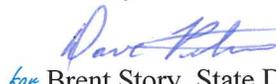


# DEPARTMENT OF TRANSPORTATION STATE OF GEORGIA

## OFFICE OF DESIGN POLICY & SUPPORT INTERDEPARTMENTAL CORRESPONDENCE

**FILE** P.I. # 0012698 **OFFICE** Design Policy & Support  
Gwinnett County  
GDOT District 1 - Gainesville **DATE** April 28, 2015  
I-85 @ SR 324  
Interchange – New Construction

**FROM**  for Brent Story, State Design Policy Engineer

**TO** SEE DISTRIBUTION

**SUBJECT** APPROVED CONCEPT REPORT

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

Attachment

**DISTRIBUTION:**

Glenn Bowman, Director of Engineering  
Joe Carpenter, Director of P3/Program Delivery  
Genetha Rice-Singleton, Assistant Director of P3/Program Delivery  
Albert Shelby, State Program Delivery Engineer  
Bobby Hilliard, Program Control Administrator  
Cindy VanDyke, State Transportation Planning Administrator  
Hiral Patel, State Environmental Administrator  
Ben Rabun, State Bridge Engineer  
Andrew Heath, State Traffic Engineer  
Angela Robinson, Financial Management Administrator  
Lisa Myers, State Project Review Engineer  
Charles "Chuck" Hasty, State Materials Engineer  
Mike Bolden, State Utilities Engineer  
Paul Tanner, Asst. State Transportation Data Administrator  
Attn: Systems & Classification Branch  
Richard Cobb, Statewide Location Bureau Chief  
Brent Cook, District Engineer  
Brandon Kirby, District Preconstruction Engineer  
Neil Kantner, District Utilities Engineer  
Charles Robinson, Project Manager  
BOARD MEMBER - 7th Congressional District

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

Project Type: <u>Interchange</u>	P.I. Number: <u>0012698</u>
GDOT District: <u>1</u>	County: <u>Gwinnett</u>
Federal Route Number: <u>I-85</u>	State Route Number: <u>SR 403 and SR 324</u>
Project Number: _____	N/A

**I-85/SR 403 at SR 324 (Gravel Springs Road) Interchange**

**Submitted for approval:**

<u>[Signature]</u> Eric J. Ricker, Gresham, Smith & Partners	<u>1/6/2015</u> Date
<u>[Signature]</u> Lewis Cooksey, Gwinnett County Department of Transportation	<u>1/6/2015</u> Date
<u>[Signature]</u> State Program Delivery Engineer	<u>1/23/2015</u> Date
<u>[Signature]</u> GDOT Project Manager	<u>1/21/15</u> Date

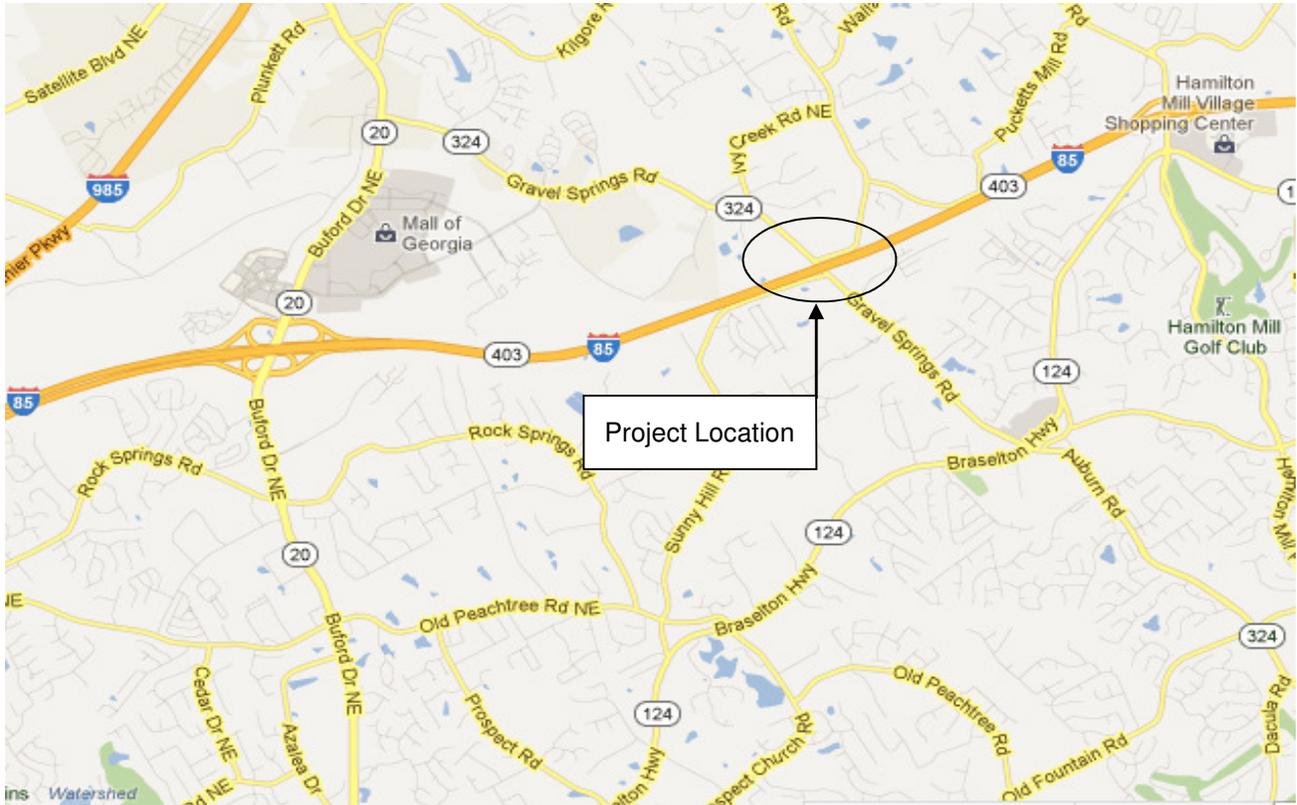
*\* Recommendation on file*  
**Recommendation for approval:**

<i>*</i> <u>[Signature]</u> State Environmental Administrator	<u>2-19-15</u> Date
<i>*</i> <u>[Signature]</u> State Traffic Engineer	<u>2-20-15</u> Date
<i>*</i> <u>[Signature]</u> Project Review Engineer	<u>2-23-15</u> Date
<i>*</i> <u>[Signature]</u> FOR State Utilities Engineer	<u>2-26-15</u> Date
District Engineer	Date
<i>*</i> <u>[Signature]</u> State Bridge Engineer	<u>2-26-15</u> Date

- MPO Area: This project is consistent with the MPO adopted Regional Transportation Plan (RTP)/Long Range Transportation Plan (LRTP).
- Rural Area: This project is consistent with the goals outlined in the Statewide Transportation Plan (SWTP) and/or is included in the State Transportation Improvement Program (STIP).

<u>[Signature]</u> State Transportation Planning Administrator	<u>2-24-15</u> Date
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### PROJECT LOCATION MAP



***Gravel Springs Road / SR 324 @ I-85/SR 403 Interchange)***

***Georgia Department of Transportation PI # 0012698***

***Gwinnett County Department of Transportation Project Number F-0782-01***

County: Gwinnett

## PLANNING AND BACKGROUND

**Project Justification Statement:** Georgia Department of Transportation PI No. 0012698/Gwinnett County Department of Transportation Project F-0782 proposes to (1) improve transportation access to and from the interstate highway system, (2) reduce in crash frequency and severity on Interstate I-85 in the vicinity of the proposed project area, (3) improve traffic operations on the local roadway network, and (4) enhance economic development opportunities by constructing an interchange on Interstate 85/ SR 403 with SR 324/ Gravel Springs Road in Gwinnett County. Interstate 85/ SR 403 is a four lane roadway with a 64 ft. depressed median with a 70 mph speed limit. SR 324/ Gravel Springs Road, which is posted for a 45 mph speed limit and crosses over Interstate 85/SR 403, was recently constructed by a separate GDOT project to be a four lane roadway with a raised median. There is presently no connection between these two roadways. Access, operational, and economic issues that will be addressed by the project are as follows:

- The SR 20 interchange, located 2.7 miles west of SR 324 along I-85, is presently the only access point on I-85 for both local and regional traffic into and out of the Mall of Georgia area. SR 324 currently provides access to the east side of the Mall of Georgia and the commercial developments surrounding the regional mall from areas east of I-85. An interstate access point at SR 324 would provide direct access for southbound traffic into the Mall of Georgia area and provide an alternate route to the same area for northbound traffic wishing to avoid either the congestion of SR 20 or the extended trip back to the commercial areas from Hamilton Mill Road.
- SR 324 has a densely populated residential area and new commercial shopping centers that support the residential developments. The existing SR 324 overpass on I-85 is located 2.7 miles east of I-85/SR 20 interchange. Without interstate access at SR 324, truck and vehicular traffic must travel 3.5 miles (measured from proposed SR 324 Interchange) on arterial roadways to reach the SR 20 interchange to access I-85. Vehicular traffic usually travels northwesterly on SR 324 then turns west onto Mall of Georgia Boulevard and then turns south onto SR 20 to the interchange. Truck traffic uses a little longer route by traveling on SR 324 to SR 20 and then onto the I-85/SR 20 interchange.
- The crash rate data for I-85 from SR 20 to Hamilton Mill Road indicate that this segment of I-85 has a moderate crash rate compared to the statewide crash rates for urban interstates. The injury rate for this segment of I-85 is slightly lower than the statewide average injury rate. However, the fatality rate ranges from 1.1 to 1.8 times the statewide average for fatalities on urban interstates. Fatality rates usually are high along parts of an interstate that has a mix of traffic traveling at widely varying speeds which is indicative of traffic congestion. Traffic congestion on the arterial roads crossing I-85 contribute to traffic queuing onto the freeway and create the potential for rear-end crashes on I-85 at the junction points of the interchanges. Specifically, I-85 at its junction points of SR 20 and Hamilton Mill Road has had a high number of rear-end collisions.
- The crash rate data for the segments of SR 20 off of the I-85/SR20 interchange show that these segments have crash rates that are higher than the statewide crash rates for urban principal arterials. Traffic volumes on SR 20 (Buford Drive) from Old Peachtree Road to Laurel Crossing Parkway have led to poor operational conditions with crash rates for 2006-2008 that are much higher than the statewide average crash rate. For that roadway segment, the crash rate ranges from 1.6 to 2.0 times higher than the statewide average. Injury rates on that segment of SR 20 ranged from 2.7 to 3.3 times higher than the statewide average for urban principal arterials. SR 20 from Laurel Crossing Parkway to Mall of Georgia Boulevard has become so congested that the crash rates on that particular segment were the second highest of the three SR 20 segments analyzed and the corresponding crash rates were 2.6 to 3.7 times higher than the statewide average for that functional classification of roadway. Injury rates on that segment of SR 20 were 3.0 to 5.7 times higher than the statewide average for those same years. Traffic volumes on the segment of SR 20 (Buford Drive) from Mall of Georgia Boulevard to South Bogan Road result in lower crash rates as compared to the Laurel Crossing Parkway to Mall of Georgia Boulevard segment. The data indicate that the crash rates for the Mall of Georgia Boulevard to South Bogan Road segment were 2.7 to 3.2 times higher than the

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statewide average for urban principal arterials. Injury rates on this segment of SR 20 were 3.4 to 4.1 times higher than the statewide average for those same years, and there was one fatality in 2007, which represented 3.8 times the statewide average rate.

- Interstate 85 showed deficient 2008 levels of service from SR 20 north to Hamilton Mill Road according to the approved Interchange Justification Report (IJR). This is partly attributable to the aforementioned queuing backup from both the SR 20 and Hamilton Mill Road interchanges onto the I-85 mainline. An additional interchange on I-85 between SR 20 and Hamilton Mill Road would help improve the mainline operation of I-85 and, as previously noted, would likely reduce the potential for rear-end crashes. An interchange at I-85 at SR 324 would also improve the near-term operations of SR 20 and Hamilton Mill Road by diverting traffic from these roadways.
- The business community has tried to develop the area in the vicinity of the project into a viable industrial and business area. Gwinnett County has already planned as part of their adopted Comprehensive Plan to facilitate this type of development. However, inadequate access for trucks would be a deterrent from the land being developed as planned by the County. Consequently, future employment opportunities from potential employment centers would be lost. Enhanced development of industrial and commercial properties within the project's vicinity would provide additional goods and services to the region and create significant employment opportunities.

Georgia Department of Transportation PI No. 0012698/Gwinnett County DOT project F-0782 originates from the year 1999, when it was noticed that there was a traffic capacity problem along SR 324 (Gravel Springs Road) from SR 20 (Buford Drive) to SR 124 (Braselton Highway). It was identified that there was a need to widen SR 324 to provide sufficient capacity and provide adequate turn lanes at the major street intersections. In 2005, Gwinnett County employed a consultant to conduct a traffic study of this same geographic area and to establish the feasibility for a possible new interchange at I-85/SR 324. GDOT's Office of Urban Design, Division of Preconstruction, and the FHWA reviewed the feasibility information in October 2005 and advised Gwinnett County that the County could roll the feasibility data and analyses into an Interchange Justification Report (IJR). The IJR was authorized by GDOT's Office of Planning with the study starting in January 2007 and approved by the Federal Highway Administration (FHWA) in January 2012.

**Existing conditions:** I-85/ SR 403 has two travel lanes in each direction with a depressed median and full access control. However, GDOT project PI #110600, which is scheduled to be completed prior to PI #0012698, plans to add a managed 'HOT' lane in each direction separated by a median barrier. These managed 'HOT' lanes would be buffered from the existing general purpose lanes. Additionally, a northbound general purpose auxiliary lane would be placed between the SR 20 interchange entrance ramp and a point immediately south of the existing SR 324/Gravel Springs Road overpass. SR 324/Gravel Springs Road is currently a four lane roadway with a raised median and urban border areas going over Interstate 85/ SR 403, but with no access to Interstate 85/SR 403 or access control.

**Other projects in the area:**

- Project NHIM0-0085-02 (164), P.I. No. 110600: I-85/SR 403 managed lanes from Old Peachtree Road to Hamilton Mill Road. This project would extend the existing I-85/SR 403 concurrent managed lanes, which have recently been converted to HOT3+ lanes as part of GDOT's ongoing HOV2HOT initiative, creating continuous managed lanes from the I-285 interchange to Hamilton Mill Road. A concurrent managed lane is proposed in each direction adjacent to the general purpose lanes. In addition, a northbound general purpose auxiliary lane is proposed to begin from the entrance ramp at the SR 20 interchange and end just south of SR 324/Gravel Springs Road overpass. This project will have a design-build delivery and is anticipated to be let in 2015 with a 2017 completion. The design and schedule of PI #0012698 has been coordinated with the design of PI #110600 (see attachments for meeting minutes).
- Project NHIM0-0085-02 (165), P.I. No. 110610: I-85 widening from north of CR 134 (Hamilton Mill Road) to north of SR 211. This project would expand the interstate to 3 lanes in each direction. This

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project would also include construction of a contiguous managed lane in each direction. There is no additional right-of-way required for project implementation. The construction is programmed in 2019.

- Project CSSTP-0007-00 (850), P.I. No. 0007850: Metro Arterial Connector - SR 20 (Buford Drive). This project involves widening SR 20 from I-85 to Rock Springs Road, which would expand the existing roadway from 4 lanes to 8 lanes. All phases of this project are currently scheduled in the Long-Range 2020 - 2030.
- Project CSSTP-0006-00 (924) P.I. No. 0006924: Metro Arterial Connector - Sugarloaf Parkway Extension Phase 2 from SR 316 to SR 20. This project would construct a new limited access highway. The planning and engineering phase of this project was authorized in 2006 and local funds were authorized for right-of-way (ROW) in 2010. Federal earmark funding for ROW is programmed in 2015. Construction is currently scheduled in Long-Range 2031-2040.
- Project CSSTP-0006-00 (925), P.I. No. 0006925: Sugarloaf Parkway Extension Phase 3 from SR 20 (Buford Drive/Mall of Georgia Parkway) to Peachtree Industrial Boulevard. This project would construct a new limited access highway. The planning and engineering phase of this project was authorized in 2006 and local funds were authorized for right-of-way (ROW) in 2010. Federal earmark funding for ROW is programmed in 2015. Construction is currently scheduled in Long-Range 2031-2040.

**MPO:** Atlanta Regional Commission (ARC)**TIA Regional Commission:** Atlanta Regional Commission

RC Project ID: GW-388

**Congressional District(s):** 7**Federal Oversight:**  PoDI  Exempt  State Funded  Other**Projected Traffic:** AADT

Roadway	Current Year (2014)	Open Year (2020)	Design Year (2040)	24 Hour Truck Percentage
Gravel Springs Road/ SR 324	20,550	31,125	25,125	6%
I-85 SB On Ramp (Ramp A)	N/A	4,675	10,175	N/A
I-85 SB Off Ramp (Ramp B)	N/A	3,200	8,500	N/A
I-85 NB On Ramp (Ramp C)	N/A	3,200	8,500	N/A
I-85 NB Off Ramp (Ramp D)	N/A	4,675	10,175	N/A
I-85/SR 403 Mainline	72,850	77,340	107,290	21%

Traffic Projections Performed by: Gresham, Smith and Partners

**Functional Classification (I-85/SR 403):** Urban Interstate Principal Arterial**Functional Classification (SR 324/Gravel Springs Road):** Urban Collector Street**Complete Streets - Bicycle, Pedestrian, and/or Transit Standard Warrants:**Warrants met:  None  Bicycle  Pedestrian  Transit

- The Mall of Georgia is in close proximity to the project and is a potential bicycle traffic generator. 'Share the road' signage and pavement markings will be placed on SR 324/ Gravel Springs

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Road's outside travel lanes throughout the project since these travel lanes, urban border areas and I-85/ SR 403 overpass bridge have been constructed recently by previous projects,

- GRTA routes 411 and 413 pass through the project on Interstate 85/ SR 403.

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

**Pavement Evaluation and Recommendations**

Preliminary Pavement Evaluation Summary Report Required?     No                       Yes

Preliminary Pavement Type Selection Report Required?         No                       Yes

Feasible Pavement Alternatives:                       HMA                       PCC                       HMA & PCC

## DESIGN AND STRUCTURAL

**Description of the proposed project:** GDOT PI #1112698/GCDOT project F-0782-01 proposes four new ramps to create a new location, full access diamond interchange with the existing overpass of (non-controlled access) SR 324/ Gravel Springs Road over (controlled access) I-85/SR 403. The interchange will be situated between the existing SR 20/Buford Drive and Hamilton Mill Road interchanges at MP 118 within Gwinnett County. No new bridge or bridge widening is proposed by this project (See Major Structures table below).

