30 PM	479	
12:45 AM	99		12:45 PM	488	
1:00 AM	61	350	1:00 PM	456	1964
1:15 AM	113		1:15 PM	474	
1:30 AM	97		1:30 PM	553	
1:45 AM	79		1:45 PM	481	
2:00 AM	126	460	2:00 PM	537	2125
2:15 AM	99		2:15 PM	524	
2:30 AM	121		2:30 PM	559	
2:45 AM	114		2:45 PM	505	
3:00 AM	127	495	3:00 PM	562	2226
3:15 AM	136		3:15 PM	541	
3:30 AM	135		3:30 PM	553	
3:45 AM	97		3:45 PM	570	
4:00 AM	122	544	4:00 PM	588	2458
4:15 AM	125		4:15 PM	609	
4:30 AM	160		4:30 PM	652	
4:45 AM	137		4:45 PM	609	
5:00 AM	143	741	5:00 PM	640	2443
5:15 AM	163		5:15 PM	654	
5:30 AM	215		5:30 PM	605	
5:45 AM	220		5:45 PM	544	
6:00 AM	181	961	6:00 PM	547	1929
6:15 AM	239		6:15 PM	470	
6:30 AM	232		6:30 PM	472	
6:45 AM	309		6:45 PM	440	
7:00 AM	328	1363	7:00 PM	324	1350
7:15 AM	349		7:15 PM	364	
7:30 AM	330		7:30 PM	358	
7:45 AM	356		7:45 PM	304	
8:00 AM	396	1588	8:00 PM	325	1281
8:15 AM	362		8:15 PM	352	
8:30 AM	389		8:30 PM	321	
8:45 AM	441		8:45 PM	283	
9:00 AM	370	1611	9:00 PM	269	1003
9:15 AM	390		9:15 PM	257	
9:30 AM	442		9:30 PM	248	
9:45 AM	409		9:45 PM	229	
10:00 AM	473	1794	10:00 PM	293	902
10:15 AM	426		10:15 PM	224	
10:30 AM	439		10:30 PM	208	
10:45 AM	456		10:45 PM	177	
11:00 AM	464	1798	11:00 PM	156	638
11:15 AM	461		11:15 PM	192	
11:30 AM	431		11:30 PM	148	
11:45 AM	442		11:45 PM	142	

	SB
24 Hour Volume	32404

12:00 AM - 12:00 PM	SB	**12:00 PM - 12:00 AM** SB
Count	12204	20200
Peak Hour	10:30 AM	4:30 PM
Volume	1820	2555
Factor	0.98	0.98

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 , BRYAN COUNTY

Title1:	I-95 South of NB OFF Ramp to	Site:	#9014
Title2:	SR 144-Ford Ave	Date:	8/23/2012
Title3:			Thursday

Daily Volume, per Channel

Channel: NB

Interval Begin			Interval Begin		
12:00 AM	145	508	12:00 PM	561	2375
12:15 AM	121		12:15 PM	591	
12:30 AM	129		12:30 PM	607	
12:45 AM	113		12:45 PM	616	
1:00 AM	82	336	1:00 PM	614	2356
1:15 AM	100		1:15 PM	586	
1:30 AM	76		1:30 PM	521	
1:45 AM	78		1:45 PM	635	
2:00 AM	88	364	2:00 PM	632	2550
2:15 AM	101		2:15 PM	699	
2:30 AM	105		2:30 PM	571	
2:45 AM	70		2:45 PM	648	
3:00 AM	89	407	3:00 PM	669	2381
3:15 AM	115		3:15 PM	612	
3:30 AM	108		3:30 PM	557	
3:45 AM	95		3:45 PM	543	
4:00 AM	126	531	4:00 PM	562	2169
4:15 AM	115		4:15 PM	530	
4:30 AM	152		4:30 PM	536	
4:45 AM	138		4:45 PM	541	
5:00 AM	177	981	5:00 PM	473	1986
5:15 AM	243		5:15 PM	541	
5:30 AM	292		5:30 PM	497	
5:45 AM	269		5:45 PM	475	
6:00 AM	335	1544	6:00 PM	452	1747
6:15 AM	386		6:15 PM	430	
6:30 AM	413		6:30 PM	441	
6:45 AM	410		6:45 PM	424	
7:00 AM	502	1992	7:00 PM	369	1447
7:15 AM	505		7:15 PM	389	
7:30 AM	544		7:30 PM	328	
7:45 AM	441		7:45 PM	361	
8:00 AM	479	1767	8:00 PM	277	1080
8:15 AM	441		8:15 PM	283	
8:30 AM	410		8:30 PM	278	
8:45 AM	437		8:45 PM	242	
9:00 AM	437	1839	9:00 PM	227	931
9:15 AM	465		9:15 PM	259	
9:30 AM	462		9:30 PM	239	
9:45 AM	475		9:45 PM	206	
10:00 AM	477	2144	10:00 PM	241	858
10:15 AM	549		10:15 PM	211	
10:30 AM	488		10:30 PM	216	
10:45 AM	630		10:45 PM	190	
11:00 AM	549	2327	11:00 PM	181	675
11:15 AM	547		11:15 PM	176	
11:30 AM	592		11:30 PM	165	
11:45 AM	639		11:45 PM	153	

	NB
24 Hour Volume	35295

12:00 AM - 12:00 PM	NB	**12:00 PM - 12:00 AM** NB
Count	14740	20555
Peak Hour	11:00 AM	2:15 PM
Volume	2327	2587
Factor	0.91	0.93

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: SR 144-Ford Ave. West of
Title2: Thunderbird Rd.
Title3:

Site: #9015
Date: 8/14/2012
Tuesday

Daily Volume

Begin	EB		WB		Combined		Begin	EB		WB		Combined	
12:00 AM	13	45	12	32	25	77	12:00 PM	113	476	104	406	217	882
12:15 AM	18		10		28		12:15 PM	120		93		213	
12:30 AM	5		5		10		12:30 PM	127		103		230	
12:45 AM	9		5		14		12:45 PM	116		106		222	
1:00 AM	9	31	7	22	16	53	1:00 PM	130	518	106	413	236	931
1:15 AM	8		5		13		1:15 PM	128		105		233	
1:30 AM	5		6		11		1:30 PM	125		103		228	
1:45 AM	9		4		13		1:45 PM	135		99		234	
2:00 AM	5	28	1	13	6	41	2:00 PM	129	507	104	368	233	875
2:15 AM	10		2		12		2:15 PM	119		100		219	
2:30 AM	7		2		9		2:30 PM	125		94		219	
2:45 AM	6		8		14		2:45 PM	134		70		204	
3:00 AM	6	19	15	35	21	54	3:00 PM	133	643	97	400	230	1043
3:15 AM	6		4		10		3:15 PM	175		113		288	
3:30 AM	5		12		17		3:30 PM	168		95		263	
3:45 AM	2		4		6		3:45 PM	167		95		262	
4:00 AM	6	46	11	110	17	156	4:00 PM	176	819	119	474	295	1293
4:15 AM	8		27		35		4:15 PM	205		108		313	
4:30 AM	9		33		42		4:30 PM	203		137		340	
4:45 AM	23		39		62		4:45 PM	235		110		345	
5:00 AM	46	185	98	474	144	659	5:00 PM	231	994	110	511	341	1505
5:15 AM	49		124		173		5:15 PM	252		137		389	
5:30 AM	48		150		198		5:30 PM	239		116		355	
5:45 AM	42		102		144		5:45 PM	272		148		420	
6:00 AM	30	220	94	575	124	795	6:00 PM	238	713	111	423	349	1136
6:15 AM	50		107		157		6:15 PM	188		129		317	
6:30 AM	58		169		227		6:30 PM	146		85		231	
6:45 AM	82		205		287		6:45 PM	141		98		239	
7:00 AM	94	395	188	775	282	1170	7:00 PM	103	404	80	263	183	667
7:15 AM	84		208		292		7:15 PM	112		77		189	
7:30 AM	92		196		288		7:30 PM	98		53		151	
7:45 AM	125		183		308		7:45 PM	91		53		144	
8:00 AM	132	435	158	539	290	974	8:00 PM	69	231	44	183	113	414
8:15 AM	107		158		265		8:15 PM	53		52		105	
8:30 AM	102		108		210		8:30 PM	64		51		115	
8:45 AM	94		115		209		8:45 PM	45		36		81	
9:00 AM	99	363	93	384	192	747	9:00 PM	56	194	32	116	88	310
9:15 AM	76		90		166		9:15 PM	46		30		76	
9:30 AM	100		112		212		9:30 PM	48		25		73	
9:45 AM	88		89		177		9:45 PM	44		29		73	
10:00 AM	84	385	95	339	179	724	10:00 PM	31	120	17	80	48	200
10:15 AM	91		85		176		10:15 PM	28		12		40	
10:30 AM	100		90		190		10:30 PM	27		31		58	
10:45 AM	110		69		179		10:45 PM	34		20		54	
11:00 AM	108	419	103	394	211	813	11:00 PM	20	64	16	39	36	103
11:15 AM	114		90		204		11:15 PM	18		10		28	
11:30 AM	91		106		197		11:30 PM	13		9		22	
11:45 AM	106		95		201		11:45 PM	13		4		17	

	EB	WB	Combined
24 Hour Volume	8254 (52.8%)	7368 (47.2%)	15622

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	EB	WB	Combined	EB	WB	Combined
Count	2571	3692	6263	5683	3676	9359
	41.1 %	58.9 %		60.7 %	39.3 %	
Peak Hour	7:45 AM	6:45 AM	7:15 AM	5:15 PM	5:15 PM	5:15 PM
Volume	466	797	1178	1001	512	1513
Factor	0.88	0.96	0.96	0.92	0.86	0.90

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Thunderbird Rd. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9016
Date: 8/14/2012
Tuesday

Daily Volume

Begin	SB		NB		Combined		Begin	SB		NB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	13	43	7	18	20	61
12:15 AM	0		0		0		12:15 PM	7		3		10	
12:30 AM	0		0		0		12:30 PM	14		4		18	
12:45 AM	0		0		0		12:45 PM	9		4		13	
1:00 AM	0	0	0	0	0	0	1:00 PM	12	40	7	26	19	66
1:15 AM	0		0		0		1:15 PM	13		10		23	
1:30 AM	0		0		0		1:30 PM	6		5		11	
1:45 AM	0		0		0		1:45 PM	9		4		13	
2:00 AM	0	0	0	0	0	0	2:00 PM	9	32	3	19	12	51
2:15 AM	0		0		0		2:15 PM	9		4		13	
2:30 AM	0		0		0		2:30 PM	9		4		13	
2:45 AM	0		0		0		2:45 PM	5		8		13	
3:00 AM	0	0	0	0	0	0	3:00 PM	12	28	2	22	14	50
3:15 AM	0		0		0		3:15 PM	3		4		7	
3:30 AM	0		0		0		3:30 PM	9		6		15	
3:45 AM	0		0		0		3:45 PM	4		10		14	
4:00 AM	0	0	0	2	0	2	4:00 PM	7	31	7	48	14	79
4:15 AM	0		0		0		4:15 PM	11		16		27	
4:30 AM	0		0		0		4:30 PM	5		14		19	
4:45 AM	0		2		2		4:45 PM	8		11		19	
5:00 AM	0	1	3	28	3	29	5:00 PM	9	71	11	62	20	133
5:15 AM	0		5		5		5:15 PM	27		21		48	
5:30 AM	0		18		18		5:30 PM	24		16		40	
5:45 AM	1		2		3		5:45 PM	11		14		25	
6:00 AM	1	27	3	15	4	42	6:00 PM	11	60	9	40	20	100
6:15 AM	7		1		8		6:15 PM	20		17		37	
6:30 AM	12		5		17		6:30 PM	16		10		26	
6:45 AM	7		6		13		6:45 PM	13		4		17	
7:00 AM	9	35	4	28	13	63	7:00 PM	9	48	3	18	12	66
7:15 AM	5		11		16		7:15 PM	15		2		17	
7:30 AM	11		7		18		7:30 PM	17		7		24	
7:45 AM	10		6		16		7:45 PM	7		6		13	
8:00 AM	5	27	14	59	19	86	8:00 PM	9	22	2	11	11	33
8:15 AM	9		23		32		8:15 PM	4		6		10	
8:30 AM	6		11		17		8:30 PM	1		2		3	
8:45 AM	7		11		18		8:45 PM	8		1		9	
9:00 AM	5	42	21	52	26	94	9:00 PM	5	7	0	0	5	7
9:15 AM	23		9		32		9:15 PM	1		0		1	
9:30 AM	8		6		14		9:30 PM	1		0		1	
9:45 AM	6		16		22		9:45 PM	0		0		0	
10:00 AM	18	66	9	43	27	109	10:00 PM	0	3	0	2	0	5
10:15 AM	22		8		30		10:15 PM	0		0		0	
10:30 AM	12		12		24		10:30 PM	0		0		0	
10:45 AM	14		14		28		10:45 PM	3		2		5	
11:00 AM	15	53	5	22	20	75	11:00 PM	0	0	0	0	0	0
11:15 AM	6		4		10		11:15 PM	0		0		0	
11:30 AM	17		5		22		11:30 PM	0		0		0	
11:45 AM	15		8		23		11:45 PM	0		0		0	

	SB	NB	Combined
24 Hour Volume	636 (55.3%)	515 (44.7%)	1151

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	SB	NB	Combined	SB	NB	Combined
Count	251	249	500	385	266	651
	50.2 %	49.8 %		59.1 %	40.9 %	
Peak Hour	10:00 AM	8:15 AM	10:00 AM	5:15 PM	5:00 PM	5:00 PM
Volume	66	66	109	73	62	133
Factor	0.75	0.72	0.91	0.68	0.74	0.69

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	SR-Ford Ave. East of	Site:	#9017
Title2:	Driveway	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: EB

Interval Begin			Interval Begin		
12:00 AM	6	36	12:00 PM	86	415
12:15 AM	16		12:15 PM	114	
12:30 AM	3		12:30 PM	124	
12:45 AM	11		12:45 PM	91	
1:00 AM	8	26	1:00 PM	122	458
1:15 AM	6		1:15 PM	114	
1:30 AM	6		1:30 PM	104	
1:45 AM	6		1:45 PM	118	
2:00 AM	5	23	2:00 PM	109	459
2:15 AM	8		2:15 PM	109	
2:30 AM	4		2:30 PM	117	
2:45 AM	6		2:45 PM	124	
3:00 AM	3	11	3:00 PM	121	577
3:15 AM	4		3:15 PM	138	
3:30 AM	4		3:30 PM	168	
3:45 AM	0		3:45 PM	150	
4:00 AM	2	24	4:00 PM	141	728
4:15 AM	4		4:15 PM	185	
4:30 AM	4		4:30 PM	195	
4:45 AM	14		4:45 PM	207	
5:00 AM	18	76	5:00 PM	213	929
5:15 AM	17		5:15 PM	230	
5:30 AM	19		5:30 PM	250	
5:45 AM	22		5:45 PM	236	
6:00 AM	23	194	6:00 PM	230	690
6:15 AM	48		6:15 PM	182	
6:30 AM	42		6:30 PM	150	
6:45 AM	81		6:45 PM	128	
7:00 AM	73	347	7:00 PM	114	402
7:15 AM	79		7:15 PM	102	
7:30 AM	88		7:30 PM	109	
7:45 AM	107		7:45 PM	77	
8:00 AM	129	421	8:00 PM	78	264
8:15 AM	97		8:15 PM	56	
8:30 AM	99		8:30 PM	72	
8:45 AM	96		8:45 PM	58	
9:00 AM	84	362	9:00 PM	63	204
9:15 AM	86		9:15 PM	48	
9:30 AM	100		9:30 PM	50	
9:45 AM	92		9:45 PM	43	
10:00 AM	83	396	10:00 PM	24	111
10:15 AM	117		10:15 PM	25	
10:30 AM	85		10:30 PM	26	
10:45 AM	111		10:45 PM	36	
11:00 AM	107	408	11:00 PM	17	57
11:15 AM	99		11:15 PM	16	
11:30 AM	98		11:30 PM	12	
11:45 AM	104		11:45 PM	12	

	EB
24 Hour Volume	7618

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	EB	EB
Count	2324	5294
Peak Hour	7:45 AM	5:15 PM
Volume	432	946
Factor	0.84	0.95

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	SR 144-Ford Ave. East of	Site:	#9017
Title2:	Driveway	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: WB

Interval Begin			Interval Begin		
12:00 AM	12	29	12:00 PM	101	395
12:15 AM	9		12:15 PM	83	
12:30 AM	3		12:30 PM	107	
12:45 AM	5		12:45 PM	104	
1:00 AM	6	21	1:00 PM	103	397
1:15 AM	5		1:15 PM	103	
1:30 AM	6		1:30 PM	99	
1:45 AM	4		1:45 PM	92	
2:00 AM	1	13	2:00 PM	99	350
2:15 AM	2		2:15 PM	79	
2:30 AM	3		2:30 PM	94	
2:45 AM	7		2:45 PM	78	
3:00 AM	12	31	3:00 PM	94	371
3:15 AM	3		3:15 PM	97	
3:30 AM	12		3:30 PM	83	
3:45 AM	4		3:45 PM	97	
4:00 AM	12	115	4:00 PM	113	466
4:15 AM	28		4:15 PM	108	
4:30 AM	31		4:30 PM	130	
4:45 AM	44		4:45 PM	115	
5:00 AM	99	475	5:00 PM	97	473
5:15 AM	122		5:15 PM	141	
5:30 AM	159		5:30 PM	102	
5:45 AM	95		5:45 PM	133	
6:00 AM	97	564	6:00 PM	109	415
6:15 AM	107		6:15 PM	121	
6:30 AM	154		6:30 PM	95	
6:45 AM	206		6:45 PM	90	
7:00 AM	180	753	7:00 PM	81	247
7:15 AM	207		7:15 PM	62	
7:30 AM	187		7:30 PM	51	
7:45 AM	179		7:45 PM	53	
8:00 AM	172	572	8:00 PM	43	181
8:15 AM	168		8:15 PM	50	
8:30 AM	116		8:30 PM	52	
8:45 AM	116		8:45 PM	36	
9:00 AM	106	380	9:00 PM	31	109
9:15 AM	85		9:15 PM	29	
9:30 AM	107		9:30 PM	23	
9:45 AM	82		9:45 PM	26	
10:00 AM	89	325	10:00 PM	12	71
10:15 AM	77		10:15 PM	13	
10:30 AM	97		10:30 PM	27	
10:45 AM	62		10:45 PM	19	
11:00 AM	102	385	11:00 PM	10	30
11:15 AM	88		11:15 PM	9	
11:30 AM	101		11:30 PM	8	
11:45 AM	94		11:45 PM	3	

	WB
24 Hour Volume	7168

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	WB	WB
Count	3663	3505
Peak Hour	6:45 AM	5:15 PM
Volume	780	485
Factor	0.94	0.86

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: SR 144-Ford Ave. West of
Title2: Laurel St.
Title3:

Site: #9018
Date: 8/14/2012
Tuesday

Daily Volume

Begin	EB		WB		Combined		Begin	EB		WB		Combined	
12:00 AM	7	34	11	31	18	65	12:00 PM	86	405	119	452	205	857
12:15 AM	14		12		26		12:15 PM	104		96		200	
12:30 AM	2		2		4		12:30 PM	118		113		231	
12:45 AM	11		6		17		12:45 PM	97		124		221	
1:00 AM	7	25	6	21	13	46	1:00 PM	108	427	124	456	232	883
1:15 AM	6		4		10		1:15 PM	109		120		229	
1:30 AM	5		6		11		1:30 PM	95		107		202	
1:45 AM	7		5		12		1:45 PM	115		105		220	
2:00 AM	4	22	1	13	5	35	2:00 PM	98	431	118	427	216	858
2:15 AM	8		2		10		2:15 PM	109		107		216	
2:30 AM	5		2		7		2:30 PM	107		104		211	
2:45 AM	5		8		13		2:45 PM	117		98		215	
3:00 AM	3	11	12	31	15	42	3:00 PM	109	543	101	451	210	994
3:15 AM	4		3		7		3:15 PM	145		128		273	
3:30 AM	4		10		14		3:30 PM	156		101		257	
3:45 AM	0		6		6		3:45 PM	133		121		254	
4:00 AM	2	23	12	110	14	133	4:00 PM	143	716	127	525	270	1241
4:15 AM	4		25		29		4:15 PM	181		112		293	
4:30 AM	4		30		34		4:30 PM	188		161		349	
4:45 AM	13		43		56		4:45 PM	204		125		329	
5:00 AM	8	48	104	488	112	536	5:00 PM	205	902	114	536	319	1438
5:15 AM	13		113		126		5:15 PM	223		152		375	
5:30 AM	10		160		170		5:30 PM	235		119		354	
5:45 AM	17		111		128		5:45 PM	239		151		390	
6:00 AM	18	160	96	552	114	712	6:00 PM	223	671	118	488	341	1159
6:15 AM	43		109		152		6:15 PM	174		147		321	
6:30 AM	38		162		200		6:30 PM	144		117		261	
6:45 AM	61		185		246		6:45 PM	130		106		236	
7:00 AM	73	318	195	768	268	1086	7:00 PM	105	385	92	310	197	695
7:15 AM	70		204		274		7:15 PM	103		87		190	
7:30 AM	73		194		267		7:30 PM	100		69		169	
7:45 AM	102		175		277		7:45 PM	77		62		139	
8:00 AM	122	384	181	591	303	975	8:00 PM	76	251	47	199	123	450
8:15 AM	80		172		252		8:15 PM	54		56		110	
8:30 AM	96		113		209		8:30 PM	64		56		120	
8:45 AM	86		125		211		8:45 PM	57		40		97	
9:00 AM	84	332	106	400	190	732	9:00 PM	59	184	35	135	94	319
9:15 AM	83		92		175		9:15 PM	44		42		86	
9:30 AM	88		111		199		9:30 PM	42		28		70	
9:45 AM	77		91		168		9:45 PM	39		30		69	
10:00 AM	78	355	86	358	164	713	10:00 PM	22	101	14	75	36	176
10:15 AM	96		96		192		10:15 PM	24		11		35	
10:30 AM	78		93		171		10:30 PM	21		29		50	
10:45 AM	103		83		186		10:45 PM	34		21		55	
11:00 AM	97	375	109	416	206	791	11:00 PM	18	57	12	37	30	94
11:15 AM	92		101		193		11:15 PM	17		12		29	
11:30 AM	89		106		195		11:30 PM	10		9		19	
11:45 AM	97		100		197		11:45 PM	12		4		16	

	EB	WB	Combined
24 Hour Volume	7160 (47.6%)	7870 (52.4%)	15030

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	EB	WB	Combined	EB	WB	Combined
Count	2087	3779	5866	5073	4091	9164
	35.6 %	64.4 %		55.4 %	44.6 %	
Peak Hour	7:45 AM	6:45 AM	7:15 AM	5:15 PM	4:30 PM	5:15 PM
Volume	400	778	1121	920	552	1460
Factor	0.82	0.95	0.92	0.96	0.86	0.94

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/14/2012
Tuesday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	1	5	2	7	3	12
12:15 AM	0		0		0		12:15 PM	3		0		3	
12:30 AM	0		0		0		12:30 PM	0		2		2	
12:45 AM	0		0		0		12:45 PM	1		3		4	
1:00 AM	0	0	0	0	0	0	1:00 PM	4	6	1	7	5	13
1:15 AM	0		0		0		1:15 PM	1		4		5	
1:30 AM	0		0		0		1:30 PM	1		1		2	
1:45 AM	0		0		0		1:45 PM	0		1		1	
2:00 AM	0	0	0	1	0	1	2:00 PM	0	2	1	4	1	6
2:15 AM	0		1		1		2:15 PM	0		1		1	
2:30 AM	0		0		0		2:30 PM	2		0		2	
2:45 AM	0		0		0		2:45 PM	0		2		2	
3:00 AM	0	0	0	0	0	0	3:00 PM	0	6	1	4	1	10
3:15 AM	0		0		0		3:15 PM	2		0		2	
3:30 AM	0		0		0		3:30 PM	3		2		5	
3:45 AM	0		0		0		3:45 PM	1		1		2	
4:00 AM	0	0	0	0	0	0	4:00 PM	1	10	1	2	2	12
4:15 AM	0		0		0		4:15 PM	2		0		2	
4:30 AM	0		0		0		4:30 PM	4		1		5	
4:45 AM	0		0		0		4:45 PM	3		0		3	
5:00 AM	0	1	0	3	0	4	5:00 PM	1	3	3	6	4	9
5:15 AM	0		1		1		5:15 PM	1		1		2	
5:30 AM	1		1		2		5:30 PM	0		1		1	
5:45 AM	0		1		1		5:45 PM	1		1		2	
6:00 AM	0	0	0	3	0	3	6:00 PM	2	4	2	7	4	11
6:15 AM	0		1		1		6:15 PM	0		1		1	
6:30 AM	0		0		0		6:30 PM	0		2		2	
6:45 AM	0		2		2		6:45 PM	2		2		4	
7:00 AM	0	1	0	1	0	2	7:00 PM	0	1	1	5	1	6
7:15 AM	0		0		0		7:15 PM	1		2		3	
7:30 AM	0		1		1		7:30 PM	0		2		2	
7:45 AM	1		0		1		7:45 PM	0		0		0	
8:00 AM	1	3	0	4	1	7	8:00 PM	1	3	0	2	1	5
8:15 AM	0		1		1		8:15 PM	0		1		1	
8:30 AM	1		2		3		8:30 PM	2		0		2	
8:45 AM	1		1		2		8:45 PM	0		1		1	
9:00 AM	1	1	1	3	2	4	9:00 PM	0	1	0	0	0	1
9:15 AM	0		2		2		9:15 PM	1		0		1	
9:30 AM	0		0		0		9:30 PM	0		0		0	
9:45 AM	0		0		0		9:45 PM	0		0		0	
10:00 AM	0	2	2	6	2	8	10:00 PM	0	3	0	0	0	3
10:15 AM	0		0		0		10:15 PM	0		0		0	
10:30 AM	1		1		2		10:30 PM	3		0		3	
10:45 AM	1		3		4		10:45 PM	0		0		0	
11:00 AM	0	1	1	3	1	4	11:00 PM	0	0	0	0	0	0
11:15 AM	1		1		2		11:15 PM	0		0		0	
11:30 AM	0		0		0		11:30 PM	0		0		0	
11:45 AM	0		1		1		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	53 (43.8%)	68 (56.2%)	121

	12:00 AM - 12:00 PM			**12:00 PM - 12:00 AM**		
	NB	SB	Combined	NB	SB	Combined
Count	9	24	33	44	44	88
	27.3 %	72.7 %		50.0 %	50.0 %	
Peak Hour	7:45 AM	8:30 AM	8:30 AM	4:00 PM	12:30 PM	12:30 PM
Volume	3	6	9	10	10	16
Factor	0.75	0.75	0.75	0.63	0.63	0.80

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/15/2012
Wednesday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	0	3	2	3	2	6
12:15 AM	0		0		0		12:15 PM	0		0		0	
12:30 AM	0		0		0		12:30 PM	1		0		1	
12:45 AM	0		0		0		12:45 PM	2		1		3	
1:00 AM	0	0	0	0	0	0	1:00 PM	1	4	2	3	3	7
1:15 AM	0		0		0		1:15 PM	0		0		0	
1:30 AM	0		0		0		1:30 PM	1		1		2	
1:45 AM	0		0		0		1:45 PM	2		0		2	
2:00 AM	0	0	0	0	0	0	2:00 PM	1	2	0	3	1	5
2:15 AM	0		0		0		2:15 PM	1		2		3	
2:30 AM	0		0		0		2:30 PM	0		1		1	
2:45 AM	0		0		0		2:45 PM	0		0		0	
3:00 AM	0	0	1	1	1	1	3:00 PM	1	5	2	8	3	13
3:15 AM	0		0		0		3:15 PM	1		3		4	
3:30 AM	0		0		0		3:30 PM	1		1		2	
3:45 AM	0		0		0		3:45 PM	2		2		4	
4:00 AM	0	0	0	0	0	0	4:00 PM	2	5	4	8	6	13
4:15 AM	0		0		0		4:15 PM	1		2		3	
4:30 AM	0		0		0		4:30 PM	0		1		1	
4:45 AM	0		0		0		4:45 PM	2		1		3	
5:00 AM	0	1	0	1	0	2	5:00 PM	0	4	0	2	0	6
5:15 AM	0		0		0		5:15 PM	1		1		2	
5:30 AM	0		0		0		5:30 PM	3		1		4	
5:45 AM	1		1		2		5:45 PM	0		0		0	
6:00 AM	0	0	1	1	1	1	6:00 PM	0	1	1	5	1	6
6:15 AM	0		0		0		6:15 PM	0		0		0	
6:30 AM	0		0		0		6:30 PM	0		3		3	
6:45 AM	0		0		0		6:45 PM	1		1		2	
7:00 AM	0	0	1	1	1	1	7:00 PM	2	6	0	6	2	12
7:15 AM	0		0		0		7:15 PM	0		2		2	
7:30 AM	0		0		0		7:30 PM	2		3		5	
7:45 AM	0		0		0		7:45 PM	2		1		3	
8:00 AM	1	4	0	2	1	6	8:00 PM	1	5	0	3	1	8
8:15 AM	0		0		0		8:15 PM	2		1		3	
8:30 AM	0		0		0		8:30 PM	0		0		0	
8:45 AM	3		2		5		8:45 PM	2		2		4	
9:00 AM	0	2	1	4	1	6	9:00 PM	0	2	2	3	2	5
9:15 AM	1		1		2		9:15 PM	1		0		1	
9:30 AM	0		1		1		9:30 PM	1		0		1	
9:45 AM	1		1		2		9:45 PM	0		1		1	
10:00 AM	0	2	1	4	1	6	10:00 PM	0	4	0	1	0	5
10:15 AM	2		2		4		10:15 PM	2		0		2	
10:30 AM	0		0		0		10:30 PM	0		1		1	
10:45 AM	0		1		1		10:45 PM	2		0		2	
11:00 AM	1	5	2	3	3	8	11:00 PM	0	0	0	1	0	1
11:15 AM	1		0		1		11:15 PM	0		1		1	
11:30 AM	1		0		1		11:30 PM	0		0		0	
11:45 AM	2		1		3		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	55 (46.6%)	63 (53.4%)	118

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	NB	SB	Combined	NB	SB	Combined
Count	14	17	31	41	46	87
	45.2 %	54.8 %		47.1 %	52.9 %	
Peak Hour	11:00 AM	8:45 AM	8:45 AM	7:30 PM	3:15 PM	3:15 PM
Volume	5	5	9	7	10	16
Factor	0.63	0.63	0.45	0.88	0.63	0.67

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/16/2012
Thursday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	1	4	1	5	2	9
12:15 AM	0		0		0		12:15 PM	0		1		1	
12:30 AM	0		0		0		12:30 PM	2		2		4	
12:45 AM	0		0		0		12:45 PM	1		1		2	
1:00 AM	0	2	0	1	0	3	1:00 PM	2	4	1	2	3	6
1:15 AM	2		0		2		1:15 PM	0		1		1	
1:30 AM	0		1		1		1:30 PM	0		0		0	
1:45 AM	0		0		0		1:45 PM	2		0		2	
2:00 AM	0	0	0	0	0	0	2:00 PM	0	5	1	5	1	10
2:15 AM	0		0		0		2:15 PM	1		0		1	
2:30 AM	0		0		0		2:30 PM	2		2		4	
2:45 AM	0		0		0		2:45 PM	2		2		4	
3:00 AM	0	0	0	1	0	1	3:00 PM	2	5	1	6	3	11
3:15 AM	0		1		1		3:15 PM	1		1		2	
3:30 AM	0		0		0		3:30 PM	0		3		3	
3:45 AM	0		0		0		3:45 PM	2		1		3	
4:00 AM	1	1	0	0	1	1	4:00 PM	2	7	1	9	3	16
4:15 AM	0		0		0		4:15 PM	3		3		6	
4:30 AM	0		0		0		4:30 PM	1		4		5	
4:45 AM	0		0		0		4:45 PM	1		1		2	
5:00 AM	0	1	0	1	0	2	5:00 PM	2	6	0	3	2	9
5:15 AM	0		0		0		5:15 PM	1		0		1	
5:30 AM	1		0		1		5:30 PM	2		2		4	
5:45 AM	0		1		1		5:45 PM	1		1		2	
6:00 AM	0	0	1	5	1	5	6:00 PM	0	4	3	9	3	13
6:15 AM	0		1		1		6:15 PM	3		4		7	
6:30 AM	0		1		1		6:30 PM	1		1		2	
6:45 AM	0		2		2		6:45 PM	0		1		1	
7:00 AM	0	2	0	3	0	5	7:00 PM	1	6	0	3	1	9
7:15 AM	1		1		2		7:15 PM	2		1		3	
7:30 AM	0		1		1		7:30 PM	0		2		2	
7:45 AM	1		1		2		7:45 PM	3		0		3	
8:00 AM	0	0	0	2	0	2	8:00 PM	0	3	1	4	1	7
8:15 AM	0		0		0		8:15 PM	0		2		2	
8:30 AM	0		2		2		8:30 PM	0		0		0	
8:45 AM	0		0		0		8:45 PM	3		1		4	
9:00 AM	2	3	2	5	4	8	9:00 PM	1	1	0	0	1	1
9:15 AM	1		1		2		9:15 PM	0		0		0	
9:30 AM	0		1		1		9:30 PM	0		0		0	
9:45 AM	0		1		1		9:45 PM	0		0		0	
10:00 AM	0	2	1	4	1	6	10:00 PM	0	3	0	2	0	5
10:15 AM	0		1		1		10:15 PM	1		0		1	
10:30 AM	1		0		1		10:30 PM	1		1		2	
10:45 AM	1		2		3		10:45 PM	1		1		2	
11:00 AM	0	2	1	3	1	5	11:00 PM	0	0	0	1	0	1
11:15 AM	1		0		1		11:15 PM	0		0		0	
11:30 AM	0		2		2		11:30 PM	0		0		0	
11:45 AM	1		0		1		11:45 PM	0		1		1	

	NB	SB	Combined
24 Hour Volume	61 (45.2%)	74 (54.8%)	135

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	NB	SB	Combined	NB	SB	Combined
Count	13	25	38	48	49	97
	34.2 %	65.8 %		49.5 %	50.5 %	
Peak Hour	8:30 AM	6:00 AM	8:30 AM	3:45 PM	5:30 PM	3:45 PM
Volume	3	5	8	8	10	17
Factor	0.38	0.63	0.50	0.67	0.63	0.71

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/17/2012
Friday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	0	4	0	2	0	6
12:15 AM	0		0		0		12:15 PM	0		1		1	
12:30 AM	0		0		0		12:30 PM	2		1		3	
12:45 AM	0		0		0		12:45 PM	2		0		2	
1:00 AM	0	0	0	0	0	0	1:00 PM	3	8	2	12	5	20
1:15 AM	0		0		0		1:15 PM	4		6		10	
1:30 AM	0		0		0		1:30 PM	0		3		3	
1:45 AM	0		0		0		1:45 PM	1		1		2	
2:00 AM	0	0	0	0	0	0	2:00 PM	1	1	1	4	2	5
2:15 AM	0		0		0		2:15 PM	0		1		1	
2:30 AM	0		0		0		2:30 PM	0		1		1	
2:45 AM	0		0		0		2:45 PM	0		1		1	
3:00 AM	0	1	0	1	0	2	3:00 PM	0	3	2	3	2	6
3:15 AM	0		0		0		3:15 PM	2		0		2	
3:30 AM	0		0		0		3:30 PM	0		1		1	
3:45 AM	1		1		2		3:45 PM	1		0		1	
4:00 AM	0	1	0	0	0	1	4:00 PM	2	6	2	6	4	12
4:15 AM	1		0		1		4:15 PM	1		0		1	
4:30 AM	0		0		0		4:30 PM	2		3		5	
4:45 AM	0		0		0		4:45 PM	1		1		2	
5:00 AM	0	0	0	2	0	2	5:00 PM	2	4	2	5	4	9
5:15 AM	0		1		1		5:15 PM	1		2		3	
5:30 AM	0		0		0		5:30 PM	0		0		0	
5:45 AM	0		1		1		5:45 PM	1		1		2	
6:00 AM	0	1	1	2	1	3	6:00 PM	0	3	0	5	0	8
6:15 AM	0		0		0		6:15 PM	0		1		1	
6:30 AM	0		0		0		6:30 PM	1		4		5	
6:45 AM	1		1		2		6:45 PM	2		0		2	
7:00 AM	0	3	1	6	1	9	7:00 PM	0	3	2	8	2	11
7:15 AM	1		1		2		7:15 PM	0		2		2	
7:30 AM	1		2		3		7:30 PM	2		2		4	
7:45 AM	1		2		3		7:45 PM	1		2		3	
8:00 AM	0	0	0	1	0	1	8:00 PM	0	5	3	7	3	12
8:15 AM	0		0		0		8:15 PM	1		1		2	
8:30 AM	0		0		0		8:30 PM	0		0		0	
8:45 AM	0		1		1		8:45 PM	4		3		7	
9:00 AM	0	1	0	0	0	1	9:00 PM	0	3	1	2	1	5
9:15 AM	0		0		0		9:15 PM	3		1		4	
9:30 AM	1		0		1		9:30 PM	0		0		0	
9:45 AM	0		0		0		9:45 PM	0		0		0	
10:00 AM	0	0	0	4	0	4	10:00 PM	0	2	0	2	0	4
10:15 AM	0		1		1		10:15 PM	0		0		0	
10:30 AM	0		1		1		10:30 PM	0		1		1	
10:45 AM	0		2		2		10:45 PM	2		1		3	
11:00 AM	0	4	0	5	0	9	11:00 PM	2	3	1	1	3	4
11:15 AM	2		2		4		11:15 PM	0		0		0	
11:30 AM	1		2		3		11:30 PM	1		0		1	
11:45 AM	1		1		2		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	56 (41.8%)	78 (58.2%)	134

	12:00 AM - 12:00 PM			**12:00 PM - 12:00 AM**		
	NB	SB	Combined	NB	SB	Combined
Count	11	21	32	45	57	102
	34.4 %	65.6 %		44.1 %	55.9 %	
Peak Hour	11:00 AM	7:00 AM	7:00 AM	12:30 PM	1:00 PM	12:30 PM
Volume	4	6	9	11	12	20
Factor	0.50	0.75	0.75	0.69	0.50	0.50

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/18/2012
Saturday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	1	0	1	12:00 PM	2	12	4	10	6	22
12:15 AM	0		0		0		12:15 PM	1		2		3	
12:30 AM	0		0		0		12:30 PM	4		2		6	
12:45 AM	0		1		1		12:45 PM	5		2		7	
1:00 AM	0	0	0	1	0	1	1:00 PM	0	3	1	5	1	8
1:15 AM	0		0		0		1:15 PM	1		1		2	
1:30 AM	0		1		1		1:30 PM	1		2		3	
1:45 AM	0		0		0		1:45 PM	1		1		2	
2:00 AM	0	1	0	0	0	1	2:00 PM	1	2	0	7	1	9
2:15 AM	1		0		1		2:15 PM	0		4		4	
2:30 AM	0		0		0		2:30 PM	1		2		3	
2:45 AM	0		0		0		2:45 PM	0		1		1	
3:00 AM	0	0	0	0	0	0	3:00 PM	2	4	1	4	3	8
3:15 AM	0		0		0		3:15 PM	2		0		2	
3:30 AM	0		0		0		3:30 PM	0		2		2	
3:45 AM	0		0		0		3:45 PM	0		1		1	
4:00 AM	0	0	0	1	0	1	4:00 PM	0	2	0	0	0	2
4:15 AM	0		0		0		4:15 PM	1		0		1	
4:30 AM	0		0		0		4:30 PM	0		0		0	
4:45 AM	0		1		1		4:45 PM	1		0		1	
5:00 AM	0	1	0	2	0	3	5:00 PM	1	3	1	3	2	6
5:15 AM	0		0		0		5:15 PM	0		2		2	
5:30 AM	1		1		2		5:30 PM	0		0		0	
5:45 AM	0		1		1		5:45 PM	2		0		2	
6:00 AM	0	0	1	1	1	1	6:00 PM	0	3	1	5	1	8
6:15 AM	0		0		0		6:15 PM	1		1		2	
6:30 AM	0		0		0		6:30 PM	1		1		2	
6:45 AM	0		0		0		6:45 PM	1		2		3	
7:00 AM	1	2	1	5	2	7	7:00 PM	0	4	0	5	0	9
7:15 AM	0		1		1		7:15 PM	1		1		2	
7:30 AM	1		1		2		7:30 PM	2		3		5	
7:45 AM	0		2		2		7:45 PM	1		1		2	
8:00 AM	0	3	0	8	0	11	8:00 PM	0	3	0	8	0	11
8:15 AM	1		2		3		8:15 PM	0		6		6	
8:30 AM	1		4		5		8:30 PM	3		1		4	
8:45 AM	1		2		3		8:45 PM	0		1		1	
9:00 AM	0	7	0	6	0	13	9:00 PM	1	2	1	2	2	4
9:15 AM	3		3		6		9:15 PM	0		1		1	
9:30 AM	1		3		4		9:30 PM	0		0		0	
9:45 AM	3		0		3		9:45 PM	1		0		1	
10:00 AM	2	7	0	2	2	9	10:00 PM	1	2	0	2	1	4
10:15 AM	1		0		1		10:15 PM	0		1		1	
10:30 AM	4		1		5		10:30 PM	1		1		2	
10:45 AM	0		1		1		10:45 PM	0		0		0	
11:00 AM	0	2	0	4	0	6	11:00 PM	0	0	0	0	0	0
11:15 AM	0		0		0		11:15 PM	0		0		0	
11:30 AM	1		3		4		11:30 PM	0		0		0	
11:45 AM	1		1		2		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	63 (43.4%)	82 (56.6%)	145

	12:00 AM - 12:00 PM			**12:00 PM - 12:00 AM**		
	NB	SB	Combined	NB	SB	Combined
Count	23	31	54	40	51	91
	42.6 %	57.4 %		44.0 %	56.0 %	
Peak Hour	9:45 AM	8:30 AM	9:15 AM	12:00 PM	12:00 PM	12:00 PM
Volume	10	9	15	12	10	22
Factor	0.63	0.56	0.63	0.60	0.63	0.79

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/19/2012
Sunday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	1	0	1	12:00 PM	1	3	1	2	2	5
12:15 AM	0		0		0		12:15 PM	0		1		1	
12:30 AM	0		1		1		12:30 PM	1		0		1	
12:45 AM	0		0		0		12:45 PM	1		0		1	
1:00 AM	0	0	0	0	0	0	1:00 PM	0	2	1	3	1	5
1:15 AM	0		0		0		1:15 PM	0		1		1	
1:30 AM	0		0		0		1:30 PM	2		1		3	
1:45 AM	0		0		0		1:45 PM	0		0		0	
2:00 AM	0	0	0	0	0	0	2:00 PM	0	1	2	6	2	7
2:15 AM	0		0		0		2:15 PM	0		2		2	
2:30 AM	0		0		0		2:30 PM	1		0		1	
2:45 AM	0		0		0		2:45 PM	0		2		2	
3:00 AM	0	0	0	1	0	1	3:00 PM	1	2	2	7	3	9
3:15 AM	0		1		1		3:15 PM	0		0		0	
3:30 AM	0		0		0		3:30 PM	1		3		4	
3:45 AM	0		0		0		3:45 PM	0		2		2	
4:00 AM	0	0	0	0	0	0	4:00 PM	1	4	3	9	4	13
4:15 AM	0		0		0		4:15 PM	2		2		4	
4:30 AM	0		0		0		4:30 PM	0		2		2	
4:45 AM	0		0		0		4:45 PM	1		2		3	
5:00 AM	0	0	0	1	0	1	5:00 PM	0	2	1	3	1	5
5:15 AM	0		0		0		5:15 PM	1		1		2	
5:30 AM	0		1		1		5:30 PM	0		1		1	
5:45 AM	0		0		0		5:45 PM	1		0		1	
6:00 AM	0	0	0	0	0	0	6:00 PM	0	2	2	6	2	8
6:15 AM	0		0		0		6:15 PM	1		2		3	
6:30 AM	0		0		0		6:30 PM	1		2		3	
6:45 AM	0		0		0		6:45 PM	0		0		0	
7:00 AM	0	1	0	2	0	3	7:00 PM	0	2	0	3	0	5
7:15 AM	0		1		1		7:15 PM	2		2		4	
7:30 AM	0		0		0		7:30 PM	0		0		0	
7:45 AM	1		1		2		7:45 PM	0		1		1	
8:00 AM	0	2	1	4	1	6	8:00 PM	2	5	1	5	3	10
8:15 AM	1		2		3		8:15 PM	1		2		3	
8:30 AM	1		0		1		8:30 PM	2		1		3	
8:45 AM	0		1		1		8:45 PM	0		1		1	
9:00 AM	1	4	0	4	1	8	9:00 PM	3	4	0	0	3	4
9:15 AM	0		2		2		9:15 PM	0		0		0	
9:30 AM	3		2		5		9:30 PM	1		0		1	
9:45 AM	0		0		0		9:45 PM	0		0		0	
10:00 AM	0	1	1	3	1	4	10:00 PM	0	2	0	2	0	4
10:15 AM	0		1		1		10:15 PM	2		2		4	
10:30 AM	1		1		2		10:30 PM	0		0		0	
10:45 AM	0		0		0		10:45 PM	0		0		0	
11:00 AM	0	1	0	3	0	4	11:00 PM	0	0	0	0	0	0
11:15 AM	0		0		0		11:15 PM	0		0		0	
11:30 AM	0		2		2		11:30 PM	0		0		0	
11:45 AM	1		1		2		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	38 (36.9%)	65 (63.1%)	103

	12:00 AM - 12:00 PM			**12:00 PM - 12:00 AM**		
	NB	SB	Combined	NB	SB	Combined
Count	9	19	28	29	46	75
	32.1 %	67.9 %		38.7 %	61.3 %	
Peak Hour	8:45 AM	8:45 AM	8:45 AM	8:15 PM	3:30 PM	3:30 PM
Volume	4	5	9	6	10	14
Factor	0.33	0.63	0.45	0.50	0.83	0.88

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/20/2012
Monday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	2	7	1	6	3	13
12:15 AM	0		0		0		12:15 PM	0		4		4	
12:30 AM	0		0		0		12:30 PM	4		1		5	
12:45 AM	0		0		0		12:45 PM	1		0		1	
1:00 AM	0	0	0	0	0	0	1:00 PM	1	6	0	8	1	14
1:15 AM	0		0		0		1:15 PM	1		5		6	
1:30 AM	0		0		0		1:30 PM	1		2		3	
1:45 AM	0		0		0		1:45 PM	3		1		4	
2:00 AM	0	0	0	0	0	0	2:00 PM	3	4	2	4	5	8
2:15 AM	0		0		0		2:15 PM	0		1		1	
2:30 AM	0		0		0		2:30 PM	1		1		2	
2:45 AM	0		0		0		2:45 PM	0		0		0	
3:00 AM	0	0	0	0	0	0	3:00 PM	3	6	2	8	5	14
3:15 AM	0		0		0		3:15 PM	2		2		4	
3:30 AM	0		0		0		3:30 PM	1		2		3	
3:45 AM	0		0		0		3:45 PM	0		2		2	
4:00 AM	0	0	0	0	0	0	4:00 PM	1	5	1	4	2	9
4:15 AM	0		0		0		4:15 PM	1		0		1	
4:30 AM	0		0		0		4:30 PM	0		2		2	
4:45 AM	0		0		0		4:45 PM	3		1		4	
5:00 AM	0	0	0	2	0	2	5:00 PM	0	6	0	5	0	11
5:15 AM	0		1		1		5:15 PM	0		1		1	
5:30 AM	0		1		1		5:30 PM	2		2		4	
5:45 AM	0		0		0		5:45 PM	4		2		6	
6:00 AM	0	0	1	2	1	2	6:00 PM	1	4	0	3	1	7
6:15 AM	0		1		1		6:15 PM	1		1		2	
6:30 AM	0		0		0		6:30 PM	1		1		2	
6:45 AM	0		0		0		6:45 PM	1		1		2	
7:00 AM	0	1	0	4	0	5	7:00 PM	2	3	1	6	3	9
7:15 AM	0		0		0		7:15 PM	1		3		4	
7:30 AM	0		0		0		7:30 PM	0		1		1	
7:45 AM	1		4		5		7:45 PM	0		1		1	
8:00 AM	1	1	2	4	3	5	8:00 PM	1	2	0	2	1	4
8:15 AM	0		0		0		8:15 PM	0		1		1	
8:30 AM	0		1		1		8:30 PM	0		1		1	
8:45 AM	0		1		1		8:45 PM	1		0		1	
9:00 AM	0	1	3	7	3	8	9:00 PM	0	2	0	1	0	3
9:15 AM	1		3		4		9:15 PM	1		1		2	
9:30 AM	0		1		1		9:30 PM	1		0		1	
9:45 AM	0		0		0		9:45 PM	0		0		0	
10:00 AM	1	3	1	5	2	8	10:00 PM	2	2	1	1	3	3
10:15 AM	2		0		2		10:15 PM	0		0		0	
10:30 AM	0		2		2		10:30 PM	0		0		0	
10:45 AM	0		2		2		10:45 PM	0		0		0	
11:00 AM	2	6	1	5	3	11	11:00 PM	0	1	0	0	0	1
11:15 AM	2		2		4		11:15 PM	0		0		0	
11:30 AM	1		0		1		11:30 PM	1		0		1	
11:45 AM	1		2		3		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	60 (43.8%)	77 (56.2%)	137

	12:00 AM - 12:00 PM			12:00 PM - 12:00 AM		
	NB	SB	Combined	NB	SB	Combined
Count	12	29	41	48	48	96
	29.3 %	70.7 %		50.0 %	50.0 %	
Peak Hour	11:00 AM	8:30 AM	10:30 AM	1:15 PM	1:15 PM	1:15 PM
Volume	6	8	11	8	10	18
Factor	0.75	0.67	0.69	0.67	0.50	0.75

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/21/2012
Tuesday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	1	0	1	12:00 PM	2	4	0	3	2	7
12:15 AM	0		1		1		12:15 PM	1		1		2	
12:30 AM	0		0		0		12:30 PM	0		1		1	
12:45 AM	0		0		0		12:45 PM	1		1		2	
1:00 AM	0	0	0	0	0	0	1:00 PM	1	2	0	2	1	4
1:15 AM	0		0		0		1:15 PM	1		0		1	
1:30 AM	0		0		0		1:30 PM	0		1		1	
1:45 AM	0		0		0		1:45 PM	0		1		1	
2:00 AM	0	1	0	0	0	1	2:00 PM	2	4	3	4	5	8
2:15 AM	1		0		1		2:15 PM	0		1		1	
2:30 AM	0		0		0		2:30 PM	1		0		1	
2:45 AM	0		0		0		2:45 PM	1		0		1	
3:00 AM	0	0	0	1	0	1	3:00 PM	1	6	1	2	2	8
3:15 AM	0		1		1		3:15 PM	1		0		1	
3:30 AM	0		0		0		3:30 PM	2		0		2	
3:45 AM	0		0		0		3:45 PM	2		1		3	
4:00 AM	0	0	0	0	0	0	4:00 PM	4	6	0	6	4	12
4:15 AM	0		0		0		4:15 PM	1		2		3	
4:30 AM	0		0		0		4:30 PM	0		2		2	
4:45 AM	0		0		0		4:45 PM	1		2		3	
5:00 AM	0	0	0	2	0	2	5:00 PM	1	3	0	1	1	4
5:15 AM	0		0		0		5:15 PM	1		0		1	
5:30 AM	0		1		1		5:30 PM	1		1		2	
5:45 AM	0		1		1		5:45 PM	0		0		0	
6:00 AM	1	1	1	4	2	5	6:00 PM	3	4	2	9	5	13
6:15 AM	0		1		1		6:15 PM	0		1		1	
6:30 AM	0		1		1		6:30 PM	1		1		2	
6:45 AM	0		1		1		6:45 PM	0		5		5	
7:00 AM	0	3	1	5	1	8	7:00 PM	1	4	1	3	2	7
7:15 AM	0		1		1		7:15 PM	1		1		2	
7:30 AM	2		1		3		7:30 PM	0		0		0	
7:45 AM	1		2		3		7:45 PM	2		1		3	
8:00 AM	1	2	0	4	1	6	8:00 PM	0	0	0	3	0	3
8:15 AM	0		1		1		8:15 PM	0		0		0	
8:30 AM	0		0		0		8:30 PM	0		1		1	
8:45 AM	1		3		4		8:45 PM	0		2		2	
9:00 AM	1	3	2	10	3	13	9:00 PM	0	4	0	2	0	6
9:15 AM	1		2		3		9:15 PM	1		1		2	
9:30 AM	0		5		5		9:30 PM	3		0		3	
9:45 AM	1		1		2		9:45 PM	0		1		1	
10:00 AM	3	5	2	6	5	11	10:00 PM	0	1	0	1	0	2
10:15 AM	1		1		2		10:15 PM	0		1		1	
10:30 AM	0		0		0		10:30 PM	0		0		0	
10:45 AM	1		3		4		10:45 PM	1		0		1	
11:00 AM	0	1	1	3	1	4	11:00 PM	1	2	1	2	2	4
11:15 AM	0		0		0		11:15 PM	0		1		1	
11:30 AM	0		2		2		11:30 PM	0		0		0	
11:45 AM	1		0		1		11:45 PM	1		0		1	

	NB	SB	Combined
24 Hour Volume	56 (43.1%)	74 (56.9%)	130

	12:00 AM - 12:00 PM			**12:00 PM - 12:00 AM**		
	NB	SB	Combined	NB	SB	Combined
Count	16	36	52	40	38	78
	30.8 %	69.2 %		51.3 %	48.7 %	
Peak Hour	9:15 AM	8:45 AM	8:45 AM	3:15 PM	6:00 PM	6:00 PM
Volume	5	12	15	9	9	13
Factor	0.42	0.60	0.75	0.56	0.45	0.65

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: Laurel St. North of
Title2: SR 144-Ford Ave.
Title3:

Site: #9019
Date: 8/22/2012
Wednesday

Daily Volume

Begin	NB		SB		Combined		Begin	NB		SB		Combined	
12:00 AM	0	0	0	0	0	0	12:00 PM	0	2	1	5	1	7
12:15 AM	0		0		0		12:15 PM	0		1		1	
12:30 AM	0		0		0		12:30 PM	1		1		2	
12:45 AM	0		0		0		12:45 PM	1		2		3	
1:00 AM	0	0	0	0	0	0	1:00 PM	1	4	2	7	3	11
1:15 AM	0		0		0		1:15 PM	0		2		2	
1:30 AM	0		0		0		1:30 PM	2		2		4	
1:45 AM	0		0		0		1:45 PM	1		1		2	
2:00 AM	0	0	0	0	0	0	2:00 PM	1	3	0	2	1	5
2:15 AM	0		0		0		2:15 PM	0		1		1	
2:30 AM	0		0		0		2:30 PM	2		1		3	
2:45 AM	0		0		0		2:45 PM	0		0		0	
3:00 AM	0	0	0	1	0	1	3:00 PM	0	6	2	6	2	12
3:15 AM	0		1		1		3:15 PM	2		3		5	
3:30 AM	0		0		0		3:30 PM	0		1		1	
3:45 AM	0		0		0		3:45 PM	4		0		4	
4:00 AM	0	0	0	0	0	0	4:00 PM	2	8	1	7	3	15
4:15 AM	0		0		0		4:15 PM	1		2		3	
4:30 AM	0		0		0		4:30 PM	4		3		7	
4:45 AM	0		0		0		4:45 PM	1		1		2	
5:00 AM	0	1	0	1	0	2	5:00 PM	0	3	1	5	1	8
5:15 AM	1		1		2		5:15 PM	2		0		2	
5:30 AM	0		0		0		5:30 PM	0		2		2	
5:45 AM	0		0		0		5:45 PM	1		2		3	
6:00 AM	0	1	0	6	0	7	6:00 PM	1	4	2	5	3	9
6:15 AM	1		3		4		6:15 PM	0		0		0	
6:30 AM	0		1		1		6:30 PM	1		2		3	
6:45 AM	0		2		2		6:45 PM	2		1		3	
7:00 AM	0	0	1	2	1	2	7:00 PM	1	5	2	5	3	10
7:15 AM	0		0		0		7:15 PM	2		2		4	
7:30 AM	0		0		0		7:30 PM	1		0		1	
7:45 AM	0		1		1		7:45 PM	1		1		2	
8:00 AM	3	3	2	7	5	10	8:00 PM	2	5	2	4	4	9
8:15 AM	0		2		2		8:15 PM	3		2		5	
8:30 AM	0		0		0		8:30 PM	0		0		0	
8:45 AM	0		3		3		8:45 PM	0		0		0	
9:00 AM	1	2	2	2	3	4	9:00 PM	0	3	0	5	0	8
9:15 AM	0		0		0		9:15 PM	1		2		3	
9:30 AM	0		0		0		9:30 PM	1		1		2	
9:45 AM	1		0		1		9:45 PM	1		2		3	
10:00 AM	1	4	0	5	1	9	10:00 PM	0	1	0	0	0	1
10:15 AM	0		0		0		10:15 PM	0		0		0	
10:30 AM	2		4		6		10:30 PM	1		0		1	
10:45 AM	1		1		2		10:45 PM	0		0		0	
11:00 AM	0	1	1	2	1	3	11:00 PM	1	1	0	1	1	2
11:15 AM	1		0		1		11:15 PM	0		1		1	
11:30 AM	0		1		1		11:30 PM	0		0		0	
11:45 AM	0		0		0		11:45 PM	0		0		0	

	NB	SB	Combined
24 Hour Volume	57 (42.2%)	78 (57.8%)	135

	12:00 AM - 12:00 PM			**12:00 PM - 12:00 AM**		
	NB	SB	Combined	NB	SB	Combined
Count	12	26	38	45	52	97
	31.6 %	68.4 %		46.4 %	53.6 %	
Peak Hour	9:45 AM	6:15 AM	8:00 AM	3:45 PM	12:45 PM	3:45 PM
Volume	4	7	10	11	8	17
Factor	0.50	0.58	0.50	0.69	1.00	0.61

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1: SR 144-Ford Ave. East of
Title2: Laurel St.
Title3:

Site: #9020
Date: 8/14/2012
Tuesday

Daily Vehicle Classification
Channel: EB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	29	0	22	6	0	0	0	0	0	0	0	1	0	0
1:00 AM	27	1	21	5	0	0	0	0	0	0	0	0	0	0
2:00 AM	23	0	15	7	0	1	0	0	0	0	0	0	0	0
3:00 AM	11	0	10	1	0	0	0	0	0	0	0	0	0	0
4:00 AM	21	0	16	1	1	2	0	0	0	1	0	0	0	0
5:00 AM	41	0	28	7	0	2	2	0	1	1	0	0	0	0
6:00 AM	146	1	95	35	2	9	1	0	0	3	0	0	0	0
7:00 AM	295	0	186	79	4	18	1	0	6	1	0	0	0	0
8:00 AM	346	1	234	73	3	22	1	0	9	3	0	0	0	0
9:00 AM	296	1	199	58	4	19	1	0	6	6	1	1	0	0
10:00 AM	333	2	218	71	4	22	7	0	5	4	0	0	0	0
11:00 AM	347	1	234	76	0	24	1	0	6	5	0	0	0	0
12:00 PM	382	3	250	96	7	18	0	0	4	4	0	0	0	0
1:00 PM	399	3	271	87	4	19	1	0	7	7	0	0	0	0
2:00 PM	401	2	285	94	0	11	2	0	5	2	0	0	0	0
3:00 PM	526	2	381	104	5	23	1	0	7	3	0	0	0	0
4:00 PM	660	7	483	127	4	22	0	0	9	6	0	2	0	0
5:00 PM	871	10	660	168	9	19	0	0	5	0	0	0	0	0
6:00 PM	665	3	479	152	3	23	0	0	4	1	0	0	0	0
7:00 PM	371	2	288	69	1	9	0	0	2	0	0	0	0	0
8:00 PM	248	4	184	55	1	1	1	0	1	1	0	0	0	0
9:00 PM	183	2	138	36	0	5	0	0	1	1	0	0	0	0
10:00 PM	100	0	76	18	1	3	0	0	0	1	0	1	0	0
11:00 PM	57	0	50	7	0	0	0	0	0	0	0	0	0	0
Total	6778	45	4823	1432	53	272	19	0	78	50	1	5	0	0
%		0.7	71.2	21.1	0.8	4.0	0.3	0.0	1.2	0.7	0.0	0.1	0.0	0.0

TRAFFIC DATA SERVICES

GRICE CONSULTING GROUP

P.I. #0010739 BRYAN COUNTY

Title1: SR 144/Ford Ave. East of
Title2: Laurel St.
Title3:

Site: #9020
Date: 8/14/2012
Tuesday

Daily Vehicle Classification
Channel: WB

Time	Total	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi
12:00 AM	27	0	20	4	0	2	0	0	0	1	0	0	0	0
1:00 AM	18	0	13	3	0	0	1	0	0	0	0	1	0	0
2:00 AM	10	0	6	2	0	1	0	0	1	0	0	0	0	0
3:00 AM	26	0	19	4	0	0	0	0	1	2	0	0	0	0
4:00 AM	109	1	70	34	0	3	1	0	0	0	0	0	0	0
5:00 AM	456	6	305	116	4	15	0	0	7	1	0	2	0	0
6:00 AM	536	4	358	139	2	22	3	0	6	1	0	1	0	0
7:00 AM	711	5	501	150	10	26	2	1	9	3	0	4	0	0
8:00 AM	550	4	399	118	2	19	0	0	7	1	0	0	0	0
9:00 AM	354	1	238	80	5	16	2	0	9	3	0	0	0	0
10:00 AM	306	0	189	79	4	18	2	0	7	3	0	4	0	0
11:00 AM	363	2	225	96	1	18	3	0	12	4	0	2	0	0
12:00 PM	381	2	245	93	4	29	1	0	5	1	0	1	0	0
1:00 PM	375	2	254	82	6	16	3	0	9	3	0	0	0	0
2:00 PM	339	2	238	70	2	17	1	0	4	3	0	2	0	0
3:00 PM	370	1	239	104	4	17	2	0	3	0	0	0	0	0
4:00 PM	450	3	301	113	4	12	3	0	8	4	0	2	0	0
5:00 PM	449	4	334	86	6	8	3	0	4	3	0	1	0	0
6:00 PM	406	3	287	97	3	12	0	0	4	0	0	0	0	0
7:00 PM	239	0	169	54	3	9	0	0	3	1	0	0	0	0
8:00 PM	182	0	138	36	1	6	0	0	0	1	0	0	0	0
9:00 PM	109	1	90	15	0	1	0	0	0	1	0	1	0	0
10:00 PM	71	0	56	13	0	0	1	0	1	0	0	0	0	0
11:00 PM	30	0	26	4	0	0	0	0	0	0	0	0	0	0
Total	6867	41	4720	1592	61	267	28	1	100	36	0	21	0	0
%		0.6	68.7	23.2	0.9	3.9	0.4	0.0	1.5	0.5	0.0	0.3	0.0	0.0

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	SR 144-Ford Ave. East of	Site:	#9020
Title2:	Laurel St.	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: EB

Interval Begin			Interval Begin		
12:00 AM	6	29	12:00 PM	83	382
12:15 AM	11		12:15 PM	103	
12:30 AM	4		12:30 PM	109	
12:45 AM	8		12:45 PM	87	
1:00 AM	7	27	1:00 PM	102	399
1:15 AM	8		1:15 PM	96	
1:30 AM	6		1:30 PM	97	
1:45 AM	6		1:45 PM	104	
2:00 AM	5	23	2:00 PM	89	401
2:15 AM	8		2:15 PM	95	
2:30 AM	4		2:30 PM	113	
2:45 AM	6		2:45 PM	104	
3:00 AM	3	11	3:00 PM	114	526
3:15 AM	4		3:15 PM	129	
3:30 AM	4		3:30 PM	140	
3:45 AM	0		3:45 PM	143	
4:00 AM	2	21	4:00 PM	126	660
4:15 AM	4		4:15 PM	167	
4:30 AM	3		4:30 PM	173	
4:45 AM	12		4:45 PM	194	
5:00 AM	6	41	5:00 PM	198	871
5:15 AM	12		5:15 PM	223	
5:30 AM	9		5:30 PM	229	
5:45 AM	14		5:45 PM	221	
6:00 AM	16	146	6:00 PM	226	665
6:15 AM	37		6:15 PM	177	
6:30 AM	35		6:30 PM	133	
6:45 AM	58		6:45 PM	129	
7:00 AM	65	295	7:00 PM	101	371
7:15 AM	68		7:15 PM	100	
7:30 AM	69		7:30 PM	100	
7:45 AM	93		7:45 PM	70	
8:00 AM	94	346	8:00 PM	81	248
8:15 AM	80		8:15 PM	52	
8:30 AM	88		8:30 PM	59	
8:45 AM	84		8:45 PM	56	
9:00 AM	72	296	9:00 PM	53	183
9:15 AM	76		9:15 PM	46	
9:30 AM	78		9:30 PM	42	
9:45 AM	70		9:45 PM	42	
10:00 AM	80	333	10:00 PM	23	100
10:15 AM	83		10:15 PM	21	
10:30 AM	78		10:30 PM	22	
10:45 AM	92		10:45 PM	34	
11:00 AM	87	347	11:00 PM	15	57
11:15 AM	85		11:15 PM	15	
11:30 AM	86		11:30 PM	15	
11:45 AM	89		11:45 PM	12	

	EB
24 Hour Volume	6778

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	EB	EB
Count	1915	4863
Peak Hour	7:45 AM	5:15 PM
Volume	355	899
Factor	0.94	0.98

TRAFFIC DATA SERVICES
GRICE CONSULTING GROUP
P.I. #0010739 BRYAN COUNTY

Title1:	SR 144/Ford Ave. East of	Site:	#9020
Title2:	Laurel St.	Date:	8/14/2012
Title3:			Tuesday

Daily Volume, per Channel

Channel: WB

Interval Begin			Interval Begin		
12:00 AM	10	27	12:00 PM	100	381
12:15 AM	9		12:15 PM	82	
12:30 AM	3		12:30 PM	99	
12:45 AM	5		12:45 PM	100	
1:00 AM	4	18	1:00 PM	98	375
1:15 AM	5		1:15 PM	95	
1:30 AM	5		1:30 PM	97	
1:45 AM	4		1:45 PM	85	
2:00 AM	1	10	2:00 PM	93	339
2:15 AM	1		2:15 PM	79	
2:30 AM	3		2:30 PM	92	
2:45 AM	5		2:45 PM	75	
3:00 AM	8	26	3:00 PM	94	370
3:15 AM	2		3:15 PM	98	
3:30 AM	12		3:30 PM	88	
3:45 AM	4		3:45 PM	90	
4:00 AM	12	109	4:00 PM	100	450
4:15 AM	25		4:15 PM	113	
4:30 AM	32		4:30 PM	128	
4:45 AM	40		4:45 PM	109	
5:00 AM	97	456	5:00 PM	91	449
5:15 AM	117		5:15 PM	133	
5:30 AM	153		5:30 PM	96	
5:45 AM	89		5:45 PM	129	
6:00 AM	95	536	6:00 PM	110	406
6:15 AM	99		6:15 PM	118	
6:30 AM	153		6:30 PM	93	
6:45 AM	189		6:45 PM	85	
7:00 AM	169	711	7:00 PM	70	239
7:15 AM	202		7:15 PM	67	
7:30 AM	166		7:30 PM	50	
7:45 AM	174		7:45 PM	52	
8:00 AM	171	550	8:00 PM	39	182
8:15 AM	153		8:15 PM	52	
8:30 AM	113		8:30 PM	54	
8:45 AM	113		8:45 PM	37	
9:00 AM	93	354	9:00 PM	31	109
9:15 AM	84		9:15 PM	30	
9:30 AM	93		9:30 PM	21	
9:45 AM	84		9:45 PM	27	
10:00 AM	81	306	10:00 PM	12	71
10:15 AM	77		10:15 PM	9	
10:30 AM	88		10:30 PM	32	
10:45 AM	60		10:45 PM	18	
11:00 AM	91	363	11:00 PM	10	30
11:15 AM	87		11:15 PM	9	
11:30 AM	94		11:30 PM	8	
11:45 AM	91		11:45 PM	3	

	WB
24 Hour Volume	6867

	12:00 AM - 12:00 PM	**12:00 PM - 12:00 AM**
	WB	WB
Count	3466	3401
Peak Hour	6:45 AM	5:15 PM
Volume	726	468
Factor	0.90	0.88

APPENDIX H

Synchro Analysis Reports

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	500	380	25	45	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	581	442	29	52	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	471				759	235
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	471				759	235
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				85	99
cM capacity (veh/h)	1087				341	766

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	6	291	291	295	176	58
Volume Left	6	0	0	0	0	52
Volume Right	0	0	0	0	29	6
cSH	1087	1700	1700	1700	1700	361
Volume to Capacity	0.01	0.17	0.17	0.17	0.10	0.16
Queue Length 95th (ft)	0	0	0	0	0	14
Control Delay (s)	8.3	0.0	0.0	0.0	0.0	16.9
Lane LOS	A					C
Approach Delay (s)	0.1			0.0		16.9
Approach LOS						C

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	488	145	163	250	285	221
v/c Ratio	0.65	0.22	0.41	0.26	0.78	0.45
Control Delay	25.0	4.1	10.9	8.8	44.8	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	4.1	10.9	8.8	44.8	6.8
Queue Length 50th (ft)	198	0	32	53	139	0
Queue Length 95th (ft)	321	31	66	103	213	44
Internal Link Dist (ft)	238			326	386	
Turn Bay Length (ft)			150			
Base Capacity (vph)	750	657	409	991	490	587
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.22	0.40	0.25	0.58	0.38

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	420	125	140	215	0	0	0	0	245	0	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1727	1324	1480	1570						1504	1346
Flt Permitted		1.00	1.00	0.28	1.00						0.95	1.00
Satd. Flow (perm)		1727	1324	439	1570						1504	1346
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	488	145	163	250	0	0	0	0	285	0	221
RTOR Reduction (vph)	0	0	82	0	0	0	0	0	0	0	0	167
Lane Group Flow (vph)	0	488	63	163	250	0	0	0	0	0	285	54
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		36.1	36.1	51.8	51.8						20.2	20.2
Effective Green, g (s)		36.1	36.1	51.8	51.8						20.2	20.2
Actuated g/C Ratio		0.43	0.43	0.62	0.62						0.24	0.24
Clearance Time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		751	575	401	979						366	327
v/s Ratio Prot		c0.28		c0.05	0.16							
v/s Ratio Perm			0.05	0.20							0.19	0.04
v/c Ratio		0.65	0.11	0.41	0.26						0.78	0.16
Uniform Delay, d1		18.5	13.9	8.9	7.0						29.3	24.7
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		4.3	0.4	0.7	0.1						10.0	0.2
Delay (s)		22.8	14.3	9.6	7.1						39.3	25.0
Level of Service		C	B	A	A						D	C
Approach Delay (s)		20.9			8.1			0.0			33.1	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	83.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	190	475	0	0	285	455	70	0	75	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	221	552	0	0	331	529	81	0	87	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		406										
pX, platoon unblocked												
vC, conflicting volume	331			552			1326	1326	552	1326	1326	331
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	331			552			1326	1326	552	1326	1326	331
tC, single (s)	4.2			4.1			7.3	6.5	6.4	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.7	4.0	3.5	3.5	4.0	3.3
p0 queue free %	81			100			21	100	83	100	100	100
cM capacity (veh/h)	1184			1018			104	127	498	94	127	710

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	221	552	331	529	169
Volume Left	221	0	0	0	81
Volume Right	0	0	0	529	87
cSH	1184	1700	1700	1700	175
Volume to Capacity	0.19	0.32	0.19	0.31	0.96
Queue Length 95th (ft)	17	0	0	0	188
Control Delay (s)	8.7	0.0	0.0	0.0	111.3
Lane LOS	A				F
Approach Delay (s)	2.5		0.0		111.3
Approach LOS					F

Intersection Summary			
Average Delay	11.5		
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	20	510	20	5	0	660	20	40	0	0	10	0	40
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	23	593	23	0	0	767	23	47	0	0	12	0	47
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)		663											
pX, platoon unblocked				0.00									
vC, conflicting volume	791			0	616			1035	1442	308	1122	1442	395
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	791			0	616			1035	1442	308	1122	1442	395
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			0	100			72	100	100	93	100	92
cM capacity (veh/h)	825			0	960			168	128	688	157	128	604

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	23	395	221	0	512	279	47	58
Volume Left	23	0	0	0	0	0	47	12
Volume Right	0	0	23	0	0	23	0	47
cSH	825	1700	1700	1700	1700	1700	168	385
Volume to Capacity	0.03	0.23	0.13	0.00	0.30	0.16	0.28	0.15
Queue Length 95th (ft)	2	0	0	0	0	0	27	13
Control Delay (s)	9.5	0.0	0.0	0.0	0.0	0.0	34.4	16.0
Lane LOS	A						D	C
Approach Delay (s)	0.3			0.0			34.4	16.0
Approach LOS							D	C

Intersection Summary				
Average Delay		1.8		
Intersection Capacity Utilization		33.9%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	525	680	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	0	610	791	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		931				
pX, platoon unblocked						
vC, conflicting volume	797				1099	398
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	797				1099	398
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	821				207	601

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	305	305	527	269	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	6	6
cSH	1700	1700	1700	1700	601
Volume to Capacity	0.18	0.18	0.31	0.16	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	11.0
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.0
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	380	500	45	25	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	6	432	568	51	28	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	619				821	310
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	619				821	310
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	99
cM capacity (veh/h)	957				311	686

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	6	216	216	379	241	34
Volume Left	6	0	0	0	0	28
Volume Right	0	0	0	0	51	6
cSH	957	1700	1700	1700	1700	342
Volume to Capacity	0.01	0.13	0.13	0.22	0.14	0.10
Queue Length 95th (ft)	0	0	0	0	0	8
Control Delay (s)	8.8	0.0	0.0	0.0	0.0	16.7
Lane LOS	A					C
Approach Delay (s)	0.1			0.0		16.7
Approach LOS						C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	381	80	85	403	517	216
v/c Ratio	0.61	0.15	0.28	0.55	0.87	0.33
Control Delay	29.2	4.4	16.9	20.6	39.6	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.2	4.4	16.9	20.6	39.6	3.8
Queue Length 50th (ft)	173	0	25	151	244	0
Queue Length 95th (ft)	282	22	55	254	#372	37
Internal Link Dist (ft)	238			326	386	
Turn Bay Length (ft)			150			
Base Capacity (vph)	627	542	300	790	757	784
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.15	0.28	0.51	0.68	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	335	70	75	355	0	0	0	0	455	0	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1727	1324	1480	1570						1504	1346
Flt Permitted		1.00	1.00	0.32	1.00						0.95	1.00
Satd. Flow (perm)		1727	1324	497	1570						1504	1346
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	381	80	85	403	0	0	0	0	517	0	216
RTOR Reduction (vph)	0	0	51	0	0	0	0	0	0	0	0	132
Lane Group Flow (vph)	0	381	29	85	403	0	0	0	0	0	517	84
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		29.3	29.3	38.9	38.9						31.8	31.8
Effective Green, g (s)		29.3	29.3	38.9	38.9						31.8	31.8
Actuated g/C Ratio		0.36	0.36	0.48	0.48						0.39	0.39
Clearance Time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		619	474	285	747						585	523
v/s Ratio Prot		c0.22		0.01	c0.26							
v/s Ratio Perm			0.02	0.13							0.34	0.06
v/c Ratio		0.62	0.06	0.30	0.54						0.88	0.16
Uniform Delay, d1		21.6	17.2	13.2	15.1						23.2	16.3
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		4.5	0.2	0.6	0.8						14.7	0.1
Delay (s)		26.1	17.4	13.8	15.8						38.0	16.4
Level of Service		C	B	B	B						D	B
Approach Delay (s)		24.6			15.5			0.0			31.6	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	81.7	Sum of lost time (s)	16.5
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	190	600	0	0	305	245	125	0	140	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	216	682	0	0	347	278	142	0	159	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		406										
pX, platoon unblocked												
vC, conflicting volume	347			682			1460	1460	682	1460	1460	347
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	347			682			1460	1460	682	1460	1460	347
tC, single (s)	4.2			4.1			7.3	6.5	6.4	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.7	4.0	3.5	3.5	4.0	3.3
p0 queue free %	82			100			0	100	62	100	100	100
cM capacity (veh/h)	1169			911			83	105	419	57	105	696

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	216	682	347	278	301
Volume Left	216	0	0	0	142
Volume Right	0	0	0	278	159
cSH	1169	1700	1700	1700	144
Volume to Capacity	0.18	0.40	0.20	0.16	2.09
Queue Length 95th (ft)	17	0	0	0	606
Control Delay (s)	8.8	0.0	0.0	0.0	562.8
Lane LOS	A				F
Approach Delay (s)	2.1		0.0		562.8
Approach LOS					F

Intersection Summary			
Average Delay	94.0		
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	40	660	40	5	0	510	10	20	0	0	20	0	20
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	45	750	45	0	0	580	11	23	0	0	23	0	23
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)		663											
pX, platoon unblocked				0.00									
vC, conflicting volume	591			0	795			1153	1455	398	1051	1472	295
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	591			0	795			1153	1455	398	1051	1472	295
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			0	100			84	100	100	87	100	97
cM capacity (veh/h)	981			0	822			142	123	602	175	120	701

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	45	500	295	0	386	205	23	45
Volume Left	45	0	0	0	0	0	23	23
Volume Right	0	0	45	0	0	11	0	23
cSH	981	1700	1700	1700	1700	1700	142	280
Volume to Capacity	0.05	0.29	0.17	0.00	0.23	0.12	0.16	0.16
Queue Length 95th (ft)	4	0	0	0	0	0	14	14
Control Delay (s)	8.8	0.0	0.0	0.0	0.0	0.0	35.1	20.4
Lane LOS	A						E	C
Approach Delay (s)	0.5			0.0			35.1	20.4
Approach LOS							E	C

Intersection Summary				
Average Delay		1.4		
Intersection Capacity Utilization		36.2%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	685	520	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	778	591	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		931				
pX, platoon unblocked						
vC, conflicting volume	597				983	298
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	597				983	298
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	976				246	698

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	389	389	394	203	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	6	6
cSH	1700	1700	1700	1700	698
Volume to Capacity	0.23	0.23	0.23	0.12	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	10.2
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.2
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	24.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	565	440	25	50	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	657	512	29	58	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	541				866	270
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	541				866	270
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				80	99
cM capacity (veh/h)	1024				291	728

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	6	328	328	341	200	64
Volume Left	6	0	0	0	0	58
Volume Right	0	0	0	0	29	6
cSH	1024	1700	1700	1700	1700	308
Volume to Capacity	0.01	0.19	0.19	0.20	0.12	0.21
Queue Length 95th (ft)	0	0	0	0	0	19
Control Delay (s)	8.5	0.0	0.0	0.0	0.0	19.8
Lane LOS	A					C
Approach Delay (s)	0.1			0.0		19.8
Approach LOS						C

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	25.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	552	163	174	297	314	244
v/c Ratio	0.71	0.24	0.49	0.30	0.84	0.47
Control Delay	26.5	3.7	12.8	9.4	50.5	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.5	3.7	12.8	9.4	50.5	6.8
Queue Length 50th (ft)	246	0	39	74	161	0
Queue Length 95th (ft)	359	31	67	120	#245	47
Internal Link Dist (ft)	238			326	386	
Turn Bay Length (ft)			150			
Base Capacity (vph)	774	683	354	979	447	571
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.24	0.49	0.30	0.70	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	475	140	150	255	0	0	0	0	270	0	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1727	1324	1480	1570						1504	1346
Flt Permitted		1.00	1.00	0.24	1.00						0.95	1.00
Satd. Flow (perm)		1727	1324	374	1570						1504	1346
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	552	163	174	297	0	0	0	0	314	0	244
RTOR Reduction (vph)	0	0	90	0	0	0	0	0	0	0	0	183
Lane Group Flow (vph)	0	552	73	174	297	0	0	0	0	0	314	61
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		38.6	38.6	53.5	53.5						21.5	21.5
Effective Green, g (s)		38.6	38.6	53.5	53.5						21.5	21.5
Actuated g/C Ratio		0.45	0.45	0.62	0.62						0.25	0.25
Clearance Time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		775	594	353	976						376	336
v/s Ratio Prot		c0.32		c0.05	0.19							
v/s Ratio Perm			0.06	0.25							0.21	0.05
v/c Ratio		0.71	0.12	0.49	0.30						0.84	0.18
Uniform Delay, d1		19.2	13.8	10.3	7.6						30.6	25.3
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		5.5	0.4	1.1	0.2						14.7	0.3
Delay (s)		24.7	14.3	11.4	7.8						45.3	25.6
Level of Service		C	B	B	A						D	C
Approach Delay (s)		22.3			9.1			0.0			36.7	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	210	535	0	0	330	500	75	0	80	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	244	622	0	0	384	581	87	0	93	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		406										
pX, platoon unblocked												
vC, conflicting volume	384			622			1494	1494	622	1494	1494	384
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	384			622			1494	1494	622	1494	1494	384
tC, single (s)	4.2			4.1			7.3	6.5	6.4	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.7	4.0	3.5	3.5	4.0	3.3
p0 queue free %	78			100			0	100	80	100	100	100
cM capacity (veh/h)	1132			959			77	96	454	67	96	664