The southbound entrance ramp (Ramp A) will have two through lanes that converge to a single through lane prior to merging onto I-85/SR403. The southbound exit and northbound entrance ramps (Ramps B and C, respectively) will each have a single through lane. The northbound exit ramp (Ramp D) will have two through lanes diverging from I-85/SR 403. One of these lanes will be received from an auxiliary lane constructed by GDOT PI #110600 (prior to this project).

The intersection of SR 324/ Gravel Springs Road with the southbound ramp terminals will consist of dual left turn lanes onto both I-85/SR 403 SB and SR 324/ Gravel Springs Road EB. Dedicated right turn lane will be provided onto SR 324/ Gravel Springs Road WB and I-85/SR 403 SB. The intersection of SR 324/ Gravel Springs Road with the northbound ramp terminals will consist of dual left turn lanes onto SR 324/ Gravel Springs Road WB. A single turn lane will accommodate the I-85/SR 403 NB movements.

Dedicated right turn lane will be provided onto SR 324/ Gravel Springs Road EB and I-85/SR 403 NB. Traffic signals would be placed at both of these intersections.

The project limits along I-85/SR403 are 3.14 miles long and dictated by the length of proposed ramps tapering into the through general purpose lanes and the advance signage for the interchange on both the general purpose lanes and the 'HOT' managed lanes proposed by PI #110600. The project limits along SR 324/ Gravel Springs Road are 0.45 miles long and set where the turn lanes for the ramp terminals tie back into the through lanes near the intersections with Morgan Road and Camp Branch Road.

The major structure on this project is the existing SR 324/Gravel Springs Road bridge crossing over I-85/SR 403.

### Major Structures:

Structure	Existing	Proposed
ID#135-0324D-00245E,SR 324/ Gravel Springs Road Bridge over I-85/ SR 403	This bridge was recently construction as a part of GDOT Project BRST-0998-00(001). It has an overall length of 466 ft. and a typical section consisting of a 36 ft. raised median, two 12 ft. lanes in each direction, four 2 ft. gutters, two 6 ft. shoulders, two 1 ft.-2 ½" parapets for a total width of 102 ft.-5". The bridge has a sufficiency rating of 85.00 (see attachments).	The existing bridge will be retained and incorporated into the proposed project concept. The existing raised median that is on the bridge will be removed to create room for 1-2 left turn lanes and an 8 ft. wide raised median with the ramp terminal intersections on each side of the bridge.

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**Mainline Design Features:*****I-85/SR 403 Mainline- Urban Interstate Principal Arterial***

<b>Feature</b>	<b>Existing**</b>	<b>Standard</b>	<b>Proposed</b>
<b>Typical Section</b>			
- <b>Number of Lanes</b>	4- general purpose 2-‘HOT’ managed	4	1-2 ramp lanes tapering
- <b>Lane Width(s)</b>	12 ft. with 2-14 ft. buffer between general purpose and ‘HOT’ managed lanes	12 ft.	N/A
- <b>Median Width &amp; Type</b>	10-12.6 ft. urban median with Type S Barrier	52-64 ft. Depressed	N/A
- <b>Outside Shoulder or Border Area Width</b>	10-12 ft.	12 ft. paved/2 ft. grass	12 ft. paved/2 ft. grass
- <b>Outside Shoulder Slope</b>	4:1	6:1/4:1	6:1/4:1
- <b>Inside Shoulder Width</b>	3.6-6.3 ft.	10 ft. paved/2 ft. grass	N/A
- <b>Sidewalks</b>	N/A	N/A	N/A
- <b>Auxiliary Lanes</b>	1-NB general purpose auxiliary lane received from entrance ramp at SR 20 interchange that will end just south of SR 324/Gravel Springs Road overpass	N/A	Ramps A&C: single lane entrance with 70:1 taper Ramp B: single lane parallel exit Ramp D: dual lane parallel exit (one diverging lane and one dropped auxiliary lane constructed by PI #110600)
- <b>Bike Lanes</b>	N/A	N/a	N/A
<b>Posted Speed</b>	70 mph		70 mph
<b>Design Speed</b>	70 mph	70 mph	70 mph
<b>Min Horizontal Curve Radius</b>	1810 ft.	1810 ft.	1810 ft.
<b>Maximum Superelevation Rate</b>	8%	8%	8%
<b>Maximum Grade</b>	4%	4%	4%
<b>Access Control</b>	Full	Full	Full
<b>Design Vehicle</b>	WB-67	WB-67	WB-67
<b>Pavement Type</b>	Asphalt	Asphalt	Asphalt

\*\* This is not the typical section that currently exists on I-85/SR 403, but the proposed typical section for GDOT project PI #110600 which is anticipated to be completed in 2017 in advance of PI #0012698.

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**Gravel Springs Road/SR324 Side Road- Urban Major Collector**

Feature	Existing	Standard*	Proposed
<b>Typical Section</b>			
- <b>Number of Lanes</b>	4	4	4
- <b>Lane Width(s)</b>	12 ft.	11 ft. - 12 ft.	12 ft.
- <b>Median Width &amp; Type</b>	20 ft.- 36 ft. Raised	20 ft. Raised	8-36 ft. Raised
- <b>Outside Shoulder or Border Area Width</b>	16 ft. urban border area	16 ft. urban border area	16 ft. urban border area
- <b>Outside Shoulder Slope</b>	2:1 max	2:1 max	2:1 max
- <b>Inside Shoulder Width</b>	N/A	N/A	N/A
- <b>Sidewalks</b>	5 ft.	5 ft.	5 ft.
- <b>Auxiliary Lanes</b>	N/A	12 ft. left and right turn lanes	1-2 12 ft. left with 4-16 ft. hatched buffers & 12 ft. right turn lanes
- <b>Bike Lanes</b>	N/A	N/A	N/A
<b>Posted Speed</b>	45 mph		
<b>Design Speed</b>	45 mph	45 mph	45 mph
<b>Min Horizontal Curve Radius</b>	1145 ft.	1145 ft.	1145 ft.
<b>Maximum Superelevation Rate</b>	4.0% maximum	4.0% maximum	4.0% maximum
<b>Maximum Grade</b>	5.0%	5.0%	5.0%
<b>Access Control</b>	None	300 ft. outside of ramp terminal intersections	200-600 ft. outside of ramp terminal intersections
<b>Design Vehicle</b>	WB-50	BUS-40 or SU	WB-67
<b>Pavement Type</b>	Asphalt	Asphalt	Asphalt

**Ramps A, B, C & D - Urban Freeway Ramps**

Feature	Existing	Standard*	Proposed
<b>Typical Section</b>			
- <b>Number of Lanes</b>	N/A	1	Ramp A: 1-2 Ramps B&C: 1 Ramp D: 2
- <b>Lane Width(s)</b>	N/A	16 ft.	Ramp A: 2-12 ft. merging to 1-16 ft. Ramp B&C: 1-16 ft. Ramp D: 2-12 ft.
- <b>Median Width &amp; Type</b>	N/A	N/A	N/A
- <b>Outside Shoulder or Border Area Width</b>	N/A	10 ft. Paved, 2 ft. Grass	10 ft. Paved, 2 ft. Grass
- <b>Outside Shoulder Slope</b>	N/A	6:1/4:1	4:1
- <b>Inside Shoulder Width</b>	N/A	4 ft. Paved, 4 ft. Grass	4 ft. Paved, 4 ft. Grass
- <b>Sidewalks</b>	N/A	N/A	N/A

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- <b>Auxiliary Lanes</b>	N/A	N/A	Ramp B: 1-12 ft. left turn and 1-12 ft. right turn Ramp D: 1-12 ft. left turn
- <b>Bike Lanes</b>	N/A	N/A	N/A
<b>Posted Speed</b>	N/A		N/A
<b>Design Speed</b>	N/A	45 mph-60 mph	45 mph-60 mph
<b>Min Horizontal Curve Radius</b>	N/A	587-1200 ft.	587-1200 ft.
<b>Maximum Superelevation Rate</b>	N/A	8.0%	8.0%
<b>Maximum Grade</b>	N/A	5.0%	5.0%
<b>Access Control</b>	N/A	Full	Full
<b>Design Vehicle</b>	N/A	WB-67	WB-67
<b>Pavement Type</b>	N/A	Asphalt or PCC	Asphalt or PCC

**Major Interchanges/Intersections:** Proposed interchange at I-85/SR 403 and Gravel Springs Road/SR 324

**Lighting required:**  No  Yes

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

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

If Yes: Project classified as:  Non-Significant  Significant

TMP Components Anticipated:  TTC  TO  PI

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

FHWA/AASHTO Controlling Criteria	No	Undetermined	Yes	Appvl Date (if applicable)
1. Design Speed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Lane Width	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Shoulder Width	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Bridge Width	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Horizontal Alignment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Superelevation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Vertical Alignment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8. Grade	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. Stopping Sight Distance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Cross Slope	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. Vertical Clearance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12. Lateral Offset to Obstruction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13. Bridge Structural Capacity	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

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

GDOT Standard Criteria	Reviewing Office	No	Undetermined	Yes	Appvl Date (if applicable)
1. Access Control/Median Openings	DP&S	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Feb. 24, 2015
2. Intersection Sight Distance	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3. Intersection Skew Angle	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-

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4. Lateral Offset to Obstruction	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
5. Rumble Strips	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
6. Safety Edge	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
7. Median Usage	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
8. Roundabout Illumination Levels	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
9. Complete Streets	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
10. ADA & PROWAG	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
11. GDOT Construction Standards	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
12. GDOT Drainage Manual	DP&S	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
13. GDOT Bridge & Structural Manual	Bridges	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-

**VE Study anticipated:**  No  Yes

**UTILITY AND PROPERTY**

**Temporary State Route needed:**  No  Yes  Undetermined

**Railroad Involvement:** N/A

**Utility Involvements:** Georgia Power-Distribution (electric distribution), Jackson EMC (electric distribution), City of Buford (natural gas), AT&T (communications), Comcast (communications), and Gwinnett County Department of Water Resources (water and sewer).

**SUE Required:**  No  Yes  Undetermined

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

**Right-of-Way (ROW):** Existing width: 300-370 ft. Proposed width: 376-466 ft.  
 Required Right-of-Way anticipated:  None  Yes  Undetermined  
 Easements anticipated:  None  Temporary  Permanent  Utility  Other

Anticipated total number of impacted parcels: 10  
 Displacements anticipated: Businesses: 0  
 Residences: 0  
 Other: 0  
 Total Displacements: 0

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

A 200 ft. long access control (using a design variance) will be acquired along Gravel Springs Road/SR 324 outside of the ramp terminals in the NW, SW, and SE quadrants of the proposed interchange. A 600 ft. long access control limit in NE quadrant of the interchange to the Morgan Road Intersection has been previously acquired by Gwinnett County. Access control will also be acquired outside of the four ramps and along Gravel Springs Road/SR 324 inside of the ramp terminals.

**ROUNDBABOUTS**

**Roundabout Planning Level Assessment:** A Roundabout Planning Level Assessment was prepared for this project and determined that roundabouts as intersection alternatives on the intersections of Gravel Springs Road/SR 324 with the terminals of Ramps A and B or terminals of Ramps C and D would produce a LOS of 'F'. Therefore, a roundabout is not recommended as a viable intersection alternative at either location.

**Roundabout Peer Review Required:**  No  Yes

County: Gwinnett

## CONTEXT SENSITIVE SOLUTIONS

**Issues of Concern:** There are no known context sensitive issues of concern as this project is a primarily the addition of ramps at a previously constructed grade separated overpass and will have only minor environmental and development impacts. The proposed project is consistent with its surroundings, which is a developing urban commercial area bisected by the existing wide footprint of a high speed freeway arterial highway.

**Context Sensitive Solutions Proposed:** None

## ENVIRONMENTAL & PERMITS

**Anticipated Environmental Document:**

GEPA:  NEPA:  CE  EA/FONSI  EIS

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

**Environmental Permits/Variations/Commitments/Coordination anticipated:**

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

**Is a PAR required?**  No  Yes

**Environmental Comments and Information:**

**NEPA/GEPA:** An Environmental Assessment (EA) will be prepared to reflect the current economic, environmental, cultural and social affects. All special studies will be conducted and completed in accordance with current GDOT standards. Upon the Draft EA approval by the Federal Highway Administration (FHWA), the final EA & FONSI would be prepared.

**Ecology:** Based on a preliminary desktop review of the National Wetland Inventory (NWI) and United States Geological, there appears to be jurisdictional waters of the US located along the proposed project corridor. A United States Army Corps of Engineers Section 404 Permit may be required. Due to streams being located along the proposed project, a stream buffer variance is possible. A special provision may be required for migratory birds.

**History:** The preliminary desktop review for historic resources included the Georgia Natural, Archaeological, and Historic Resources GIS database, an aerial photo survey, a review of the National Register of Historic Places listing for Gwinnett County, and a cursory property parcel review. The review of property parcels showed four (4) structures 50 years old or older within the project area of potential effect (APE). All properties were located just north of I-85. Two on the east side of SR 324 and two on the west side of SR 324. These potential historic resources will be evaluated further during the special studies phase of the project and their eligibility will be determined in a historic survey report.

County: Gwinnett

**Archeology:** The Georgia Archaeological Site files will be reviewed to determine if any previously recorded archaeological sites are in close proximity to the project area. A complete archaeological survey will be conducted during the special studies phase of the project. The findings of the archaeological survey will be included in the survey report.

**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  
 Carbon Monoxide hotspot analysis:  Required  Not Required  TBD

The FY 2014-2019 Transportation Improvement Program (TIP) under the PLAN 2040 Regional Transportation Plan (RTP) is the current adopted plan for the Atlanta area showing the region's highest transportation priorities. It was adopted by the Atlanta Regional Commission (ARC) Board on March 26, 2014 with Georgia Regional Transportation Authority (GRTA) Board action on April 9, 2014. ARC received a conformity determination from the US DOT on April 30, 2014. This project is identified in the PLAN 2040 RTP and FY 2014-2019 TIP by reference number GW-388.

**Noise Effects:** Noise Impact Assessment will be conducted using TNM. The assessment will be conducted in compliance with 23 USC Section 109(h) and (i) and according to the new GDOT Noise Abatement policy, effective July 13, 2011.

**Public Involvement:** Environmental Assessments (EAs) are required to have a Public Information open House (PIOH) before the Draft EA is prepared and a Public Hearing Open House (PHOH) upon approval of the Draft EA and prior to finalizing the FONSI/Final EA.

**Major stakeholders:** Traveling public, cities of Buford and Sugar Hill, Gwinnett County, Gwinnett County Chamber of Commerce, and other stakeholders as deemed appropriate.

## CONSTRUCTION

**Issues potentially affecting constructability/construction schedule:** The peak morning and afternoon traffic volumes of I-85/SR403 and Gravel Springs Road/ SR 324 may affect the construction of some portions of the ramps, intersections and signage.

Steel dowels were placed on the recently constructed SR 324/Gravel Springs Road overpass bridge deck to anchor the raised median at the request of GDOT Bridge Design. Removing these dowels from the bridge deck will require coordination with GDOT Bridge Design and a bridge layout.

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

## COORDINATION, ACTIVITIES, RESPONSIBILITIES, AND COSTS

**Initial Concept Meeting:** April 25, 2014 – see attachments for minutes.

**Concept Meeting:** December 3, 2014 – see attachments for minutes

**Other coordination to date:** Coordination the with design team of GDOT P.I. No. 110600, the I-85/SR 403 managed lanes from Old Peachtree Road to Hamilton Mill Road-see attachments for minutes.

Project Activity	Party Responsible for Performing Task(s)
Concept Development	Gwinnett County/GS&P with GDOT oversight
Design	Gwinnett County/GS&P with GDOT oversight
Right-of-Way Acquisition	Gwinnett County
Utility Relocation	Utility Companies
Letting to Contract	GDOT
Construction Supervision	GDOT
Providing Material Pits	GDOT/Contractor

County: Gwinnett

Providing Detours	GDOT/Contractor
Environmental Studies, Documents, & Permits	Gwinnett County/MAAI with GDOT oversight
Environmental Mitigation	Gwinnett County/MAAI with GDOT oversight
Construction Inspection & Materials Testing	GDOT

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

	Breakdown of PE	ROW	Reimbursable Utility	CST*	Environmental Mitigation	Total Cost
Funded By	Gwinnett County	Gwinnett County	Gwinnett County	GDOT	Gwinnett County	
\$ Amount	\$700,000.00	\$7,472,000.00	\$62,000.00	\$10,090,176.50	\$567,000.00	\$18,891,176.50
Date of Estimate	7/14/2014	3/05/2015	1/05/2015	3/13/2015	1/06/2015	

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

**ALTERNATIVES DISCUSSION****Alternative selection:**

<b>Preferred Alternative:</b> The preferred alternative includes four 1-2 lane new ramps to create a new location, full access diamond interchange with the existing overpass of (non-controlled access) SR 324/ Gravel Springs Road over (controlled access) I-85/SR 403. Dedicated 1-2 left turn lanes, single right turn lanes, and traffic signals would be placed at the intersections of SR 324/ Gravel Springs Road with the ramp terminals.			
<b>Estimated Property Impacts:</b>	10 parcels	<b>Estimated Total Cost:</b>	\$18,891,176.50
<b>Estimated ROW Cost:</b>	\$7,472,000.00	<b>Estimated CST Time:</b>	24 months
<b>Rationale:</b> This alternative (1) improves transportation access to and from the interstate highway system, (2) potentially reduces the crash frequency and severity on Interstate I-85 in the vicinity of the proposed project area, (3) improves traffic operations on the local roadway network, and (4) enhances economic development opportunities by constructing a full access interchange on Interstate 85/ SR 403 with SR 324/ Gravel Springs Road in Gwinnett County.			

<b>No-Build Alternative:</b> No improvements to existing overpass of Gravel Springs Road/ SR 324 over I-85/SR 403.			
<b>Estimated Property Impacts:</b>	None	<b>Estimated Total Cost:</b>	\$0.00
<b>Estimated ROW Cost:</b>	\$0.00	<b>Estimated CST Time:</b>	None
<b>Rationale:</b> This alternative (1) does not improve transportation access to and from the interstate highway system, (2) would not potentially reduce the crash frequency and severity on Interstate I-85 in the vicinity of the proposed project area, (3) would not improve traffic operations on the local roadway network, and (4) would not enhance economic development opportunities by constructing a full access interchange on Interstate 85/ SR 403 with SR 324/ Gravel Springs Road in Gwinnett County.			

County: Gwinnett

**Alternative 1:** Alternative 1 entails placing two 2 lane new ramps in the southwest and southeast quadrants to create a new location, partial access, half-diamond interchange with the existing overpass of (non-controlled access) SR 324/ Gravel Springs Road over I-85/SR 403. Dedicated dual left turn lanes, a single right turn lane, and traffic signals would be placed at the intersections of SR 324/ Gravel Springs Road with the ramp terminals.

<b>Estimated Property Impacts:</b>	7 parcels, one displacement	<b>Estimated Total Cost:</b>	\$13,941,156.49
<b>Estimated ROW Cost:</b>	\$6,000,000.00	<b>Estimated CST Time:</b>	18 months

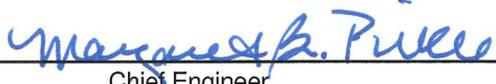
**Rationale:** This alternative (1) only partially improves transportation access to and from the interstate highway system, (2) only partially potentially reduces the crash frequency and severity on Interstate I-85 in the vicinity of the proposed project area, (3) only partially improves traffic operations on the local roadway network, and (4) only partially enhances economic development opportunities by constructing a partial access interchange on Interstate 85/ SR 403 with SR 324/ Gravel Springs Road in Gwinnett County.

**LIST OF ATTACHMENTS/SUPPORTING DATA**

1. Concept Layout
2. Typical sections
3. Detailed Cost Estimates:
  - a. Construction including Engineering and Inspection and Contingencies
  - b. Completed Liquid AC Cost Adjustment forms
  - c. Right-of-Way
  - d. Utilities
  - e. Environmental Mitigation
4. Crash summaries
5. Traffic diagrams
6. Capacity analysis summary
7. Summary of Signal Warrant Analysis
8. Roundabout Data – Planning level assessment
9. Concept Level Hydrology Study for MS4 Permit
10. Preliminary Pavement Type Evaluation and Selection Reports
11. Conforming plan's network schematics showing thru lanes.
12. Minutes of Concept meetings and coordination meetings with PI# 110600 design
13. Transportation Management Plan
14. Approved Project Interchange Justification Report (IJR)
15. SR 324/Gravel Springs Road over I-85/SR 403 Bridge Inventory Data Listing Bridge Inventory
16. TUDI vs. SPUI Comparison Discussion and SR 324/Gravel Springs Road intersection queueing analysis
17. Approved Design Variance for 200 ft. Access Control on SR 324/Gravel Springs Road in NW, SW, and SE quadrants

**APPROVALS**

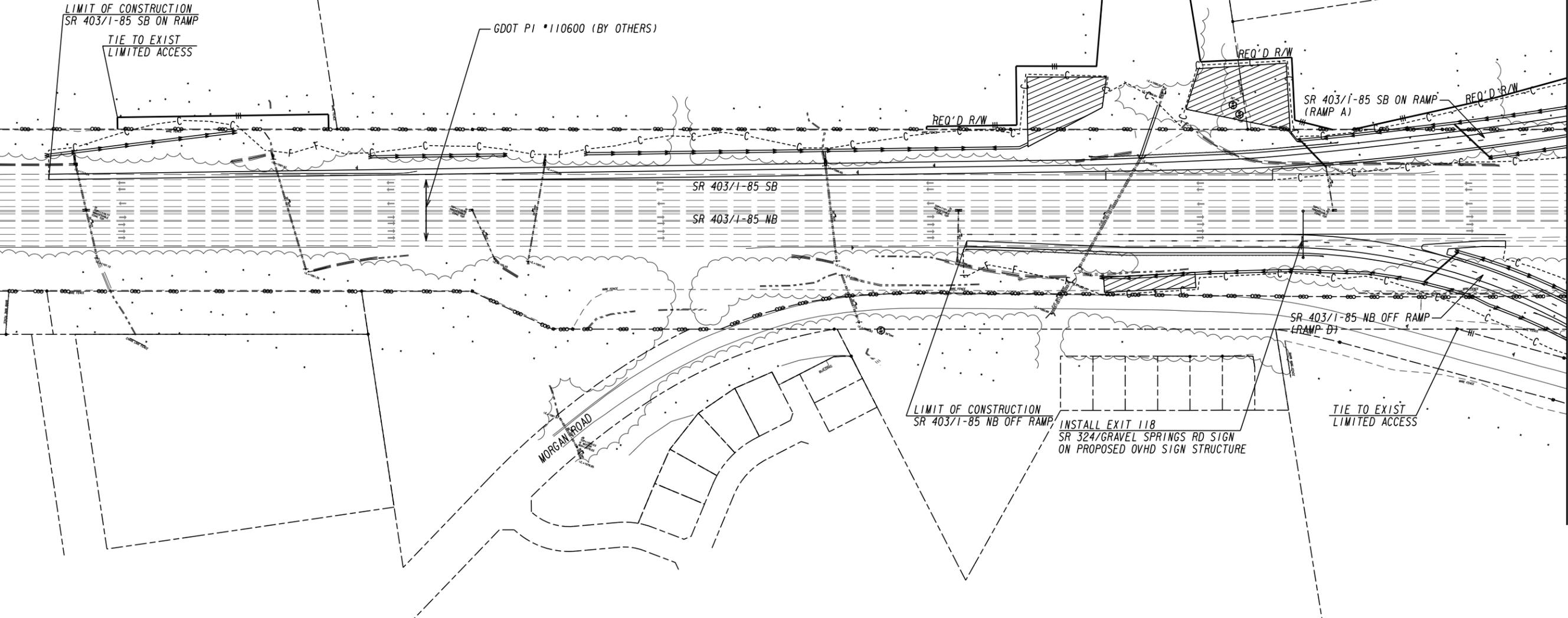
Concur:   
 Director of Engineering

Approve:   
 Chief Engineer

4.21.15  
 Date

# Attachment 1- Concept Layout

BEGIN PROJECT  
5,380 FT SOUTH OF SHEET  
FOR ADVANCE SIGNAGE  
SR 403/I-85 NB



MATCHLINE- SEE DWG 1-002

EXISTING R/W & PROPERTY LINE	----
REQUIRED R/W LINE	=====
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨▨▨▨
EASEMENT FOR CONSTR OF SLOPES	▧▧▧▧
EASEMENT FOR CONSTR OF DRIVES	▩▩▩▩

BEGIN LIMIT OF ACCESS .....	BLA
END LIMIT OF ACCESS .....	ELA
LIMIT OF ACCESS	-----
R/W AND LIMIT OF ACCESS	=====



REVISION DATES	

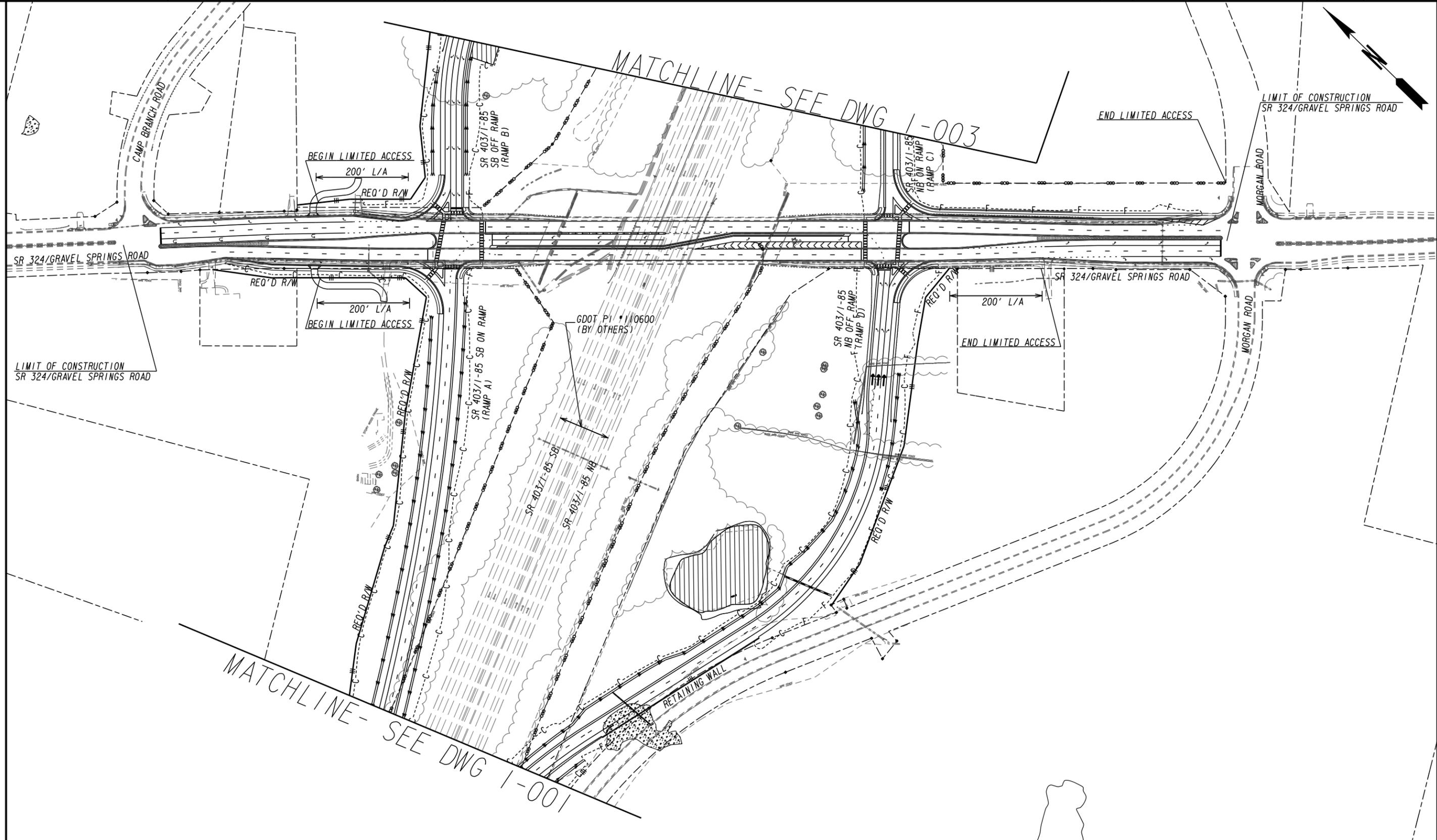
STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**CONCEPT LAYOUT**

SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE

PI: 0012698  
COUNTY: GWINNETT

DRAWING No.  
**1-001**



EXISTING R/W & PROPERTY LINE	---
REQUIRED R/W LINE	—
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨
EASEMENT FOR CONSTR OF SLOPES	▩
EASEMENT FOR CONSTR OF DRIVES	▧

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	—
R/W AND LIMIT OF ACCESS	—



GRESHAM  
SMITH AND  
PARTNERS



REVISION DATES

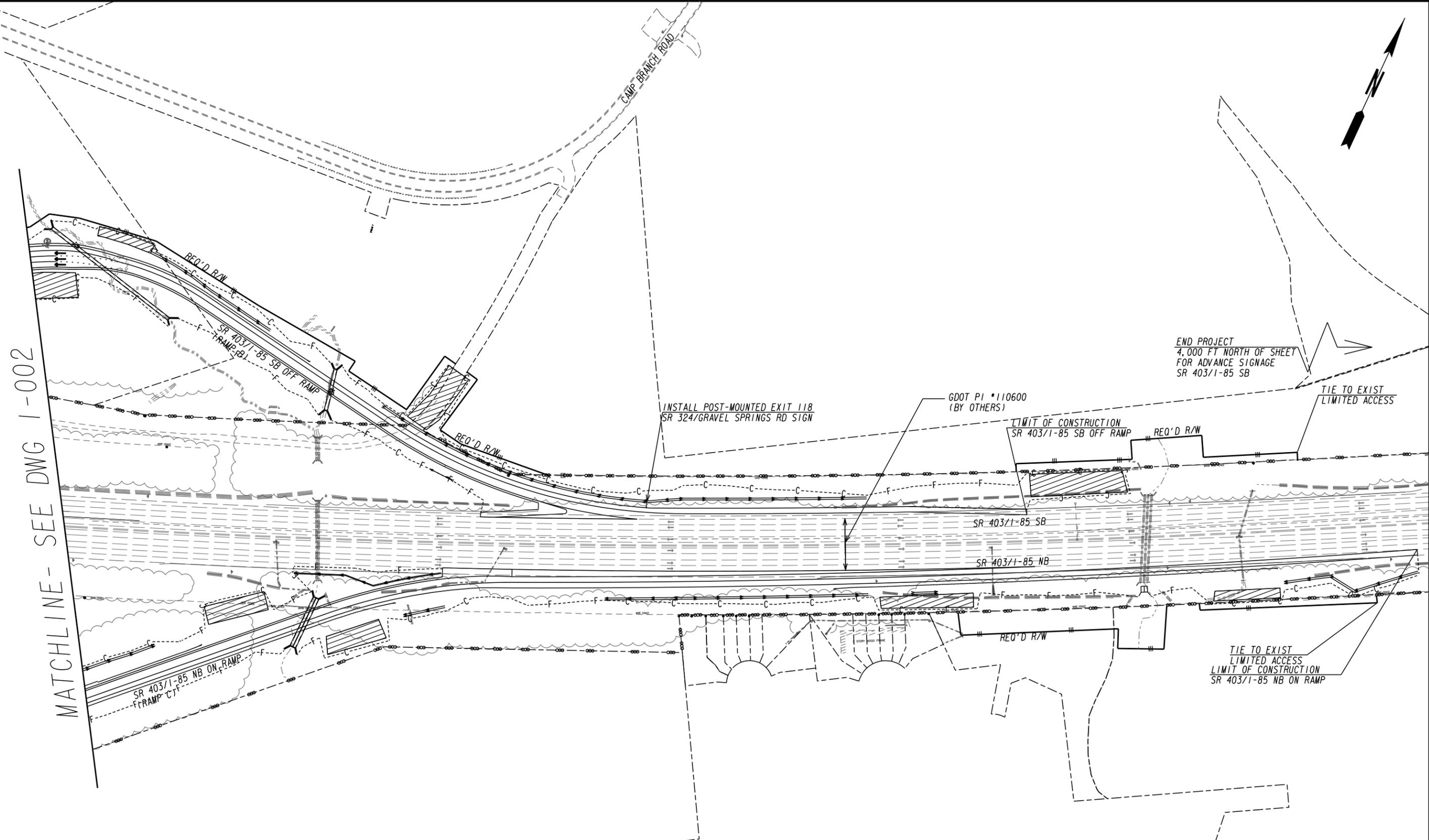
STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**CONCEPT LAYOUT**

SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE

PI: 0012698  
COUNTY: GWINNETT

DRAWING No.  
**1-002**



EXISTING R/W & PROPERTY LINE	----
REQUIRED R/W LINE	=====
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨▨▨▨
EASEMENT FOR CONSTR OF SLOPES	▧▧▧▧
EASEMENT FOR CONSTR OF DRIVES	▩▩▩▩

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	-----
R/W AND LIMIT OF ACCESS	=====



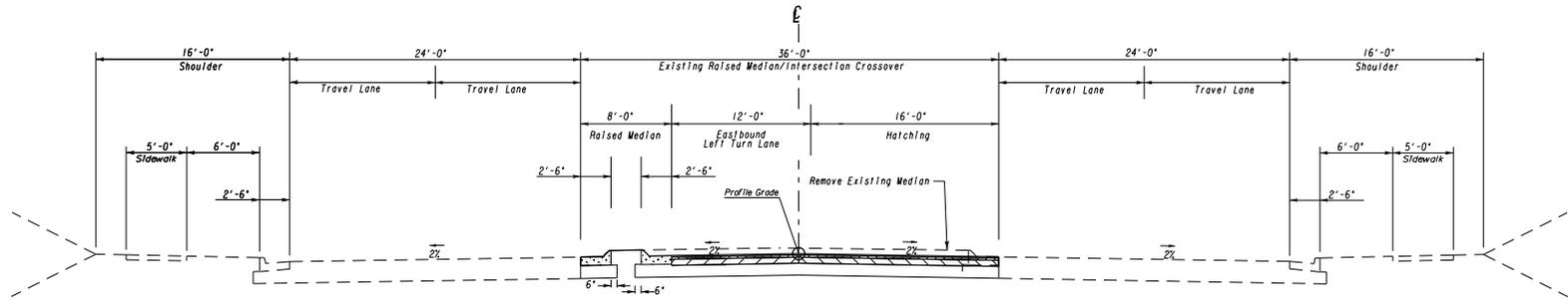
REVISION DATES

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY  
**CONCEPT LAYOUT**  
SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE  
PI: 0012698  
COUNTY: GWINNETT

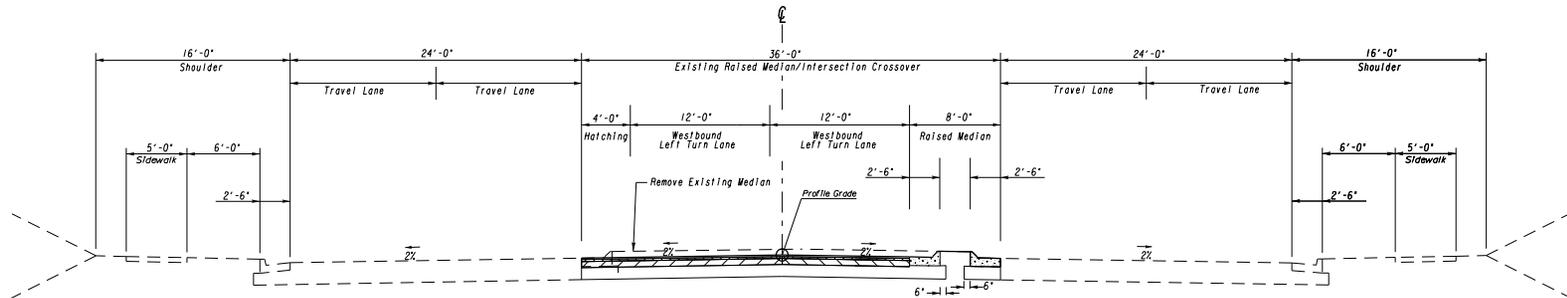
DRAWING No.  
**1-003**

# Attachment 2- Typical Sections





TANGENT SECTION  
SR 324/ GRAVEL SPRINGS RD  
@ I-85/SR 403 NB RAMP TERMINAL



TANGENT SECTION  
SR 324/ GRAVEL SPRINGS RD  
@ I-85/SR 403 SB RAMP TERMINAL



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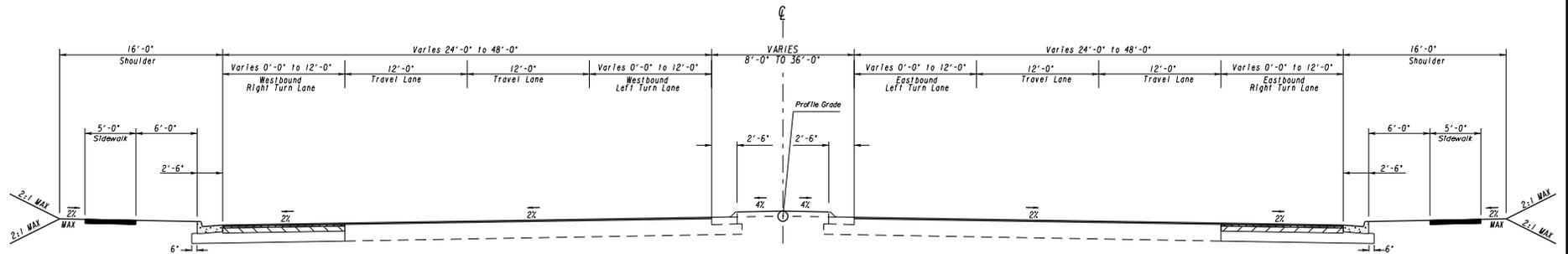
NOT TO SCALE