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	244	622	384	581	180
Volume Left	244	0	0	0	87
Volume Right	0	0	0	581	93
cSH	1132	1700	1700	1700	134
Volume to Capacity	0.22	0.37	0.23	0.34	1.34
Queue Length 95th (ft)	20	0	0	0	290
Control Delay (s)	9.1	0.0	0.0	0.0	258.7
Lane LOS	A				F
Approach Delay (s)	2.6		0.0		258.7
Approach LOS					F

Intersection Summary			
Average Delay	24.3		
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	25	565	25	5	0	740	20	45	0	0	10	0	45
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	29	657	29	0	0	860	23	52	0	0	12	0	52
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)		663											
pX, platoon unblocked				0.00									
vC, conflicting volume	884			0	686			1160	1613	343	1259	1616	442
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	884			0	686			1160	1613	343	1259	1616	442
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			0	100			61	100	100	91	100	91
cM capacity (veh/h)	761			0	904			133	99	653	124	99	563

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	29	438	248	0	574	310	52	64
Volume Left	29	0	0	0	0	0	52	12
Volume Right	0	0	29	0	0	23	0	52
cSH	761	1700	1700	1700	1700	1700	133	342
Volume to Capacity	0.04	0.26	0.15	0.00	0.34	0.18	0.39	0.19
Queue Length 95th (ft)	3	0	0	0	0	0	42	17
Control Delay (s)	9.9	0.0	0.0	0.0	0.0	0.0	48.8	17.9
Lane LOS	A						E	C
Approach Delay (s)	0.4			0.0			48.8	17.9
Approach LOS							E	C

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	580	760	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	0	674	884	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		931				
pX, platoon unblocked						
vC, conflicting volume	890				1224	445
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	890				1224	445
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	757				171	561

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	337	337	589	300	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	6	6
cSH	1700	1700	1700	1700	561
Volume to Capacity	0.20	0.20	0.35	0.18	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	11.5
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.5
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	440	565	50	25	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	6	500	642	57	28	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	699				932	349
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	699				932	349
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				89	99
cM capacity (veh/h)	894				264	647

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	6	250	250	428	271	34
Volume Left	6	0	0	0	0	28
Volume Right	0	0	0	0	57	6
cSH	894	1700	1700	1700	1700	293
Volume to Capacity	0.01	0.15	0.15	0.25	0.16	0.12
Queue Length 95th (ft)	0	0	0	0	0	10
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	18.9
Lane LOS	A					C
Approach Delay (s)	0.1			0.0		18.9
Approach LOS						C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	27.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	443	85	91	460	568	239
v/c Ratio	0.71	0.16	0.38	0.65	0.91	0.34
Control Delay	33.4	4.8	20.2	24.3	44.0	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.4	4.8	20.2	24.3	44.0	3.7
Queue Length 50th (ft)	225	0	30	201	282	0
Queue Length 95th (ft)	#359	25	58	301	#464	38
Internal Link Dist (ft)	238			326	386	
Turn Bay Length (ft)			150			
Base Capacity (vph)	622	539	237	757	725	772
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.16	0.38	0.61	0.78	0.31

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	390	75	80	405	0	0	0	0	500	0	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1727	1324	1480	1570						1504	1346
Flt Permitted		1.00	1.00	0.25	1.00						0.95	1.00
Satd. Flow (perm)		1727	1324	394	1570						1504	1346
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	443	85	91	460	0	0	0	0	568	0	239
RTOR Reduction (vph)	0	0	55	0	0	0	0	0	0	0	0	141
Lane Group Flow (vph)	0	443	30	91	460	0	0	0	0	0	568	98
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		30.1	30.1	39.0	39.0						34.7	34.7
Effective Green, g (s)		30.1	30.1	39.0	39.0						34.7	34.7
Actuated g/C Ratio		0.36	0.36	0.46	0.46						0.41	0.41
Clearance Time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		613	470	225	722						616	551
v/s Ratio Prot		c0.26		0.02	c0.29							
v/s Ratio Perm			0.02	0.17							0.38	0.07
v/c Ratio		0.72	0.06	0.40	0.64						0.92	0.18
Uniform Delay, d1		23.7	18.0	15.3	17.4						23.7	15.9
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		7.2	0.3	1.2	1.9						19.4	0.2
Delay (s)		30.9	18.3	16.4	19.3						43.1	16.1
Level of Service		C	B	B	B						D	B
Approach Delay (s)		28.9			18.8			0.0			35.1	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	28.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	84.7	Sum of lost time (s)	16.5
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	210	680	0	0	345	270	140	0	150	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	239	773	0	0	392	307	159	0	170	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		406										
pX, platoon unblocked												
vC, conflicting volume	392			773			1642	1642	773	1642	1642	392
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	392			773			1642	1642	773	1642	1642	392
tC, single (s)	4.2			4.1			7.3	6.5	6.4	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.7	4.0	3.5	3.5	4.0	3.3
p0 queue free %	79			100			0	100	54	100	100	100
cM capacity (veh/h)	1124			842			60	79	370	36	79	657

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	239	773	392	307	330
Volume Left	239	0	0	0	159
Volume Right	0	0	0	307	170
cSH	1124	1700	1700	1700	106
Volume to Capacity	0.21	0.45	0.23	0.18	3.11
Queue Length 95th (ft)	20	0	0	0	Err
Control Delay (s)	9.1	0.0	0.0	0.0	Err
Lane LOS	A				F
Approach Delay (s)	2.1		0.0		Err
Approach LOS					F

Intersection Summary				
Average Delay		1616.5		
Intersection Capacity Utilization		88.8%	ICU Level of Service	E
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	45	740	45	5	0	565	10	25	0	0	20	0	25
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	51	841	51	0	0	642	11	28	0	0	23	0	28
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)		663											
pX, platoon unblocked				0.00									
vC, conflicting volume	653			0	892			1290	1622	446	1170	1642	327
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	653			0	892			1290	1622	446	1170	1642	327
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			0	100			74	100	100	84	100	96
cM capacity (veh/h)	929			0	756			111	96	560	142	94	669

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	51	561	331	0	428	225	28	51
Volume Left	51	0	0	0	0	0	28	23
Volume Right	0	0	51	0	0	11	0	28
cSH	929	1700	1700	1700	1700	1700	111	252
Volume to Capacity	0.06	0.33	0.19	0.00	0.25	0.13	0.26	0.20
Queue Length 95th (ft)	4	0	0	0	0	0	24	19
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	0.0	48.3	22.9
Lane LOS	A						E	C
Approach Delay (s)	0.5			0.0			48.3	22.9
Approach LOS							E	C

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	765	575	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	869	653	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		931				
pX, platoon unblocked						
vC, conflicting volume	659				1091	330
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	659				1091	330
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	925				209	666

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	435	435	436	223	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	6	6
cSH	1700	1700	1700	1700	666
Volume to Capacity	0.26	0.26	0.26	0.13	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	10.5
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.5
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	815	635	40	75	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	11	937	730	46	86	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	776				1244	388
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	776				1244	388
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				47	98
cM capacity (veh/h)	836				164	611

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	11	468	468	487	289	98
Volume Left	11	0	0	0	0	86
Volume Right	0	0	0	0	46	11
cSH	836	1700	1700	1700	1700	179
Volume to Capacity	0.01	0.28	0.28	0.29	0.17	0.54
Queue Length 95th (ft)	1	0	0	0	0	70
Control Delay (s)	9.4	0.0	0.0	0.0	0.0	46.8
Lane LOS	A					E
Approach Delay (s)	0.1			0.0		46.8
Approach LOS						E

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	793	230	247	425	448	351
v/c Ratio	1.06	0.33	1.06	0.45	1.10	0.57
Control Delay	76.1	3.8	101.7	11.5	106.1	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.1	3.8	101.7	11.5	106.1	7.0
Queue Length 50th (ft)	~499	1	~111	120	~291	0
Queue Length 95th (ft)	#681	38	#242	179	#450	57
Internal Link Dist (ft)	238			326	386	
Turn Bay Length (ft)			150			
Base Capacity (vph)	750	703	232	950	409	621
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.06	0.33	1.06	0.45	1.10	0.57

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	690	200	215	370	0	0	0	0	390	0	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1727	1324	1480	1570						1504	1346
Flt Permitted		1.00	1.00	0.09	1.00						0.95	1.00
Satd. Flow (perm)		1727	1324	140	1570						1504	1346
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	0	793	230	247	425	0	0	0	0	448	0	351
RTOR Reduction (vph)	0	0	128	0	0	0	0	0	0	0	0	255
Lane Group Flow (vph)	0	793	102	247	425	0	0	0	0	0	448	96
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		39.1	39.1	54.5	54.5						24.5	24.5
Effective Green, g (s)		39.1	39.1	54.5	54.5						24.5	24.5
Actuated g/C Ratio		0.43	0.43	0.61	0.61						0.27	0.27
Clearance Time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		750	575	232	950						409	366
v/s Ratio Prot		0.46		c0.12	0.27							
v/s Ratio Perm			0.08	c0.53							0.30	0.07
v/c Ratio		1.06	0.18	1.06	0.45						1.10	0.26
Uniform Delay, d1		25.4	15.6	27.3	9.6						32.8	25.7
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		49.1	0.7	77.2	0.3						72.7	0.4
Delay (s)		74.5	16.3	104.5	10.0						105.5	26.0
Level of Service		E	B	F	A						F	C
Approach Delay (s)		61.4			44.7			0.0			70.6	
Approach LOS		E			D			A			E	

Intersection Summary			
HCM 2000 Control Delay	59.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	121.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	305	775	0	0	480	730	105	0	115	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	351	891	0	0	552	839	121	0	132	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		406										
pX, platoon unblocked				0.68			0.68	0.68	0.68	0.68	0.68	
vC, conflicting volume	552			891			2144	2144	891	2144	2144	552
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	552			604			2446	2446	604	2446	2446	552
tC, single (s)	4.2			4.1			7.3	6.5	6.4	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.7	4.0	3.5	3.5	4.0	3.3
p0 queue free %	64			100			0	100	58	100	100	100
cM capacity (veh/h)	979			662			9	14	316	6	14	534

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	351	891	552	839	253
Volume Left	351	0	0	0	121
Volume Right	0	0	0	839	132
cSH	979	1700	1700	1700	18
Volume to Capacity	0.36	0.52	0.32	0.49	13.68
Queue Length 95th (ft)	41	0	0	0	Err
Control Delay (s)	10.7	0.0	0.0	0.0	Err
Lane LOS	B				F
Approach Delay (s)	3.0		0.0		Err
Approach LOS					F

Intersection Summary				
Average Delay	877.7			
Intersection Capacity Utilization	121.5%	ICU Level of Service	H	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	35	820	35	10	0	1080	30	65	0	0	15	0	65
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	40	943	40	0	0	1241	34	75	0	0	17	0	75
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)		663											
pX, platoon unblocked				0.00									
vC, conflicting volume	1276			0	983			1664	2319	491	1810	2322	638
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1276			0	983			1664	2319	491	1810	2322	638
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			0	100			0	100	100	63	100	82
cM capacity (veh/h)	540			0	698			49	34	523	46	34	419

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	40	628	354	0	828	448	75	92
Volume Left	40	0	0	0	0	0	75	17
Volume Right	0	0	40	0	0	34	0	75
cSH	540	1700	1700	1700	1700	1700	49	167
Volume to Capacity	0.07	0.37	0.21	0.00	0.49	0.26	1.52	0.55
Queue Length 95th (ft)	6	0	0	0	0	0	178	70
Control Delay (s)	12.2	0.0	0.0	0.0	0.0	0.0	446.9	50.0
Lane LOS	B						F	F
Approach Delay (s)	0.5			0.0			446.9	50.0
Approach LOS							F	F

Intersection Summary			
Average Delay		15.6	
Intersection Capacity Utilization		47.7%	ICU Level of Service	A
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	845	1110	10	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	971	1276	11	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		931				
pX, platoon unblocked						
vC, conflicting volume	1287				1767	644
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1287				1767	644
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	97
cM capacity (veh/h)	535				75	416

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	486	486	851	437	11
Volume Left	0	0	0	0	0
Volume Right	0	0	0	11	11
cSH	1700	1700	1700	1700	416
Volume to Capacity	0.29	0.29	0.50	0.26	0.03
Queue Length 95th (ft)	0	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	0.0	13.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.9
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	635	815	75	40	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	11	713	916	84	45	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1000				1337	500
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1000				1337	500
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				68	98
cM capacity (veh/h)	688				142	516

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	11	357	357	610	390	56
Volume Left	11	0	0	0	0	45
Volume Right	0	0	0	0	84	11
cSH	688	1700	1700	1700	1700	166
Volume to Capacity	0.02	0.21	0.21	0.36	0.23	0.34
Queue Length 95th (ft)	1	0	0	0	0	35
Control Delay (s)	10.3	0.0	0.0	0.0	0.0	37.3
Lane LOS	B					E
Approach Delay (s)	0.2			0.0		37.3
Approach LOS						E

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	34.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR
Lane Group Flow (vph)	640	118	129	657	820	343
v/c Ratio	1.15	0.23	0.96	0.98	1.21	0.50
Control Delay	117.7	5.7	91.4	57.3	135.0	12.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	117.7	5.7	91.4	57.3	135.0	12.7
Queue Length 50th (ft)	~432	0	44	358	~576	73
Queue Length 95th (ft)	#628	36	#132	#584	#785	146
Internal Link Dist (ft)	238			326	386	
Turn Bay Length (ft)			150			
Base Capacity (vph)	556	506	135	671	676	684
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.15	0.23	0.96	0.98	1.21	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	570	105	115	585	0	0	0	0	730	0	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		1727	1324	1480	1570						1504	1346
Flt Permitted		1.00	1.00	0.12	1.00						0.95	1.00
Satd. Flow (perm)		1727	1324	181	1570						1504	1346
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	640	118	129	657	0	0	0	0	820	0	343
RTOR Reduction (vph)	0	0	80	0	0	0	0	0	0	0	0	79
Lane Group Flow (vph)	0	640	38	129	657	0	0	0	0	0	820	264
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		29.0	29.0	38.5	38.5						40.5	40.5
Effective Green, g (s)		29.0	29.0	38.5	38.5						40.5	40.5
Actuated g/C Ratio		0.32	0.32	0.43	0.43						0.45	0.45
Clearance Time (s)		5.5	5.5	5.5	5.5						5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		556	426	135	671						676	605
v/s Ratio Prot		c0.37		0.04	c0.42							
v/s Ratio Perm			0.03	0.37							0.55	0.20
v/c Ratio		1.15	0.09	0.96	0.98						1.21	0.44
Uniform Delay, d1		30.5	21.3	25.3	25.4						24.8	16.9
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		87.2	0.4	63.3	29.2						109.2	0.5
Delay (s)		117.7	21.7	88.6	54.5						133.9	17.4
Level of Service		F	C	F	D						F	B
Approach Delay (s)		102.8			60.1			0.0			99.6	
Approach LOS		F			E			A			F	

Intersection Summary			
HCM 2000 Control Delay	89.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	126.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	305	995	0	0	500	390	200	0	215	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	343	1118	0	0	562	438	225	0	242	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		406										
pX, platoon unblocked												
vC, conflicting volume	562			1118			2365	2365	1118	2365	2365	562
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	562			1118			2365	2365	1118	2365	2365	562
tC, single (s)	4.2			4.1			7.3	6.5	6.4	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.7	4.0	3.5	3.5	4.0	3.3
p0 queue free %	65			100			0	100	0	0	100	100
cM capacity (veh/h)	971			625			15	23	231	0	23	527

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	343	1118	562	438	466
Volume Left	343	0	0	0	225
Volume Right	0	0	0	438	242
cSH	971	1700	1700	1700	30
Volume to Capacity	0.35	0.66	0.33	0.26	15.58
Queue Length 95th (ft)	40	0	0	0	Err
Control Delay (s)	10.7	0.0	0.0	0.0	Err
Lane LOS	B				F
Approach Delay (s)	2.5		0.0		Err
Approach LOS					F

Intersection Summary				
Average Delay		1594.2		
Intersection Capacity Utilization		126.5%	ICU Level of Service	H
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	65	1080	65	10	0	820	15	35	0	0	30	0	35
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	73	1213	73	0	0	921	17	39	0	0	34	0	39
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)		663											
pX, platoon unblocked				0.00									
vC, conflicting volume	938			0	1287			1857	2334	643	1683	2362	469
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	938			0	1287			1857	2334	643	1683	2362	469
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			0	100			0	100	100	41	100	93
cM capacity (veh/h)	726			0	535			39	33	416	57	31	541

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	73	809	478	0	614	324	39	73
Volume Left	73	0	0	0	0	0	39	34
Volume Right	0	0	73	0	0	17	0	39
cSH	726	1700	1700	1700	1700	1700	39	110
Volume to Capacity	0.10	0.48	0.28	0.00	0.36	0.19	1.01	0.67
Queue Length 95th (ft)	8	0	0	0	0	0	97	86
Control Delay (s)	10.5	0.0	0.0	0.0	0.0	0.0	305.9	87.4
Lane LOS	B						F	F
Approach Delay (s)	0.6			0.0			305.9	87.4
Approach LOS							F	F

Intersection Summary			
Average Delay		8.0	
Intersection Capacity Utilization		48.9%	ICU Level of Service	A
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1120	835	10	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	1258	938	11	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		931				
pX, platoon unblocked						
vC, conflicting volume	949				1573	475
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	949				1573	475
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	98
cM capacity (veh/h)	719				101	536

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	629	629	625	324	11
Volume Left	0	0	0	0	0
Volume Right	0	0	0	11	11
cSH	1700	1700	1700	1700	536
Volume to Capacity	0.37	0.37	0.37	0.19	0.02
Queue Length 95th (ft)	0	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	0.0	11.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.9
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	565	440	25	50	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	657	512	29	58	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	541				866	526
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	541				866	526
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				80	99
cM capacity (veh/h)	1024				291	496

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	SB 1
Volume Total	6	328	328	541	64
Volume Left	6	0	0	0	58
Volume Right	0	0	0	29	6
cSH	1024	1700	1700	1700	302
Volume to Capacity	0.01	0.19	0.19	0.32	0.21
Queue Length 95th (ft)	0	0	0	0	20
Control Delay (s)	8.5	0.0	0.0	0.0	20.1
Lane LOS	A				C
Approach Delay (s)	0.1			0.0	20.1
Approach LOS					C

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	25	575	25	5	0	740	20	45	0	0	0	0	55
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	29	669	29	0	0	860	23	52	0	0	0	0	64
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)													
pX, platoon unblocked				0.00									
vC, conflicting volume	884			0	698			1172	1625	349	1265	1628	442
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	884			0	698			1172	1625	349	1265	1628	442
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			0	100			59	100	100	100	100	89
cM capacity (veh/h)	761			0	895			127	98	647	122	97	563

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	29	446	252	0	574	310	52	0	64
Volume Left	29	0	0	0	0	0	52	0	0
Volume Right	0	0	29	0	0	23	0	0	64
cSH	761	1700	1700	1700	1700	1700	127	1700	563
Volume to Capacity	0.04	0.26	0.15	0.00	0.34	0.18	0.41	0.00	0.11
Queue Length 95th (ft)	3	0	0	0	0	0	44	0	10
Control Delay (s)	9.9	0.0	0.0	0.0	0.0	0.0	51.8	0.0	12.2
Lane LOS	A						F	A	B
Approach Delay (s)	0.4			0.0			51.8		12.2
Approach LOS							F		B

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		37.8%	ICU Level of Service	A
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	580	760	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	0	674	884	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	890				1224	445
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	890				1224	445
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	757				171	561

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	337	337	589	300	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	6	6
cSH	1700	1700	1700	1700	561
Volume to Capacity	0.20	0.20	0.35	0.18	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	11.5
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.5
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	440	565	50	25	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	6	500	642	57	28	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	699				932	670
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	699				932	670
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				89	99
cM capacity (veh/h)	894				264	399

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	SB 1
Volume Total	6	250	250	699	34
Volume Left	6	0	0	0	28
Volume Right	0	0	0	57	6
cSH	894	1700	1700	1700	279
Volume to Capacity	0.01	0.15	0.15	0.41	0.12
Queue Length 95th (ft)	0	0	0	0	10
Control Delay (s)	9.1	0.0	0.0	0.0	19.7
Lane LOS	A				C
Approach Delay (s)	0.1			0.0	19.7
Approach LOS					C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	45	760	45	5	0	565	10	25	0	0	0	0	45
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	51	864	51	0	0	642	11	28	0	0	0	0	51
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)													
pX, platoon unblocked				0.00									
vC, conflicting volume	653			0	915			1312	1645	457	1182	1665	327
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	653			0	915			1312	1645	457	1182	1665	327
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			0	100			72	100	100	100	100	92
cM capacity (veh/h)	929			0	741			103	93	550	139	91	669

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	51	576	339	0	428	225	28	0	51
Volume Left	51	0	0	0	0	0	28	0	0
Volume Right	0	0	51	0	0	11	0	0	51
cSH	929	1700	1700	1700	1700	1700	103	1700	669
Volume to Capacity	0.06	0.34	0.20	0.00	0.25	0.13	0.28	0.00	0.08
Queue Length 95th (ft)	4	0	0	0	0	0	26	0	6
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	0.0	52.9	0.0	10.8
Lane LOS	A						F	A	B
Approach Delay (s)	0.5			0.0			52.9		10.8
Approach LOS							F		B

Intersection Summary			
Average Delay		1.5	
Intersection Capacity Utilization		39.1%	ICU Level of Service	A
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	765	575	5	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	869	653	6	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	659				1091	330
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	659				1091	330
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	925				209	666

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	435	435	436	223	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	6	6
cSH	1700	1700	1700	1700	666
Volume to Capacity	0.26	0.26	0.26	0.13	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	10.5
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.5
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	815	635	40	75	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	11	937	730	46	86	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	776				1244	753
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	776				1244	753
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				47	97
cM capacity (veh/h)	836				164	352

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	SB 1
Volume Total	11	468	468	776	98
Volume Left	11	0	0	0	86
Volume Right	0	0	0	46	11
cSH	836	1700	1700	1700	175
Volume to Capacity	0.01	0.28	0.28	0.46	0.56
Queue Length 95th (ft)	1	0	0	0	73
Control Delay (s)	9.4	0.0	0.0	0.0	48.9
Lane LOS	A				E
Approach Delay (s)	0.1			0.0	48.9
Approach LOS					E

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	35	835	35	10	0	1080	30	65	0	0	0	0	80
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	40	960	40	0	0	1241	34	75	0	0	0	0	92
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)													
pX, platoon unblocked				0.00									
vC, conflicting volume	1276			0	1000			1681	2336	500	1819	2339	638
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1276			0	1000			1681	2336	500	1819	2339	638
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			0	100			0	100	100	100	100	78
cM capacity (veh/h)	540			0	688			45	33	516	46	33	419

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	40	640	360	0	828	448	75	0	92
Volume Left	40	0	0	0	0	0	75	0	0
Volume Right	0	0	40	0	0	34	0	0	92
cSH	540	1700	1700	1700	1700	1700	45	1700	419
Volume to Capacity	0.07	0.38	0.21	0.00	0.49	0.26	1.65	0.00	0.22
Queue Length 95th (ft)	6	0	0	0	0	0	186	0	21
Control Delay (s)	12.2	0.0	0.0	0.0	0.0	0.0	512.6	0.0	16.0
Lane LOS	B						F	A	C
Approach Delay (s)	0.5			0.0			512.6		16.0
Approach LOS							F		C

Intersection Summary			
Average Delay		16.2	
Intersection Capacity Utilization		49.4%	ICU Level of Service
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	845	1110	10	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	0	971	1276	11	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1287				1767	644
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1287				1767	644
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	97
cM capacity (veh/h)	535				75	416

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	486	486	851	437	11
Volume Left	0	0	0	0	0
Volume Right	0	0	0	11	11
cSH	1700	1700	1700	1700	416
Volume to Capacity	0.29	0.29	0.50	0.26	0.03
Queue Length 95th (ft)	0	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	0.0	13.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.9
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	635	815	75	40	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	11	713	916	84	45	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1000				1337	958
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1000				1337	958
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				68	96
cM capacity (veh/h)	688				142	258

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	SB 1
Volume Total	11	357	357	1000	56
Volume Left	11	0	0	0	45
Volume Right	0	0	0	84	11
cSH	688	1700	1700	1700	156
Volume to Capacity	0.02	0.21	0.21	0.59	0.36
Queue Length 95th (ft)	1	0	0	0	38
Control Delay (s)	10.3	0.0	0.0	0.0	40.5
Lane LOS	B				E
Approach Delay (s)	0.2			0.0	40.5
Approach LOS					E

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations													
Volume (veh/h)	65	1110	65	10	0	820	15	35	0	0	0	0	65
Sign Control		Free				Free			Stop			Stop	
Grade		0%				0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	73	1247	73	0	0	921	17	39	0	0	0	0	73
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type		None				None							
Median storage veh)													
Upstream signal (ft)													
pX, platoon unblocked				0.00									
vC, conflicting volume	938			0	1320			1890	2368	660	1699	2396	469
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	938			0	1320			1890	2368	660	1699	2396	469
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)													
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			0	100			0	100	100	100	100	86
cM capacity (veh/h)	726			0	519			34	31	406	55	30	541

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	73	831	489	0	614	324	39	0	73
Volume Left	73	0	0	0	0	0	39	0	0
Volume Right	0	0	73	0	0	17	0	0	73
cSH	726	1700	1700	1700	1700	1700	34	1700	541
Volume to Capacity	0.10	0.49	0.29	0.00	0.36	0.19	1.15	0.00	0.14
Queue Length 95th (ft)	8	0	0	0	0	0	104	0	12
Control Delay (s)	10.5	0.0	0.0	0.0	0.0	0.0	380.4	0.0	12.7
Lane LOS	B						F	A	B
Approach Delay (s)	0.6			0.0			380.4		12.7
Approach LOS							F		B

Intersection Summary			
Average Delay		6.8	
Intersection Capacity Utilization		49.4%	ICU Level of Service
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1120	835	10	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	1258	938	11	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	949				1573	475
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	949				1573	475
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	98
cM capacity (veh/h)	719				101	536

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	629	629	625	324	11
Volume Left	0	0	0	0	0
Volume Right	0	0	0	11	11
cSH	1700	1700	1700	1700	536
Volume to Capacity	0.37	0.37	0.37	0.19	0.02
Queue Length 95th (ft)	0	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	0.0	11.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		11.9
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	552	163	174	297	157	157	244
v/c Ratio	0.22	0.21	0.34	0.14	0.63	0.63	0.56
Control Delay	12.5	3.4	12.9	6.2	44.9	44.9	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.5	3.4	12.9	6.2	44.9	44.9	9.3
Queue Length 50th (ft)	54	0	27	21	88	88	0
Queue Length 95th (ft)	95	32	111	64	132	132	49
Internal Link Dist (ft)	144			326		386	
Turn Bay Length (ft)		180	290				
Base Capacity (vph)	2536	787	607	2098	452	452	592
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.21	0.29	0.14	0.35	0.35	0.41

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	475	140	150	255	0	0	0	0	270	0	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Lane Util. Factor		0.91	1.00	1.00	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		4715	1324	1480	2983					1429	1429	1346
Flt Permitted		1.00	1.00	0.39	1.00					0.95	0.95	1.00
Satd. Flow (perm)		4715	1324	608	2983					1429	1429	1346
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	552	163	174	297	0	0	0	0	314	0	244
RTOR Reduction (vph)	0	0	75	0	0	0	0	0	0	0	0	201
Lane Group Flow (vph)	0	552	88	174	297	0	0	0	0	157	157	43
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		48.4	48.4	63.3	63.3					15.7	15.7	15.7
Effective Green, g (s)		48.4	48.4	63.3	63.3					15.7	15.7	15.7
Actuated g/C Ratio		0.54	0.54	0.70	0.70					0.17	0.17	0.17
Clearance Time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2535	712	518	2098					249	249	234
v/s Ratio Prot		0.12		c0.04	0.10							
v/s Ratio Perm			0.07	c0.20						c0.11	0.11	0.03
v/c Ratio		0.22	0.12	0.34	0.14					0.63	0.63	0.18
Uniform Delay, d1		10.9	10.3	4.7	4.4					34.5	34.5	31.7
Progression Factor		1.00	1.00	2.03	1.17					1.00	1.00	1.00
Incremental Delay, d2		0.2	0.4	0.4	0.1					5.1	5.1	0.4
Delay (s)		11.1	10.7	9.9	5.3					39.6	39.6	32.1
Level of Service		B	B	A	A					D	D	C
Approach Delay (s)		11.0			7.0			0.0			36.3	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	244	622	384	581	180
v/c Ratio	0.37	0.27	0.42	0.53	0.69
Control Delay	3.5	1.4	13.6	3.1	31.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	3.5	1.4	13.6	3.1	31.3
Queue Length 50th (ft)	0	2	109	0	45
Queue Length 95th (ft)	24	23	211	42	97
Internal Link Dist (ft)		326	177		462
Turn Bay Length (ft)					
Base Capacity (vph)	697	2268	914	1102	355
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.27	0.42	0.53	0.51

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	210	535	0	0	330	500	75	0	80	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5		5.5				
Lane Util. Factor	1.00	0.95			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		0.93				
Flt Protected	0.95	1.00			1.00	1.00		0.98				
Satd. Flow (prot)	1641	3008			1557	1468		1426				
Flt Permitted	0.44	1.00			1.00	1.00		0.98				
Satd. Flow (perm)	764	3008			1557	1468		1426				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	244	622	0	0	384	581	87	0	93	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	240	0	85	0	0	0	0
Lane Group Flow (vph)	244	622	0	0	384	341	0	95	0	0	0	0
Heavy Vehicles (%)	10%	20%	2%	2%	22%	10%	21%	2%	21%	2%	2%	2%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)	67.9	67.9			52.9	52.9		11.1				
Effective Green, g (s)	67.9	67.9			52.9	52.9		11.1				
Actuated g/C Ratio	0.75	0.75			0.59	0.59		0.12				
Clearance Time (s)	5.5	5.5			5.5	5.5		5.5				
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)	668	2269			915	862		175				
v/s Ratio Prot	c0.04	0.21			c0.25							
v/s Ratio Perm	0.24					0.23		0.07				
v/c Ratio	0.37	0.27			0.42	0.40		0.54				
Uniform Delay, d1	4.0	3.4			10.2	10.0		37.1				
Progression Factor	0.50	0.28			1.00	1.00		1.00				
Incremental Delay, d2	0.3	0.3			1.4	1.4		3.4				
Delay (s)	2.3	1.2			11.6	11.3		40.5				
Level of Service	A	A			B	B		D				
Approach Delay (s)		1.5			11.4			40.5			0.0	
Approach LOS		A			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	443	85	91	460	284	284	239
v/c Ratio	0.20	0.13	0.19	0.26	0.72	0.72	0.44
Control Delay	16.9	4.6	6.1	6.7	39.1	39.1	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.9	4.6	6.1	6.7	39.1	39.1	5.5
Queue Length 50th (ft)	53	0	20	56	153	153	0
Queue Length 95th (ft)	96	26	55	107	201	201	42
Internal Link Dist (ft)	144			326		386	
Turn Bay Length (ft)		180	290				
Base Capacity (vph)	2239	679	505	1795	643	643	737
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.13	0.18	0.26	0.44	0.44	0.32

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	390	75	80	405	0	0	0	0	500	0	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Lane Util. Factor		0.91	1.00	1.00	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		4715	1324	1480	2983					1429	1429	1346
Flt Permitted		1.00	1.00	0.43	1.00					0.95	0.95	1.00
Satd. Flow (perm)		4715	1324	669	2983					1429	1429	1346
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	443	85	91	460	0	0	0	0	568	0	239
RTOR Reduction (vph)	0	0	46	0	0	0	0	0	0	0	0	173
Lane Group Flow (vph)	0	443	39	91	460	0	0	0	0	284	284	66
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		41.7	41.7	54.2	54.2					24.8	24.8	24.8
Effective Green, g (s)		41.7	41.7	54.2	54.2					24.8	24.8	24.8
Actuated g/C Ratio		0.46	0.46	0.60	0.60					0.28	0.28	0.28
Clearance Time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2184	613	465	1796					393	393	370
v/s Ratio Prot		0.09		0.02	c0.15							
v/s Ratio Perm			0.03	0.10						c0.20	0.20	0.05
v/c Ratio		0.20	0.06	0.20	0.26					0.72	0.72	0.18
Uniform Delay, d1		14.3	13.4	7.8	8.4					29.5	29.5	24.8
Progression Factor		1.00	1.00	0.53	0.65					1.00	1.00	1.00
Incremental Delay, d2		0.2	0.2	0.2	0.3					6.4	6.4	0.2
Delay (s)		14.5	13.6	4.3	5.7					35.9	35.9	25.1
Level of Service		B	B	A	A					D	D	C
Approach Delay (s)		14.4			5.5			0.0			32.7	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	239	773	392	307	329
v/c Ratio	0.44	0.39	0.52	0.35	0.84
Control Delay	28.6	5.1	21.3	3.4	41.6
Queue Delay	0.0	0.4	0.0	0.0	0.0
Total Delay	28.6	5.5	21.3	3.4	41.6
Queue Length 50th (ft)	131	30	154	0	127
Queue Length 95th (ft)	220	82	262	44	205
Internal Link Dist (ft)		326	177		462
Turn Bay Length (ft)					
Base Capacity (vph)	559	1971	752	867	488
Starvation Cap Reductn	0	638	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.58	0.52	0.35	0.67

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	210	680	0	0	345	270	140	0	150	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5		5.5				
Lane Util. Factor	1.00	0.95			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		0.93				
Flt Protected	0.95	1.00			1.00	1.00		0.98				
Satd. Flow (prot)	1641	3008			1557	1468		1426				
Flt Permitted	0.39	1.00			1.00	1.00		0.98				
Satd. Flow (perm)	674	3008			1557	1468		1426				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	239	773	0	0	392	307	159	0	170	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	159	0	75	0	0	0	0
Lane Group Flow (vph)	239	773	0	0	392	148	0	254	0	0	0	0
Heavy Vehicles (%)	10%	20%	2%	2%	22%	10%	21%	2%	21%	2%	2%	2%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)	59.0	59.0			43.5	43.5		20.0				
Effective Green, g (s)	59.0	59.0			43.5	43.5		20.0				
Actuated g/C Ratio	0.66	0.66			0.48	0.48		0.22				
Clearance Time (s)	5.5	5.5			5.5	5.5		5.5				
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)	549	1971			752	709		316				
v/s Ratio Prot	0.05	c0.26			c0.25							
v/s Ratio Perm	0.24					0.10		0.18				
v/c Ratio	0.44	0.39			0.52	0.21		0.80				
Uniform Delay, d1	7.5	7.2			16.1	13.4		33.1				
Progression Factor	3.48	0.55			1.00	1.00		1.00				
Incremental Delay, d2	0.5	0.6			2.6	0.7		13.6				
Delay (s)	26.7	4.5			18.6	14.0		46.8				
Level of Service	C	A			B	B		D				
Approach Delay (s)		9.8			16.6			46.8			0.0	
Approach LOS		A			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	793	230	247	425	224	224	351
v/c Ratio	0.37	0.32	0.58	0.22	0.70	0.70	0.61
Control Delay	19.0	4.7	12.8	5.7	43.3	43.3	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.0	4.7	12.8	5.7	43.3	43.3	8.0
Queue Length 50th (ft)	102	0	38	28	124	124	0
Queue Length 95th (ft)	174	48	52	42	177	177	54
Internal Link Dist (ft)	144			326		386	
Turn Bay Length (ft)		180	290				
Base Capacity (vph)	2132	724	516	1951	436	436	655
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.32	0.48	0.22	0.51	0.51	0.54

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	690	200	215	370	0	0	0	0	390	0	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Lane Util. Factor		0.91	1.00	1.00	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		4715	1324	1480	2983					1429	1429	1346
Flt Permitted		1.00	1.00	0.27	1.00					0.95	0.95	1.00
Satd. Flow (perm)		4715	1324	421	2983					1429	1429	1346
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	0	793	230	247	425	0	0	0	0	448	0	351
RTOR Reduction (vph)	0	0	126	0	0	0	0	0	0	0	0	273
Lane Group Flow (vph)	0	793	104	247	425	0	0	0	0	224	224	78
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		40.7	40.7	58.9	58.9					20.1	20.1	20.1
Effective Green, g (s)		40.7	40.7	58.9	58.9					20.1	20.1	20.1
Actuated g/C Ratio		0.45	0.45	0.65	0.65					0.22	0.22	0.22
Clearance Time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2132	598	424	1952					319	319	300
v/s Ratio Prot		0.17		c0.08	0.14							
v/s Ratio Perm			0.08	c0.30						c0.16	0.16	0.06
v/c Ratio		0.37	0.17	0.58	0.22					0.70	0.70	0.26
Uniform Delay, d1		16.2	14.7	7.4	6.3					32.2	32.2	28.8
Progression Factor		1.00	1.00	1.09	0.76					1.00	1.00	1.00
Incremental Delay, d2		0.5	0.6	1.5	0.2					6.8	6.8	0.5
Delay (s)		16.7	15.3	9.6	4.9					39.0	39.0	29.3
Level of Service		B	B	A	A					D	D	C
Approach Delay (s)		16.4			6.6			0.0			34.8	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	351	891	552	839	253
v/c Ratio	0.68	0.41	0.67	0.75	0.83
Control Delay	34.7	6.9	21.9	8.0	45.5
Queue Delay	2.3	0.3	0.0	0.0	0.0
Total Delay	37.0	7.2	21.9	8.0	45.5
Queue Length 50th (ft)	135	149	237	37	84
Queue Length 95th (ft)	266	268	352	146	#183
Internal Link Dist (ft)		326	177		462
Turn Bay Length (ft)					
Base Capacity (vph)	539	2171	824	1115	340
Starvation Cap Reductn	90	645	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.78	0.58	0.67	0.75	0.74

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	305	775	0	0	480	730	105	0	115	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5		5.5				
Lane Util. Factor	1.00	0.95			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		0.93				
Flt Protected	0.95	1.00			1.00	1.00		0.98				
Satd. Flow (prot)	1641	3008			1557	1468		1426				
Flt Permitted	0.30	1.00			1.00	1.00		0.98				
Satd. Flow (perm)	512	3008			1557	1468		1426				
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	351	891	0	0	552	839	121	0	132	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	337	0	82	0	0	0	0
Lane Group Flow (vph)	351	891	0	0	552	502	0	171	0	0	0	0
Heavy Vehicles (%)	10%	20%	2%	2%	22%	10%	21%	2%	21%	2%	2%	2%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)	65.0	65.0			47.7	47.7		14.0				
Effective Green, g (s)	65.0	65.0			47.7	47.7		14.0				
Actuated g/C Ratio	0.72	0.72			0.53	0.53		0.16				
Clearance Time (s)	5.5	5.5			5.5	5.5		5.5				
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)	517	2172			825	778		221				
v/s Ratio Prot	c0.09	0.30			0.35							
v/s Ratio Perm	c0.40					0.34		0.12				
v/c Ratio	0.68	0.41			0.67	0.64		0.77				
Uniform Delay, d1	7.9	4.9			15.4	15.1		36.5				
Progression Factor	5.60	1.17			1.00	1.00		1.00				
Incremental Delay, d2	3.3	0.5			4.3	4.1		15.5				
Delay (s)	47.7	6.3			19.7	19.2		51.9				
Level of Service	D	A			B	B		D				
Approach Delay (s)		18.0			19.4			51.9			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	640	118	129	657	410	410	343
v/c Ratio	0.40	0.22	0.38	0.43	0.78	0.78	0.59
Control Delay	25.5	6.8	10.3	10.4	35.0	35.0	16.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.5	6.8	10.3	10.4	35.0	35.0	16.5
Queue Length 50th (ft)	103	0	39	121	207	207	88
Queue Length 95th (ft)	155	41	m61	m170	281	281	147
Internal Link Dist (ft)	144			326		386	
Turn Bay Length (ft)		180	290				
Base Capacity (vph)	1617	531	362	1516	658	658	693
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.22	0.36	0.43	0.62	0.62	0.49

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	570	105	115	585	0	0	0	0	730	0	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Lane Util. Factor		0.91	1.00	1.00	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		4715	1324	1480	2983					1429	1429	1346
Flt Permitted		1.00	1.00	0.30	1.00					0.95	0.95	1.00
Satd. Flow (perm)		4715	1324	469	2983					1429	1429	1346
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	640	118	129	657	0	0	0	0	820	0	343
RTOR Reduction (vph)	0	0	77	0	0	0	0	0	0	0	0	86
Lane Group Flow (vph)	0	640	41	129	657	0	0	0	0	410	410	257
Heavy Vehicles (%)	2%	10%	22%	22%	21%	2%	2%	2%	2%	20%	2%	20%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	Perm
Protected Phases		6		5	2						8	
Permitted Phases			6	2						8		8
Actuated Green, G (s)		30.9	30.9	45.8	45.8					33.2	33.2	33.2
Effective Green, g (s)		30.9	30.9	45.8	45.8					33.2	33.2	33.2
Actuated g/C Ratio		0.34	0.34	0.51	0.51					0.37	0.37	0.37
Clearance Time (s)		5.5	5.5	5.5	5.5					5.5	5.5	5.5
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1618	454	344	1518					527	527	496
v/s Ratio Prot		0.14		0.04	c0.22							
v/s Ratio Perm			0.03	0.15						c0.29	0.29	0.19
v/c Ratio		0.40	0.09	0.38	0.43					0.78	0.78	0.52
Uniform Delay, d1		22.5	20.0	12.4	13.9					25.1	25.1	22.2
Progression Factor		1.00	1.00	0.62	0.64					1.00	1.00	1.00
Incremental Delay, d2		0.7	0.4	0.3	0.3					7.1	7.1	0.9
Delay (s)		23.2	20.4	8.0	9.3					32.3	32.3	23.1
Level of Service		C	C	A	A					C	C	C
Approach Delay (s)		22.7			9.1			0.0			29.6	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	343	1118	562	438	467
v/c Ratio	0.94	0.63	0.89	0.51	0.99
Control Delay	68.1	7.5	43.7	4.2	65.9
Queue Delay	0.0	0.8	0.0	0.0	0.0
Total Delay	68.1	8.3	43.7	4.2	65.9
Queue Length 50th (ft)	213	98	291	0	218
Queue Length 95th (ft)	#362	114	#483	54	#414
Internal Link Dist (ft)		326	177		462
Turn Bay Length (ft)					
Base Capacity (vph)	363	1788	631	855	473
Starvation Cap Reductn	0	357	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.94	0.78	0.89	0.51	0.99

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	305	995	0	0	500	390	200	0	215	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5		5.5				
Lane Util. Factor	1.00	0.95			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		0.93				
Flt Protected	0.95	1.00			1.00	1.00		0.98				
Satd. Flow (prot)	1641	3008			1557	1468		1426				
Flt Permitted	0.19	1.00			1.00	1.00		0.98				
Satd. Flow (perm)	330	3008			1557	1468		1426				
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	343	1118	0	0	562	438	225	0	242	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	260	0	70	0	0	0	0
Lane Group Flow (vph)	343	1118	0	0	562	178	0	397	0	0	0	0
Heavy Vehicles (%)	10%	20%	2%	2%	22%	10%	21%	2%	21%	2%	2%	2%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)	53.5	53.5			36.5	36.5		25.5				
Effective Green, g (s)	53.5	53.5			36.5	36.5		25.5				
Actuated g/C Ratio	0.59	0.59			0.41	0.41		0.28				
Clearance Time (s)	5.5	5.5			5.5	5.5		5.5				
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)	363	1788			631	595		404				
v/s Ratio Prot	c0.12	0.37			0.36							
v/s Ratio Perm	c0.44					0.12		0.28				
v/c Ratio	0.94	0.63			0.89	0.30		0.98				
Uniform Delay, d1	16.0	11.8			24.9	18.1		32.0				
Progression Factor	2.91	0.50			1.00	1.00		1.00				
Incremental Delay, d2	31.6	1.4			17.2	1.3		40.2				
Delay (s)	78.1	7.3			42.1	19.4		72.3				
Level of Service	E	A			D	B		E				
Approach Delay (s)		24.0			32.1			72.3			0.0	
Approach LOS		C			C			E			A	

Intersection Summary			
HCM 2000 Control Delay	34.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX I

SIDRA Analysis Reports

MOVEMENT SUMMARY

Site: SB Ramp 2017 AM 2-Lane

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SR 144											
4	L2	174	22.0	0.316	11.0	LOS B	0.0	0.0	0.00	0.53	60.6
5	T1	297	21.0	0.316	4.3	LOS A	0.0	0.0	0.00	0.53	62.6
Approach		471	21.4	0.316	6.8	LOS A	0.0	0.0	0.00	0.53	61.9
North: I-95 SB Ramp											
7	L2	314	20.0	0.337	16.8	LOS C	2.0	16.3	0.66	0.82	55.3
8	T1	1	2.0	0.337	9.8	LOS A	2.0	16.3	0.65	0.77	67.6
9	R2	244	20.0	0.337	9.6	LOS A	2.0	16.3	0.65	0.77	60.7
Approach		559	20.0	0.337	13.7	LOS B	2.0	16.3	0.65	0.80	57.5
West: SR 144											
11	T1	552	10.0	0.652	9.4	LOS A	4.9	37.4	0.74	0.88	60.3
12	R2	163	22.0	0.163	5.5	LOS A	0.7	5.7	0.33	0.52	60.4
Approach		715	12.7	0.652	8.5	LOS A	4.9	37.4	0.64	0.80	60.3
All Vehicles		1745	17.4	0.652	9.7	LOS A	4.9	37.4	0.47	0.73	59.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: NB Ramp 2017 AM

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: I-95 NB Ramp											
1	L2	87	21.0	0.339	18.4	LOS C	1.4	11.3	0.65	0.89	55.3
2	T1	1	2.0	0.339	11.8	LOS B	1.4	11.3	0.65	0.89	63.2
3	R2	93	21.0	0.339	11.6	LOS B	1.4	11.3	0.65	0.89	57.7
Approach		181	20.9	0.339	14.9	LOS B	1.4	11.3	0.65	0.89	56.5
East: SR 144											
4u	U	12	0.0	0.414	15.9	LOS C	2.7	22.1	0.62	0.65	60.8
5	T1	384	22.0	0.414	6.9	LOS A	2.7	22.1	0.62	0.65	60.7
6	R2	581	10.0	0.509	6.2	LOS A	3.7	28.2	0.58	0.63	61.9
Approach		977	14.6	0.509	6.6	LOS A	3.7	28.2	0.59	0.64	61.4
West: SR 144											
10	L2	244	10.0	0.298	10.9	LOS B	2.1	16.8	0.10	0.56	61.6
11	T1	622	20.0	0.298	4.7	LOS A	2.2	17.8	0.10	0.43	63.2
Approach		866	17.2	0.298	6.4	LOS A	2.2	17.8	0.10	0.47	62.8
All Vehicles		2024	16.3	0.509	7.3	LOS A	3.7	28.2	0.39	0.59	61.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: SB Ramp 2017 PM 2-Lane

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SR 144											
4	L2	91	22.0	0.369	11.0	LOS B	0.0	0.0	0.00	0.46	61.9
5	T1	460	21.0	0.369	4.3	LOS A	0.0	0.0	0.00	0.46	64.0
Approach		551	21.2	0.369	5.4	LOS A	0.0	0.0	0.00	0.46	63.6
North: I-95 SB Ramp											
7	L2	568	20.0	0.522	19.8	LOS C	4.1	33.8	0.78	0.95	53.2
8	T1	1	2.0	0.522	12.5	LOS B	4.1	33.8	0.78	0.92	62.6
9	R2	239	20.0	0.522	12.4	LOS B	4.1	33.8	0.78	0.92	56.7
Approach		808	20.0	0.522	17.6	LOS C	4.1	33.8	0.78	0.94	54.2
West: SR 144											
11	T1	443	10.0	0.606	9.8	LOS A	4.1	31.5	0.78	0.92	60.0
12	R2	85	22.0	0.079	4.9	LOS A	0.3	2.6	0.22	0.47	60.9
Approach		528	11.9	0.606	9.0	LOS A	4.1	31.5	0.69	0.84	60.2
All Vehicles		1888	18.1	0.606	11.7	LOS B	4.1	33.8	0.53	0.77	58.3

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: NB Ramp 2017 PM

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: I-95 NB Ramp											
1	L2	159	21.0	0.678	24.1	LOS C	4.1	34.1	0.81	1.04	51.0
2	T1	1	2.0	0.678	17.5	LOS C	4.1	34.1	0.81	1.04	57.7
3	R2	170	21.0	0.678	17.3	LOS C	4.1	34.1	0.81	1.04	53.1
Approach		331	20.9	0.678	20.6	LOS C	4.1	34.1	0.81	1.04	52.1
East: SR 144											
4u	U	23	0.0	0.467	16.7	LOS C	3.3	26.9	0.71	0.73	59.9
5	T1	392	22.0	0.467	7.6	LOS A	3.3	26.9	0.71	0.73	59.9
6	R2	307	10.0	0.277	5.8	LOS A	1.6	12.3	0.47	0.58	62.4
Approach		722	16.2	0.467	7.1	LOS A	3.3	26.9	0.60	0.67	60.9
West: SR 144											
10	L2	239	10.0	0.358	11.0	LOS B	2.8	22.4	0.17	0.53	61.8
11	T1	773	20.0	0.358	4.7	LOS A	2.9	23.5	0.17	0.42	62.8
Approach		1011	17.6	0.358	6.2	LOS A	2.9	23.5	0.17	0.45	62.6
All Vehicles		2064	17.7	0.678	8.8	LOS A	4.1	34.1	0.42	0.62	60.1

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: SB Ramp 2037 AM 2-Lane

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SR 144											
4	L2	247	22.0	0.434	11.0	LOS B	0.0	0.0	0.00	0.53	60.7
5	T1	425	21.0	0.434	4.3	LOS A	0.0	0.0	0.00	0.53	62.6
Approach		672	21.4	0.434	6.8	LOS A	0.0	0.0	0.00	0.53	61.9
North: I-95 SB Ramp											
7	L2	448	20.0	0.519	21.5	LOS C	4.4	35.8	0.82	1.00	51.9
8	T1	1	2.0	0.519	13.4	LOS B	4.4	35.8	0.82	0.94	63.1
9	R2	351	20.0	0.519	13.3	LOS B	4.4	35.8	0.82	0.94	57.1
Approach		800	20.0	0.519	17.9	LOS C	4.4	35.8	0.82	0.97	54.0
West: SR 144											
11	T1	793	10.0	0.942	20.3	LOS C	15.2	115.4	1.00	1.38	51.6
12	R2	230	22.0	0.218	5.8	LOS A	1.0	8.2	0.39	0.56	60.1
Approach		1023	12.7	0.942	17.0	LOS C	15.2	115.4	0.86	1.20	53.3
All Vehicles		2495	17.4	0.942	14.5	LOS B	15.2	115.4	0.62	0.95	55.6

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: NB Ramp 2037 AM

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: I-95 NB Ramp											
1	L2	121	21.0	0.484	20.8	LOS C	2.4	19.7	0.75	0.97	53.4
2	T1	1	2.0	0.484	14.2	LOS B	2.4	19.7	0.75	0.97	60.8
3	R2	132	21.0	0.484	14.0	LOS B	2.4	19.7	0.75	0.97	55.7
Approach		254	20.9	0.484	17.2	LOS C	2.4	19.7	0.75	0.97	54.6
East: SR 144											
4u	U	17	0.0	0.591	18.6	LOS C	5.5	45.3	0.79	0.85	59.4
5	T1	552	22.0	0.591	9.5	LOS A	5.5	45.3	0.79	0.85	59.3
6	R2	839	10.0	0.723	9.5	LOS A	9.0	68.1	0.81	0.83	59.3
Approach		1408	14.6	0.723	9.6	LOS A	9.0	68.1	0.80	0.84	59.3
West: SR 144											
10	L2	351	10.0	0.415	10.9	LOS B	3.7	28.8	0.16	0.55	61.3
11	T1	891	20.0	0.415	4.7	LOS A	3.7	30.7	0.15	0.42	62.9
Approach		1241	17.2	0.415	6.5	LOS A	3.7	30.7	0.15	0.46	62.5
All Vehicles		2903	16.2	0.723	8.9	LOS A	9.0	68.1	0.52	0.69	60.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: SB Ramp 2037 PM 2-Lane

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: SR 144											
4	L2	129	22.0	0.507	11.0	LOS B	0.0	0.0	0.00	0.46	61.9
5	T1	657	21.0	0.507	4.3	LOS A	0.0	0.0	0.00	0.46	64.0
Approach		787	21.2	0.507	5.4	LOS A	0.0	0.0	0.00	0.46	63.6
North: I-95 SB Ramp											
7	L2	820	20.0	0.840	39.0	LOS E	15.5	127.2	1.00	1.37	42.1
8	T1	1	2.0	0.840	29.9	LOS D	15.5	127.2	1.00	1.38	48.5
9	R2	343	20.0	0.840	29.8	LOS D	15.5	127.2	1.00	1.38	44.9
Approach		1164	20.0	0.840	36.3	LOS E	15.5	127.2	1.00	1.37	42.9
West: SR 144											
11	T1	640	10.0	0.979	29.2	LOS D	16.2	123.4	1.00	1.50	46.0
12	R2	118	22.0	0.103	5.1	LOS A	0.4	3.4	0.26	0.48	60.7
Approach		758	11.9	0.979	25.5	LOS D	16.2	123.4	0.88	1.35	47.8
All Vehicles		2709	18.1	0.979	24.3	LOS C	16.2	127.2	0.68	1.10	48.9

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: NB Ramp 2037 PM

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: I-95 NB Ramp											
1	L2	225	21.0	1.042	67.8	LOS F	18.9	156.3	1.00	1.76	32.1
2	T1	1	2.0	1.042	61.2	LOS F	18.9	156.3	1.00	1.76	34.6
3	R2	242	21.0	1.042	61.1	LOS F	18.9	156.3	1.00	1.76	32.9
Approach		467	21.0	1.042	64.3	LOS F	18.9	156.3	1.00	1.76	32.5
East: SR 144											
4u	U	34	0.0	0.688	21.8	LOS C	8.0	66.3	0.92	1.03	56.1
5	T1	562	22.0	0.688	12.8	LOS B	8.0	66.3	0.92	1.03	56.1
6	R2	438	10.0	0.387	6.4	LOS A	2.6	19.7	0.60	0.65	61.8
Approach		1034	16.2	0.688	10.4	LOS B	8.0	66.3	0.78	0.87	58.3
West: SR 144											
10	L2	343	10.0	0.506	11.1	LOS B	5.2	40.9	0.27	0.52	61.3
11	T1	1118	20.0	0.506	4.8	LOS A	5.3	43.3	0.26	0.42	62.3
Approach		1461	17.7	0.506	6.3	LOS A	5.3	43.3	0.27	0.44	62.0
All Vehicles		2962	17.7	1.042	16.9	LOS C	18.9	156.3	0.56	0.80	53.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INDICATION OF LIGHTING SUPPORT

ROUNDABOUT LIGHTING

Georgia Department of Transportation
ATTN: Scott MacLean, Lead Design Engineer
Office of Design Policy & Support, 26th Floor
600 West Peachtree Street, NW
Atlanta, GA 30308

Location

The ***City of Richmond Hill*** supports the consideration of roundabout lighting as part of the project listed below:

Description: ***SR 144 @ I-95 SB & NB off-ramps***

State/County Route Numbers: (see above)

County & P.I. No. ***Bryan County ~ P.I. No. 0010739***

Associated Conditions

The undersigned agrees to participate in the following maintenance of installed roundabout lighting at the above locations:

- The full and entire cost to energize the lighting systems installed and to provide for the operation/maintenance thereof.

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

this 18th day of November, 2014

Attest: _____
City Clerk

By: _____

Title: _____

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

TECHNICAL MEMORANDUM

SR 144 at I-95 Roundabout Peer Review

Feasibility Study and Roundabout Concept Review

Date:	August 31, 2015	Project #: 13518.4
To:	Rudolph Frampton, Heath & Lineback Engineers, Inc.	
From:	Justin Bansen, P.E., Pete Jenior, and Zachary Bugg	

Kittelson & Associates, Inc. (KAI) performed a peer review of the proposed roundabouts at the SR 144/I-95 interchange ramp terminals in the City of Richmond Hill, Georgia. This document summarizes KAI's first review and comments pertaining to the concept-phase information. The following information was provided by Heath & Lineback (H&L) for KAI's review:

- Roundabout Feasibility Study, SR 14 (Ford Avenue) Improvements at I-95. Prepared August 2015 by Kimley Horn and Associates (KHA).
- MicroStation files for horizontal roundabout concept (files dated 8/11/2015).
- Electronic files showing fastest path and design vehicle swept path checks.

Our review has been conducted in general accordance with the guidance provided in NCHRP Report 672, *Roundabouts: An Informational Guide, Second Edition* (Reference 1) and our experience with peer reviews of this type.

FEASIBILITY STUDY REPORT

KAI reviewed the Roundabout Feasibility Study Report and appendices, including traffic analysis, concept layouts, fastest path speeds, and truck turning templates.

Section 2 - Existing Conditions

1. Page 8 - The accident history summarized under Section 2.8 includes data for approximately 0.5 miles of SR 144, including the ramp terminal intersections, and notes some of the safety benefits roundabouts offer. However, the aggregated data makes it difficult to identify the specific locations of crashes and the safety performance of the existing ramp terminal intersections. If GDOT desires predictive safety analysis for implementation of a roundabout (to support benenefit/cost calculations), then the historical safety data would need to be broken down to better reflect the individual intersections.
2. Page 8 – The text cites that the roundabout will reduce both rear-end and angle crashes. It is likely that the roundabout will address angle crash types at the ramp terminal intersections. However, the magnitude of rear-end crash reductions is more difficult to predict and may or may not be reduced depending upon the magnitude or rear-end crashed actually occurring at the ramp terminal intersections. Consider including statistics from NCHRP Report 672 or the CMF Clearinghouse to describe the expected reduction in total and severe crashes when converting from a two-way stop control to multilane roundabout control.

Section 3 - Existing Traffic

3. Figures 4 and 8 show that the I-95 southbound ramp and SR 144 west of the interchange have an a.m. peak hour of 5-6 a.m., and this is outside of the time the turning movement counts were conducted. Please note this unusual peak hour time period in the report text and describe how it was incorporated into the peak hour traffic analysis

Section 5 - Operational Analysis

4. Page 16 – The discussion regarding LOS for roundabouts states: "One or more movements at an intersection may experience a low LOS, while the roundabout as a whole may operate acceptably". Similar to other unsignalized intersections, roundabouts should have lane configurations established to provide acceptable operations on each of the individual approaches. Weighted average delay and LOS for the overall intersection can be useful in providing comparisons against other control types (such as a signal); however, it should not be the sole basis for determining acceptability of the roundabout lane configurations.
5. KAI reviewed the reported operational analysis results in Table 7. KAI attempted to replicate the analysis results using the SIDRA Intersection software. However, we were not able to achieve the same results as summarized in the report or appendix output sheets. Please update Appendix I to include the "Detailed Output" report from SIDRA to document the geometric variables, environmental factor, etc assumed in the analyis.
6. The KHA SIDRA analysis reports for the 2037 PM at the I-95 NB ramps indicate a v/c ratio of 1.04 and LOS F for the NB off-ramp movement. This results in a 19 vehicle queue (approximately 475 feet) on the off-ramp. Consideration should be given in the design to allow for inclusion of a Yield controlled NB right-turn bypass lane (or a two lane entry with the outside lane being a right-turn only lane) as part of the ultimate roundabout configuration.
7. KAI prepared an independent operational analysis to verify the needed lane configurations for roundabouts at both ramp terminal intersections. The analysis utilized the latest US roundabout capacity models developed as part of NCHRP Project TOPR 34. The new TOPR 34 capacity models were adopted in June 2015 by the Transportation Research Board Committee on Highway Capacity and Quality of Service for inclusion in a major update to the Highway Capacity Manual expected to be released in late 2015/early 2016. Results of KAI's analysis are summarized in Table 1.

Table 1 – Design Year 2037 Traffic Operations Analysis (Lane Configurations Reflect Those Included in KHA Feasibility Study and H&L Concepts, except where noted).

Intersection	Approach	Movement	TOPR 34 Capacity Model Results			
			AM Peak Hour		PM Peak Hour	
			Delay	v/c	Delay	v/c
SB Ramp	Eastbound	Left-Through	**148.5**	**1.25**	**178.0**	**1.31**
		Yield RT Bypass	7.4	0.28	4.9	0.12
	Westbound	Left-Through	10.6	0.59	13.3	0.69
	Southbound	Left	13.1	0.42	43.7	0.87
		Left-Through	12.0	0.37	31.7	0.77
		Yield RT Bypass*	13.3	0.52	23.7	0.67
NB Ramp	Eastbound	Left-Through	8.1	0.48	9.7	0.57
		Through-Right	9.2	0.54	11.4	0.64
	Westbound	Left-Through	30.2	0.84	44.5	0.92
		Yield RT Bypass	**50.9**	**0.99**	11.1	0.51
	Northbound	Left-Through-Right	39.4	0.74	**249.8**	**1.45**

*Note: H&L design assumed continuous flow rather than yield control.

Key findings:

- The TOPR 34 capacity model indicates that a single-lane EB entry at the SB Ramp intersection will not be sufficient to serve 2037 AM and PM peak hour volumes. Converting the right-turn bypass lane into a second EB entry lane (shared through-right lane configuration) is expected to result in the EB entry having a v/c ratio of 0.88 or better for both peak hours.
- The TOPR 34 capacity model results in v/c ratios greater than 1 for the NB off-ramp, which further supports the need for an additional right-turn lane on the NB entry at the NB Ramp intersection.
- The Yield Controlled WB right-turn bypass lane at the NB Ramp Intersection is projected to be near-capacity and near the LOS "F" delay threshold in the 2037 AM peak hour. This analysis assumes existing peak hour factors (PHF) of 0.87. As volumes grow, the PHF may also increase. Assuming a slightly higher default PHF of 0.92 would result in a 2037 v/c ratio of 0.92 and a delay of 35.5 seconds.

Section 7.1 Recommendations

8. As outlined in the operational analysis comments, KAI recommends adjustment to the lane configurations on the EB approach at the SB Ramp intersection and at the NB approach to the NB Ramp Intersection. The illustration below reflects the recommended lane configurations and corresponding operational performance summarized in Table 2. Note that the diagram below is *only* intended to reflect lane configurations. No geometric design guidance is intended to be inferred from the lane configuration diagram.

Figure 1 – Alternative Roundabout Lane Configurations

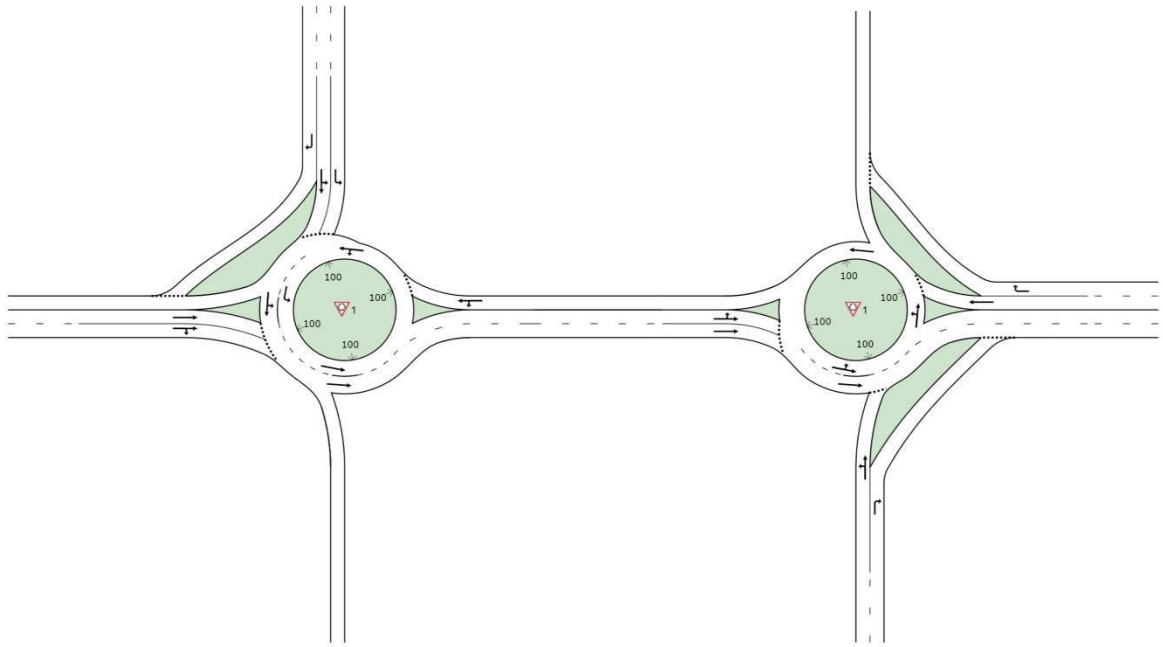


Table 2 – Design Year 2037 Traffic Operations Analysis (Revised Lane Configurations)

Intersection	Approach	Movement	TOPR 34 Capacity Model Results			
			AM Peak Hour		PM Peak Hour	
			Delay	v/c	Delay	v/c
SB Ramp	Eastbound	***Left-Through***	39.0	0.87	43.9	0.84
		Through-Right	37.4	0.88	38.7	0.83
	Westbound	Left-Through	10.6	0.59	13.3	0.69
	Southbound	Left	13.1	0.42	43.7	0.87
		Left-Through	12.0	0.37	31.7	0.77
		Yield RT Bypass	13.3	0.52	23.7	0.67
NB Ramp	Eastbound	Left-Through	8.1	0.48	9.7	0.57
		Through-Right	9.2	0.54	11.4	0.64
	Westbound	Left-Through	30.2	0.84	44.5	0.92
		Yield RT Bypass	**50.9**	**0.99**	11.1	0.51
	Northbound	Left-Through-Right	18.0	0.35	36.9	0.70
		Yield RT Bypass	11.9	0.28	20.0	0.54

Note: Analysis assumes all original volumes, PHF, and Truck % from KHA analysis.

9. Additional discussion should be added to the Feasibility Study Report to identify the intended phasing of the roundabout implementation and the approximate year when the future bypass lanes are expected to be required.

GEOMETRIC REVIEW

Fastest Path Speeds

10. KAI prepared independent fastest path speed checks for the two proposed roundabouts. Fastest paths are provided in the attached mark-ups. KAI found higher fastest path speeds for some movements. The following are the findings related to fastest path speed control:
    a. The fastest paths developed by H&L appear to be developed using compound curves instead of B-Splines. Consider using B-splines to develop the fastest paths when performing checks of the updated design.
    b. Speeds on the EB entry lane and EB right-turn bypass lane at the SB Ramp Intersection both exceed the desired 25 mph threshold for a single-lane entry. In the operational analysis section, the EB approach is recommended for conversion to a two-lane entry, which will change the speed threshold to less than 30 mph (assuming drivers ignore all lane lines). Additional adjustment for improving speed control may need to be undertaken along with modification of the approach lane configurations. Offsetting the approach alignment further to the left of center is one option for achieving improved speed control for the EB entry.
    c. The southbound right-turn movement at the SB Ramp intersection allows fastest path speeds greater than 30 mph. Offsetting the approach alignment on the west leg to the left of center will benefit both the EB entry as well as the SB right-turn to improve speed control for both movements.
    d. At the NB Ramp, the NB right-turn movement will allow a fastest path speed of 28 mph, which exceeds the desired threshold of 25 mph. Adjustment to the approach alignment and/or the EB exit alignment may be options to further improve fastest path speed control for the NB right-turn movement.
    e. At the NB Ramp, the WB entry lane and WB right-turn bypass lane both allow fastest path speeds of 26 mph, which exceeds the desired speed of 25 mph. Slight adjustments to the lane widths and/or radii may be possible to further reduce vehicle speeds. Based upon review of the truck turn paths, a WB-67 appears to have greater than 2 feet of shy distance to each curbline, which suggests that the geometry could be adjusted for reduced speeds without negatively impacting truck accommodations.

Design Vehicle Accomodation

11. KAI reviewed the WB-67 truck turning templates contained in Appendix C of the Roundabout Feasibility Study. Red-line mark-up of the WB-67 truck paths are attached. KAI had the following findings related to truck accommodations:
    a. The H&L design checks indicate that the proposed roundabouts will accommodate WB-67s for all turn movements with at least 1 to 2 feet of buffer to any curbline.
    b. For selected movements, lane widths may be able to be reduced to improve speed control. Attached redline mark-ups provide examples.
    c. At the SB Ramp intersection, the two lane portions of the circulatory roadway are 36 feet (two 18 foot lanes) in order to accommodate a truck turning left adjacent to a passenger vehicle. This is greater than the typical range of circulating width of 28 to 32 feet (14 to 16 foot lanes). The offset-left alignment of the SB approach and geometry of the EB exit are contributing to the additional off-tracking of the WB-67 making the left-turn maneuvers from the outside lane. The wide circulating width could result in higher fastest path speeds for the WB through movement and encourage vehicles to travel adjacent to trucks through the roundabout rather than

staggering their position. Possible options that could be further explored include:

i. Adjust the approach alignments to achieve recommended fastest path speed thresholds even with wider than desirable circulatory roadway.
ii. Adjust the SB Entry and WB exit approach alignment to increase the angle that the truck turns through. This may reduce the width of the truck path when making a left-turn and allow for a narrower circulating width to be utilized.
iii. Signing the SB approach to require trucks to claim both lanes on the SB entry or to use the inside (left) entry lane. This would allow the circulating width to be reduced down to 32 feet or less by expanding the central island diameter, which will further support improved speed control.

12. The feasibility study does not appear to include any discussion of oversize/overweight (OSOW) vehicles. Typically these types of vehicles require permits that could be used to further verify frequency and size of OSOW loads to support inclusion of features such as outside aprons (sometimes called "blisters") to accommodate OSOW vehicle off-tracking. Given the role the interchange serves regionally, additional investigation of OSOW vehicles appears to be appropriate.

SB Ramp Geometric Design Notes

13. The close proximity of Longwood Drive to the SB Ramp roundabout creates an undesirable set of potential conflicts. Between Longwood Drive and the edge of the roundabout circulatory roadway is only approximately 160 feet.
    a. During the design year peak hours, the back of queue for the WB roundabout entry is expected to spill back through the Longwood Drive intersection which could create conflicts for SB left-turning vehicles.
    b. The proposed future SB to WB free-flow right-turn bypass lane would create a short weave section (approximately 80 feet) for vehicles to change lanes from the WB roundabout exit to turn right onto Longwood Drive. Converting the bypass lane to a Yield controlled bypass would remove the short weave section.
    c. The geometry of the proposed future SB to WB free-flow right-turn bypass lane would allow for a relatively high speed on the bypass lane. Vehicles turning to/from Longwood Drive immediately downstream of the bypass curve may be unexpected for vehicles traveling along the bypass lane. The combination of the speed and short distance for perception/reaction could lead to angle or rear-end crashes. Conversion to a yield controlled bypass is expected to help maintain slow vehicle speeds for the SB to WB right-turn.
14. The design of the proposed future SB to WB free-flow right-turn bypass lane does not include a protected pedestrian refuge between the WB roundabout exit and the bypass lane. Given the free-flow nature of both movements, an appropriately designed pedestrian refuge would be required if the proposed free-flow bypass is retained in the design. If the bypass is converted to Yield control, the crossing becomes simplified to a single-lane with no refuge required.
15. The current design of the EB right-turn bypass lane results in an undesirable driver view angle. An angle of approximately 50 degrees is provided, where NCHRP Report 672 identifies a minimum angle of 75 degrees as desirable. As outlined in the operations analysis, removal of the right-turn bypass is recommended in lieu of a two-lane entry on the EB approach. With conversion to a two-lane entry the entry angle should be adjusted to provide appropriate driver view angles.
16. When converting the EB entry to two-lanes, the current design is not expected to provide acceptable fastest path speed control. Consider offsetting the alignment of the west leg to the left of the roundabout center in order to improve deflection.

17. If the SB bypass lane is converted to Yield control, the alignment of the bypass lane will likely require shifting to the west along with an adjustment to the WB exit to use larger exit radii, as illustrated in the attached redlines, to provide appropriate speed control.
18. The SB entry provides a driver view angle of approximately 60 degrees, which is less than the desired 75 degree (or greater) angle. Adjusting the SB entry alignment is recommended to improve the driver view angle from both SB entry lanes.
19. Along the south side of the central island a tangent and relatively small radius are used to develop a spiral around the circulatory roadway. This will create an awkward path for drivers when attempting a u-turn maneuver. Consider smoothing the circulatory roadway travel path as illustrated in the attached redlines.
20. Update the spelling for all "YIELD" legends shown in the design. The drawings are currently misspelled "YEILD".
21. To minimize additional impacts on the north leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the east to improve driver view angles and alignment of the SB to WB right-turn bypass lane with less impact to the west side of the existing I-95 off-ramp.

NB Ramp Geometric Design Notes

22. The EB entry is approximately 45 feet wide as currently designed. This is much wider than the typical range of 24 to 30 feet. It appears that the entry width can be reduced while still providing adequate WB-67 truck accommodation.
23. On the NB approach, add a Yield controlled right-turn bypass lane to the design to preserve necessary space to accommodate the future construction.
24. Adjust the curbline between the NB entry and the EB exit to smooth out the driver path. Drivers are more likely to swing wide to make the right-turn in a smooth arc than to navigate the tight reverse curves. This could result in sideswipe type crashes within the circulatory roadway. A tangent through the EB exit could be used in combination with an adjusted radius on the NB entry to smooth out the path.
25. The proposed WB to NB right-turn bypass lane provides an undesirable driver view angle. One option to improve the view angle is to "flatten" the NB exit geometry such that the yield line for the bypass lane is pulled back from its current position.
26. For the multilane pedestrian crossing on the EB exit, push the crossing back approximately 70 feet from the edge of the circulatory roadway to create a staggered crossing. This configuration allows for addition of supplemental treatment, such as a Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacons, to support crossing by visually impaired pedestrians. The identified crosswalk setback represents space for vehicle queuing plus minimum buffers between a stop bar and the PHB. If not implemented as part of the initial design, this configuration would better support addition of a PHB in the future, if desired by GDOT or required by the final adopted PROWAG requirements.
27. Update the spelling for all "YIELD" legends shown in the design.
28. Use of a tangent through the EB exit is suggested to reduce the potential for exit vehicle path overlap and support addition of a Yield controlled NB right-turn bypass lane.
29. Consider re-aligning the south leg of the roundabout to better align the entry with the receiving lane within the circulatory roadway.
30. To minimize additional impacts on the south leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the west to improve driver view angles and alignment of the WB to NB right-turn bypass lane with less impact to the east side of the existing I-95 off- and on-ramps.

Additional Multimodal Notes:

31. For multilane roundabouts, it is common for bike ramps to be provided to and from an adjacent multiuse path to allow bicycle riders the option of exiting the roadway to navigate around the roundabout rather than ride through as a vehicle. No bike ramps are currently provided. However, the close proximity of driveways and roadways such as Thunderbird Drive and Longwood Drive do provide opportunities for bicyclists to transition to and from the adjacent sidewalk. Please provide further discussion of the intended bicycle accommodation features as part of the roundabout feasibility study.
32. A 5 foot sidewalk is currently proposed around the interchange area. To accommodate pedestrians and bicycles, a path at least 8 feet wide (10 foot desirable) is suggested. However, it is unclear whether a wider path will fit under the Existing I-95 bridge structure.

Construction Staging

33. No information was provided regarding construction staging. Construction staging and maintenance of traffic will be evaluated as part of future review iteration.