REVISION DATES

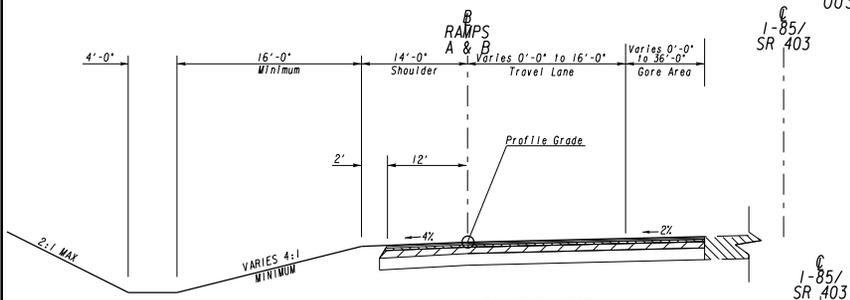

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**CONCEPT TYPICAL SECTIONS**  
SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE  
PI: 0012698  
COUNTY: GWINNETT

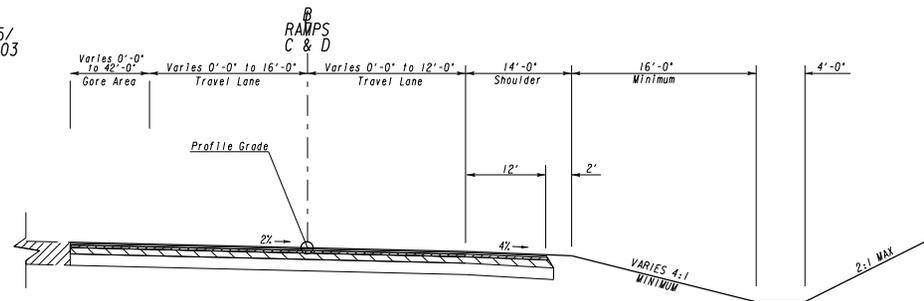
DRAWING NO.  
**05-002**



TANGENT SECTION  
SR 324/ GRAVEL SPRINGS RD  
OUTSIDE OF I-85/SR 403  
RAMP TERMINALS



TANGENT SECTION  
I-85/SR 403  
TAPER TIEN IN  
WITH RAMPS A & B



TANGENT SECTION  
I-85/SR 403  
TAPER TIEN IN  
WITH RAMPS C & D

NOT TO SCALE

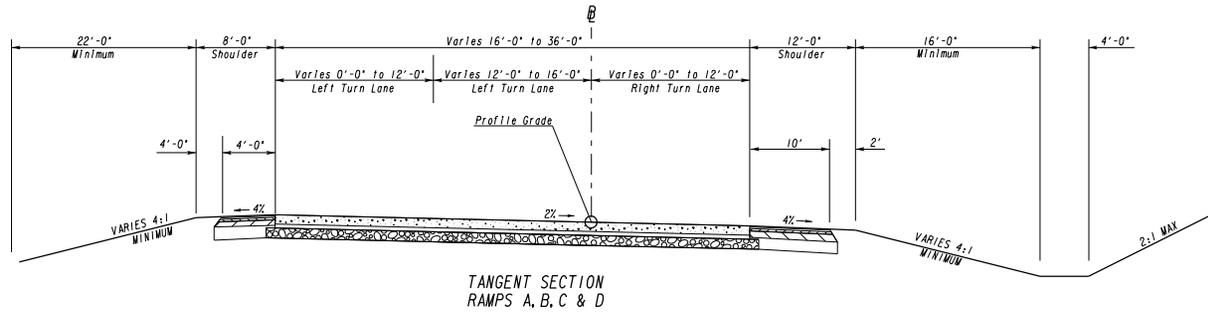


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PARTNERS

REVISION DATES


STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY  
**CONCEPT TYPICAL SECTIONS**  
SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE  
PI: 0012698  
COUNTY: GWINNETT

DRAWING NO.  
**05-003**

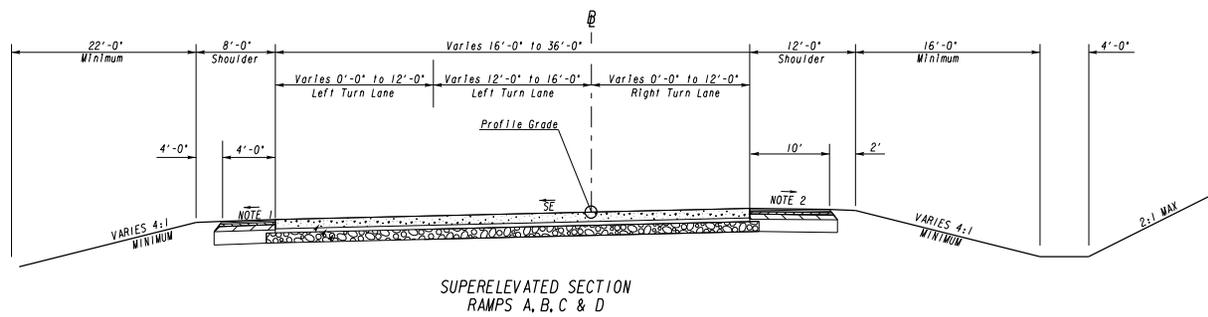


S. E. RATE	shoulder slope
2.0% OR 3.0%	4.0%
4.0% OR 5.0%	2.0%
6.0% OR 7.0%	1.0%
8.0% +	0.0%

RAMP TYPICAL SECTIONS ALSO APPLY TO OPPOSITE HAND SECTIONS - SEE CONSTRUCTION PLAN SHEETS FOR LOCATIONS AND DIRECTION OF SUPERELEVATION AND LOCATIONS OF TURN LANES

NOTE 1: SHOULDER TO SLOPE AT 4% OR SUPERELEVATION RATE, WHICHEVER IS GREATER

NOTE 2: SHOULDER TO SLOPE AT NORMAL RATE, HOWEVER, THE ALGEBRAIC DIFFERENCE IN PAVING SLOPE AND SHOULDER SLOPE SHALL NOT EXCEED 0%. THE MINIMUM SHOULDER SLOPE SHALL BE 1%.



GRESHAM  
SMITH AND  
PARTNERS

NOT TO SCALE

REVISION DATES

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**CONCEPT TYPICAL SECTIONS**  
SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE

PI: 0012698  
COUNTY: GWINNETT

DRAWING No. 05-004

# Attachment 3- Detailed Cost Estimates

**DEPARTMENT OF TRANSPORTATION  
STATE OF GEORGIA**

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INTERDEPARTMENT CORRESPONDENCE

FILE P.I. No. 0012698

OFFICE Program Delivery

**PROJECT DESCRIPTION**

SR 324 @ I-85/SR 403 Interchange

DATE March 13, 2015

From: Albert V. Shelby III, State Program Delivery Engineer

To: Lisa L. Myers, State Project Review Engineer

Subject: **REVISIONS TO PROGRAMMED COSTS**

PROJECT MANAGER Charles Robinson

MGMT LET DATE 4/1/2019

MGMT ROW DATE 12/1/2017

**PROGRAMMED COSTS (TPro W/OUT INFLATION)**

**LAST ESTIMATE UPDATE**

CONSTRUCTION \$ N/A

DATE N/A

RIGHT OF WAY \$ N/A

DATE N/A

UTILITIES \$ N/A

DATE N/A

**REVISED COST ESTIMATES**

CONSTRUCTION\* \$ 10,090,176.50

RIGHT OF WAY \$ 7,472,000.00

UTILITIES \$ 62,000.00

\*Cost Contains 15 % Contingency

**REASONS FOR COST INCREASE AND CONTINGENCY JUSTIFICATION:**

Concept development.

# CONTINGENCY SUMMARY

<b>A. CONSTRUCTION COST ESTIMATE:</b>	\$	8,154,068.70	Base Estimate From CES	
<b>B. ENGINEERING AND INSPECTION (E &amp; I):</b>	\$	407,703.44	Base Estimate (A) x	5 %
<b>C. CONTINGENCY:</b>	\$	1,284,265.82	Base Estimate (A) + E & I (B) x	15 %
			<a href="#">See % Table in "Risk Based Cost Estimation" Memo</a>	
<b>D. TOTAL LIQUID AC ADJUSTMENT:</b>	\$	244,138.54	Total From Liquid AC Spreadsheet	
<b>E. CONSTRUCTION TOTAL:</b>	\$	10,090,176.50	(A + B + C + D = E)	

## REIMBURSABLE UTILITY COSTS

UTILITY OWNER	REIMBURSABLE COST
Georgia Power Distribution	\$ 22,000.00
Jackson EMC	\$ 40,000.00
<b>TOTAL</b>	\$ 62,000.00

**ATTACHMENTS:**

- 1.) PI #0012698 CES Output
- 2.) PI #0012698 Asphalt and Fuel Price Adjustment Spreadsheet
- 3.) PI #0012698 Right of Way Cost Estimate
- 4.) PI #0012698 Utility Cost Estimate
- 5.) PI #0012698 Environmental Mitigation Estimate

## STATE HIGHWAY AGENCY

DATE : 3/13/2015

## JOB ESTIMATE REPORT

JOB NUMBER: 0012698  
 DESCRIPTION: SR 324 @ I-85/SR403 INTERCHANGE  
 GWINNETT COUNTY

SPEC YEAR: 13

## ITEMS FOR JOB 0012698

ITEM NO.	DESCRIPTION	UNITS	QUANTITY	PRICE	AMOUNT
<b>ROADWAY ITEMS</b>					
150-1000	TRAFFIC CONTROL - PI# 0012698	LS	1	\$400,000.00	\$400,000.00
201-1500	CLEARING & GRUBBING - PI# 0012698	LS	1	\$600,000.00	\$600,000.00
205-0001	UNCLASS EXCAV	CY	124000	\$4.68	\$581,473.20
206-0002	BORROW EXCAV, INCL MATL	CY	3000	\$4.60	\$13,804.62
310-1101	GR AGGR BASE CRS, INCL MATL	TN	26000	\$19.03	\$494,982.02
402-1812	RECYL AC LEVELING, INC BM&HL	TN	1000	\$78.02	\$78,024.78
402-3121	RECYL AC 25MM SP, GP1/2, BM&HL	TN	4800	\$72.23	\$346,728.86
402-3130	RECYL AC 12.5MM SP, GP2, BM&HL	TN	4500	\$77.77	\$349,991.10
402-3190	RECYL AC 19 MM SP, GP 1 OR 2 , INC BM&HL	TN	5600	\$71.72	\$401,648.69
413-1000	BITUM TACK COAT	GL	2500	\$3.01	\$7,526.05
430-0210	PLN PC CONC PVMT/CL1C/ 11" TK	SY	18700	\$50.00	\$935,000.00
432-5010	MILL ASPH CONC PVMT, VARB DEPTH	SY	13300	\$2.56	\$34,048.93
441-0014	DRIVEWAY CONCRETE, 4 IN TK	SY	1450	\$20.00	\$29,000.00
441-0104	CONC SIDEWALK, 4 IN	SY	780	\$31.54	\$24,602.39
441-0754	CONC MEDIAN, 7 1/2 IN	SY	220	\$50.17	\$11,038.44
441-4020	CONC VALLEY GUTTER, 6 IN	SY	60	\$39.73	\$2,384.17
441-6222	CONC CURB & GUTTER/ 8"X30"TP2	LF	2100	16.95	\$35,612.83
441-6740	CONC CURB & GUTTER/ 8"X30" TP7	LF	620	\$15.32	\$9,500.71
446-1100	PVMT REF FAB STRIPS, TP2, 18 INCH WIDTH	LF	11150	\$3.30	\$36,806.37
500-9999	CL B CONC, BASE OR PVMT WIDEN	CY	25	\$182.52	\$4,563.06
621-4020	CONCRETE SIDE BARRIER, TY 2	LF	450	\$355.27	\$159,871.50
634-1200	RIGHT OF WAY MARKERS	EA	50	\$114.32	\$5,716.14
641-1200	GUARDRAIL, TP W	LF	5575	\$15.81	\$88,151.96
641-5001	GUARDRAIL ANCHORAGE, TP 1	EA	8	\$867.61	\$6,940.92
641-5012	GUARDRAIL ANCHORAGE, TP 12	EA	10	\$1,960.27	\$19,602.80
<b>DRAINAGE ITEMS</b>					
441-3999	CONCRETE V GUTTER	LF	11660	\$13.74	\$160,224.26
500-3101	CLASS A CONCRETE	CY	640	\$529.75	\$339,040.51
511-1000	BAR REINF STEEL	LB	60300	\$0.78	\$47,518.81
550-1180	STM DR PIPE 18", H 1-10	LF	8460	\$31.67	\$268,003.16
550-1240	STM DR PIPE 24", H 1-10	LF	40	\$52.59	\$2,103.85
550-1300	STM DR PIPE 30", H 1-10	LF	80	\$58.90	\$4,712.08
550-1360	STM DR PIPE 36", H 1-10	LF	912	\$64.06	\$58,430.75
550-2180	SIDE DR PIPE 18", H 1-10	LF	200	\$30.53	\$6,107.90
550-3318	SAFETY END SECTION 18", STD, 4:1	EA	4	\$570.78	\$2,283.14
550-4118	FLARED END SECT 18 IN, SIDE DR	EA	10	\$363.64	\$3,636.41
550-4218	FLARED END SECT 18 IN, ST DR	EA	7	\$539.11	\$3,773.79
550-4224	FLARED END SECT 24 IN, ST DR	EA	2	\$671.66	\$1,343.33
550-4230	FLARED END SECT 30 IN, ST DR	EA	4	\$722.93	\$2,891.74
550-4236	FLARED END SECT 36 IN, ST DR	EA	2	\$1,103.29	\$2,206.58
668-1100	CATCH BASIN, GP 1	EA	14	\$2,333.62	\$32,670.81
668-1110	CATCH BASIN, GP 1, ADDL DEPTH	LF	10	\$197.10	\$1,971.03
668-2100	DROP INLET, GP 1	EA	10	\$1,831.60	\$18,316.01
668-2105	DROP INLET, GP 1, SPLC DES	EA	12	\$2,248.63	\$26,983.56

## STATE HIGHWAY AGENCY

DATE : 3/13/2015

## JOB ESTIMATE REPORT

JOB NUMBER: 0012698  
 DESCRIPTION: SR 324 @ I-85/SR403 INTERCHANGE  
 GWINNETT COUNTY

SPEC YEAR: 13

## ITEMS FOR JOB 0012698

ITEM NO.	DESCRIPTION	UNITS	QUANTITY	PRICE	AMOUNT
668-2110	DROP INLET, GP 1, ADDL DEPTH	LF	10	\$186.87	\$1,868.75
999-3110	DETENTION POND	EA	12	\$50,000.00	\$600,000.00
<b>PERMANENT EROSION CONTROL ITEMS</b>					
441-0204	PLAIN CONC DITCH PAVING, 4 IN	SY	1000	\$28.62	\$28,628.37
603-2180	STN DUMPED RIP RAP, TP 3, 12"	SY	400	\$28.73	\$11,494.05
603-7000	PLASTIC FILTER FABRIC	SY	400	\$3.45	\$1,380.82
700-6910	PERMANENT GRASSING	AC	50	\$892.20	\$44,610.05
700-7000	AGRICULTURAL LIME	TN	150	\$65.49	\$9,824.60
700-8000	FERTILIZER MIXED GRADE	TN	35	\$502.49	\$17,587.46
700-9300	SOD	SY	260	\$5.38	\$1,400.96
716-2000	EROSION CONTROL MATS, SLOPES	SY	30000	\$0.91	\$27,477.90
<b>TEMPORARY EROSION CONTROL ITEMS</b>					
163-0232	TEMPORARY GRASSING	AC	25	\$438.14	\$10,953.64
163-0240	MULCH	TN	725	\$162.29	\$117,662.61
163-0300	CONSTRUCTION EXIT	EA	8	\$1,288.75	\$10,310.03
163-0528	CONSTR AND REM FAB CK DAM -TP C SLT FN	LF	4400	\$2.76	\$12,174.27
163-0531	CONSTR & REM SEDIMENT BASIN,TP 1,STA NO- .	EA	6	\$11,871.71	\$71,230.31
163-0550	CONS & REM INLET SEDIMENT TRAP	EA	14	\$125.21	\$1,753.02
165-0030	MAINT OF TEMP SILT FENCE, TP C	LF	9295	\$0.51	\$4,746.03
165-0041	MAINT OF CHECK DAMS - ALL TYPES	LF	1380	\$1.13	\$1,564.92
165-0060	MAINT OF TEMP SEDIMENT BASIN,STA NO -	EA	12	\$2,351.07	\$28,212.94
165-0101	MAINT OF CONST EXIT	EA	8	\$783.80	\$6,270.40
165-0105	MAINT OF INLET SEDIMENT TRAP	EA	14	\$41.93	\$587.02
167-1000	WATER QUALITY MONITORING AND SAMPLING	EA	2	\$220.48	\$440.96
167-1500	WATER QUALITY INSPECTIONS	MO	24	\$544.64	\$13,071.49
171-0030	TEMPORARY SILT FENCE, TYPE C	LF	18590	\$2.65	\$49,373.37
711-0100	TURF REINFORCING MATTING, TP 1	SY	15260	\$3.40	\$51,884.00
<b>SIGNING AND MARKING ITEMS</b>					
636-1033	HWY SIGNS, TP1MAT,REFL SH TP 9	SF	836	\$16.71	\$13,973.95
636-1072	HWY SIGNS,ALUM EXTRD PNLS, RS TP 3	SF	3000	\$23.42	\$70,260.69
636-2080	GALV STEEL POSTS, TP 8	LF	656	\$8.83	\$5,798.44
638-1011	STR SUPPORT OVHD SIGN,TP I,MP- 1	LS	1	\$90,000.00	\$90,000.00
638-1011	STR SUPPORT OVHD SIGN,TP I,MP- 2	LS	1	\$90,000.00	\$90,000.00
638-1011	STR SUPPORT OVHD SIGN,TP I,MP- 3	LS	1	\$90,000.00	\$90,000.00
638-1011	STR SUPPORT OVHD SIGN,TP I,MP- 4	LS	1	\$90,000.00	\$90,000.00
638-1011	STR SUPPORT OVHD SIGN,TP I,MP- 5	LS	1	\$90,000.00	\$90,000.00
638-1011	STR SUPPORT OVHD SIGN,TP I,MP- 6	LS	1	\$90,000.00	\$90,000.00
653-0105	PAVEMENT MARKING, BIKE SHARED LN SYM	EA	9	\$300.00	\$2,700.00
653-0120	THERM PVMT MARK, ARROW, TP 2	EA	26	\$76.29	\$1,983.67
653-0170	THERM PVMT MARK, ARROW, TP 7	EA	4	\$96.53	\$386.14
653-1501	THERMO SOLID TRAF ST 5 IN, WHI	LF	19230	\$0.37	\$7,200.29
653-1502	THERMO SOLID TRAF ST, 5 IN YEL	LF	3500	\$0.50	\$1,780.56

STATE HIGHWAY AGENCY

DATE : 3/13/2015

JOB ESTIMATE REPORT

JOB NUMBER: 0012698  
 DESCRIPTION: SR 324 @ I-85/SR403 INTERCHANGE  
 GWINNETT COUNTY

SPEC YEAR: 13

ITEMS FOR JOB 0012698

ITEM NO.	DESCRIPTION	UNITS	QUANTITY	PRICE	AMOUNT
653-1704	THERM SOLID TRAF STRIPE,24",WH	LF	230	\$5.73	\$1,318.52
653-1804	THERM SOLID TRAF STRIPE, 8",WH	LF	1650	\$2.12	\$3,513.91
653-3501	THERMO SKIP TRAF ST, 5 IN, WHI	GLF	6860	\$0.23	\$1,631.31
653-6004	THERM TRAF STRIPING, WHITE	SY	560	\$3.67	\$2,058.02
653-6006	THERM TRAF STRIPING, YELLOW	SY	150	\$3.83	\$575.15
657-1054	PRF PL SD PVMT MKG,5",WH,TP PB	LF	17720	\$2.96	\$52,541.93
657-1084	PRF PL SD PVMT MKG,8",WH,TP PB	LF	1210	\$5.04	\$6,100.78
657-1243	PRF PL SD PVMT MKG,24",WH,TPPB	LF	60	\$12.50	\$750.00
657-4054	PRF PL SK PVMT MKG,5",WH,TP PB	GLM	3720	\$2.83	\$10,527.60
657-5001	PREFORMED PLASTIC PVMT MKG, WHITE, TP PB	SY	140	\$19.92	\$2,789.58
657-5002	PREFORMED PLASTIC PVMT MKG, YE, TP PB	SY	260	\$20.37	\$5,298.61
657-5017	PRF PL PVT MKG,ARW TP2,WH,TPPB	EA	32	\$487.52	\$15,600.90
657-5019	PRF PL PVT MKG,ARW TP4,WH,TPPB	EA	6	\$637.01	\$3,822.06
657-6054	PRF PL SD PVMT MKG,5",YW,TP PB	LF	1550	\$3.94	\$6,115.53
999-7000	TEN CHARACTER LED MODULE	EA	2	\$75,000.00	\$150,000.00

TRAFFIC SIGNAL ITEMS

647-1000	TRAF SIGNAL INSTALLATION NO - 1	LS	1	\$90,000.00	\$90,000.00
647-1000	TRAF SIGNAL INSTALLATION NO - 2	LS	1	\$90,000.00	\$90,000.00

BRIDGE ITEMS

500-0100	GROOVED CONCRETE	SY	1900	\$5.01	\$9,536.94
500-1006	SUPERSTR CONCRETE, CL AA, BR NO - .	LS	1	\$29,700.00	\$29,700.00
540-1201	REM OF PARTS OF EX BR, STA NO- .	LS	1	\$43,000.00	\$43,000.00

RETAINING WALL ITEMS

621-4022	CONCRETE SIDE BARRIER, TY 2B	LF	400	\$503.39	\$201,358.89
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ITEM TOTAL					\$8,154,068.66
INFLATED ITEM TOTAL					\$8,154,068.66

TOTALS FOR JOB 0012698

ESTIMATED COST:					\$8,154,068.70
CONTINGENCY PERCENT (0%)					\$0.00
ESTIMATED TOTAL:					\$8,154,068.70

**PROJ. NO.** N/A  
**P.I. NO.** 0012698  
**DATE** 3/13/2015

CALL NO. 9/29/2009

INDEX (TYPE)	DATE	INDEX
REG. UNLEADED	Mar-15	\$ 2.291
DIESEL		\$ 2.848
LIQUID AC		\$ 505.00

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)				<b>240885</b>	\$	<b>240,885.00</b>
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	\$	808.00		
Monthly Asphalt Cement Price month project let (APL)			\$	505.00		
Total Monthly Tonnage of asphalt cement (TMT)				795		

ASPHALT	Tons	%AC	AC ton
Leveling	1000	5.0%	50
12.5 OGFC		5.0%	0
12.5 mm	4500	5.0%	225
9.5 mm SP		5.0%	0
25 mm SP	4800	5.0%	240
19 mm SP	5600	5.0%	280
	<b>15900</b>		<b>795</b>

**BITUMINOUS TACK COAT**

Price Adjustment (PA)				\$	<b>3,253.54</b>	\$	<b>3,253.54</b>
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	\$	808.00			
Monthly Asphalt Cement Price month project let (APL)			\$	505.00			
Total Monthly Tonnage of asphalt cement (TMT)				10.7377523			

Bitum Tack

Gals	gals/ton	tons
2500	232.8234	10.7377523

**BITUMINOUS TACK COAT (surface treatment)**

Price Adjustment (PA)					\$	<b>0</b>	\$	<b>-</b>
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	\$	808.00				
Monthly Asphalt Cement Price month project let (APL)			\$	505.00				
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

**TOTAL LIQUID AC ADJUSTMENT** \$ **244,138.54**

**GEORGIA DEPARTMENT OF TRANSPORTATION  
PRELIMINARY ROW COST ESTIMATE SUMMARY**

Date: 3/5/2015 Project: SR 324 @ I-85  
 Revised: County: Gwinnett  
 PI: 0012698

Description: On/Off Ramps for I-85 @ SR 324  
 Project Termini:

Existing ROW: Varies  
 Required ROW: Varies  
 Parcels: 10

Land and Improvements \$7,270,125.00

Proximity Damage	\$34,000.00
Consequential Damage	\$277,500.00
Cost to Cures	\$50,000.00
Trade Fixtures	\$0.00
Improvements	\$0.00

Valuation Services \$12,500.00

Legal Services \$81,750.00

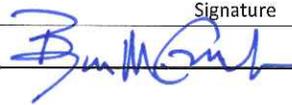
Relocation \$20,000.00

Demolition \$0.00

Administrative \$87,500.00

TOTAL ESTIMATED COSTS \$7,471,875.00

**TOTAL ESTIMATED COSTS (ROUNDED) \$7,472,000.00**

Preparation Credits	Hours	Signature
Benjamin M. Garland Jr.		

Prepared By:  CG#: 270880 3/5/15 (DATE)  
 Approved By:  CG#: 286999 03/20/2015 (DATE)

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

SR 324 @ Interstate 85 Interchange

Cost Estimate

1/5/15

Utility	Quantity	Unit	Cost per unit	Reimburseable	Cost
<b>Electrical Transmission</b>		None on Project		N/A	\$0.00
<b>Georgia Power Distribution</b> Underground Power Georgia Power indicated this cable is very deep.	200	Feet	\$110.00	Yes	\$22,000.00
<b>Jackson EMC</b>	2	pole	\$20,000.00	Yes	\$40,000.00
<b>CATV (Aerial)</b> 1 Coax & 1 Fiber		No prior rights		No	\$0.00
<b>AT&amp;T Distribution</b>		No prior rights		No	\$0.00
<b>Buford Gas</b> 4 in MP HDPE		No Conflicts with new construction		N/A	\$0.00
<b>Water</b>		No Conflicts with new construction		N/A	\$0.00
<b>Sanitary Sewer</b>		No Conflicts with new construction		N/A	\$0.00
				Total	\$62,000.00

## Rickert, Eric

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**From:** Hank Collins <hcollins@maai.net>  
**Sent:** Tuesday, January 06, 2015 8:50 AM  
**To:** Rickert, Eric  
**Cc:** Lewis Cooksey; Chris Parypinski  
**Subject:** RE: PI #0012698, SR 324 @ I-85-Concept Environmental Mitigation Estimate

Thanks for these Eric. Based on some quick figuring and assumed values we have an environmental mitigation value for you to use in the Concept report.

We are assuming 810' of impacts. We are assuming all perineal streams. This would equate to roughly 5670 credits necessary. **Assuming \$100/credit this would amount to \$567,000 for environmental mitigation.**

Also, the large diagonal culvert across the ramp appears that it will definitely throw us into requiring an Individual Permit with the Corps.

Thanks,  
Hank

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# Attachment 4- Crash Summaries

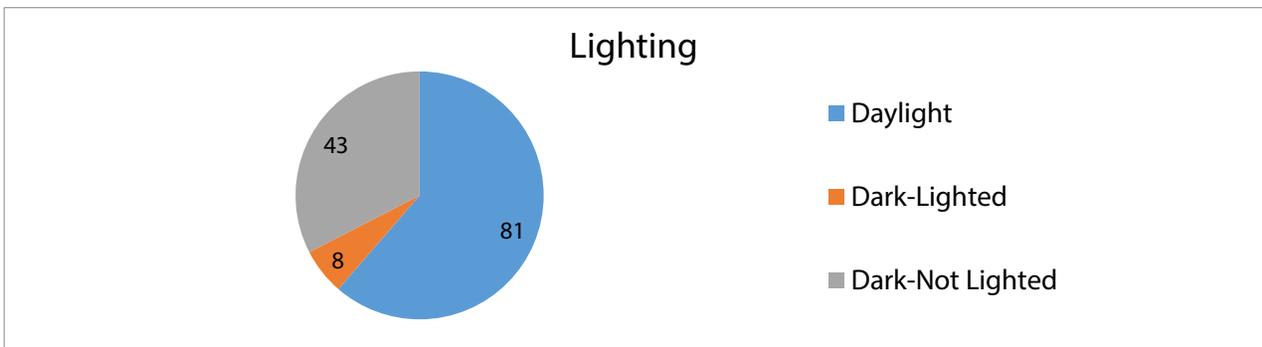
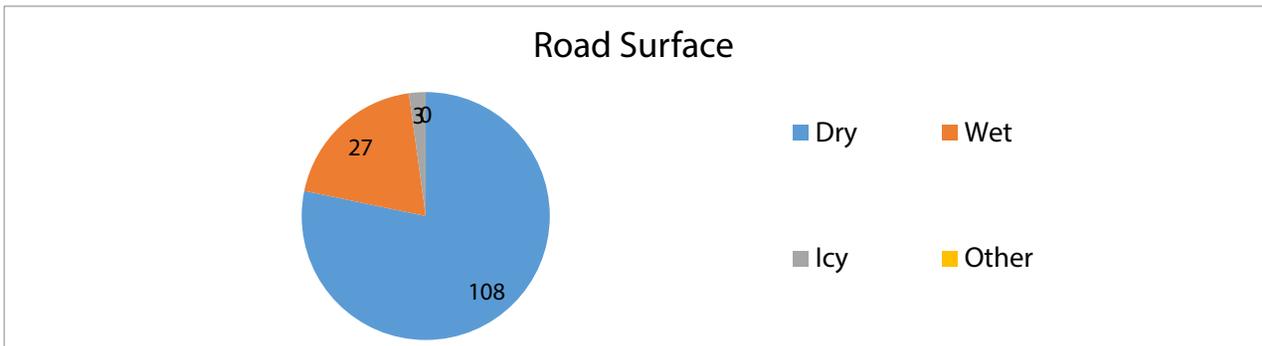
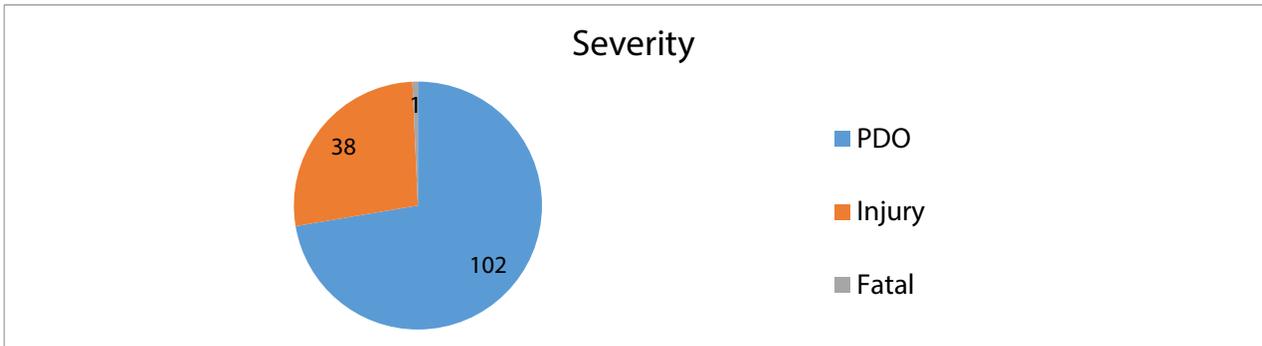
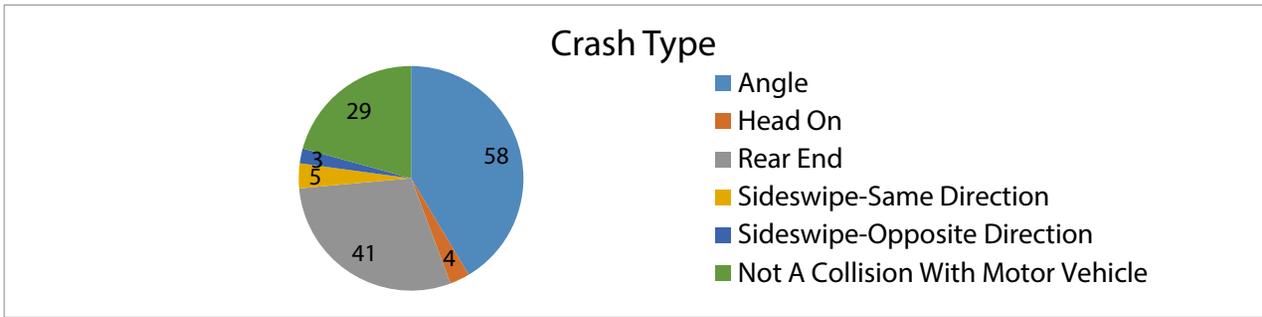
Crash Analysis -- SR 324 from Camp Branch Road to Morgan Road, Gwinnett County -- Years 2007 to 2013

Year	Crash Type						Total Crashes
	Angle	Head On	Rear End	Sideswipe-Same Direction	Sideswipe-Opposite Direction	Not A Collision With Motor Vehicle	
2007	9	0	7	1	2	6	25
2008	8	1	3	2	0	3	17
2009	9	0	9	1	0	7	26
2010	10	1	6	0	1	5	24
2011	6	1	6	0	0	2	15
2012	6	0	5	0	0	3	14
2013	10	1	5	1	0	3	20
Total	58	4	41	5	3	29	141

Year	Severity			Total Crashes
	PDO	Injury	Fatal	
2007	17	8	0	25
2008	14	3	0	17
2009	16	10	0	26
2010	19	5	0	24
2011	14	1	0	15
2012	11	3	0	14
2013	11	8	1	20
Total	102	38	1	141

Year	Road Surface				Total Crashes
	Dry	Wet	Icy	Other	
2007	18	7	0	0	25
2008	13	4	0	0	17
2009	21	5	0	0	26
2010	14	4	3	0	24
2011	15	0	0	0	15
2012	14	0	0	0	14
2013	13	7	0	0	20
Total	108	27	3	0	141

Year	Lighting			Total Crashes
	Daylight	Dark-Lighted	Dark-Not Lighted	
2007	12	1	9	25
2008	8	3	4	17
2009	20	1	3	26
2010	11	0	12	24
2011	9	0	6	15
2012	10	2	2	14
2013	11	1	7	20
Total	81	8	43	141



**Summary of Traffic Crash History along SR 324 from Camp Branch Road to Morgan Road in Gwinnett County**  
**Milelogs: 2.21 to 2.67**

Year	Crashes			Crashes Per 100 Million Vehicle Miles <sup>1</sup>		
	Total	Injury	Fatal	Total	Injury	Fatal
2007	25	8	0	807 (514)	258 (126)	0.00 (1.34)
2008	17	3	0	549 (471)	97 (116)	0.00 (1.33)
2009	26	10	0	839 (463)	323 (114)	0.00 (1.05)
2010	24	5	0	775 (464)	161 (113)	0.00 (1.08)
2011	15	1	0	484 (482)	32 (110)	0.00 (1.15)
2012	14	3	0	452 (544)	97 (120)	0.00 (1.12)
2013	20	8	1	646 (-)	258 (-)	32.28 (-)
Total	141	38	1			
<b>Average</b>	<b>20</b>	<b>5</b>	<b>0</b>	<b>646 (490)</b>	<b>161 (117)</b>	<b>0.00 (1.18)</b>

Note: (1) The number in parentheses represents the statewide average crash rates for Urban Minor Arterials

# Attachment 5- Traffic Diagrams

# Department of Transportation State of Georgia

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## INTERDEPARTMENT CORRESPONDENCE