SB Ramp Intersection Roundabout Operations Analysis - 2037 AM Peak Hour

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LTR				LTR				LTR				L, LTR		
(Note: This assumes 4 legs.)	Case:	1			Case:	1			Case:	1			Case:	5		
RT bypass configuration		Yield				None				None				Yield		
(Note: This is in addition to the entry lane(s))			Case:	2			Case:	1			Case:	1			Case:	2
Number of conflicting circ lanes		2				1				2			1	1		
Number of conflicting exit lanes for bypass lane (if used)			1												1	
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		0	690	200		215	370	0		0	0	0		390	0	305
% HV	2	2	10	22	2	22	21	2	2	2	2	2	2	20	2	20
PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)		1380				1380				1380			1420	1420		
B (coefficient)		0.00102				0.00102				0.00102			0.00091	0.00091		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	N/A	774	230		N/A	672	N/A		N/A	0	N/A		238	211	351	
Entry lane capacity (veh/h)	N/A	618	832		N/A	1137	N/A		N/A	428	N/A		563	563	681	
x (v/c ratio)	N/A	1.25	0.28		N/A	0.59	N/A		N/A	0.00	N/A		0.42	0.37	0.52	
Lane control delay (s/veh)	N/A	148.5	7.4		N/A	10.6	N/A		N/A	8.4	N/A		13.1	12.0	13.3	
Lane LOS	N/A	F	A		N/A	B	N/A		N/A	A	N/A		B	B	B	
Approach control delay (s/veh)	116.1				10.6				0.0				12.9			
Approach LOS	F				B				N/A				B			
Intersection control delay (s/veh)	54.2															
Intersection LOS	F															
95th percentile queue (veh)	N/A	29.4	1.1		N/A	4.0	N/A		N/A	0.0	N/A		2.1	1.7	3.0	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

SB Ramp Intersection Roundabout Operations Analysis - 2037 PM Peak Hour

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LTR				LTR				LTR				L, LTR		
(Note: This assumes 4 legs.)	Case:	1			Case:	1			Case:	1			Case:	5		
RT bypass configuration		Yield				None				None				Yield		
(Note: This is in addition to the entry lane(s))			Case:	2			Case:	1			Case:	1			Case:	2
Number of conflicting circ lanes		2				1				2			1	1		
Number of conflicting exit lanes for bypass lane (if used)			1												1	
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		0	570	105		115	585	0		0	0	0		730	0	305
% HV	2	2	10	22	2	22	21	2	2	2	2	2	2	20	2	20
PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)		1380				1380				1380			1420	1420		
B (coefficient)		0.00102				0.00102				0.00102			0.00091	0.00091		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	N/A	629	118		N/A	786	N/A		N/A	0	N/A		435	385	343	
Entry lane capacity (veh/h)	N/A	481	964		N/A	1139	N/A		N/A	338	N/A		498	498	511	
x (v/c ratio)	N/A	1.31	0.12		N/A	0.69	N/A		N/A	0.00	N/A		0.87	0.77	0.67	
Lane control delay (s/veh)	N/A	178.0	4.9		N/A	13.3	N/A		N/A	10.7	N/A		43.7	31.7	23.7	
Lane LOS	N/A	F	A		N/A	B	N/A		N/A	B	N/A		E	D	C	
Approach control delay (s/veh)	150.6				13.3				0.0				33.8			
Approach LOS	F				B				N/A				D			
Intersection control delay (s/veh)	60.2															
Intersection LOS	F															
95th percentile queue (veh)	N/A	27.2	0.4		N/A	5.9	N/A		N/A	0.0	N/A		9.4	6.9	5.0	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

SB Ramp Intersection Roundabout Operations Analysis - 2037 AM Peak Hour - Improved

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LT, TR				LTR				LTR				L, LTR		
(Note: This assumes 4 legs.)	Case:	4			Case:	1			Case:	1			Case:	5		
RT bypass configuration		None				None				None				Yield		
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	1			Case:	1			Case:	2
Number of conflicting circ lanes	2	2				1				2			1	1		
Number of conflicting exit lanes for bypass lane (if used)															1	
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		0	690	200		215	370	0		0	0	0		390	0	305
% HV	2	2	10	22	2	22	21	2	2	2	2	2	2	20	2	20
PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)	1420	1380			1420	1380			1420	1380			1420	1420		
B (coefficient)	0.00091	0.00102			0.00091	0.00102			0.00091	0.00102			0.00091	0.00091		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	493	555	N/A		N/A	672	N/A		N/A	0	N/A		238	211	351	
Entry lane capacity (veh/h)	567	633	N/A		N/A	1137	N/A		N/A	428	N/A		563	563	681	
x (v/c ratio)	0.87	0.88	N/A		N/A	0.59	N/A		N/A	0.00	N/A		0.42	0.37	0.52	
Lane control delay (s/veh)	39.0	37.4	N/A		N/A	10.6	N/A		N/A	8.4	N/A		13.1	12.0	13.3	
Lane LOS	E	E	N/A		N/A	B	N/A		N/A	A	N/A		B	B	B	
Approach control delay (s/veh)	38.2				10.6				0.0				12.9			
Approach LOS	E				B				N/A				B			
Intersection control delay (s/veh)	22.8															
Intersection LOS	C															
95th percentile queue (veh)	9.7	10.4	N/A		N/A	4.0	N/A		N/A	0.0	N/A		2.1	1.7	3.0	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

SB Ramp Intersection Roundabout Operations Analysis - 2037 PM Peak Hour - Improved

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LT, TR				LTR				LTR				L, LTR		
(Note: This assumes 4 legs.)	Case:	4			Case:	1			Case:	1			Case:	5		
RT bypass configuration		None				None				None				Yield		
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	1			Case:	1			Case:	2
Number of conflicting circ lanes	2	2				1				2			1	1		
Number of conflicting exit lanes for bypass lane (if used)															1	
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		0	570	105		115	585	0		0	0	0		730	0	305
% HV	2	2	10	22	2	22	21	2	2	2	2	2	2	20	2	20
PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)	1420	1380			1420	1380			1420	1380			1420	1420		
B (coefficient)	0.00091	0.00102			0.00091	0.00102			0.00091	0.00102			0.00091	0.00091		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	363	408	N/A		N/A	786	N/A		N/A	0	N/A		435	385	343	
Entry lane capacity (veh/h)	430	489	N/A		N/A	1139	N/A		N/A	338	N/A		498	498	511	
x (v/c ratio)	0.84	0.83	N/A		N/A	0.69	N/A		N/A	0.00	N/A		0.87	0.77	0.67	
Lane control delay (s/veh)	43.9	38.7	N/A		N/A	13.3	N/A		N/A	10.7	N/A		43.7	31.7	23.7	
Lane LOS	E	E	N/A		N/A	B	N/A		N/A	B	N/A		E	D	C	
Approach control delay (s/veh)	41.1				13.3				0.0				33.8			
Approach LOS	E				B				N/A				D			
Intersection control delay (s/veh)	30.0															
Intersection LOS	D															
95th percentile queue (veh)	8.2	8.3	N/A		N/A	5.9	N/A		N/A	0.0	N/A		9.4	6.9	5.0	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

NB Ramp Intersection Roundabout Operations Analysis - 2037 AM Peak Hour

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LT, TR				LTR				LTR				LTR		
(Note: This assumes 4 legs.)	Case:	4			Case:	1			Case:	1			Case:	1		
RT bypass configuration		None				Yield				None				None		
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	2			Case:	1			Case:	1
Number of conflicting circ lanes	1	1				1				2				1		
Number of conflicting exit lanes for bypass lane (if used)							1									
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		305	775	0		0	480	730		105	0	115		0	0	0
% HV	2	10	20	2	2	2	22	10	2	21	2	21	2	2	2	2
PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)	1420	1420				1380				1380				1380		
B (coefficient)	0.00091	0.00091				0.00102				0.00102				0.00102		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	584	658	N/A		N/A	586	839		N/A	253	N/A		N/A	0	N/A	
Entry lane capacity (veh/h)	1212	1212	N/A		N/A	699	846		N/A	340	N/A		N/A	599	N/A	
x (v/c ratio)	0.48	0.54	N/A		N/A	0.84	0.99		N/A	0.74	N/A		N/A	0.00	N/A	
Lane control delay (s/veh)	8.1	9.2	N/A		N/A	30.2	50.9		N/A	39.4	N/A		N/A	6.0	N/A	
Lane LOS	A	A	N/A		N/A	D	F		N/A	E	N/A		N/A	A	N/A	
Approach control delay (s/veh)	8.7				42.4				39.4				0.0			
Approach LOS	A				E				E				N/A			
Intersection control delay (s/veh)	27.8															
Intersection LOS	D															
95th percentile queue (veh)	2.7	3.4	N/A		N/A	9.4	17.3		N/A	5.7	N/A		N/A	0.0	N/A	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

NB Ramp Intersection Roundabout Operations Analysis - 2037 PM Peak Hour

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LT, TR				LTR				LTR				LTR		
(Note: This assumes 4 legs.)	Case:	4			Case:	1			Case:	1			Case:	1		
RT bypass configuration		None				Yield				None				None		
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	2			Case:	1			Case:	1
Number of conflicting circ lanes	1	1				1				2				1		
Number of conflicting exit lanes for bypass lane (if used)							1									
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		305	995	0		0	500	390		200	0	215		0	0	0
% HV	2	10	20	2	2	2	22	10	21	2	21	2	2	2	2	2
PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)	1420	1420				1380				1380				1380		
B (coefficient)	0.00091	0.00091				0.00102				0.00102				0.00102		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	687	774	N/A		N/A	588	438		N/A	468	N/A		N/A	0	N/A	
Entry lane capacity (veh/h)	1207	1207	N/A		N/A	636	854		N/A	323	N/A		N/A	542	N/A	
x (v/c ratio)	0.57	0.64	N/A		N/A	0.92	0.51		N/A	1.45	N/A		N/A	0.00	N/A	
Lane control delay (s/veh)	9.7	11.4	N/A		N/A	44.5	11.1		N/A	249.8	N/A		N/A	6.6	N/A	
Lane LOS	A	B	N/A		N/A	E	B		N/A	F	N/A		N/A	A	N/A	
Approach control delay (s/veh)	10.6				30.2				249.8				0.0			
Approach LOS	B				D				F				N/A			
Intersection control delay (s/veh)	55.3															
Intersection LOS	F															
95th percentile queue (veh)	3.7	4.9	N/A		N/A	12.1	3.0		N/A	25.1	N/A		N/A	0.0	N/A	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

NB Ramp Intersection Roundabout Operations Analysis - 2037 AM Peak Hour - Improved

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LT, TR				LTR				LTR				LTR		
(Note: This assumes 4 legs.)	Case:	4			Case:	1			Case:	1			Case:	1		
RT bypass configuration		None				Yield				Yield				None		
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	2			Case:	2			Case:	1
Number of conflicting circ lanes	1	1				1				2				1		
Number of conflicting exit lanes for bypass lane (if used)							1				2					
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		305	775	0		0	480	730		105	0	115		0	0	0
% HV	2	10	20	2	2	2	22	10	2	21	2	21	2	2	2	2
PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)	1420	1420				1380				1380				1380		
B (coefficient)	0.00091	0.00091				0.00102				0.00102				0.00102		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	584	658	N/A		N/A	586	839		N/A	121	132		N/A	0	N/A	
Entry lane capacity (veh/h)	1212	1212	N/A		N/A	699	846		N/A	340	473		N/A	599	N/A	
x (v/c ratio)	0.48	0.54	N/A		N/A	0.84	0.99		N/A	0.35	0.28		N/A	0.00	N/A	
Lane control delay (s/veh)	8.1	9.2	N/A		N/A	30.2	50.9		N/A	18.0	11.9		N/A	6.0	N/A	
Lane LOS	A	A	N/A		N/A	D	F		N/A	C	B		N/A	A	N/A	
Approach control delay (s/veh)	8.7				42.4				14.9				0.0			
Approach LOS	A				E				B				N/A			
Intersection control delay (s/veh)	25.7															
Intersection LOS	D															
95th percentile queue (veh)	2.7	3.4	N/A		N/A	9.4	17.3		N/A	1.6	1.1		N/A	0.0	N/A	

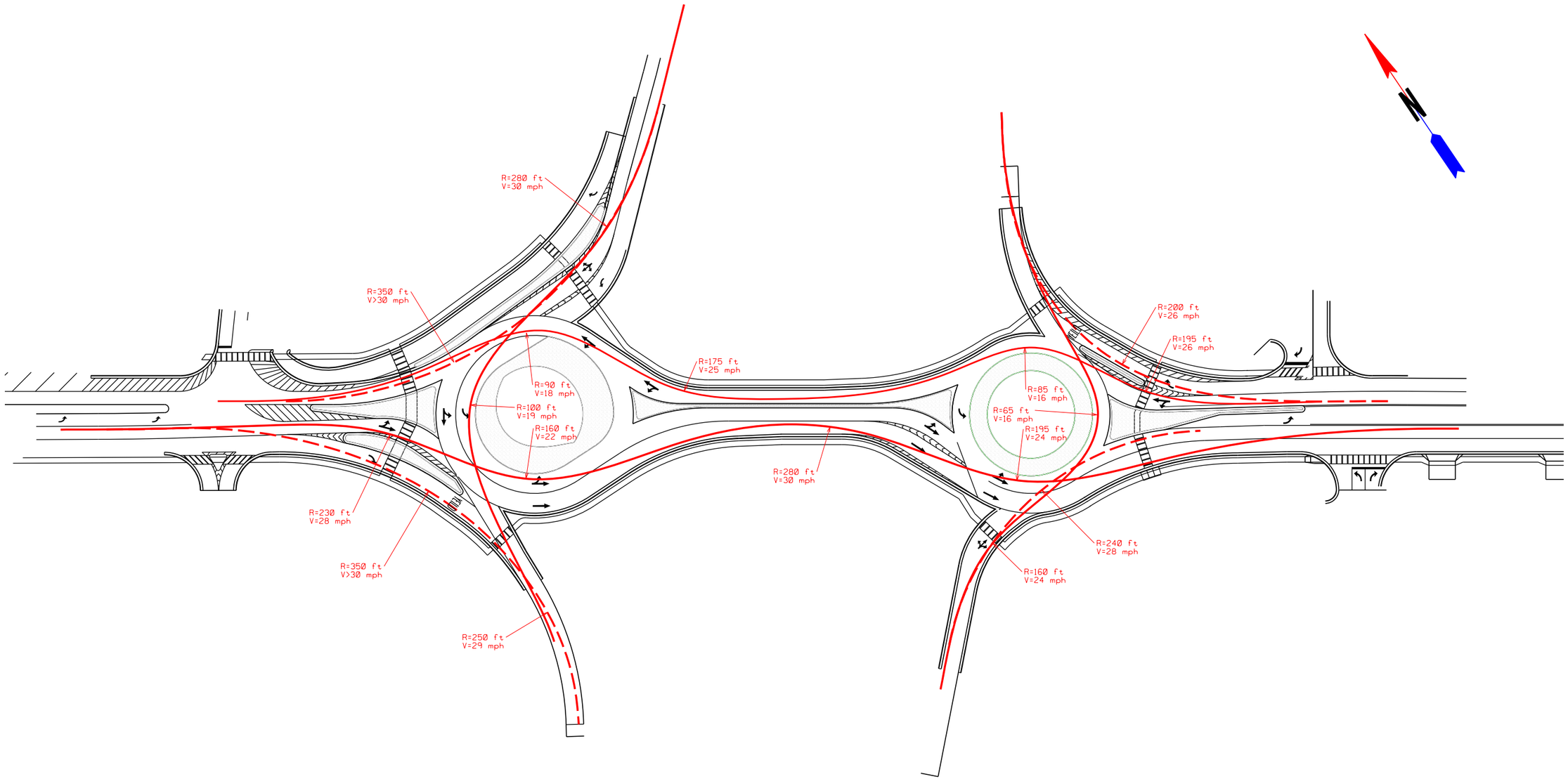
Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

NB Ramp Intersection Roundabout Operations Analysis - 2037 PM Peak Hour - Improved

Parameter	Approach															
	EB (West Leg)				WB (East Leg)				NB (South Leg)				SB (North Leg)			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LT, TR				LTR				LTR				LTR		
(Note: This assumes 4 legs.)	Case:	4			Case:	1			Case:	1			Case:	1		
RT bypass configuration		None				Yield				Yield				None		
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	2			Case:	2			Case:	1
Number of conflicting circ lanes	1	1				1				2				1		
Number of conflicting exit lanes for bypass lane (if used)							1				2					
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		305	995	0		0	500	390		200	0	215		0	0	0
% HV	2	10	20	2	2	2	22	10	21	2	21	2	2	2	2	2
PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
Default Values																
Lane volume assignment																
Case 4: LT, TR (bias to right lane)																
% Volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Case 5: L, LTR (bias to left lane)																
% volume in left lane, right lane	0.53	0.47			0.53	0.47			0.53	0.47			0.53	0.47		
Case 6: LTR, R (bias to right lane)																
% volume in left lane, right lane	0.47	0.53			0.47	0.53			0.47	0.53			0.47	0.53		
Capacity models																
Case 1: 1 confl lane																
Calibration parameters																
A (intercept)	1420	1420				1380				1380				1380		
B (coefficient)	0.00091	0.00091				0.00102				0.00102				0.00102		
Case 2: 2 confl lanes																
Calibration parameters																
A (intercept)	1350	1420			1350	1420			1350	1420			1350	1420		
B (coefficient)	0.00092	0.00085			0.00092	0.00085			0.00092	0.00085			0.00092	0.00085		
RT bypass, 1 confl lane (assumed same as Case 1 above)																
Calibration parameters																
A (intercept)	1380				1380				1380				1380			
B (coefficient)	0.00102				0.00102				0.00102				0.00102			
RT bypass, 2 confl lanes (assumed right lane, Case 2 above)																
Calibration parameters																
A (intercept)	1420				1420				1420				1420			
B (coefficient)	0.00085				0.00085				0.00085				0.00085			
SUMMARY																
Entry lane volume (veh/h)	687	774	N/A		N/A	588	438		N/A	225	242		N/A	0	N/A	
Entry lane capacity (veh/h)	1207	1207	N/A		N/A	636	854		N/A	323	445		N/A	542	N/A	
x (v/c ratio)	0.57	0.64	N/A		N/A	0.92	0.51		N/A	0.70	0.54		N/A	0.00	N/A	
Lane control delay (s/veh)	9.7	11.4	N/A		N/A	44.5	11.1		N/A	36.9	20.0		N/A	6.6	N/A	
Lane LOS	A	B	N/A		N/A	E	B		N/A	E	C		N/A	A	N/A	
Approach control delay (s/veh)	10.6				30.2				28.2				0.0			
Approach LOS	B				D				D				N/A			
Intersection control delay (s/veh)	20.2															
Intersection LOS	C															
95th percentile queue (veh)	3.7	4.9	N/A		N/A	12.1	3.0		N/A	5.0	3.2		N/A	0.0	N/A	

Notes:
*Anaysis results reflect use of draft capacity models developed as part of FHWA Project TOPR 34.

KAI Fastest Vehicle Path Design Checks



SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

SCALE IN FEET:
1" = 40' (11X17 PAPER)

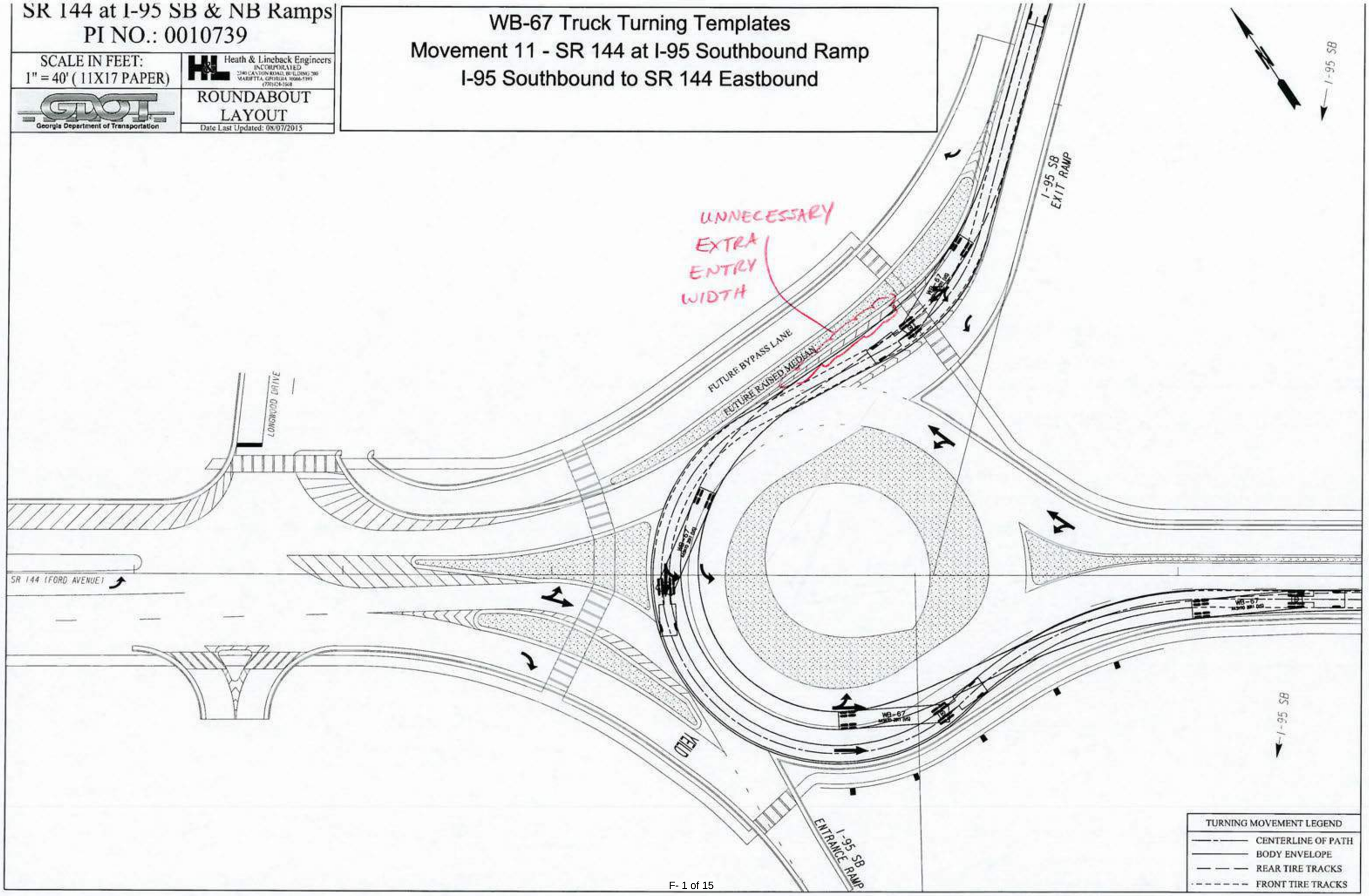
Heath & Lineback Engineers INCORPORATED
2240 CANTON ROAD, BUILDING 500
MARIETTA, GEORGIA 30066-5395
(770)424-3568

Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015

WB-67 Truck Turning Templates
Movement 11 - SR 144 at I-95 Southbound Ramp
I-95 Southbound to SR 144 Eastbound



WB-67 Truck Turning Templates
Movement 9 - SR 144 at I-95 Northbound Ramp
SR 144 Westbound to I-95 Northbound

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

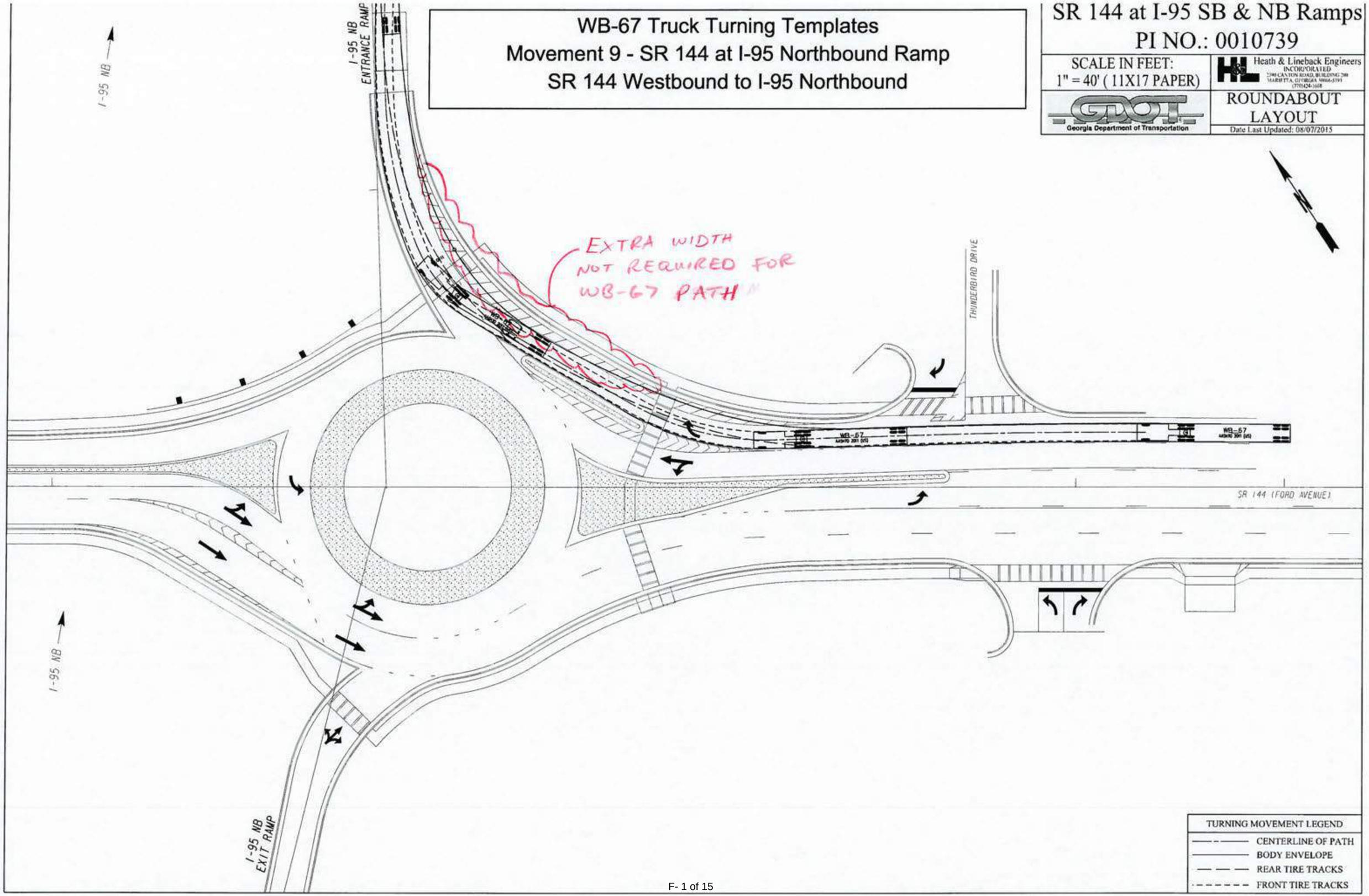
SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers INCORPORATED
2300 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5193
(770)424-1668

Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



WB-67 Truck Turning Templates
Movement 7 - SR 144 at I-95 Northbound Ramp
SR 144 Westbound Through Movement

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

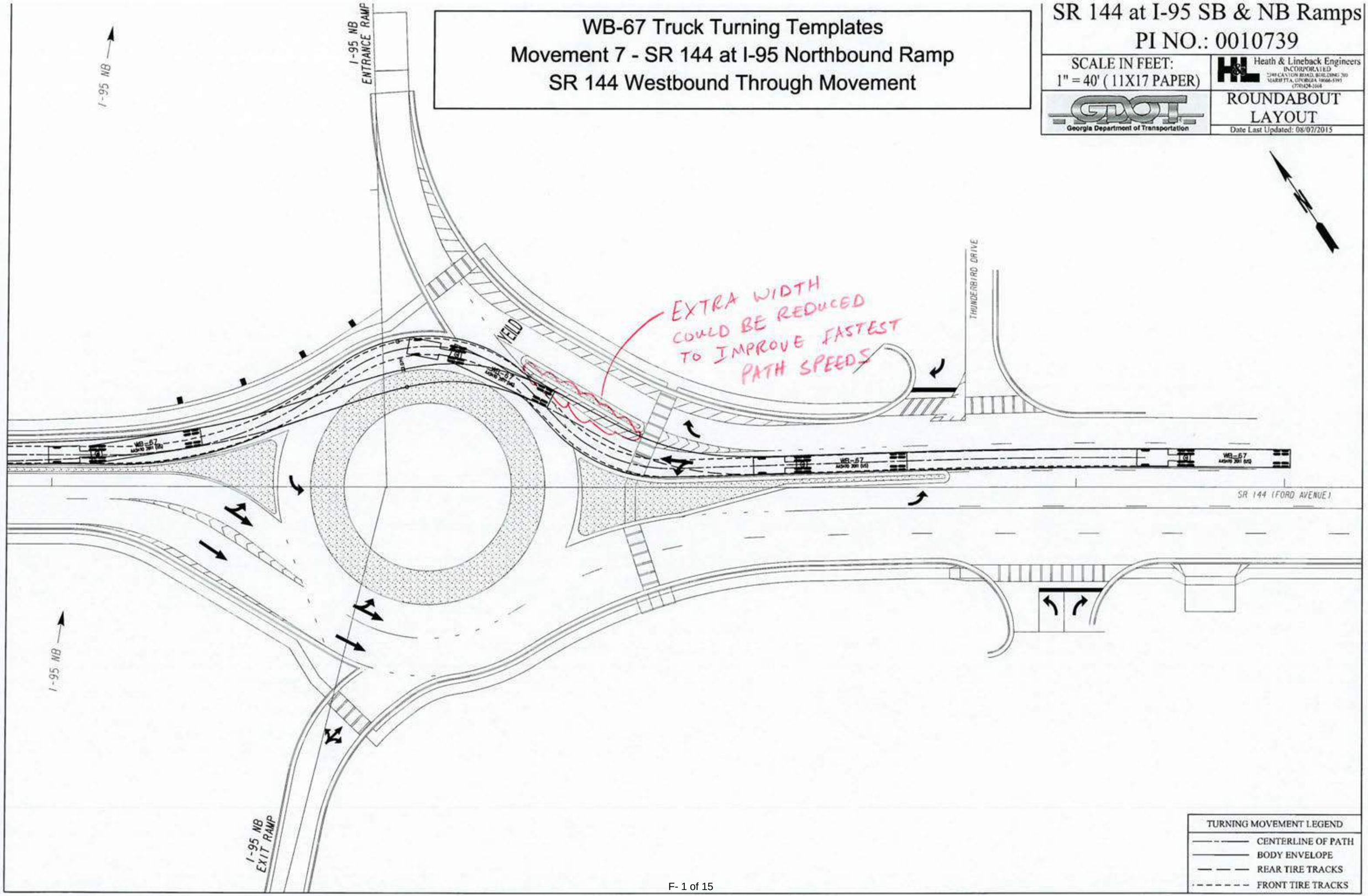
SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
INCORPORATED
2240 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5395
(770)424-1068

Georgia Department of Transportation

ROUNDABOUT LAYOUT

Date Last Updated: 08/07/2015



WB-67 Truck Turning Templates
Movement 2 - SR 144 at I-95 Northbound Ramp
SR 144 Eastbound Through Movement

SR 144 at I-95 SB & NB Ramps
PI NO.: 0010739

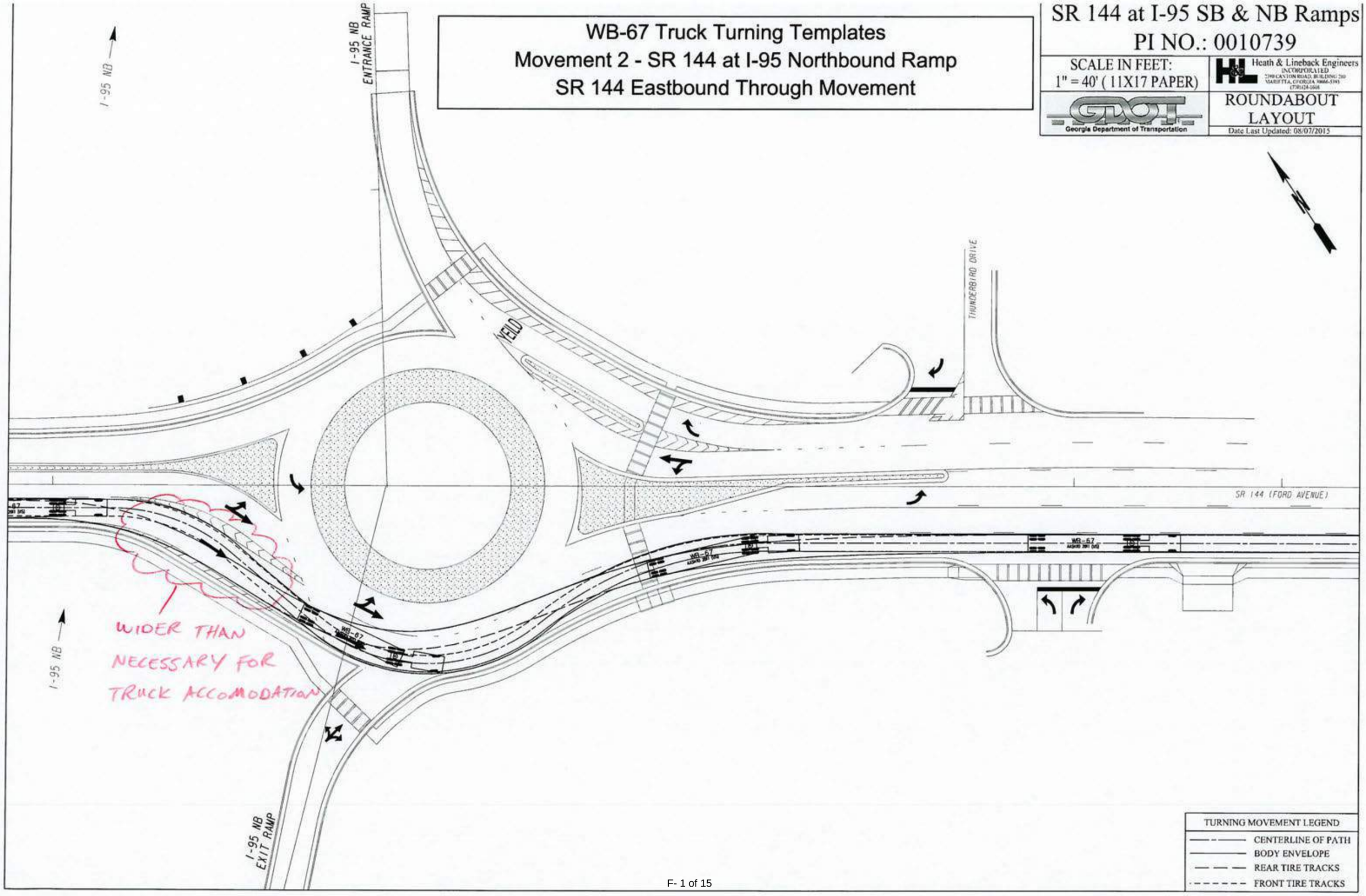
SCALE IN FEET:
1" = 40' (11X17 PAPER)

Heath & Lineback Engineers
INCORPORATED
2300 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1008

Georgia Department of Transportation

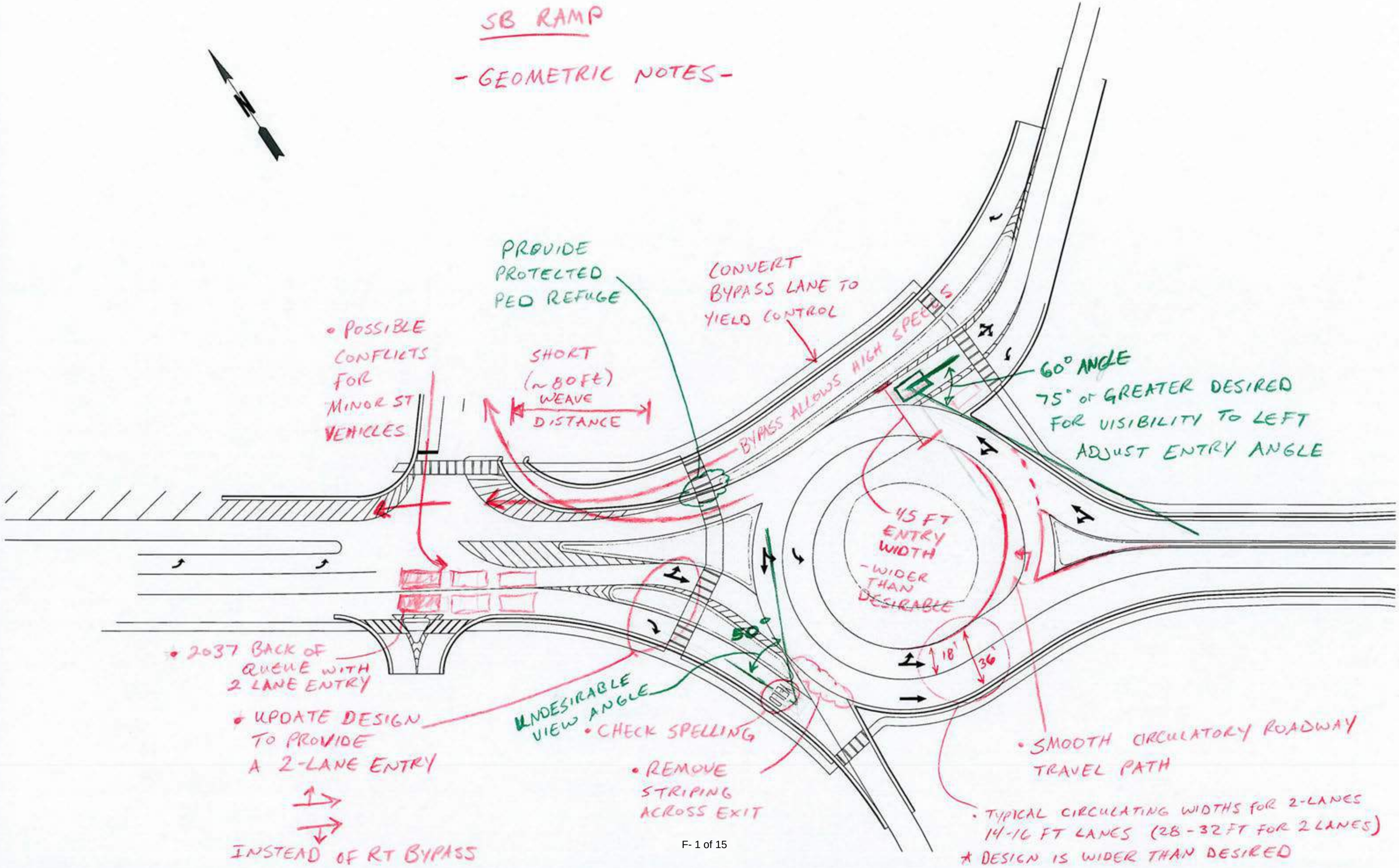
ROUNDABOUT
LAYOUT

Date Last Updated: 08/07/2015



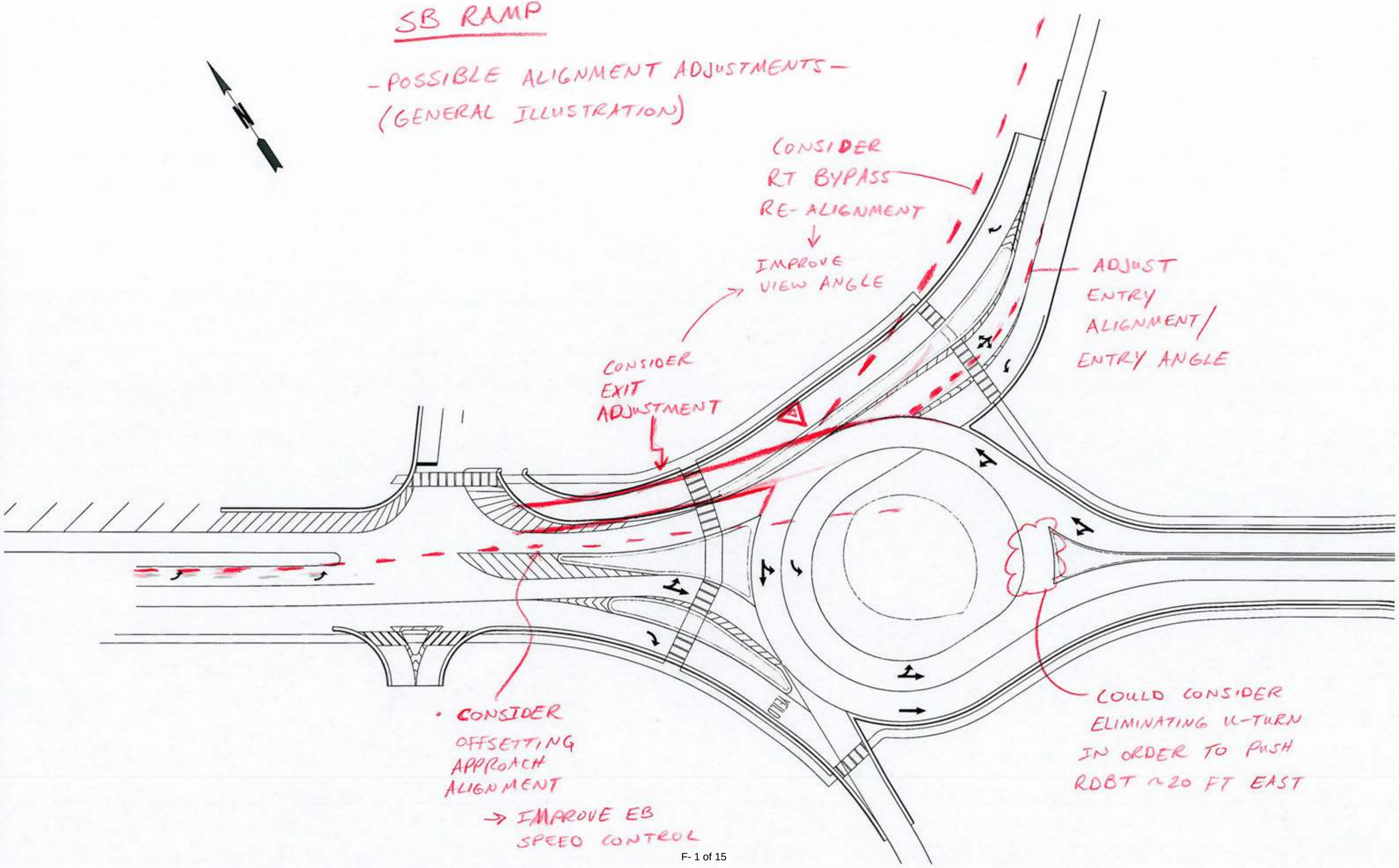
SB RAMP

- GEOMETRIC NOTES -



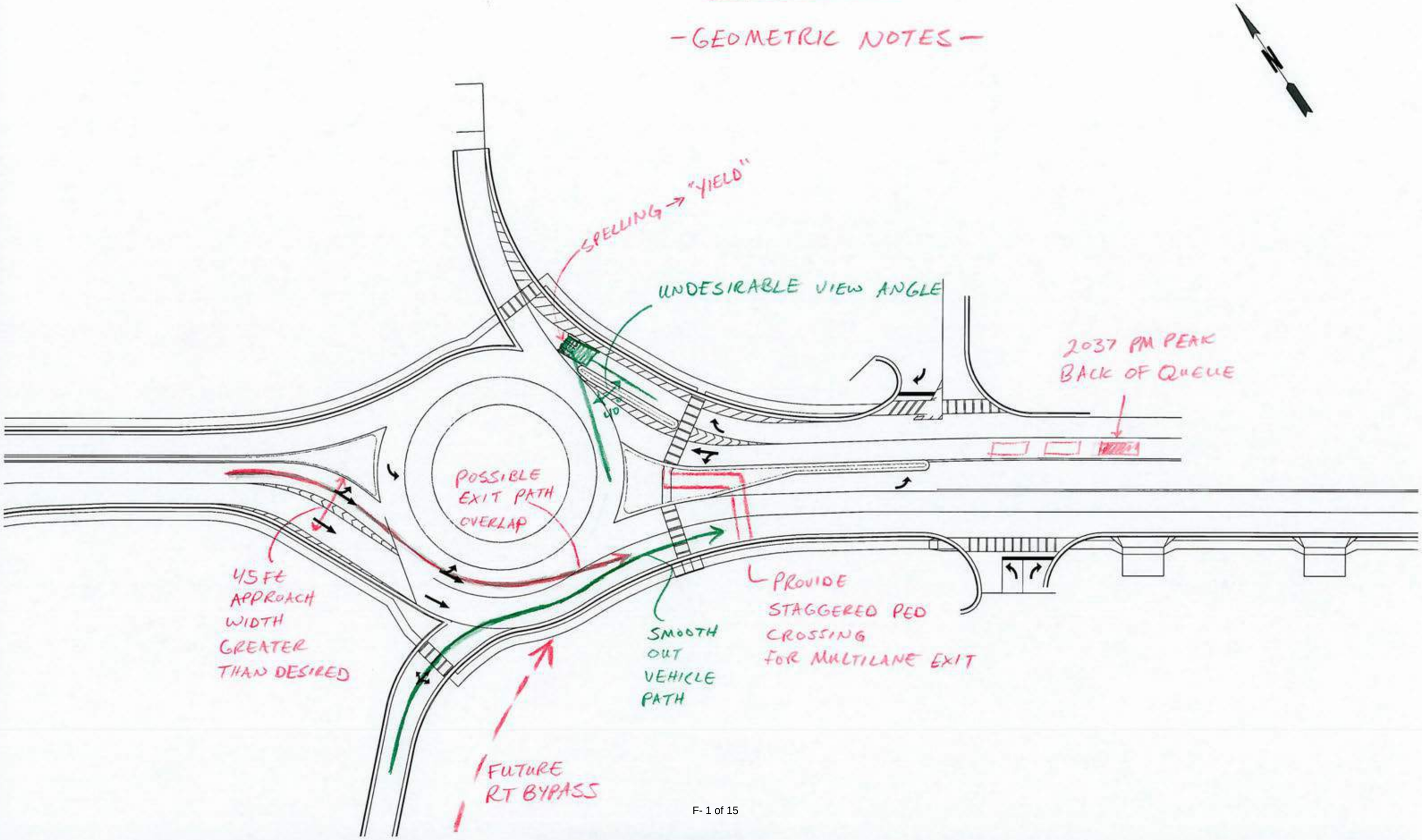
SB RAMP

- POSSIBLE ALIGNMENT ADJUSTMENTS -
(GENERAL ILLUSTRATION)



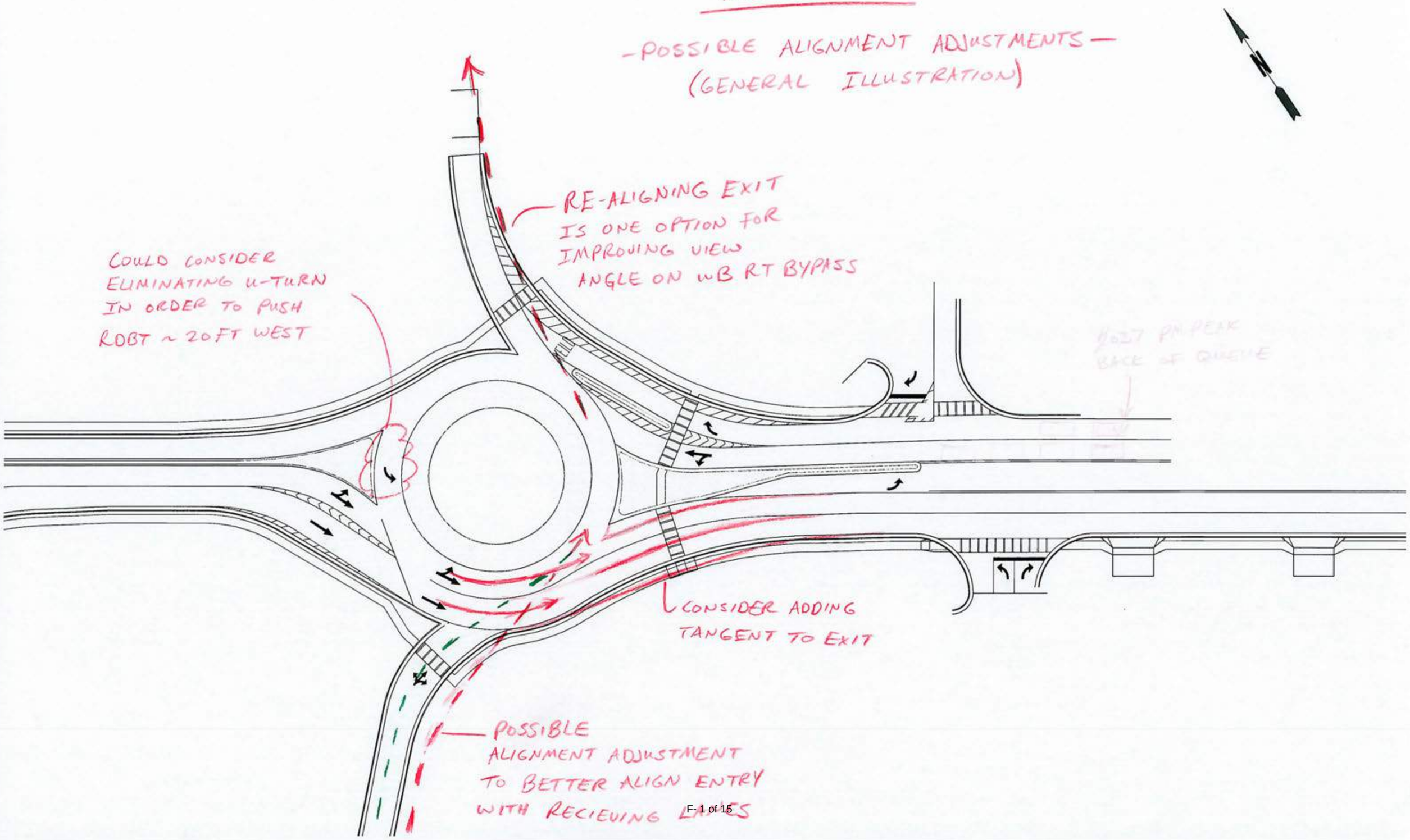
NB RAMP

-GEOMETRIC NOTES-



NB RAMP

-POSSIBLE ALIGNMENT ADJUSTMENTS-
(GENERAL ILLUSTRATION)



Peer Review Responses

Project: TOOPSDDES110124, PI No.: 0010739, Bryan County
SR 144 at I-95 SB & NB Off Ramps

Date: 10-02-2015

H&L Project Number: 2011.006.020

Peer Review Performed by: Justin Bansen (Kittelson & Associates, Inc.)

Peer Review Responses By: Warren Dimsdale (Heath and Lineback Engineers, Inc.)

Section 2 - Existing Conditions

1. Page 8 - The accident history summarized under Section 2.8 includes data for approximately 0.5 miles of SR 144, including the ramp terminal intersections, and notes some of the safety benefits roundabouts offer. However, the aggregated data makes it difficult to identify the specific locations of crashes and the safety performance of the existing ramp terminal intersections. If GDOT desires predictive safety analysis for implementation of a roundabout (to support benenefit/cost calculations), then the historical safety data would need to be broken down to better reflect the individual intersections.
   The quality of the data provided by the GDOT is limited to the quality and level of detail provided by the reporting police officer. For this interchange, location details of the majority of the reported crashes are absent or erroneous.
2. Page 8 – The text cites that the roundabout will reduce both rear-end and angle crashes. It is likely that the roundabout will address angle crash types at the ramp terminal intersections. However, the magnitude of rear-end crash reductions is more difficult to predict and may or may not be reduced depending upon the magnitude or rear-end crashed actually occurring at the ramp terminal intersections. Consider including statistics from NCHRP Report 672 or the CMF Clearinghouse to describe the expected reduction in total and severe crashes when converting from a two-way stop control to multilane roundabout control.
   The report will be modified accordingly.

Section 3 - Existing Traffic

3. Figures 4 and 8 show that the I-95 southbound ramp and SR 144 west of the interchange have an a.m. peak hour of 5-6 a.m., and this is outside of the time the turning movement counts were conducted. Please note this unusual peak hour time period in the report text and describe how it was incorporated into the peak hour traffic analysis
   Additional traffic counts have been made for the 5-6 a.m. turning movement and analysis scenarios based on the "Early AM" peak hour are in progress. The report will be modified accordingly.

Section 5 - Operational Analysis

4. Page 16 – The discussion regarding LOS for roundabouts states: "One or more movements at an intersection may experience a low LOS, while the roundabout as a whole may operate acceptably". Similar to other unsignalized intersections, roundabouts should have lane configurations established to provide acceptable operations on each of the individual approaches. Weighted average delay and LOS for the overall intersection can be useful in providing comparisons against other control types (such as a signal); however, it should not be the sole basis for determining acceptability of the roundabout lane configurations.
   All movements of the roundabout are being analyzed and will be included in the report. The roundabout lane configuration will be modified as needed to address any LOS deficiencies.
5. KAI (Kittelson & Associates Inc.) reviewed the reported operational analysis results in Table 7. KAI attempted to replicate the analysis results using the SIDRA Intersection software. However, we were not able to achieve the same results as summarized in the report or appendix output sheets. Please update Appendix I to include the "Detailed Output" report from SIDRA to document the geometric variables, environmental factor, etc assumed in the analyis.
   The requested data will be included in the appendix of the report.
6. The KHA SIDRA analysis reports for the 2037 PM at the I-95 NB ramps indicate a v/c ratio of 1.04 and LOS F for the NB off-ramp movement. This results in a 19 vehicle queue (approximately 475 feet) on the off-ramp. Consideration should be given in the design to allow for inclusion of a Yield controlled NB right-turn bypass lane (or a two lane entry with the outside lane being a right-turn only lane) as part of the ultimate roundabout configuration.
   The v/c ratio is being reviewed and modified. A bypass lane has been added to the design at the NB off ramp.
7. KAI prepared an independent operational analysis to verify the needed lane configurations for roundabouts at both ramp terminal intersections. The analysis utilized the latest US roundabout capacity models developed as part of NCHRP Project TOPR 34. The new TOPR 34 capacity models were adopted in June 2015 by the Transportation Research Board Committee on Highway Capacity and Quality of Service for inclusion in a major update to the Highway Capacity Manual expected to be released in late 2015/early 2016. Results of KAI's analysis are summarized in Table 1.
   The results have been reviewed and the following changes have been made:
   a. **The SR 144 EB entrance at the SB ramp has been converted to a 2 lane entrance, the Bypass Lane has been removed.**
   b. **The NB off ramp has been modified to have a right turn bypass lane.**

Section 7.1 Recommendations

8. As outlined in the operational analysis comments, KAI recommends adjustment to the lane configurations on the EB approach at the SB Ramp

intersection and at the NB approach to the NB Ramp Intersection. The illustration below reflects the recommended lane configurations and corresponding operational performance summarized in Table 2. Note that the diagram below is *only* intended to reflect lane configurations. No geometric design guidance is intended to be inferred from the lane configuration diagram.
The recommended changes to the EB approach at the SB Ramp intersection and the NB approach to the NB Ramp intersection have been made.

9. Additional discussion should be added to the Feasibility Study Report to identify the intended phasing of the roundabout implementation and the approximate year when the future bypass lanes are expected to be required.
The bypass lane will be constructed with the initial construction of the project. The report will be modified accordingly.
10. KAI prepared independent fastest path speed checks for the two proposed roundabouts. Fastest paths are provided in the attached mark-ups. KAI found higher fastest path speeds for
some movements. The following are the findings related to fastest path speed control:
    a. The fastest paths developed by H&L appear to be developed using compound curves instead of B-Splines. Consider using B-splines to develop the fastest paths when performing checks of the updated design.
    The fastest path speeds were developed using B-Splines.
    b. Speeds on the EB entry lane and EB right-turn bypass lane at the SB Ramp Intersection both exceed the desired 25 mph threshold for a single-lane entry. In the operational analysis section, the EB approach is recommended for conversion to a two-lane entry, which will change the speed threshold to less than 30 mph (assuming drivers ignore all lane lines). Additional adjustment for improving speed control may need to be undertaken along with modification of the approach lane configurations. Offsetting the approach alignment further to the left of center is one option for achieving improved speed control for the EB entry.
    The EB approach at the SB Ramp has been modified to a two lane entry. The fastest path will be calculated and kept below the 30 MPH threshold.
    c. The southbound right-turn movement at the SB Ramp intersection allows fastest path speeds greater than 30 mph. Offsetting the approach alignment on the west leg to the left of center will benefit both the EB entry as well as the SB right-turn to improve speed control for both movements.
    Construction of the SB Exit Ramp By-Pass lane with the project will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold.
    d. At the NB Ramp, the NB right-turn movement will allow a fastest path speed of 28 mph, which exceeds the desired threshold of 25 mph. Adjustment to the approach alignment and/or the EB exit alignment may be options to further improve fastest path speed control for the NB right-turn movement.
    Construction of the NB Exit Ramp By-Pass lane with the project will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold.
    e. At the NB Ramp, the WB entry lane and WB right-turn bypass lane both allow fastest path speeds of 26 mph, which exceeds the desired speed of 25 mph. Slight adjustments to the lane widths and/or radii may be possible to further reduce vehicle speeds. Based upon review of the truck turn paths, a WB-67 appears to have greater than 2 feet of shy distance to each curbline, which suggests that the geometry could be adjusted for reduced speeds without negatively impacting truck accommodations.
    H&L's fastest path calculations show the speed to be below the 25MPH threshold. No change is required.

Design Vehicle Accommodation

11. KAI reviewed the WB-67 truck turning templates contained in Appendix C of the Roundabout Feasibility Study. Red-line mark-up of the WB-67 truck paths are attached. KAI had the following findings related to truck accommodations:
    a. The H&L design checks indicate that the proposed roundabouts will accommodate WB-67s for all turn movements with at least 1 to 2 feet of buffer to any curbline.
    Yes, TMC/GDOT requested that the design allow a car to be next to a WB-67 so that in the event that someone finds themselves in that situation they can safely continue through the roundabout.
    b. For selected movements, lane widths may be able to be reduced to improve speed control. Attached redline mark-ups provide examples.
    Lane widths will be reduced at the noted locations where it is determined that it will not affect the WB-67 movements through the intersection.
    c. At the SB Ramp intersection, the two lane portions of the circulatory roadway are 36 feet (two 18 foot lanes) in order to accommodate a truck turning left adjacent to a passenger vehicle. This is greater than the typical range of circulating width of 28 to 32 feet (14 to 16 foot lanes). The offset-left alignment of the SB approach and geometry of the EB exit are contributing to the additional off-tracking of the WB-67 making the left-turn maneuvers from the outside lane. The wide circulating width could result in higher fastest path speeds for the WB through movement and encourage vehicles to travel adjacent to trucks through the roundabout rather than staggering their position. Possible options that could be further explored include:
        i. Adjust the approach alignments to achieve recommended fastest path speed thresholds even with wider than desirable circulatory roadway.
        Approach alignments have been adjusted to keep the fastest path within the allowable threshold.
        ii. Adjust the SB Entry and WB exit approach alignment to increase the angle that the truck turns through. This may reduce the width of the truck path when making a left-turn and allow for a narrower circulating width to be utilized.
        The long distance the truck travels around the roundabout causes the tracking to push into the adjacent lane. Adjusting the entry angle did not significantly reduce the tracking offset.
        iii. Signing the SB approach to require trucks to claim both lanes on the SB entry or to use the inside (left) entry lane. This would allow the circulating width to be reduced down to 32 feet or less by expanding the central island diameter, which will further support improved speed control.
        TMC/GDOT requested that the design allow a car to be next to a WB-67.
12. The feasibility study does not appear to include any discussion of oversize/overweight (OSOW) vehicles. Typically these types of vehicles require permits that could be used to further verify frequency and size of OSOW loads to support inclusion of features such as outside aprons (sometimes called "blisters") to accommodate OSOW vehicle off-tracking. Given the role the interchange serves regionally, additional investigation of OSOW vehicles appears to be appropriate.
OSOW loads have been accommodated in the design with the use of blisters and truck aprons. The use of OSOW loads through the intersection by Fort Stewart will be addressed in the report.

13. The close proximity of Longwood Drive to the SB Ramp roundabout creates an undesirable set of potential conflicts. Between Longwood Drive and the edge of the roundabout circulatory roadway is only approximately 160 feet.
    a. During the design year peak hours, the back of queue for the WB roundabout entry is expected to spill back through the Longwood Drive intersection which could create conflicts for SB left-turning vehicles.
       The WB entry has been modified to a 2 lane entry, this change will help to alleviate queueing and this conflict.
    b. The proposed future SB to WB free-flow right-turn bypass lane would create a short weave section (approximately 80 feet) for vehicles to change lanes from the WB roundabout exit to turn right onto Longwood Drive. Converting the bypass lane to a Yield controlled bypass would remove the short weave section.
       SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.
    c. The geometry of the proposed future SB to WB free-flow right-turn bypass lane would allow for a relatively high speed on the bypass lane. Vehicles turning to/from Longwood Drive immediately downstream of the bypass curve may be unexpected for vehicles traveling along the bypass lane. The combination of the speed and short distance for perception/reaction could lead to angle or rear-end crashes. Conversion to a yield controlled bypass is expected to help maintain slow vehicle speeds for the SB to WB right-turn.
       SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.
14. The design of the proposed future SB to WB free-flow right-turn bypass lane does not include a protected pedestrian refuge between the WB roundabout exit and the bypass lane. Given the free-flow nature of both movements, an appropriately designed pedestrian refuge would be required if the proposed free-flow bypass is retained in the design. If the bypass is converted to Yield control, the crossing becomes simplified to a single-lane with no refuge required.
    SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.
15. The current design of the EB right-turn bypass lane results in an undesirable driver view angle. An angle of approximately 50 degrees is provided, where NCHRP Report 672 identifies a minimum angle of 75 degrees as desirable. As outlined in the operations analysis, removal of the right-turn bypass is recommended in lieu of a two-lane entry on the EB approach. With conversion to a two-lane entry the entry angle should be adjusted to provide appropriate driver view angles.
    A line of sight of 75 degrees or greater will be designed where possible. However, existing development and constraints limit the placement of the roundabouts and the design of the approaches. In an effort to achieve a balanced design, a minimum of angle of 60 degrees will be used at some approaches. This meets the allowable intersection skew angles defined by AASHTO.
16. When converting the EB entry to two-lanes, the current design is not expected to provide acceptable fastest path speed control. Consider offsetting the alignment of the west leg to the left of the roundabout center in order to improve deflection.
    The approach alignment of the EB approach has been modified to not exceed allowable fastest path speeds.
17. If the SB bypass lane is converted to Yield control, the alignment of the bypass lane will likely require shifting to the west along with an adjustment to the WB exit to use larger exit radii, as illustrated in the attached redlines, to provide appropriate speed control.
    The recommended changes have been made.
18. The SB entry provides a driver view angle of approximately 60 degrees, which is less than the desired 75 degree (or greater) angle. Adjusting the SB entry alignment is recommended to improve the driver view angle from both SB entry lanes.
    The SB approach has been converted to multilane entry as recommended, the bypass lane has been removed.
19. Along the south side of the central island a tangent and relatively small radius are used to develop a spiral around the circulatory roadway. This will create an awkward path for drivers when attempting a u-turn maneuver. Consider smoothing the circulatory roadway travel path as illustrated in the attached redlines.
    A smoother curve will be designed and used at this location.
20. Update the spelling for all "YIELD" legends shown in the design. The drawings are currently misspelled "YEILD".
    The spelling has been corrected.
21. To minimize additional impacts on the north leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the east to improve driver view angles and alignment of the SB to WB right-turn bypass lane with less impact to the west side of the existing I-95 off-ramp.
    This change was considered early in the conceptual layout of the project. It was decided to keep the u-turn movement since full access is not being provided at all side roads.

<u>NB Ramp Geometric Design Notes</u>

22. The EB entry is approximately 45 feet wide as currently designed. This is much wider than the typical range of 24 to 30 feet. It appears that the entry width can be reduced while still providing adequate WB-67 truck accommodation.
    The entry width will be reduced to the minimum width that will allow a WB-67 to approach the roundabout without encroaching into the adjacent lane or outside the pavement limits.
23. On the NB approach, add a Yield controlled right-turn bypass lane to the design to preserve necessary space to accommodate the future construction.
    The recommended change has been made.
24. Adjust the curbline between the NB entry and the EB exit to smooth out the driver path. Drivers are more likely to swing wide to make the right-turn in a smooth arc than to navigate the tight reverse curves. This could result in sideswipe type crashes within the circulatory roadway. A tangent through the EB exit could be used in combination with an adjusted radius on the NB entry to smooth out the path.
    The recommended change has been made.
25. The proposed WB to NB right-turn bypass lane provides an undesirable driver view angle. One option to improve the view angle is to "flatten" the NB exit geometry such that the yield line for the bypass lane is pulled back from its current position.
    The NB Exit was modified as recommended to increase the line of sight angle from the WB slip lane. Existing development and constraints limit the placement of the roundabout and the design of the approaches. In an effort to achieve a balanced design, a minimum angle of 60 degrees is used. This meets the allowable intersection skew angles defined by AASHTO.
26. For the multilane pedestrian crossing on the EB exit, push the crossing back approximately 70 feet from the edge of the circulatory roadway to create a

staggered crossing. This configuration allows for addition of supplemental treatment, such as a Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacons, to support crossing by visually impaired pedestrians. The identified crosswalk setback represents space for vehicle queuing plus minimum buffers between a stop bar and the PHB. If not implemented as part of the initial design, this configuration would better support addition of a PHB in the future, if desired by GDOT or required by the final adopted PROWAG requirements.
The crosswalk was staggered from 20-feet to 40-feet from the edge of the circulatory roadway. An offset of 70-feet was not used because it would reduce the already small storage provided at the EB left turn lane for Thunderbird Drive.

27. Update the spelling for all "YIELD" legends shown in the design.
The spelling has been corrected.
28. Use of a tangent through the EB exit is suggested to reduce the potential for exit vehicle path overlap and support addition of a Yield controlled NB right-turn bypass lane.
The recommended change has been made.
29. Consider re-aligning the south leg of the roundabout to better align the entry with the receiving lane within the circulatory roadway.
The recommended change has been made.
30. To minimize additional impacts on the south leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the west to improve driver view angles and alignment of the WB to NB right-turn bypass lane with less impact to the east side of the existing I-95 off- and on-ramps.
This change was considered early in the conceptual layout of the project. It was decided to keep the u-turn movement since full access is not being provided at all side roads.
31. For multilane roundabouts, it is common for bike ramps to be provided to and from an adjacent multiuse path to allow bicycle riders the option of exiting the roadway to navigate around the roundabout rather than ride through as a vehicle. No bike ramps are currently provided. However, the close proximity of driveways and roadways such as Thunderbird Drive and Longwood Drive do provide opportunities for bicyclists to transition to and from the adjacent sidewalk. Please provide further discussion of the intended bicycle accommodation features as part of the roundabout feasibility study.
This project does not meet bicycle warrants defined by GDOT and is not part of the local MPO planned bicycle routes. The project is located at the end of the rural area of Richmond Hill and the area to the west of the project consist of rural land and a military base. There are no destinations that would lead a bicyclist through the project.
32. A 5 foot sidewalk is currently proposed around the interchange area. To accommodate pedestrians and bicycles, a path at least 8 feet wide (10 foot desirable) is suggested. However, it is unclear whether a wider path will fit under the Existing I-95 bridge structure.
This project does not meet bicycle warrants defined by GDOT and is not part of the local MPO planned bicycle routes. There are no destinations that would lead a bicyclist through the project. Providing 10-feet sidewalks between the bridge bents and the approaches & exits of the roundabouts would require shifting the roundabouts outwards from their current location, causing additional impacts to developments adjacent to the project.

<u>Construction Staging</u>

33. No information was provided regarding construction staging. Construction staging and maintenance of traffic will be evaluated as part of future review iteration.
Construction staging will be provided for future reviews of the project.

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TECHNICAL MEMORANDUM

SR 144 at I-95 Roundabout Feasibility Study

Feasibility Study and Roundabout Concept Review – 2nd Review

Date: November 6, 2015 Project #: 13518.4
To: Rudolph Frampton, Heath & Lineback Engineers, Inc.
From: Justin Bansen, P.E., and Pete Jenior

Kittelson & Associates, Inc. previously peer reviewed concept plans and a feasibility study for roundabouts proposed at the I-95/SR 144 ramp terminal intersections and provided comments on August 31, 2015. Heath & Lineback (H&L) provided updated concept plans and responses to the comments on October 12, 2015. This memo summarizes KAI's re-review of the concept plans and H&L responses to comments.

RESPONSE TO H&L'S COMMENT RESPONSES

KAI's original comments from the August 31 memo appear below in black. H&L's responses from October 2 appear in red. KAI's new responses appear in blue italics.

Section 2 - Existing Conditions

1. Page 8 - The accident history summarized under Section 2.8 includes data for approximately 0.5 miles of SR 144 including the ramp terminal intersections, and notes some of the safety benefits roundabouts offer. However, the aggregated data makes it difficult to identify the specific locations of crash and the safety performance of the existing ramp terminal intersections. If GDOT desires predictive safety analysis for implementation of a roundabout (to support benefit/cost calculations), then the historical safety data would need to be broken down to better reflect the individual intersections.

   H&L Response: The quality of the data provided by the GDOT is limited to the quality and level of detail provided by the reporting police officer. For this interchange, location details of the majority of the reported crashes are absent or erroneous.

   KAI Response: No further comment at this time.

2. Page 8 – The text cites that the roundabout will reduce both rear-end and angle crashes. It is likely that the roundabout will address angle crash types at the ramp terminal intersections. However, the magnitude of rear-end crash reductions is more difficult to predict and may or may not be reduced depending upon the magnitude or rear-end crashed actually occurring at the ramp terminal intersections. Consider including statistics from NCHRP Report 672 or the CMF Clearinghouse to describe the expected reduction in total and severe crashes when converting from a two-way stop control to multilane roundabout control.

   H&L Response: The report will be modified accordingly.

   KAI Response: No further comment at this time.

Section 3 - Existing Traffic

3. Figures 4 and 8 show that the I-95 southbound ramp and SR 144 west of the interchange have an a.m. peak hour of 5-6 a.m., and this is outside of the time the turning movement counts were conducted. Please note this unusual peak hour time period in the report text and describe how it was incorporated into the peak hour traffic analysis

   H&L Response: Additional traffic counts have been made for the 5-6 a.m. turning movement and analysis scenarios based on the "Early AM" peak hour are in progress. The report will be modified accordingly.

   KAI Response: No further comment at this time.

Section 5 - Operational Analysis

4. Page 16 – The discussion regarding LOS for roundabouts states: "One or more movements at an intersection may experience a low LOS, while the roundabout as a whole may operate acceptably". Similar to other unsignalized intersections, roundabouts should have lane configurations established to provide acceptable operations on each of the individual approaches. Weighted average delay and LOS for the overall intersection can be useful in providing comparisons against other control types (such as a signal); however, it should not be the sole basis for determining acceptability of the roundabout lane configurations.

   H&L Response: All movements of the roundabout are being analyzed and will be included in the report. The roundabout lane configuration will be modified as needed to address any LOS deficiencies.

   KAI Response: Consider also updating the text in the report to remove/modify the statement referenced in the original comment.

5. KAI reviewed the reported operational analysis results in Table 7. KAI attempted to replicate the analysis results using the SIDRA Intersection software. However, we were not able to achieve the same results as summarized in the report or appendix output sheets. Please update Appendix I to include the "Detailed Output" report from SIDRA to document the geometric variables, environmental factor, etc. assumed in the analysis.

   H&L Response: The requested data will be included in the appendix of the report.

   KAI Response: No further comment at this time.

6. The KHA SIDRA analysis reports for the 2037 PM at the I-95 NB ramps indicate a v/c ratio of 1.04 and LOS F for the NB off-ramp movement. This results in a 19 vehicle queue (approximately 475 feet) on the off-ramp. Consideration should be given in the design to allow for inclusion of a Yield controlled NB right-turn bypass lane (or a two lane entry with the outside lane being a right-turn only lane) as part of the ultimate roundabout configuration.

   H&L Response: The v/c ratio is being reviewed and modified. A bypass lane has been added to the design at the NB off ramp.

   KAI Response: No further comment.

7. KAI prepared an independent operational analysis to verify the needed lane configurations for roundabouts at both ramp terminal intersections. The analysis utilized the latest US roundabout capacity models developed as part of NCHRP Project TOPR 34. The new TOPR 34

capacity models were adopted in June 2015 by the Transportation Research Board Committee on Highway Capacity and Quality of Service for inclusion in a major update to the Highway Capacity Manual expected to be released in late 2015/early 2016. Results of KAI's analysis are summarized in Table 1.

H&L Response: The results have been reviewed and the following changes have been made: a) The SR 144 EB entrance at the SB ramp has been converted to a 2 lane entrance, the Bypass Lane has been removed and b) The NB off ramp has been modified to have a right turn bypass lane.

KAI Response: No further comment.

Section 7.1 Recommendations

8. As outlined in the operational analysis comments, KAI recommends adjustment to the lane configurations on the EB approach at the SB Ramp intersection and at the NB approach to the NB Ramp Intersection. The illustration below reflects the recommended lane configurations and corresponding operational performance summarized in Table 2. Note that the diagram below is *only* intended to reflect lane configurations. No geometric design guidance is intended to be inferred from the lane configuration diagram.

   H&L Response: The recommended changes to the EB approach at the SB Ramp intersection and the NB approach to the NB Ramp intersection have been made.

   KAI Response: No further comment.

9. Additional discussion should be added to the Feasibility Study Report to identify the intended phasing of the roundabout implementation and the approximate year when the future bypass lanes are expected to be required.

   H&L Response: The bypass lane will be constructed with the initial construction of the project. The report will be modified accordingly.

   KAI Response: Staged construction of roundabouts is often preferable to initially constructing all lanes needed in the design year since fewer lanes results in fewer conflict points and improved safety performance. It is ultimately up to the project team and GDOT; however, consideration could still be given to staging implementation of the SB bypass lane at the SB Ramp Intersection and NB bypass lane at the NB ramp intersection.

Fastest Path Speeds

10. KAI prepared independent fastest path speed checks for the two proposed roundabouts. Fastest paths are provided in the attached mark-ups. KAI found higher fastest path speeds for some movements. The following are the findings related to fastest path speed control:
    a. The fastest paths developed by H&L appear to be developed using compound curves instead of B-Splines. Consider using B-splines to develop the fastest paths when performing checks of the updated design.

       H&L Response: The fastest path speeds were developed using B-Splines.

       KAI Response: No further comment.

    b. Speeds on the EB entry lane and EB right-turn bypass lane at the SB Ramp Intersection both exceed the desired 25 mph threshold for a single-lane entry. In the operational analysis section, the EB approach is recommended for conversion to a

two-lane entry, which will change the speed threshold to less than 30 mph (assuming drivers ignore all lane lines). Additional adjustment for improving speed control may need to be undertaken along with modification of the approach lane configurations. Offsetting the approach alignment further to the left of center is one option for achieving improved speed control for the EB entry.

H&L Response: The EB approach at the SB Ramp has been modified to a two lane entry. The fastest path will be calculated and kept below the 30 MPH threshold.

KAI Response: Some of the fastest paths drawn by H&L do not represent smooth curves that are likely to be followed by a driver. For the EB through path at the SB Ramp, the inflection point along the path that is dictating the start of the R1 curve is too close to the entry. This is resulting in an artificially small radius near the beginning of the path. KAI prepared an independent set of fastest paths and also found a 30 mph speed for the EB entry. In this case, we achieved the same speed estimate with different paths since H&L did not measure their path at the location with the tightest radius. We suggest that the H&L fastest paths be updated for documentation purposes, but no additional action is necessary related to this comment.

c. The southbound right-turn movement at the SB Ramp intersection allows fastest path speeds greater than 30 mph. Offsetting the approach alignment on the west leg to the left of center will benefit both the EB entry as well as the SB right-turn to improve speed control for both movements.

H&L Response: Construction of the SB Exit Ramp By-Pass lane with the project will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold.

KAI Response: The H&L fastest path checks do not show the speed of the right-turn bypass lane. This should be added for documentation purposes. Based upon independent checks by KAI, the SB to WB right-turn bypass speed is 27 mph, which exceeds the desired 25 mph threshold. The fastest path speed of the R5 right turn movement from the other southbound entry lanes (labeled as R2 in H&L's fastest path drawing) is 31 MPH.

d. At the NB Ramp, the NB right-turn movement will allow a fastest path speed of 28 mph, which exceeds the desired threshold of 25 mph. Adjustment to the approach alignment and/or the EB exit alignment may be options to further improve fastest path speed control for the NB right-turn movement.

H&L Response: Construction of the NB Exit Ramp By-Pass lane with the project will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold.

KAI Response: If the NB right-turn bypass is not included as part of the original construction, then the NB right-turn movement would still be served by the NB entry. The fastest path curve for the northbound right-turn movement using the bypass lane does not appear in H&L's fastest path speed drawings. KAI independently drew this curve and found the northbound right-turn speed to be 30 MPH (see attachments).

e. At the NB Ramp, the WB entry lane and WB right-turn bypass lane both allow fastest path speeds of 26 mph, which exceeds the desired speed of 25 mph. Slight adjustments to the lane widths and/or radii may be possible to further reduce vehicle speeds. Based upon review of the truck turn paths, a WB-67 appears to have greater

than 2 feet of shy distance to each curbline, which suggests that the geometry could be adjusted for speeds without negatively impacting truck accommodations.

H&L Response: H&L's fastest path calculations show the speed to be below the 25MPH threshold. No change is required.

KAI Response: It appears that an adjustment was made that reduces the speed to within the 25 mph desired entry speed. No further comment regarding the speed control. However, the desired 1 to 2 feet of buffer distance is no longer provided between the design vehicle and the splitter island curb. Adjustments to address the truck accommodation should be verified that they do not adversely impact the speed control.

Design Vehicle Accommodation

11. KAI reviewed the WB-67 truck turning templates contained in Appendix C of the Roundabout Feasibility Study. Red-line mark-up of the WB-67 truck paths are attached. KAI had the following findings related to truck accommodations:
    a. The H&L design checks indicate that the proposed roundabouts will accommodate WB-67s for all turn movements with at least 1 to 2 feet of buffer to any curbline.

       H&L Response: Yes, TMC/GDOT requested that the design allow a car to be next to a WB-67 so that in the event that someone finds themselves in that situation they can safely continue through the roundabout.

       KAI Response: The turning templates currently show WB-67s side-by-side. KAI recommends the templates be revised to show a passenger car beside WB-67s, and this may indicate that lane widths can be reduced in some areas. The two lane portions of the circulatory roadway are currently 36 feet wide, which is greater than the typical range.

    b. For selected movements, lane widths may be able to be reduced to improve speed control. Attached redline mark-ups provide examples.

       H&L Response: Lane widths will be reduced at the noted locations where it is determined that it will not affect the WB-67 movements through the intersection.

       KAI Response: No further comment.

    c. At the SB Ramp intersection, the two lane portions of the circulatory roadway are 36 feet (two 18 foot lanes) in order to accommodate a truck turning left adjacent to a passenger vehicle. This is greater than the typical range of circulating width of 28 to 32 feet (14 to 16 foot lanes). The offset-left alignment of the SB approach and relatively small ICD for the roundabout is likely contributing to the additional off-tracking of the WB-67 making the left-turn maneuvers from the outside lane. The wide circulating width could result in higher fastest path speeds for the WB through movement and encourage vehicles to travel adjacent to trucks through the roundabout rather than staggering their position. Possible options that could be further explored include:
       i. Adjust the approach alignments to achieve recommended fastest path speed thresholds even with wider than desirable circulatory roadway.

          H&L Response: Approach alignments have been adjusted to keep the fastest path within the allowable threshold.

ii. Adjust the SB Entry and WB exit approach alignment to increase the angle that the truck turns through. This may reduce the width of the truck path when making a left-turn and allow for a narrow circulating width to be utilized.

H&L Response: The long distance the truck travels around the roundabout causes the tracking to push into the adjacent lane. Adjusting the entry angle did not significantly reduce the tracking offset.

iii. Signing the approach to require trucks to claim both lanes on the SB entry or to use the inside (left) entry lane. This would allow the circulating width to be reduced down to at least 32 feet by expanding the central island diameter, which will further support improved speed control.

H&L Response: TMC/GDOT requested that the design allow a car to be next to a WB-67.

KAI Response for all parts of Comment 11C: KAI recommends the design vehicle figures be revised to show a passenger car beside a WB-67s instead of two WB-67s side-by-side. As described in the original comment, it is desirable to reduce the circulating width, if possible in the southern and western portions of the circulatory roadway.

12. The feasibility study does not appear to include any discussion of oversize/overweight (OSOW) vehicles. Typically these types of vehicles require permits that could be used to further verify frequency and size of oversize loads to support inclusion of features such as outside aprons (sometimes called "blisters") to accommodate oversize vehicle off-tracking. Given the role the interchange serves regionally, additional investigation of OSOW vehicles appears to be appropriate.

H&L Response: OSOW loads have been accommodated in the design with the use of blisters and truck aprons. The use of OSOW loads through the intersection by Fort Stewart will be addressed in the report.

KAI Response: It appears that the OSOW vehicles shown in the truck checks are not fully accommodated for some movements. See additional "new" comments at the end of this memo for additional information. No further response to this comment is required. KAI will re-review the report once it has been updated.

SB Ramp Geometric Design Notes

13. The close proximity of Longwood Drive to the SB Ramp roundabout creates an undesirable set of potential conflicts. Between Longwood Drive and the edge of the roundabout circulatory roadway is only approximately 160 feet.
    a. During the design year peak hours, the back of queue for the WB roundabout entry is expected to spill back through the Longwood Drive intersection which could create conflicts for SB left-turning vehicles.

H&L Response: The WB entry has been modified to a 2 lane entry, this change will help to alleviate queueing and this conflict.

KAI Response: KAI's traffic analysis indicates WB queue with a two-lane entry will have a 95th percentile queue of 8 vehicles (PM Peak) to 10 vehicles (AM Peak), which will still occasionally spill back to Longwood Drive. However, this is shorter than the queues

associated with the previous lane configuration and average queues are expected to be adequately stored between the roundabout and Longwood Drive. No further response is required.

b. The proposed future SB to WB free-flow right-turn bypass lane would create a short weave section (approximately 80 feet) for vehicles to change lanes from the WB roundabout exit to turn right onto Longwood Drive. Converting the bypass lane to a Yield controlled bypass would remove the short weave section.

H&L Response: SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.

KAI Response: No further comment.

c. The geometry of the proposed future SB to WB free-flow right-turn bypass lane would allow for a relatively high speed on the bypass lane. Vehicles turning to/from Longwood Drive immediately downstream of the bypass curve may be unexpected for vehicles traveling along the bypass lane. The combination of the speed and short distance for perception/reaction could lead to angle or rear-end crashes. Conversion to a yield controlled bypass is expected to help maintain slow vehicle speeds for the SB to WB right-turn.

H&L Response: SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.

KAI Response: No further comment.

14. The design of the proposed future SB to WB free-flow right-turn bypass lane does not include a protected pedestrian refuge between the WB roundabout exit and the bypass lane. Given the free-flow nature of both movements, an appropriately designed pedestrian refuge would be required if the proposed free-flow bypass is retained in the design. If the bypass is converted to Yield control, the crossing becomes simplified to a single-lane with no refuge required.

H&L Response: SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.

KAI Response: No further comment.

15. The current design of the EB right-turn bypass lane results in an undesirable driver view angle. An angle of approximately 50 degrees is provided, where NCHRP Report 672 identifies a minimum angle of 75 degrees as desirable. As outlined in the operations analysis, removal of the right-turn bypass is recommended in lieu of a two-lane entry on the EB approach. With conversion to a two-lane entry the entry angle should be adjusted to provide appropriate driver view angles.

H&L Response: A line of sight of 75 degrees or greater will be designed where possible. However, existing development and constraints limit the placement of the roundabouts and the design of the approaches. In an effort to achieve a balanced design, a minimum of angle of 60 degrees will be used at some approaches. This meets the allowable intersection skew angles defined by AASHTO.

KAI Response: Where possible, it is desirable to strive to achieve the 75 degree (or greater) view angle.

16. When converting the EB entry to two-lanes, the current design is not expected to provide acceptable fastest path speed control. Consider offsetting the alignment of the west leg to the left of the roundabout center in order to improve deflection.

    H&L Response: The approach alignment of the EB approach has been modified to not exceed allowable fastest path speeds.

    KAI Response: KAI's independent checks identified a 30 mph speed for the EB R1. This meets the guidance in NCHRP report 672. No further comment.

17. If the SB bypass lane is converted to Yield control, the alignment of the bypass lane will likely require shifting to the west along with an adjustment to the WB exit to use larger exit radii, as illustrated in the attached redlines, to provide appropriate speed control.

    H&L Response: The recommended changes have been made.

    KAI Response: No further comment.

18. The SB entry provides a driver view angle of approximately 60 degrees, which is less than the desired 75 degree (or greater) angle. Adjusting the SB entry alignment is recommended to improve the driver view angle from both SB entry lanes.

    H&L Response: The SB approach has been converted to multilane entry as recommended, the bypass lane has been removed.

    KAI Response: The SB approach was previously a multilane entry, and the view angle appears to be approximately the same despite minor adjustment to the approach geometry. The heavy offset left of the SB approach is also creating the need for a longer tangent at the entry and additional width for truck offtracking. Adjustment to the SB approach alignment or shape of the western roundabout (more of an oval shape) would be two possible options for further improving the view angles if it they can be accommodated within the project constraints.

19. Along the south side of the central island a tangent and relatively small radius are used to develop a spiral around the circulatory roadway. This will create an awkward path for drivers when attempting a u-turn maneuver. Consider smoothing the circulatory roadway travel path as illustrated in the attached redlines.

    H&L Response: A smoother curve will be designed and used at this location.

    KAI Response: The updated plans do not appear to have incorporated the suggested edit. Consider adjusting the shape of the central island to provide a smoother u-turn per the original comment.

20. Update the spelling for all "YIELD" legends shown in the design. The drawings are currently misspelled "YEILD".

    H&L Response: The spelling has been corrected.

    KAI Response: No further comment.

21. To minimize additional impacts on the north leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the east to improve driver view angles and alignment of the SB to WB right-turn bypass lane with less impact to the west side of the existing I-95 off-ramp.

    H&L Response: This change was considered early in the conceptual layout of the project. It was decided to keep the u-turn movement since full access is not being provided at all side roads.

KAI Response: No further comment.

NB Ramp Geometric Design Notes

22. The EB entry is approximately 45 feet wide as currently designed. This is much wider than the typical range of 24 to 30 feet. It appears that the entry width can be reduced while still providing adequate WB-67 truck accommodation.

    H&L Response: The entry width will be reduced to the minimum width that will allow a WB-67 to approach the roundabout without encroaching into the adjacent lane or outside the pavement limits.

    KAI Response: The revised design still incorporates a 40 foot entry width. WB-67 vehicles are commonly accommodated with a narrower width closer to the typical range. OSOW vehicles may need additional aprons. The truck checks show the WB-67 in the outside lane to not use any of the striped vein island separating the two entry lanes. Commonly the vein island separating the two lanes is utilized by trucks in both lanes to minimize the overall entry width. It appears that the EB entry width could be reduced by at least 6 feet to better match the width of the circulatory roadway.

23. On the NB approach, add a Yield controlled right-turn bypass lane to the design to preserve necessary space to accommodate the future construction.

    H&L Response: The recommended change has been made.

    KAI Response: No further comment.

24. Adjust the curbline between the NB entry and the EB exit to smooth out the driver path. Drivers are more likely to swing wide to make the right-turn in a smooth arc than to navigate the tight reverse curves. This could result in sideswipe type crashes within the circulatory roadway. A tangent through the EB exit could be used in combination with an adjusted radius on the NB entry to smooth out the path.

    H&L Response: The recommended change has been made.

    KAI Response: There continues to be a hard angle point where the curbline on the right side of the NB entry meets the circulatory roadway. This could be rounded off to make a smoother transition.

25. The proposed WB to NB right-turn bypass lane provides an undesirable driver view angle. One option to improve the view angle is to "flatten" the NB exit geometry such that they yield line for the bypass lane is pulled back from its current position.

    H&L Response: The NB Exit was modified as recommended to increase the line of sight angle from the WB slip lane. Existing development and constraints limit the placement of the roundabout and the design of the approaches. In an effort to achieve a balanced design, a minimum angle of 60 degrees is used. This meets the allowable intersection skew angles defined by AASHTO.

    KAI Response: It appears that a minor adjustment to the right-turn alignment is possible (without increasing the roundabout footprint) that would bring the driver view angle closer to 70 degrees. While achieving at least a 75 degree view angle is desirable, the alignment should be adjusted to the extent possible within the project constraints.

26. For the multilane pedestrian crossing on the EB exit, push the crossing back approximately 70 feet from the edge of the circulatory roadway to create a staggered crossing. This configuration allows for addition of supplemental treatment, such as a Pedestrian Hybrid

Beacon (PHB) or Rectangular Rapid Flashing Beacons, to support crossing by visually impaired pedestrians. The identified crosswalk setback represents space for vehicle queuing plus minimum buffers between a stop bar and the PHB. If not implemented as part of the initial design, this configuration would better support addition of a PHB in the future, if desired or required by the final adopted PROWAG requirements.

H&L Response: The crosswalk was staggered from 20-feet to 40-feet from the edge of the circulatory roadway. An offset of 70-feet was not used because it would reduce the already small storage provided at the EB left turn lane for Thunderbird Drive.

KAI Response: The position of the crosswalk may impact the types of supplemental pedestrian crossing devices that may be able to be utilized for the multilane exit. However, no further response is required.

27. Update the spelling for all "YIELD" legends shown in the design.

    H&L Response: The spelling has been corrected.

    KAI Response: No further comment.

28. Use of a tangent through the EB exit is suggested to reduce the potential for exit vehicle path overlap and support addition of a Yield controlled NB right-turn bypass lane.

    H&L Response: The recommended change has been made.

    KAI Response: No further comment.

29. Consider re-aligning the south leg of the roundabout to better align the entry with the receiving lane within the circulatory roadway.

    H&L Response: The recommended change has been made.

    KAI Response: The south leg entry remains offset to the left more than required to achieve the necessary speed control. In addition, the heavy offset-left alignment is making it more difficult for WB-67 and other oversize vehicle accommodation that is resulting in the need for a wide entry. The fastest path speed for this entry is 23 MPH, so there is an opportunity to shift the entry to the right of its current position and maintain an acceptable entry speed. See Figure 4.

30. To minimize additional impacts on the south leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the west to improve driver view angles and alignment of the WB to NB right-turn bypass lane with less impact to the east side of the existing I-95 off- and on-ramps.

    H&L Response: This change was considered early in the conceptual layout of the project. It was decided to keep the u-turn movement since full access is not being provided at all side roads.

    KAI Response: No further comment.

Additional Multimodal Notes:

31. For multilane roundabouts, it is common for bike ramps to be provided to and from an adjacent multiuse path to allow bicycle riders the option of exiting the roadway to navigate around the roundabout rather than ride through as a vehicle. No bike ramps are currently provided. However, the close proximity of driveways and roadways such as Thunderbird Drive and Longwood Drive do provide opportunities for bicyclists to transition to and from

the adjacent sidewalk. Please provide further discussion of the intended bicycle accommodation features as part of the roundabout feasibility study.

H&L Response: This project does not meet bicycle warrants defined by GDOT and is not part of the local MPO planned bicycle routes. The project is located at the end of the rural area of Richmond Hill and the area to the west of the project consists of rural land and a military base. There are no destinations that would lead a bicyclist through the project.

KAI Response: If no bicycle facilities are provided upstream/downstream of the roundabouts along SR 144 then bike ramps would not be required. However, the H&L team should coordinate with GDOT staff to verify the teams approach to omit bike amenities form the multilane roundabout design.

32. A 5 foot sidewalk is currently proposed around the interchange area. To accommodate pedestrians and bicycles, a path at least 8 feet wide (10 foot desirable) is suggested. However, it is unclear whether a wider path will fit under the Existing I-95 bridge structure.

    H&L Response: This project does not meet bicycle warrants defined by GDOT and is not part of the local MPO planned bicycle routes. There are no destinations that would lead a bicyclist through the project. Providing 10-feet sidewalks between the bridge bents and the approaches & exits of the roundabouts would require shifting the roundabouts outwards from their current location, causing additional impacts to developments adjacent to the project.

    KAI Response: If no bike ramps are provided onto the sidewalk and bikes are not anticipated to be using the sidewalk, then a standard width sidewalk can be utilized in lieu of a multiuse path. However, the H&L team should coordinate with GDOT staff to verify this approach.

Construction Staging

33. No information was provided regarding construction staging. Construction staging and maintenance of traffic will be evaluated as part of future review iteration.

    H&L Response: Construction staging will be provided for future reviews of the project.

    KAI Response: No further comment at this time.

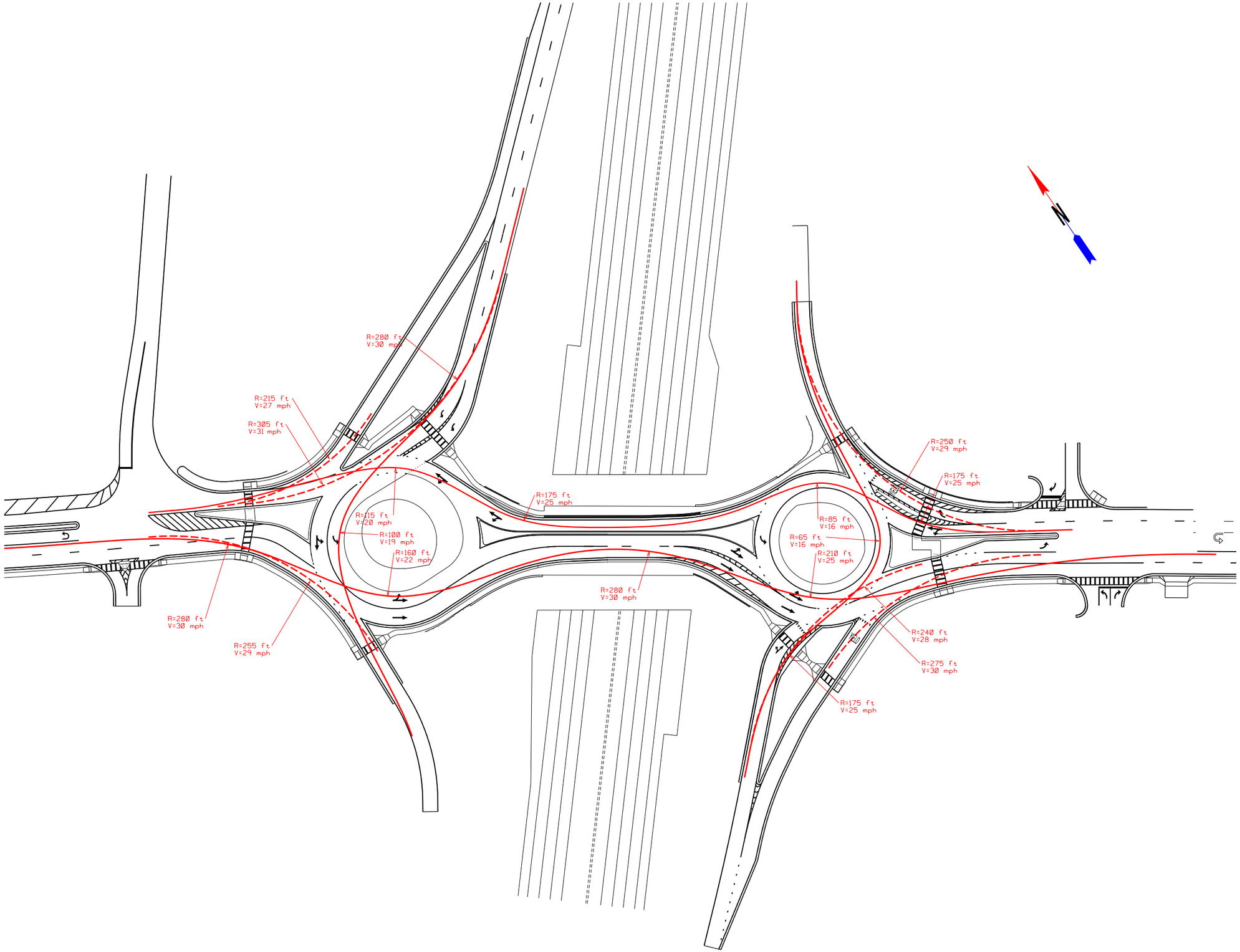
NEW COMMENTS

The following are new comments generated as part of review of the updated roundabout design received from H&L on 10/12/15.

34. On the eastbound exit of the eastern roundabout, the H&L WB-67 truck paths show the cab of the truck tracking over the splitter island; however, it appears the template could be adjusted to allow the truck to remain in its lane.
35. Various locations at both roundabouts appear to have wider pavement width than needed to accommodate WB-67s. We recommended continuing to look for opportunities to reduce lane widths where possible. See redline mark-ups for examples.
36. For locations where extra striped out space is provided for accommodation of OSOW vehicles (such as the NB entry), consider using an outside apron instead of just striping out the pavement to keep the entry width closer to the typical ranges outlined in NCHRP Report 672.
37. The OSOW truck turning templates show booster trailers off-tracking over curbs in several locations. Examples include:

   a. Tracking over the splitter separating the EB entry and EB bypass lanes at the eastern roundabout.
   b. Tracking over the landscaped area of the central island for the NB to WB left-turn movement at the eastern roundabout.
   c. Tracking over the outside curbline for the SB right-turn at the western roundabout.
   d. Tracking over the inside curbline at the SB exit from the western roundabout as well as off-tracking along the SB ramp itself.

38. At the western roundabout, along the central island near the SB entry, the truck apron has a sharp point to it. The way design vehicles will track over this point on the truck apron, there is the potential for premature wear. Rounding off the point on the truck apron will minimize the extent to which trucks need to use the apron as well as help to minimize wear.
39. At the eastern roundabout, the single-lane portions of the circulatory roadway have a width of 16 feet. This is at the narrow end of the typical range (16 to 20 feet). Increasing the circulating width may help with truck accommodation for the EB entry.
40. Use gore striping between the two entry lanes on the west leg of the western roundabout for consistency with other multilane entries.
41. The placement of some crosswalks could be improved. In the absence of site-specific constraints, crosswalks should be placed approximately 20 feet back from the roundabout on entries, yield-controlled bypass lanes, and single-lane exits and several car lengths back from the roundabout on multilane exits to support signalization in the event is required in the future by PROWAG. Consider the following adjustments to the crossing locations:
   a. The crosswalk on the west leg entry of the western roundabout is approximately 70' back from the roundabout and should be closer to 20 feet back
   b. The crosswalk on the north leg bypass lane of the western roundabout is approximately 30 feet back from the yield line and should be closer to 20 feet back if there is sufficient space on the island to develop a ramp and level landing. Please also make sure that the pedestrian crossing is appropriately aligned
   c. The crosswalk on the south leg bypass lane of the eastern roundabout is approximately 70 feet back from the yield line and should be closer to 20 feet back.
   d. The crosswalk on the east leg entry of the eastern roundabout is approximately 30 feet back from the yield line and should be closer to 20 feet back.
42. For the cut-through areas of the splitter islands, align the curblines within the pedestrian refuge to generally be in-line with the actual crossing. Adjustments could be made to the west leg of the western roundabout and the east leg at the eastern roundabout.
43. At the eastern roundabout, the island separating the WB entry from the WB right-turn bypass lane does not extend through the pedestrian crossing. This results in no raised ped refuge to protect pedestrians. We recommend that the island be extended further to the east to accommodate a raised pedestrian refuge.
44. H&L provided sight triangles for intersection sight distance (ISD). The following notes were identified from a cursory review of the sight triangles.
   a. When drawing the ISD triangles, the starting point for the triangles should be based on a vehicle positioned 50 feet back from the yield line, not at the yield line. This is illustrated on Page 6-63 of NCHRP Report 672. Each of the ISD sight triangles should be updated to reflect the correct starting point.
   b. The shading of ISD triangles should include areas over islands, not just areas over the roadway. This is important for developing the landscaping plan.
   c. Stopping sight distance triangles on the approaches and within the circulatory roadway should also be prepared.


R=280 ft
V=30 mph
R=215 ft
V=27 mph
R=305 ft
V=31 mph
R=115 ft
V=20 mph
R=100 ft
V=19 mph
R=160 ft
V=22 mph
R=175 ft
V=25 mph
R=280 ft
V=30 mph
R=255 ft
V=29 mph
R=280 ft
V=30 mph
R=250 ft
V=29 mph
R=175 ft
V=25 mph
R=85 ft
V=16 mph
R=65 ft
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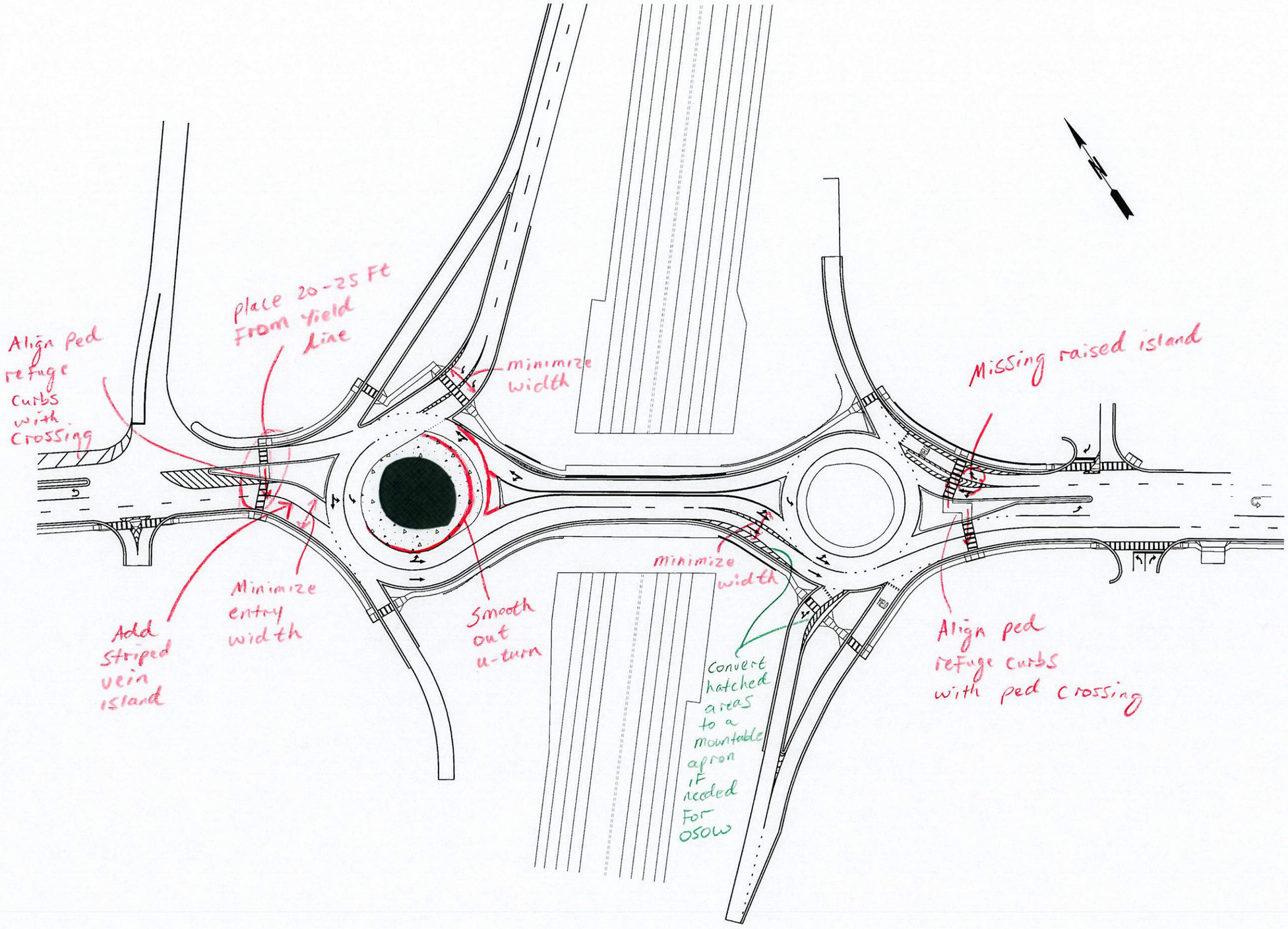
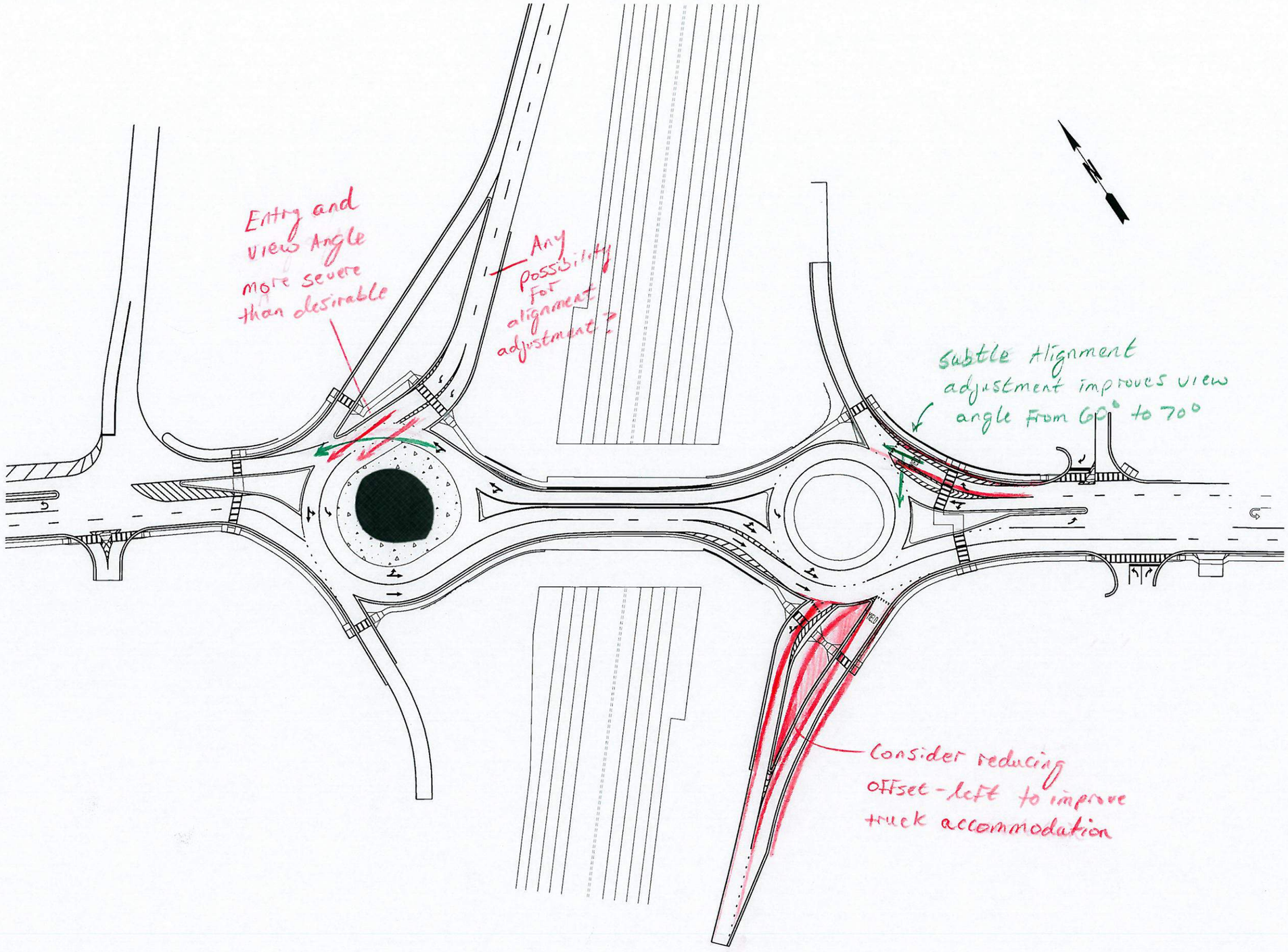
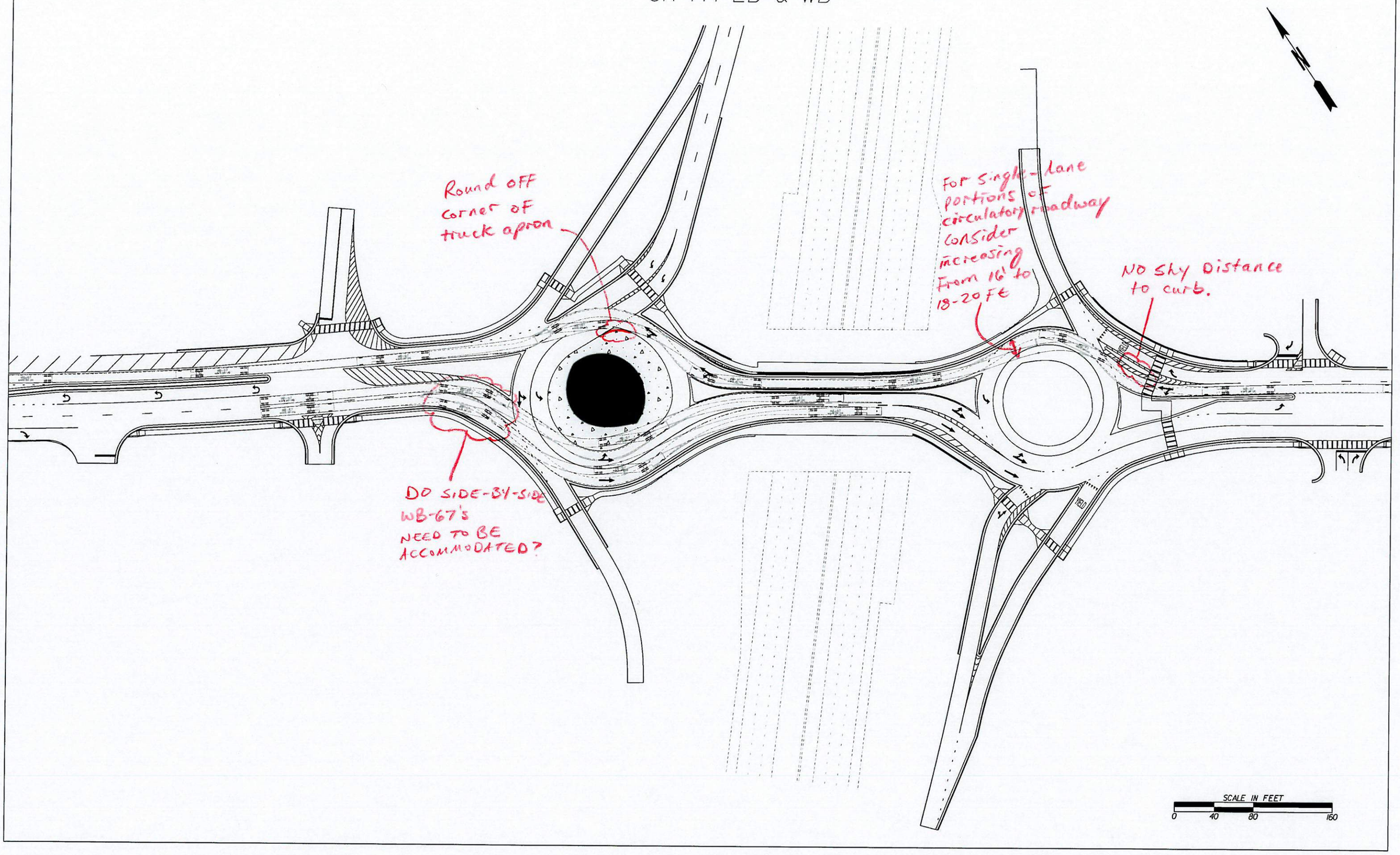
R=275 ft
V=30 mph
R=175 ft
V=25 mph

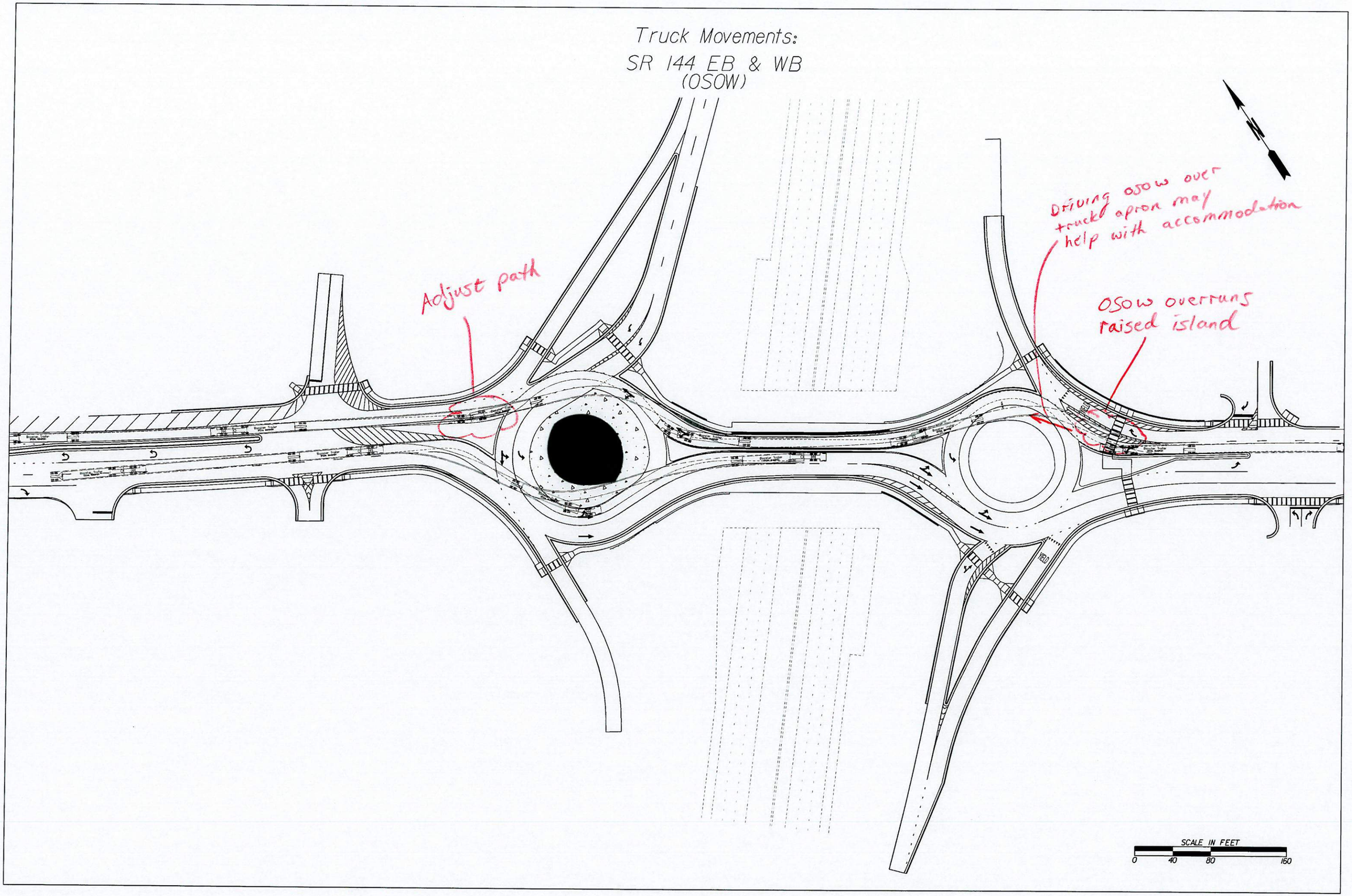

Align Ped refuge curbs with crossing
place 20-25 Ft from yield line
minimize width
Missing raised island
Add striped vein island
Minimize entry width
Smooth out u-turn
minimize width
Convert hatched areas to a mountable apron if needed for OSOW
Align ped refuge curbs with ped crossing

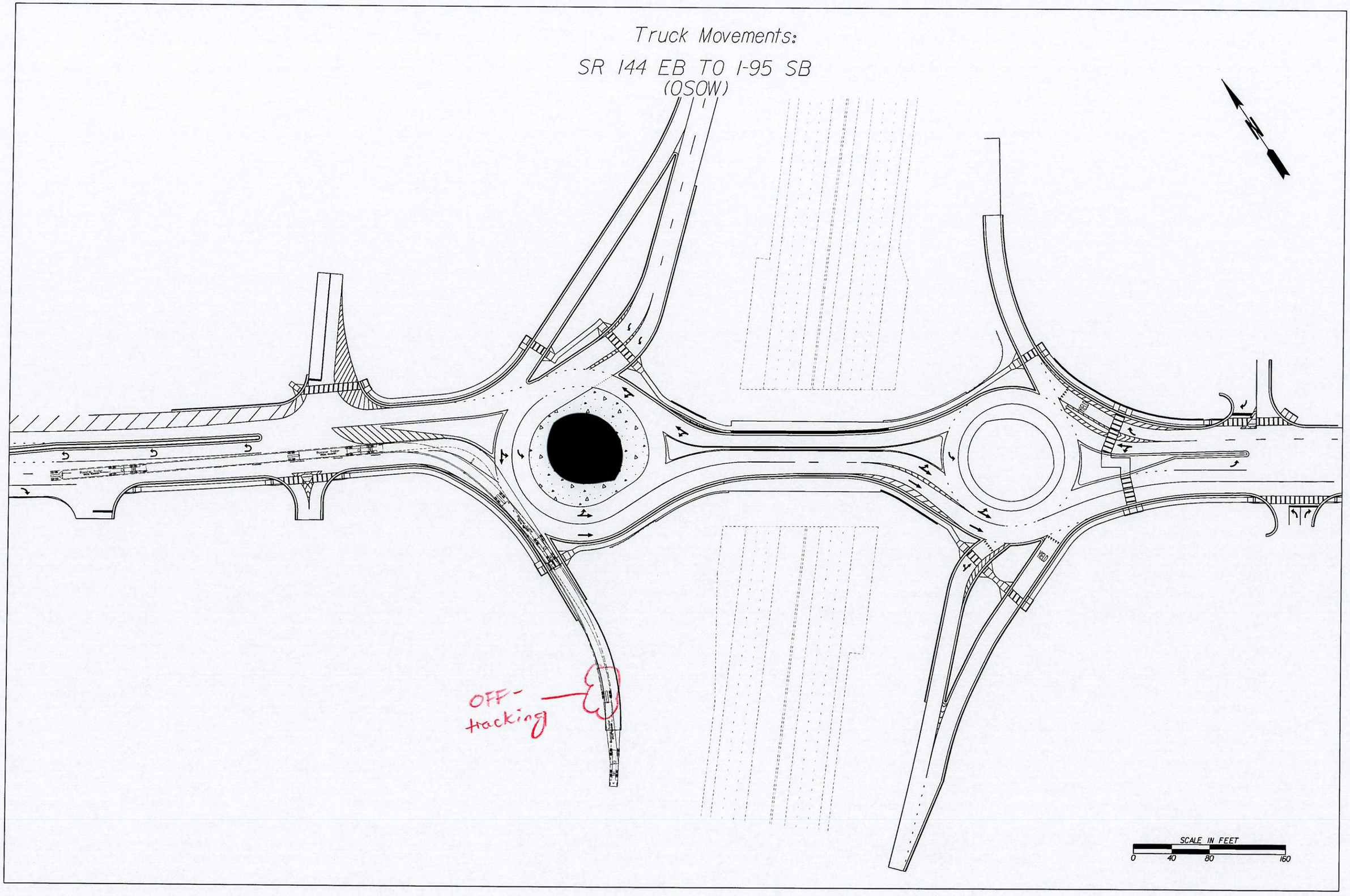

Entry and view Angle more severe than desirable
Any possibility for alignment adjustment?
Subtle Alignment adjustment improves view angle from 60° to 70°
Consider reducing offset-left to improve truck accommodation

Truck Movements:

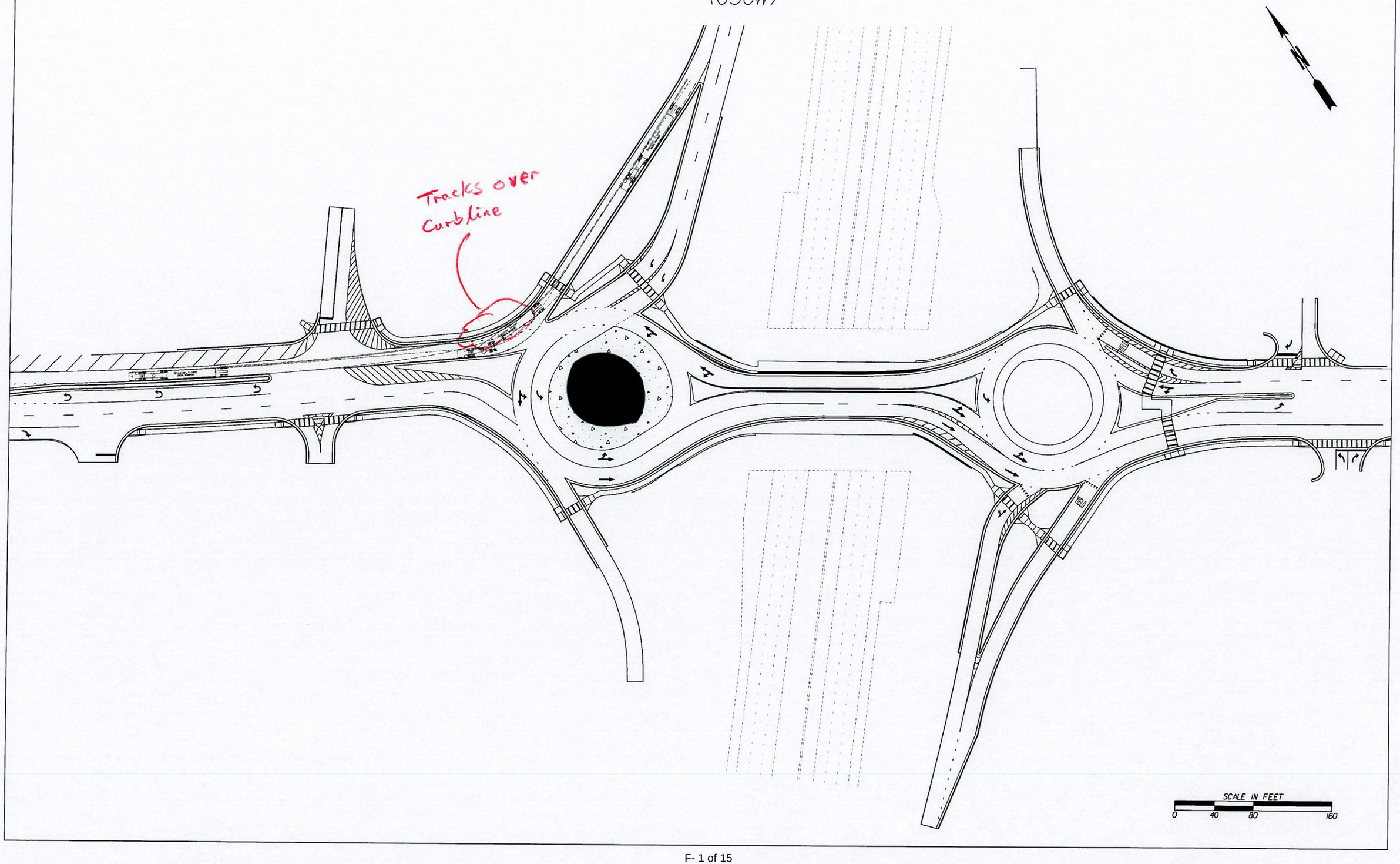
SR 144 EB & WB




Truck Movements:
SR 144 EB & WB
(OSOW)
Adjust path
Driving OSOW over truck apron may help with accommodation
OSOW overruns raised island
SCALE IN FEET
0
40
80
160

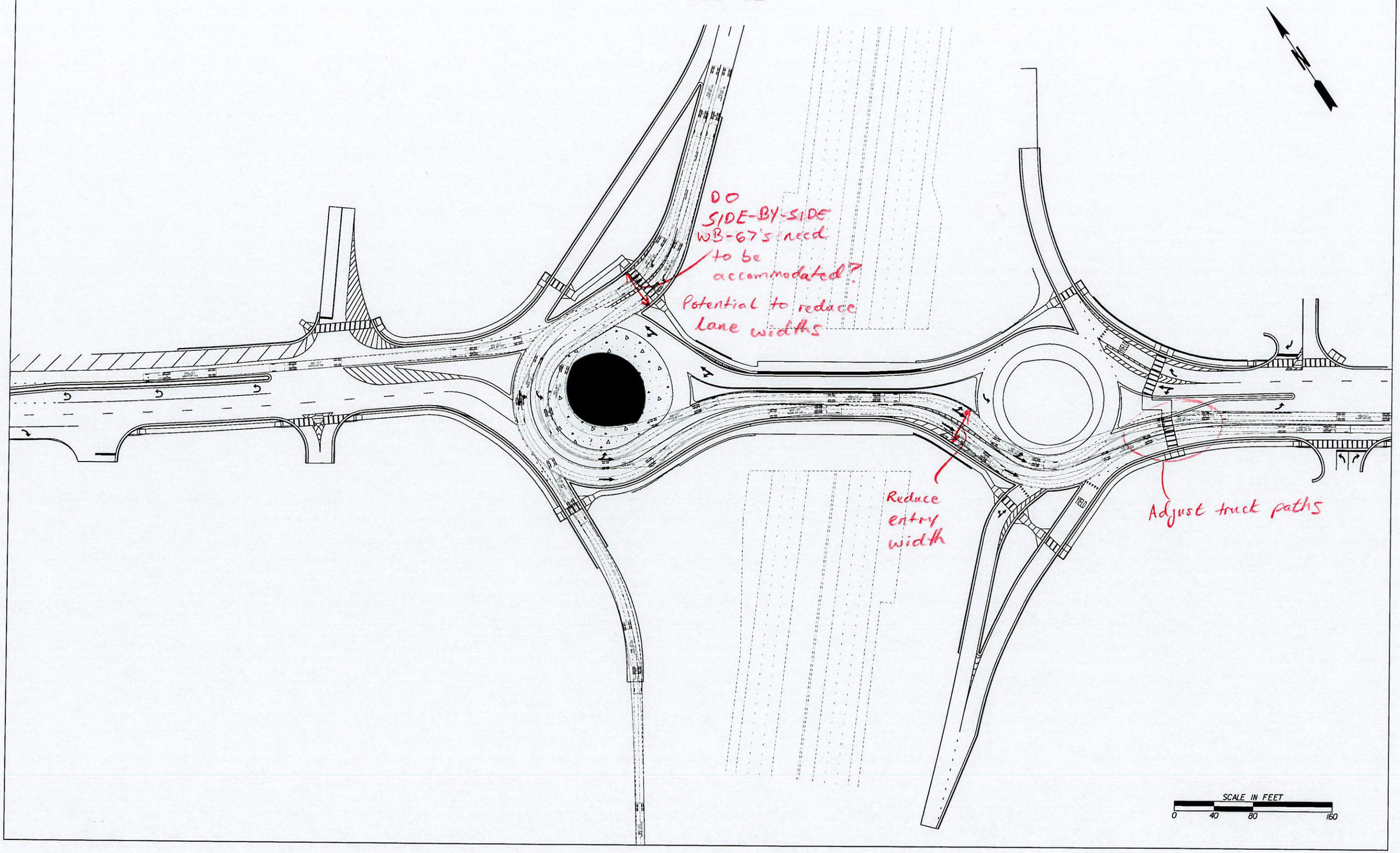

Truck Movements:
SR 144 EB TO I-95 SB
(OSOW)
OFF-
tracking
SCALE IN FEET
0
40
80
160

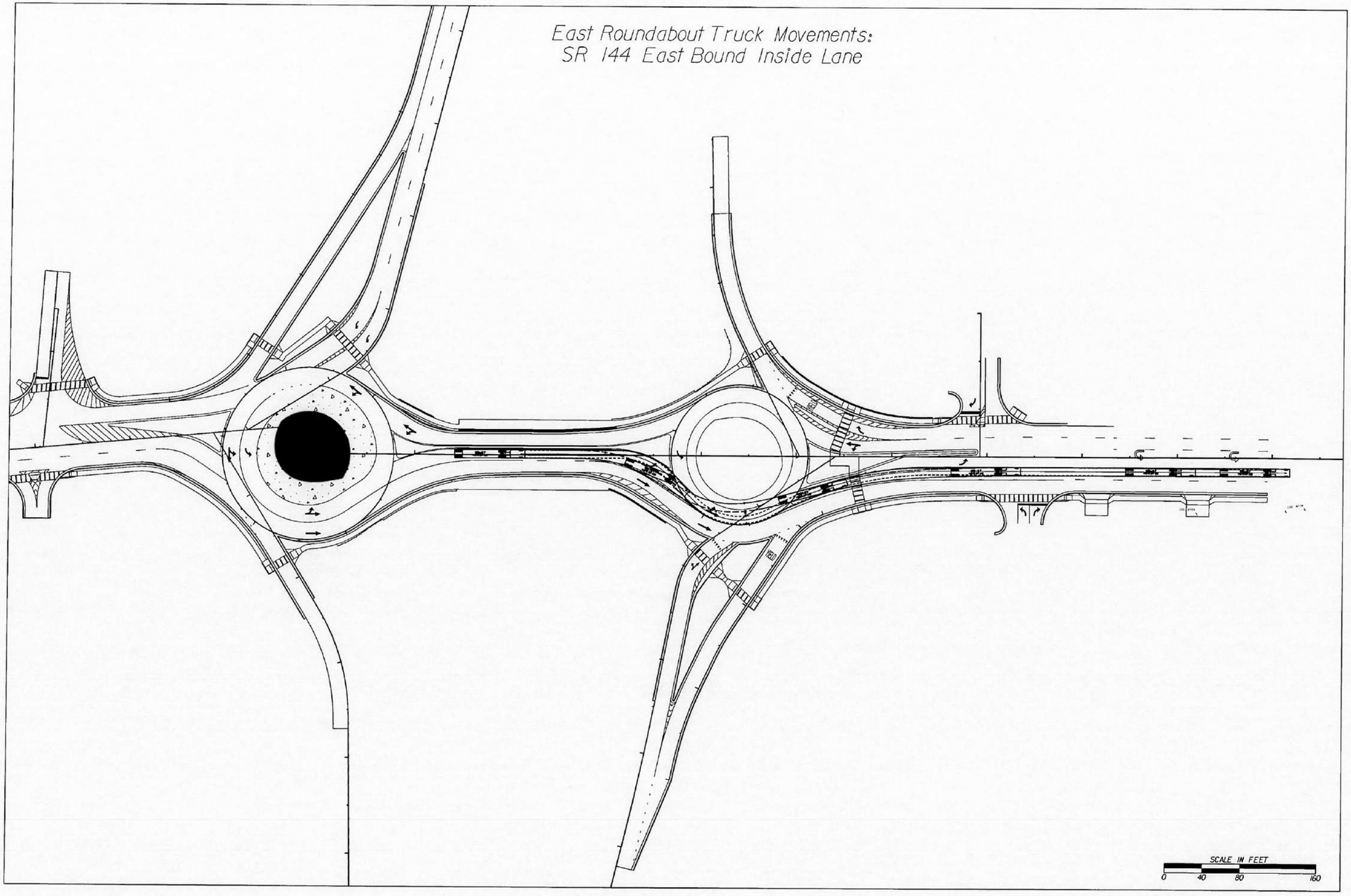
Truck Movements:
I-95 SB Bypass Lane
(OSOW)

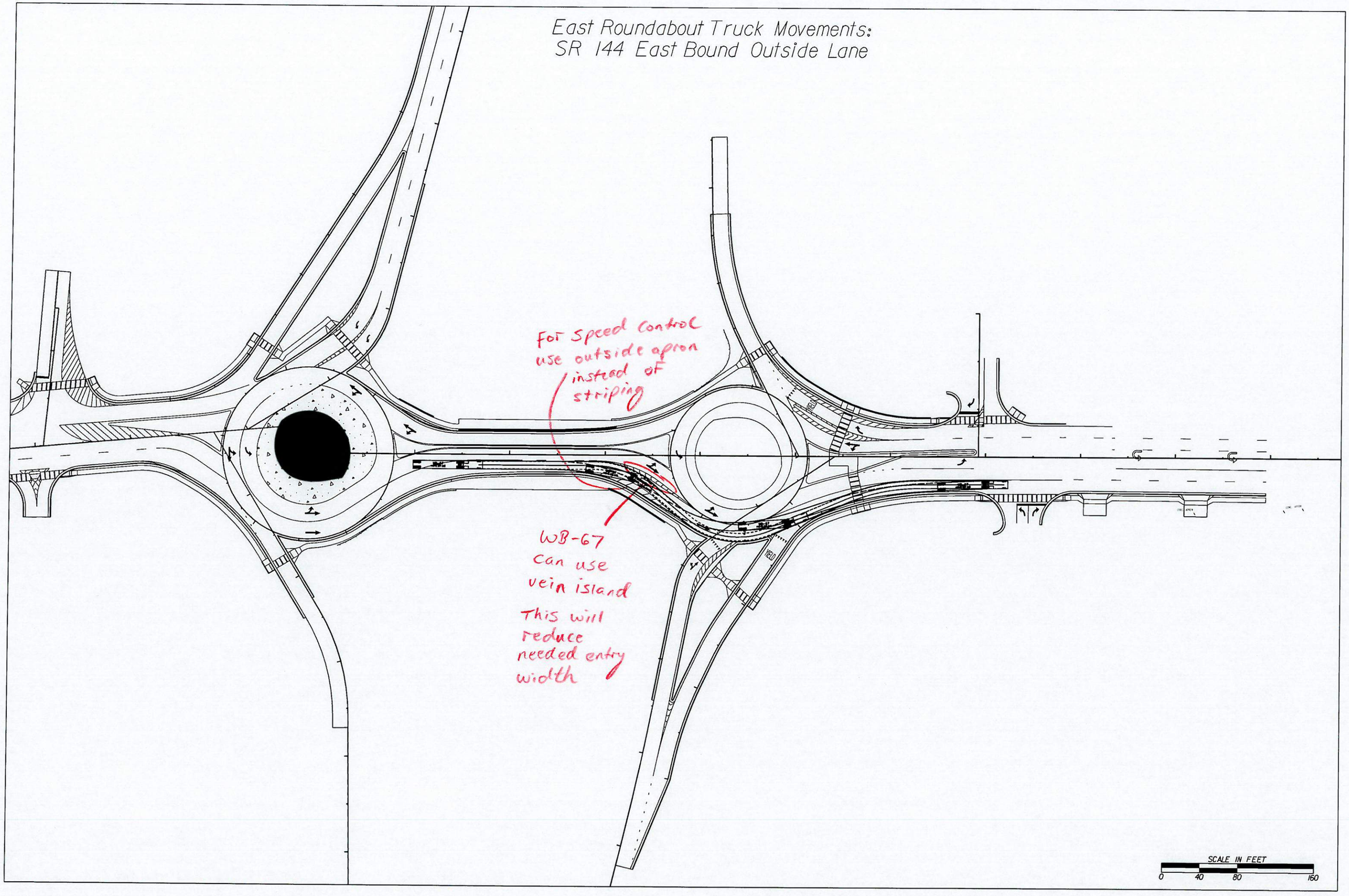


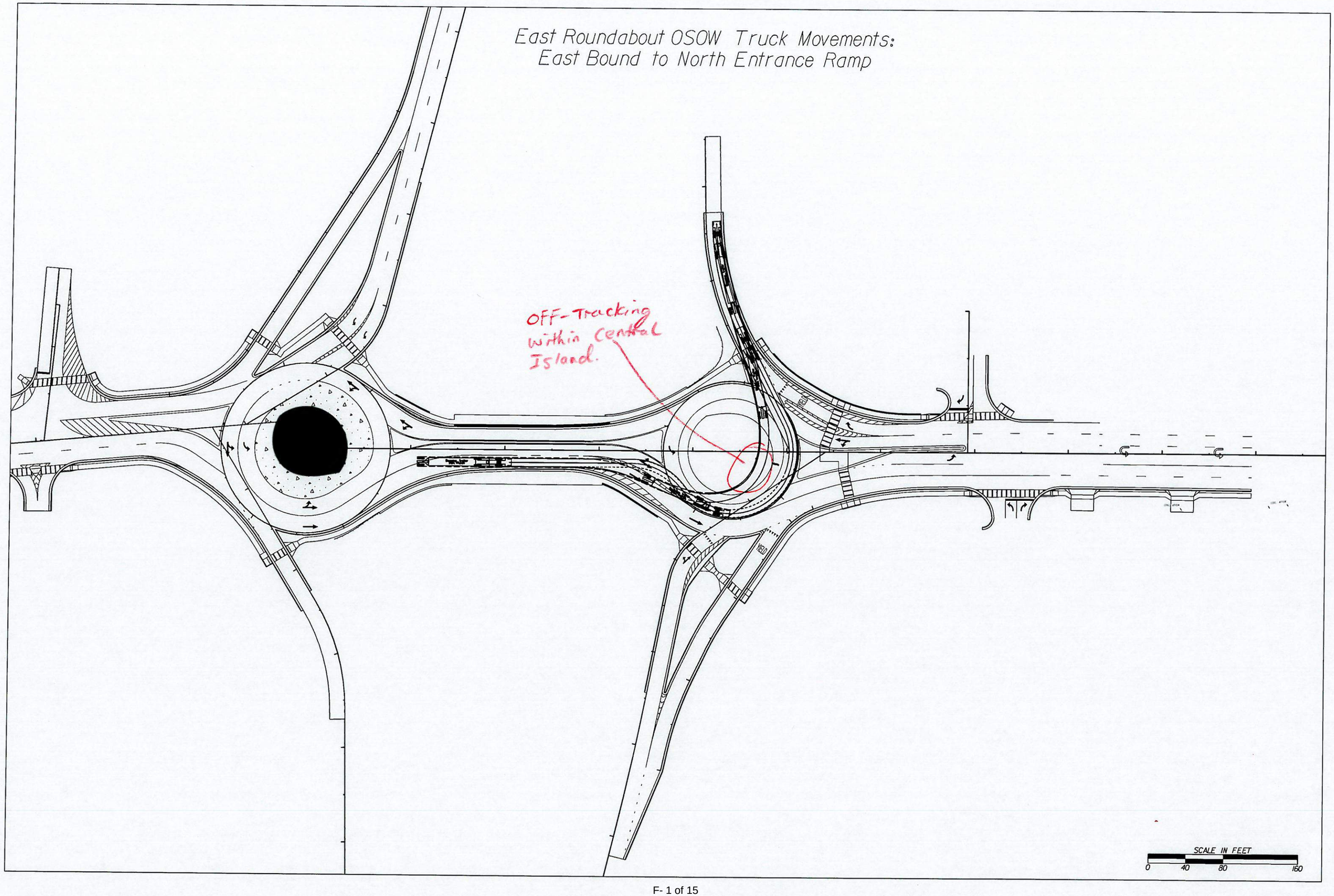
Truck Movements:

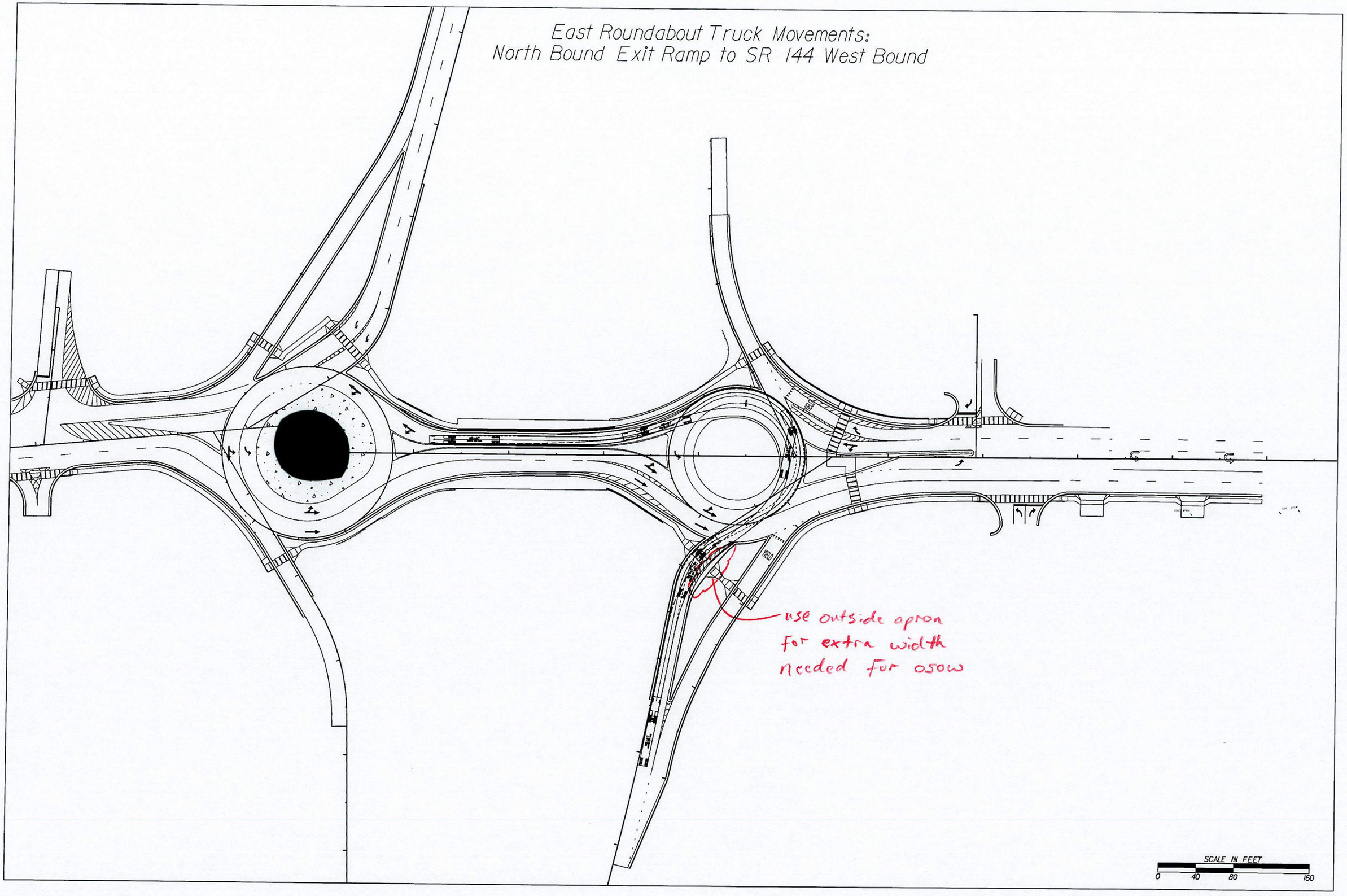
I-95 SB

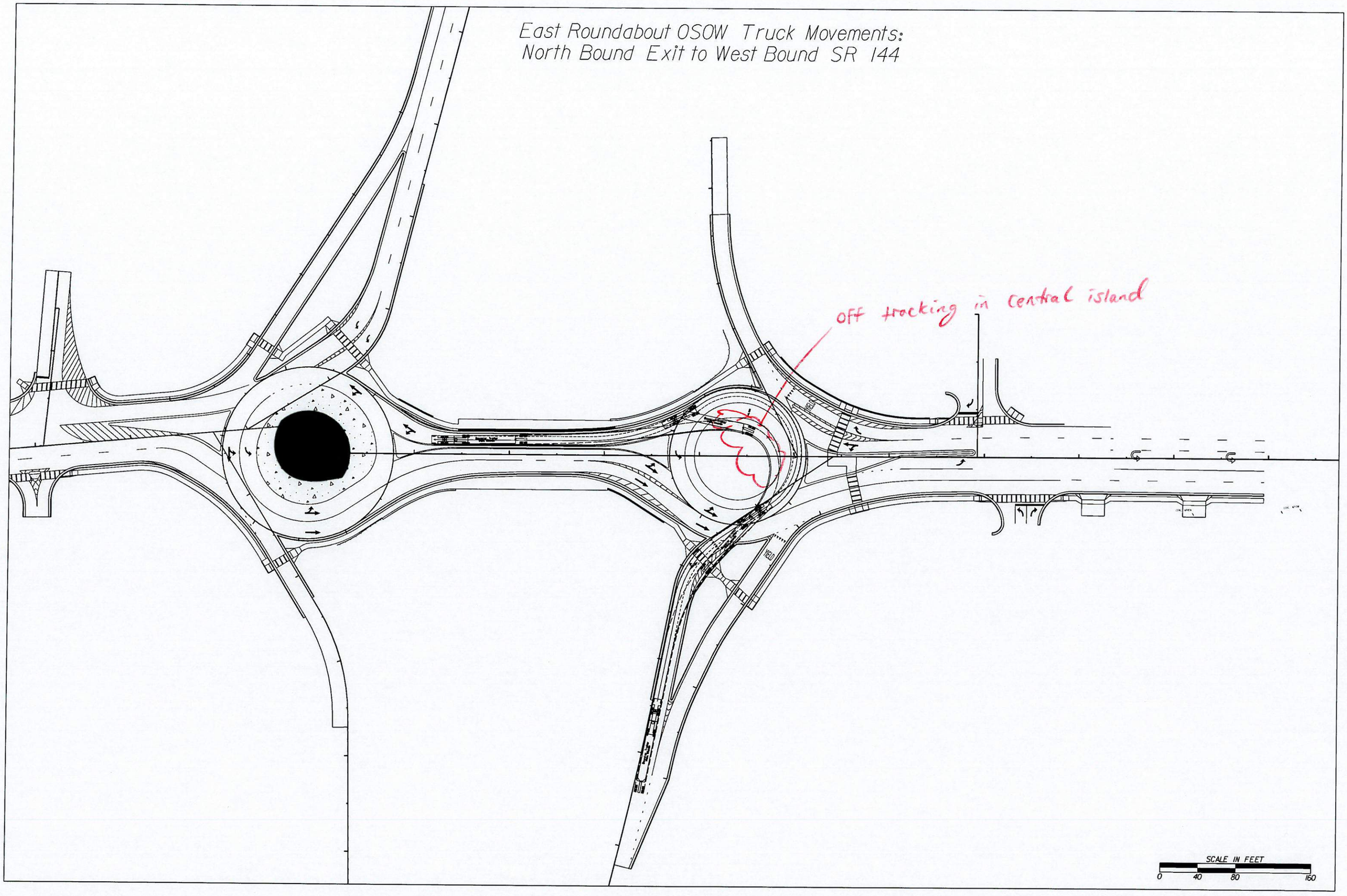


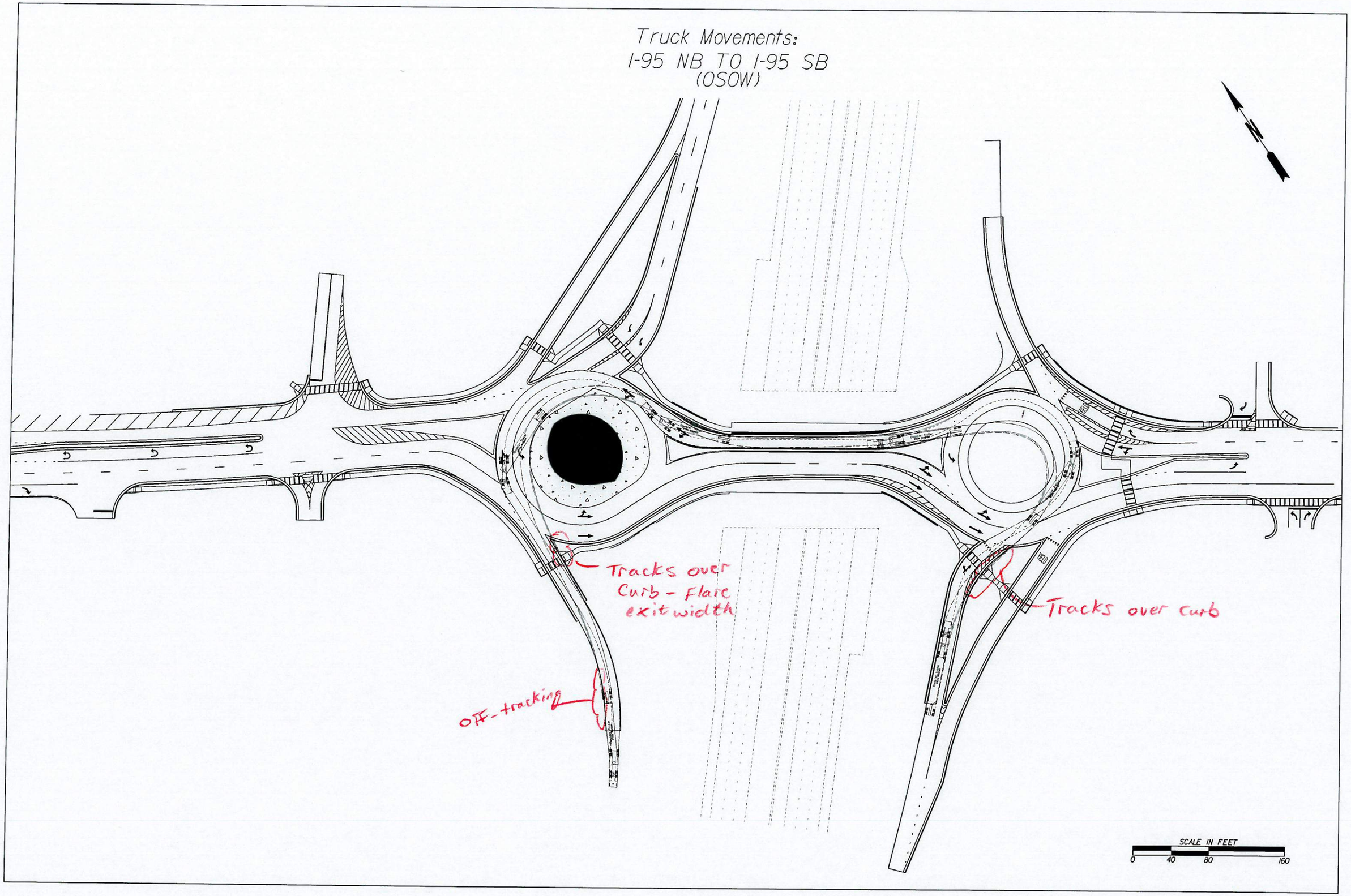

East Roundabout Truck Movements:
SR 144 East Bound Inside Lane
SCALE IN FEET
0
40
80
160


East Roundabout Truck Movements:
SR 144 East Bound Outside Lane
For Speed Control use outside apron instead of striping
WB-67 can use vein island
This will reduce needed entry width
SCALE IN FEET
0
40
80
160


East Roundabout OSOW Truck Movements:
East Bound to North Entrance Ramp
OFF-Tracking within Central Island.
YIELD
SCALE IN FEET
0
40
80
160


East Roundabout Truck Movements:
North Bound Exit Ramp to SR 144 West Bound
use outside apron
for extra width
needed for osow
SCALE IN FEET
0
40
80
160

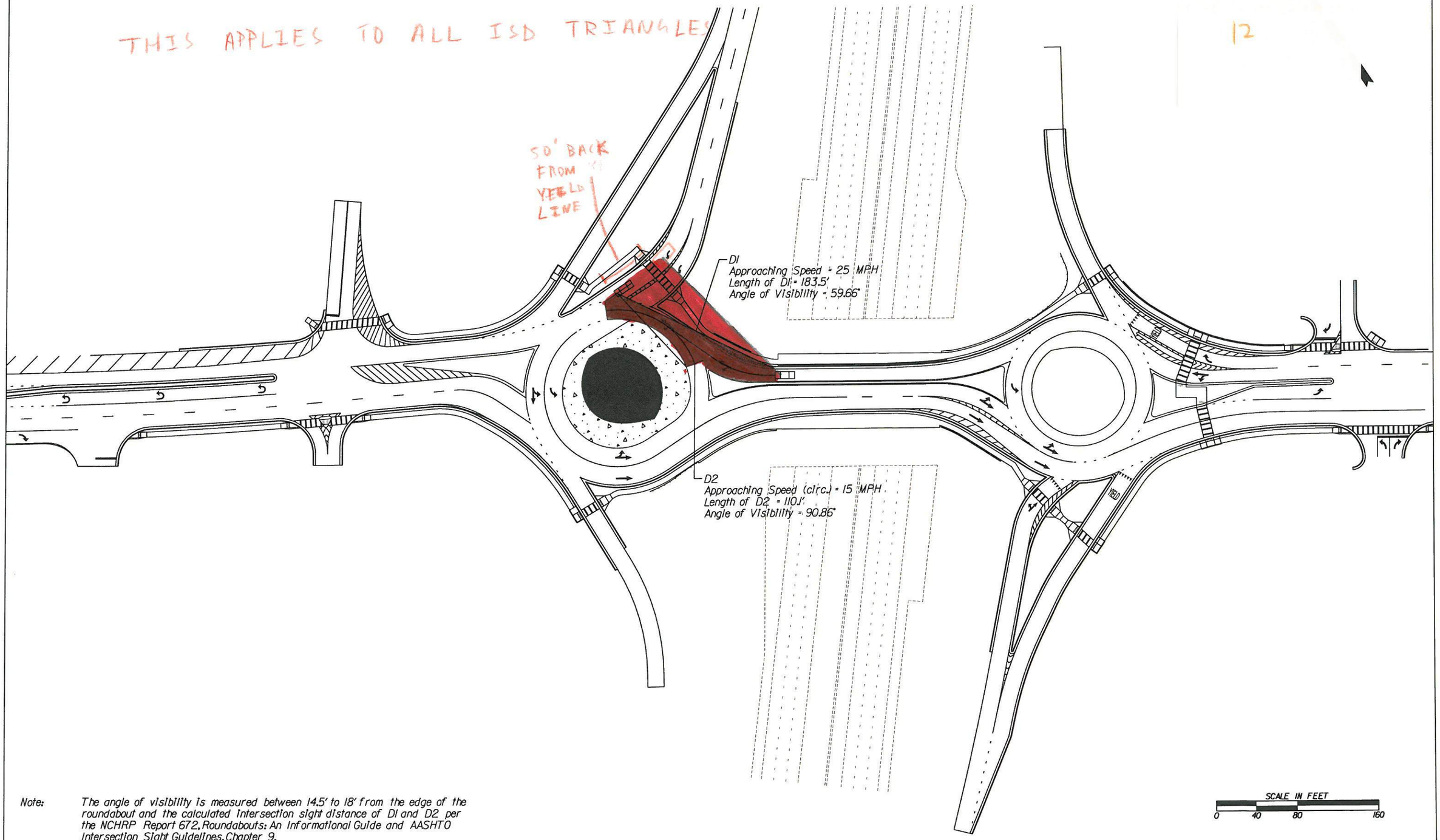

East Roundabout OSOW Truck Movements:
North Bound Exit to West Bound SR 144
off tracking in central island
SCALE IN FEET
0
40
80
160


Truck Movements:
I-95 NB TO I-95 SB
(OSOW)
Tracks over
Curb - Flare
exit width
Tracks over curb
Off-tracking
SCALE IN FEET
0
40
80
160

Sight Distance Info
Entrance from I-95 SB Exit Ramp

THIS APPLIES TO ALL ISD TRIANGLES

12



Note: The angle of visibility is measured between 14.5' to 18' from the edge of the roundabout and the calculated intersection sight distance of D1 and D2 per the NCHRP Report 672, Roundabouts: An Informational Guide and AASHTO Intersection Sight Guidelines, Chapter 9.

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TECHNICAL MEMORANDUM

SR 144 at I-95 Roundabout Feasibility Study

Feasibility Study and Roundabout Concept Review – 2nd Review

Date:	November 6, 2015	Project #: 13518.4
To:	Rudolph Frampton, Heath & Lineback Engineers, Inc.	
From:	Justin Bansen, P.E., and Pete Jenior	
Responses By:	Rudolph Frampton & Warren Dimsdale	
Responses By:	12-11-2015	

Kittelson & Associates, Inc. previously peer reviewed concept plans and a feasibility study for roundabouts proposed at the I-95/SR 144 ramp terminal intersections and provided comments on August 31, 2015. Heath & Lineback (H&L) provided updated concept plans and responses to the comments on October 12, 2015. This memo summarizes KAI's re-review of the concept plans and H&L responses to comments.

RESPONSE TO H&L'S COMMENT RESPONSES

KAI's original comments from the August 31 memo appear below in black. H&L's responses from October 2 appear in red. KAI's new responses appear in blue italics.

Section 2 - Existing Conditions

1. Page 8 - The accident history summarized under Section 2.8 includes data for approximately 0.5 miles of SR 144 including the ramp terminal intersections, and notes some of the safety benefits roundabouts offer. However, the aggregated data makes it difficult to identify the specific locations of crash and the safety performance of the existing ramp terminal intersections. If GDOT desires predictive safety analysis for implementation of a roundabout (to support benefit/cost calculations), then the historical safety data would need to be broken down to better reflect the individual intersections.

   H&L Response: The quality of the data provided by the GDOT is limited to the quality and level of detail provided by the reporting police officer. For this interchange, location details of the majority of the reported crashes are absent or erroneous.

   KAI Response: No further comment at this time.

2. Page 8 – The text cites that the roundabout will reduce both rear-end and angle crashes. It is likely that the roundabout will address angle crash types at the ramp terminal intersections. However, the magnitude of rear-end crash reductions is more difficult to predict and may or may not be reduced depending upon the magnitude or rear-end crashed actually occurring at the ramp terminal intersections. Consider including statistics from NCHRP Report 672 or the CMF Clearinghouse to describe the expected reduction in total and severe crashes when converting from a two-way stop control to multilane roundabout control.

H&L Response: The report will be modified accordingly.

KAI Response: No further comment at this time.

Section 3 - Existing Traffic

3. Figures 4 and 8 show that the I-95 southbound ramp and SR 144 west of the interchange have an a.m. peak hour of 5-6 a.m., and this is outside of the time the turning movement counts were conducted. Please note this unusual peak hour time period in the report text and describe how it was incorporated into the peak hour traffic analysis

   H&L Response: Additional traffic counts have been made for the 5-6 a.m. turning movement and analysis scenarios based on the "Early AM" peak hour are in progress. The report will be modified accordingly.

   KAI Response: No further comment at this time.

Section 5 - Operational Analysis

4. Page 16 – The discussion regarding LOS for roundabouts states: "One or more movements at an intersection may experience a low LOS, while the roundabout as a whole may operate acceptably". Similar to other unsignalized intersections, roundabouts should have lane configurations established to provide acceptable operations on each of the individual approaches. Weighted average delay and LOS for the overall intersection can be useful in providing comparisons against other control types (such as a signal); however, it should not be the sole basis for determining acceptability of the roundabout lane configurations.

   H&L Response: All movements of the roundabout are being analyzed and will be included in the report. The roundabout lane configuration will be modified as needed to address any LOS deficiencies.

   KAI Response: Consider also updating the text in the report to remove/modify the statement referenced in the original comment.
   H&L Response: The design team will coordinate with the GDOT to determine the preferred wording to be used in the report.

5. KAI reviewed the reported operational analysis results in Table 7. KAI attempted to replicate the analysis results using the SIDRA Intersection software. However, we were not able to achieve the same results as summarized in the report or appendix output sheets. Please update Appendix I to include the "Detailed Output" report from SIDRA to document the geometric variables, environmental factor, etc. assumed in the analysis.

   H&L Response: The requested data will be included in the appendix of the report.

   KAI Response: No further comment at this time.

6. The KHA SIDRA analysis reports for the 2037 PM at the I-95 NB ramps indicate a v/c ratio of 1.04 and LOS F for the NB off-ramp movement. This results in a 19 vehicle queue (approximately 475 feet) on the off-ramp. Consideration should be given in the design to allow for inclusion of a Yield controlled NB right-turn bypass lane (or a two lane entry with the outside lane being a right-turn only lane) as part of the ultimate roundabout configuration.

   H&L Response: The v/c ratio is being reviewed and modified. A bypass lane has been added to the design at the NB off ramp.

KAI Response: No further comment.

7. KAI prepared an independent operational analysis to verify the needed lane configurations for roundabouts at both ramp terminal intersections. The analysis utilized the latest US roundabout capacity models developed as part of NCHRP Project TOPR 34. The new TOPR 34capacity models were adopted in June 2015 by the Transportation Research Board Committee on Highway Capacity and Quality of Service for inclusion in a major update to the Highway Capacity Manual expected to be released in late 2015/early 2016. Results of KAI's analysis are summarized in Table 1.

   H&L Response: The results have been reviewed and the following changes have been made: a) The SR 144 EB entrance at the SB ramp has been converted to a 2 lane entrance, the Bypass Lane has been removed and b) The NB off ramp has been modified to have a right turn bypass lane.

   KAI Response: No further comment.

Section 7.1 Recommendations

8. As outlined in the operational analysis comments, KAI recommends adjustment to the lane configurations on the EB approach at the SB Ramp intersection and at the NB approach to the NB Ramp Intersection. The illustration below reflects the recommended lane configurations and corresponding operational performance summarized in Table 2. Note that the diagram below is *only* intended to reflect lane configurations. No geometric design guidance is intended to be inferred from the lane configuration diagram.

   H&L Response: The recommended changes to the EB approach at the SB Ramp intersection and the NB approach to the NB Ramp intersection have been made.

   KAI Response: No further comment.

9. Additional discussion should be added to the Feasibility Study Report to identify the intended phasing of the roundabout implementation and the approximate year when the future bypass lanes are expected to be required.

   H&L Response: The bypass lane will be constructed with the initial construction of the project. The report will be modified accordingly.

   KAI Response: Staged construction of roundabouts is often preferable to initially constructing all lanes needed in the design year since fewer lanes results in fewer conflict points and improved safety performance. It is ultimately up to the project team and GDOT; however, consideration could still be given to staging implementation of the SB bypass lane at the SB Ramp Intersection and NB bypass lane at the NB ramp intersection.

   H&L Response: The bypass lanes are no longer proposed to be constructed in the future. Additional traffic studies showed the bypass lanes to be warranted at the build year of the project.

Fastest Path Speeds

10. KAI prepared independent fastest path speed checks for the two proposed roundabouts. Fastest paths are provided in the attached mark-ups. KAI found higher fastest path speeds for some movements. The following are the findings related to fastest path speed control:

    a. The fastest paths developed by H&L appear to be developed using compound curves instead of B-Splines. Consider using B-splines to develop the fastest paths when performing checks of the updated design.

H&L Response: The fastest path speeds were developed using B-Splines.

KAI Response: No further comment.

b. Speeds on the EB entry lane and EB right-turn bypass lane at the SB Ramp Intersection both exceed the desired 25 mph threshold for a single-lane entry. In the operational analysis section, the EB approach is recommended for conversion to a two-lane entry, which will change the speed threshold to less than 30 mph (assuming drivers ignore all lane lines). Additional adjustment for improving speed control may need to be undertaken along with modification of the approach lane configurations. Offsetting the approach alignment further to the left of center is one option for achieving improved speed control for the EB entry.

H&L Response: The EB approach at the SB Ramp has been modified to a two lane entry. The fastest path will be calculated and kept below the 30 MPH threshold.

KAI Response: Some of the fastest paths drawn by H&L do not represent smooth curves that are likely to be followed by a driver. For the EB through path at the SB Ramp, the inflection point along the path that is dictating the start of the R1 curve is too close to the entry. This is resulting in an artificially small radius near the beginning of the path. KAI prepared an independent set of fastest paths and also found a 30 mph speed for the EB entry. In this case, we achieved the same speed estimate with different paths since H&L did not measure their path at the location with the tightest radius. We suggest that the H&L fastest paths be updated for documentation purposes, but no additional action is necessary related to this comment.

c. The southbound right-turn movement at the SB Ramp intersection allows fastest path speeds greater than 30 mph. Offsetting the approach alignment on the west leg to the left of center will benefit both the EB entry as well as the SB right-turn to improve speed control for both movements.

H&L Response: Construction of the SB Exit Ramp By-Pass lane with the project will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold.

KAI Response: The H&L fastest path checks do not show the speed of the right-turn bypass lane. This should be added for documentation purposes. Based upon independent checks by KAI, the SB to WB right-turn bypass speed is 27 mph, which exceeds the desired 25 mph threshold. The fastest path speed of the R5 right turn movement from the other southbound entry lanes (labeled as R2 in H&L's fastest path drawing) is 31 MPH.

H&L Response: Per NCHRP 672 "The fastest path is drawn for a vehicle traversing through the entry, around the central island, and out the relevant exit." While obtaining the 25 mph & 30 mph fastest path speeds is desirable, it is not a requirement. However, H&L's fastest path checks at these locations show a 25 mph and 30 mph speed at these locations. No further action is required.

d. At the NB Ramp, the NB right-turn movement will allow a fastest path speed of 28

mph, which exceeds the desired threshold of 25 mph. Adjustment to the approach alignment and/or the EB exit alignment may be options to further improve fastest path speed control for the NB right-turn movement.

H&L Response: Construction of the NB Exit Ramp By-Pass lane with the project will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold.

KAI Response: If the NB right-turn bypass is not included as part of the original construction, then the NB right-turn movement would still be served by the NB entry. The fastest path curve for the northbound right-turn movement using the bypass lane does not appear in H&L's fastest path speed drawings. KAI independently drew this curve and found the northbound right-turn speed to be 30 MPH (see attachments).

H&L Response: Construction of the NB Exit Ramp By-Pass lane will be included in this project and will eliminate the right turn movement through the roundabout at this location. The right turn fastest path movement from the bypass lane is within the allowable threshold. No further action is required.

e. At the NB Ramp, the WB entry lane and WB right-turn bypass lane both allow fastest path speeds of 26 mph, which exceeds the desired speed of 25 mph. Slight adjustments to the lane widths and/or radii may be possible to further reduce vehicle speeds. Based upon review of the truck turn paths, a WB-67 appears to have greater than 2 feet of shy distance to each curbline, which suggests that the geometry could be

adjusted for speeds without negatively impacting truck accommodations.

H&L Response: H&L's fastest path calculations show the speed to be below the 25MPH threshold. No change is required.

KAI Response: It appears that an adjustment was made that reduces the speed to within the 25 mph desired entry speed. No further comment regarding the speed control. However, the desired 1 to 2 feet of buffer distance is no longer provided between the design vehicle and the splitter island curb. Adjustments to address the truck accommodation should be verified that they do not adversely impact the speed control.

H&L Response: The splitter island has been modified to provide 1-foot of clearance from the WB-67 movement. The fastest path has been check based of the relocated curb face and is within the allowable threshold.

Design Vehicle Accommodation

11. KAI reviewed the WB-67 truck turning templates contained in Appendix C of the Roundabout Feasibility Study. Red-line mark-up of the WB-67 truck paths are attached. KAI had the following findings related to truck accommodations:

    a. The H&L design checks indicate that the proposed roundabouts will accommodate WB-67s for all turn movements with at least 1 to 2 feet of buffer to any curbline.

    H&L Response: Yes, TMC/GDOT requested that the design allow a car to be next to a

WB67 so that in the event that someone finds themselves in that situation they can safely continue through the roundabout.

KAI Response: The turning templates currently show WB-67s side-by-side. KAI recommends the templates be revised to show a passenger car beside WB-67s, and this may indicate that lane widths can be reduced in some areas. The two lane portions of the circulatory roadway are currently 36 feet wide, which is greater than the typical range.

H&L Response: Turning templates were analyzed for both, a passenger vehicle and a WB-67 on the inside lane, while a WB-67 occupies the outside lane. The clearance from the back of the WB-67 trailer to the face of curb is 11-feet. Allowing 2-feet of clearance between the passenger car and trailer and 1-foot between the curb and passenger car yields a clearance for an 8-foot wide vehicle. H&L does not recommend reducing this amount beyond what is shown, the circulatory width will remain 36-feet. Both layouts will be filed in the design data book. No further action is needed.

b. For selected movements, lane widths may be able to be reduced to improve speed control. Attached redline mark-ups provide examples.

H&L Response: Lane widths will be reduced at the noted locations where it is determined that it will not affect the WB-67 movements through the intersection.

KAI Response: No further comment.

c. At the SB Ramp intersection, the two lane portions of the circulatory roadway are 36 feet (two 18 foot lanes) in order to accommodate a truck turning left adjacent to a passenger vehicle. This is greater than the typical range of circulating width of 28 to 32 feet (14 to 16 foot lanes). The offset-left alignment of the SB approach and relatively small ICD for the roundabout is likely contributing to the additional off-tracking of the WB-67 making the left-turn maneuvers from the outside lane. The wide circulating width could result in higher fastest path speeds for the WB through movement and encourage vehicles to travel adjacent to trucks through the roundabout rather than staggering their position. Possible options that could be further explored include:

i. Adjust the approach alignments to achieve recommended fastest path speed thresholds even with wider than desirable circulatory roadway.