**FILE** P.I. # 0012698, Gwinnett County **OFFICE** Planning  
**DATE** August 19, 2014

**FROM** Cynthia L. VanDyke, State Transportation Planning Administrator

**TO** Albert Shelby, State Program Delivery Engineer  
**Attention:** Charles Robinson

**SUBJECT** **Reviewed** Design Traffic for SR 324/ Gravel Springs Road at I-85/ SR 403.

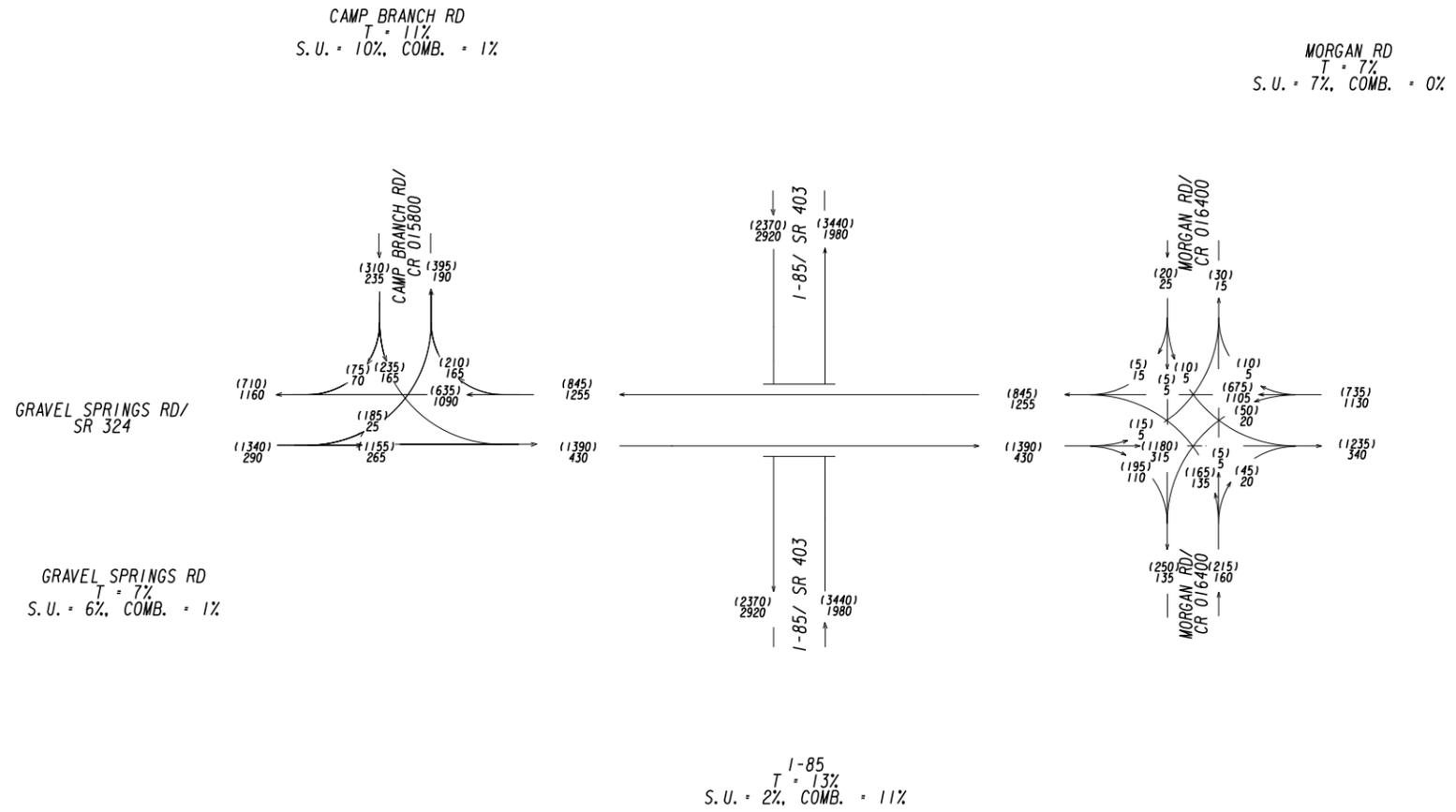
As per your request, we reviewed the consultant's Design Traffic for the above project.

The Design Traffic is approved based on the information furnished. If you have any questions concerning this information please contact Daniel R. Funk at (404) 631-1959.

CLV/df

SHEET 1 OF 8

P. I. NO: 0012698



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



G R E S H A M  
S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

REVISION DATES

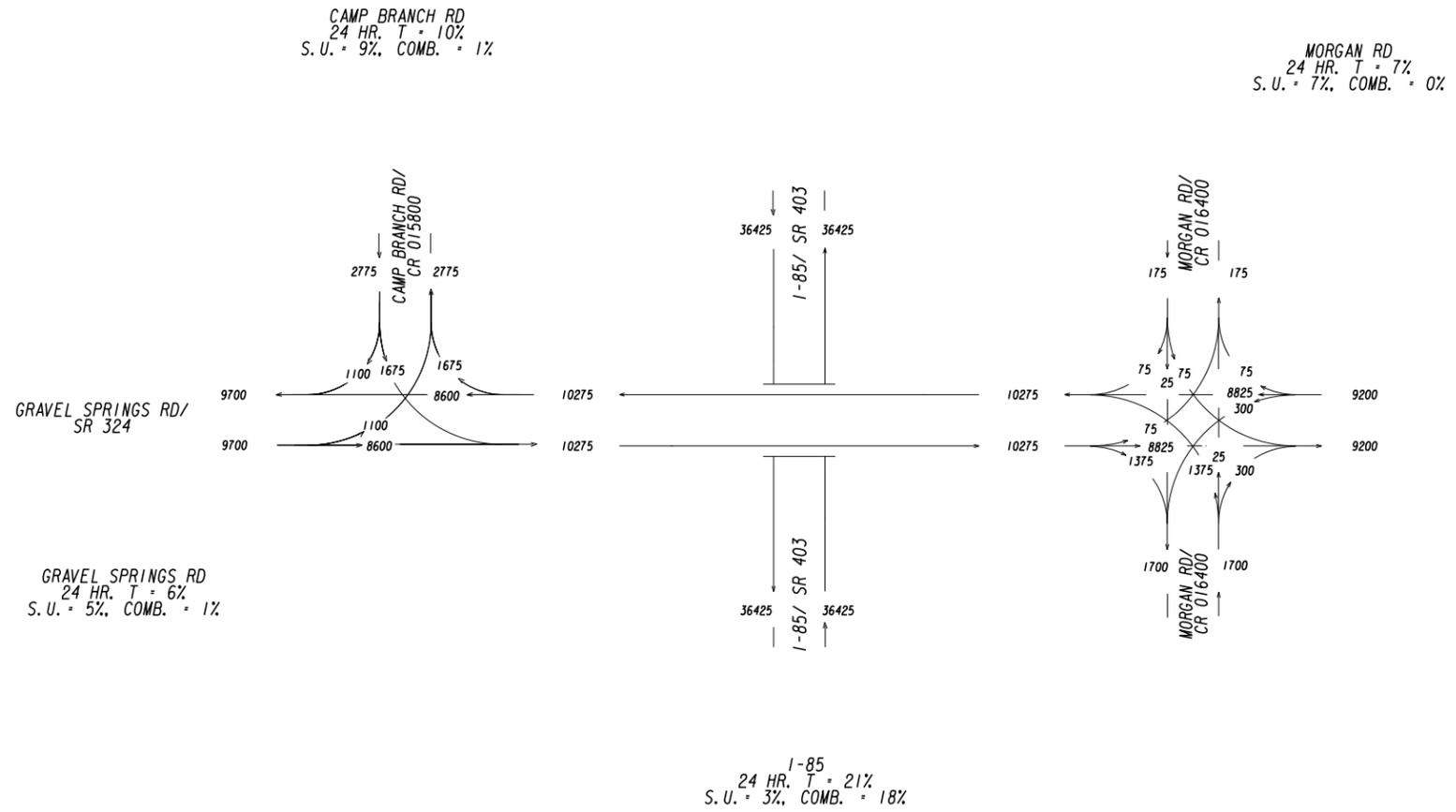

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**  
GWINNETT COUNTY

DRAWING No.  
**10-001**

SHEET 2 OF 8

P. I. NO: 0012698



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S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

REVISION DATES

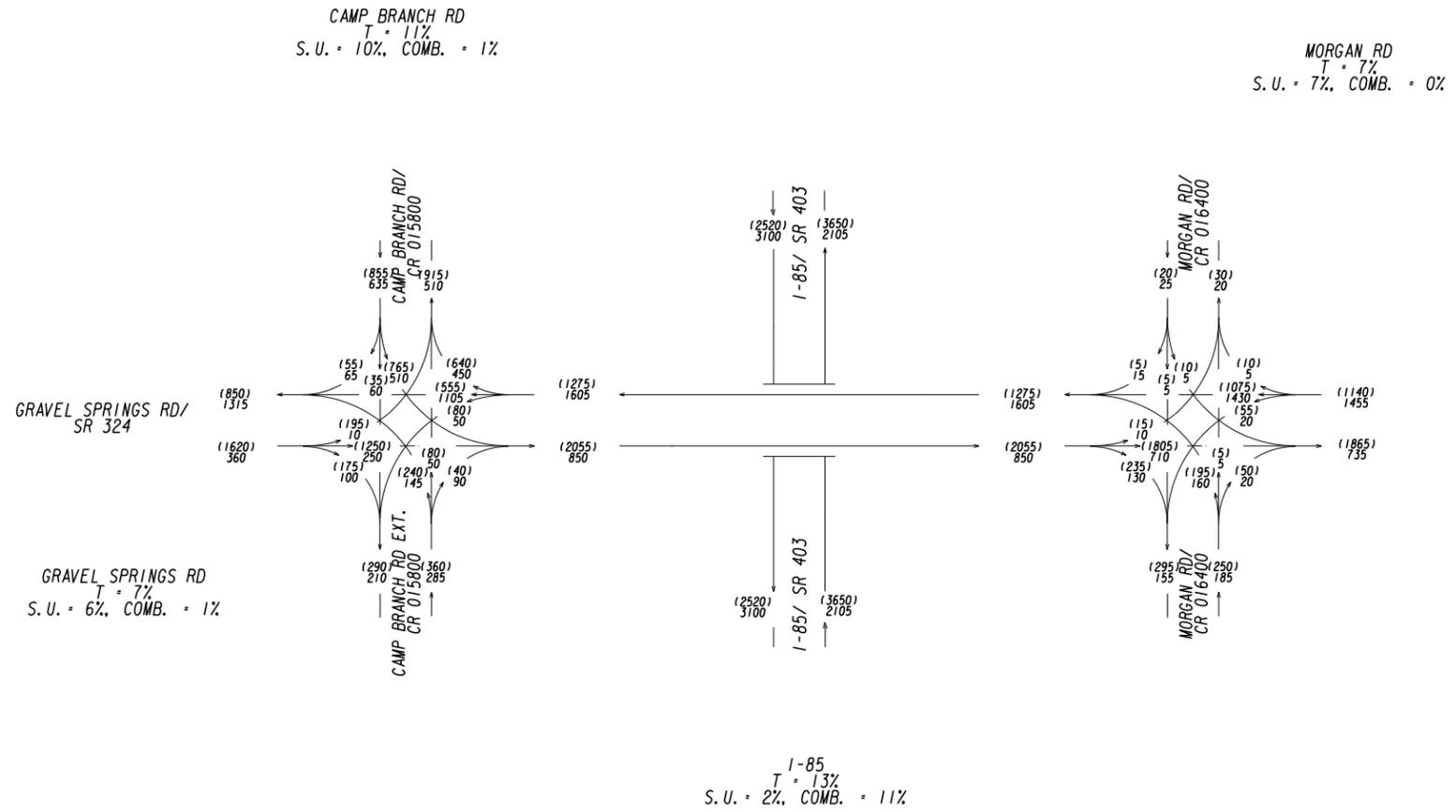

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**  
GWINNETT COUNTY

DRAWING No.  
**10-002**

SHEET 3 OF 8

P. I. NO: 0012698



2020 NO BUILD PM DHV = (000)  
2020 NO BUILD AM DHV = 000



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S M I T H A N D  
P A R T N E R S

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STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

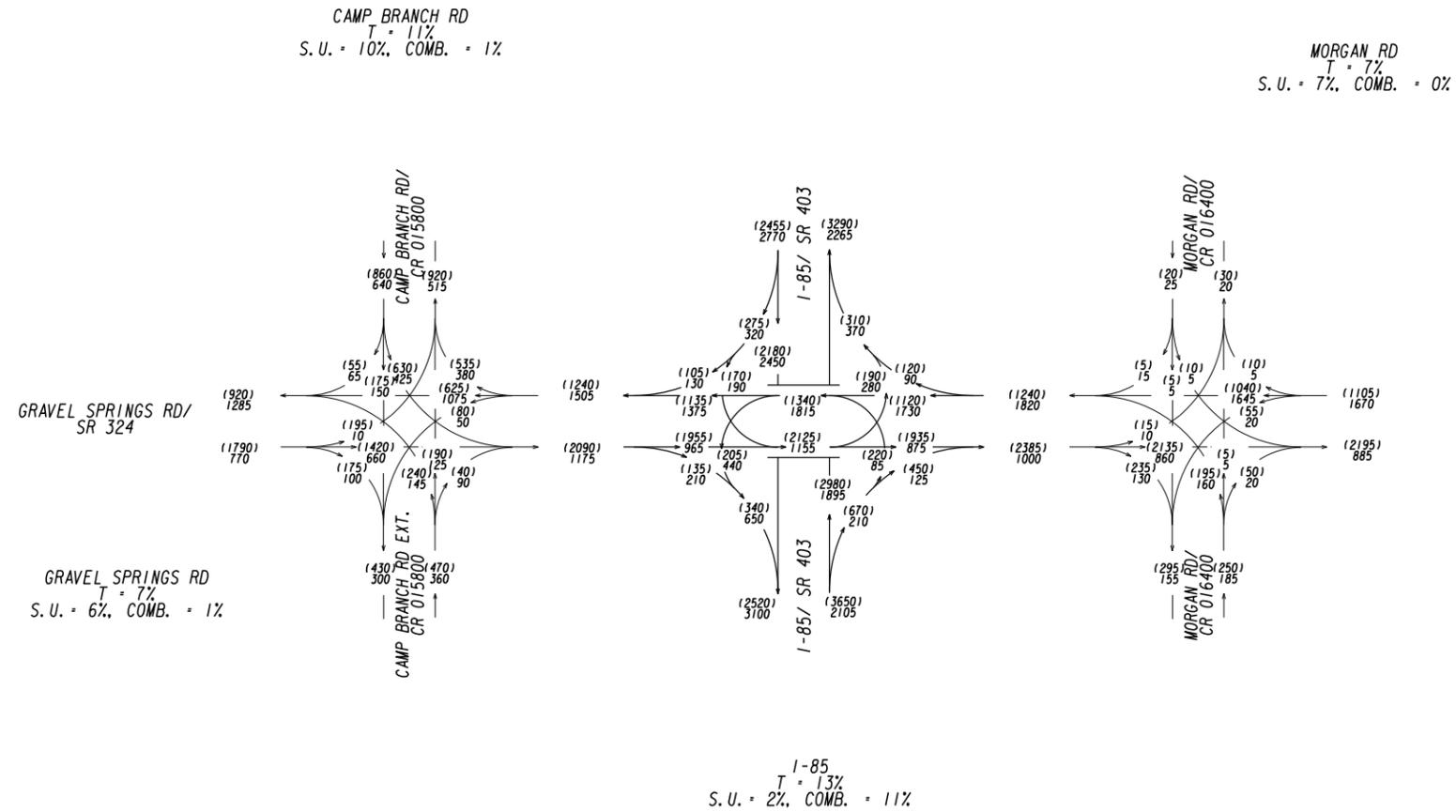
**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**

GWINNETT COUNTY

DRAWING No.  
**10-003**

SHEET 4 OF 8

P. I. NO: 0012698



2020 BUILD PM DHV = (000)  
2020 BUILD AM DHV = 000



G R E S H A M  
S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

REVISION DATES


STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

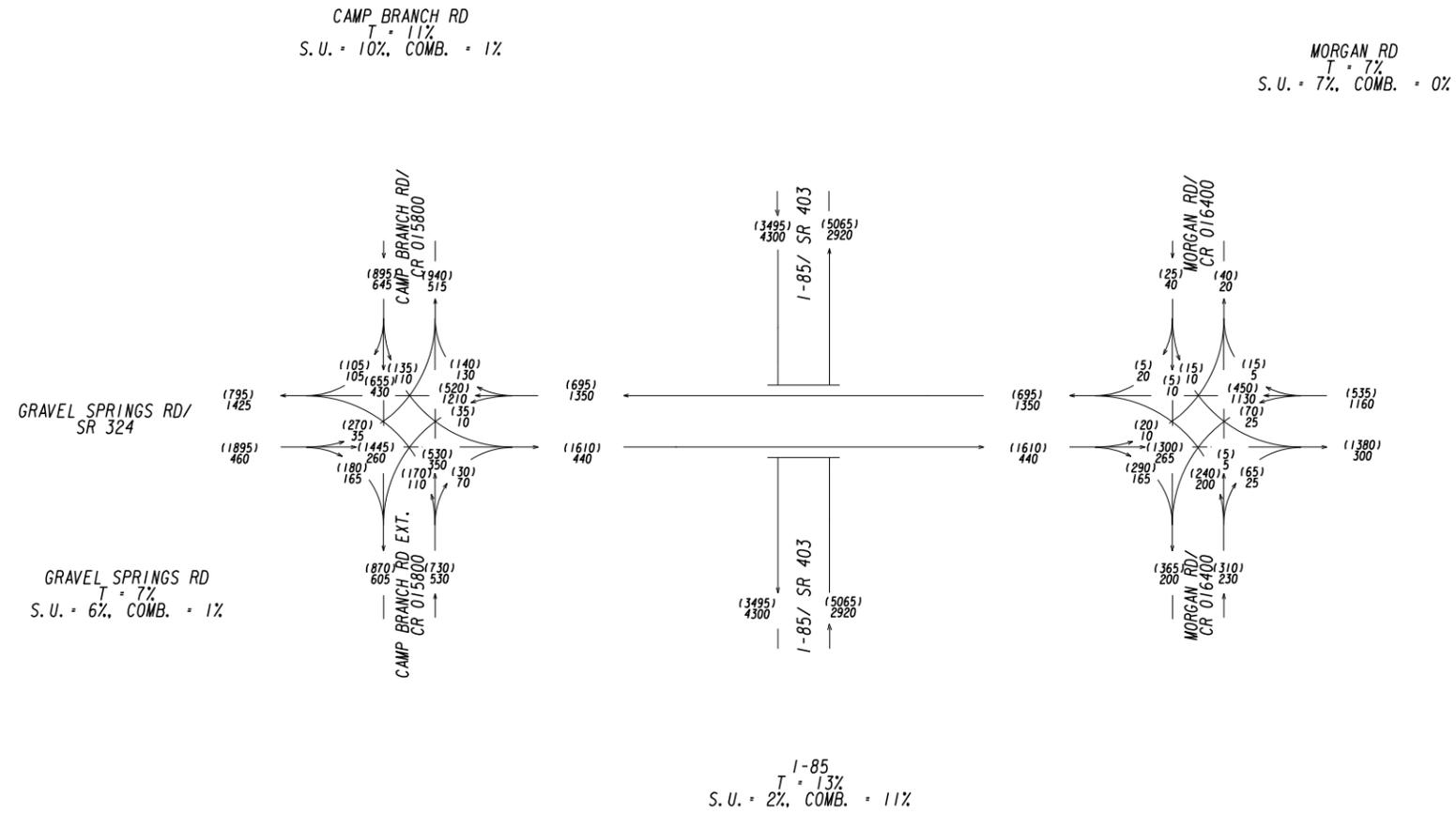
**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**