H&L Response: Approach alignments have been adjusted to keep the fastest path within the allowable threshold.

ii. Adjust the SB Entry and WB exit approach alignment to increase the angle that the truck turns through. This may reduce the width of the truck path when making a left-turn and allow for a narrow circulating width to be utilized.

H&L Response: The long distance the truck travels around the roundabout causes the tracking to push into the adjacent lane. Adjusting the entry angle did not significantly reduce the tracking offset.

iii. Signing the approach to require trucks to claim both lanes on the SB entry or to use the inside (left) entry lane. This would allow the circulating width to be reduced down to at least 32 feet by expanding the central island diameter,

which will further support improved speed control.

H&L Response: TMC/GDOT requested that the design allow a car to be next to a WB-67.

KAI Response for all parts of Comment 11C: KAI recommends the design vehicle figures be revised to show a passenger car beside a WB-67s instead of two WB-67s side-by-side. As described in the original comment, it is desirable to reduce the circulating width, if possible in the southern and western portions of the circulatory roadway.

H&L Response: Turning templates were analyzed for both, a passenger vehicle and a WB-67 on the inside lane, while a WB-67 occupies the outside lane. The clearance from the back of the WB-67 trailer to the face of curb is 11-feet. Allowing 2-feet of clearance between the passenger car and trailer and 1-foot between the curb and passenger car yields a clearance for an 8-foot wide vehicle. H&L does not recommend reducing this amount beyond what is shown, the circulatory width will remain 36-feet. Both layouts will be filed in the design data book. No further action is needed.

12. The feasibility study does not appear to include any discussion of oversize/overweight (OSOW) vehicles. Typically these types of vehicles require permits that could be used to further verify frequency and size of oversize loads to support inclusion of features such as outside aprons (sometimes called "blisters") to accommodate oversize vehicle off-tracking. Given the role the interchange serves regionally, additional investigation of OSOW vehicles appears to be appropriate.

    H&L Response: OSOW loads have been accommodated in the design with the use of blisters and truck aprons. The use of OSOW loads through the intersection by Fort Stewart will be addressed in the report.

    KAI Response: It appears that the OSOW vehicles shown in the truck checks are not fully accommodated for some movements. See additional "new" comments at the end of this memo for additional information. No further response to this comment is required. KAI will re-review the report once it has been updated.

SB Ramp Geometric Design Notes

13. The close proximity of Longwood Drive to the SB Ramp roundabout creates an undesirable set of potential conflicts. Between Longwood Drive and the edge of the roundabout circulatory roadway is only approximately 160 feet.

    a. During the design year peak hours, the back of queue for the WB roundabout entry is expected to spill back through the Longwood Drive intersection which could create conflicts for SB left-turning vehicles.

    H&L Response: The WB entry has been modified to a 2 lane entry, this change will help to alleviate queueing and this conflict.

    KAI Response: KAI's traffic analysis indicates WB queue with a two-lane entry will have a 95th percentile queue of 8 vehicles (PM Peak) to 10 vehicles (AM Peak), which will still occasionally spill back to Longwood Drive. However, this is shorter than the queues associated with the previous lane configuration and average queues are expected to be

adequately stored between the roundabout and Longwood Drive. No further response is required.

b. The proposed future SB to WB free-flow right-turn bypass lane would create a short weave section (approximately 80 feet) for vehicles to change lanes from the WB roundabout exit to turn right onto Longwood Drive. Converting the bypass lane to a Yield controlled bypass would remove the short weave section.

H&L Response: SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.

KAI Response: No further comment.

c. The geometry of the proposed future SB to WB free-flow right-turn bypass lane would allow for a relatively high speed on the bypass lane. Vehicles turning to/from Longwood Drive immediately downstream of the bypass curve may be unexpected for vehicles traveling along the bypass lane. The combination of the speed and short distance for perception/reaction could lead to angle or rear-end crashes. Conversion to a yield controlled bypass is expected to help maintain slow vehicle speeds for the SB to WB right-turn.

H&L Response: SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.

KAI Response: No further comment.

14. The design of the proposed future SB to WB free-flow right-turn bypass lane does not include a protected pedestrian refuge between the WB roundabout exit and the bypass lane. Given the free-flow nature of both movements, an appropriately designed pedestrian refuge would be required if the proposed free-flow bypass is retained in the design. If the bypass is converted to Yield control, the crossing becomes simplified to a single-lane with no refuge required.

H&L Response: SR 144 WB has been reduced to a 1 lane section at this location. The SB Exit By-Pass lane has been tied in and converted to Yield controlled. These changes have eliminated the conflicts.

KAI Response: No further comment.

15. The current design of the EB right-turn bypass lane results in an undesirable driver view angle. An angle of approximately 50 degrees is provided, where NCHRP Report 672 identifies a minimum angle of 75 degrees as desirable. As outlined in the operations analysis, removal of the right-turn bypass is recommended in lieu of a two-lane entry on the EB approach. With conversion to a two-lane entry the entry angle should be adjusted to provide appropriate driver view angles.

H&L Response: A line of sight of 75 degrees or greater will be designed where possible. However, existing development and constraints limit the placement of the roundabouts and the design of the approaches. In an effort to achieve a balanced design, a minimum of angle of 60 degrees will be used at some approaches. This meets the allowable intersection skew angles defined by AASHTO.

KAI Response: Where possible, it is desirable to strive to achieve the 75 degree (or greater) view angle.

H&L Response: The design team will continue to look for opportunities to improve the design throughout the design process, including the above comment. These changes, if possible, will be made during the final design phase.

16. When converting the EB entry to two-lanes, the current design is not expected to provide acceptable fastest path speed control. Consider offsetting the alignment of the west leg to the left of the roundabout center in order to improve deflection.

    H&L Response: The approach alignment of the EB approach has been modified to not exceed allowable fastest path speeds.

    KAI Response: KAI's independent checks identified a 30 mph speed for the EB R1. This meets the guidance in NCHRP report 672. No further comment.

17. If the SB bypass lane is converted to Yield control, the alignment of the bypass lane will likely require shifting to the west along with an adjustment to the WB exit to use larger exit radii, as illustrated in the attached redlines, to provide appropriate speed control.

    H&L Response: The recommended changes have been made.

    KAI Response: No further comment.

18. The SB entry provides a driver view angle of approximately 60 degrees, which is less than the desired 75 degree (or greater) angle. Adjusting the SB entry alignment is recommended to improve the driver view angle from both SB entry lanes.

    H&L Response: The SB approach has been converted to multilane entry as recommended, the bypass lane has been removed.

    KAI Response: The SB approach was previously a multilane entry, and the view angle appears to be approximately the same despite minor adjustment to the approach geometry. The heavy offset left of the SB approach is also creating the need for a longer tangent at the entry and additional width for truck offtracking. Adjustment to the SB approach alignment or shape of the western roundabout (more of an oval shape) would be two possible options for further improving the view angles if it they can be accommodated within the project constraints.

    H&L Response: Oval shapes are not preferred due to the changing in speed and turning radius through the roundabout. We do not believe that would be an appropriate design solution. The line of sight meets the minimum per AASHTO and the design team will continue to look for opportunities to increase it to the desirable 75 degrees.

19. Along the south side of the central island a tangent and relatively small radius are used to develop a spiral around the circulatory roadway. This will create an awkward path for drivers when attempting a u-turn maneuver. Consider smoothing the circulatory roadway travel path as illustrated in the attached redlines.

    H&L Response: A smoother curve will be designed and used at this location.

    KAI Response: The updated plans do not appear to have incorporated the suggested edit. Consider adjusting the shape of the central island to provide a smoother u-turn per the original comment.

    H&L Response: A smoother curve will be designed and used at this location.

20. Update the spelling for all "YIELD" legends shown in the design. The drawings are currently misspelled "YEILD".

H&L Response: The spelling has been corrected.

KAI Response: No further comment.

21. To minimize additional impacts on the north leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the east to improve driver view angles and alignment of the SB to WB right-turn bypass lane with less impact to the west side of the existing I-95 off-ramp.

    H&L Response: This change was considered early in the conceptual layout of the project. It was decided to keep the U-turn movement since full access is not being provided at all side roads.

    KAI Response: No further comment.

NB Ramp Geometric Design Notes

22. The EB entry is approximately 45 feet wide as currently designed. This is much wider than the typical range of 24 to 30 feet. It appears that the entry width can be reduced while still providing adequate WB-67 truck accommodation.

    H&L Response: The entry width will be reduced to the minimum width that will allow a WB-67 to approach the roundabout without encroaching into the adjacent lane or outside the pavement limits.

    KAI Response: The revised design still incorporates a 40 foot entry width. WB-67 vehicles are commonly accommodated with a narrower width closer to the typical range. OSOW vehicles may need additional aprons. The truck checks show the WB-67 in the outside lane to not use any of the striped vein island separating the two entry lanes. Commonly the vein island separating the two lanes is utilized by trucks in both lanes to minimize the overall entry width. It appears that the EB entry width could be reduced by at least 6 feet to better match the width of the circulatory roadway.

    H&L Response: The entry width has been reduced to the minimum width that will allow a WB-67 to approach the roundabout without encroaching into the adjacent lane or outside the pavement limits. This design considers WB-67's side by side at the entry. The striped out areas shown in the layout are used by the adjacent lane truck's off tracking. No further action is needed.

23. On the NB approach, add a Yield controlled right-turn bypass lane to the design to preserve necessary space to accommodate the future construction.

    H&L Response: The recommended change has been made.

    KAI Response: No further comment.

24. Adjust the curbline between the NB entry and the EB exit to smooth out the driver path. Drivers are more likely to swing wide to make the right-turn in a smooth arc than to navigate the tight reverse curves. This could result in sideswipe type crashes within the circulatory roadway. A tangent through the EB exit could be used in combination with an adjusted radius on the NB entry to smooth out the path.

    H&L Response: The recommended change has been made.

    KAI Response: There continues to be a hard angle point where the curbline on the right side of

the NB entry meets the circulatory roadway. This could be rounded off to make a smoother transition.

H&L Response: The tight radius is designed to discourage right turns at this location. Right turn movement will be made using the bypass lane. No further action is needed.

25. The proposed WB to NB right-turn bypass lane provides an undesirable driver view angle. One option to improve the view angle is to "flatten" the NB exit geometry such that they yield line for the bypass lane is pulled back from its current position.

    H&L Response: The NB Exit was modified as recommended to increase the line of sight angle from the WB slip lane. Existing development and constraints limit the placement of the roundabout and the design of the approaches. In an effort to achieve a balanced design, a minimum angle of 60 degrees is used. This meets the allowable intersection skew angles defined by AASHTO.

    KAI Response: It appears that a minor adjustment to the right-turn alignment is possible (without increasing the roundabout footprint) that would bring the driver view angle closer to 70 degrees. While achieving at least a 75 degree view angle is desirable, the alignment should be adjusted to the extent possible within the project constraints.

    H&L Response: The design as shown provides an acceptable line of sight angel per AASHTO. The design team will strive to improve the line of sight angle through the design process while balancing the impacts to existing development.

26. For the multilane pedestrian crossing on the EB exit, push the crossing back approximately 70 feet from the edge of the circulatory roadway to create a staggered crossing. This configuration allows for addition of supplemental treatment, such as a Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacons, to support crossing by visually impaired pedestrians. The identified crosswalk setback represents space for vehicle queuing plus minimum buffers between a stop bar and the PHB. If not implemented as part of the initial design, this configuration would better support addition of a PHB in the future, if desired or required by the final adopted PROWAG requirements.

    H&L Response: The crosswalk was staggered from 20-feet to 40-feet from the edge of the circulatory roadway. An offset of 70-feet was not used because it would reduce the already small storage provided at the EB left turn lane for Thunderbird Drive.

    KAI Response: The position of the crosswalk may impact the types of supplemental pedestrian crossing devices that may be able to be utilized for the multilane exit. However, no further response is required.

27. Update the spelling for all "YIELD" legends shown in the design.

    H&L Response: The spelling has been corrected. *KAI Response: No further comment.*

28. Use of a tangent through the EB exit is suggested to reduce the potential for exit vehicle path overlap and support addition of a Yield controlled NB right-turn bypass lane.

    H&L Response: The recommended change has been made. *KAI Response: No further comment.*

29. Consider re-aligning the south leg of the roundabout to better align the entry with the receiving lane within the circulatory roadway.

H&L Response: The recommended change has been made.

KAI Response: The south leg entry remains offset to the left more than required to achieve the necessary speed control. In addition, the heavy offset-left alignment is making it more difficult for WB-67 and other oversize vehicle accommodation that is resulting in the need for a wide entry. The fastest path speed for this entry is 23 MPH, so there is an opportunity to shift the entry to the right of its current position and maintain an acceptable entry speed. See Figure 4.

H&L Response: The design team will continue to look for opportunities to improve the design throughout the design process, including the above comment. These changes, if possible, will be made during the final design phase.

30. To minimize additional impacts on the south leg of the intersection from re-alignments, alternative consideration could be given to eliminating the u-turn movement from the roundabout. This would allow the roundabout to be pushed approximately 20 feet to the west to improve driver view angles and alignment of the WB to NB right-turn bypass lane with less impact to the east side of the existing I-95 off- and on-ramps.

    H&L Response: This change was considered early in the conceptual layout of the project. It was decided to keep the u-turn movement since full access is not being provided at all side roads.

    KAI Response: No further comment.

Additional Multimodal Notes:

31. For multilane roundabouts, it is common for bike ramps to be provided to and from an adjacent multiuse path to allow bicycle riders the option of exiting the roadway to navigate around the roundabout rather than ride through as a vehicle. No bike ramps are currently provided. However, the close proximity of driveways and roadways such as Thunderbird Drive and Longwood Drive do provide opportunities for bicyclists to transition to and from the adjacent sidewalk. Please provide further discussion of the intended bicycle accommodation features as part of the roundabout feasibility study.

    H&L Response: This project does not meet bicycle warrants defined by GDOT and is not part of the local MPO planned bicycle routes. The project is located at the end of the rural area of Richmond Hill and the area to the west of the project consists of rural land and a military base. There are no destinations that would lead a bicyclist through the project.

    KAI Response: If no bicycle facilities are provided upstream/downstream of the roundabouts along SR 144 then bike ramps would not be required. However, the H&L team should coordinate with GDOT staff to verify the teams approach to omit bike amenities form the multilane roundabout design.

    H&L Response: This project does not meet bicycle warrants defined by GDOT.

32. A 5 foot sidewalk is currently proposed around the interchange area. To accommodate pedestrians and bicycles, a path at least 8 feet wide (10 foot desirable) is suggested. However, it is unclear whether a wider path will fit under the Existing I-95 bridge structure.

    H&L Response: This project does not meet bicycle warrants defined by GDOT.

    KAI Response: If no bike ramps are provided onto the sidewalk and bikes are not anticipated to be using the sidewalk, then a standard width sidewalk can be utilized in lieu of a multiuse path. However, the H&L team should coordinate with GDOT staff to verify this approach.

H&L Response: This project does not meet bicycle warrants defined by GDOT and is not part of the local MPO planned bicycle routes. No further action is needed.

Construction Staging

33. No information was provided regarding construction staging. Construction staging and maintenance of traffic will be evaluated as part of future review iteration.

    H&L Response: Construction staging will be provided for future reviews of the project.

    KAI Response: No further comment at this time.

NEW COMMENTS

The following are new comments generated as part of review of the updated roundabout design received from H&L on 10/12/15.

34. On the eastbound exit of the eastern roundabout, the H&L WB-67 truck paths show the cab of the truck tracking over the splitter island; however, it appears the template could be adjusted to allow the truck to remain in its lane.

    H&L Response: The cab tracking over the splitter island was shown in error. The truck paths have been updated. No further action is required.

35. Various locations at both roundabouts appear to have wider pavement width than needed to accommodate WB-67s. We recommended continuing to look for opportunities to reduce lane widths where possible. See redline mark-ups for examples.

    H&L Response: The design team will continue to look for opportunities to improve the design throughout the design process, including the above comment. These changes, if possible, will be made during the final design phase.

36. For locations where extra striped out space is provided for accommodation of OSOW vehicles (such as the NB entry), consider using an outside apron instead of just striping out the pavement to keep the entry width closer to the typical ranges outlined in NCHRP Report 672.

    H&L Response: The stripped out area is designed to accommodate the WB-67 off tracking, blisters are used where needed for OSOW accommodations. The design team will continue to look for opportunities to improve the design throughout the design process.

37. The OSOW truck turning templates show booster trailers off-tracking over curbs in several locations. Examples include:

    a. Tracking over the splitter separating the EB entry and EB bypass lanes at the eastern roundabout.

    b. Tracking over the landscaped area of the central island for the NB to WB left-turn movement at the eastern roundabout.

    c. Tracking over the outside curbline for the SB right-turn at the western roundabout.

    d. Tracking over the inside curbline at the SB exit from the western roundabout as well as off-tracking along the SB ramp itself.

H&L Response: The OSOW will be allowed to off track over the curb. The off tracking will be accommodated with blisters or truck apron. The curb used in the area of off tracking will be mountable and vertical clearance will be verified as the design progresses. No further action is needed.

38. At the western roundabout, along the central island near the SB entry, the truck apron has a sharp point to it. The way design vehicles will track over this point on the truck apron, there is the potential for premature wear. Rounding off the point on the truck apron will minimize the extent to which trucks need to use the apron as well as help to minimize wear.

    H&L Response: The recommended change has been made.

39. At the eastern roundabout, the single-lane portions of the circulatory roadway have a width of 16 feet. This is at the narrow end of the typical range (16 to 20 feet). Increasing the circulating width may help with truck accommodation for the EB entry.

    H&L Response: Increasing the circulatory width to the maximum of 20-feet would not avoid the WB-67 using the truck apron. During final design of the apron, smaller trucks could be studied and the apron could be adjusted if it would reduce conflicts. The design team will continue to look for opportunities to improve the design throughout the design process, including the above comment. These changes, if possible, will be made during the final design phase.

40. Use gore striping between the two entry lanes on the west leg of the western roundabout for consistency with other multilane entries.

    H&L Response: The recommended change has been made

41. The placement of some crosswalks could be improved. In the absence of site-specific constraints, crosswalks should be placed approximately 20 feet back from the roundabout on entries, yield-controlled bypass lanes, and single-lane exits and several car lengths back from the roundabout on multilane exits to support signalization in the event is required in the future by PROWAG. Consider the following adjustments to the crossing locations:

    a. The crosswalk on the west leg entry of the western roundabout is approximately 70' back from the roundabout and should be closer to 20 feet back

    b. The crosswalk on the north leg bypass lane of the western roundabout is approximately 30 feet back from the yield line and should be closer to 20 feet back if there is sufficient space on the island to develop a ramp and level landing. Please also make sure that the pedestrian crossing is appropriately aligned

    c. The crosswalk on the south leg bypass lane of the eastern roundabout is approximately 70 feet back from the yield line and should be closer to 20 feet back.

    d. The crosswalk on the east leg entry of the eastern roundabout is approximately 30 feet back from the yield line and should be closer to 20 feet back.

    H&L Response: The location of the cross walks have been modified.

42. For the cut-through areas of the splitter islands, align the curblines within the pedestrian refuge to generally be in-line with the actual crossing. Adjustments could be made to the west leg of the western roundabout and the east leg at the eastern roundabout.

H&L Response: It is GDOT standard practice to keep the crosswalk perpendicular to the roadway to reduce the length of the pedestrian crossing to the minimum. The recommended changes was not made.

43. At the eastern roundabout, the island separating the WB entry from the WB right-turn bypass lane does not extend through the pedestrian crossing. This results in no raised ped refuge to protect pedestrians. We recommend that the island be extended further to the east to accommodate a raised pedestrian refuge.

    H&L Response: The refuge area provided by this would be less than the 6-foot width required by NCHRP 672 and would not provide a safe area for pedestrian refuge. This bypass should be studied to see if the refuge area can be increased to the 6-foot requirement. Due to the status of the environmental studies, changes affecting Right of Way cannot be made at this time. The recommended change should be studied, and if it is viable, made during the final design phase.

44. H&L provided sight triangles for intersection sight distance (ISD). The following notes were identified from a cursory review of the sight triangles.

    a. When drawing the ISD triangles, the starting point for the triangles should be based on a vehicle positioned 50 feet back from the yield line, not at the yield line. This is illustrated on Page 6-63 of NCHRP Report 672. Each of the ISD sight triangles should be updated to reflect the correct starting point.

    b. The shading of ISD triangles should include areas over islands, not just areas over the roadway. This is important for developing the landscaping plan.

    c. Stopping sight distance triangles on the approaches and within the circulatory roadway should also be prepared.

    H&L Response: The design team will continue to look for opportunities to improve the design throughout the design process, including the above comment. These changes will be made during the final design phase.

Concept Meeting Minutes

Project: TOOPSDDES110124, PI No.: 0010739, Bryan County
SR 144 at I-95 SB & NB Off Ramps

Date: 11-05-2014

H&L Project Number: 2011.006.020

Attendees: Matt Bennett (GDOT – Program Manager)
Cassius Edwards (GDOT – Project Manager)
John Walker (Kimley-Horn - Traffic)
Rudolph Frampton (Heath & Lineback)
Warren Dimsdale (Heath & Lineback)
Paul Williams (GDOT – Utilities)
Scott Allison (City of Richmond Hills)
Chris Lovell (City of Richmond Hills)
Harold Fowler (City of Richmond Hills)
John Kopotic (GDOT – Engineering Services)
Scott Burns (GDOT – Traffic Operations)
Aaron Burgess (GDOT – NEPA Specialist) – Via Phone
Cory Knox (GDOT – OES) – Via Phone
Matthew Kear – (GDOT - History) – Via Phone
Paul DeNard (GDOT - Traffic Operations) – Via Phone
Darrell Richardson (GDOT – Performance Management) – Via Phone
Scott Zehngraff (GDOT – Traffic Operations) – Via Phone

Minutes By: Warren Dimsdale

Overview

A Concept Meeting was held November 4, 2014 at the Richmond Hill City Hall.

This project proposes operational improvements on SR 144 at the I-95 interchange. The proposed improvements consist of adding roundabouts on SR 144 at the I-95 ramps, dedicated right turn lanes from SR 144 onto the I-95 NB & SB Entrance Ramps and pedestrian accommodations throughout the project limits.

Project Concept Report Discussion:

Warren Dimsdale gave an overview of the proposed project layout as described in the concept report.

Chris Lovell asked if an opening allowing full circular movement around each roundabout was needed. He was concerned that this movement would add confusion to the function/usage of the roundabouts. John Walker said he would model the roundabouts with and without the opening and compare the results.

Rudolph Frampton noted that the current roundabout configuration design will allow pedestrian access underneath the I-95 overpass bridge unlike the signal alternate which restricted pedestrian access.

It was noted that this is a deployment route for Fort Stewart and that the design team should meet with Ft Stewart to ensure that the design does not limit their mobility (I.E. Low boy that is a WB 67 with an additional 40-foot articulating rear wheel section).

Scott Zehngraff noted that alignment offsets for speed control between the roundabouts will not be necessary. The alignment offsets will be needed at the approaches to the outside of the roundabouts.

Matt Bennett noted that a Staging and Transportation Management Plan will be required for the project and the SP 150 will cover it on construction.

Matt Bennett said that if we choose to check yes for the Context Sensitive Design section then we should highlight the use of the roundabouts as being a context sensitive design. This will include the fact that GDOT is going to hold public meetings to educate the public and promote public awareness of the roundabouts. H&L should add as much information to explain why we believe it is a context sensitive design.

Paul Williams said that he would get existing utility information to HLE by the end of the week (11/7/14).

Arron Burgess gave a summary of the Environmental Task:

- The Carbon Monoxide hotspot analysis will be required which will take approximately 2 months to complete after getting the ISSR.
- An ecology field survey will be required for the additional project area. If wetlands are picked up in the survey a 404 permit may be required.
- History studies should be complete by the end of February 2015. A history field survey will be required for the additional project area. A finding of no effects is expected on the historic resource that was located.
- Archeology studies will take 3 months to complete from the time they received the ISSR.
- Aaron Burgess said an Open House will be warranted for the project. The project schedule should allow 3 months for the open house process.

Warren Dimsdale asked if a preliminary Pavement Type Study will need to be performed now that the design will reconfigure the intersection. Matt Bennett said the need for the pavement type study and a pavement design needs to be determined. This may also change the concept report from the Limited Scope report to the full Concept Report. Additionally, the schedule should account for the time needed to get an approved pavement design. Rudolph will contact Dave Peters to determine the type of Concept Report required.

Right of Way:

Matt Bennett asked that H&L verify how much right of way is needed and reduce what we are showing where possible. H&L should limit right of way to 10-feet beyond the cut/fill slope.

Matt Bennett said the minimum time required for Right of Way will be 9 months. The project schedule should assume 12 months for the Right of Way process.

Rudolph Frampton noted that a one year adjustment for Right of Way will put the Project Let Date at November 2016. This will still be a slightly accelerated Let Date ahead of the original GDOT scheduled Let Date of February 2017.

Matt Bennett said a PCRF (Project Change Request Form) will not be required for adding Right of Way to the Schedule since the proposed scheduled let date will be before the original GDOT Let Date of February 2017.

All GDOT peer reviews and feasibility studies should be done prior to finalizing right of way.

Public Involvement:

Matt Bennett said that PIOH could be held as soon as February. The PIOH layout should show the ESA areas. Scheduling of a peer review will probably control the date the PIOH can be held. This would place the PIOH date around April 2015.

Contracts:

Paul DeNard is working on the scope for the feasibility study and peer review.

Scott Zehngraff would like to hold incremental peer reviews. Rudolph Frampton agreed that H&L would welcome the additional quality it would add.

The project will likely shift from an operational improvement project to a safety improvement project, which will allow for different funding.

Traffic:

John Walker said he would send Paul DeNard and Scott Zehngraff his traffic data for use in their review.

John Walker noted that the traffic reports have not been updated to reflect the roundabout configuration.

Scott asked that we set up a meeting in Atlanta at TMC to review the design and give the department a chance to suggest design changes before the design is sent out for peer review. The meeting should be set up through Paul DeNard or Scott Zehngraff and include Heath and Lineback and Kimley Horn.

Matt Bennett noted the major priorities of the project are to reduce backup and delay on the interstate ramps and to address the AM and PM traffic coming from Fort Stewart.

Matt Bennett noted that this is not a capacity improvement project therefore logical termini is not a requirement for this project.

Matt Bennett noted that the traffic data will need to be less than 5 years old when the reevaluation is performed for air and noise.

Risk Management:

Engineering Risk:

Darrell Richardson pointed out that a Design Exception will be required for the encroachments within the required limited access area of 300-ft from the interstate ramp radius returns. Matt Bennett said to verify where the existing limited access area stops now because there are interchanges in the area that do not have the required 300-ft limited access.

Darrell Richardson noted the required alignment offset for the roundabouts may affect the required right of way and the independent peer review could modify the design. Coordinating with Scott Zehngraff and Paul DeNard on the design will help reduce this risk.

Environmental Risk:

Arron Burgess gave a summary of the Environmental Risk:

- OES will need the updated traffic report.
- A 404 permit may require a lockout time for plan review. This should be verified with Lee Williams and included in the project schedule.
- Public controversy or public opposition may be a risk for the roundabout option. Public meetings can help mitigate this risk.

Darrell Richardson noted that constant coordination will need to take place between the designer and the environmentalist to keep OES aware of any changes on the project.

Action Items:

1. John Walker will model the roundabouts with and without the opening that allows full circular movement of each roundabout and make a recommendation.
2. John Walker will send Scott Zehngraff and Paul DeNard his traffic data for the roundabouts for their use in reviewing the roundabouts.
3. Aaron Burgess will send ESA delineations to H&L to include in the PIOH layouts.
4. Warren Dimsdale will send a revised ISSR form to Aaron Burgess for the environmental studies.
5. Rudolph Frampton will schedule a meeting with Scott Zehngraff, Paul DeNard and John Walker within the next 2 weeks to review the design and give the department a chance to discuss and suggest design changes with the design team.
6. Cassius Edwards will schedule a meeting with stakeholders from Fort Stewart to discuss their design needs, desires and constraint criteria (including design vehicle).
7. Rudolph Frampton will contact Dave Peters to determine the type of concept report required.

Project Team Meeting Minutes

Project: TOOPSDDES110124, PI No.: 0010739, Bryan County
SR 144 at I-95 SB & NB Off Ramps

Date: 6-02-2014

H&L Project Number: 2011.006.020

Attendees: Cassius Edwards (GDOT)
Warren Dimsdale (Heath and Lineback Engineers)
Rudolph Frampton (Heath and Lineback Engineers)
Grey Hunter (McKim and Creed)
Lee Williams (Edwards-Pitman)

Minutes By: Warren Dimsdale

Overview

A project kick off meeting was held June 2, 2014 on the project site at 11:00 am. The purpose of this meeting was to introduce the project team, provide the opportunity to discuss the role of each team member, to discuss project schedule and scope, and hold a team site visit.

Meeting Minutes

Scope & Schedule:

- Rudolph and Warren described the planned improvements. The southbound exit ramp will be improved to have 2-left turn lanes and 1-right turn lane. The northbound exit ramp will be improved to have 1-left turn / right turn combined lane (no additional lanes anticipated). SR 144 will be improved to have 2-thru lanes in each direction under the I-95 overpass, left turn lanes for the northbound and southbound entrance ramps under the I-95 overpass and extending out as storage requires, and right turn lanes for the I-95 northbound and southbound entrance ramps. A traffic signal will be studied and installed if warranted at the northbound exit/entrance ramp. See attached layout.
- The project schedule is currently 24 months. GDOT would like to reduce the schedule to 18 months. H&L is working to develop a modified schedule. McKim & Creed, Edwards-Pitman, and Kimley Horn will attempt to reduce the contracted work deadlines.
- The project is classified as a Quick Project. All team members should become familiar with the PDP process for Quick Projects.

Environmental:

- PCE or CE level document is anticipated for the project.
- Edwards-Pitman will be responsible for Ecology Studies.
    - Lee Williams noted that a field visit with DNR is needed for consultation pertaining to identification of existing resources. H&L Requested that this be done ASAP.
- GDOT will be responsible for the NEPA document. All studies and reports outside of Ecology will be completed by GDOT OES.

Survey:

- Rudolph noted that property entry letters will need to be prepared ASAP for submittal to property owners.
- Grey expects his survey team to mobilize for survey field work in approximately 2 weeks.
- Grey will consult with H&L to determine if there are any changes to the limits of the survey boundary before beginning field work.

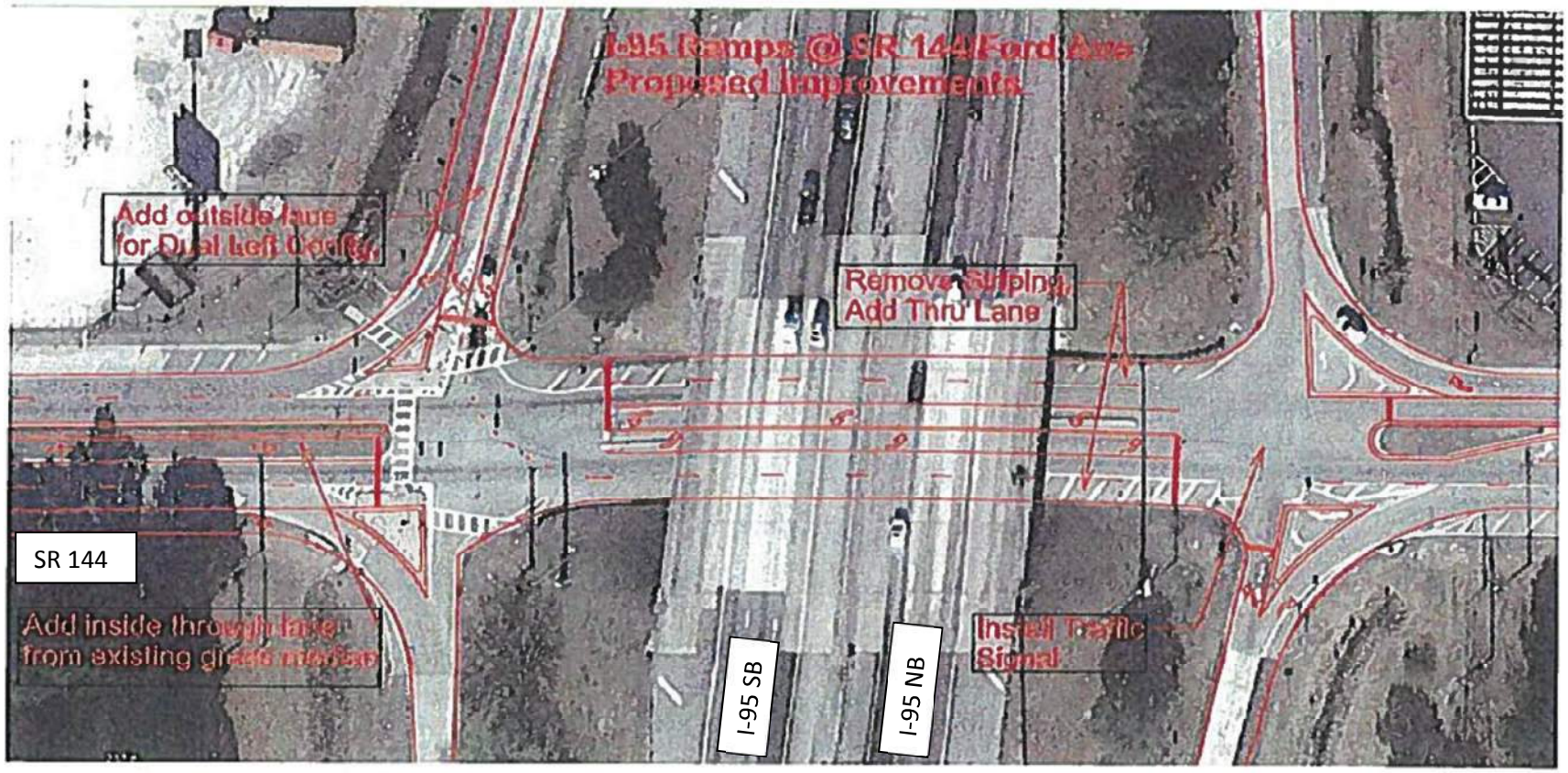
Reporting & Project Status:

- Rudolph noted that regular project updates will be provided as need.
- Cassius mentioned that he would like to hold status meetings which could be done by phone. The frequency will be determined.

Action Items:

All Subs:	Submit Revised Schedule to H&L
Edwards-Pitman:	Schedule meeting with DNR to identify existing project resources.
McKim and Creed:	Complete property letters and provide to H&L for review, then submit to property owners.
GDOT PM:	Provide H&L with NEPA Specialist contact information.

Project layout:



Project Team Meeting Minutes

Project: TOOPSDDES110124, PI No.: 0010739, Bryan County
SR 144 at I-95 SB & NB Off Ramps

Date: 7-10-2014

H&L Project Number: 2011.006.020

Attendees: Cassius Edwards (GDOT - PM) – Video Conference
Aaron Burgess (GDOT – NEPA Specialist)
Jim Pomfret (GDOT – Archeology)
Matthew Kear – (GDOT - History)
Jaime Collazo (GDOT - Ecology)
Soli Shakshuki (GDOT – Air & Noise)
Collin Lane (Edwards Pitman - Ecology)
Warren Dimsdale (Heath and Lineback Engineers)
Rudolph Frampton (Heath and Lineback Engineers)
Allen Krivsky (Heath and Lineback Engineers)

Minutes By: Warren Dimsdale

Overview

A project Team meeting was held July 10, 2014 at the GDOT Office of Environmental Services at 1:00 pm. The purpose of this meeting was to review the scope of the project with the team, discuss the project schedule, anticipated level of environmental document, and project concerns. This project is classified as a quick project.

Meeting Minutes

Project Scope:

- Warren discussed the Project Justification that was provided by GDOT for the project. The Justification Statement was approved on February 7, 2012. Warren wanted to make sure there were no issues with the document being 2 ½ years old.
- The proposed typical section for SR 144 includes two 11-foot travel lanes in each direction under the I-95 overpass and opposing 11-foot left turn lanes for the I-95 northbound and southbound entrance ramps under the I-95 overpass extending out as storage requires. SR 144 will have variable width rural shoulders; existing curb and gutter will be retained or replaced and all work will remain within the existing pavement limits of SR 144. SR 144 improvements will also

include a right turn lane for the I-95 southbound entrance ramp. The additional lane will be added to the outside of the existing pavement limits of SR 144. Right of way is currently anticipated on the parcel adjacent to this added right turn lane.

The typical section for the I-95 southbound exit ramp will be improved to have two 12-foot left turn lanes and one 12-foot right turn lane at the approach to SR 144 with 12-foot shoulders and rural side ditches. The additional lane will be added to the outside of the existing southbound exit ramp. The I-95 southbound entrance ramp will be modified at the intersection with SR 144 to tie into the SR 144 improvements. The I-95 northbound exit ramp will be improved at its intersection with SR 144 to have one 16-foot left turn lane with a right turn slip lane at the approach to SR 144 and to tie into the SR 144 improvements. The I-95 northbound entrance ramp layout will remain the same.

- Rudolph noted that the proposed project will not provide pedestrian access underneath the bridge. Any pedestrians crossing underneath the bridge would currently use the existing 14-foot paved shoulders. The proposed lane configuration provides an approximate 3-foot wide shoulder from the edge of travel lane to face of the existing bent. A barrier is anticipated which would further reduce the shoulder width.
- Aaron noted that he would look into whether pedestrians are crossing under the bridge currently. He also mentioned that some public outreach may be required (possible P.I.O.H.).
- Soli Shakshuki noted that there may be a construction cost limit on quick projects. Cassius should verify that there is no conflict.

Environmental Document and Studies:

- The team consensus was a CE level document will be required for the project.
- GDOT's project baseline schedule has the LET date approximately 33 months from the Notice to proceed date. GDOT would like to reduce the schedule to 18 months from the Notice to Proceed date.
- Rudolph has developed a modified schedule to meet the 18 month date. The modified schedule requires submittal of the CE document to FHWA for approval by January 14, 2015.
- The 18 month schedule is based on no Right of Way being required for the project. The project was scoped to have a CE completed in 9 months.
- Edwards-Pitman will be responsible for Ecology Studies.
    - Collin Lane noted that Lee Williams will need to schedule a field visit with DNR and EPD for consultation on identification of existing resources.
    - Collin Lane does not believe that there will be an issue completing the report for the schedule if no streams are identified. He did voice concerns that Corps may identify the ditches as jurisdictional.
    - This would cause scheduling issues with needing to apply for Stream Buffer variances.
    - Collin Lane also noted that if endangered species are identified this would lengthen the time Edwards Pitman needs to complete reports.

- GDOT will be responsible for the NEPA document. All studies and reports outside of Ecology will be completed by GDOT OES.
- Soli Shakshuki said he will need traffic Level of Service, Elevations, Edge of pavement, and Right of Way lines to complete the Air and Noise study.
- Soli Shakshuki estimates it will take him 2-3 months to complete his studies once he has all the required data.
- Matthew Kear does not anticipate any historic resources being present since the project is located within an existing interstate interchange.
- Matthew Kear noted that if any historic resources are found it may present schedule conflicts.
- Jim Pomfret noted that archeology studies would take 2 to 3 months to complete.
- All OES team members requested a copy of the DGN files.
- Aaron requested that we update the Initial Special Studies Request to include the need for Right of Way in the South West quadrant of the project.
- Initial screenings will being soon after the revised special studies request is received.
- Heath and Lineback will need to determine if the design can be modified to avoid Right of Way in the South West quadrant of the project.
- Warren will need to estimate the amount of Right of Way needed and send Aaron area.

Reporting & Project Status:

- OES status updates will go through Aaron Burgess

Action Items:

- Aaron Burgess will look into pedestrian access crossing issue underneath the bridge.
- Heath & Lineback will update the special studies request to include the need for Right of Way and the amount of Right of way needed.
- Heath & Lineback will provide .dgn files to Aaron Burgess for distribution to the team.
- Heath & Lineback will need to verify when additional traffic counts can be taken so that LOS can be provided for Air and Noise studies.
- Cassius Edwards will verify if the project qualifies as a quick project.
- Lee Williams to Schedule field meeting with the EPD/CORPS.

Attachments:

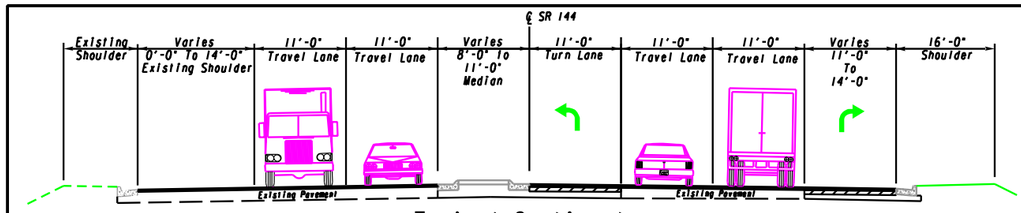
- Current Concept Layout
- Schedule
- Sign-in Sheet

SR 144 at I-95 SB & NB Ramps

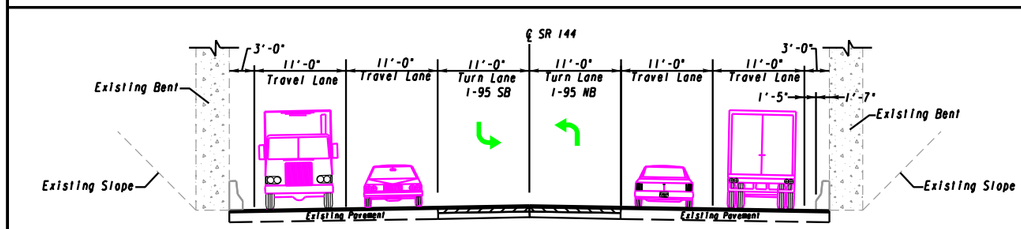
SCALE IN FEET
0 50 100 200

Heath & Lineback Engineers
INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393
(770)424-1668

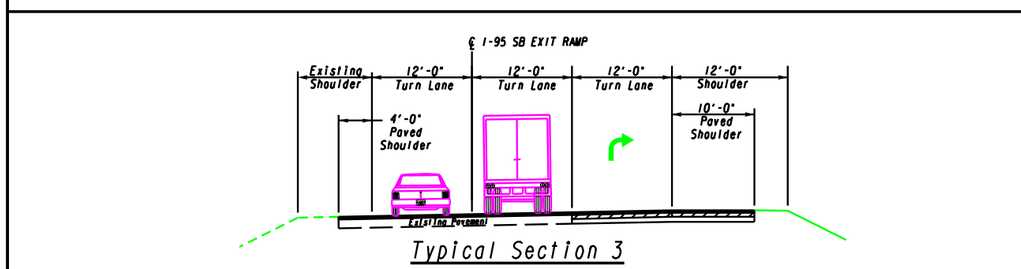
Georgia Department of Transportation



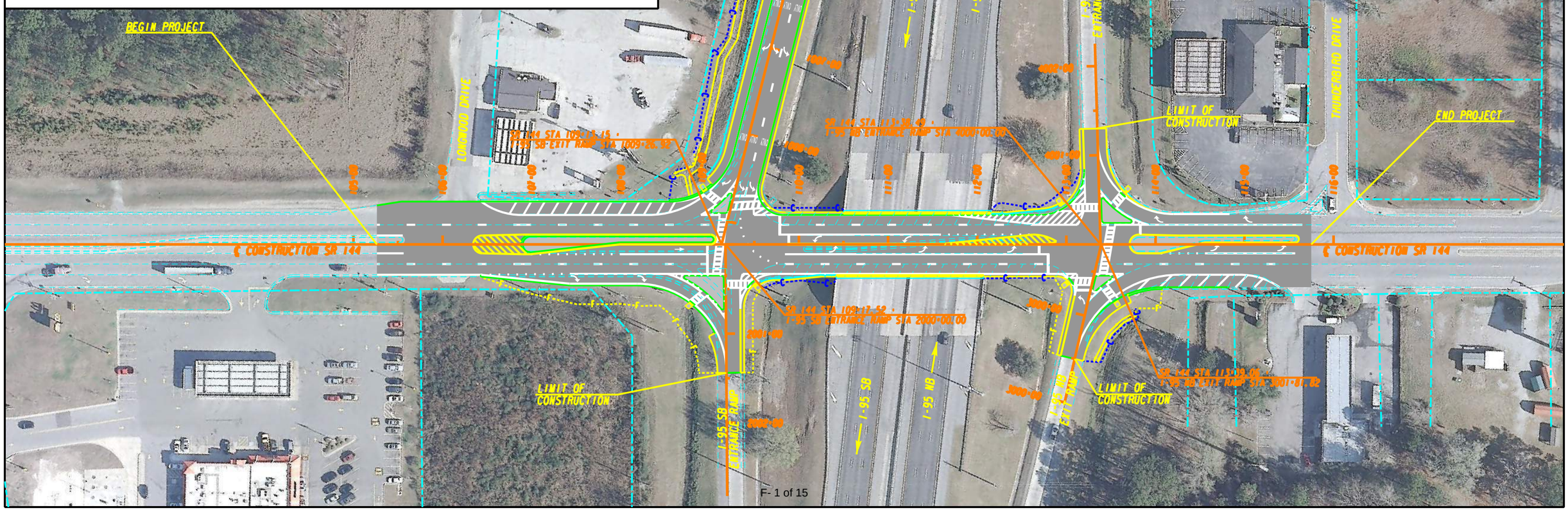
Typical Section 1



Typical Section 2

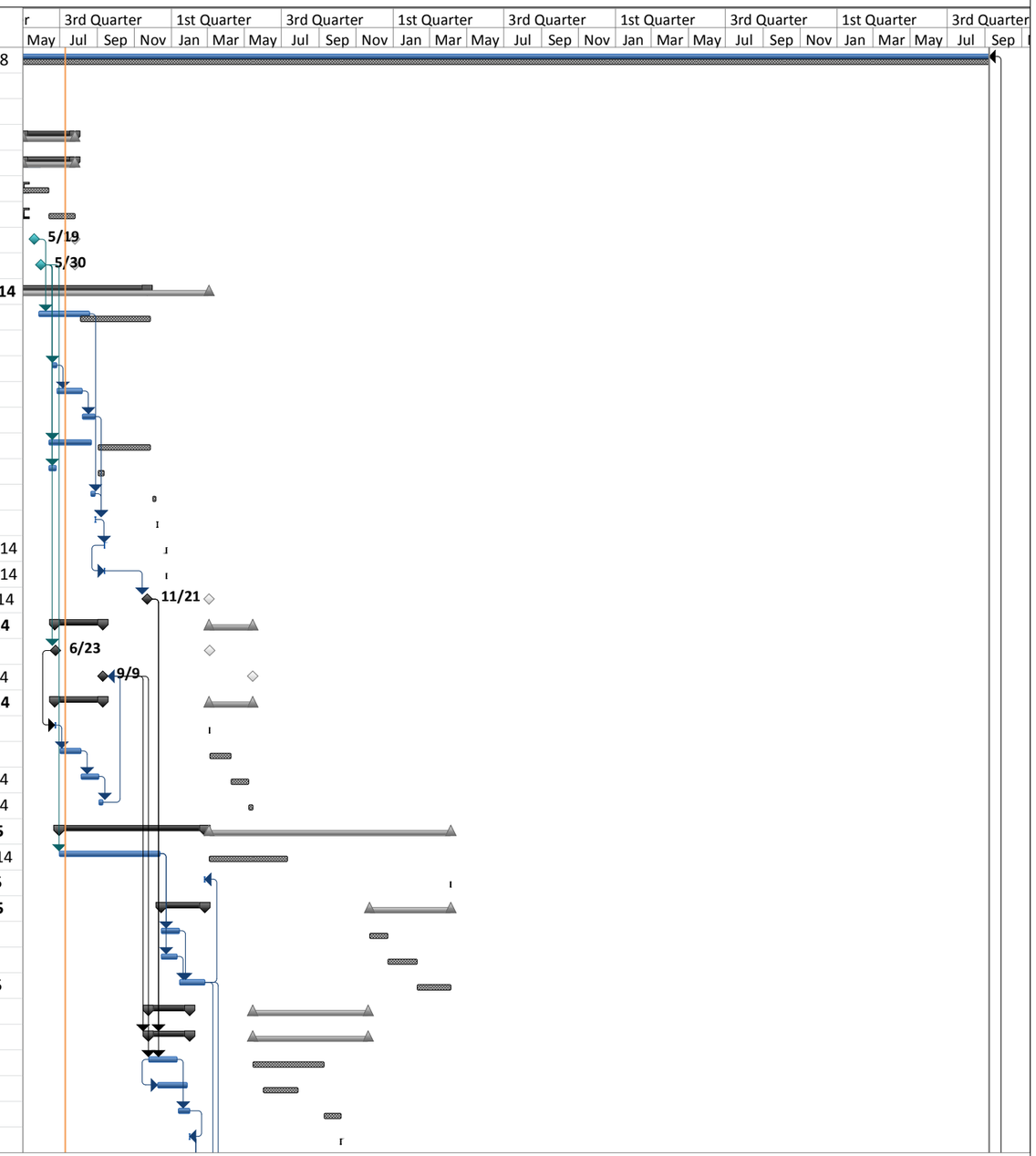


Typical Section 3



SR 144 at I-95 SB and NB Off Ramps
P.I.#:0010739, Bryan County

ID	Task Name	Duration	Baseline Start	Baseline Finish	Start	Finish
1	Project Summary	1719 days	February 7, 2012	September 7, 2018	February 7, 2012	September 7, 2018
2	**Project Initialization**	**0 days**	**March 22, 2012**	**March 22, 2012**	**March 22, 2012**	**March 22, 2012**
3	PE Funding Authorization	1 day	March 22, 2012	March 22, 2012	March 22, 2012	March 22, 2012
4	**Consultant Contract**	**62 days**	**May 1, 2014**	**July 25, 2014**	**May 1, 2014**	**July 25, 2014**
5	**Consultant Contract Summary**	**62 days**	**May 1, 2014**	**July 25, 2014**	**May 1, 2014**	**July 25, 2014**
6	Consultant Signs Contract	1 day	May 1, 2014	June 12, 2014	May 1, 2014	May 1, 2014
7	GDOT Signs Contract	1 day	June 13, 2014	July 25, 2014	May 1, 2014	May 1, 2014
8	PE Notice to Proceed	1 day	July 25, 2014	July 25, 2014	May 19, 2014	May 19, 2014
9	Subs NTP	0 days	July 25, 2014	July 25, 2014	May 30, 2014	May 30, 2014
10	**Concept Development**	**729 days**	**February 7, 2012**	**March 3, 2015**	**February 7, 2012**	**November 21, 2014**
11	Define Project Concept	60 days	August 4, 2014	November 26, 2014	May 27, 2014	August 18, 2014
12	Project Justification	1 day	February 7, 2012	February 7, 2012	February 7, 2012	February 7, 2012
13	Traffic Counts	5 days	NA	NA	June 19, 2014	June 25, 2014
14	Traffic Report/Signal Warrant	6 wks	NA	NA	June 26, 2014	August 6, 2014
15	Approval of Traffic Report/Signal Warrant	3 wks	NA	NA	August 7, 2014	August 27, 2014
16	Request Ecological & Historic Resources	50 days	September 2, 2014	November 26, 2014	June 13, 2014	August 21, 2014
17	Noise and Air Impacts Identification	8 days	September 2, 2014	September 11, 2014	June 13, 2014	June 24, 2014
18	Review Local/Consultant Concept	5 days	December 1, 2014	December 5, 2014	August 21, 2014	August 27, 2014
19	Concept Team Meeting	1 day	December 8, 2014	December 8, 2014	August 28, 2014	August 28, 2014
20	PM Submit Concept Report	1 day	December 23, 2014	December 23, 2014	September 12, 2014	September 12, 2014
21	Concept Report Review and Comments	1 day	December 23, 2014	December 23, 2014	September 12, 2014	September 12, 2014
22	Management Concept Approval	1 day	March 3, 2015	March 3, 2015	November 21, 2014	November 21, 2014
23	**Database Preparation**	**57 days**	**March 4, 2015**	**May 14, 2015**	**June 23, 2014**	**September 9, 2014**
24	Start Database Preparation	1 day	March 4, 2015	March 4, 2015	June 23, 2014	June 23, 2014
25	Database Complete	0 days	May 14, 2015	May 14, 2015	September 9, 2014	September 9, 2014
26	**Field Survey**	**57 days**	**March 4, 2015**	**May 14, 2015**	**June 23, 2014**	**September 9, 2014**
27	Pre-Survey Field Meeting	1 day	March 4, 2015	March 4, 2015	June 23, 2014	June 23, 2014
28	Field Surveys	25 days	March 5, 2015	April 8, 2015	July 1, 2014	August 4, 2014
29	SDE Process Work	21 days	April 9, 2015	May 7, 2015	August 5, 2014	September 2, 2014
30	Review Local/Consultant Field Survey	5 days	May 8, 2015	May 14, 2015	September 3, 2014	September 9, 2014
31	**Environmental**	**172 days**	**March 4, 2015**	**April 4, 2016**	**June 30, 2014**	**February 24, 2015**
32	Start Environmental/Request & Develop(Special Studies)	120 days	March 4, 2015	July 10, 2015	June 30, 2014	December 12, 2014
33	Environmental Approval Complete	1 day	April 4, 2016	April 4, 2016	February 24, 2015	February 24, 2015
34	**CE**	**52 days**	**November 23, 2015**	**April 4, 2016**	**December 15, 2014**	**February 24, 2015**
35	Categorical Exclusion Development	22 days	November 23, 2015	December 22, 2015	December 15, 2014	January 13, 2015
36	Review Ecological Studies/Report	20 days	December 23, 2015	February 8, 2016	December 15, 2014	January 9, 2015
37	Submit CE to FHWA for Approval	30 days	February 9, 2016	April 4, 2016	January 14, 2015	February 24, 2015
38	**Preliminary Plans Phase**	**50 days**	**May 15, 2015**	**November 20, 2015**	**November 24, 2014**	**January 30, 2015**
39	**Preliminary Plans Design Phase Summary**	**50 days**	**May 15, 2015**	**November 20, 2015**	**November 24, 2014**	**January 30, 2015**
40	Preliminary Roadway Plans	35 days	May 15, 2015	September 8, 2015	November 24, 2014	January 9, 2015
41	Request/Receive Utilities First Submission	35 days	June 1, 2015	July 27, 2015	December 9, 2014	January 26, 2015
42	Review Local/Consultant Preliminary Plans	15 days	September 9, 2015	October 6, 2015	January 12, 2015	January 30, 2015
43	Preliminary Plans Complete	1 day	October 6, 2015	October 6, 2015	January 30, 2015	January 30, 2015

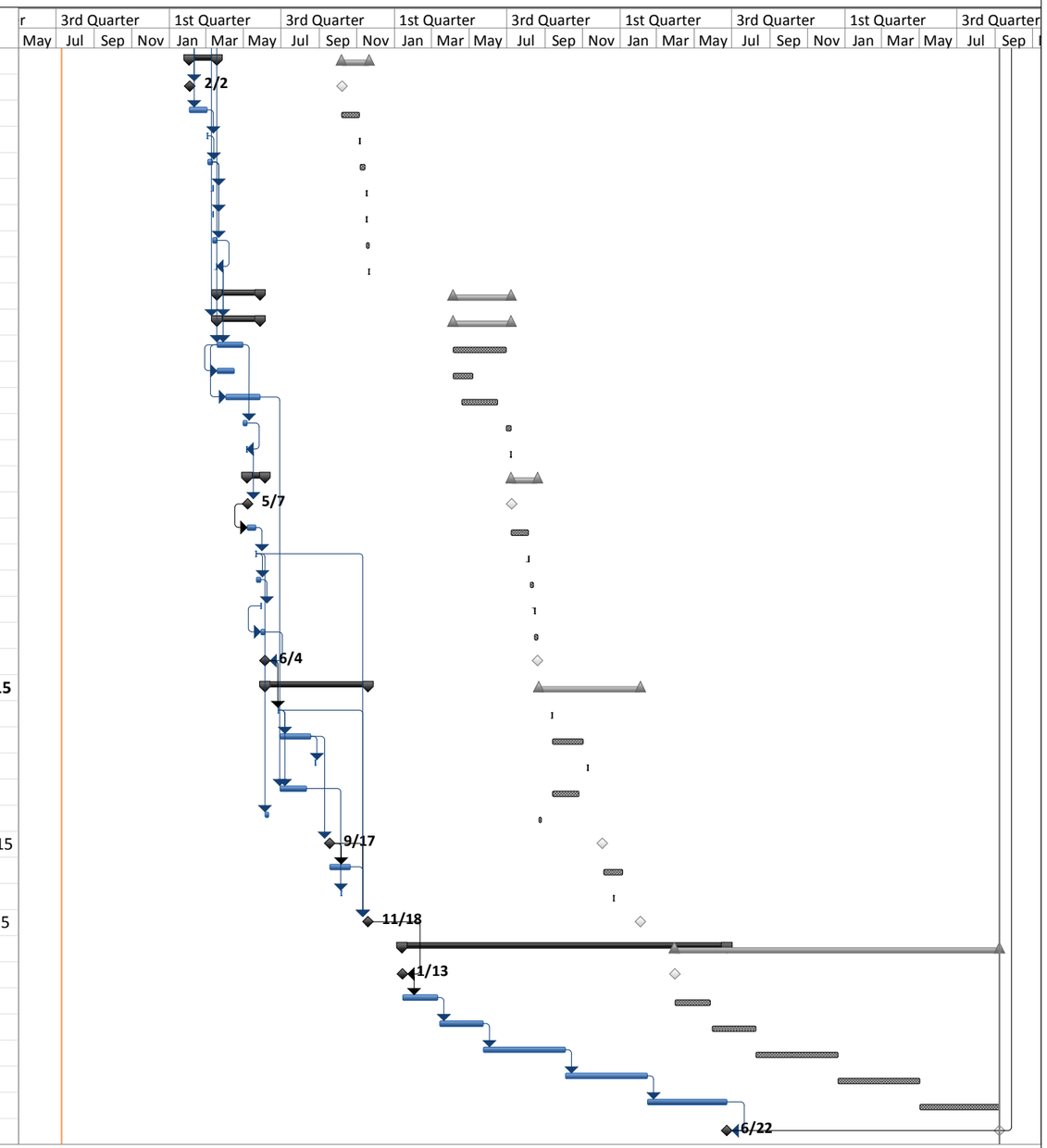


Project: 0010739
Date: July 10, 2014

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline		Baseline	
Split		External Tasks		Inactive Summary		Manual Summary		Baseline Milestone			
Milestone		External Milestone		Manual Task		Start-only		Baseline Summary			
Summary		Inactive Task		Duration-only		Finish-only		Progress			

SR 144 at I-95 SB and NB Off Ramps
P.I.#:0010739, Bryan County

ID	Task Name	Duration	Baseline Start	Baseline Finish	Start	Finish
44	**PFPR**	**33 days**	**October 7, 2015**	**November 20, 2015**	**February 2, 2015**	**March 18, 2015**
45	PM Request PFPR	1 day	October 7, 2015	October 7, 2015	February 2, 2015	February 2, 2015
46	PFPR Request (OES)	21 days	October 7, 2015	November 4, 2015	February 2, 2015	March 2, 2015
47	PFPR Inspection	1 day	November 5, 2015	November 5, 2015	March 3, 2015	March 3, 2015
48	PFPR Report Preparation	6 days	November 6, 2015	November 13, 2015	March 4, 2015	March 11, 2015
49	PFPR Report Approval and Distribution	1 day	November 16, 2015	November 16, 2015	March 12, 2015	March 12, 2015
50	PM Submits PFPR Responses to OES	1 day	November 16, 2015	November 16, 2015	March 12, 2015	March 12, 2015
51	Verify PFPR Responses	5 days	November 16, 2015	November 20, 2015	March 12, 2015	March 18, 2015
52	PM Distributes PFPR Responses	1 day	November 20, 2015	November 20, 2015	March 18, 2015	March 18, 2015
53	**Final Design Phase**	**50 days**	**April 5, 2016**	**July 7, 2016**	**March 19, 2015**	**May 27, 2015**
54	**Final Plans Design Phase Summary**	**50 days**	**April 5, 2016**	**July 7, 2016**	**March 19, 2015**	**May 27, 2015**
55	Final Construction Plans	30 days	April 5, 2016	June 29, 2016	March 19, 2015	April 29, 2015
56	Pavement Design Preparation, Review, Approval	20 days	April 5, 2016	May 6, 2016	March 19, 2015	April 15, 2015
57	Request/Receive Utilities Second Submittal	40 days	April 19, 2016	June 15, 2016	April 2, 2015	May 27, 2015
58	Project Manager Final Plan Review	5 days	June 30, 2016	July 7, 2016	April 30, 2015	May 6, 2015
59	Final Construction Plans Complete	1 day	July 7, 2016	July 7, 2016	May 6, 2015	May 6, 2015
60	**FFPR**	**21 days**	**July 8, 2016**	**August 19, 2016**	**May 7, 2015**	**June 4, 2015**
61	PM Request FFPR	1 day	July 8, 2016	July 8, 2016	May 7, 2015	May 7, 2015
62	FFPR Request (OES)	10 days	July 8, 2016	August 4, 2016	May 7, 2015	May 20, 2015
63	FFPR Inspection	1 day	August 5, 2016	August 5, 2016	May 21, 2015	May 21, 2015
64	FFPR Report Preparation	5 days	August 8, 2016	August 12, 2016	May 22, 2015	May 28, 2015
65	PM Submits FFPR Responses to OES	1 day	August 15, 2016	August 15, 2016	May 29, 2015	May 29, 2015
66	Verify FFPR Responses (OES)	5 days	August 15, 2016	August 19, 2016	May 29, 2015	June 4, 2015
67	PM Distributes FFPR Responses	1 day	August 19, 2016	August 19, 2016	June 4, 2015	June 4, 2015
68	**Final Submittals**	**119 days**	**August 22, 2016**	**February 2, 2017**	**June 5, 2015**	**November 18, 2015**
69	Submit Corrected FFPR Plans	1 day	September 12, 2016	September 12, 2016	June 26, 2015	June 26, 2015
70	Environmental Certification for CST	36 days	September 13, 2016	November 1, 2016	June 29, 2015	August 17, 2015
71	Submit Final Plans & Special Provision Package	1 day	November 9, 2016	November 9, 2016	August 25, 2015	August 25, 2015
72	Utility Agreements Preparation and Coordination	31 days	September 13, 2016	October 25, 2016	June 29, 2015	August 10, 2015
73	G. O. R/W Certification	4 days	August 22, 2016	August 25, 2016	June 5, 2015	June 10, 2015
74	Construction Authorization	1 day	December 2, 2016	December 2, 2016	September 17, 2015	September 17, 2015
75	Project Advertisement	23 days	December 5, 2016	January 4, 2017	September 18, 2015	October 20, 2015
76	Utilities Notice to Proceed	1 day	December 21, 2016	December 21, 2016	October 6, 2015	October 6, 2015
77	Let Contract	1 day	February 2, 2017	February 2, 2017	November 18, 2015	November 18, 2015
78	**CST**	**377 days**	**March 30, 2017**	**September 7, 2018**	**January 13, 2016**	**June 22, 2017**
79	Construction Notice to Proceed	1 day	March 30, 2017	March 30, 2017	January 13, 2016	January 13, 2016
80	Construction 10% Complete	41 days	March 31, 2017	May 26, 2017	January 14, 2016	March 10, 2016
81	Construction 25% Complete	51 days	May 30, 2017	August 8, 2017	March 14, 2016	May 23, 2016
82	Construction 50% Complete	95 days	August 9, 2017	December 19, 2017	May 24, 2016	October 3, 2016
83	Construction 75% Complete	95 days	December 20, 2017	May 1, 2018	October 4, 2016	February 13, 2017
84	Construction 100% Complete	93 days	May 2, 2018	September 7, 2018	February 14, 2017	June 22, 2017
85	Construction Final Payment	1 day	September 7, 2018	September 7, 2018	June 22, 2017	June 22, 2017



Project: 0010739
Date: July 10, 2014

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline		Baseline	
Split		External Tasks		Inactive Summary		Manual Summary		Baseline Milestone			
Milestone		External Milestone		Manual Task		Start-only		Baseline Summary			
Summary		Inactive Task		Duration-only		Finish-only		Progress			

SR 144 at I-95 SB & NB Exit Ramps

SIGN-IN SHEET

Subject: Project Team Meeting with OES

Date: July 10, 2014

Location: GDOT General Office

Project No.: TOOPDDES110124, PI No.: 0010739, Bryan County

1. WARREN DIMSDALE - HEATH & LINEBACK
2. Rudolph Frampton - HLE - rframpton@heath-lineback.com
3. ALLEN KRIVSKY - HLE akrivsky@heath-lineback.com
4. COLLIN LANE - EPEI clane@edwards-pitman.com
5. Aaron Burgess aburgess@ga.dot.gov
6. Jim Pomfret - GDOT jpomfret@dot.ga.gov
7. Matthew Kear - GDOT mkear@dot.ga.gov
8. Jaime Collazo - GDOT Ecology jcollazo@dot.ga.gov
9. Suli Shakshuki - GDOT-OES sshakshuki@dot.ga.gov
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Memorandum

To: Matt Bennett

CC: Cassius Edwards

From: William A. Krivsky

Date: 10/20/2014

Re: **SR 144 at I-95 SB & NB Off Ramps**

The purpose of this memo is to document the project team's recommendation for the SR 144 at I-95 interchange improvement. The proposed improvements consist of adding a signal, modifying a signal, adding left and right turn lanes on SR 144 for the I-95 ramps, and adding dedicated left and right turn lanes to the I-95 SB Exit Ramp.

As the project concept study has progressed, concerns have been raised with the current signalized alternate. Matt Bennett expressed that GDOT has concerns with the signal locations being too close together. This has caused the Department to revisit an alternate consisting of roundabouts at the I-95 SB & NB ramps.

John Walker said the signals will have to be interconnected at the I-95 SB and NB ramps. The signals and lane configuration improvements will provide an adequate LOS for the interchange (See attached LOS data).

John Walker said that a roundabout would be a hybrid single-lane and multi-lane to accommodate the dual left turn movement from the I-95 SB Exit Ramp. Roundabouts will operate with a slightly better LOS compared to the signals. (See attached LOS Data)

Allen Krivsky said the roundabout design would lengthen the project schedule and increase the project cost. Additionally, roundabouts will require the acquisition of Right of Way from some parcels adjacent to the interchange. The current design with traffic signals will not require right of way. The required right of Way for the roundabouts will not impact the parking lots or operations of any of the businesses along the project.

Allen Krivsky pointed out that the current traffic signal design of adding turn lanes underneath the I-95 overpass will have a substandard shoulder width of less than 3-Feet due to the location of the existing bridge bents. This will require a design variance as noted in the Concept Report.

Allen Krivsky also pointed out that pedestrian access with the traffic signal alternate is a concern. Even though there are no existing sidewalks, the existing lanes have 14-foot paved shoulders underneath the I-95 overpass bridge that pedestrians could use. The proposed traffic signal design results in shoulder widths of less than 3 feet and pedestrian access would need to be restricted underneath the bridge.

Rudolph Frampton noted that the design of the existing barrier for the I-95 bridge bents is also a design concern. It is unknown if these barriers have been designed as impact barriers.

Matt Bennett requested the team to stop work on the current design. He requested that the team send him a report documenting the concerns and our recommendations. The department will be reviewing the project and revisit the roundabout alternate.

Pros and Cons of Roundabout Alternate Vs Traffic Signal Alternate:

Pros:

- Roundabout Alternate improves LOS compared to the Signalized Alternate.
- Roundabout Alternate improves intersection safety compared to the Signalized Intersection.
- Roundabout Alternate will have standard shoulder widths within the interchange; the Signalized Alternate will have substandard shoulder widths within the interchange.
- Roundabout Alternate will provide safe pedestrian access underneath the bridge; the Signalized Alternate will restrict pedestrian access from crossing underneath the I-95 Bridge.

Cons:

- Roundabout Alternate will require right of way acquisition. Signalized alternate will not.
- Roundabout Alternate will lengthen the project schedule approximately 12 months compared to the Signalized Alternate.
- Roundabout Alternate will have a higher construction cost compared to the Signalized Alternate.

Project Status:

- Environmental studies have begun to support the CE document.
- Concept plans are complete.
- Concept Meeting was requested by H&L on 10-01-2014.
- The Concept Meeting is scheduled to be held on 10-07-2014.
- Some preliminary design has started to support the Environmental Studies.

Recommendations:

The project team recommends a roundabout design at the I-95 southbound and northbound intersections with SR 144 based on the facts above.

Team Meeting Minutes

Project: TOOPSDDES110124, PI No.: 0010739, Bryan County
SR 144 at I-95 SB & NB Off Ramps

Date: 11-17-2014

H&L Project Number: 2011.006.020

Attendees: Cassius Edwards (GDOT – Project Manager) – Via Phone
Scott Zehngraff (GDOT – Traffic Operations)
Paul DeNard (GDOT - Traffic Operations)
Christina Barry (GDOT - Traffic Operations)
Chester Thomas (GDOT - Traffic Operations)
John Walker (Kimley-Horn - Traffic)
Rudolph Frampton (Heath & Lineback)
Warren Dimsdale (Heath & Lineback)

Minutes By: Warren Dimsdale

Overview

A Team Meeting was held November 17, 2014 in Scott Zehngraff's Office at the Georgia Department of Transportation's Transportation Management Center. The purpose of this meeting was to discuss possible design changes with the two proposed roundabouts.

This project proposes operational improvements on SR 144 at the I-95 interchange. The proposed improvements consist of adding roundabouts on SR 144 at the I-95 ramps.

Meeting Minutes:

I-95 SB Intersection:

1. Increase the left-off-set for the SR 144 EB approach. Consider moving the roundabout southward and eastward to increase approach offset and reduce Right of Way impacts
2. John Walker needs to evaluate if removing the acceleration lane on the I-95 SB Entrance Ramp will provide an acceptable Level of Service (LOS). The LOS with the acceleration lane is "A". The lane should be removed if the LOS is acceptable without it.
3. John Walker should evaluate the need to add a third lane on the I-95 SB exit approach such that two lanes enter the roundabout, while providing a right-turn slip-lane to the west. This additional right-turn lane is in response to the projected traffic queues on the SB approach during the PM peak hour. (NOTE: If this third lane is not warranted, the design should accommodate the future addition of a right turn slip-lane.)

4. Increase the roundabout from 160' inscribed diameter to the maximum possible while not impacting the bridge structure and not significantly impacting adjacent parcels.
5. The controlling design requirement will be to accommodate a tractor trailer in the outside lane and a car in the inside lane of the roundabout simultaneously.
6. For the SR 144 EB approach, the right-turn slip-lane onto the SB Entrance Ramp should stay as close as permissible to the roundabout, and would operate under "Yield" condition into the existing single lane of the I-95 Entrance Ramp.

I-95 NB Intersection

1. Increase the left-off-set for the SR 144 WB approach and the I-95 NB exit approach.
2. John Walker needs to evaluate if removing the acceleration lane on the I-95 NB Entrance Ramp will provide an acceptable Level of Service (LOS). The LOS with the acceleration lane is "A". The lane should be removed if the LOS is acceptable without it.
3. Increase the roundabout from 160' inscribed diameter to the maximum possible while not impacting the bridge structure and not significantly impacting adjacent parcels.
4. For the dual EB approach, consider using two 12' lanes separate by a 6' gore, to keep vehicles separated as they enter the roundabout. The out-out pavement width will remain the same.
5. For the SR 144 WB approach, the right-turn slip-lane onto the I-95 NB entrance ramp should stay as close as permissible to the roundabout, and would operate under "Yield" condition into the existing single lane of the I-95 Entrance Ramp.
6. Just east of the roundabout, a short left-turn lane should be provided for SR 144 EB vehicles turning left onto Thunderbird Drive.

General:

1. Scott Zehngraff said that we can reduce the median widths to allow for trucks to swing wider on the entrances and exits of the roundabout and at the splitter island at the perimeter of the roundabout. The location of marking would not change. However, this would not be the preferred method of accommodating trucks.
2. An Inscribed Diameter of less than 160'should not be used for the roundabouts.
3. The width of the median between the roundabouts (underneath the I-95 bridge) can be reduced to help the design to fit within the constraints of the existing abutments.
4. Consider moving the sidewalk location to behind the existing I-95 bridge bents. This would allow for a reduction of the shoulder width between the roadway and existing bridge bent.
5. The design vehicle for Ft Stewart will not control the design. However, accommodations can be made for large trucks that will utilize the roadway on rare occasions.
6. Multilane roundabout cross walks will require conduit for future signalization.
7. The Roundabout Feasibility Study will be prepared by KHA.
8. H&L and the GDOT PM will discuss the appropriate Contract measures available to perform a Roundabout Peer Review.

FW: 0010739 - SR 144 at I-95 Draft Concept Report

Monday, January 19, 2015 10:13 AM

Subject	**FW: 0010739 - SR 144 at I-95 Draft Concept Report**
From	Warren Dimsdale
To	Rudolph Frampton; William A. Krivsky
Sent	Friday, January 16, 2015 9:01 AM

A few quick (internal) responses TMC comments. # 2 would be the only time consuming change.

1. Recommend re-design of the NW quad to allow bypass lane to enter existing striped out pavement.
   The bypass lane will not be built with this project; the project will be designed to allow for a bypass lane to be built in the future. The project has been designed to allow the bypass lane to tie to the existing striped out area when it is built.
2. Extend EB splitter island to the west. As shown, vehicle can make left turn or U-turn.
   Design change will be made during preliminary design.
3. Clarify why two-lanes EB and one WB is proposed versus two in each direction.
   The number of lanes is based on the traffic report recommendation.
4. Typical Section #5 – recommend reverse crown travel lanes. Set PG at truck apron header curb. This will improve the tie-ins with the ramps.
   Agree. Can easily modify section.
5. Recommend making the striped spiral in the west roundabout raised and mountable.
   Ok. Can easily modify.
6. Verify that the crosswalks on the EB leg are at least 20' back from the yield line; they appear to be too close.
   Will verify they are still 20'
7. Recommend increasing width of truck apron at centerline on the east roundabout (NB off ramp to WB/Fort Stewart).
   Truck Apron has been designed to accommodate WB-67 Tracking. The truck apron design will not be finalized until preliminary design when Fort Stewart has identified their oversized loads.
8. Review width of truck apron on west roundabout. It looks excessively wide.
   Truck Apron has been designed to accommodate WB-67 Tracking. The truck apron design will not be finalized until preliminary design when Fort Stewart has identified their oversized loads.
9. Show the GAB extending under the truck apron on typical section 5.
   The typical section has been modified.
10. Label slopes and recommend showing & using 4:1. Per GDOT Pedestrian & Streetscape Guide, page 96 (sidewalk), minimum shoulder behind/outside sidewalk should be 4 feet. Page 96 states for Sidewalks: A level area approximately 4 feet wide minimum is recommended for the sides of a sidewalk or walkway. When a vertical drop is more than 30 inches/2.5 feet, exceeds a down slope grade of 1:2, and is located less than 4 feet from the edge of the walkway, railing needs to be installed along the extent of the grade drop.
    Slopes will be Labeled accordingly
11. Thunderbird Drive & Gas Station drive should be made right-in/right-out.
    That is our intent.
12. Typical sections need to show all of the existing pavement, i.e.: #2, there is +/- 68' of pavement under the bridge so why are we removing it.
    We are removing it to because we are only putting back 2 lanes, and it gives us room for sidewalk.
13. Typical Section #3, will existing pavement be removed to install curb & gutter and

median? Recommend showing 7.5" integral concrete median.
Typical has already been modified to show integral C&G.

14. Recommend replacing thru arrow with thru/left arrows on typical sections 1 and 3.
Ok- easy change

Warren W. Dimsdale, P.E., Heath-Lineback Engineers, Inc. wdimsdale@heath-lineback.com

From: Edwards, Cassius Octavius [mailto:cedwards@dot.ga.gov]
Sent: Thursday, January 15, 2015 3:40 PM
To: Rudolph Frampton
Cc: Warren Dimsdale; William A. Krivsky
Subject: FW: 0010739 - SR 144 at I-95 Draft Concept Report

Rudolph, TMC has some comments that need to be addressed on Alternate 5 Layout. See the highlighted email below.

From: Barry, Christina
Sent: Thursday, January 15, 2015 3:30 PM
To: Edwards, Cassius Octavius; DeNard, Paul; Bennett, Matt; Turpeau Jr, Michael; Zehngraff, Scott E.
Cc: Werho, Ken
Subject: RE: 0010739 - SR 144 at I-95 Draft Concept Report

Cassius,

We have done a quick review of the design and below are the comments that we have. Please address these comments before submitting the revised concept.

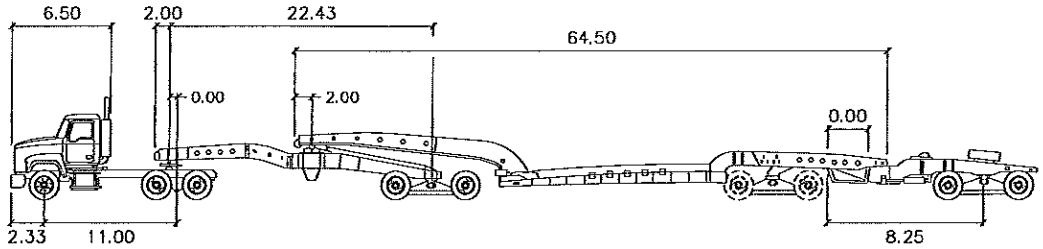
1. Recommend re-design of the NW quad to allow bypass lane to enter existing striped out pavement.
2. Extend EB splitter island to the west. As shown, vehicle can make left turn or U-turn.
3. Clarify why two-lanes EB and one WB is proposed versus two in each direction.
4. Typical Section #5 – recommend reverse crown travel lanes. Set PG at truck apron header curb. This will improve the tie-ins with the ramps.
5. Recommend making the striped spiral in the west roundabout raised and mountable.
6. Verify that the crosswalks on the EB leg are at least 20' back from the yield line, they appear to be too close.
7. Recommend increasing width of truck apron at centerline on the east roundabout (NB off ramp to WB/Fort Stewart).
8. Review width of truck apron on west roundabout. It looks excessively wide.
9. Show the GAB extending under the truck apron on typical section 5.
10. Label slopes and recommend showing & using 4:1. Per GDOT Pedestrian & Streetscape Guide, page 96 (sidewalk), minimum shoulder behind/outside sidewalk should be 4 feet. Page 96 states for Sidewalks: A level area approximately 4 feet wide minimum is recommended for the sides of a sidewalk or walkway. When a vertical drop is more than 30 inches/2.5 feet, exceeds a down slope grade of 1:2, and is located less than 4 feet from the edge of the walkway, railing needs to be installed along the extent of the grade drop.
11. Thunderbird Drive & Gas Station drive should be made right-in/right-out.
12. Typical sections need to show all of the existing pavement, i.e.: #2, there is +/- 68' of pavement under the bridge so why are we removing it.
13. Typical Section #3, will existing pavement be removed to install curb & gutter and median? Recommend showing 7.5" integral concrete median.
14. Recommend replacing thru arrow with thru/left arrows on typical sections 1 and 3.

USE THIS ONE

SCALE IN FEET

0 50 100

N



Booster Trailer feet

Tractor Width	: 8.50	Lock to Lock Time	: 6.0
Trailer Width	: 4.00	Steering Angle	: 40.0
Tractor Track	: 8.50	Articulating Angle	: 70.0
Trailer Track	: 8.50		

Kimley-Horn and Associates, Inc.