GWINNETT COUNTY

DRAWING No.  
**10-004**

SHEET 5 OF 8

P. I. NO: 0012698



2040 NO BUILD PM DHV = (000)  
2040 NO BUILD AM DHV = 000



G R E S H A M  
S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

REVISION DATES


STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

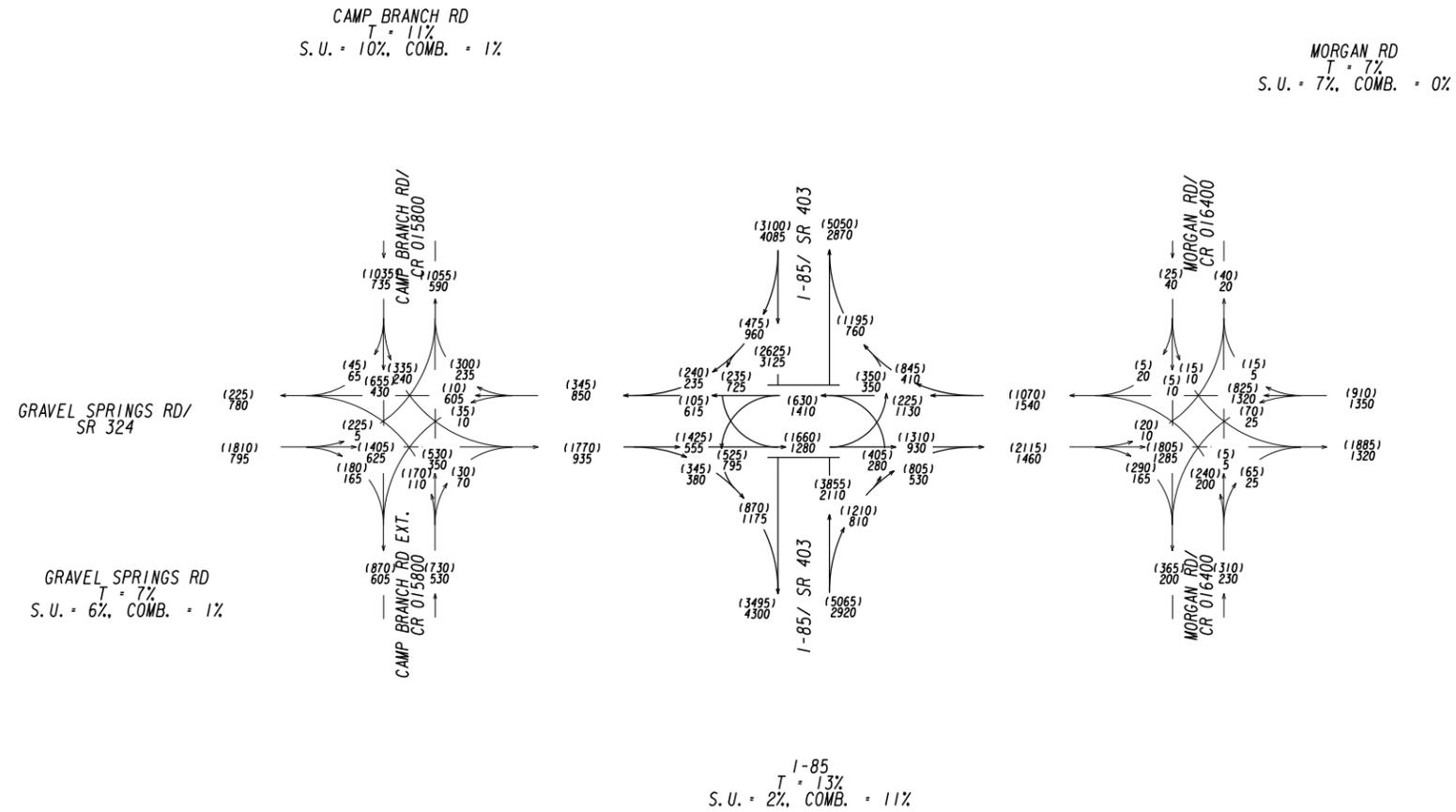
**TRAFFIC DIAGRAM**  
**1-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**

GWINNETT COUNTY

DRAWING No.  
**10-005**

SHEET 6 OF 8

P. I. NO: 0012698



2040 BUILD PM DHV = (000)  
2040 BUILD AM DHV = 000



G R E S H A M  
S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

REVISION DATES


STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

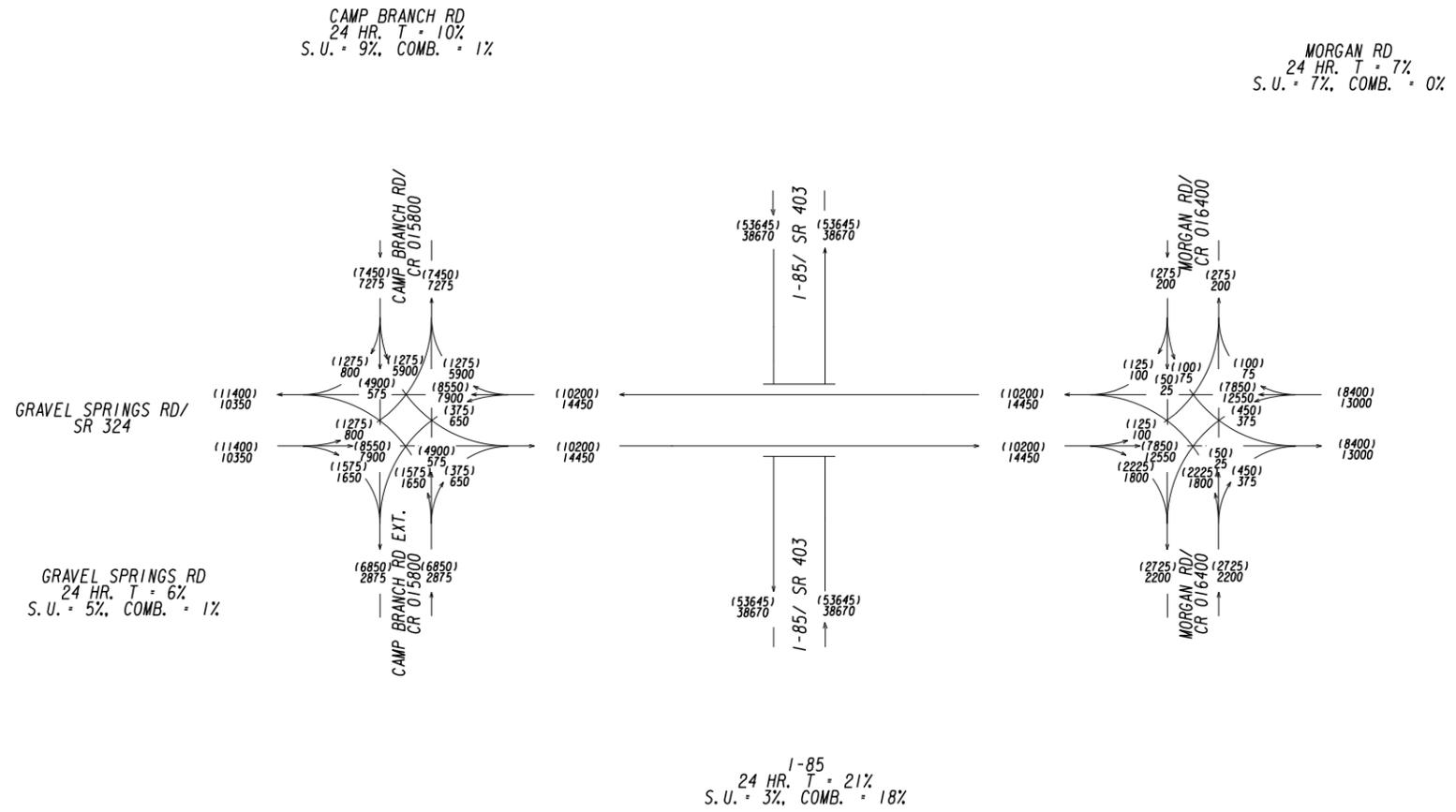
**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**

GWINNETT COUNTY

DRAWING No.  
**10-006**

SHEET 7 OF 8

P. I. NO: 0012698



2040 NO BUILD AADT= (000)  
2020 NO BUILD AADT= 000



G R E S H A M  
S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

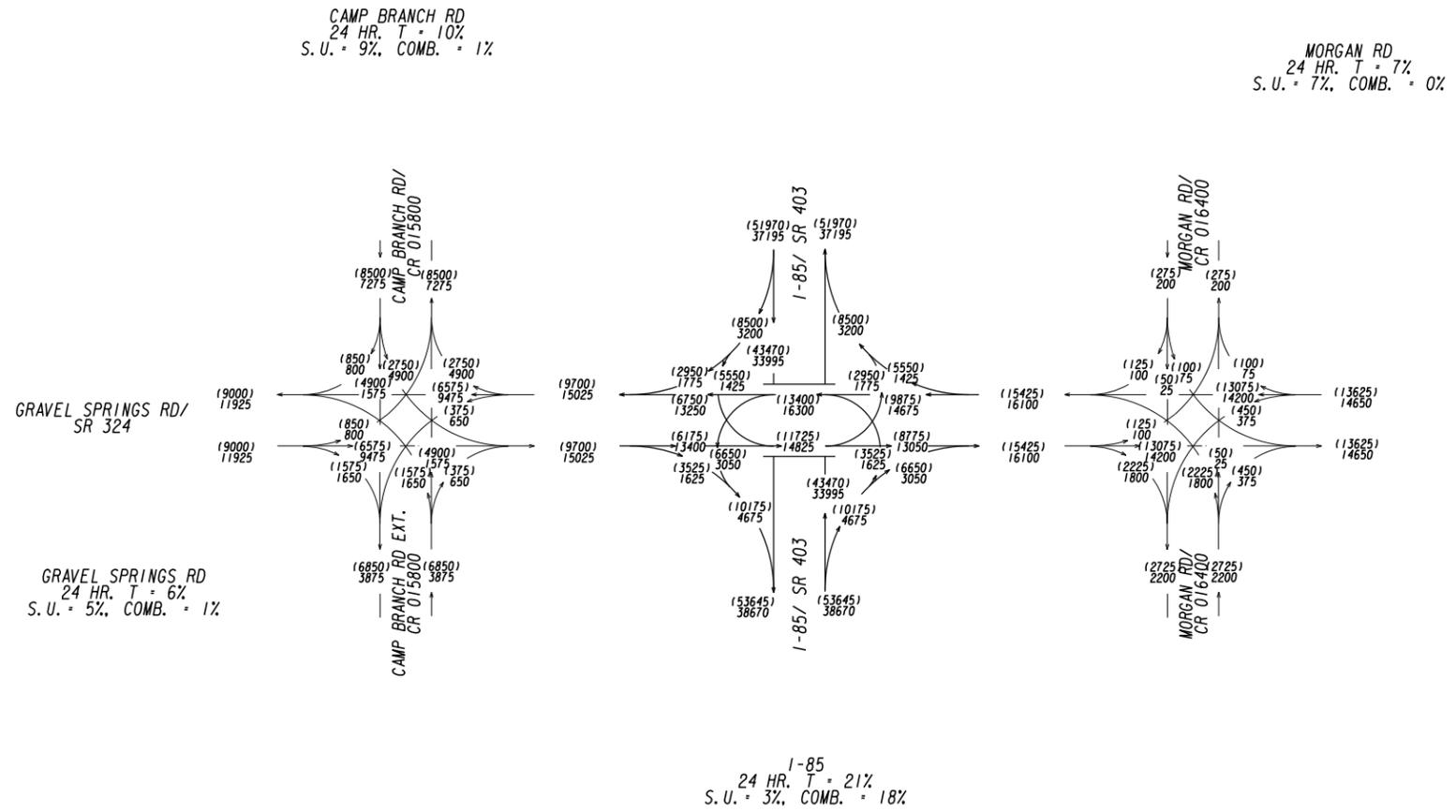
REVISION DATES


STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY  
**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**  
GWINNETT COUNTY

DRAWING No.  
**10-007**

SHEET 8 OF 8

P. I. NO: 0012698



2040 BUILD AADT= (000)  
2020 BUILD AADT= 000



G R E S H A M  
S M I T H A N D  
P A R T N E R S

**GEORGIA**  
DEPARTMENT  
OF  
TRANSPORTATION

REVISION DATES


STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY

**TRAFFIC DIAGRAM**  
**I-85 @ SR 324/ GRAVEL SPRINGS ROAD**  
**INTERCHANGE PROJECT**

WINNETT COUNTY

DRAWING No.  
**10-008**

# Attachment 6- Capacity Analysis Summary

### Year 2013 Existing Intersection Levels of Service

	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Signalized Intersection				
SR 324/Gravel Springs Rd @ Camp Branch Rd	A	8.6	B	10.8
SR 324/Gravel Springs Rd @ Morgan Rd	A	8.0	A	9.4

### 2020 Opening Year No Build Intersection Levels of Service

	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Signalized Intersection				
SR 324/Gravel Springs Rd @ Camp Branch Rd <sup>1</sup>	C	23.3	D	45.1
SR 324/Gravel Springs Rd @ Morgan Rd	A	9.6	B	14.0

### 2040 Design Year No Build Intersection Levels of Service

	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Signalized Intersection				
SR 324/Gravel Springs Rd @ Camp Branch Rd <sup>1</sup>	A	6.7	A	7.6
SR 324/Gravel Springs Rd @ Morgan Rd	B	10.8	B	13.9

<sup>1</sup> The traffic forecasts for the 2040 Design Year condition included the build-out of the I-85 @ SR 20/Buford Drive interchange. This new interchange redistributes the traffic in the region and therefore the overall traffic volumes at the SR 324/Gravel Springs Rd @ Camp Branch Rd intersection is projected to be lower in the 2040 Design Year condition than in the 2020 Opening Year condition. As a result, the LOS at this intersection is better in the 2040 Design Year condition than in the 2020 Opening Year condition.

### 2020 Opening Year Build Intersection Levels of Service

	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Signalized Intersection				
SR 324/Gravel Springs Rd @ Camp Branch Rd <sup>1</sup>	B	11.6	C	31.7
SR 324/Gravel Springs Rd @ I-85 SB Ramps	A	7.8	A	7.7
SR 324/Gravel Springs Rd @ I-85 NB Ramps	B	14.5	A	6.8
SR 324/Gravel Springs Rd @ Morgan Rd	A	8.5	A	6.7

### 2040 Design Year Build Intersection Levels of Service

	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
Signalized Intersection				
SR 324/Gravel Springs Rd @ Camp Branch Rd <sup>1</sup>	A	8.1	B	17.7
SR 324/Gravel Springs Rd @ I-85 SB Ramps	D	36.9	B	17.7
SR 324/Gravel Springs Rd @ I-85 NB Ramps	B	19.4	B	15.1
SR 324/Gravel Springs Rd @ Morgan Rd	A	7.5	A	7.6

# Attachment 7- Summary of Signal Warrant Analysis

**SR 324 Interchange Traffic Study: :: Signal Warrant Analysis - 100 Percent Warrant**

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2020 Opening Year Eighth-Highest Hourly Volume	Minor	Mainline	8 Hour Warrants			
	Approach		Condition A	Condition B	Condition C	Condition Met?
	Max	Total				
SR 324/Gravel Springs Rd @ I-85 SB Ramps	80	1493	No	Yes	No	Yes
SR 324/Gravel Springs Rd @ I-85 NB Ramps	91	1553	No	Yes	No	Yes

---

**Attachment 8- Roundabout  
Data- Planning Level  
Assessment**

## Roundabout Build Intersection Levels of Service

	AM Peak Hour		PM Peak Hour	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
2020 Opening Year (HCS 2010 Methodology)				
SR 324/Gravel Springs Rd @ I-85 SB Ramps	F	58.6	F	>100.0s
SR 324/Gravel Springs Rd @ I-85 NB Ramps	F	>100.0s	F	>100.0s
2040 Design Year (HCS 2010 Methodology) <sup>1</sup>				
SR 324/Gravel Springs Rd @ I-85 SB Ramps	F	>100.0s	F	>100.0s
SR 324/Gravel Springs Rd @ I-85 NB Ramps	F	>100.0s	F	>100.0s

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<sup>1</sup> The HCM 2010 calibrated methodology was used for Year 2040

General & Site Information		v2.1	
Analyst:	Nithin Gomez		
Agency/Co:	GS&P		
Date:	8/20/2014		
Project or PI#:			
Year, Peak Hour:	Year 2020 AM Peak		
County/District:	Gwinnett County, GA		
Intersection:	SR 324/Gravel Springs Rd @ I-85 SB Ramps		

		<p>North</p>						

Volumes		Entry Legs (FROM)							
		N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)
<b>Lane Designation</b>		No Lane	Left Only	SELECT	SELECT	Left-Thru	Thru	SELECT	SELECT
<b>Exit Legs (TO)</b>	N (1), vph								
	NE (2), vph								
	E (3), vph		190						
	SE (4), vph								
	S (5), vph					440			
	SW (6), vph								
	W (7), vph					413	962		
	NW (8), vph								
Entry Volume, vph		0	190	0	0	853	962	0	0
		S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)
<b>Lane Designation</b>		No Lane	No Lane	SELECT	SELECT	Thru	Thru	SELECT	SELECT
	N (1), vph								
	NE (2), vph								
	E (3), vph					552	413		
	SE (4), vph								
	S (5), vph								
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
Entry Volume, vph		0	0	0	0	552	413	0	0