ROUNDABOUT EXHIBIT

OCTOBER 2, 2013

Processed Date:10/1/2015

Parameters: Bridge Serial Num

Bridge Inventory Data Listing

Structure ID:029-0043-0 **Bryan** **SUFF. RATING: 72.80**

Location & Geography

Structure ID:	029-0043-0
200 Brdge Information:	06
*6A Feature Int:	SR 144
*6B Critical Bridge:	
*7A Route No Carried:	SR00405
*7B Facility Carried:	I-95
9 Location:	2.1 MILES NW RICHMOND HILL
2 Dot District:	4841500000 - D5 District Five Jesup
207 Year Photo:	2013
*91 Inspection Frequency:	24 Date: 10/29/2013
92A Fract Crit Insp Freq:	0 Date: 02/01/1901
92B Underwater Insp Freq:	00 Date: 02/01/1901
92C Other Spc. Insp Freq:	00 Date: 02/01/1901
* 4 Place Code:	65044
*5 Inventory Route(O/U):	1
Type:	1 - Interstate
Designation:	1- Mainline
Number:	00095
Direction:	0. Not applicable
*16 Latitude:	31.0000- 57.6024 HMMS Prefix:SR
*17 Longtitude:	81.0000- 19.7388 HMMS Suffix:00
	MP: 89.18
98 Border Bridge:	% Shared:00
99 ID Number:	000000000000000
*100 STRAHNET:	1- The Feature is on an Interstate STRAHNET route
12 Base Highway Network:	1
13A LRS Inventory Route:	291040500
13B Sub Inventory Route:	0.00
*101 Parallel Structure:	N. No parallel structure exists
*102 Direction of Traffic:	1- One Way
*264 Road Inventory Mile Post:	009.62
*208 Inspection Area:	Area 05 Initials: KAS
Engineer's Initials:	bcn
* Location ID No:	029-00405D-089.18N

*104 Highway System:	1-Inventory Route is on the NHS
*26 Functional Classification:	11- Urban - Principal Arterial - Interstate
*204 Federal Route Type:	I - Interstate. No: 00951
105 Federal Lands Highway:	0. Not applicable
*110 Truck Route:	0
206 School Bus Route:	0
217 Benchmark Elevation:	0036.84
218 Datum:	2- Mean Sea Level
*19 Bypass Length:	1
*20 Toll:	3- On a Free Road or Non-Highway
*21 Maintanance:	01-State Highway Agency.
*22 Owner:	01-State Highway Agency.
*31 Design Load:	6- HS 20 + Mod (2-24,000# Axles @ 4ft Ctrs., when they govern)
37 Historical Significance:	5- Not eligible for the National Register of Historic Places
205 Congressional District:	1 - ONE
27 Year Constructed:	1969
106 Year Reconsrtucted:	1996
33 Bridge Median	3-Closed (with
34 Skew:	10
35 Structure Flared:	No
38 Navigation Control:	N- Bridge is not over water
213 Special Steel Design:	0- Not applicable or other
267 Type of Paint:	2- Non-Lead Oil Alkyd System (System IV).
*42 Type of Service On:	1-Highway
Type of Service Under:	1-Highway (with or without pedestrians)
214 Movable Bridge:	0
203 Type Bridge:	D - Concr - O. Concrete M. Steel - O. Concrete
259 Pile Encasement	3
*43 Structure Type Main:	3-Steel 2-Stringer/Multi-Beam or Girder
45 No.Spans Main:	3
44 Structure Type Appr:	0- Other 0- Other
46 No Spans Appr:	0
226 Bridge Curve Horz	0 Vert: 0.00
111 Pier Protection	N - Navigation Control item coded 0, or Feature not a waterway
107 Deck Structure Type:	
108 Wearing Structure Type:	
Membrane Type:	
Deck Protection:	

Signs & Attachments

225 Expansion Joint Type:	02- Open or sealed concrete joint (silicone sealant).
242 Deck Drains:	0- None.
243 Parapet Location:	0- None present.
Height:	0.00
Width:	0.00
238 Curb Height:	0
Curb Material:	0- None.
239 Handrail	9- Concrete New Jersey Type Barrier 9- Concrete New Jersey
*240 Median Barrier Rail:	1- New Jersey
241 Bridge Median Height:	3
* Bridge Median Width:	3
230 Guardrail Loc. Dir. Rear:	6- Both sides, approach and continuous.
Fwrd:	6- Both sides, approach and continuous.
Oppo. Dir. Rear:	6- Both sides, approach and continuous
Oppo. Fwrd:	6- Both sides, approach and continuous
244 Aproach Slab	3- Forward and Rear.
224 Retaining Wall:	0- None.
233Posted Speed Limit:	70
236 Warning Sign:	0.00
234 Delineator:	1.00
235 Hazard Boards:	0
237 Utilities Gas:	00- Not Applicable
Water:	00- Not Applicable
Electric:	00- Not Applicable
Telephone:	00- Not Applicable
Sewer:	00- Not Applicable
247 Lighting Street:	0
Navigation:	0
Aerial:	0- Not a
*248 County Continuity No.:	00

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Bridge Inventory Data Listing

Structure ID:029-0043-0

Programming Data

201 Project No:	IM-NH-95-1 (108)
202 Plans Available:	4- Plans in InfoImage.
249 Prop Proj No:	00000000000000000000000
250 Approval Status:	0000
251 PI Number:	0000000
252 Contract Date:	02/01/1901
260 Seismic No:	00000
75 Type Work:	0- Not Applicable 0- Initial Inventory
94 Bridge Imp: Cost:	$1,193
95 Roadway Imp. Cost:	$119
96 Total Imp Cost:	$1789
76 Imp Length:	0
97 Imp Year:	2013
114 Furure ADT:	101925 Year:2032

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. Bridge not over waterway.
216 Water Depth:	00.0 Br.Height:00.0
222 Slope Protection:	4
221Spur Dikes Rear	0 Fwd:0
219 Fender System	0- None.
220 Dolphin:	
223 Culvert Cover:	000
Type:	0- Not Applicable
No. Barrels:	0
Width:	0.00 Height:0
Length:	0 Apron:0
*265 U/W Insp. Area	0 Diver:ZZZ
*Location ID No:	029-00405D-089.18N

Measurements:

*29 ADT	67950 Year:2012
109 %Trucks:	1
* 28 Lanes On:	6 Under:4
210 No. Tracks On:	00 Under:00
* 48 Max. Span Length	77
* 49 Structure Length:	146
51 Br. Rwdy. Width	159.40
52 Deck Width:	165.40
* 47 Tot. Horiz. Cl:	67
50 Curb / Sidewalk Width	0.00 / 0.00
32 Approach Rdwy. Width	124
*229 Shoulder Width:	
Rear Lt:	13.0Type:2 - Rt:13
Fwd. Lt:	13.00Type:2 - Rt:13
Pavement Width:	
Rear:	36.00 Type: 2- Asphalt.
	36.00 Type: 2- Asphalt.
Intersaction Rear:	0 Fwd: 0
36Safety Features Br. Rail:	2- Inspected feature meets acceptable construction date standards.
Transition:	2- Inspected feature meets acceptable construction date standards.
App. G. Rail:	2- Inspected feature meets acceptable construction date standards.
App. Rail End:	2- Inspected feature meets acceptable construction date standards.
53 Minimum Cl. Over:	99'99"
Under:	H- Highway beneath structure. 16.00'2.00"
*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- Highway beneath structure. 14.20
56 Lateral Undercl. Lt:	0.00
*10 Max Min Vert Cl:	99' 99" Dir:0
39 Nav Vert Cl:	000 Horiz:0
116 Nav Vert Cl Closed:	000
245 Deck Thickness Main	7.00
Deck Thick Approach:	0.00
246 Overlay Thickness:	0.00
212 Year Last Painted:	Sup:1994 Sub:0000

65 Inventory Rating Method:	1-Load Factor (LF)
63 Operating Rating Method:	1-Load Factor (LF)
66 Inventory Type:	2 - HS loading. Rating: 21
64 Operating Type:	2 - HS loading. Rating: 35
231Calculated Loads:	
H-Modified:	20 0
HS-Modified:	22 0
Type 3:	20 0
Type 3s2:	34 0
Timber:	28 0
Piggyback:	40 0
261 H Inventory Rating:	19
262 H Operating Rating	32
67 Structural Evaluation:	4
58 Deck Condition:	6 - Satisfactory Condition
59 Superstructure Condition:	6 - Satisfactory Condition
* 227 Collision Damage:	0
60A Substructure Condition:	7 - Good Condition
60B Scour Condition:	N - Not Applicable
60C Underwater Condition	N - Not Applicable
71 Waterway Adequacy:	Not Applicable.
61 Channel Protection Cond.:	10
68 Deck Geometry:	9
69 UnderClr. Horz/Vert:	6
72 Appr. Alignment:	8-No reduction of vehicle operating speed required.
62 Culvert:	N - Not Applicable

Posting Data

70 Bridge Posting Required	5. Equal to or above legal loads
41 Struct Open, Posted, CL:	A. Open, no restriction
* 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

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REPORT

Pavement Evaluation Summary
P.I. No. 0010739
SR 144 at I-95 Southbound and Northbound Ramps
Bryan County
Georgia

Project Number
2015.0859.01

November 17, 2015
FINAL DRAFT

We're here for you
UNITED CONSULTING

November 17, 2015

Mr. Rudolph Frampton, P.E.
Heath and Lineback Engineers, Inc.
2390 Canton Road
Building 200
Marietta, Georgia 30066

Via Email: rframpton@heath-lineback.com

RE: Report of Pavement Evaluation Summary
P.I. No. 0010739
SR 144 at I-95 Southbound and Northbound Ramps
Bryan County, Georgia
UC Project No. **2015.0859.01**

Dear Mr. Frampton:

United Consulting is pleased to submit this report of the Pavement Evaluation Summary for the above referenced project site. We appreciate the opportunity to assist you with this project and look forward to working with you on future projects. If you have any questions regarding this report, or if we can of further assistance, please feel free to contact us.

Sincerely,

UNITED CONSULTING

Lonnie Rucker, E.I.T.
Staff Engineer

Mehdi Moazami, Ph.D., P.E.
Senior Geotechnical Engineer

GEORGIA REGISTERED NO. 23121 PROFESSIONAL ENGINEER MEHDI MOAZAMI

Chris L. Roberds, P.G.
Senior Executive Vice President

LR/MM/CLR/nj

http://ucblade10/sites/Geotechenv/5728/2015.0859.01/Geotechnical Documents/Pavement/2015.0859.01 PES DRAFT.doc

FINAL DRAFT

PAVEMENT EVALUATION SUMMARY

For

SR 144 at I-95 Southbound and Northbound Ramps
Bryan County, Georgia
P.I. No. 0010739

1. LOCATION / DESCRIPTION

This project is for the roadway improvement, widening, and interchange reconstruction of SR 144 at I-95. The project is located partially inside the city limits of Richmond Hills in Bryan County, Georgia. The proposed improvement will consist of four-lane widening and realignment with curb, gutter and sidewalks. The total length of the project is approximately 0.77 miles. The station numbering of SR 144 re-adjust where Station 226+87.74 ≡ 120+88.15. This project is located within the following station limits based on the preliminary drawings provided at the time of this survey.

Station to Station	Location
220+10± to 226+87.73± and 120+88.15 to ±131+00±	SR 144 (Ford Avenue)
1000+00± to 1007+63.47±	I-95 Southbound Exit Ramp
2003+29.90± to 2006+75.51±	I-95 Southbound Entrance Ramp
4000+00± to 4003+52.89±	I-95 Northbound Entrance Ramp
2996+88.10± to 3005+96.26±	I-95 Northbound Exit Ramp

2. PAVEMENT CONDITION SUMMARY

SR 144 and I-95 Ramps
The existing pavement for SR 144 and the I-95 ramps within the evaluated sections is in good to poor condition based on latest COPACES in 2014, the findings in the field observations, and core conditions. The pavement distresses and core conditions are summarized in section 6 and 8 of this report.

Side Roads
No pavement evaluation was performed on the side roads.

3. PAVEMENT RECOMMENDATION SUMMARY

The following types of construction are recommended along the interchange reconstruction project of SR 144 at I-95 Southbound and Northbound Ramps: **See "Section 11 - Assumptions and Justifications" section for details.**

Location	Construction Limits	Description	Recommendation
SR 144	220+10± to 225+93±	Existing/Widening	Full Depth Replacement poor Core and Pavement Condition/ Full Depth Construction for Widening
	225+93± to 226+87.71± and 120+88.15± to 121+79±	New Construction Roundabout	Full Depth Construction
	121+79± to 124+95±	Existing/Widening	Full Depth Replacement Poor Core Condition / Full Depth Construction Widening
	124+95± to 126+22±	New Construction Roundabout	Full Depth Construction
	126+22± to 131+00±	Existing/Widening	Full Depth Replacement low Pavement Rating – Full Depth Construction Widening
I-95 Southbound Exit Ramp	1000+00± to 1001+62±	Existing/New Alignment	Full Depth Replacement – Full Depth Construction for New Alignment and Widening
	1001+62± to 1007+63.47±	Existing/New Alignment	Diamond Grind Faulting, Replace Broken Slabs, Cut Out and Replaced Joint Spall – Full depth Construction for Widening and New Alignment
I-95 Southbound Entrance Ramp	2003+29.90± to 2004+86±	Existing/New Alignment	Replace Broken Slabs, Cut Out and Replaced Joint Spall – Full depth Construction for Widening and New Alignment
	2004+86± to 2006+75.51±	Existing/New Alignment	Full Depth Replacement poor Pavement Condition - Full Depth Construction for Widening and New Alignment
I-95 Northbound Entrance Ramp	4000+00± to 4001+36±	Existing/New Alignment	Full Depth Replacement Poor Core Condition – Full Depth Construction for Widening and New Alignment
	4001+36± to 4003+52.89±	Existing/New Alignment	Cut Out and Repair Joint Defects – Full depth Construction for Widening and New Alignment
I-95 Northbound Exit Ramp	2996+88.10± to 3004+25±	Existing/New Alignment	Replace Broken Slabs and Slabs with Longitudinal Cracks, Cut Out and Repair Joint Defects – Full Depth Construction for Widening and New Alignment
	3004+25± to 3005+96.26±	Existing/New Alignment	Full Depth Replacement due to Poor Pavement Condition – Full Depth Construction for Widening and New Alignment

Notation:
Inlay/Overlay Construction = Existing roadway, overlay conditions are acceptable.
Full Depth Construction = Widening, new roadway and/or alignment.
Full Depth Replacement = Existing Roadway cannot accommodate overlay due to poor pavement condition or the required overlay exceeds 7.5 inches.

For purposes of this report, SR 144 will be considered an east-west oriented roadway. The I-95 ramps will be considered north-south oriented roadways. We recommend that the existing asphalt shoulder for the ramps be replaced Full Depth.

4. FULL-DEPTH SECTIONS

The following full-depth pavement structures are recommended for use on this project.

Full-depth design for SR 144 FLEXIBLE PAVEMENT WITH GAB				
PAY ITEM NUMBER	**MATERIAL**	**COURSE**	**THICKNESS**	**SPREAD RATE**
402-3130	12.5 mm Superpave	Surface	1.50 inches	165 lbs/yd^2
402-3190	19 mm Superpave	Binder	2.00 inches	220 lbs/yd^2
402-3121	25 mm Superpave	Asphalt Base	6.00 inches	660 lbs/yd^2
310-1101	Graded Aggregate Base	Base	8.00 inches	N/A

Alternate Full-depth design for SR 144 FLEXIBLE PAVEMENT WITH SOIL CEMENT				
PAY ITEM NUMBER	**MATERIAL**	**COURSE**	**THICKNESS**	**SPREAD RATE**
402-3130	12.5 mm Superpave	Surface	1.50 inches	165 lbs/yd^2
402-3190	19 mm Superpave	Binder	2.00 inches	220 lbs/yd^2
402-3121	25 mm Superpave	Asphalt Base	6.00 inches	660 lbs/yd^2
301-2140	Soil-Cement	Base	8.00 inches	N/A

Full-depth design for I-95 Ramps* FLEXIBLE PAVEMENT WITH GAB				
PAY ITEM NUMBER	**MATERIAL**	**COURSE**	**THICKNESS**	**SPREAD RATE**
402-3130	12.5 mm Superpave	Surface	1.50 inches	165 lbs/yd^2
402-3190	19 mm Superpave	Binder	2.00 inches	220 lbs/yd^2
402-3121	25 mm Superpave	Asphalt Base	6.00 inches	660 lbs/yd^2
310-1101	Graded Aggregate Base	Base	12.00 inches	N/A

Alternate Full-depth design for I-95 Ramps* FLEXIBLE PAVEMENT WITH SOIL CEMENT				
PAY ITEM NUMBER	**MATERIAL**	**COURSE**	**THICKNESS**	**SPREAD RATE**
402-3130	12.5 mm Superpave	Surface	1.50 inches	165 lbs/yd^2
402-3190	19 mm Superpave	Binder	2.00 inches	220 lbs/yd^2

Alternate Full-depth design for I-95 Ramps* FLEXIBLE PAVEMENT WITH SOIL CEMENT				
PAY ITEM NUMBER	MATERIAL	COURSE	THICKNESS	SPREAD RATE
402-3121	25 mm Superpave	Asphalt Base	7.00 inches	660 lbs/yd^2
301-2140	Soil-Cement	Base	8.00 inches	N/A

* Even though based on the traffic data slightly thinner (up to 1 inch) flexible pavement section may be used for NB entrance and exit ramps and SB entrance ramp, to facilitate construction, we recommend single pavement section for all ramps.

Full-depth design for I-95 Ramps RIGID PAVEMENT				
PAY ITEM NUMBER	MATERIAL	COURSE	THICKNESS	SPREAD RATE
N/A	P.C.C.	Surface	12.00 inches	4,000 lbs/in^2
402-3190	19 mm Superpave	Binder	3.00 inches	330 lbs/yd^2
310-1101	Graded Aggregate Base	Base	12.00 inches	N/A

5. OVERLAY SECTIONS

The existing asphalt pavement along I-95 Southbound Exit Ramp from Station 1000+00 to 1001+62 does not exceed the distress criteria as outlined in Appendix H. However, the required overlay will be in excess of 8 inches. Therefore, Overlay is not recommended for this project.

Please refer to Section 11 "**Additional Recommendations**" section of the report.

6. PAVEMENT DISTRESSES

Except for the following, no other significant distresses were encountered during the field exploration of this project within the evaluated sections (See Appendix H for details):

SR 144

Rutting On **SR 144,** rutting measurements were taken at various locations. Rutting measurements ranged from zero inches to a maximum of $^1/_2$ inches. The highest rut depths were near the intersection of the I-95 in the eastbound and westbound left-turn-lanes and in the eastbound lane 1 of SR 144.

Load Cracking On **SR 144,** Level 1 to Level 4 load cracking was observed within the evaluated sections.

Block Cracking On **SR 144**, Level 1 to Level 3 block cracking was observed within the evaluated sections.

Raveling On **SR 144,** Level 1 to Level 3 raveling was observed within the evaluated sections.

Edge Distress On **SR 144**, Level 2 edge distress was observed within the evaluated sections.

Bleeding/ Flushing On **SR 144**, Level 1 bleeding/ flushing was observed from Station 122+20± to Station 122+22± in the westbound left turn lane near the centerline of the lane, and it was also observed from Station 221+10± to Station 221+17± in the eastbound right turn lane.

Patches, Potholes, and Local Base Failures On **SR 144**, potholes were observed at Station 220+17± in the westbound left turn lane and at Station 220+65± in the westbound left turn lane, and a patch was observed in this lane at Station 220+17±.

I-95 Southbound Exit Ramp

Rutting On the **I-95 Southbound Exit Ramp,** rutting measurements were taken at some locations near the intersection with SR 144. No rutting was present at the locations measured.

Block Cracking On the **I-95 Southbound Exit Ramp**, Level 1 to Level 3 block cracking was observed within the evaluated sections.

Edge Distress On the **I-95 Southbound Exit Ramp,** Level 1 edge distress cracking was observed along the right asphalt shoulder within the evaluated sections.

Faulting On the **I-95 Southbound Exit Ramp,** faulting was observed from Station 1001+62± to Station 1002+25± between southbound lane 1 and southbound lane 2.

Broken Slabs On the **I-95 Southbound Exit Ramp,** Level 2 broken slabs were observed within the evaluated sections.

Joint Defects On the **I-95 Southbound Exit Ramp,** joint defects were observed within the evaluated sections.

Shoulder Joint Distress On the **I-95 Southbound Exit Ramp,** shoulder joint distress was observed within the evaluated sections.

I-95 Southbound Entrance Ramp

Load Cracking On the **I-95 Southbound Entrance Ramp,** Level 1 and Level 3 load cracking were observed within the evaluated sections.

Block/ Transverse Cracking On the **I-95 Southbound Entrance Ramp,** Level 1 and Level 3 block/ transverse cracking were observed within the evaluated sections.

Bleeding/ Flushing On the **I-95 Southbound Entrance Ramp,** Level 1 bleeding or flushing was observed in the form of small circles patches of bituminous material on the surface of the pavement.

Joint Defects On the **I-95 Southbound Entrance Ramp,** joint defects were observed within the evaluated sections.

Shoulder Joint Distress On the I-95 **Southbound Entrance Ramp,** shoulder joint distress was observed within the evaluated sections.

Map Cracking On the I-95 **Southbound Entrance Ramp,** map cracking was observed within the evaluated sections.

I-95 Northbound Entrance Ramp

Load Cracking On the I-95 **Northbound Entrance Ramp,** Level 1 load cracking was observed within the evaluated sections.

Block/ Transverse Cracking On the I-95 **Northbound Entrance Ramp, Level** 2 block/ transverse cracking was observed within the evaluated sections.

Cracking Due to a Trench Excavation On the I-95 **Northbound Entrance Ramp,** cracking due to a trench excavation was observed at Station 4000+73± to Station 4001+02± in northbound Lane 1.

Edge Distress On the I-95 **Northbound Entrance Ramp, Level** 2 and Level 3 edge distress were observed along the existing shoulder within the evaluated sections.

Patches, Potholes, and Local Base Failures On the **I-95 Northbound Entrance Ramp,** a patch was observed at Station 4001+43 in the northbound shoulder of the existing ramp.

Joint Defects On the **I-95 Northbound Entrance Ramp,** joint defects were observed within the evaluated sections.

Shoulder Joint Distress On the **I-95 Northbound Entrance Ramp,** shoulder joint distress was observed within the evaluated sections.

Map Cracking On the **I-95 Northbound Entrance Ramp,** map cracking was observed within the evaluated sections.

I-95 Northbound Exit Ramp

Rutting On the I-95 **Northbound Exit Ramp,** rutting measurements were taken at Station 3004+43± in the northbound left turn lane and the northbound right turn lane. No rutting was present at the locations measured.

Block/ Transverse Cracking On the I-95 **Northbound Exit Ramp,** Level 1 to Level 3 block/ transverse cracking was observed within the evaluated sections.

Corrugation/ Pushing	On the I-95 **Northbound Exit Ramp,** Level 1 corrugation/pushing was observed from Station 3004+25± to Station 3005+61± in the northbound left turn lane.
Broken Slabs	On the I-95 **Northbound Exit Ramp,** Level 1 broken slabs were observed within the evaluated sections.
Slabs with Longitudinal Cracks	On the I-95 **Northbound Exit Ramp,** slabs with longitudinal cracks Level 1 were observed within the evaluated sections.
Replaced Slabs	On the I-95 **Northbound Exit Ramp,** replaced slabs were observed within the evaluated sections.
Failed Replaced Slabs	On the I-95 **Northbound Exit Ramp,** failed replaced slabs were observed within the evaluated sections.
Joint Defects	On the I-95 **Northbound Exit Ramp,** joint defects were observed within the evaluated sections.
Shoulder Joint Distress	On the **I-95 Northbound Exit Ramp,** shoulder joint distress was observed within the evaluated sections.
Popouts	On the **I-95 Northbound Exit Ramp,** popouts were observed within the evaluated sections.
Map Cracking	On the **I-95 Northbound Exit Ramp,** map cracking was observed within the evaluated sections.

7. COPACES

COPACES ratings are based on a visual survey of distresses of the pavement surface. United Consulting requested COPACE information from the local GDOT District Office. The assistant area engineer of the Georgia Department of Transportation District 5 responded with an email containing a recent Pavement Condition Survey completed in 2014. This condition survey gave a Project Rating of 48% to 68% for the stretch of SR 144 between Mile Marker 8.1 to Mile Marker 11.5. The assistant area engineer also said that the Georgia Department of Transportation did not conduct a Pavement Condition Survey for the I-95 ramps. Based on our pavement evaluation conducted between August 28 and September 2, 2015 using the criteria outlined in the Appendix E of the GDOT Pavement Design Manual, the Average Project Rating of the pavement sections evaluated are as shown in the following table.

Location	Station to Station	Average Rating
SR 144	220+10 to 226+30	11%
	121+60 to 124+95	51%
	125+85 to 131+00	50%
For the asphalt portion of the I-95 ramps		
I-95 Southbound Exit Ramp		61%
I-95 Southbound Entrance Ramp		53%
I-95 Northbound Exit Ramp		65%
I-85 Northbound Entrance Ramp		56%

No project rating was given by us for the asphalt shoulders of the I-95 ramps because the asphalt shoulders of the ramps will be replaced with concrete shoulders according to the provided cross sections (See **Appendix F** for details).

8. CORES

Cores were recovered from thirteen (13) separate locations in the travel lanes of this project to determine the thicknesses and condition of the existing pavement sections. The results of the coring operation are tabulated below:

Core/ Sample Number	Location	Station/Direction/ Location	Asphalt Core Length (inches)	Core Condition	Underlying Material
C-1	I-95 SB Exit Ramp	**1001+39± SB, RTL, 12' Lt**	7.50	Good, Vertical Crack from bottom to 0.50" from bottom, Horizontal Crack 1.00" long 0.50" from bottom	GAB=6.25"
C-2	I-95 NB Entrance Ramp	**4000+92± NB, Ln 1, 13' Lt**	6.25	Poor, Vertical Crack full depth, Horizontal Crack at 3.75" to 3.50" from top, and missing asphalt in one area from 4.75" to 5.75" from top	Concrete=1.50", GAB=7.50"
C-3	SR 144	**226+11± WB, Ln 1, 16.5' Lt**	7.00	Fair to poor, Diagonal and Vertical Crack from 0" to 3.50" to 3.75" from top in two places, Horizontal Crack 5.00" long at 3.50" to 3.75" from top, Vertical Crack in two area 4.50" apart from 3.75" to 7.25" from top, Horizontal Crack 2.00" long at 3.75" from top	GAB=6.00"
C-4	SR 144	**122+49± WB, Ln 1, 19.5' Lt**	6.00	Fair to poor, Vertical Crack full depth, Oval Crack area from 3.50" to 4.75" from top of core	GAB=9.75"

Core/ Sample Number	Location	Station/Direction/ Location	Asphalt Core Length (inches)	Core Condition	Underlying Material
C-5	SR 144	**123+96± EB, LTL, 15.0' Rt**	7.00	Good to Fair, Vertical Crack from 0" to 3.25" from top in one area, Vertical Crack from 0" to 1.75" from top in another area	GAB=10.00"
C-6	SR 144	**126+69± EB, Ln 1, 15.5' Rt**	8.50	Good to Fair, Horizontal Delamination at 6.25" from top	Bituminous Base=4.00"
C-7	SR 144	**129+44± WB, Ln 1, 15.0' Lt**	6.50	Good to Fair, Vertical Crack from top to 1.25" from top, Air Voids/Coarse Mix from 1.75" to 3.75" from top	GAB=7.50"
C-8	SR 144	**223+96± EB, RTL, 34.0' Rt**	7.25	Fair to Poor, Vertical Crack from top to 2.50" from top, Diagonal Crack from 2.50" to 3.50" from top, Horizontal Crack from 3.50" to 5.00" from top, area of missing asphalt from top to 1.00" from top, another area of missing asphalt from 2.50" to 4.75" from top, Horizontal Delamination from 5.50" to 6.00" from top	Soil Cement=8.25"
C-9	SR 144	**226+24± EB, Ln 1, 10.5' Rt**	6.00	Good, Horizontal Crack at 4.00" from top	GAB=7.00"
C-10	SR 144	**226+24± EB, Ln 1, 13.5' Rt**	6.00	Good, Vertical Crack from top to 2.00" from top	GAB=9.00"
C-11	SR 144	**226+24± EB, Ln 1, 16.5' Rt**	6.00	Good, a small Air Void at 1.50" from top, Vertical Crack from bottom to 1.00" from bottom, Horizontal Crack at 0.5" from bottom	GAB=9.00"
C-12	I-95 SB Entrance Ramp	**2005+30± SB, Ln 1, 5.5' Rt**	7.00	Fair to Poor, Vertical Crack from top to 3.75" from top, Diagonal Crack from 3.75" to 6.00" from top, Horizontal Crack at 4.00" from top, area of missing asphalt from 5.50" to 7.00" from top	GAB=5.75"
C-13	I-95 NB Exit Ramp	**3004+73± NB, RTL, 19.0' Rt**	6.25	Good	GAB=7.75"

Notation:
CL = Centerline
EB = Eastbound
WB = Westbound
Ln = Designated Travel Lane

Lt = Left of the existing centerline, direction of travel (lower to higher station)
NB = Northbound
Rt = Right of the existing centerline, direction of travel (lower to higher station)
SB = Southbound
LTL = Left Turn Lane
RTL = Right Turn Lane

9. OTHER INFORMATION

- The Soil Survey Summary for this project is being prepared by United Consulting and will be issued under a separate cover. The attached pavement designs used the design values recommended in the Soil Survey and is consistent with the Appendix G of the GDOT Pavement Design Manual.

- The traffic information provided below is based on the information provided to us by **Heath and Lineback Engineers, Inc.**

- The full-depth design analyses are attached to this report. All designs are based on a computer program named GDOT Pavement Design Version 2.0 developed by Georgia Department of Transportation, Pavement Management Branch.

- **Design Considerations for SR 144**
  - Number of lanes (in one-direction): 1 to 2
  - With Curb and Gutter
  - Provided Traffic Data A.D.T. (2017): 10,700; (2036): 15,600
  - Provided Project Let Date: 2016
  - **TRAFFIC DATA**
    - A.D.T. (2017): (See Traffic Data Table below)
    - A.D.T. (2037): (See Traffic Data Table below)
    - Directional Distribution: 50/50 for Area 1 and Area 3 and 70/30 for Area 2
    - Lane Distribution: 90% to 100%
    - 24 Hr. Trucks: 7.0%
    - % MU: 2.0%, % SU: 5.0%
    - Function Class: Urban Minor Arterial
    - Speed Design: ≤45 mph
    - Terminal Serviceability Index: 2.50
    - Soil Support: 4.0 (Based on Laboratory Tests)
    - Regional Factor: 1.7 (GDOT Pavement Design Manual Appendix H)

TRAFFIC DATA TABLE:

Area No.	Station Range		ADT (1-Way) for Year		No. of Lanes	Lane Dist (%)	% 24-hr Truck (%MU/%SU)
	From	To	2017	2037			
1	226+30±	225+93±	7,200	10,500	1 to 2	90/10 to 100/0	7 (2/5)
2	225+93± 120+88.15 ±	226+87.73± 124+95±	10,700	15,600	1 to 2	90/10 to 100/0	7 (2/5)
3	124+95±	131+00±	8,400	12,250	1 to 2	90/10 to 100/0	7 (2/5)

- **Design Considerations for I-95 Ramps**
  - Number of lanes (in one-direction): 1 to 2
  - Without Curb and Gutter
  - Provided Project Let Date: 2016
  - **TRAFFIC DATA**
    - A.D.T. (2017): (See Traffic Data Table below)
    - A.D.T. (2037): (See Traffic Data Table below)
    - Directional Distribution: 100/0
    - Lane Distribution: (See Traffic Data Table below)
    - % 24 Hr. Trucks: (See Traffic Data Table below)
    - % MU and % SU: (See Traffic Data Table below)
    - Function Class: Urban Principal Arterial
    - Speed Design: ≤ 55 mph
    - Terminal Serviceability Index: 2.50
    - Soil Support: 4.0 (Based on Laboratory Tests)
    - Regional Factor: 1.7 (Appendix H)

TRAFFIC DATA TABLE:

Ramp	Station Range		ADT (1-Way) for Year		No. of Lanes	Lane Dist (%)	% 24-hr Truck (%MU/% SU)
	From	To	2017	2037			
I-95 SB Exit Ramp	1000+00	1007+63.47	8,600	12,500	2	90/10	21 (11/10)
I-95 SB Entrance Ramp	2003+29.90	2006+75.51	2,800	4,050	1	100/0	30 (25/5)
I-95 NB Entrance Ramp	4000+00	4003+52.89	8,600	12,500	1	100/0	13 (8/5)
I-95 NB Exit Ramp	2996+88.10	3005+96.26	2,800	4,050	1	100/0	34 (29/5)

- **Mill the top 1.50 inches** of the existing pavement for at all tie-in locations. See "**Additional Recommendations Section**" for more details.

- **Testing**

  - GDT-115, Determining Rutting Susceptibility Using the Loaded Wheel Tester.

  Rut testing of selected asphalt core samples was performed. Other laboratory testing of selected asphalt cores consisted of asphalt density testing. Based on the laboratory testing the specimens tested survived the LWT and were visually in fair condition, with the exception of sample Core No. C-9. The rut depth measurement for Core C-9 averaged to about 6.52 mm. Based on the laboratory testing bond strength appears to be adequate. No visual evidence of excess asphalt cement was evident in the Post LWT testing. The results of the laboratory tests are included in Appendix I of the report.

- **Historical Information**

  No additional historical information regarding previous pavement overlays, pavement management or construction dates were readily available for review for this project.

10. ADDITIONAL RECOMMENDATIONS

- We recommend a minimum 200 feet and 400 feet tie-in transition for SR 144 at the beginning and ending of the project, respectively. In addition, we recommend a minimum 100 foot tie-in transition for the side roads. The tie-in transition will consist of milling 1.50 inches and inlay with 12.5 mm Superpave asphalt concrete mix.

- We recommend that the mainline full depth construction be extended to all side roads to the turnouts. We also recommend that full depth construction be performed for the construction of the ramps and for the construction of the area of the proposed roundabouts.

- New pavements should be constructed flush with all existing and/ or new utility manholes or vaults.

- We recommend staggered joints for each asphaltic concrete layer to reduce the potential moisture migration from subgrade soils.

- We recommend the application of a 2-foot wide pavement reinforcement fabric, centered on joints to reduce the potential for crack migration through the new asphalt.

- We recommend milling the asphaltic concrete pavement, as per Section 432 of the Standard Specifications.

- We recommend waterproofing the joints and cracks of the asphalt concrete pavement prior to the overlaying operation, as per Section 445 of the Standard Specifications.

- After milling and immediately prior to inlaying/overlaying, we recommend that any surface cracks shall be sealed with a Type M crack sealant, as per Section 407 of the Standard Specifications.

11. ASSUMPTIONS AND JUSTIFICATIONS

- The provided pavement design is based on the traffic information provided by **Heath and Lineback Engineers, Inc.**

- Based on the pavement and core conditions and pavement rating, full depth replacement will be required for SR 144 and for I-95 ramps.

- No information regarding Mile Markers were available on the website or in our field observations for the I-95 ramps or the side roads.

- The station locations for SR 144 and the I-95 ramps were not provided or staked in the field by a surveyor. United Consulting determined the approximate location of these stations by using a measuring wheel from the nearest identified stationary object marked on the provided plans.

12. LIMITATIONS

This report is for the exclusive use of the **Georgia Department of Transportation (GDOT),** its agents, and **Heath and Lineback Engineers, Inc.**; the designers of the project described herein, and may only be applied to this specific project. Our conclusions and recommendations have been prepared using generally accepted standards of Pavement Engineering practice in the State of Georgia and are valid for a period of two years from the issuance of this report. Should the implementation of the recommendations presented in this report be delayed more than two years, re-evaluation of the pavement should be performed. No other warranty is expressed or implied. Our firm is not responsible for conclusions, opinions or recommendations of others. The right to rely upon this report and the data within may not be assigned without **UNITED CONSULTING'S** written permission.

Our preliminary conclusions and recommendations are based upon design information furnished to us, data obtained from the previously described exploration and testing program and our past experience. They do not reflect variations in the subsurface conditions that may be present intermediate of our coring/ borings and in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon "on-site" observations of the conditions.

Our conclusions and recommendations are based on our site reconnaissance, anticipated existing pavement thicknesses, and our past experience.

UNITED CONSULTING

Reported By: Lonnie Rucker, E.I.T.
Reviewed By: Mehdi Moazzami, Ph.D., P.E.
QC Reviewed By: Chris L. Roberds, P.G.

Appendix A – Figures (4-pages)

Figure 1: Project Location Map
Figure 1A: Project Location Map
Figure 2 and Figure 3: Core Location Plan

Appendix B – Project Photographs (29) – (15-pages)

Appendix C – Roadway Photographs (93) – (48-pages)

Appendix D – Example Photographs (37) – (19-pages)

Appendix E – Core Photographs (30) – (15-pages)

Appendix F – Pavement Ratings (15-pages)

GDOT Flexible Pavement Condition Survey (1-page)
Pavement Rating for SR 144 from Station 220+10 to Station 226+30 (2-pages)
Pavement Rating for SR 144 from Station 121+60± to Station 124+95± (2-pages)
Pavement Rating for SR 144 from Station 125+85 to Station 131+00± (2-pages)
Pavement Rating for I-95 Southbound Exit Ramp (2-pages)
Pavement Rating for I-95 Southbound Entrance Ramp (2-pages)
Pavement Rating for I-95 Northbound Entrance Ramp (2-pages)
Pavement Rating for I-95 Northbound Exit Ramp (2-pages)

Appendix G – Recommended Pavement Section (13-pages)

Bryan County Approved Traffic Letter (1-page)
Traffic Diagram for SR 144 and the I-95 Ramps (1-page)
SR 144 – Full Depth Flexible with GAB (1-page)
SR 144 – Full Depth Flexible with Soil Cement (1-page)
I-95 Southbound Exit Ramp – Full Depth Flexible with GAB (1-page)
I-95 Southbound Entrance Ramp – Full Depth Flexible with GAB (1-page)
I-95 Northbound Entrance Ramp – Full Depth Flexible with GAB (1-page)
I-95 Northbound Exit Ramp – Full Depth Flexible with GAB (1-page)
I-95 Southbound Exit Ramp – Full Depth Flexible with Soil Cement (1-page)
I-95 Southbound Entrance Ramp – Full Depth Flexible with Soil Cement (1-page)

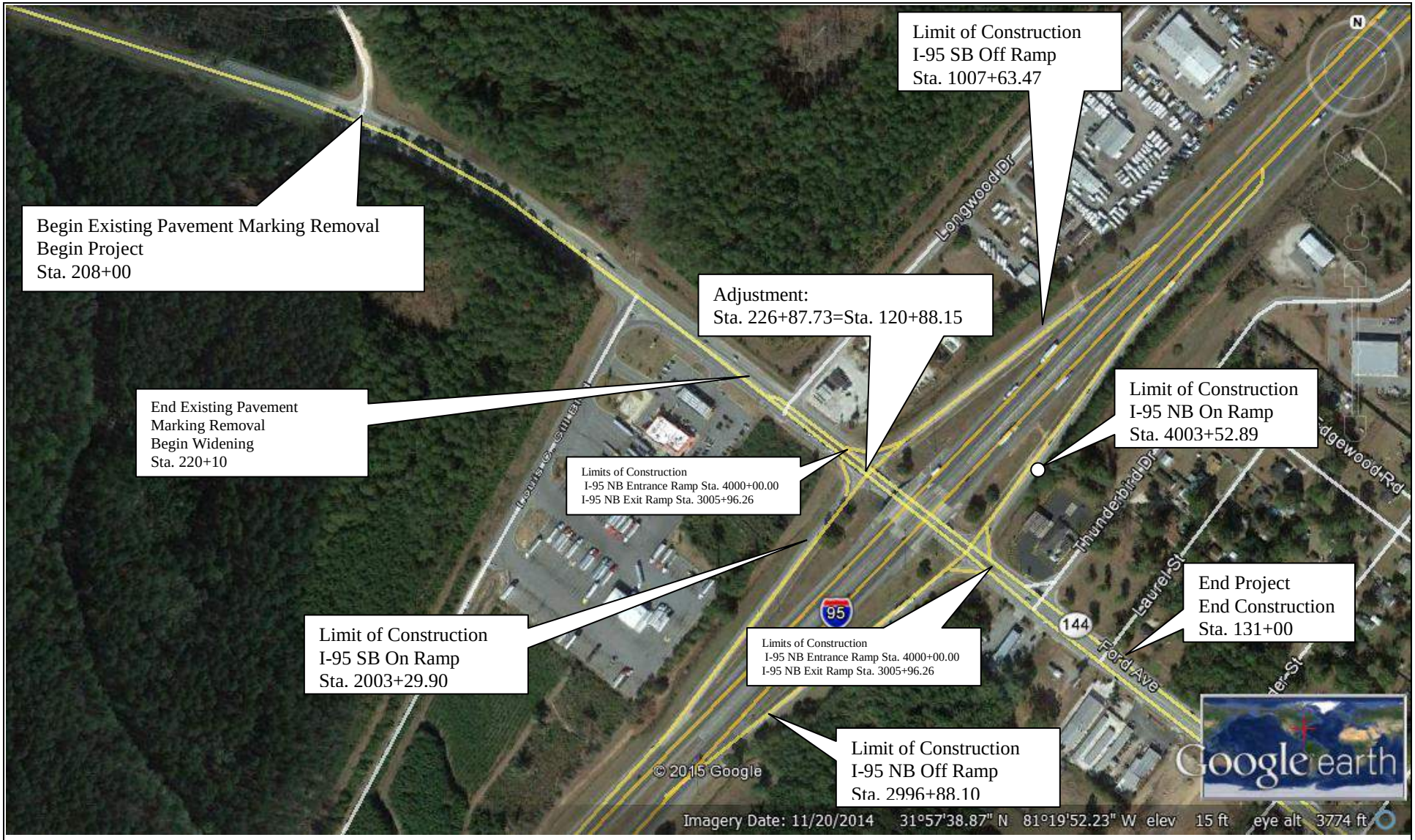
I-95 Northbound Entrance Ramp – Full Depth Flexible with Soil Cement (1-page)
I-95 Northbound Exit Ramp – Full Depth Flexible with Soil Cement (1-page)
I-95 Southbound Exit Ramp – Rigid Pavement (1-page)

Appendix H - Roadway Survey and Asphalt Core Properties (16-pages)

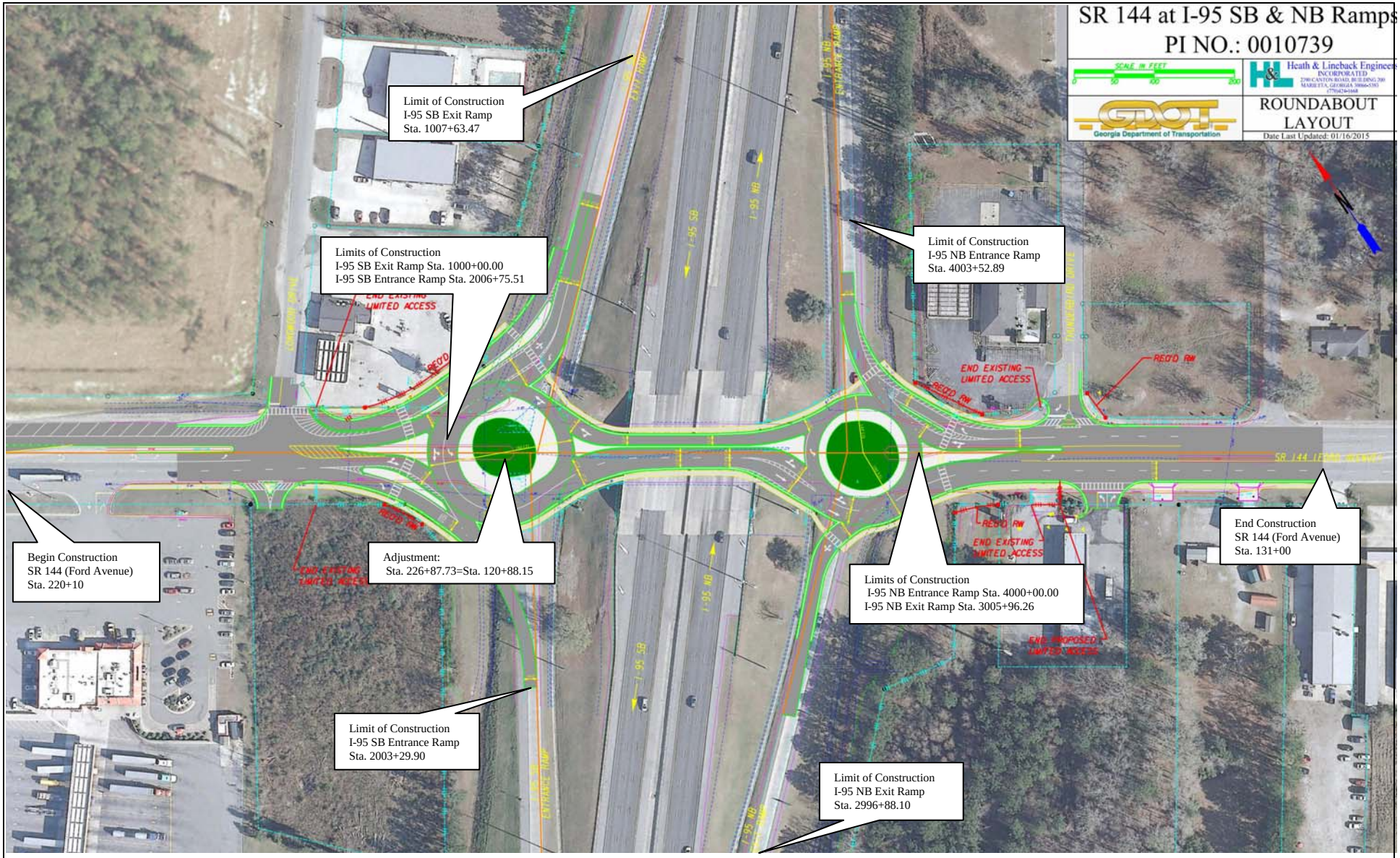
Appendix I – Laboratory Testing Results (10-pages)

Summary of Testing Results on Asphalt Samples (10-pages)

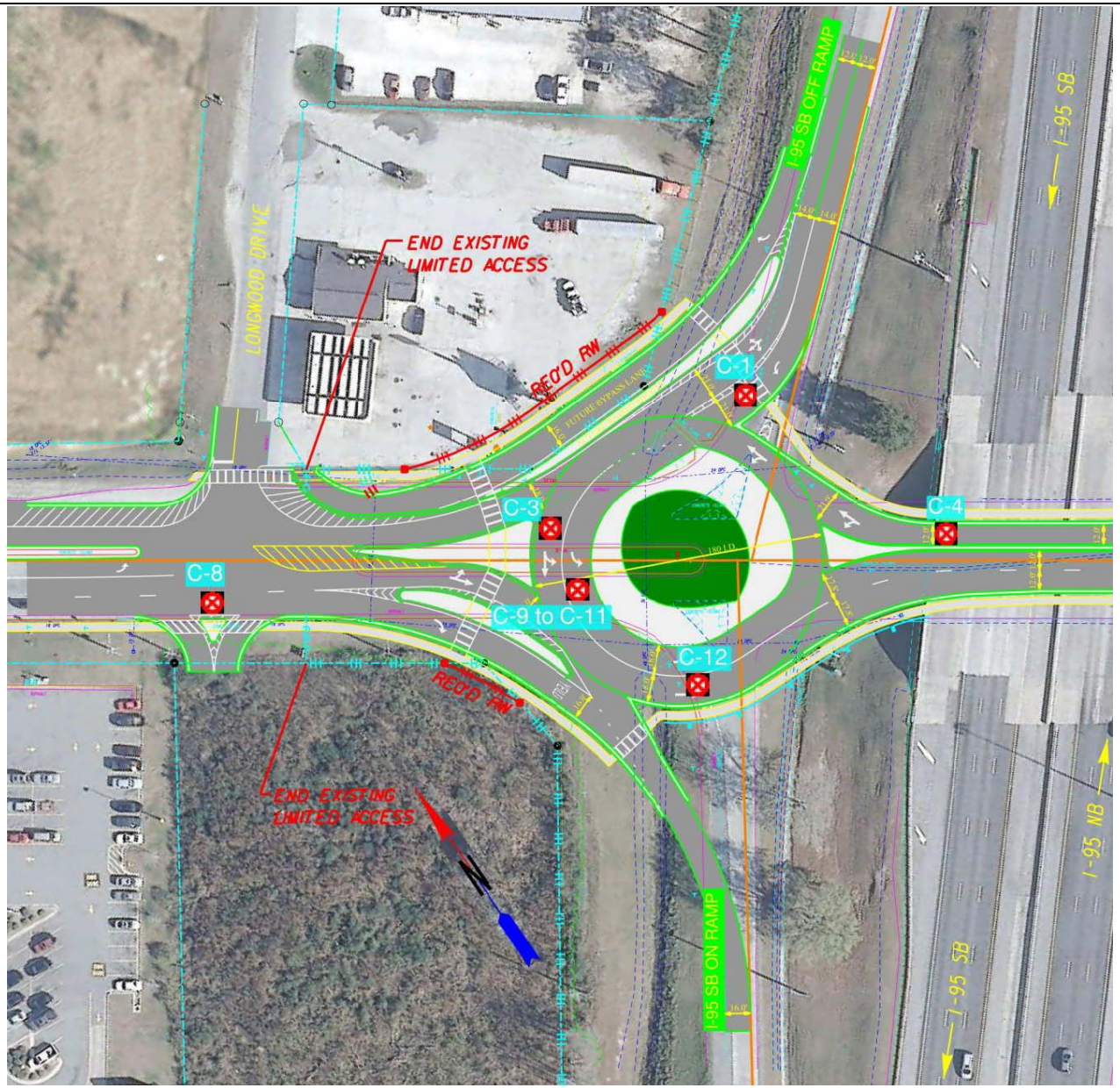
APPENDIX A
FIGURES (4-pages)



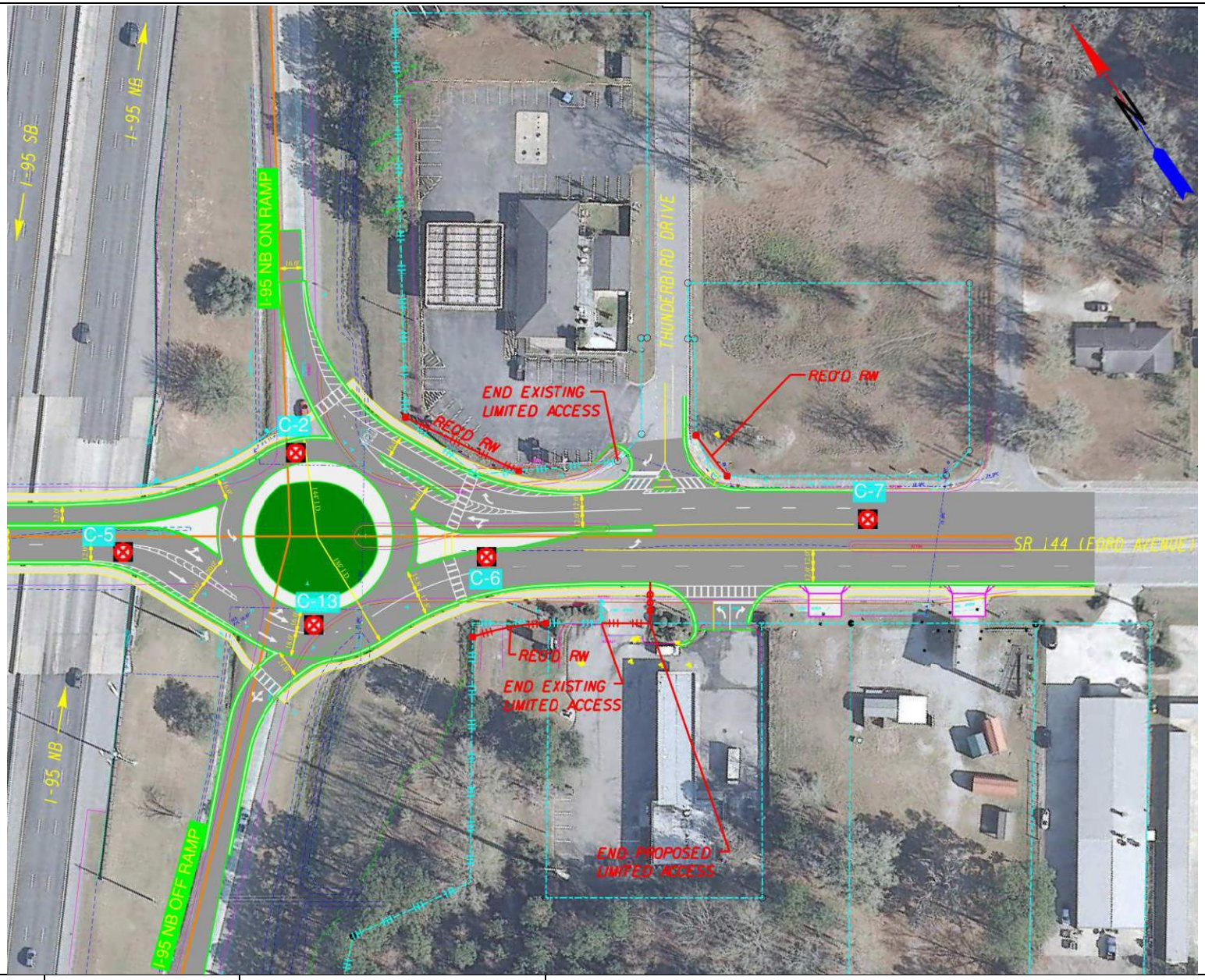
SCALE: NTS	DATE: 10/15/2015	PROJECT NO: 2015.0859.01	TITLE: PROJECT LOCATION MAP SR 144 at I-95 SB and NB Off Ramps Bryan County, P.I. No: 0010739	FIG. 1
PREPARED: LR	CHECKED:	REVISIONS:		
CLIENT: HEATH & LINEBACK ENGINEERS, INC.	N		UNITED CONSULTING 625 Holcomb Bridge Road, Norcross, GA 30071 Tel. 770/209-0029 FAX 770/582-2900 www.unitedconsulting.com We're here for you UNITED CONSULTING	



SCALE: NTS	DATE: 09/08/2015	PROJECT NO: 2015.0859.01	TITLE: PROJECT LOCATION MAP SR 144 at I-95 SB and NB Off Ramps Bryan County, P.I. No: 0010739	FIG. 1A
PREPARED: LR	CHECKED:	REVISIONS:		
CLIENT: HEATH & LINEBACK ENGINEERS, INC.			UNITED CONSULTING 625 Holcomb Bridge Road, Norcross, GA 30071 Tel. 770/209-0029 FAX 770/582-2900 www.unitedconsulting.com We're here for you UNITED CONSULTING	



SCALE: NTS	DATE: 09/08/2015	PROJECT NO: 2015.0859.01	TITLE: CORE LOCATION PLAN SR 144 at I-95 SB and NB Off Ramps Bryan County, P.I. No: 0010739	FIG. 2
PREPARED: LR	CHECKED:	REVISIONS:		
CLIENT: HEATH & LINEBACK ENGINEERS, INC.			UNITED CONSULTING 625 Holcomb Bridge Road, Norcross, GA 30071 Tel. 770/209-0029 FAX 770/582-2900 www.unitedconsulting.com We're here for you UNITED CONSULTING	



Kj SCALE: NTS	DATE: 09/08/2015	PROJECT NO: 2015.0859.01	TITLE: CORE LOCATION PLAN SR 144 at I-95 SB and NB Off Ramps Bryan County, P.I. No: 0010739	FIG. 3
PREPARED: LR	CHECKED:	REVISIONS:		
CLIENT: HEATH & LINEBACK ENGINEERS, INC.			UNITED CONSULTING 625 Holcomb Bridge Road, Norcross, GA 30071 Tel. 770/209-0029 FAX 770/582-2900 www.unitedconsulting.com We're here for you UNITED CONSULTING	

APPENDIX B
PROJECT PHOTOGRAPHS (15-pages)

PHOTOGRAPH LEGEND

Photograph Type	Label Protocol	Project Information
County Number	A three digit number	029
Route Code	State, County, or other code route	1 = State Highway or Interstate 2 = County Road 3 = City Street 6 = Ramp
Route Number	A four digit ID followed by two character suffix SR 144 = 0144 I-95 = 0095	0144 XX 00 = SR or CR 03 = City
Direction of Travel	N or S E or W	E = Eastbound W = Westbound N = Northbound S = Southbound
Lane of Travel	A one-digit number LTL	1,2,3 LTL = Left Turn Lane
With Traffic or Facing Traffic	W or F	W or F
Milepost	MP	MP 8.41 to MP 8.73

029 1 0144 00 E LTL F AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, LOOKING WEST

029 1 0144 00 E LTL W AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, LOOKING EAST

029 1 0144 00 N AT STATION 224+12±, MP 8.48
SR 120, FORD AVENUE, LOOKING NORTH ALONG LONGWOOD DRIVE

029 1 0144 00 N AT STATION 121+27±, MP 8.54
SR 144, FORD AVENUE, LOOKING NORTH ALONG THE I-95 SOUTHBOUND EXIT RAMP

029 1 0144 00 S AT STATION 121+27±, MP 8.54
SR 144, FORD AVENUE, LOOKING SOUTH ALONG THE I-95 SOUTHBOUND ENTRANCE RAMP

029 1 0144 00 W LTL W AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, LOOKING WEST

029 1 0144 00 W LTL F AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, LOOKING EAST

029 1 0144 00 N AT STATION 125+46±, MP 8.62
SR 144, FORD AVENUE, LOOKING NORTH ALONG THE I-95 NORTHBOUND ENTRANCE RAMP

029 1 0144 00 S AT STATION 125+46±, MP 8.62
SR 144, FORD AVENUE, LOOKING SOUTH ALONG THE I-95 NORTHBOUND EXIT RAMP

029 1 0144 00 E LTL F AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, LOOKING WEST

029 1 0144 00 E LTL W AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, LOOKING EAST

029 1 0144 00 N AT STATION 127+93±, MP 8.67
SR 144, FORD AVENUE, LOOKING NORTH ALONG THUNDERBIRD DRIVE

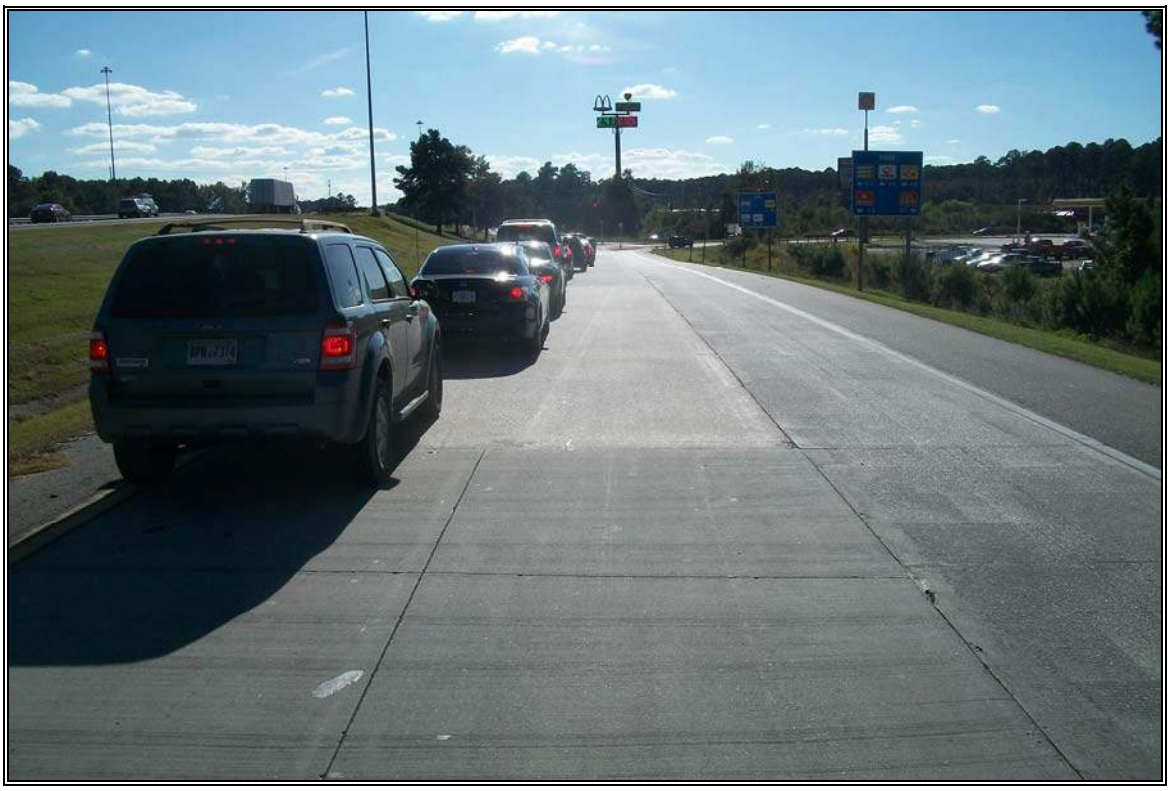
029 1 0144 00 N AT STATION 130+45±, MP 8.72
SR 144, FORD AVENUE, LOOKING NORTH ALONG LAUREL STREET

029 1 0144 00 W LTL WAT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, LOOKING WEST

029 1 0144 00 W LTL F AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, LOOKING EAST

029 6 0095 00 S LTL W AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LOOKING SOUTH

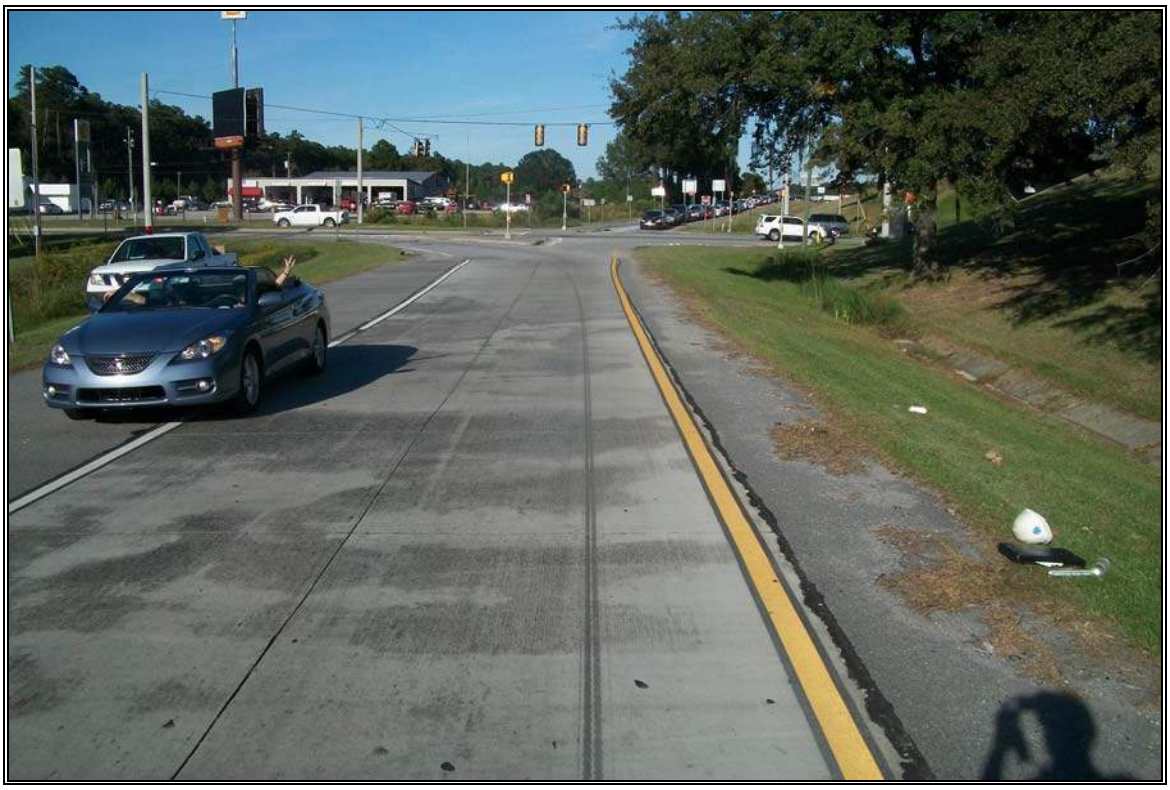
029 6 0095 00 S 1 F AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LOOKING NORTH



029 6 0095 00 S 1 W AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LOOKING SOUTH

029 6 0095 00 S 1 F AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LOOKING NORTH

029 6 0095 00 S 1 W AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, LOOKING SOUTH



029 6 0095 00 S 1 F AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, LOOKING NORTH

029 6 0095 00 S 1 W AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, LOOKING SOUTH

029 6 0095 00 S 1 F AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, LOOKING NORTH

029 6 0095 00 N 1 F AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, LOOKING SOUTH

029 6 0095 00 N 1 W AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, LOOKING NORTH

029 6 0095 00 N 1 F AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, LOOKING SOUTH

029 6 0095 00 N 1 W AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, LOOKING NORTH

029 6 0095 00 N 1 F AT STATION 3004+16±
I-95 NORTHBOUND EXIT RAMP, LOOKING SOUTH

029 6 0095 00 N 1 W AT STATION 3004+16±
I-95 NORTHBOUND EXIT RAMP, LOOKING NORTH

APPENDIX C
ROADWAY PHOTOGRAPHS (48-pages)

PHOTOGRAPH LEGEND

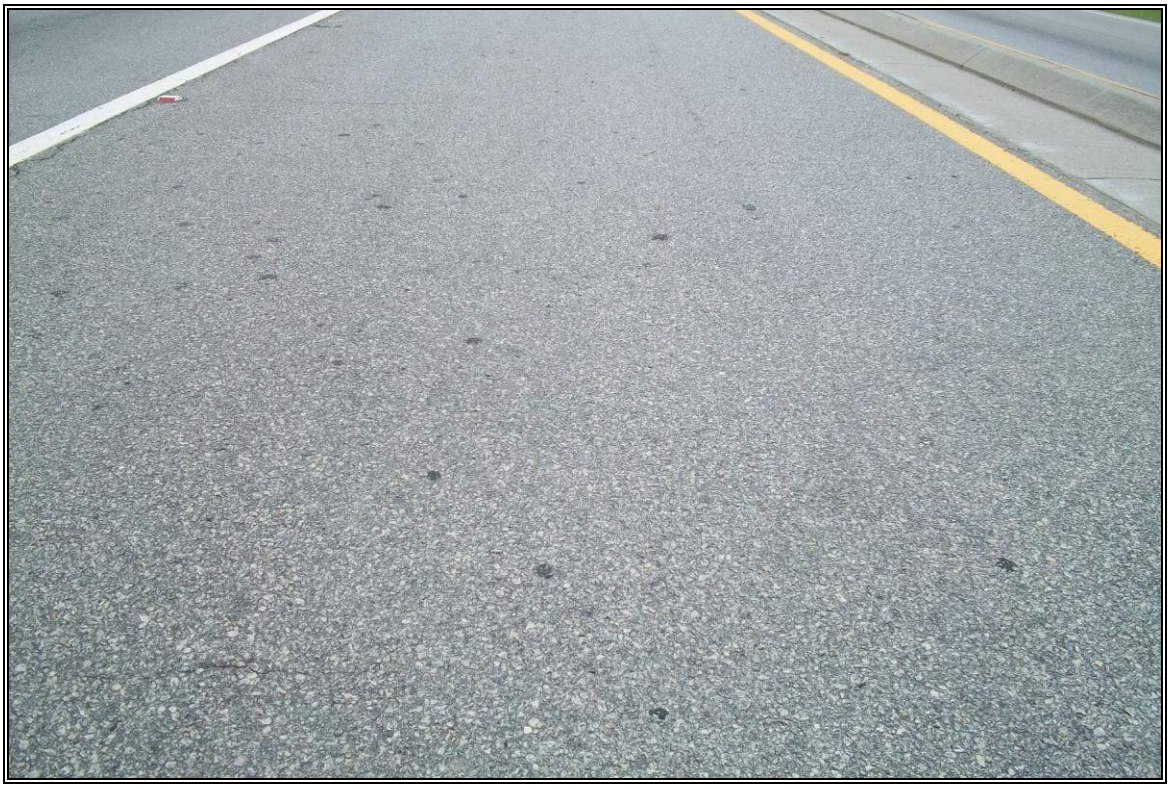
Photograph Type	Label Protocol	Project Information
County Number	A three digit number	029
Route Code	State, County, or other code route	1 = State Highway or Interstate 2 = County Road 3 = City Street 6 = Ramp
Route Number	A four digit ID followed by two character suffix SR 144 = 0144 I-95 = 0095	0144 XX 00 = SR or CR 03 = City
Direction of Travel	N or S E or W	E = Eastbound W = Westbound N = Northbound S = Southbound
Lane of Travel	A one-digit number LTL RTL SHLDR R SHLDR L SHLDR ML	1,2 LTL = Left Turn Lane RTL = Right Turn Lane SHLDR = Shoulder R SHLDR = Right Shoulder L SHLDR = Left Shoulder ML = Merge Lane
With Traffic or Facing Traffic	W or F	W or F
Milepost	MP	MP 8.41 to MP 8.73

029 1 0144 00 E 2 F AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, EASTBOUND, LANE 2, FACING TRAFFIC

029 1 0144 00 E RTL W AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, EASTBOUND, RIGHT TURN LANE, WITH TRAFFIC

029 1 0144 00 E 1 F AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, EASTBOUND, LANE 1, FACING TRAFFIC

029 1 0144 00 E 1 W AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, EASTBOUND, LANE 1, WITH TRAFFIC



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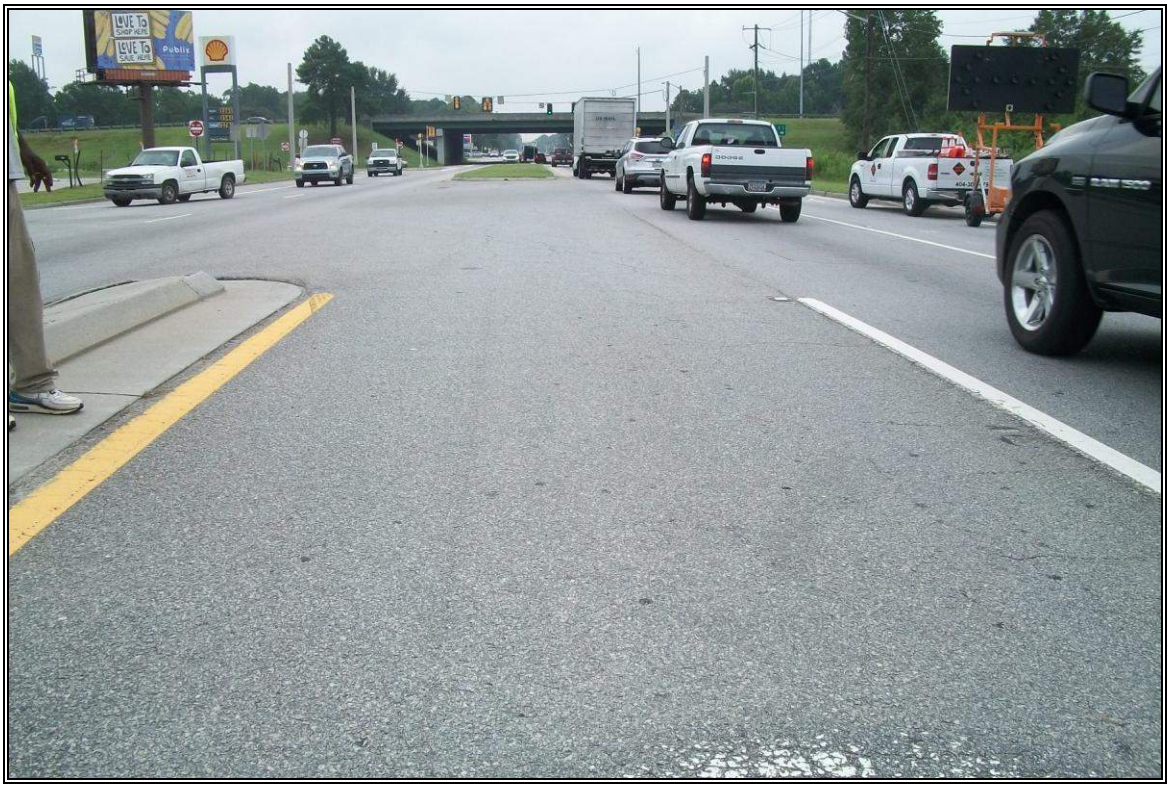
SR 144, FORD AVENUE, EASTBOUND, LEFT TURN LANE, FACING TRAFFIC



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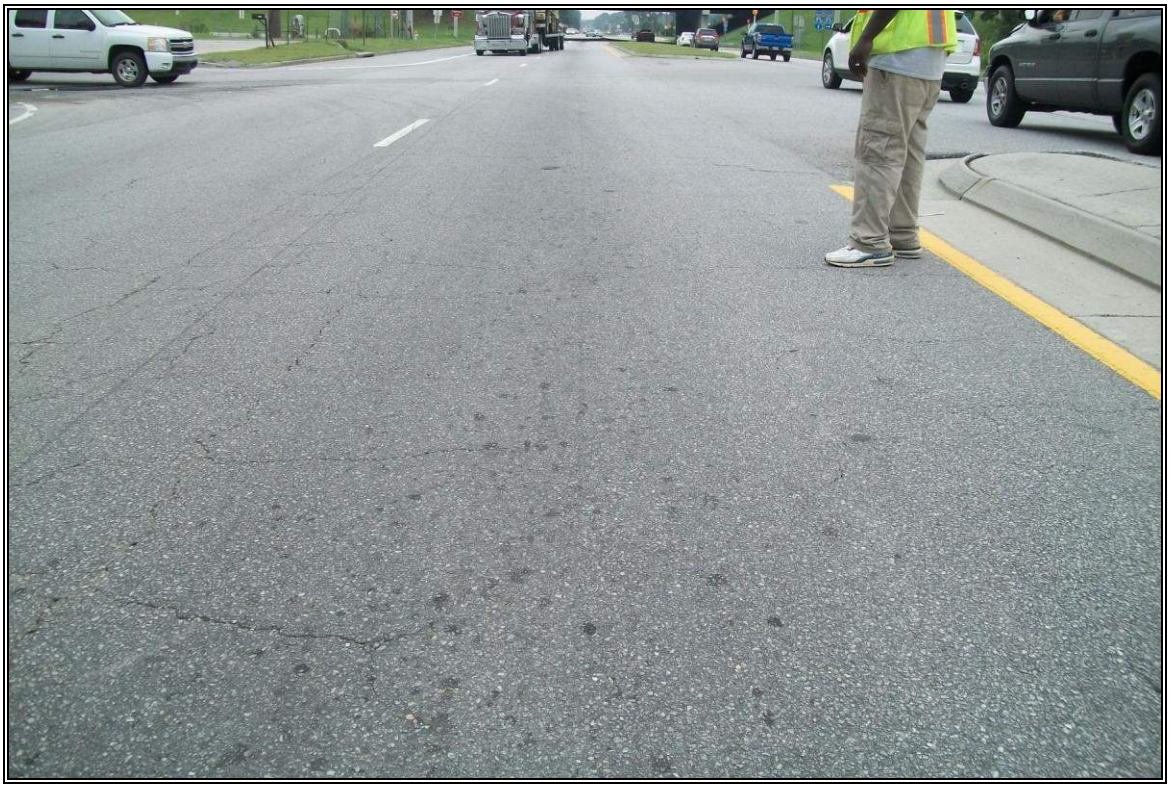
SR 144, FORD AVENUE, WESTBOUND, LANE 1, WITH TRAFFIC



029 1 0144 00 W 1 F AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, WESTBOUND, LANE 1, FACING TRAFFIC

029 1 0144 00 W 2 W AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, WESTBOUND, LANE 2, WITH TRAFFIC

029 1 0144 00 W 2 F AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, WESTBOUND, LANE 2, FACING TRAFFIC

029 1 0144 00 W SHLDR W AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, WESTBOUND, SHOULDER, WITH TRAFFIC

029 1 0144 00 W SHLDR F AT STATION 223+12±, MP 8.46
SR 144, FORD AVENUE, WESTBOUND, SHOULDER, FACING TRAFFIC

029 1 0144 00 E SHLDR F AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, EASTBOUND, SHOULDER, FACING TRAFFIC

029 1 0144 00 E SHLDR W AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, EASTBOUND, SHOULDER, WITH TRAFFIC

029 1 0144 00 E 1 F AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, EASTBOUND, LANE 1, FACING TRAFFIC

029 1 0144 00 E 1 W AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, EASTBOUND, LANE 1, WITH TRAFFIC

029 1 0144 00 W LTL W AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, WESTBOUND, LEFT TURN LANE, WITH TRAFFIC

029 1 0144 00 W LTL F AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, WESTBOUND, LEFT TURN LANE, FACING TRAFFIC

029 1 0144 00 W 1 W AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, WESTBOUND, LANE 1, WITH TRAFFIC

029 1 0144 00 W 1 F AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, WESTBOUND, LANE 1, FACING TRAFFIC

029 1 0144 00 W SHLDR W AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, WESTBOUND, SHOULDER, WITH TRAFFIC

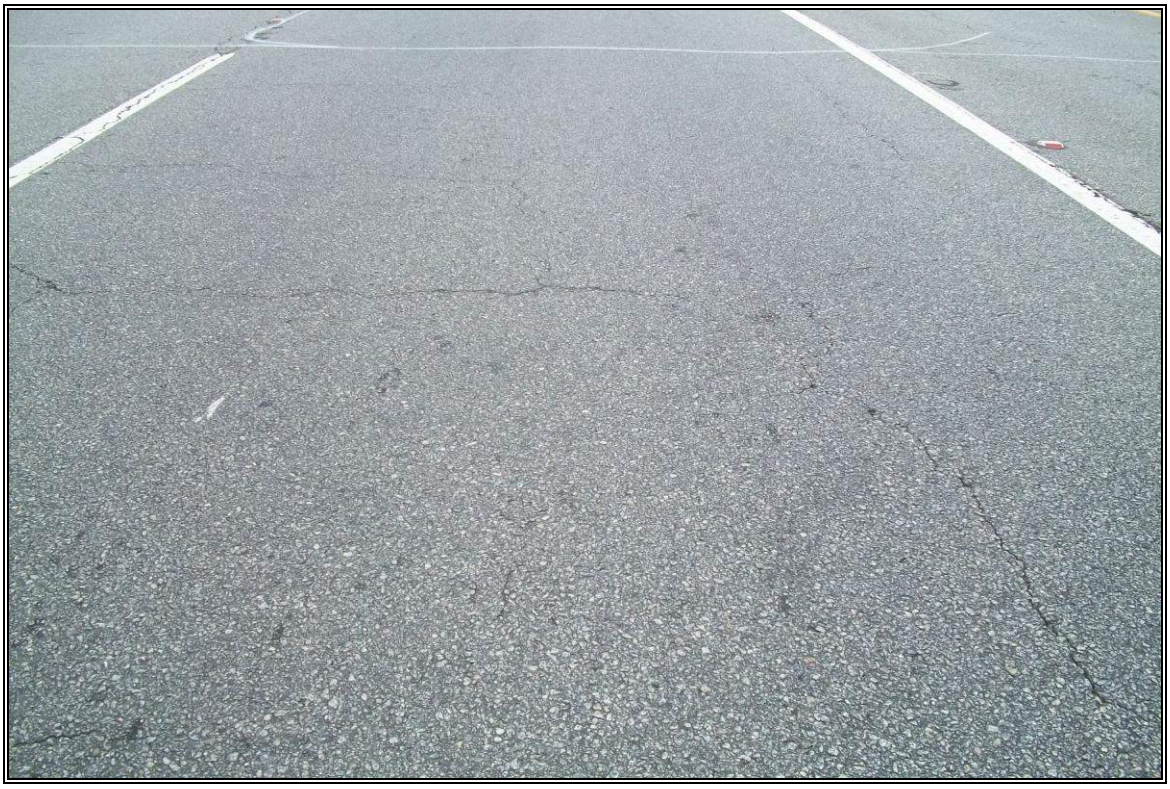
029 1 0144 00 W SHLDR F AT STATION 122+23±, MP 8.56
SR 144, FORD AVENUE, WESTBOUND, SHOULDER, FACING TRAFFIC

029 1 0144 00 E SHLDR F AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, SHOULDER, FACING TRAFFIC

029 1 0144 00 E SHLDR W AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, SHOULDER, WITH TRAFFIC

029 1 0144 00 E 2 F AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, LANE 2, FACING TRAFFIC

029 1 0144 00 E 2 W AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, LANE 2, WITH TRAFFIC



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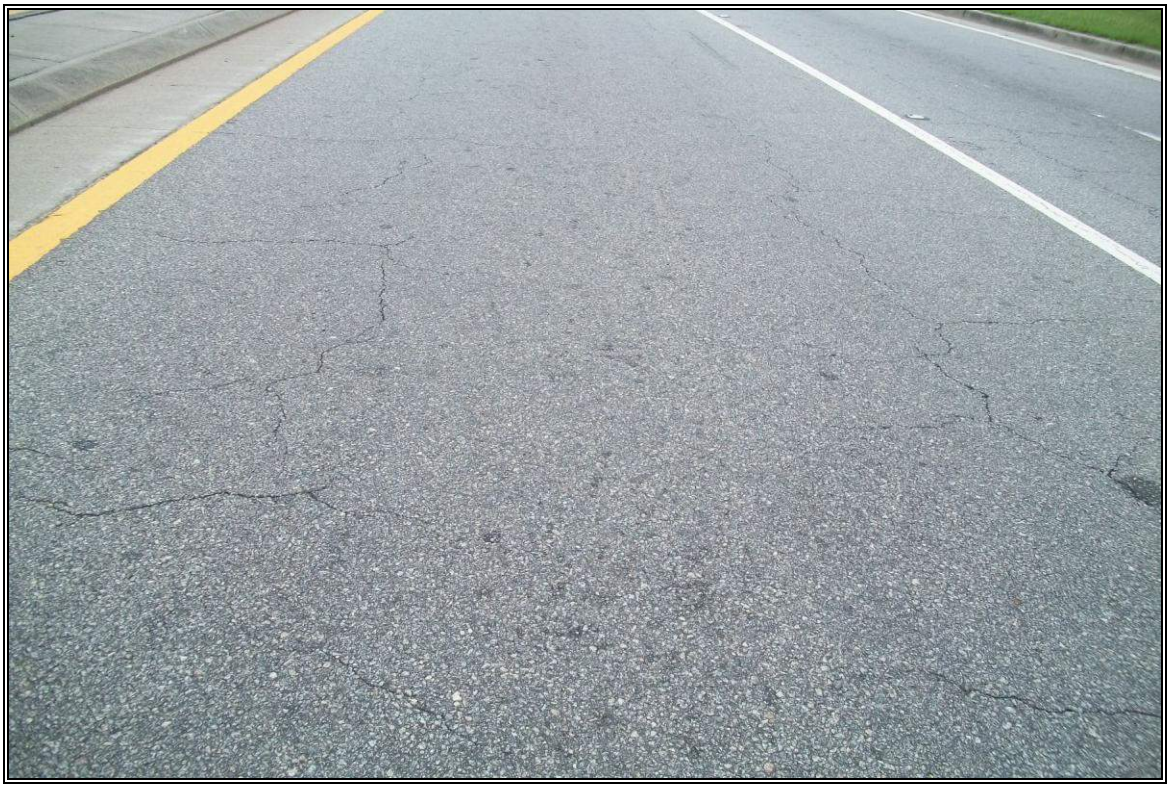
029 1 0144 00 E 1 W AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, LANE 1, WITH TRAFFIC

029 1 0144 00 E LTL F AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, LEFT TURN LANE, FACING TRAFFIC

029 1 0144 00 E LTL W AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, EASTBOUND, LEFT TURN LANE, WITH TRAFFIC



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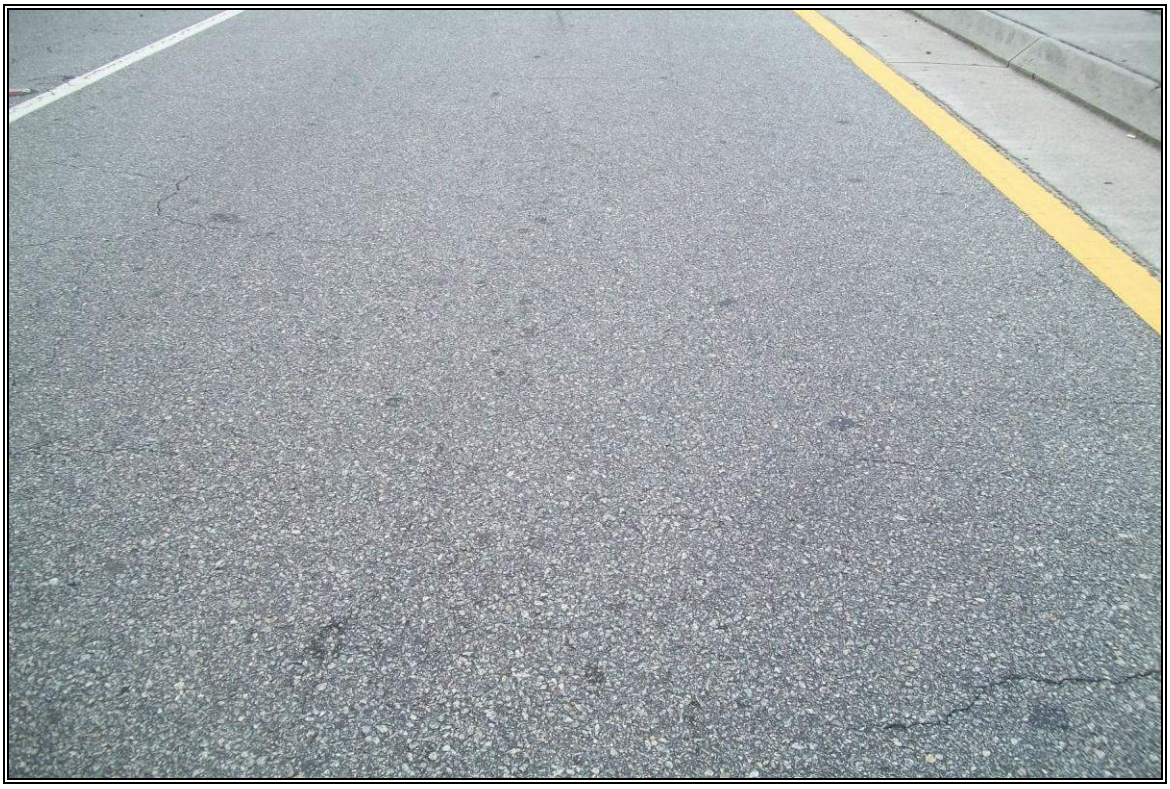

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SR 144, FORD AVENUE, WESTBOUND, LANE 1, FACING TRAFFIC

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SR 144, FORD AVENUE, WESTBOUND, LANE 2, WITH TRAFFIC

029 1 0144 00 W 2 F AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, WESTBOUND, LANE 2, FACING TRAFFIC

029 1 0144 00 W ML W AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, WESTBOUND, MERGE LANE, WITH TRAFFIC

029 1 0144 00 W ML F AT STATION 127+02±, MP 8.65
SR 144, FORD AVENUE, WESTBOUND, MERGE LANE, FACING TRAFFIC

029 1 0144 00 E 2 F AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, EASTBOUND, LANE 2, FACING TRAFFIC

029 1 0144 00 E 2 W AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, EASTBOUND, LANE 2, WITH TRAFFIC

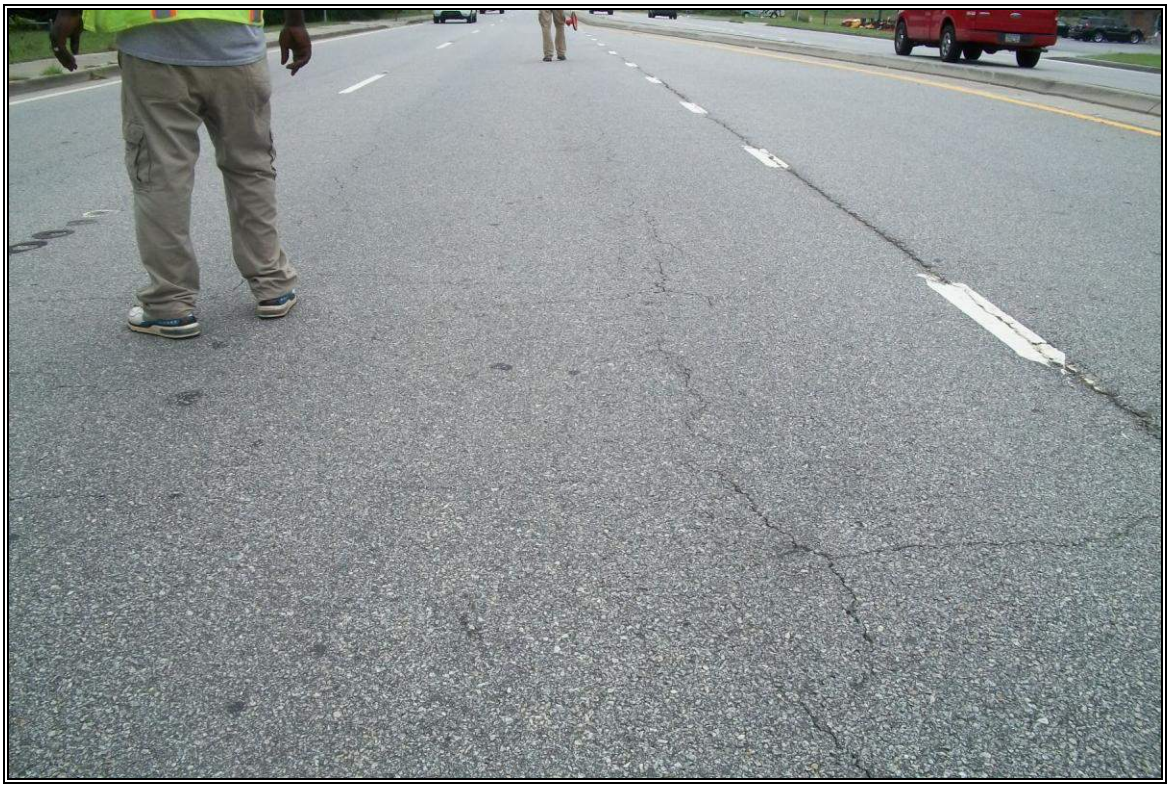
029 1 0144 00 E 1 F AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, EASTBOUND, LANE 1, FACING TRAFFIC

029 1 0144 00 E 1 W AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, EASTBOUND, LANE 1, WITH TRAFFIC

029 1 0144 00 W LTL W AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, WESTBOUND, LEFT TURN LANE, WITH TRAFFIC

029 1 0144 00 W LTL F AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, WESTBOUND, LEFT TURN LANE, FACING TRAFFIC

029 1 0144 00 W 1 W AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, WESTBOUND, LANE 1, WITH TRAFFIC



029 1 0144 00 W 1 F AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, WESTBOUND, LANE 1, FACING TRAFFIC

029 1 0144 00 W 2 W AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, WESTBOUND, LANE 2, WITH TRAFFIC

029 1 0144 00 W 2 F AT STATION 130+96±, MP 8.73
SR 144, FORD AVENUE, WESTBOUND, LANE 2, FACING TRAFFIC

029 6 0095 00 S R SHLDR F AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, RIGHT SHOULDER, FACING TRAFFIC

029 6 0095 00 S R SHLDR W AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, RIGHT SHOULDER, WITH TRAFFIC

029 6 0095 00 S 2 F AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LANE 2, FACING TRAFFIC

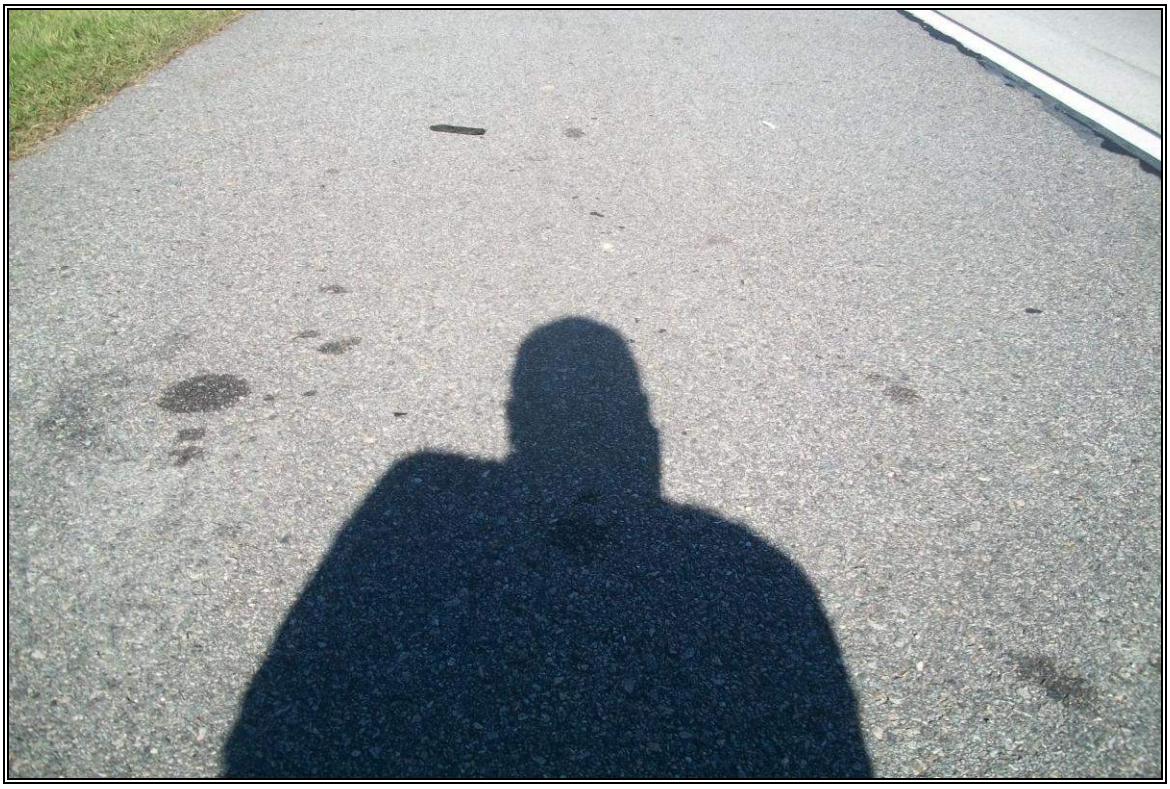
029 6 0095 00 S 2 W AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LANE 2, WITH TRAFFIC

029 6 0095 00 S 1 F AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 S 1 W AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LANE 1, WITH TRAFFIC

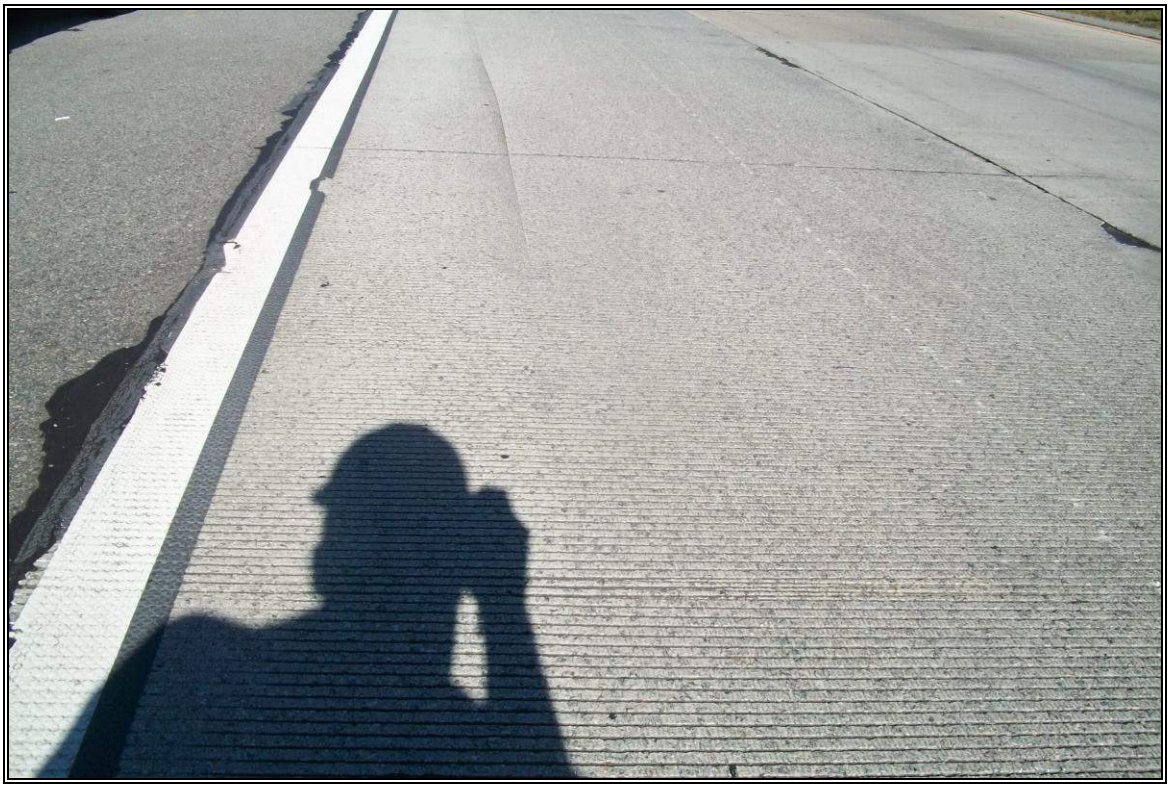
029 6 0095 00 S L SHLDR F AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LEFT SHOULDER, FACING TRAFFIC

029 6 0095 00 S L SHLDR W AT STATION 1001+80±
I-95 SOUTHBOUND EXIT RAMP, LEFT SHOULDER, WITH TRAFFIC



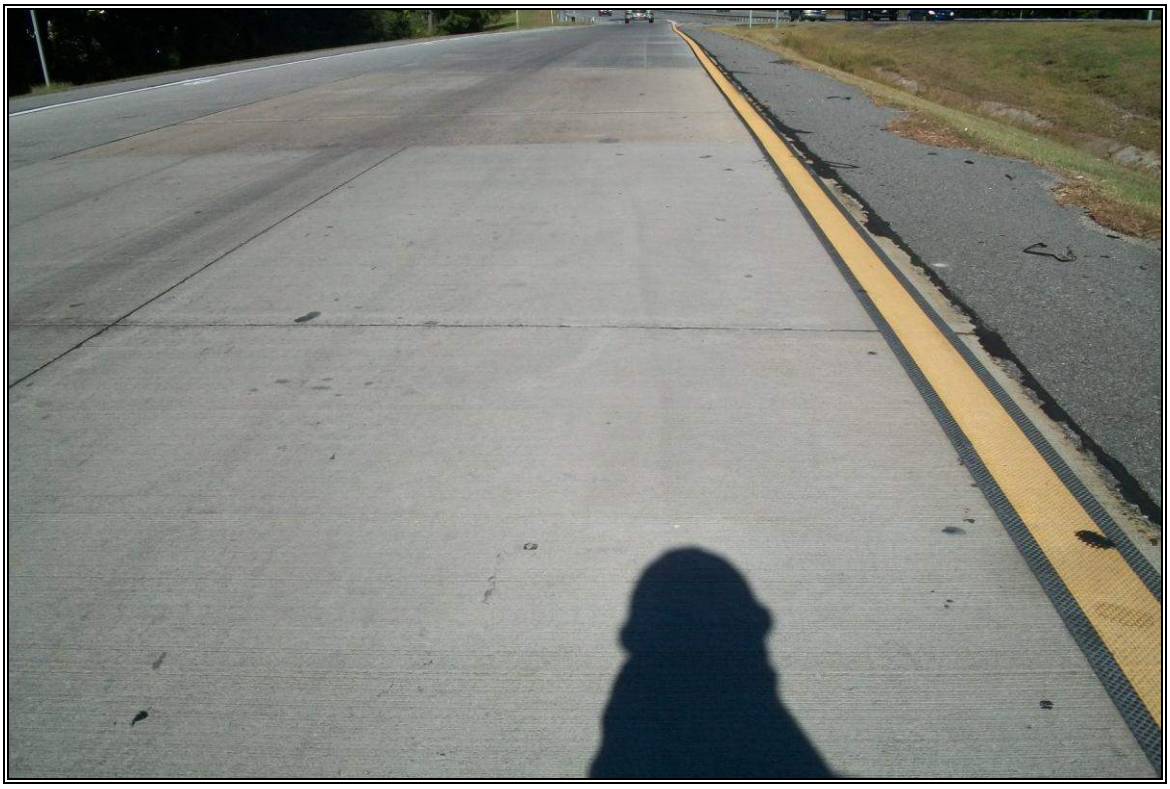
029 6 0095 00 S R SHLDR F AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, RIGHT SHOULDER, FACING TRAFFIC

029 6 0095 00 S R SHLDR W AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, RIGHT SHOULDER, WITH TRAFFIC



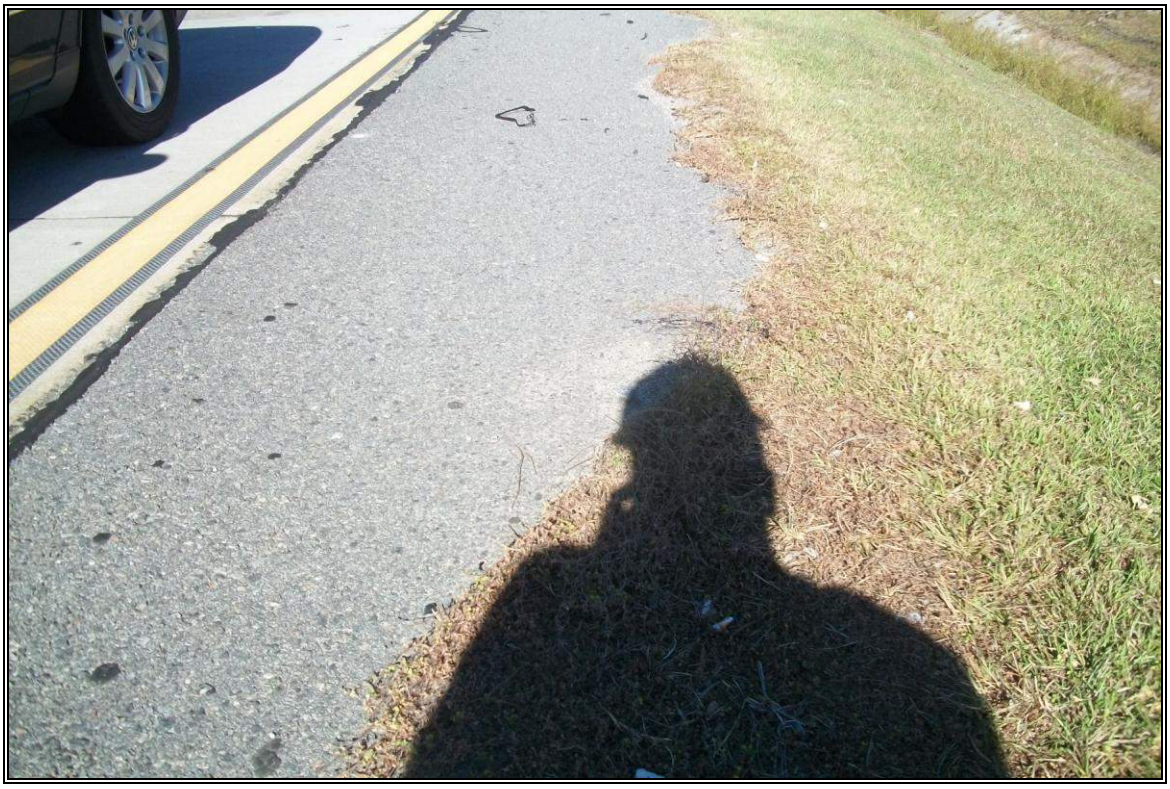
029 6 0095 00 S 2 F AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LANE 2, FACING TRAFFIC

029 6 0095 00 S 2 W AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LANE 2, WITH TRAFFIC



029 6 0095 00 S 1 F AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 S 1 W AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LANE 1, WITH TRAFFIC



029 6 0095 00 S L SHLDR F AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LEFT SHOULDER, FACING TRAFFIC

029 6 0095 00 S L SHLDR W AT STATION 1006+50±
I-95 SOUTHBOUND EXIT RAMP, LEFT SHOULDER, WITH TRAFFIC

029 6 0095 00 S R SHLDR F AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, RIGHT SHOULDER, FACING TRAFFIC

029 6 0095 00 S R SHLDR W AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, RIGHT SHOULDER, WITH TRAFFIC

029 6 0095 00 S 1 F AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 S 1 W AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, LANE 1, WITH TRAFFIC

029 6 0095 00 S L SHLDR F AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, LEFT SHOULDER, FACING TRAFFIC

029 6 0095 00 S L SHLDR W AT STATION 2003+50±
I-95 SOUTHBOUND ENTRANCE RAMP, LEFT SHOULDER, WITH TRAFFIC

029 6 0095 00 S R SHLDR F AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, RIGHT SHOULDER, FACING TRAFFIC

029 6 0095 00 S R SHLDR W AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, RIGHT SHOULDER, WITH TRAFFIC

029 6 0095 00 S 1 F AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 S 1 W AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, LANE 1, WITH TRAFFIC

029 6 0095 00 S L SHLDR F AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, LEFT SHOULDER, FACING TRAFFIC

029 6 0095 00 S L SHLDR W AT STATION 2004+96±
I-95 SOUTHBOUND ENTRANCE RAMP, LEFT SHOULDER, WITH TRAFFIC

029 6 0095 00 S 1 AT STATION 2005+00±
I-95 SOUTHBOUND ENTRANCE RAMP, LOOKING WEST AT A CHANGE IN PAVEMENT TYPES

029 6 0095 00 N 1 AT STATION 4001+36±
I-95 NORTHBOUND ENTRANCE RAMP, LOOKING EAST TOWARD A CHANGE IN PAVEMENT TYPES

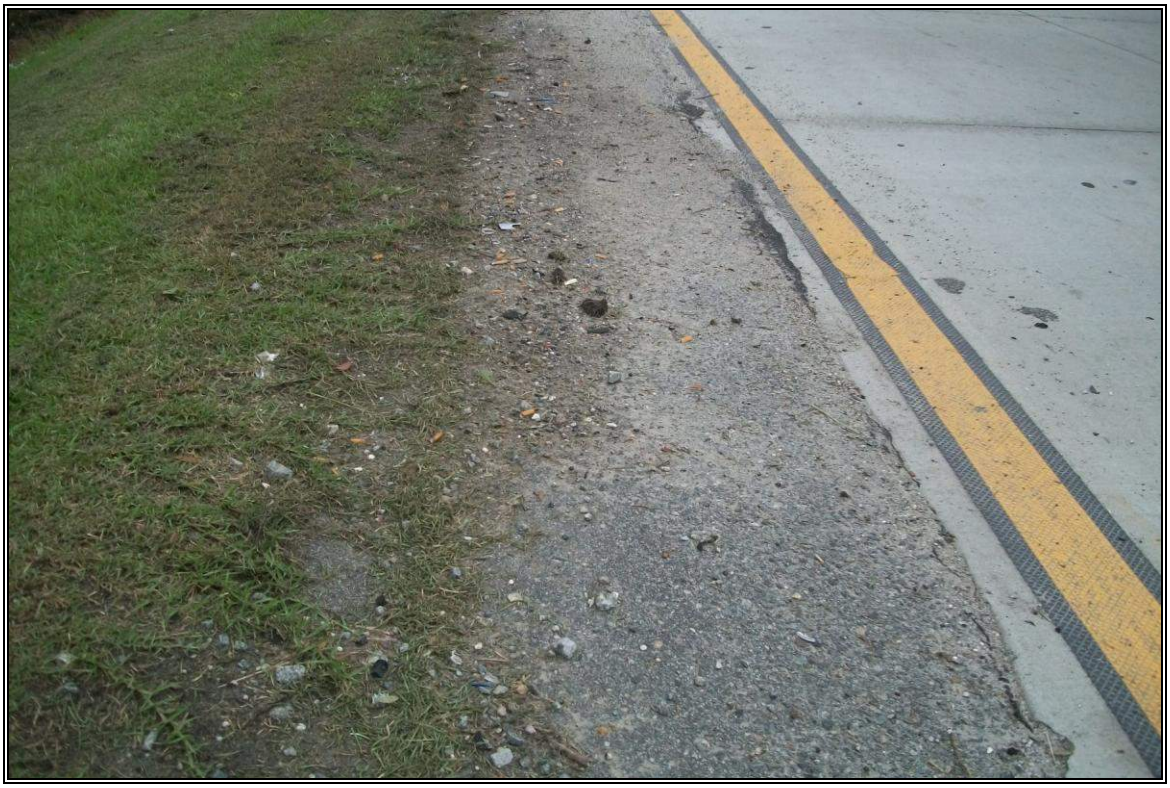
029 6 0095 00 N R SHLDR F AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, RIGHT SHOULDER, FACING TRAFFIC

029 6 0095 00 N R SHLDR W AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, RIGHT SHOULDER, WITH TRAFFIC

029 6 0095 00 N 1 F AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 N 1 W AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, LANE 1, WITH TRAFFIC

029 6 0095 00 N L SHLDR F AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, LEFT SHOULDER, FACING TRAFFIC



029 6 0095 00 N L SHLDR W AT STATION 4001+43±
I-95 NORTHBOUND ENTRANCE RAMP, LEFT SHOULDER, WITH TRAFFIC

029 6 0095 00 N R SHLDR F AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, RIGHT SHOULDER, FACING TRAFFIC

029 6 0095 00 N R SHLDR W AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, RIGHT SHOULDER, WITH TRAFFIC

029 6 0095 00 N 1 F AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 N 1 W AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, LANE 1, WITH TRAFFIC

029 6 0095 00 N L SHLDR F AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, LEFT SHOULDER, FACING TRAFFIC

029 6 0095 00 N L SHLDR W AT STATION 2999+16±
I-95 NORTHBOUND EXIT RAMP, LEFT SHOULDER, WITH TRAFFIC

029 6 0095 00 N 1 F AT STATION 3004+16±
I-95 NORTHBOUND EXIT RAMP, LANE 1, FACING TRAFFIC

029 6 0095 00 N 1 W AT STATION 3004+16±
I-95 NORTHBOUND EXIT RAMP, LANE 1, WITH TRAFFIC

029 6 0095 00 N L SHLDR F AT STATION 3004+16±
I-95 NORTHBOUND EXIT RAMP, LEFT SHOULDER, FACING TRAFFIC

029 6 0095 00 N L SHLDR W AT STATION 3004+16±
I-95 NORTHBOUND EXIT RAMP, LEFT SHOULDER, WITH TRAFFIC

029 6 0095 00 N 1 AT STATION 3004+25±
I-95 NORTHBOUND EXIT RAMP, LOOKING WEST TOWARD A CHANGE IN PAVEMENT TYPES

APPENDIX D
EXAMPLE PHOTOGRAPHS (19-pages)

LOAD CRACKING LEVEL 1, SR 144, STATION 223+82±, EB, LTL, DW, MP=8.48

LOAD CRACKING LEVEL 2, SR 144, STATION 224+28±, WB, LN 1, DW, MP=8.49

LOAD CRACKING LEVEL 3, SR 144, STATION 221+10±, WB, LN 1, PW, MP=8.43

LOAD CRACKING LEVEL 3, SR 144, STATION 224+00±, EB, RTL, DW, MP=8.48

LOAD CRACKING LEVEL 4, SR 144, STATION 220+59±, WB, LN 1, DW, MP=8.42

BLOCK/TRANSVERSE CRACKING LEVEL 1, SR 144, STATION 129+45±, EB, LN 2, MP=8.65

BLOCK/TRANSVERSE CRACKING LEVEL 2, SR 144, STATION 223+86±, WB, LN 1, MP=8.48

BLOCK/TRANSVERSE CRACKING LEVEL 3, SR 144, STATION 221+07±, EB, LN 2, PW, MP=8.42

BLOCK/TRANSVERSE CRACKING LEVEL 3, I-95 SOUTHBOUND EXIT RAMP, STATION 1001+10±, SB, RTL

BLOCK/TRANSVERSE CRACKING LEVEL 3, I-95 NORTHBOUND EXIT RAMP, STATION 3004+87±, NB, LTL

BLOCK/TRANSVERSE CRACKING LEVEL 3, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4000+82±, NB, LN 1

BLEEDING LEVEL 1, SR 144, STATION 122+21±, WB, LTL, MP=8.56

BLEEDING LEVEL 1, I-95 SOUTHBOUND ENTRANCE RAMP, STATION 1002+44±, SB, R SHLDR

CRACKING DUE TO TRENCH EXCAVATION, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4000+76±, NB, LN 1, PW

RAVELING LEVEL 1, SR 144, STATION 123+13±, WB, LN 1, DW, MP=8.58

RAVELING LEVEL 2, SR 144, STATION 123+31±, EB, LTL, MP=8.58

RAVELING LEVEL 3, SR 144, STATION 123+66±, EB, LTL, MP=8.59

EDGE DISTRESS LEVEL 1, I-95 SOUTHBOUND EXIT RAMP, STATION 1003+40±, SB, R SHLDR

EDGE DISTRESS LEVEL 1 AND SHOULDER JOINT DISTRESS, I-95 SOUTHBOUND EXIT RAMP, STATION 1003+62±, SB, R SHLDR

EDGE DISTRESS LEVEL 2, SR 144, STATION 129+39±, WB, LTL, MP=8.70

EDGE DISTRESS LEVEL 3, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4001+48±, NB, R SHLDR

PATCH AND POTHOLE, SR 144, STATION 220+17±, WB, LTL, PW, MP=8.40

POTHOLE, SR 144, STATION 220+65±, WB, LTL, DW, MP=8.41

PATCH, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4001+43±, NB, R SHLDR

FAULTING (1.00”), I-95 SOUTHBOUND EXIT RAMP, STATION 1002+56±, SB, LN 2

BROKEN SLAB LEVEL 1, I-95 NORTHBOUND EXIT RAMP, STATION 2997+23±, NB, LN 1

BROKEN SLAB LEVEL 2 AND FAULTING (up to 0.75”), I-95 SOUTHBOUND EXIT RAMP, STATION 1002+61±, SB, LN 2

SLAB WITH LONGITUDINAL CRACK LEVEL 1, I-95 NORTHBOUND EXIT RAMP, STATION 2997+44±, NB, LN 1

REPLACED SLAB, I-95 NORTHBOUND EXIT RAMP, STATION 3002+69±, NB, LN 1

REPLACED SLAB WITH LONGITUDINAL CRACKS LEVEL 1, I-95 NORTHBOUND EXIT RAMP, STATION 3003+37±, NB, LN 1

JOINT WITH SPALL, I-95 NORTHBOUND EXIT RAMP, STA. 3002+72±, NB, LN 1

JOINT WITH SPALL AND SPALL PATCH, I-95 SOUTHBOUND EXIT RAMP, STATION 1004+20±, SB, LN 2, DW

JOINT WITH SPALL PATCH, I-95 SOUTHBOUND EXIT RAMP, STATION 1004+88±, SB, LN 2, DW

JOINT WITH SPALL AND SPALL PATCHES, I-95 NORTHBOUND ENTRANCE RAMP, STATION 3002+98±, NB, LN 1

SHOULDER JOINT DISTRESS LEVEL 1, I-95 NORTHBOUND ENTRANCE RAMP, STATION 3003+10±, NB, LN 1, LEFT SIDE OF LANE

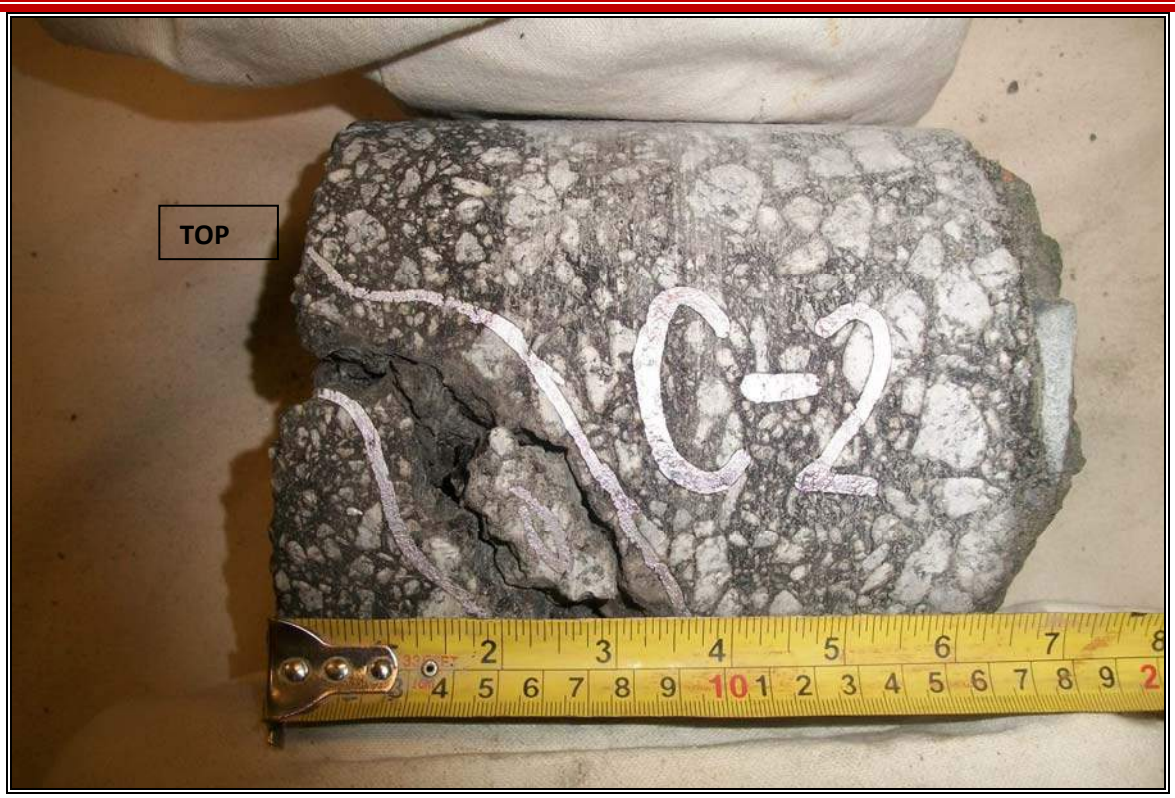
POPOUTS, I-95 NORTHBOUND EXIT RAMP, STATION 2997+34±, NB, LN 1, PW

MAP CRACKING, I-95 SOUTHBOUND ENTRANCE RAMP, STATION 2004+14±, SB, LN 1

APPENDIX E
CORE PHOTOGRAPHS (15-pages)

CORE C-1, I-95 SOUTHBOUND EXIT RAMP, STATION 1001+39±, SB, RTL, PW

CORE C-2, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4000+92, NB, LN 1, DW



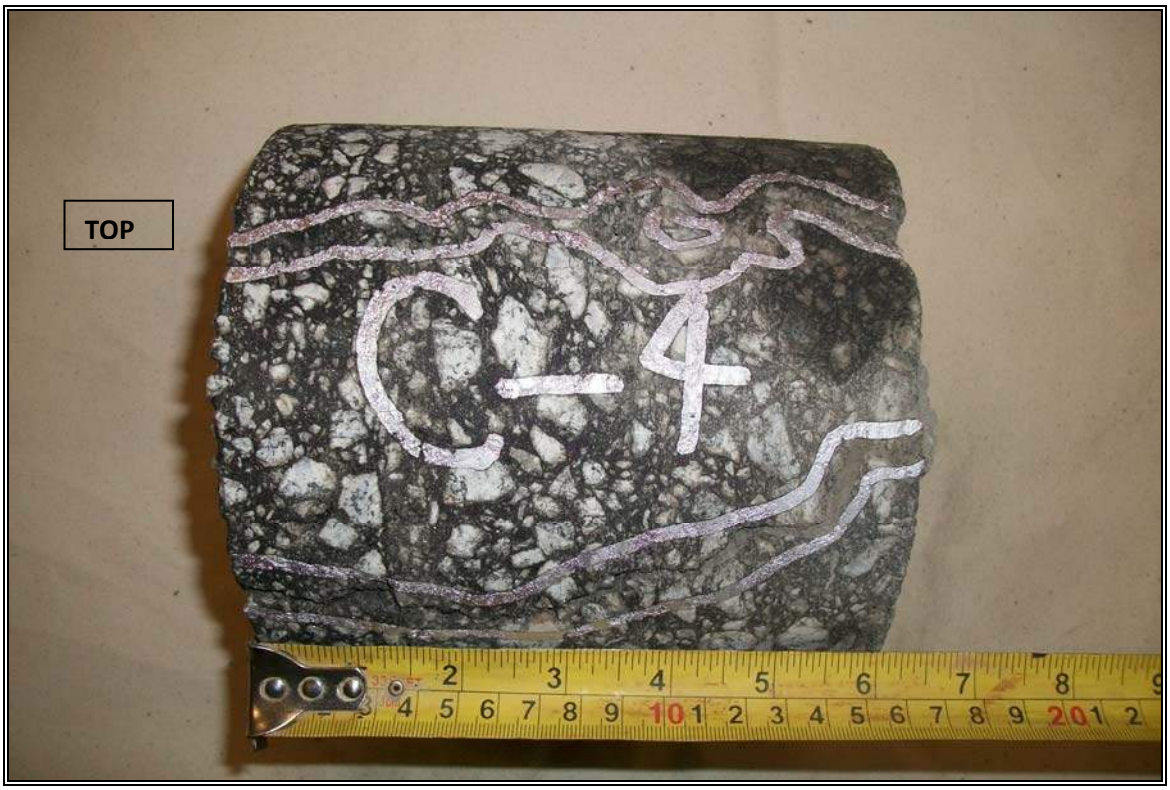
CORE C-2, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4000+92, NB, LN 1, DW, showing another side of the core

CORE C-2, I-95 NORTHBOUND ENTRANCE RAMP, STATION 4000+92, NB, LN 1, DW, showing a side of the core without cracks

CORE C-3, SR 144, STATION 226+11, WB, LN 1, PW, MP= 8.52

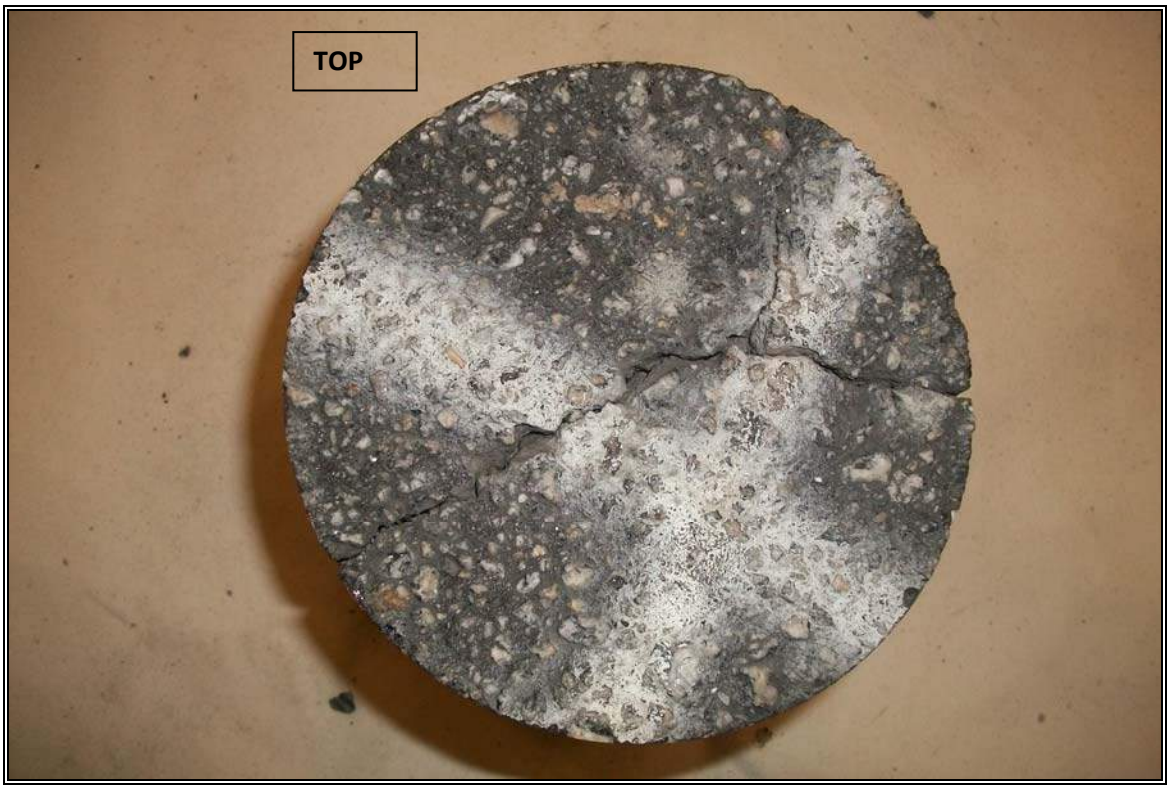
CORE C-3, SR 144, STATION 226+11, WB, LN 1, PW, MP= 8.52, showing another side of the core

CORE C-3, SR 144, STATION 226+11, WB, LN 1, PW, MP= 8.52, showing the top of the core



CORE C-4, SR 144, STATION 122+49, WB, LN 1, DW, MP= 8.56

CORE C-4, SR 144, STATION 122+49, WB, LN 1, DW, MP= 8.56, showing another side of the core



CORE C-4, SR 144, STATION 122+49, WB, LN 1, DW, MP= 8.56, showing the top of the core

CORE C-5, SR 144, STATION 123+96, EB, LTL, PW, MP= 8.59

CORE C-5, SR 144, STATION 123+96, EB, LTL, PW, MP= 8.59, showing another side of the core

CORE C-5, SR 144, STATION 123+96, EB, LTL, PW, MP= 8.59, showing the top of the core

CORE C-6, SR 144, STATION 126+69, EB, LN 1, PW, MP= 8.65

CORE C-6, SR 144, STATION 126+69, EB, LN 1, PW, MP= 8.65, showing the bottom portion of the core with bituminous base

CORE C-6, SR 144, STATION 126+69, EB, LN 1, PW, MP= 8.65, showing the bottom of the core with bituminous base

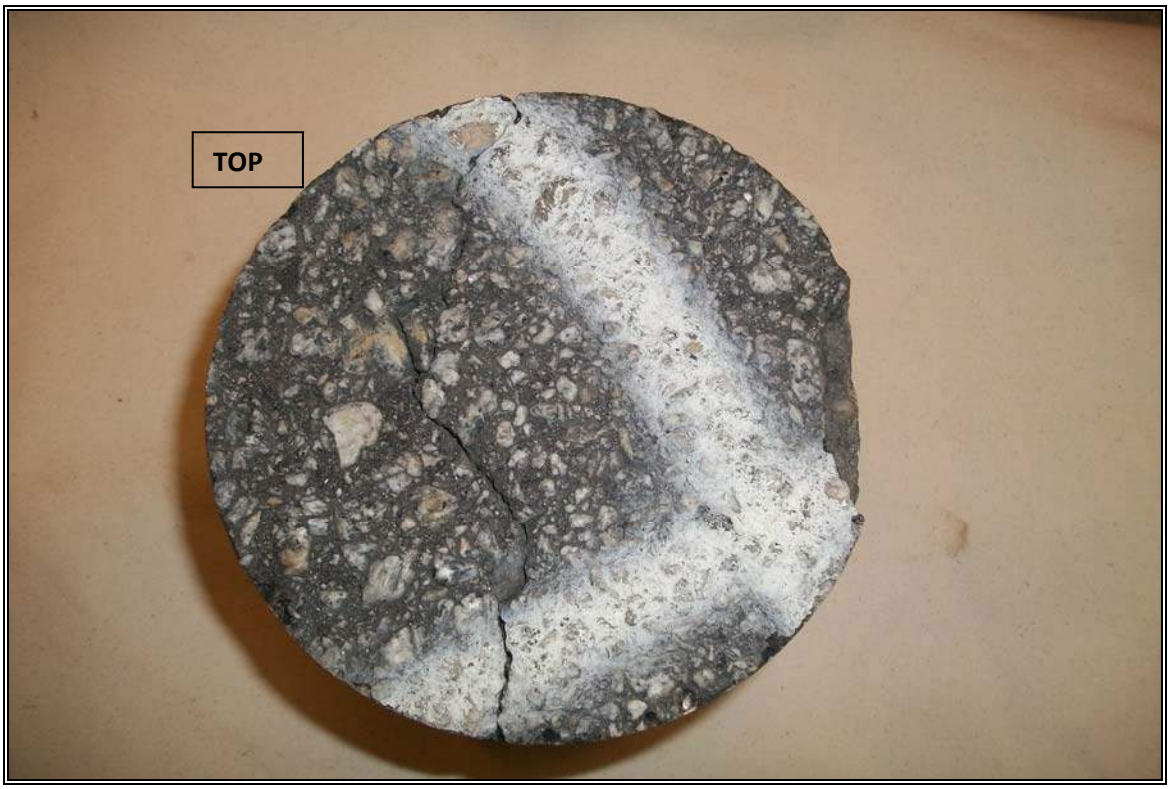
CORE C-7, SR 144, STATION 129+44, WB, LN 1, DW, MP= 8.70

CORE C-7, SR 144, STATION 129+44, WB, LN 1, DW, MP= 8.70, showing the top of the core

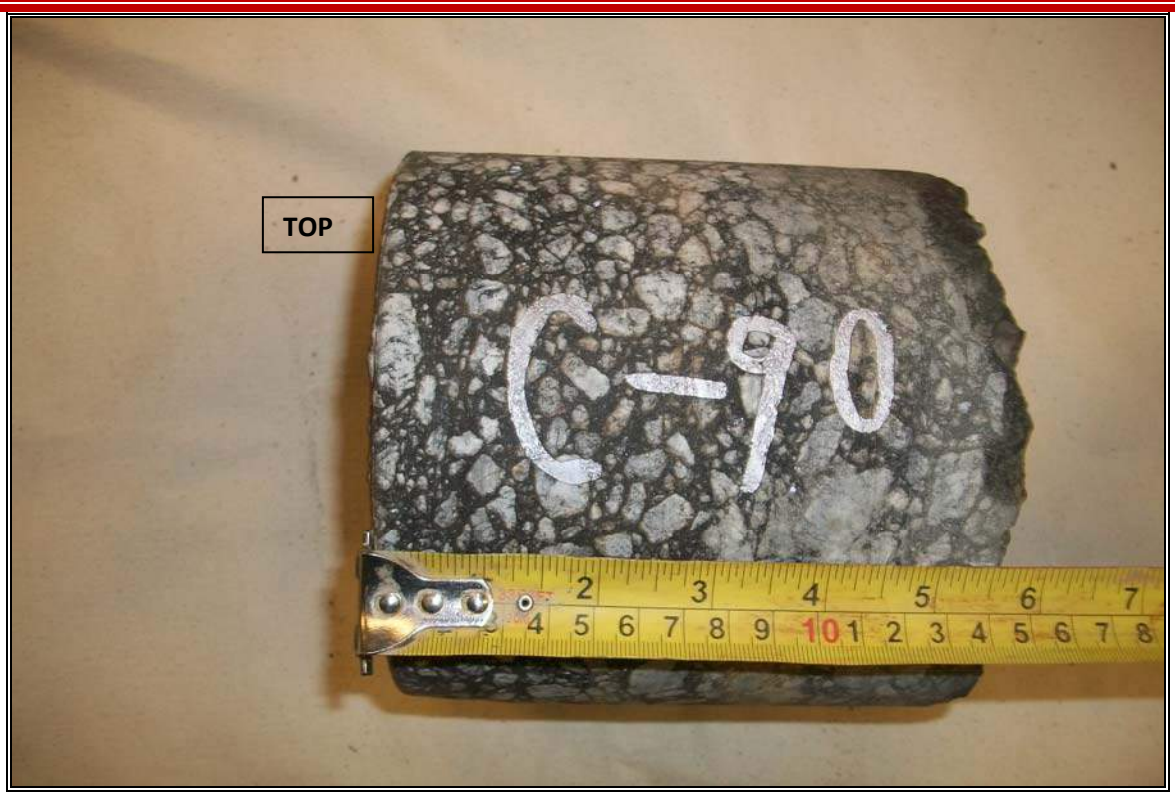
CORE C-8, SR 144, STATION 223+96, EB, RTL, DW, MP= 8.47

CORE C-8, SR 144, STATION 223+96, EB, RTL, DW, MP= 8.47, showing another side of the core

CORE C-8, SR 144, STATION 223+96, EB, RTL, DW, MP= 8.47, showing another side of the core



CORE C-8, SR 144, STATION 223+96, EB, RTL, DW, MP= 8.47, showing the top of the core



CORE C-9, SR 144, STATION 226+24, EB, LN 1, DW, MP= 8.52

CORE C-10, SR 144, STATION 226+24, EB, LN 1, CL of lane, MP= 8.52

CORE C-11, SR 144, STATION 226+24, EB, LN 1, PW, MP= 8.52

CORE C-12, I-95 SOUTHBOUND ENTRANCE RAMP, STATION 2005+30, SB, LN 1, PW

CORE C-12, I-95 SOUTHBOUND ENTRANCE RAMP, STATION 2005+30, SB, LN 1, PW, showing another side of the core

CORE C-12, I-95 SOUTHBOUND ENTRANCE RAMP, STATION 2005+30, SB, LN 1, PW, showing another side of the core

CORE C-12, I-95 SOUTHBOUND ENTRANCE RAMP, STATION 2005+30, SB, LN 1, PW, showing the top of the core

CORE C-13, I-95 NORTHBOUND EXIT RAMP, STATION 3004+73, NB, RTL, PW

APPENDIX F
PAVEMENT RATINGS (15-pages)

File name: Data\FY2015_D5_A5_Merged_Final.mdb

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 11/19/2014 10:25:45 AM | Project Rating: 48 | Office: A5 | Rater: T. GOOBER- W.PARKER

A. PROJECT LOCATION

District: 5	Route Type: 1	Route No: 0144	Route Suffix: 00
County1:BRYAN	**CountyNO: 029**	**Milepost From: 8.1**	To: 11.5
County2:	**CountyNO:**	**Milepost From2:**	To2:
County3:	**CountyNO:**	**Milepost From3:**	To3:

Project Limits: BEGINNING OF DIVIDED HIGHWAY TO END OF DIVIDED HIGHWAY.

Estimated length of the cutter & gutter that requires MILLING(mile): 6.8

B. ROADWAY INFORMATION

Surface Type: ASPHALT CONCRETE	Divided Highway: YES	Direction: POS.	
Typical Pavement Width(ft.): 52	Typical Shoulder Width(ft.): 0	No. Bridges: 0	Bridge Width(ft.):
STAA: NO	AADT: 19280	% Truck: 15.1	

C. REMARKS

Sample Location							Rut Depth		Load Cracking				Block Cracking		Reflection Cracking			Raveling		Edge Distress		Bleeding/ Flushing		Corrugation /Pushing		Loss Pavement Section		Cross Slopes			Seg. Rating	Crack Width	Remarks
Milepost																																		
From	To	County	Sample Location	Lane Direction	Lane No (1,2,3...)	Project Limit	Outside W.P. (1/8 inch)	Inside W.P. (1/8 inch)	Severity 1	Severity 2	Severity 3	Severity 4	% of Sample	Severity (1,2,3)	No. of Cracks	Total Length	Severity (1,2,3)	% of Sample	Severity (1,2,3)	% of Sample	Severity (1,2,3)	% of Sample	Severity (1,2,3)	% of Sample	Severity (1,2,3)	% of Sample	Severity (1,2,3)	Left (1/8 inch)	Right (1/8inch)	Patches & Potholes	Rating	Greater than 1/8 inch?	
8.1	9	029	7	POS.	2	1	1	1	5	10			100	1																0	68	NO	
9	10	029	7	POS.	1	0	1	2		100			40	1																0	56	YES	
10	11	029	9	POS.	1	0	1	1	50	50			100	1																1	48	NO	
11	11.5	029	4	POS.	1	1	1	1	50	50			100	1																1	48	NO	

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/17/2015 **Project Rating:** 11 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 1 **Route No: 0144** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**8.41**	**8.53**
County 2:			
County 3:			

Project Limits: Station 220+10 to Station 226+30.
Estimated Length of the curb & gutter that requires MILLING (mile): 0.07

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 63
Typical Shoulder Width (ft): 10*
Divided Highway: YES Direction: 2 way Surface Type: ASPHALT CONCRETE
AADT: 7,200 Initial Year: 2017
AADT: 10,500 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 0 feet to 10 feet paved and 2 to 20 feet unpaved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	44.9	20.0	18.6	0.0	
Deduct Points	15.0	16.8	27.1	0.0	59

Block Cracking	%Level 1	%Level 2	%Level 3	
	45.6	54.4	0.0	
Deduct Points	9.4	18.6	0.0	28.0

Rutting	Rutting Extent (inch)	
	1/27	
Deduct Point	0	0

Patches and Potholes (# per mile)= 2	1 to 2	3 to 6	7 to 10	11 to 15	> 15	2
	2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 0	1	1	2	4	0
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 0	1	1	2	3	4	0
Severity Rating 2 = 0	2	2	4	6	7	0
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 0	0
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

		Loss of Pavement (%)				
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

		Bleeding or Flushing Extent (%)			
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 11

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DRAFT

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/17/2015 **Project Rating:** 51 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 1 **Route No: 0144** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**8.54**	**8.61**
County 2:			
County 3:			

Project Limits: Station 121+60 to Station 124+95.
Estimated Length of the curb & gutter that requires MILLING (mile): 0.06

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 65
Typical Shoulder Width (ft): 10*
Divided Highway: YES Direction: 2 way Surface Type: ASPHALT CONCRETE
AADT: 10,700 Initial Year: 2017
AADT: 15,600 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 10 feet to 14 feet paved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	5.0	25.0	0.0	0.0	
Deduct Points	3.6	18.7	0.0	0.0	22

Block Cracking	%Level 1	%Level 2	%Level 3	
	25.0	30.0	0.0	
Deduct Points	6.4	12.5	0.0	19.0

Rutting	Rutting Extent (inch)	
	1/30	
Deduct Point	0	0

Patches and Potholes (# per mile)=	0	1 to 2	3 to 6	7 to 10	11 to 15	> 15	0
		2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 0	1	1	2	4	0
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 0	1	1	2	3	4	0
Severity Rating 2 = 0	2	2	4	6	7	0
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 30	8
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

		Loss of Pavement (%)				
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

		Bleeding or Flushing Extent (%)			
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 51

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DRAFT

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/17/2015 **Project Rating:** 50 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 1 **Route No: 0144** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**8.63**	**8.73**
County 2:			
County 3:			

Project Limits: Station 125+85 to Station 131+00.
Estimated Length of the curb & gutter that requires MILLING (mile): 0.1

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 63
Typical Shoulder Width (ft): 10*
Divided Highway: YES Direction: 2 way Surface Type: ASPHALT CONCRETE
AADT: 8,400 Initial Year: 2017
AADT: 12,250 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 0 feet to 10 feet paved and 2 to 20 feet unpaved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	85.0	15.0	0.0	0.0	
Deduct Points	15.0	14.5	0.0	0.0	30

Block Cracking	%Level 1	%Level 2	%Level 3	
	100.0	0.0	0.0	
Deduct Points	18.0	0.0	0.0	18.0

Rutting	Rutting Extent (inch)	
	0	
Deduct Point	0	0

Patches and Potholes (# per mile)= 0	1 to 2	3 to 6	7 to 10	11 to 15	> 15	0
	2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 0	1	1	2	4	0
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 0	1	1	2	3	4	0
Severity Rating 2 = 10	2	2	4	6	7	2
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 0	0
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

		Loss of Pavement (%)				
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

		Bleeding or Flushing Extent (%)			
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 50

DRAFT

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/17/2015 **Project Rating:** 61 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 6 **Route No: 0095** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**NA**	**NA**
County 2:			
County 3:			

Project Limits: Station 1001+10 to Station 1001+62, I-95 Southbound Exit Ramp.
Estimated Length of the curb & gutter that requires MILLING (mile): 0

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 25
Typical Shoulder Width (ft): 10*
Divided Highway: NO Direction: 1 way Surface Type: ASPHALT CONCRETE
AADT: 8,600 Initial Year: 2017
AADT: 12,500 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 0 feet to 10 feet paved and 2 to 20 feet unpaved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	0.0	0.0	0.0	0.0	
Deduct Points	0.0	0.0	0.0	0.0	0

Block Cracking	%Level 1	%Level 2	%Level 3	
	45.0	25.0	25.0	
Deduct Points	9.3	11.2	16.3	36.8

Rutting	Rutting Extent (inch)	
	1/30	
Deduct Point	0	0

Patches and Potholes (# per mile)=	0	1 to 2	3 to 6	7 to 10	11 to 15	> 15	0
		2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 0	1	1	2	4	0
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 35	1	1	2	3	4	2
Severity Rating 2 = 0	2	2	4	6	7	0
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 0	0
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

	Loss of Pavement (%)					
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

	Bleeding or Flushing Extent (%)				
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 61

DRAFT

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/29/2015 **Project Rating:** 53 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 6 **Route No: 0095** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**NA**	**NA**
County 2:			
County 3:			

Project Limits: Station 2005+07 to Station 2005+49 I-95 Southbound Entrance Ramp.
Estimated Length of the curb & gutter that requires MILLING (mile): 0

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 30
Typical Shoulder Width (ft): 10*
Divided Highway: NO Direction: 1 way Surface Type: ASPHALT CONCRETE
AADT: 2,800 Initial Year: 2017
AADT: 4,500 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 0 feet to 10 feet paved and 2 to 20 feet unpaved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	0.0	0.0	20.0	0.0	
Deduct Points	0.0	0.0	27.9	0.0	28

Block Cracking	%Level 1	%Level 2	%Level 3	
	0.0	0.0	35.0	
Deduct Points	0.0	0.0	19.4	19.4

Rutting	Rutting Extent (inch)	
	0	
Deduct Point	0	0

Patches and Potholes (# per mile)= 0	1 to 2	3 to 6	7 to 10	11 to 15	> 15	0
	2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 0	1	1	2	4	0
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 0	1	1	2	3	4	0
Severity Rating 2 = 0	2	2	4	6	7	0
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 0	0
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

		Loss of Pavement (%)				
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

		Bleeding or Flushing Extent (%)			
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 53

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DRAFT

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/29/2015 **Project Rating:** 56 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 6 **Route No: 0095** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**NA**	**NA**
County 2:			
County 3:			

Project Limits: Station 4000+73 to Station 4001+02 I-95 Northbound Entrance Ramp.
Estimated Length of the curb & gutter that requires MILLING (mile): 0

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 41
Typical Shoulder Width (ft): 10*
Divided Highway: NO Direction: 1 way Surface Type: ASPHALT CONCRETE
AADT: 8,600 Initial Year: 2017
AADT: 12,500 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 0 feet to 10 feet paved and 2 to 20 feet unpaved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	40.0	0.0	0.0	0.0	
Deduct Points	12.9	0.0	0.0	0.0	13

Block Cracking	%Level 1	%Level 2	%Level 3	
	0.0	100.0	0.0	
Deduct Points	0.0	31.0	0.0	31.0

Rutting	Rutting Extent (inch)	
	0	
Deduct Point	0	0

Patches and Potholes (# per mile)= 0	1 to 2	3 to 6	7 to 10	11 to 15	> 15	0
	2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 0	1	1	2	4	0
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 0	1	1	2	3	4	0
Severity Rating 2 = 0	2	2	4	6	7	0
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 0	0
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

		Loss of Pavement (%)				
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

		Bleeding or Flushing Extent (%)			
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 56

DRAFT

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

FLEXIBLE PAVEMENT CONDITION SURVEY

Date: 9/29/2015 **Project Rating:** 65 **Rater:** Lonnie Rucker

A: PROJECT LOCATION

District: 5 Route Type: 6 **Route No: 0095** Route Suffix: 00

		Milepost From	Milepost To
County 1:	**029**	**NA**	**NA**
County 2:			
County 3:			

Project Limits: Station 3004+25 to Station 3004+61 I-95 Northbound Exit Ramp.
Estimated Length of the curb & gutter that requires MILLING (mile): 0

B: ROADWAY INFORMATION

Typical Pavement Width (ft): 16
Typical Shoulder Width (ft): 10*
Divided Highway: NO Direction: 1 way Surface Type: ASPHALT CONCRETE
AADT: 2,800 Initial Year: 2017
AADT: 4,050 Final Year: 2037
No. Bridge: 0 Bridge Width (ft): NA

C: REMARKS

* Typical Shoulder is about 0 feet to 10 feet paved and 2 to 20 feet unpaved.
Details of the ratting calculation is provided in the next page

SR 144 at I-95 Southbound and Northbound Off Ramps
P.I. NO. 0010739, BRYAN COUNTY

PAVEMENT RATING

Load Cracking	%Level 1	%Level 2	%Level 3	%Level 4	Sum from Each Type of Crack
	0.0	0.0	0.0	0.0	
Deduct Points	0.0	0.0	0.0	0.0	0

Block Cracking	%Level 1	%Level 2	%Level 3	
	0.0	100.0	0.0	
Deduct Points	0.0	31.0	0.0	31.0

Rutting	Rutting Extent (inch)	
	1/30	
Deduct Point	0	0

Patches and Potholes (# per mile)=	0	1 to 2	3 to 6	7 to 10	11 to 15	> 15	0
		2	5	10	17	25	

	Corrugation/Pushing Extent(%)				
	Severity	1 to 10	11 to 25	>25	
Severity Rating 1 = 100	1	1	2	4	4
Severity Rating 2 = 0	2	2	4	7	0
Severity Rating 3 = 0	3	3	6	10	0

		Edge Cracking Extent (%)				
	Severity	5 to 25	26 to 50	51 to 75	>75	
Severity Rating 1 = 0	1	1	2	3	4	0
Severity Rating 2 = 0	2	2	4	6	7	0
Severity Rating 3 = 0	3	3	6	8	10	0

		Reflective Cracking (%)				
	Severity	5 to 15	16 to 30	31 to 45	>45	
Severity Rating 1 = 0	1	3	5	6	8	0
Severity Rating 2 = 0	2	6	8	11	14	0
Severity Rating 3 = 0	3	8	12	16	20	0

Raveling Extent (%)	
Severity Rating 1 = 0	0
Severity Rating 2 = 0	0
Severity Rating 3 = 0	0

		Loss of Pavement (%)				
	Severity	0 to 25	25 to 50	50 to 75	75 to 100	
Severity Rating 1 = 0	1	0	1	2	3	0
Severity Rating 2 = 0	2	2	4	6	8	0
Severity Rating 3 = 0	3	3	5	10	12	0

		Bleeding or Flushing Extent (%)			
	Severity	**1 to 10**	**11 to 30**	**>30**	
Severity Rating 1 = 0	1	2	5	8	0
Severity Rating 2 = 0	2	5	10	15	0

Project Rating = 65

DRAFT

APPENDIX G
RECOMMENDED PAVEMENT SECTION (13-pages)

Department of Transportation
State of Georgia

INTERDEPARTMENT CORRESPONDENCE

FILE Bryan County
P.I. # 0010739

OFFICE Planning

DATE December 3, 2012

FROM Cynthia L. VanDyke, State Transportation Planning Administrator

TO Genetha Rice-Singleton, State Program Delivery Engineer
Attention: Cassius Edwards

SUBJECT **Reviewed** Design Traffic for SR 144 @ I-95 SB & NB OFF RAMPS

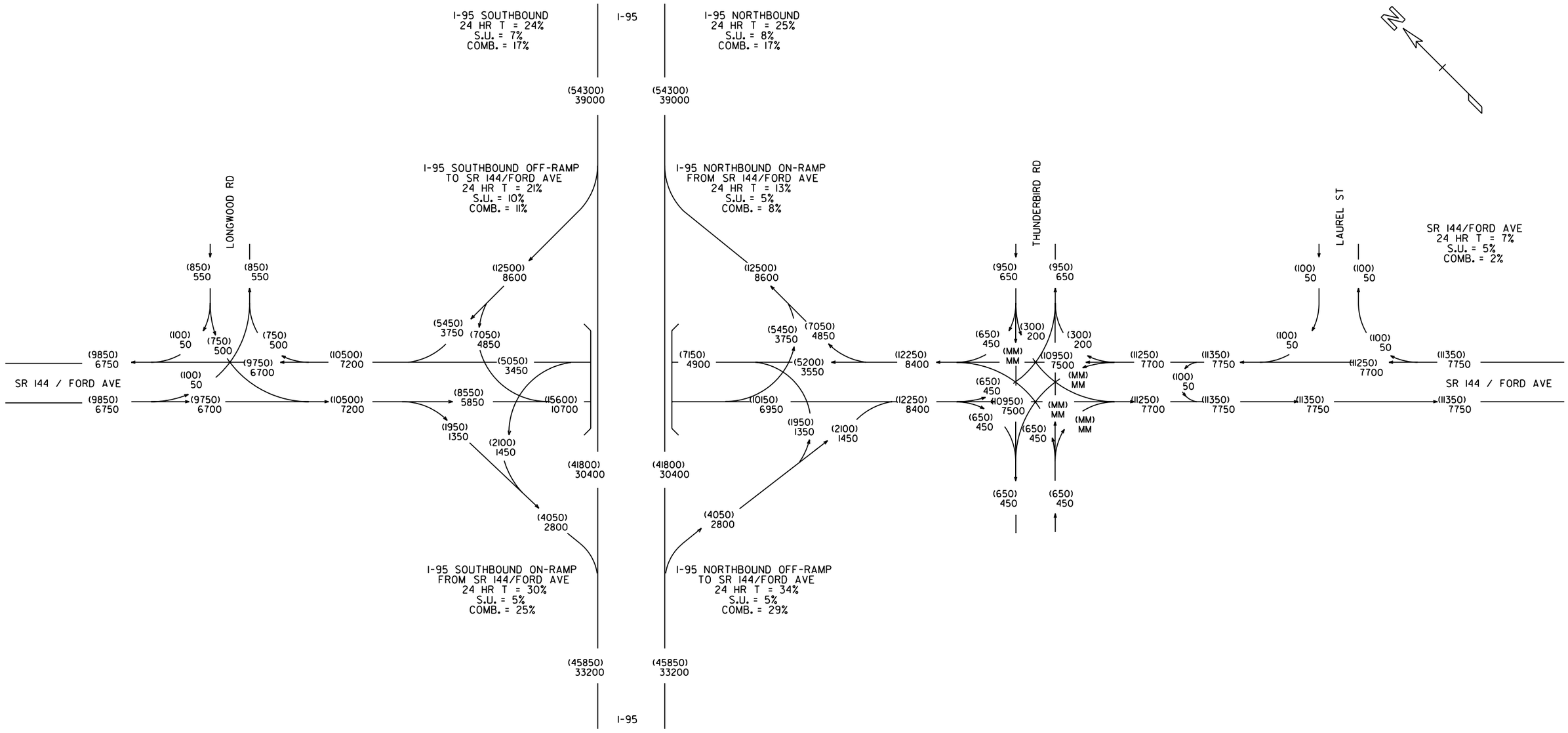
We have reviewed the consultant's design traffic data for the above project. Based on the information furnished, we find the Design Traffic to be satisfactory, and approve the Design Traffic volume.

If you have any questions concerning this information please contact Andre Washington at (404) 631-1925.

CLV/AMW

SHEET 1 OF 1

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF PLANNING



GRICE CONSULTING GROUP

P.I.# 0010739
BRYAN COUNTY
SR 144 (FORD AVE)
SR 144 @ I-95
SB & NB RAMPS

2037 BUILD/NO-BUILD ADT = (000)
2017 BUILD/NO-BUILD ADT = 000

HF
11/12

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	SR 144 Full Depth
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	10,700	**24 Hour Truck %**	7.00	**Lanes in one direction**	2
Final Design Year	2037	**Final AADT, VPD**	15,600	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	13,150	**MU Truck %**	2.00		

Design Data					
Lane Distribution Factor (%)	90.00	**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	1.06	**Calculated 18-KIP ESAL**	0.71
Non-Standard Value Comment					

Design Loading (User Provided 18-KIP ESAL Factor)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
13,150	90.00	24 Hour Truck	7.00	1.06	879
				Total Design Period ESALs	6,416,700

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Graded Aggregate Base	8.00	0.1600	1.28

Required SN	4.98	**Proposed pavement is 4.37% Underdesigned**	**Proposed SN**	4.76

Design Remarks	SR 144 Full Depth with GAB-Sta. 220+10 to Sta. 226+87.73 and Sta. 120+88.15 to Sta. 131+00-with GAB

Prepared By 11/12/2015 5:46 PM

United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	SR 144-Full Depth
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	10,700	**24 Hour Truck %**	7.00	**Lanes in one direction**	2
Final Design Year	2037	**Final AADT, VPD**	15,600	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	13,150	**MU Truck %**	2.00		

Design Data					
Lane Distribution Factor (%)	90.00	**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	1.06	**Calculated 18-KIP ESAL**	0.71
Non-Standard Value Comment					

Design Loading (User Provided 18-KIP ESAL Factor)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
13,150	90.00	24 Hour Truck	7.00	1.06	879
				Total Design Period ESALs	6,416,700

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Soil Cement Base	8.00	0.2000	1.60

Required SN 4.98 **Proposed pavement is 2.06% Overdesigned** **Proposed SN** 5.08

Design Remarks	SR 144 Full Depth-Sta. 220+10 to Sta. 226+87.73 and Sta. 120+88.15 to Sta. 131+00-with Soil Cement

Prepared By 11/12/2015 2:28 PM

United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Southbound Exit Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	8,600	**24 Hour Truck %**	21.00	**Lanes in one direction**	2
Final Design Year	2037	**Final AADT, VPD**	12,500	**SU Truck %**	10.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	10,550	**MU Truck %**	11.00		

Design Data					
Lane Distribution Factor (%)	90.00	**Soil Support Value**	4.00	**Single Unit ESAL**	0.40
Terminal Serviceability Index	2.50	**Regional Factor**	1.80	**Multiple Unit ESAL**	1.50
		User Defined 18-KIP ESAL	1.06	**Calculated 18-KIP ESAL**	0.98
Non-Standard Value Comment					

Design Loading (User Provided 18-KIP ESAL Factor)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
10,550	90.00	24 Hour Truck	21.00	1.06	2,114
				Total Design Period ESALs	15,432,200

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Graded Aggregate Base	12.00	0.1600	1.92

Required SN	5.67	**Proposed pavement is 4.73% Underdesigned**	**Proposed SN**	5.40

Design Remarks	I-95 Southbound Exit Ramp-Flexible Pavement with Curb and Gutter with GAB

Prepared By 11/12/2015 8:37 AM

United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Southbound Entrance Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	2,800	**24 Hour Truck %**	30.00	**Lanes in one direction**	1
Final Design Year	2037	**Final AADT, VPD**	4,050	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	3,425	**MU Truck %**	25.00		

Design Data					
Lane Distribution Factor (%)	100.00	**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	0.95	**Calculated 18-KIP ESAL**	1.32
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
3,425	100.00	Single Unit Truck	5.00	0.40	69
		Multi Unit Truck	25.00	1.50	1,285
				Total Daily ESALs	1,354
				Total Design Period ESALs	9,884,200

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		4.00	0.3000	1.20
Course 4	Graded Aggregate Base	12.00	0.1600	1.92

Required SN 5.29 **Proposed pavement is 3.68% Underdesigned** **Proposed SN** 5.10

Design Remarks	I-95 Southbound Entrance Ramp-Flexible Pavement with Curb and Gutter with GAB

Prepared By 11/12/2015 3:58 PM

United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Filename: C:\GDOTdata\GDOT Pavement Design Tool v2.0.xlsm
GDOT Pavement Design Tool - Version 2.0

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Northbound Entrance Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	8,600	**24 Hour Truck %**	13.00	**Lanes in one direction**	1
Final Design Year	2037	**Final AADT, VPD**	12,500	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	10,550	**MU Truck %**	8.00		

Design Data					
Lane Distribution Factor (%)	100.00	**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	1.06	**Calculated 18-KIP ESAL**	1.08
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
10,550	100.00	Single Unit Truck	5.00	0.40	211
		Multi Unit Truck	8.00	1.50	1,266
				Total Daily ESALs	1,477
				Total Design Period ESALs	10,782,100

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		4.00	0.3000	1.20
Course 4	Graded Aggregate Base	12.00	0.1600	1.92

Required SN 5.35 **Proposed pavement is 4.72% Underdesigned** **Proposed SN** 5.10

Design Remarks	I-95 Northbound Entrance Ramp-Flexible Pavement with GAB

Prepared By 11/12/2015 9:19 AM

United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Northbound Exit Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	2,800	**24 Hour Truck %**	34.00	**Lanes in one direction**	1
Final Design Year	2037	**Final AADT, VPD**	4,050	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	3,425	**MU Truck %**	29.00		

Design Data					
Lane Distribution Factor (%)	100.00	**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	0.95	**Calculated 18-KIP ESAL**	1.34
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
3,425	100.00	Single Unit Truck	5.00	0.40	69
		Multi Unit Truck	29.00	1.50	1,490
				Total Daily ESALs	1,559
				Total Design Period ESALs	11,380,700

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		4.00	0.3000	1.20
Course 4	Graded Aggregate Base	12.00	0.1600	1.92

Required SN 5.40 **Proposed pavement is 5.49% Underdesigned** **Proposed SN** 5.10

Design Remarks	I-95 Northbound Exit Ramp-Flexible Pavement with GAB

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United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Southbound Exit Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	8,600	**24 Hour Truck %**	21.00	**Lanes in one direction**	2
Final Design Year	2037	**Final AADT, VPD**	12,500	**SU Truck %**	10.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	10,550	**MU Truck %**	11.00		

Design Data					
Lane Distribution Factor (%)	90.00	**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	1.06	**Calculated 18-KIP ESAL**	0.98
Non-Standard Value Comment					

Design Loading (User Provided 18-KIP ESAL Factor)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
10,550	90.00	24 Hour Truck	21.00	1.06	2,114
				Total Design Period ESALs	15,432,200

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		6.00	0.3000	1.80
Course 4	Soil Cement Base	8.00	0.2000	1.60

Required SN 5.63 **Proposed pavement is 4.41% Underdesigned** **Proposed SN** 5.38

Design Remarks	I-95 Southbound Exit Ramp-Flexible Pavement with Curb and Gutter with Soil Cement

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Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Southbound Entrance Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	2,800	**24 Hour Truck %**	30.00	**Lanes in one direction**	1
Final Design Year	2037	**Final AADT, VPD**	4,050	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	3,425	**MU Truck %**	25.00		

Design Data					
Lane Distribution Factor (%)	100.00	**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	0.95	**Calculated 18-KIP ESAL**	1.32
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
3,425	100.00	Single Unit Truck	5.00	0.40	69
		Multi Unit Truck	25.00	1.50	1,285
				Total Daily ESALs	1,354
				Total Design Period ESALs	9,884,200

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Soil Cement Base	8.00	0.2000	1.60

Required SN 5.29 **Proposed pavement is 4.06% Underdesigned** **Proposed SN** 5.08

Design Remarks	I-95 Southbound Entrance Ramp-Flexible Pavement with Soil Cement

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Consultant Design Phase Leader **Date**

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State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Northbound Entrance Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	8,600	**24 Hour Truck %**	13.00	**Lanes in one direction**	1
Final Design Year	2037	**Final AADT, VPD**	12,500	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	10,550	**MU Truck %**	8.00		

Design Data					
Lane Distribution Factor (%)	100.00	**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	1.06	**Calculated 18-KIP ESAL**	1.08
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
10,550	100.00	Single Unit Truck	5.00	0.40	211
		Multi Unit Truck	8.00	1.50	1,266
				Total Daily ESALs	1,477
				Total Design Period ESALs	10,782,100

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Soil Cement Base	8.00	0.2000	1.60

Required SN 5.35 **Proposed pavement is 5.09% Underdesigned** **Proposed SN** 5.08

Design Remarks	I-95 Northbound Entrance Ramp-Flexible Pavement with Soil Cement

Prepared By 11/12/2015 2:19 PM

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Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

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GDOT Pavement Design Tool - Version 2.0

Flexible Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan
Project Number	2015.0859.01	**Design Name**	I-95 Northbound Exit Ramp
Project Description	SR 144 at I-95 Southbound and Northbound Ramps		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	2,800	**24 Hour Truck %**	34.00	**Lanes in one direction**	1
Final Design Year	2037	**Final AADT, VPD**	4,050	**SU Truck %**	5.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	3,425	**MU Truck %**	29.00		

Design Data					
Lane Distribution Factor (%)	100.00	**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	0.95	**Calculated 18-KIP ESAL**	1.34
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
3,425	100.00	Single Unit Truck	5.00	0.40	69
		Multi Unit Truck	29.00	1.50	1,490
				Total Daily ESALs	1,559
				Total Design Period ESALs	11,380,700

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Soil Cement Base	8.00	0.2000	1.60

Required SN 5.40 **Proposed pavement is 5.86% Underdesigned** **Proposed SN** 5.08

Design Remarks	I-95 Northbound Exit Ramp-Flexible Pavmenet with Soil Cement

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Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

Rigid Pavement Design Analysis

PI Number	0010739	**County(s)**	Bryan		
Project Number	2015.0859.01	**Design Name**	I-95 Southbound Exit Ramp		
Project Description	SR 144 at I-95 Southbound and Northbound Ramps				
Section Location	I-95 Ramps			**Type Section**	JPCP
Begin Section Station	1001+62	**End Section Station**	1007+63.47	**Section Length**	601.47

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2017	**Initial AADT, VPD**	8,600	**24 Hour Truck %**	21.00	**Lanes in one direction**	2
Final Design Year	2037	**Final AADT, VPD**	12,500	**SU Truck %**	10.00	**Curb & Gutter/Barrier**	No
		Mean AADT, VPD	10,550	**MU Truck %**	11.00	**Interstate**	Yes

Design Loading (Calculated 18-KIP ESAL)

Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
10,550	90	Other Vehicles	79.00	0.004	31
		Single Unit Truck	10.00	0.500	475
		Multi Unit Truck	11.00	2.680	2,800
				Total Daily ESALs	3,306
				Total Design Period ESALs	24,133,800

Design Data

Terminal Serviceability Index (P_t)	2.50	**Working Stress (psi)**	450	**Modulus of Elasticity (psi)**	3,200,000		
Soil Support Value	4.00	**Subgrade Modulus (k)**	190	**Subbase Modulus (k_1)**	280	**Subbase Modulus (k_{eff})**	345
Trial Depth of PCC Pavement (inches)	12.00	**Calculated Stress from Equation (psi)**	404.25				
% Understressed	10.17	**% Overdesigned**	11.32	**Balanced Thickness (inches)**	11.31		
Non-Standard Value Comment							

Proposed Rigid Pavement Structure

Material	**Thickness (inches)**
JPCP - Jointed Portland Cement Concrete Pavement	12.00
19 mm Superpave Asphaltic Concrete Interlayer	3.00
Graded Aggregate Base	12.00

JPCP - Dowel Bar Size and Spacing

Refer to GDOT Standard 5046H:
Joint Details for Portland Cement Concrete Paving

Design Remarks	I-95 Ramps-No Curb and Gutter

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United Consulting **Date**

Recommended By

Consultant Design Phase Leader **Date**

Approved By

State Pavement Engineer **Date**

APPENDIX H

ROADWAY SURVEY AND ASPHALT CORE PROPERTIES (16-pages)

APPENDIX H
ROADWAY DESIGNATION

For **SR 144**, the roadway designation is considered an east-west oriented roadway. Travel lanes are designated with numbers. Lane 1 = Eastbound (EB), Westbound (WB), Inside Lane closest to the centerline of the existing roadway. Lane 2 = Outside Lane adjacent and right of Lane 1 in the direction of travel. Left Turn Lane (LTL) is to the left of Lane 1 in the direction of travel, and it separates eastbound and westbound travel lanes close to the intersections. Right Turn Lane (RTL) is the outside lane, closest to the right edge of the pavement.

For the **I-95 Southbound and Northbound Ramps,** the roadway designation is considered a north-south oriented roadway. Travel lanes are designated with numbers. Lane 1 = Northbound (NB), Southbound (SB), Inside Lane closest to the centerline of existing I-95. Lane 2 = Outside Lane adjacent and right of Lane 1 in the direction of travel. Left Turn Lane (LTL) is the left lane in the direction of travel which turns onto SR 144 from the exit ramps close to the intersection with SR 144. Right Turn Lane (RTL) is the right lane in the direction of travel which turns to the right onto SR 144 from the exit ramps close to the intersection with SR 144.

EXISTING PAVEMENT SURVEY

This project consisted of evaluation of the existing roadway and shoulders for the realignment/ improvement of **SR 144 at I-95 Southbound and Northbound Ramps.** The total length of the existing pavement evaluation sections of the project was approximately 4,058 feet. On **SR 144**, the project began at Station 220+10, Milepost (MP) = 8.41, and it continues in an easterly direction to Station 226+87.73, Milepost (MP) = 8.54, and the centerline continues east from Station 226+87.73, where it is renumbered as Station 120+88.15 and continues east to Station 131+00, MP 8.73. The station locations and all roadways associated with this project were not provided or staked in the field by a surveyor. United Consulting determined the approximate location of these stations by using a measuring wheel from the nearest identified stationary object marked on the provided plans.

On the **I-95 ramps**, the project began at the southernmost limits of construction and station numbers increased in number toward the north within the following station limits:

Station to Station	Location
1000+00 to 1007+63.47	I-95 Southbound Exit Ramp
2003+29.90 to 2006+75.51	I-95 Southbound Entrance Ramp
4000+00 to 4003+52.89	I-95 Northbound Entrance Ramp
2996+88.10 to 3005+96.26	I-95 Northbound Exit Ramp

No information about mile markers was available for the I-95 ramps.

SR 144

From: Station 220+10± to Station 226+30±.

The existing pavement/alignment consists of flexible asphalt concrete pavement with three (3) to four (4) main travel lanes, depending on the location. From Station 220+10 to Station 223+10±, there are two eastbound and two westbound divided travel lanes, along with the beginning of an eastbound left turn lane and the beginning of a westbound left turn lane. Upstation from Station 223+10±, the eastbound Lane 2 becomes an eastbound right turn lane that directs traffic onto the I-95 southbound entrance ramp, and there is one (1) eastbound and two (2) westbound travel lanes, and a westbound left turn lane to the west of the intersection with Longwood Drive. The second westbound travel lane ends upstation from the intersection of SR 144 and the I-95 southbound off ramp. A grass median exists along SR 144 between the intersection with Longwood Drive and the intersection with the I-95 southbound ramps, and a concrete median exists along the portion of SR 144 west of the intersection with Longwood Drive.

Pavement Conditions: Poor to Good. The field observation findings rated the existing roadway conditions as follows: Severity rating, level 1 to level 4 load cracking and level 1 to level 3 block/transverse cracking were observed within the evaluated segmented area. Severity rating level 1 raveling, patches and potholes were also observed within the evaluated segmented area. Bleeding and flushing was also observed within the evaluated segmented area. Extensive rutting was observed near the intersection of SR 144 and the I-95 southbound off ramp. The width of the main travel lanes for the section of roadway ranged from 11.5 feet to 13 feet.

Shoulder/ Structure and Drainage Conditions: The unpaved shoulder width varied from 1 foot to 10+ feet depending on location. Shoulders appeared to be well maintained. Concrete curb and gutter existed in the areas near the intersections along with two storm water catch basins. A grass median exists east of Longwood Drive and a concrete median exists west of Longwood Drive in this area.

From: Station 226+30± to Station 226+87.73± and Station 120+88.15± to Station 121+60±.

This area is going to be an island in the proposed roundabout and therefore no pavement evaluation was performed on this section of roadway.

From: Station 121+60± to Station 124+95±.

The existing pavement/alignment consists of flexible asphalt concrete pavement with two (2) main divided travel lanes. There is one (1) eastbound and one (1) westbound divided travel lanes, and a left turn lane in each direction that allows traffic onto the I-95 northbound and southbound on-ramps. This area is mostly underneath the I-95 overpass over SR 144.

Pavement Conditions: Fair to Good. The field observation findings rated the existing roadway conditions as follows: Severity rating, level 1 and level 2 load cracking and level 1 and level 2 block/transverse cracking, and Severity Level 1 to level 3 raveling were observed within the evaluated segmented area. Severity rating level 1 bleeding was also observed within the

evaluated segmented area. Extensive rutting was also observed in one area close to the intersection of SR 144 and the I-95 southbound entrance ramp. The width of the main travel lanes for the section of roadway ranged from 11.5 feet to 12.5 feet.

Shoulder/ Structure and Drainage Conditions: The paved shoulder width varied from 14 feet to 14.5 feet depending on location. Shoulders appeared to be well maintained. Concrete bridge bents are adjacent to the paved shoulders in this location. The median in this area is raised concrete curb.

From: Station 124+95± to Station 125+85±.

This area is going to be an island in the proposed roundabout and therefore no pavement evaluation was performed on this section of roadway.

From: Station 125+85± to Station 131+00±.

The existing pavement/alignment consists of flexible asphalt concrete pavement with two (2) to four (4) main travel lanes. West of the intersection of SR 144 and Thunderbird Drive, there are two (2) eastbound and one (1) westbound travel lane, and a westbound right turn lane that directs traffic onto the I-95 northbound entrance ramp and an eastbound left turn lane, and a concrete and grass median between the eastbound and westbound lanes. East of the intersection of SR 144 and Thunderbird Drive, there are two (2) eastbound travel lanes and one (1) westbound travel lane downstation from about 140 feet east of Thunderbird Drive and two (2) westbound travel lanes upstation from about 140 feet east of Thunderbird Drive and a westbound left turn lane that ends downstation from about 140 feet east of Thunderbird Drive. There is also a westbound right turn lane east of the intersection with Thunderbird Drive that directs traffic onto Thunderbird Drive, which becomes a second travel lane upstation from about 140 feet east of Thunderbird Drive, and an eastbound right turn lane to the right of the eastbound travel lanes in this area east of the intersection with Thunderbird Drive.

Pavement Conditions: Fair to good . The field observation findings rated the existing roadway conditions as follows: Severity Level, 1 to 2 load cracking and Level 1 block cracking, and Level 2 edge distress were observed within the evaluated segment area. There was also one small area of Severity Level 1 bleeding and flushing. The width of the main travel lanes for the section of roadway is about 12 feet.

Shoulder/ Structure and Drainage Conditions: The paved shoulder width varied from 11 feet to 12.5 feet depending on location. The unpaved shoulder width varied from 1 foot to greater than 10 feet depending on location. The paved shoulder width varied from 11 feet to 12.5 feet depending on location. Concrete curb and gutter existed in the areas near the intersections along with three storm water catch basins. The median in this area is raised concrete curb, or a grass island with a concrete curb, depending on the locations.

I-95 Southbound Exit Ramp
From: Station 1000+00± to Station 1007+63.47±
The existing pavement/ alignment consists of mainly Portland cement concrete, with asphalt concrete pavement downstation from Station 1001+62±, with shoulders made of asphalt concrete. There are two (2) southbound travel lanes that divides into one southbound left turn lane and one southbound right turn lane going south toward the intersection with SR 144. There are shoulders to the left and right of the travel lanes.

Pavement Conditions: Good to poor. The field observation findings rated the existing roadway conditions as follows: In the asphalt portion of the ramp lanes, Severity Level 1 to level 3 block cracking were observed within the evaluated segment area. Severity Level 1 edge distress was observed in the right asphalt shoulder within the evaluated segment area. Faulting of the Portland cement concrete pavement at the longitudinal joint was visually observed and measured from Station 1001+62± to Station 1002+25±, Southbound, Lane 2. A broken slab Severity Level 2 was observed at Station 1001+67± to Station 1001+82±, Southbound, Lane 2. Slabs with longitudinal cracks Severity Level 1 were observed along the evaluated segment area. Replaced slabs were also observed along the evaluated segment area. Joint spall and spall patch and shoulder joint distress were also observed along the evaluated segment area. The width of the main travel lanes for this section of roadway ranged from 12 feet to 14 feet.

No pavement was evaluated from Station 1000+00± to Station 1001+10± because the pavement will not be reused in these areas due to the construction of the new roundabouts and a new proposed alignment in these areas.

Shoulder/ Structure and Drainage Conditions: The width of the left paved shoulder was about 3 feet. The width of the right paved shoulder varied from 8 feet to about 12 feet based on location. The width of the unpaved shoulder varied from 2 feet to more than 10 feet based on location. Concrete curb and gutter existed downstation from Station 1001+62±.

I-95 Southbound Entrance Ramp
From: Station 2003+29.90± to Station 2006+75.51±
The existing pavement/ alignment consists of mostly Portland cement concrete, with asphalt concrete upstation from Station 2004+86±. There is one (1) southbound travel lane and shoulders to the left and right of the travel lane, and there is a lane that merges into this lane from the right turn lane of SR 144 near the intersection of SR 144 and the I-95 Southbound entrance ramp.

Pavement Conditions: Good to poor. The field observation findings rated the existing roadway conditions as follows: In the asphalt portion of the ramp, Severity Level 1 and level 3 load cracking and Severity Level 1 and level 3 block cracking were observed within the evaluated segment area within the southbound travel lanes and the southbound right shoulder. Severity level 1 bleeding and flushing were also observed along the right shoulder within the evaluated segment area. In the concrete portion of the ramp, joints with spalls, shoulder joint distress and map cracking were observed along the evaluated segment area. The width of the main travel lane within this section of roadway was 16 feet.

No pavement was evaluated from Station 2004+14± to Station 2005+07± or Station 2005+49± to Station 2006+75.51± because the pavement will not be reused in these areas due to the construction of the new roundabouts and a new proposed alignment in these areas.

Shoulder/ Structure and Drainage Conditions: The width of the left paved shoulder was about 2 feet. The width of the right paved shoulder was about 11 feet to 12 feet. The width of the unpaved shoulder varied from 2 feet to more than 10 feet depending on location. Concrete curb and gutter to the right of the travel lane exists upstation from Station 2004+90±.

I-95 Northbound Entrance Ramp
From: Station 4000+00± to Station 4003+52.89±
The existing pavement/ alignment consists of mostly Portland cement concrete, with asphalt concrete downstation from Station 4001+36±. There is one (1) northbound travel lane and shoulders to the left and right of the travel lane.

Pavement Conditions: Good to fair. The field observation findings rated the existing roadway conditions as follows: In the asphalt portion of the ramp, Severity Level 1 load cracking, cracking due to a trench excavation, and Severity Level 2 block cracking were observed within the evaluated segment area. Along the paved shoulder of the ramp, level 3 edge distress and patching were observed at Station 4001+37± to Station 4001+39±. In the concrete portion of the ramp, joint defects, shoulder joint distress, and map cracking were observed within the evaluated segment area. The width of the main travel lane within this section of roadway was 16 feet.

No pavement was evaluated from Station 4000+00± to Station 4000+73 or Station 4001+02± to Station 4001+36± because the pavement will not be reused in these areas due to the construction of the new roundabouts and a new proposed alignment in these areas.

Shoulder/ Structure and Drainage Conditions: The width of the left paved shoulder was about 2 feet. The width of the right paved shoulder was about 11 feet to 12 feet. The width of the unpaved shoulder varied from 2 feet to more than 10 feet depending on location. Concrete curb and gutter to the right of the travel lane exists downstation from Station 4002+36±.

I-95 Northbound Exit Ramp
From: Station 2996+88.10± to Station 3005+96.26±
The existing pavement/ alignment consists of mostly Portland cement concrete, with asphalt concrete upstation from Station 3004+25±. There is one (1) northbound travel lane in the ramp that becomes a left turn lane at the intersection with SR 144, and there is a short right turn lane close to the intersection of SR 144 and the I-95 northbound exit ramp.

Pavement Conditions: Good to poor. The field observation findings rated the existing roadway conditions as follows: In the asphalt portion of the ramp, Severity Level 1 to Level 3 block cracking and Severity Level 1 corrugation/ pushing were observed within the evaluated segment area. In the concrete portion of the ramp Severity Level 1 broken slabs, slabs with longitudinal cracks Severity Level 1, replaced slabs, failed replaced slabs Severity Level 1 and Level 2, joint defects, shoulder joint distress, popouts, and map cracking were observed within the evaluated segment area. The width of the main travel lanes for this section of roadway was 16 feet.

No pavement was evaluated from Station 3005+61± to Station 3005+96.26± because the pavement will not be reused in these areas due to the construction of an island along the proposed centerline in this area.

Shoulder/ Structure and Drainage Conditions: The width of the left paved shoulder was about 2 feet. The width of the right paved shoulder was about 11 feet to 12 feet. The width of the unpaved shoulder varied from 2 feet to more than 10 feet depending on location. Concrete curb and gutter to the right of the right turn lane exists upstation from Station 3004+48±.

Side Roads
At the time of this survey, no information regarding stations numbers were assigned to the side roads. No pavement evaluation was performed on the side roads during this survey.

ROADWAY EVALUATION

Note: Distresses not listed within the following roadway evaluated segmented areas were not observed during this survey.

SR 144
From
Station 220+10± to Station 226+87.73± and Station 120+88.15± to Station 131+00±

Rutting
On **SR 144,** rutting measurements were evaluated at various locations. Rutting measurements ranged from a minimum of zero inches to a maximum of $^{1}/_{2}$ inches at the coring locations and near some of the intersections within the evaluated sections. Measurements are provided to the nearest $^{1}/_{8}$ inch increments.

Designation for wheel paths are as follows: Drivers Wheel Path = DW, Passenger Wheel Path = PW, Eastbound = EB, Westbound = WB, Right Turn Lane = RTL, Left Turn Lane = LTL.

SR 144

Station	WB Lane 2 and/or RTL		WB Lane 1		WB/EB LTL		EB Lane 1		EB Lane 2 and/or RTL	
	PW	DW	PW	DW	PW	DW	DW	PW	DW	PW
223+79±	0	0	0	0	0	0	0	0	$^{1}/_{8}$	$^{1}/_{4}$
226+11±	0	0	0	$^{1}/_{8}$	NA	NA	0	0	0	0
226+25±	0	0	0	0	NA	NA	$^{1}/_{8}$	$^{1}/_{2}$	0	0
122+08±	NA	NA	0	0	$^{1}/_{2}$	$^{1}/_{2}$	0	0	NA	NA
122+49±	NA	NA	$^{1}/_{8}$	$^{1}/_{8}$	0	0	0	0	NA	NA
123+96±	NA	NA	0	0	$^{3}/_{8}$	$^{1}/_{8}$	0	0	0	0
126+69±	0	0	0	0	0	0	$^{1}/_{8}$	0	0	0
127+52±	0	0	0	0	$^{1}/_{8}$	0	0	0	0	0
129+44±	0	0	0	0	0	0	0	0	0	0

Load Cracking

On **SR 144,** Severity Level 1 to Level 4 load cracking was observed from the following evaluated sections:

Station to Station		Load Cracking (%)			
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**	**Level 4**
221+00± – 222+00± WB, Lane 2	220+10± to 222+71±	60	10	0	0
221+00± – 222+00± WB, Lane 1		25	20	30	0
220+10 – 221+00± WB, Left Turn Lane		0	0	0	70
221+00± – 222+00± EB, Left Turn Lane		5	0	0	0
221+00± – 222+00± EB, Lane 1		60	0	0	0
221+00± – 222+00± EB, Lane 2		20	30	0	0
220+17 – 221+17 EB, RTL		0	0	0	0
223+12 – 224+12± WB, Lane 2	222+71± to 226+50±	75	10	0	0
223+12± – 224+12± WB, Lane 1		90	5	0	0
223+12± – 224+12± EB, Left Turn Lane		40	0	0	0
223+12± – 224+12± EB, Lane 1		30	5	0	0
223+12± – 224+12± EB, Right Turn Lane		60	20	10	0
122+23± – 123+23± WB, Lane 1	121+60± to 124+95±	5	25	0	0
122+23± – 123+23± WB, Left Turn Lane		0	0	0	0
123+23± – 124+23 EB, Left Turn Lane		0	0	0	0
122+33± – 123+33± EB, Lane 1		20	0	0	0
128+96 – 129+96 WB, Lane 2	125+85± to 131+00±	85	15	0	0
128+96± – 129+96± WB, Lane 1		45	0	0	0
128+96± – 129+96± WB, Left Turn Lane		0	0	0	0
128+96± – 129+96± EB, Lane 1		75	0	0	0
128+96± – 129+96± EB, Lane 2		100	0	0	0
128+96± – 129+96± EB, Right Turn Lane		5	0	0	0

Block/Transverse Cracking

On **SR 144,** Severity Level 1 to Level 3 block/transverse cracking was observed from the following evaluated sections:

Station to Station		Block/ Transverse Cracking (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
221+00± – 222+00± WB, Lane 2	220+10± to 222+71±	100	0	0
221+00± – 222+00± WB, Lane 1		0	100	0
220+10 – 221+00± WB, Left Turn Lane		55	10	30
221+00± – 222+00± EB, Left Turn Lane		35	0	0
221+00± – 222+00± EB, Lane 1		80	0	0
221+00± – 222+00± EB, Lane 2		0	0	100
220+17 – 221+17 EB, Right Turn Lane		5	0	0
223+12± – 224+12± WB, Lane 2	222+71± to 226+30±	100	0	0

Station to Station		Block/ Transverse Cracking (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
223+12± – 224+12± WB, Lane 1		70	30	0
223+12± – 224+12± EB, Left Turn Lane		60	0	0
223+12± – 224+12± EB, Lane 1		50	0	0
223+12± – 224+12± EB, Right Turn Lane		80	20	0
122+23± – 123+23± WB, Lane 1	121+60± to 124+95±	25	30	0
122+23± – 123+23± WB, Left Turn Lane		0	0	0
123+23± – 124+23 EB, Left Turn Lane		5	0	0
122+33 – 123+33 EB, Lane 1		0	10	0
128+96± – 129+96± WB, Lane 2	125+85± to 131+00±	100	0	0
128+96± – 129+96± WB, Lane 1		65	0	0
128+96± – 129+96± WB, Left Turn Lane		90	0	0
128+96± – 129+96± EB, Lane 1		100	0	0
128+96± – 129+96± EB, Lane 2		100	0	0
128+96± – 129+96± EB, Right Turn Lane		25	0	0

Raveling

On **SR 144,** Severity Level 1 to Level 3 raveling was observed from the following evaluated sections:

Station to Station		Raveling (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
220+17 – 221+17 EB, Right Turn Lane	220+10± to 222+71±	40	0	0
122+23± – 123+23± WB, Lane 1	121+60± to 124+95±	30	0	0
122+23± – 123+23± WB, Left Turn Lane		15	0	0
123+23± – 124+23± EB, Left Turn Lane		0	15	60
122+33± – 123+33± EB, Lane 1		0	0	0

Edge Distress

On **SR 144,** Severity Level 2 edge distress was observed from the following evaluated section:

Station to Station		Edge Distress (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
128+96± – 129+96± WB, Left Turn Lane	125+85± to 131+00±	0	65	0

Bleeding/Flushing

On **SR 144,** Severity Level 1 bleeding/flushing was observed from Station 122+20± to Station 122+22± in the westbound left turn lane close to the centerline of the lane and from Station 221+10± to Station 221+17± in the eastbound right turn lane.

Patches, Potholes, and Local Base Failures

On **SR 144,** potholes were observed at Station 220+17± in the westbound left turn lane and at Station 220+65± in the westbound left turn lane. A patch was also observed at Station 220+17± in the westbound left turn lane.

I-95 Southbound Exit Ramp
From
Station 1001+10± to Station 1001+62±

Rutting

On the **I-95 Southbound Exit Ramp,** rutting measurements were taken at various locations. Rutting measurements ranged from a minimum of zero inches to a maximum of ⅛ inches at the locations. Measurements are provided to the nearest $^{1}/_{8}$ inch increments.

Designation for wheel paths are as follows: Drivers Wheel Path = DW, Passenger Wheel Path = PW, Southbound = SB, Right Turn Lane = RTL, Left Turn Lane = LTL.

SR 144

Station	SB LTL		SB RTL	
	DW	PW	DW	PW
1001+20±	$^{1}/_{8}$	0	0	0
1001+39±	0	0	0	0

Block Cracking

On the **I-95 Southbound Exit Ramp,** Severity Level 1 to Level 3 block cracking was observed from the following evaluated sections:

Station to Station		Block Cracking (%)		
Evaluated Test Section	Representing	Level 1	Level 2	Level 3
1001+18± – 1001+33± SB, Left Turn Lane	1000+10± to 1001+62±	100	0	0
1001+18± – 1001+33± SB, Right Turn Lane		45	25	25

From
Station 1001+62± to Station 1007+63.47±

Edge Distress

On the **I-95 Southbound Exit Ramp,** Severity Level 1 edge distress was observed from the following evaluated section:

Station to Station		Edge Distress (%)		
Evaluated Test Section	Representing	Level 1	Level 2	Level 3
1001+80± – 1002+61± NB, Right Shoulder	1001+62± to 1007+63.47±	35	0	0

Faulting

On the **I-95 Southbound Exit Ramp,** faulting was noted between southbound Lane 1 and southbound Lane 2. The faulting was noted between Station 1001+62± and Station 1002+25±. The faulting was measured up to about 1 inch.

Broken Slabs

On the **I-95 Southbound Exit Ramp,** Severity Level 2 broken slabs were observed along the evaluated segmented area. One Level 2 broken slab was observed within the 601.47 linear feet evaluated. The slab from Station 1001+67± to Station 1001+82± in the southbound Lane 2 was a Level 2 broken slab.

Slabs with Longitudinal Cracks

On the **I-95 Southbound Exit Ramp,** slabs with longitudinal cracks Severity Level 1 were observed along the evaluated segmented area. Two slabs with longitudinal cracks were observed within the 601.47 linear feet evaluated.

Replaced Slabs

On the **I-95 Southbound Exit Ramp,** replaced slabs were observed along the evaluated segment area. Four replaced slabs were observed within 601.47 linear feet evaluated.

Joint Defects

On the **I-95 Southbound Exit Ramp,** joints with spalls were observed along the evaluated segmented area. Ten joints were observed with spalls within the 601.47 linear feet evaluated, and one patched spall at one of the ten joints was observed within the 601.47 linear feet evaluated.

Shoulder Joint Distress

On the **I-95 Southbound Exit Ramp,** shoulder joint distress was observed along the evaluated segmented area. Shoulder joint distress was observed between the edges of both travel lanes and the asphalt shoulder of the I-95 southbound exit ramp along the entire length of the 601.47 feet evaluated.

I-95 Southbound Entrance Ramp
From
Station 2003+29.90± to Station 2004+14±

Block Cracking

On the **I-95 Southbound Entrance Ramp,** Severity Level 1 block cracking was observed from the following evaluated section:

Station to Station		Block Cracking (%)		
Evaluated Test Section	Representing	Level 1	Level 2	Level 3
2003+29.90 – 2004+14± SB, Right Shoulder	2003+29.90± to 2004+14±	80	0	0

Bleeding/ Flushing

On the **I-95 Southbound Entrance Ramp**, Severity Level 1 bleeding or flushing was observed along the following section:
At Station 2003+84± to past Station 2004+14, southbound, right shoulder, small circular patches of bituminous material were observed on the surface of the pavement.

Faulting

On the **I-95 Southbound Entrance Ramp,** faulting was not observed.

Joint Defects

On the **I-95 Southbound Entrance Ramp,** joints with spalls were observed along the evaluated segment area. One joint with a spall was observed within the 84.1 linear feet evaluated.

Shoulder Joint Distress

On the **I-95 Southbound Entrance Ramp,** shoulder joint distress was observed along the entire length of the evaluated segment area along both shoulders of the ramp.

Map Cracking

On the **I-95 Southbound Entrance Ramp,** map cracking was observed along the evaluated segment area.

From
Station 2005+07± to Station 2005+49±

Load Cracking

On the **I-95 Southbound Entrance Ramp,** Severity Level 1 and Level 3 load cracking was observed from the following evaluated stations:

Station to Station		Load Cracking (%)			
Evaluated Test Section	Representing	Level 1	Level 2	Level 3	Level 4
2005+07± – 2005+49± SB, Lane 1	2005+07± to 2005+49±	10	0	0	0
2005+07± – 2005+49± SB, Lane 2		0	0	20	0

Block Cracking

On the **I-95 Southbound Entrance Ramp,** Severity Level 1 and Level 3 block cracking was observed from the following evaluated sections:

Station to Station		Block Cracking (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
2005+07± – 2005+49± SB, Lane 1	2005+07± to 2005+49±	55	0	0
2005+07± – 2005+49± SB, Lane 2		0	0	35

I-95 Northbound Entrance Ramp
From
Station 4000+73± to Station 4001+02±

Load Cracking

On the **I-95 Northbound Entrance Ramp,** Severity Level 1 load cracking was observed from the following evaluated section:

Station to Station		Load Cracking (%)			
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**	**Level 4**
4000+73± – 4001+02± NB, Lane 1	4000+73± to 4001+02±	40	0	0	0

Block Cracking

On the **I-95 Northbound Entrance Ramp,** Severity Level 2 block cracking was observed from the following evaluated section:

Station to Station		Block Cracking (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
4000+73± – 4001+02± NB, Lane 1	4000+73± to 4001+02±	0	100	0

Cracking Due to a Trench Excavation

On the **I-95 Northbound Entrance Ramp,** cracking due to a trench excavation was observed at Station 4000+73± to Station 4001+02± in northbound Lane 1.

From
Station 4001+36± to Station 4003+52.89±

Edge Distress

On the **I-95 Northbound Entrance Ramp,** Severity Level 2 and Level 3 edge distress was observed along the following evaluated section.

Station to Station		Edge Distress (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
4001+42± – 4002+40± NB, Right Shoulder	4001+36± to 4003+52.89±	0	15	5

Patches, Potholes, and Local Base Failures

On the **I-95 Northbound Entrance Ramp,** a patch was observed at Station 4001+43± in the northbound right shoulder of the ramp.

Faulting

On the **I-95 Northbound Entrance Ramp,** faulting was not observed.

Joint Defects

On the **I-95 Northbound Entrance Ramp,** joints with spalls were observed along the evaluated segmented area. One joint with a spall and a patched spalled was observed along the evaluated segmented area, and two other joints with spalls were observed within the 216.89 linear feet evaluated.

Shoulder Joint Distress

On the **I-95 Northbound Entrance Ramp,** shoulder joint distress was observed along both shoulders from Station 4001+36± to Station 4003+52.89±.

Map Cracking

On the **I-95 Northbound Entrance Ramp,** map cracking was observed along the evaluated segmented area.

I-95 Northbound Exit Ramp
From
Station 2996+88.10± to Station 3004+25±

Faulting

On the **I-95 Northbound Exit Ramp,** faulting was not observed.

Broken Slabs

On the **I-95 Northbound Exit Ramp,** Severity Level 1 broken slabs were observed along the evaluated segment area. Two Level 1 broken slabs were observed within the 736.9 linear feet evaluated.

Slabs with Longitudinal Cracks

On the **I-95 Northbound Exit Ramp,** slabs with longitudinal cracks Severity Level 1 were observed along the evaluated segment area. One slab with a longitudinal crack Severity Level 1 was observed within the 736.9 linear feet evaluated. This slab was at Station 2997+39± to Station 2997+47±.

Replaced Slabs

On the **I-95 Northbound Exit Ramp,** replaced slabs were observed along the evaluated segment area. One replaced slab was observed within the 736.9 linear feet evaluated. That replaced slab that was not broken was located at Station 3002+69± to Station 3002+76± in the Northbound Lane 1.

Failed Replaced Slabs

On the **I-95 Northbound Exit Ramp,** failed replaced slabs were observed along the evaluated segment area. Two replaced slabs with longitudinal cracks were observed within the 736.9 linear feet evaluated. One had a longitudinal crack Severity Level 1, and the other had a longitudinal crack Severity Level 2. The replaced slab with a longitudinal crack Severity Level 1 was located at Station 3002+50± to Station 3002+69± in Northbound Lane 1. The replaced slab with a longitudinal crack Severity Level 2 was observed at Station 3003+41± to Station 3004+00± in Northbound Lane 1.

Joint Defects

On the **I-95 Northbound Exit Ramp,** joints with spalls were observed along the evaluated segmented area. Four joints with spalls were observed within the 736.9 linear feet evaluated.

Shoulder Joint Distress

On the **I-95 Northbound Exit Ramp,** shoulder joint distress was observed along both shoulders of the ramp along the entire evaluated segmented area.

Popouts

On the **I-95 Northbound Exit Ramp,** popouts were observed along the evaluated segmented area. Popouts were observed at Station 2997+49± and Station 2997+88± in Northbound Lane 1.

Map Cracking

On the **I-95 Northbound Exit Ramp,** map cracking was observed along the evaluated segmented area.

From
Station 3004+25± to Station 3005+61±

Rutting

On the **I-95 Northbound Exit Ramp,** rutting measurements were taken at various locations. Rutting measurements were 0 inches at the locations measured.

Block Cracking

On the **I-95 Northbound Exit Ramp,** Severity Level 1 to Level 3 block cracking was observed from the following evaluated section:

Station to Station		Block Cracking (%)		
Evaluated Test Section	**Representing**	**Level 1**	**Level 2**	**Level 3**
3004+25± – 3004+61± NB, Left Turn Lane	3004+25± to 3005+61±	0	100	15
3004+25± – 3004+61± NB, Right Turn Lane	3004+25± to 3005+61±	70	0	0

Corrugation/Pushing

On the **I-95 Northbound Exit Ramp,** Level 1 corrugation/pushing was observed from Station 3004+25± to Station 3005+61± in the northbound left turn lane.

ASPHALT CORE PROPERTIES LENGTH/TYPE

Core/ Sample Number	Location	Station/Location/ Direction	Asphalt Core Length (ins)	Asphalt Type/ Depth (ins.)
				Top to Bottom
C-1	**I-95 SB EXIT RAMP**	**Station 1001+39±** SB, RTL, 12’ Lt, PW	7.50	F=2.00, E=1.00, E=1.50, B=2.00, E=1.25
C-2	**I-95 NB ENTRANCE RAMP**	**Station 4000+92±** NB, Ln 1, 13’ Lt, DW	6.25	E=1.50, E=1.75, B=1.00, B=2.00, Soil Cement=1.50
C-3	**SR 144**	**Station 226+11±** WB, Ln 1, 16.5’ Lt, PW	7.00	E=1.00, E=1.75, B=2.00, B=2.25
C-4	**SR 144**	**Station 122+49±** WB, Ln 1, 19.5’ Lt, DW	6.00	E=1.75, B=1.50, E=0.75, B=2.00
C-5	**SR 144**	**Station 123+96±** EB, LTL, 15.00’ Rt, PW	7.00	E=1.25, E=1.75, B=2.00, B=2.00
C-6	**SR 144**	**Station 126+69±** EB, Ln 1, 15.50’ Rt, PW	8.50	E=1.75, E=2.00, E=1.25, E=2.50, Bin=1.00, Bituminous Base=4.00
C-7	**SR 144**	**Station 129+44±** WB, Ln 1, 15.00’ Lt,	6.50	F=1.50, E=2.00, B=2.00, B=1.00

Core/ Sample Number	Location	Station/Location/ Direction	Asphalt Core Length (ins)	Asphalt Type/ Depth (ins.)
				Top to Bottom
		DW		
C-8	**SR 144**	**Station 223+96 ±** EB, RTL, 34.00' Rt , DW	7.25	E=1.25, B=1.75, E=1.5, E=1.5, E=1.25, Soil Cement=8.25
C-9	**SR 144**	**Station 226+24±** EB, Ln 1, 10.50' Rt, DW	6.00	E=0.75, E=0.75, E=2.00, B=2.50
C-10	**SR 144**	**Station 226+24±** EB, Ln 1, 13.50' Rt, CL of lane	6.00	E=0.75, E=0.75, E=1.75, B=2.75
C-11	**SR 144**	**Station 226+24±** EB, Ln 1, 16.50' Rt, PW	6.00	F=0.75, E=0.75, E=2.25, B=2.25
C-12	**I-95 SB ENTRANCE RAMP**	**Station 2005+30±** SB, Ln 1, 5.50' Rt, PW	7.00	F=2.00, E=2.00, B=3.00
C-13	**I-95 NB EXIT RAMP**	**Station 3004+73±** NB, RTL, 19.00' Rt, PW	6.25	E=1.50, F=0.75, E=1.75, B=2.25

Notation:
DW = Driver's Wheel Path
EB = Eastbound
Ln = Designated Travel Lane
Lt = Left of the existing centerline, direction of travel (lower to higher station)
PW = Passengers Wheel Path
Rt = Right of the existing centerline, direction of travel (lower to higher station)
LTL = Left Turn Lane
RTL = Right Turn Lane
WB = Westbound
NB = Northbound
SB = Southbound

Asphalt Type:
F= Asphalt mix with < ⅜ inch stone size matrix
E= Asphalt mix with < ¾ inch stone size matrix
Bin = Binder = Black mix
B=Base = Asphalt mix with > ¾ inch stone size matrix

APPENDIX I

Laboratory Testing Results for Asphalt Samples (10-pages)

CONSTRUCTION MATERIALS SERVICES, INC.
105 Park 42 Dr Suite A Locust Grove, GA. 30248-2545
Phone (770) 914-1744 Fax (770) 914-0412
Email: info@cmsnatl.com

Geotechnical Engineering - Materials Testing - Asphalt Mix Design - Soil Surveys – Environmental

September 18, 2015

United Consulting
ATTN: Ray Halbert
625 Holcomb Bridge
Norcross, Georgia 30071

RE: HMA Lab Testing
Project Name: SR 144 @ 95
Richmond Hill, GA
UC # 2015-0859.01
CMS Project # 15-208

Dear Ray,

Per your written request, we have completed testing per our proposal and your instructions. This testing was in general conformance with applicable GDOT methods and standards. Attached is the Test Result Summaries, and photos for the test specimens.

All testing and reporting was accomplished as stated in our original email proposal.

*Our LWT "wet" results on specimen C-10 and C-11 generally yielded acceptable rutting less than 5mm. Specimen C-9 had and average rut of greater than 5mm. (See attached results.)

* CMS did not determine core locations. Cores were obtained by United Consulting (UC) and shipped to our Lab in Locust Grove for Laboratory testing. Visually the cores were stable and in fair condition when received into our Lab.

*The specimens tested survived the LWT and were visually in fair condition.

*Assuming the test depths proposed by United Consulting are the elevations of the proposed overlays, the bond strength appears to be adequate. CMS did not perform any testing to ensure adequate bond strength between any of the existing and/or proposed asphalt layers.

* No visual evidence of excess asphalt cement was evident post LWT testing.

*No tensile strength testing was requested for this round of testing.

We thank you for the opportunity to serve you. If you have any questions, please call me at (770) 914-1744.

Respectfully submitted,

Andrew Johnson, P.E.
President

AJ:ceh

Attachments

S:\ATLANTA\CMS Lab\Soil-GEOTECHNICAL\Soil-GEOTECHNICAL--PAVEMENT EVALS\2015\15208 SR 144 @ I-95 (United Consulting)\Final Report of Cores 9-18-15.doc

Construction Materials Services, Inc.
LWT Entry Sheet

Project No.: 15-208

Date: 9/16/15
Contractor: United Consulting
Lab#: 008L

Design Level:
SP Designation:
No. of Gyrations:

Method of Test for Determining Rutting Susceptibility Using the APA, (GDT-115m)

Lab #	Left Pills					Center Pills					Right Pills				
	Pill #	C9	Pill #	C10		Pill #	C11	Pill #	Blank		Pill #	Blank	Pill #	Blank	
Position	Aft	Aft Ctr	Fwd Ct	Fwd		Aft	Aft Ctr	Fwd Ct	Fwd		Aft	Aft Ctr	Fwd Ct	Fwd	
8000	12.61	12.22	10.82	10.60	Avg	9.87	10.42			Avg					Avg
0	6.46	5.33	8.13	7.34	Rut	6.66	5.88			Rut					Rut
DEF., mm	6.15	6.89	2.69	3.26		3.21	4.54								

Mixing Temp., C
Comp. Temp., C

Average Gmb
Average Air Voids, %

Conditioning Requirements
Testing Temp., C: 64°C

Average Height of Specimens, mm
Average Deformation, mm

Testing Apparatus
Date Tested

Gmm @ Opt. Pb, %
Opt. AC%
Nd=

Marshall Density

Construction Materials Services, Inc.

LWT Specimens

Date 9/9/15
Project 15-208

Design With Lime

Specimen No.	C9	C10	C11						
Height	3.375	3.125	3.125						
Air Wt.	3491.0	3344.5	3398.6						
Water Wt.	2066.1	1957.8	2019.6						
S. S. D. Wt.	3492.3	3346.5	3400.4						
Sp. Gravity	2.448	2.408	2.461						
Density	152.7	150.3	153.6						
Avg. Density	152.2								

Tensiles

Specimen No.	A	B	C	A	B	C	A	B	C
Height									
Air Wt.									
Water Wt.									
S. S. D. Wt.									
Sp. Gravity									
Density									
Avg. Density									

Design Without Lime / 75 Blow

Specimen No.	A	B	C	A	B	C	A	B	C
Height									
Air Wt.									
Water Wt.									
S. S. D. Wt.									
Sp. Gravity									
Density									
Avg. Density									

Specimen No.	A	B	C	A	B	C	A	B	C
Height									
Air Wt.									
Water Wt.									
S. S. D. Wt									
Sp. Gravity									
Density									
Avg. Density									

Bowl No.	1	2	3	4	
% A C					
Air Wt.					
Water Wt.					
Max. Grav.					
A C Grav.					Eff. Grav.
Eff. Grav.					

S:\ATLANTA\CMS Lab\Soil-GEOTECHNICAL\Soil-GEOTECHNICAL--PAVEMENT EVALS\2015\15208 SR 144 @ I-95 (United Consulting)\Marshall Density 09-09-15

Construction Materials Services, Inc.

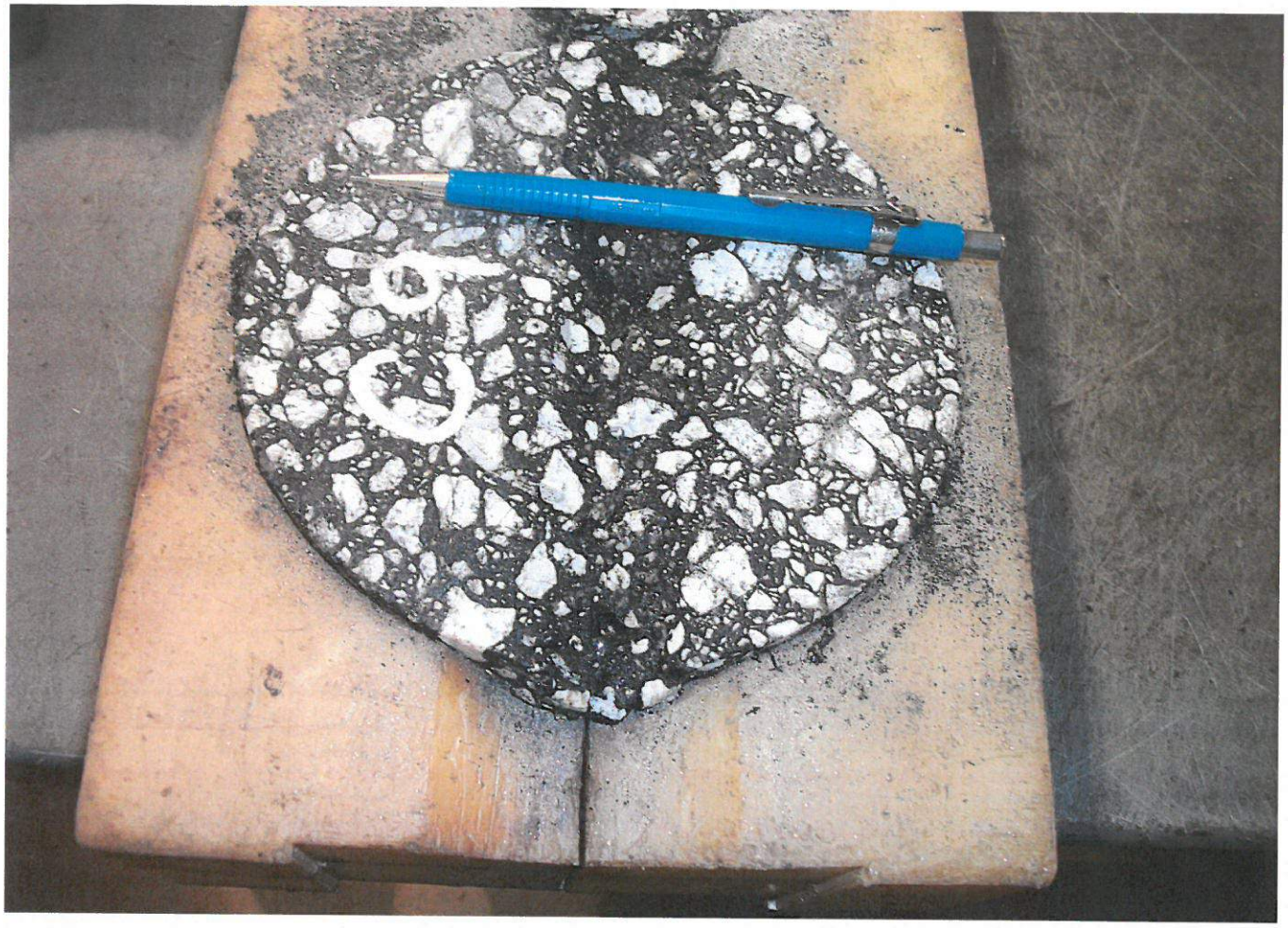
105 Park 42 Drive, Suite A; Locust Grove, Georgia 30248-2545

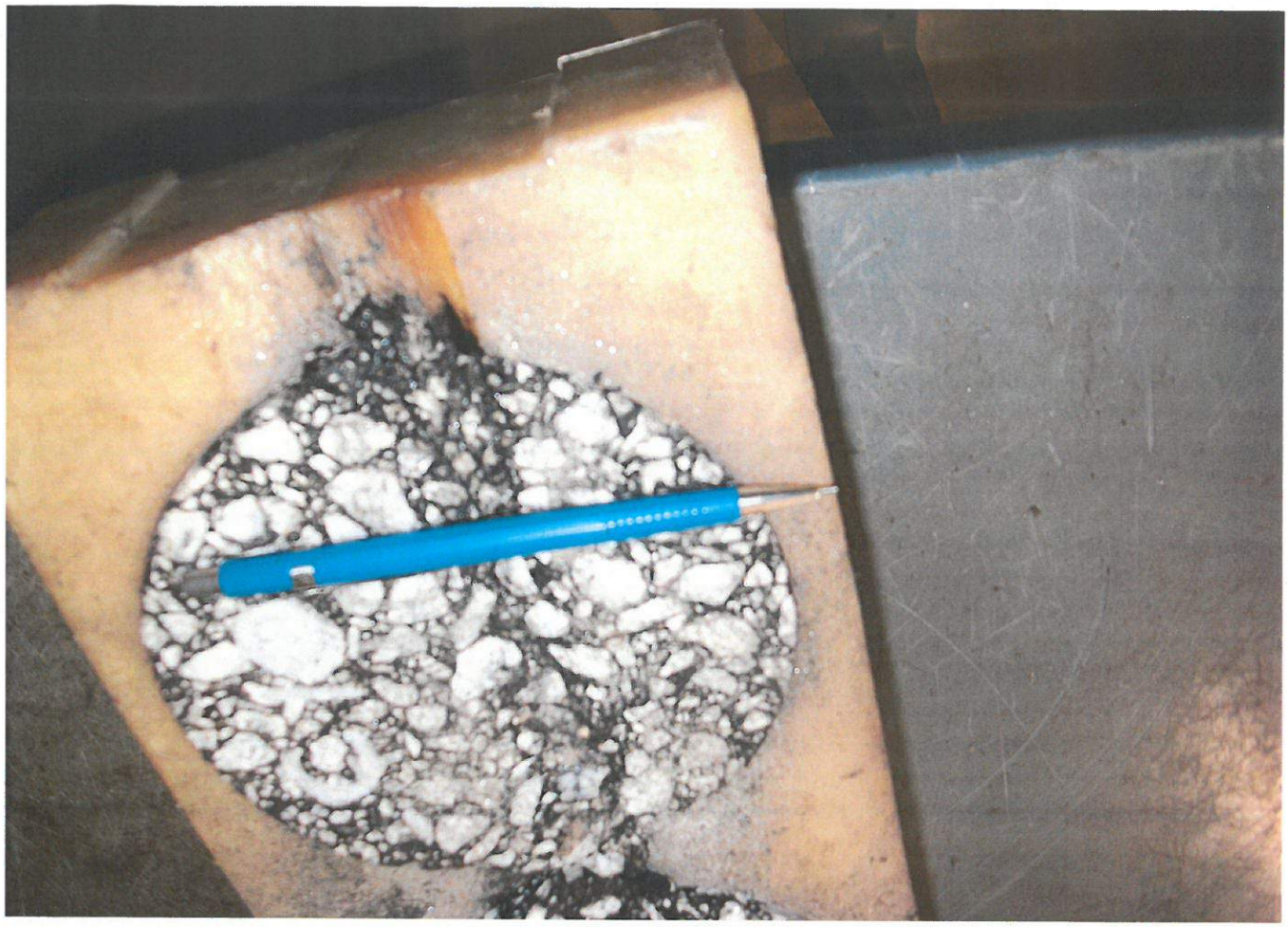
Project: 15-208
Consultant: United Consulting
Date: 09/09/15

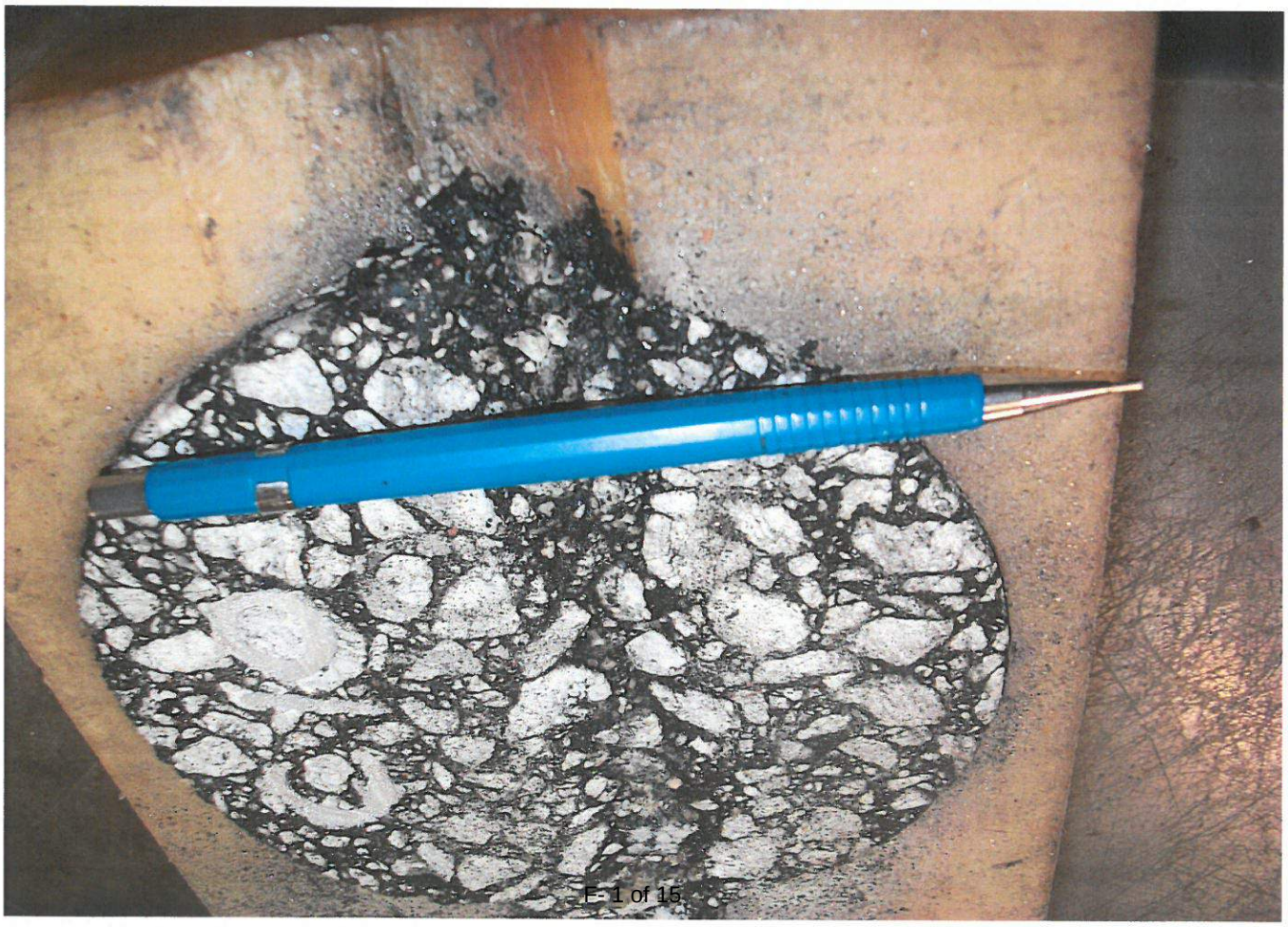
Bulk>>pcf
Gmax>>pcf
Tensiles>>psi
AV=Air Voids >> %

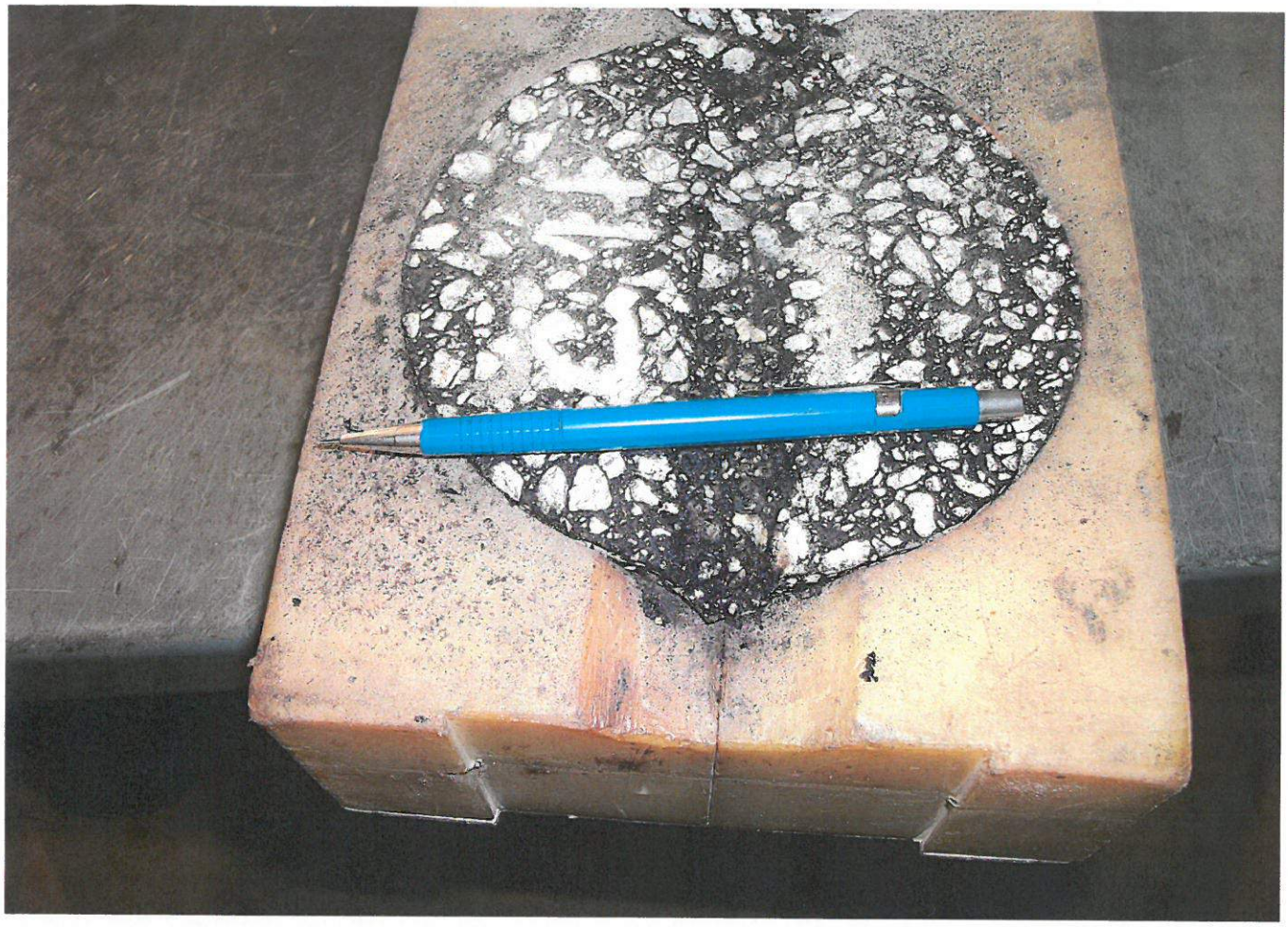
I - Core Intact
S - Segregated
C - Cracked
V - Voided
P - Permaflex
B - Broke
G - Good Condition

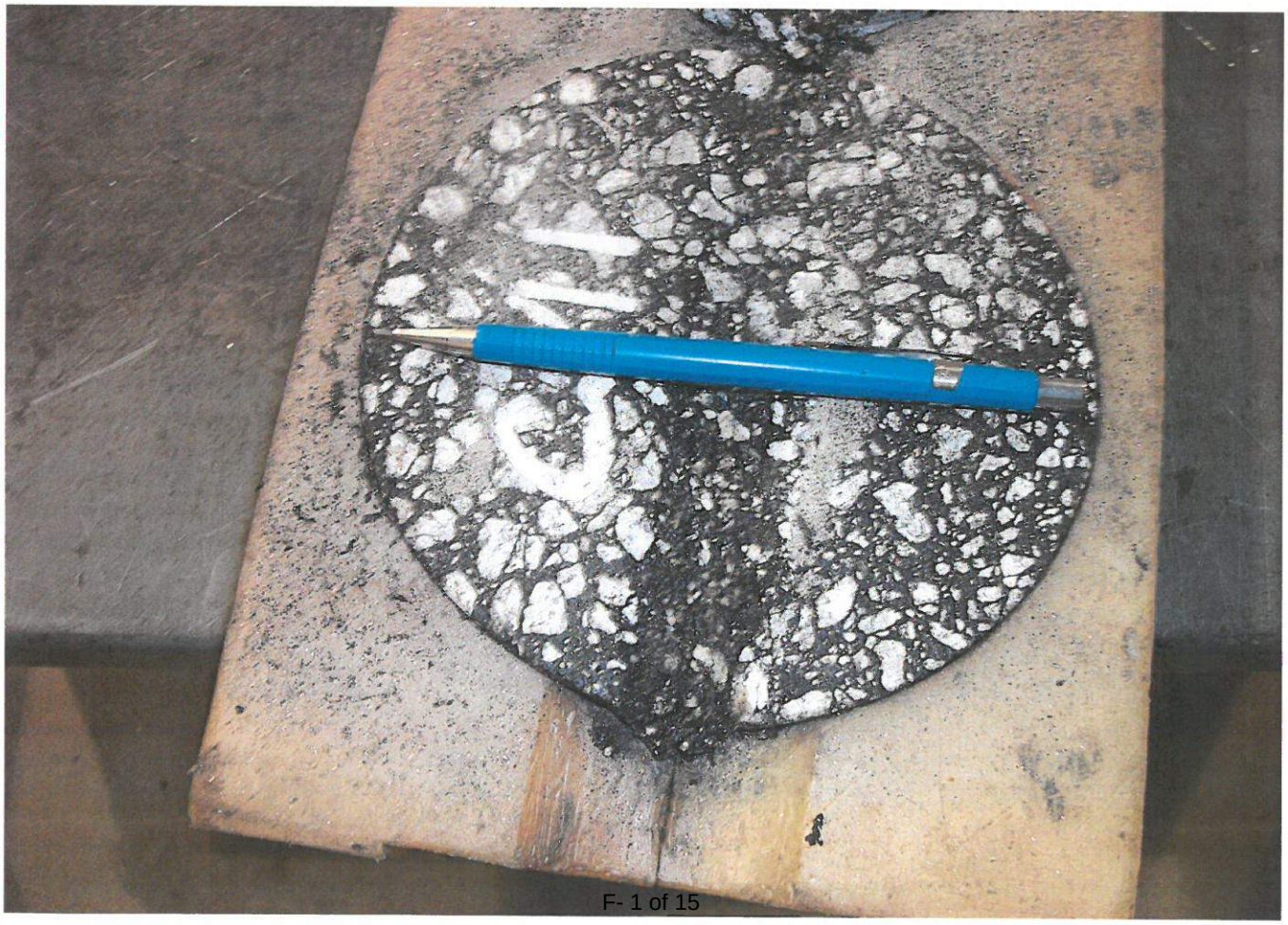
ID	Thick.	Bulk	AV	Gmax	Ext.	Ten	Rut	Core Notes - Mix type	
C-9									I
1	1.50							12.5 mm	
2	2.00							19 mm	
3	2.25							25 mm	
4									
5									
6									
7									
T	5.75								
ID	Thick.	Bulk	AV	Gmax	Ext.	Ten	Rut		
C-10									I
1	1.50							12.5 mm	
2	2.25							19 mm	
3	2.25							25 mm	
4									
5									
6									
7									
T	6.00								
ID	Thick.	Bulk	AV	Gmax	Ext.	Ten	Rut		
C-11									I
1	1.50							12.5 mm	
2	2.00							19 mm	
3	2.50							25 mm	
4									
5									
6									
7									
T	6.00								

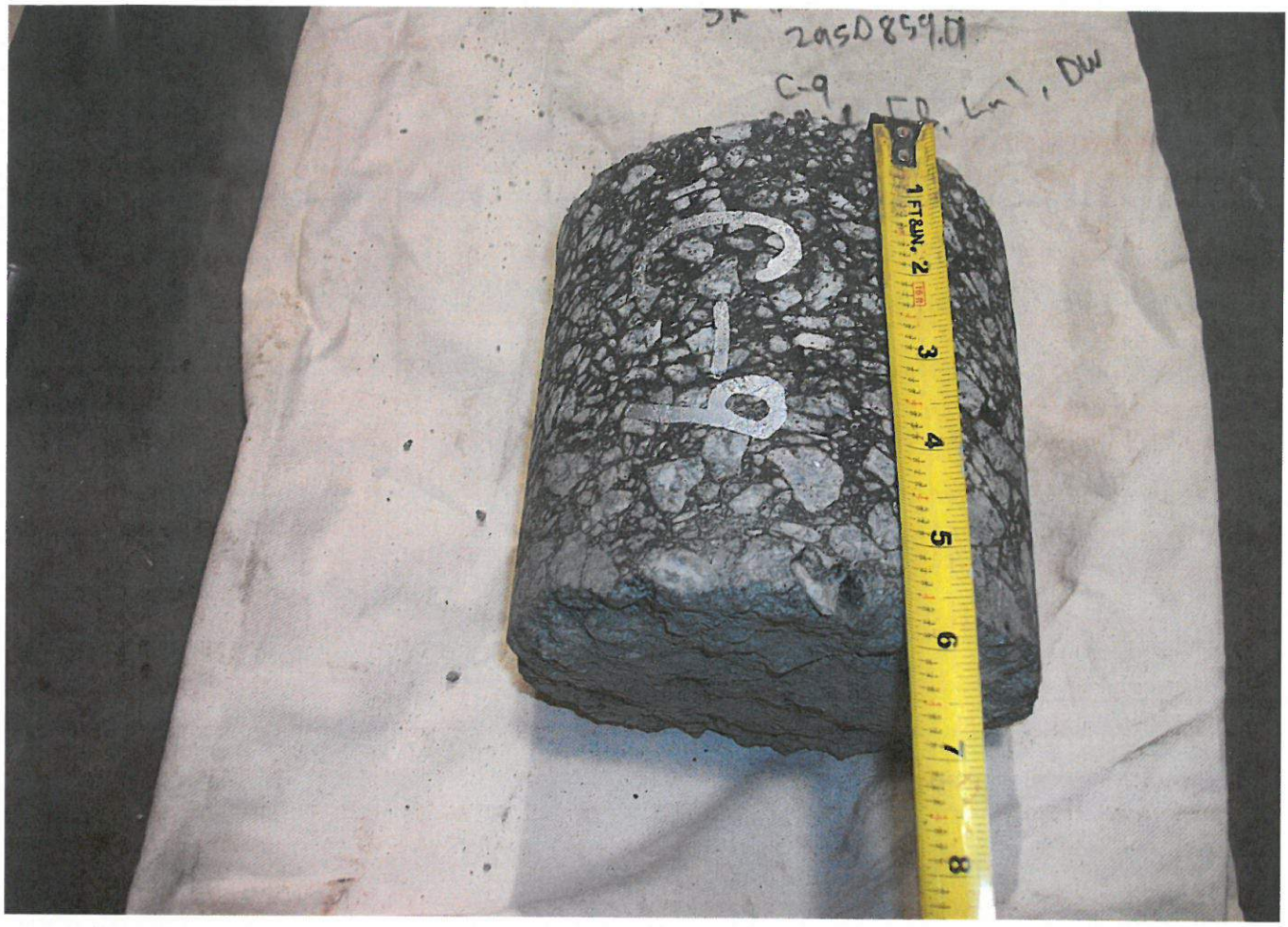











2ASD859.01
C-9
EB, Ln 1, DW
1 FT&IN. 2
3
4
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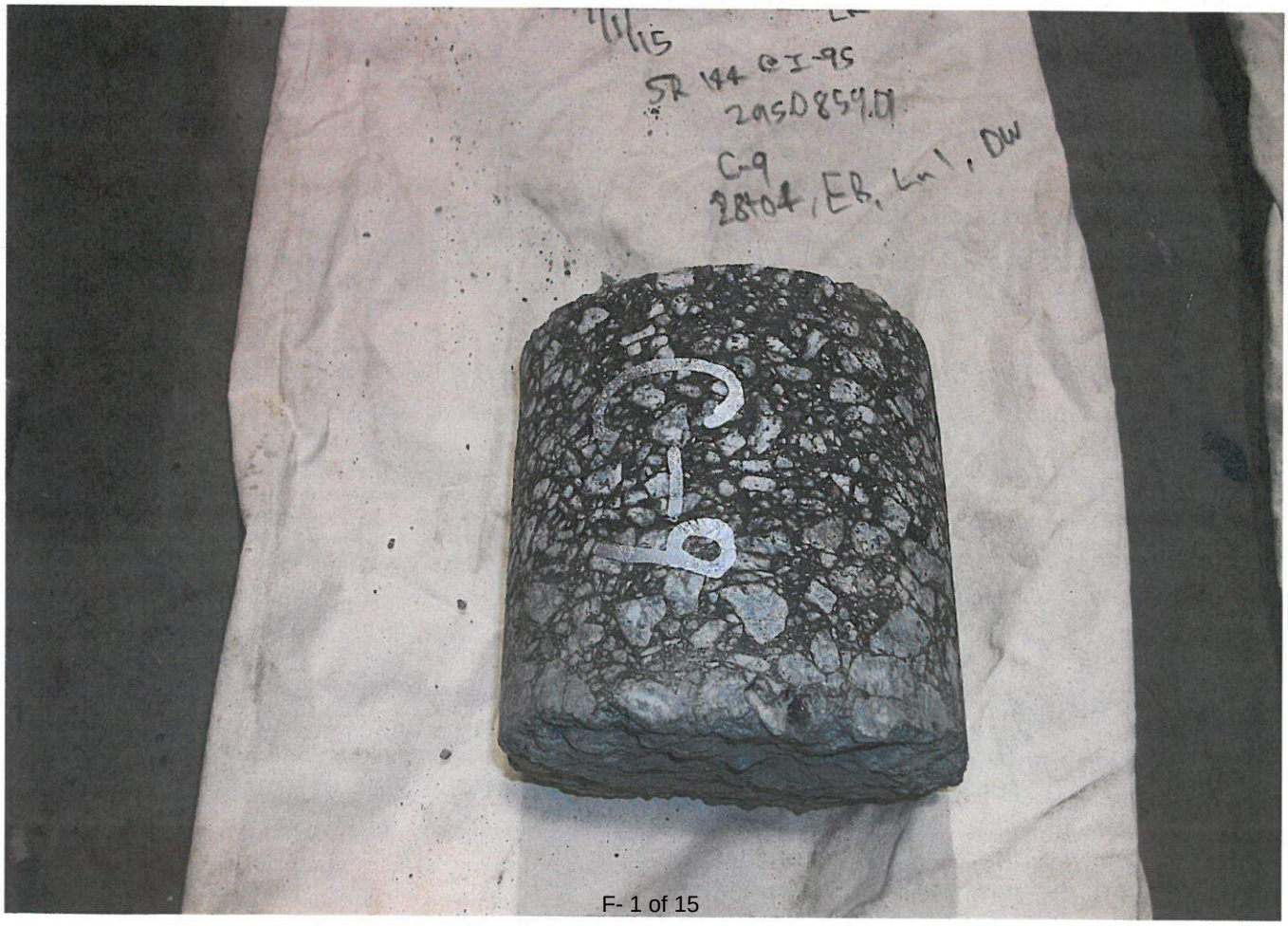
8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SR 144 @ I-95
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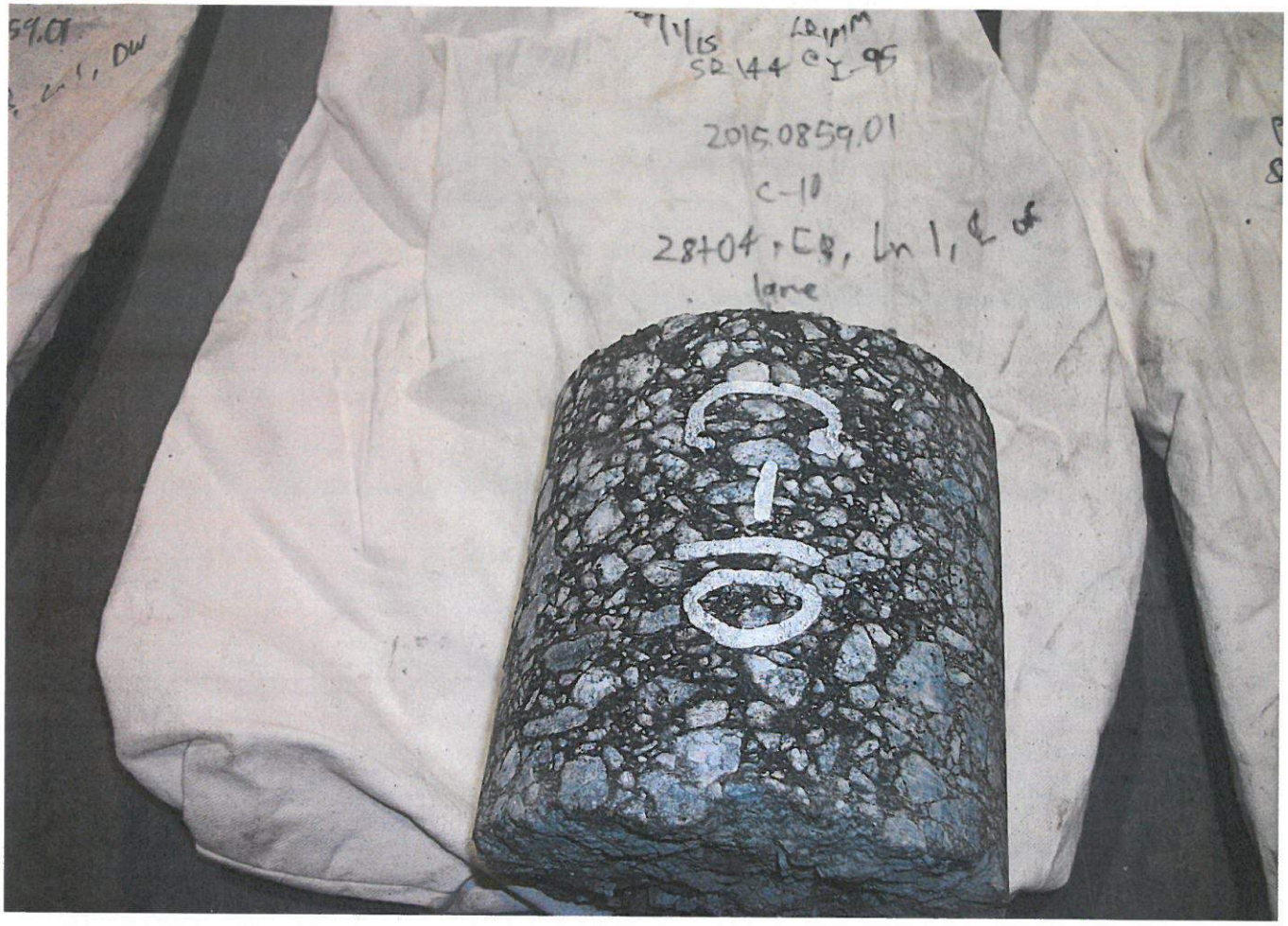
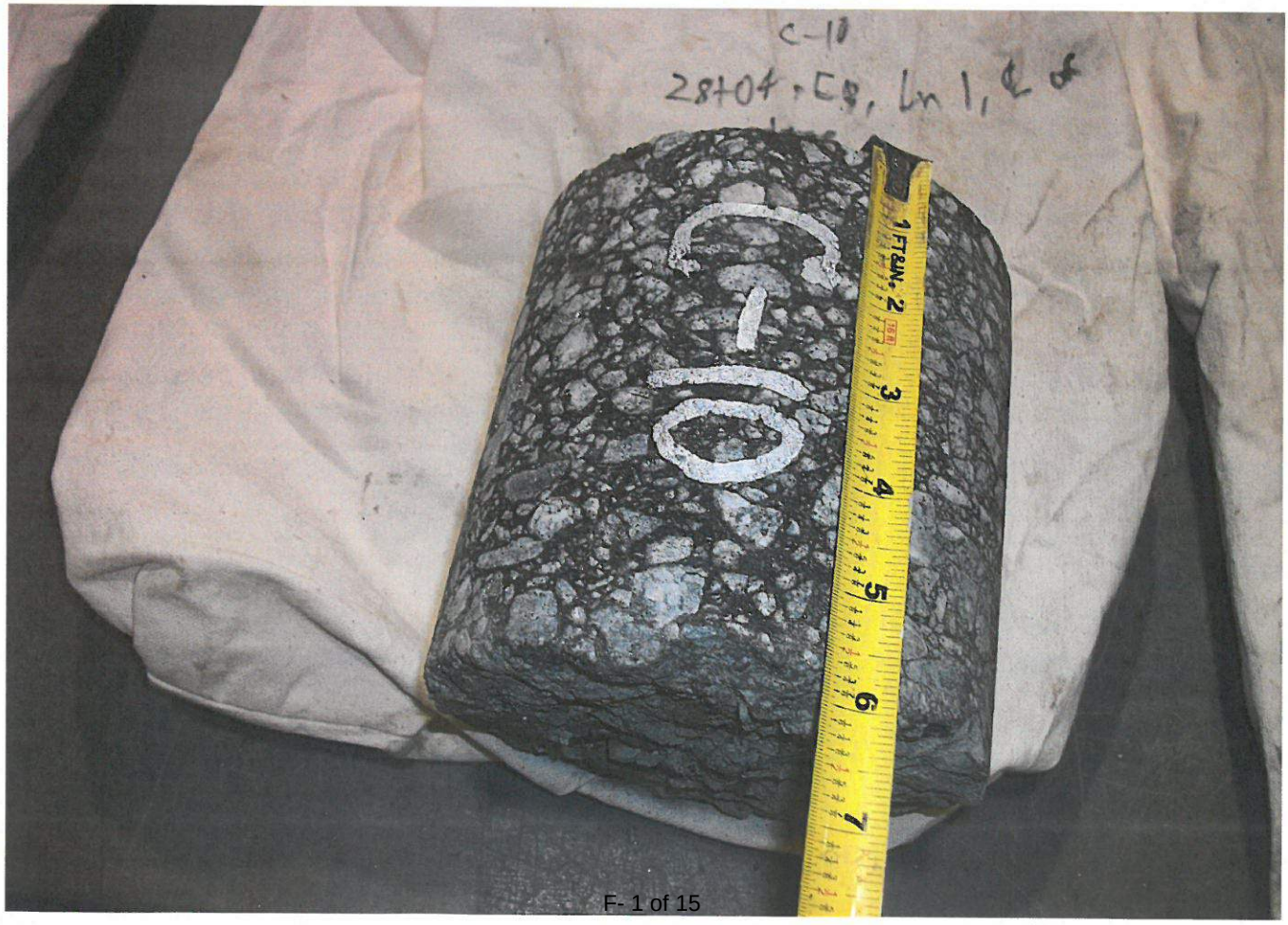
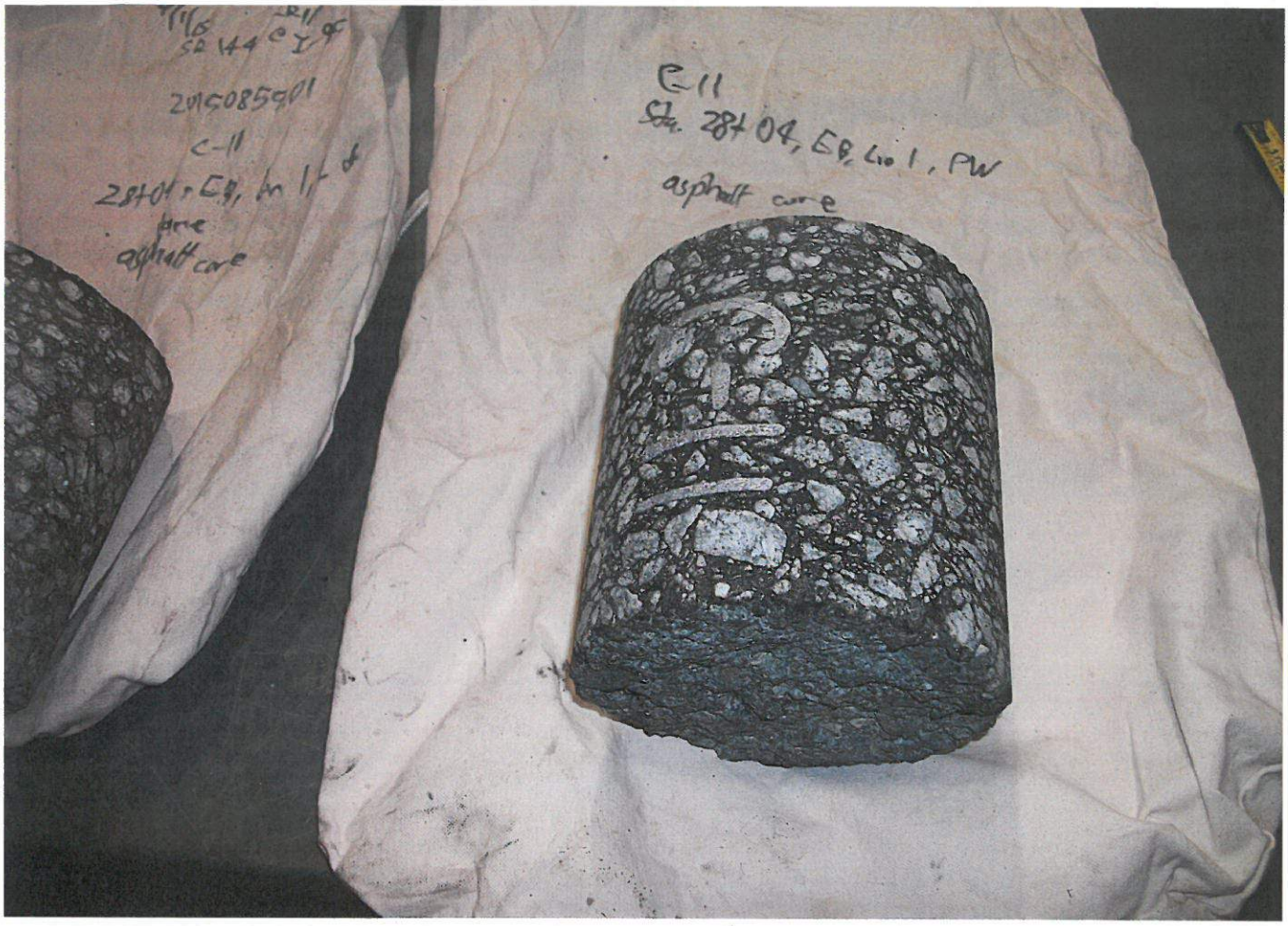
C-9
28+04, EB, Ln 1, DW


2015.0859.01
C-10
28+04, EB, Ln 1, ℄ of
lane


C-10
28+04, EB, Ln 1, ℄ of


C-11
Sta. 28+04, EB, Lin 1, PW
asphalt core

asphalt core
1 FT&IN. 2
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Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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e-mail: info@asfe.org www.asfe.org

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Concept Report Review Comments & Responses

Project: TOOPSDDES110124, PI No.: 0010739, Bryan County
SR 144 at I-95 SB & NB Off Ramps

Comments By: Daniel G Pass
Windy Bickers
Merishia Robinson
Bill Duvall

Response Date: 12-14-2015

H&L Project Number: 2011.006.020

Responses By: Warren Dimsdale & Rudolph Frampton

Comments By: Daniel G. Pass; Office of Design Policy & Support

1. **Project Justification Statement:** The benefits of roundabout in addressing adverse crash histories is appreciated. Nevertheless, *suggest* at least a brief explanation of the need specific to this location.
   An updated Project Justification Statement has been requested from the Office of Planning.
   Response from Office of Planning: We have been advised to generalize these statements. Placing specific information about the location in the justification statement would conflict with that direction and lead to the possibility of conflicting with other information within the concept report

2. **Pavement Evaluation and Recommendations**: Preliminary PES and PTS reports are noted as required. These are concept level reports meant to identify feasible pavement types. If they are required for concept phase, they would normally be attached to the concept report.
   Due to the limited time frame till the contract expiration date on March 7, 2016, the PTS will need to be completed during the final phase. A PES has been prepared but not approved. The results of the PES report have been included in the appendix of the concept report. We have moved forward with the recommended pavement types and sections listed in the PES report. SR 144 will be asphalt including the roundabouts and all ramps and bypass lanes will be concrete.

3. **Mainline Design Features**:
   - Is 711-ft the minimum radius being "proposed" or is it simply a repeating of the minimum criteria?
     It is a repeat of the minimum allowable, which we would not exceed. We have a proposed curve of R=5930, Normal Crown at 45 mph.
   - Regarding the design vehicle, please contact the Oversize Permit Unit in the Office of Traffic operations and request a tabulation of all oversize vehicles which have passed through these ramp terminals. The use of a low boy for a check vehicle is appreciated, but there may be other

type of oversize vehicles which need to be accommodated through these intersection (e.g., a larger truck, a mobile home…). This can be done early in preliminary design.
The GDOT project manager is pursuing this information. The design will be modified to accommodate any additional oversized loads that the permit office has records of using this intersection.

4. **Ramp Design Features**:
   - Correct entry for proposed posted speed.
     The proposed posted speed entry has been corrected.
   - Design speed for ramps should range from 35 mph to 60 mph. See Table 3.1 and Section 3.3.3 of the GDOT DPM.
     The proposed design speed has been corrected.
   - Correct Standard for max SE, should read 8%.
     The Maximum Superelevation Rate has been changed to 8%.
   - Where was the range for Standard Maximum Grade obtained?
     The range for the Standard Maximum Grade was taken from the 2011 publication of AASHTO, Chapter 10-Grade Separations and Interchanges, "Grade and Profile Design", page 10-92. Additional Guidance specific to roundabout interchanges is also provided in AASHTO, Chapter 10-Grade Separations and Interchanges, "Double Roundabout Interchange", page 10-42.

5. **Design Exceptions/Variances:** Recommend submitting variance for access control early in preliminary design.
   A design variance will be submitted for review and approval.

6. **Conceptual Layout:** This is perhaps the most important comment to be addressed. Verify whether or not there is an adverse crash history related to the very short ramps. If so, it may or may not be practical to address this concern and I expect this project will improve the condition. Nonetheless, this needs to be confirmed, and if it has been confirmed, then it should be documented in the report.
   The existing ramps are approximately 950 feet in length from SR 144 to the converging/diverging points with I-95. This length exceeds the minimum stopping sight distance of 598 feet at 60 mph (AASHTO), even when taking queue lengths into account. The proposed design will not reconfigure the interchange layout or lengthen the existing ramps, this work would be beyond the scope of the project. The I-95 northbound exit ramp has an existing substandard vertical curve in an area where widening is proposed, a design variance to keep the existing vertical curve will be submitted for approval. According to the three-year crash history provided by GDOT, one crash has been recorded as occurring on one of the interchange ramps. For the most part, the recorded crashes occurred on SR 144. By reducing the number of conflict points and providing lower travel speeds through the intersection, it is expected that the installation of roundabouts will result in less sever crashes and a lower total number of crashes.

7. **Roundabout feasibility study:** Has the peer reviewer re-reviewed the corrected layout, and roundabout feasibility study? Given the large number of comments, this should be done either now or in early preliminary design – to ensure that detailed design proceeds based on a good layout.

The peer reviewer has reviewed the corrected layout and revised Roundabout Feasibility Study and all subsequent comments have been addressed.

Comment By: Windy Bickers; Office of Financial Management

The Liquid A/C needs to be updated. According to the attachment, it is from either from 1-19-2014 or 9-29-2009.
The Liquid A/C cost OF $429 was the current cost for October 2015. The date on the spread sheet has been updated accordingly.

Comment By: Merishia Robinson; Office of Utilities

Under the "Coordination, Activities, Responsibilities, and Costs" section, update the Project Activity box to read "Utility Coordination/Relocation" and the Party Responsible for Performing Task(s) to read "GDOT/Utility Owners".
The section has been updated.

Comment By: Bill DuVall, Office of Bridge Design

The minimum vertical clearance for I-95 over SR 144 is 16'-2". The minimum vertical clearance for State Routes is 16'-9" according to the Bridge and Structures Design Manual. This is not listed under the Design Variances section of the Concept Report.
A design variance will be submitted for review and approval.