	N	NE	E	SE	S	SW	W	NW
<b># of Entry Flow Lanes</b>	1	0	2	0	0	0	2	0
<b># of Conflict Flow Lanes</b>	2	2	1	2	2	2	1	2

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	89%	100%	94%	100%	89%	100%	94%	100%
% Heavy Vehicles	11%	0%	6%	0%	11%	0%	6%	0%
% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92
F <sub>hv</sub>	0.903	1.000	0.947	1.000	1.000	1.000	0.947	1.000
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	0	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	221	0	0	0	0	0	1072	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	489	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	1527	0	0	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	221	0	2016	0	0	0	1072	0
	Entry flow Lane 1, pcu/h	0	0	948	0	0	0	613	0
	Entry flow Lane 2, pcu/h	221	0	1069	0	0	0	459	0
	Conflicting flow, pcu/h	2016	0	0	0	0	0	710	0

**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
Entry Capacity, veh/h		NA	249	1071	1071	NA	NA	526	526
Entry Flow Rates, veh/h		NA	200	898	1012	NA	NA	581	435
V/C ratio		#VALUE!	0.80	0.84	0.95	#VALUE!	#VALUE!	1.10	0.83
Control Delay, s/veh		#VALUE!	59.1	22.1	35.6	#VALUE!	#VALUE!	98.0	35.6
LOS		#VALUE!	F	C	E	#VALUE!	#VALUE!	F	E
95th % Queue (ft)		#VALUE!	170	277	427	#VALUE!	#VALUE!	490	218
Approach Delay, LOS		39.9 sec, LOS E		29.3 sec, LOS D		#VALUE!		58.6 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS				#VALUE!				#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
Entry Capacity, veh/h		NA	241	1364	1364	NA	NA	671	671
Entry Flow Rates, veh/h		NA	200	898	1012	NA	NA	581	435
V/C ratio		#VALUE!	0.83	0.66	0.74	#VALUE!	#VALUE!	0.87	0.65
Control Delay, s/veh		#VALUE!	64.5	10.8	13.5	#VALUE!	#VALUE!	34.4	17.9
LOS		#VALUE!	F	B	B	#VALUE!	#VALUE!	D	C
95th % Queue (ft)		#VALUE!	179	140	195	#VALUE!	#VALUE!	269	126
Approach Delay, LOS		43.1 sec, LOS E		12.3 sec, LOS B		#VALUE!		22.4 sec, LOS C	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS				#N/A				#N/A	

v2.1

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	N (1)	W (7)				
Select Exit Leg for Bypass (TO)	W (7)	S (5)				
Does the bypass have a dedicated receiving lane?	No	Yes				
# of Conflicting Exit Flow Lanes	2	1	2	2	2	2
<b>Volumes</b>						
Entry Leg: Insert Right Turn Volume	130	210				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	1069	326				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<b>Volume Characteristics</b>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.90	0.95				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.						
<b>Entry/Conflicting Flows</b>						
Entry Flow	151	233				
Conflicting Critical Flow	1069	326				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	483	1200				
Flow Rates of Exiting Traffic, veh/h	137	221				
V/C ratio	0.28	0.19				
Control Delay, sec/pcu	11.8	0.0				
LOS	B	A				
95th % Queue (ft)	32	19				

General & Site Information		v2.1
Analyst:	Nithin Gomez	
Agency/Co:	GS&P	
Date:	8/20/2014	
Project or PI#:		
Year, Peak Hour:	Year 2020 AM Peak	
County/District:	Gwinnett County, GA	
Intersection:	SR 324/Gravel Springs Rd @ I-85 NB Ramps	

Volumes	Entry Legs (FROM)							
	N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)

Lane Designation		No Lane	No Lane			Thru	Right-Thru		
<b>Exit Legs (TO)</b>	N (1), vph								
	NE (2), vph								
	E (3), vph					855	875		
	SE (4), vph								
	S (5), vph								
	SW (6), vph								
	W (7), vph								
	NW (8), vph								
	Entry Volume, vph	0	0	0	0	855	875	0	0

Lane Designation	S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)
------------------	--------	--------	---------	---------	--------	--------	---------	---------

Lane Designation		Left Only	Right only			Left-Thru	Thru		
<b>Exit Legs (TO)</b>	N (1), vph					280			
	NE (2), vph								
	E (3), vph					263	612		
	SE (4), vph								
	S (5), vph								
	SW (6), vph								
	W (7), vph	85							
	NW (8), vph								
	Entry Volume, vph	85	0	0	0	543	612	0	0

	N	NE	E	SE	S	SW	W	NW
<b># of Entry Flow Lanes</b>	0	0	2	0	1	0	2	0
<b># of Conflict Flow Lanes</b>	2	2	1	2	2	2	1	2

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
------------------------	---	----	---	----	---	----	---	----

% Cars	89%	100%	94%	100%	89%	100%	94%	100%
% Heavy Vehicles	11%	0%	6%	0%	11%	0%	6%	0%
% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92
F <sub>hv</sub>	1.000	1.000	0.947	1.000	0.903	1.000	0.947	1.000
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	311	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	0	0	1922	0	0	0	972	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	0	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	0	0	99	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	0	0	1922	0	99	0	1283	0
	Entry flow Lane 1, pcu/h	0	0	950	0	99	0	603	0
	Entry flow Lane 2, pcu/h	0	0	972	0	0	0	680	0
	Conflicting flow, pcu/h	0	0	410	0	3205	0	1922	0

**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	710	710	108	NA	157	157
Entry Flow Rates, veh/h		NA	NA	900	921	89	NA	571	644
V/C ratio		#VALUE!	#VALUE!	1.27	1.30	0.83	#VALUE!	3.65	4.11
Control Delay, s/veh		#VALUE!	#VALUE!	150.6	162.7	116.1	#VALUE!	1250.0	1457.4
LOS		#VALUE!	#VALUE!	F	F	F	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	#VALUE!	889	948	131	#VALUE!	1470	1706
Approach Delay, LOS		#VALUE!		149.2 sec, LOS F		66 sec, LOS F		1359.9 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#VALUE!		#VALUE!		#VALUE!		#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	905	905	83	NA	200	200
Entry Flow Rates, veh/h		NA	NA	900	921	89	NA	571	644
V/C ratio		#VALUE!	#VALUE!	0.99	1.02	1.08	#VALUE!	2.86	3.23
Control Delay, s/veh		#VALUE!	#VALUE!	49.8	55.7	213.1	#VALUE!	887.7	1050.0
LOS		#VALUE!	#VALUE!	E	F	F	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	#VALUE!	476	517	172	#VALUE!	1338	1573
Approach Delay, LOS		#VALUE!		50.4 sec, LOS F		105.3 sec, LOS F		973.7 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#N/A		#N/A		#N/A		#N/A	

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	E (3)	S (5)				
Select Exit Leg for Bypass (TO)	N (1)	E (3)				
Does the bypass have a dedicated receiving lane?	No	No				
# of Conflicting Exit Flow Lanes	1	2	2	2	2	2
<b>Volumes</b>						
Entry Leg: Insert Right Turn Volume	90	125				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	207	1930				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<b>Volume Characteristics</b>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.95	0.90				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.						
<b>Entry/Conflicting Flows</b>						
Entry Flow	100	146				
Conflicting Critical Flow	207	1930				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	870	264				
Flow Rates of Exiting Traffic, veh/h	95	132				
V/C ratio	0.11	0.55				
Control Delay, sec/pcu	5.2	31.9				
LOS	A	D				
95th % Queue (ft)	10	85				

General & Site Information		v2.1																																																																															
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Volumes		Entry Legs (FROM)																																																																															
		N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)																																																																								
Lane Designation		No Lane	Left Only	SELECT	SELECT	Left-Thru	Thru	SELECT	SELECT																																																																								
Exit Legs (TO)	N (1), vph																																																																																
	NE (2), vph																																																																																
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	NW (8), vph																																																																																
	Entry Volume, vph		0	170	0	0	630	710	0	0																																																																							
		S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)																																																																								
Lane Designation		No Lane	No Lane	SELECT	SELECT	Thru	Thru	SELECT	SELECT																																																																								
	N (1), vph																																																																																
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	E (3), vph					982	973																																																																										
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	NW (8), vph																																																																																
	Entry Volume, vph		0	0	0	0	982	973	0	0																																																																							
		<table border="1"> <thead> <tr> <th></th> <th>N</th> <th>NE</th> <th>E</th> <th>SE</th> <th>S</th> <th>SW</th> <th>W</th> <th>NW</th> </tr> </thead> <tbody> <tr> <td># of Entry Flow Lanes</td> <td>1</td> <td>0</td> <td>2</td> <td>0</td> <td>0</td> <td>0</td> <td>2</td> <td>0</td> </tr> <tr> <td># of Conflict Flow Lanes</td> <td>2</td> <td>2</td> <td>1</td> <td>2</td> <td>2</td> <td>2</td> <td>1</td> <td>2</td> </tr> </tbody> </table>									N	NE	E	SE	S	SW	W	NW	# of Entry Flow Lanes	1	0	2	0	0	0	2	0	# of Conflict Flow Lanes	2	2	1	2	2	2	1	2																																													
	N	NE	E	SE	S	SW	W	NW																																																																									
# of Entry Flow Lanes	1	0	2	0	0	0	2	0																																																																									
# of Conflict Flow Lanes	2	2	1	2	2	2	1	2																																																																									
		<table border="1"> <thead> <tr> <th>Volume Characteristics</th> <th>N</th> <th>NE</th> <th>E</th> <th>SE</th> <th>S</th> <th>SW</th> <th>W</th> <th>NW</th> </tr> </thead> <tbody> <tr> <td>% Cars</td> <td>87%</td> <td>100%</td> <td>96%</td> <td>100%</td> <td>87%</td> <td>100%</td> <td>96%</td> <td>100%</td> </tr> <tr> <td>% Heavy Vehicles</td> <td>13%</td> <td>0%</td> <td>4%</td> <td>0%</td> <td>13%</td> <td>0%</td> <td>4%</td> <td>0%</td> </tr> <tr> <td>% Bicycles</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td># of Pedestrians (ped/hr)</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>PHF</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> </tr> <tr> <td>F<sub>hv</sub></td> <td>0.888</td> <td>1.000</td> <td>0.958</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>0.958</td> <td>1.000</td> </tr> <tr> <td>F<sub>ped</sub></td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> </tr> </tbody> </table>								Volume Characteristics	N	NE	E	SE	S	SW	W	NW	% Cars	87%	100%	96%	100%	87%	100%	96%	100%	% Heavy Vehicles	13%	0%	4%	0%	13%	0%	4%	0%	% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%	# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0	PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92	F <sub>hv</sub>	0.888	1.000	0.958	1.000	1.000	1.000	0.958	1.000	F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Volume Characteristics	N	NE	E	SE	S	SW	W	NW																																																																									
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# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0																																																																									
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92																																																																									
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F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000																																																																									

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	0	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	202	0	0	0	0	0	2152	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	226	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	1249	0	0	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	202	0	1475	0	0	0	2152	0
	Entry flow Lane 1, pcu/h	0	0	693	0	0	0	1081	0
	Entry flow Lane 2, pcu/h	202	0	782	0	0	0	1071	0
	Conflicting flow, pcu/h	1475	0	0	0	0	0	428	0

**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
Entry Capacity, veh/h		NA	357	1083	1083	NA	NA	706	706
Entry Flow Rates, veh/h		NA	179	664	749	NA	NA	1036	1026
V/C ratio		#VALUE!	0.50	0.61	0.69	#VALUE!	#VALUE!	1.47	1.45
Control Delay, s/veh		#VALUE!	22.3	11.5	13.9	#VALUE!	#VALUE!	235.2	229.4
LOS		#VALUE!	C	B	B	#VALUE!	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	76	115	154	#VALUE!	#VALUE!	1282	1253
Approach Delay, LOS		17.2 sec, LOS C		12.8 sec, LOS B		#VALUE!		217.3 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS				#VALUE!				#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
Entry Capacity, veh/h		NA	386	1380	1380	NA	NA	900	900
Entry Flow Rates, veh/h		NA	179	664	749	NA	NA	1036	1026
V/C ratio		#VALUE!	0.46	0.48	0.54	#VALUE!	#VALUE!	1.15	1.14
Control Delay, s/veh		#VALUE!	19.5	7.4	8.4	#VALUE!	#VALUE!	99.8	95.9
LOS		#VALUE!	C	A	A	#VALUE!	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	67	71	89	#VALUE!	#VALUE!	782	758
Approach Delay, LOS		15.5 sec, LOS C		7.9 sec, LOS A		#VALUE!		91.6 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS				#N/A				#N/A	

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	N (1)	W (7)				
Select Exit Leg for Bypass (TO)	W (7)	S (5)				
Does the bypass have a dedicated receiving lane?	No	Yes				
# of Conflicting Exit Flow Lanes	2	1	2	2	2	2
<i>Volumes</i>						
Entry Leg: Insert Right Turn Volume	105	135				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	833	151				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<i>Volume Characteristics</i>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.89	0.96				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.						
<i>Entry/Conflicting Flows</i>						
Entry Flow	125	149				
Conflicting Critical Flow	833	151				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	560	1200				
Flow Rates of Exiting Traffic, veh/h	111	142				
V/C ratio	0.20	0.12				
Control Delay, sec/pcu	9.0	0.0				
LOS	A	A				
95th % Queue (ft)	21	11				

General & Site Information		v2.1
Analyst:	Nithin Gomez	
Agency/Co:	GS&P	
Date:	8/20/2014	
Project or PI#:		
Year, Peak Hour:	Year 2020 PM Peak	
County/District:	Gwinnett County, GA	
Intersection:	SR 324/Gravel Springs Rd @ I-85 NB Ramps	

Volumes	Entry Legs (FROM)							
	N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)

Lane Designation	No Lane	No Lane			Thru	Right-Thru		
Exit								
Legs (TO)								
N (1), vph								
NE (2), vph								
E (3), vph					583	537		
SE (4), vph								
S (5), vph								
SW (6), vph								
W (7), vph								
NW (8), vph								
Entry Volume, vph	0	0	0	0	583	537	0	0

	S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)
--	--------	--------	---------	---------	--------	--------	---------	---------

Lane Designation	Left Only	Right only			Left-Thru	Thru		
N (1), vph					190			
NE (2), vph								
E (3), vph					809	1126		
SE (4), vph								
S (5), vph								
SW (6), vph								
W (7), vph	220							
NW (8), vph								
Entry Volume, vph	220	0	0	0	999	1126	0	0

	N	NE	E	SE	S	SW	W	NW
# of Entry Flow Lanes	0	0	2	0	1	0	2	0
# of Conflict Flow Lanes	2	2	1	2	2	2	1	2

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
------------------------	---	----	---	----	---	----	---	----

% Cars	87%	100%	96%	100%	87%	100%	96%	100%
% Heavy Vehicles	13%	0%	4%	0%	13%	0%	4%	0%
% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92
F <sub>hv</sub>	1.000	1.000	0.958	1.000	0.888	1.000	0.958	1.000
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	209	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	0	0	1233	0	0	0	2130	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	0	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	0	0	261	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	0	0	1233	0	261	0	2339	0
	Entry flow Lane 1, pcu/h	0	0	642	0	261	0	1100	0
	Entry flow Lane 2, pcu/h	0	0	591	0	0	0	1239	0
	Conflicting flow, pcu/h	0	0	470	0	3572	0	1233	0

**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	676	676	82	NA	316	316
Entry Flow Rates, veh/h		NA	NA	615	566	232	NA	1054	1188
V/C ratio		#VALUE!	#VALUE!	0.91	0.84	2.82	#VALUE!	3.34	3.76
Control Delay, s/veh		#VALUE!	#VALUE!	40.4	30.7	930.0	#VALUE!	1084.8	1275.1
LOS		#VALUE!	#VALUE!	E	D	F	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	#VALUE!	308	241	636	#VALUE!	2514	2947
Approach Delay, LOS		#VALUE!		32.8 sec, LOS D		810.5 sec, LOS F		1185.7 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#VALUE!		#VALUE!		#VALUE!		#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	862	862	58	NA	402	402
Entry Flow Rates, veh/h		NA	NA	615	566	232	NA	1054	1188
V/C ratio		#VALUE!	#VALUE!	0.71	0.66	3.97	#VALUE!	2.62	2.95
Control Delay, s/veh		#VALUE!	#VALUE!	17.4	15.1	1479.6	#VALUE!	757.1	906.1
LOS		#VALUE!	#VALUE!	C	C	F	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	#VALUE!	162	132	708	#VALUE!	2245	2675
Approach Delay, LOS		#VALUE!		15.2 sec, LOS C		991 sec, LOS F		836.1 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#VALUE!		#N/A		#VALUE!		#N/A	

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	<b>E (3)</b>	<b>S (5)</b>				
Select Exit Leg for Bypass (TO)	<b>N (1)</b>	<b>E (3)</b>				
<b>Does the bypass have a dedicated receiving lane?</b>	<b>No</b>	<b>No</b>				
<b># of Conflicting Exit Flow Lanes</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<i>Volumes</i>						
Entry Leg: Insert Right Turn Volume	120	450				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	139	2243				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<i>Volume Characteristics</i>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.96	0.89				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
<b>***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.</b>						
<i>Entry/Conflicting Flows</i>						
Entry Flow	132	535				
Conflicting Critical Flow	139	2243				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	942	209				
Flow Rates of Exiting Traffic, veh/h	127	475				
<b>V/C ratio</b>	0.13	2.56				
<b>Control Delay, sec/pcu</b>	5.1	752.2				
LOS	A	F				
<b>95th % Queue (ft)</b>	<b>12</b>	<b>1272</b>				

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		N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)																																																																								
Lane Designation		No Lane	Left Only	SELECT	SELECT	Left-Thru	Thru	SELECT	SELECT																																																																								
Exit Legs (TO)	N (1), vph																																																																																
	NE (2), vph																																																																																
	E (3), vph		725																																																																														
	SE (4), vph																																																																																
	S (5), vph					795																																																																											
	SW (6), vph																																																																																
	W (7), vph					0	615																																																																										
	NW (8), vph																																																																																
	Entry Volume, vph		0	725	0	0	795	615	0	0																																																																							
		S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)																																																																								
Lane Designation		No Lane	No Lane	SELECT	SELECT	Thru	Thru	SELECT	SELECT																																																																								
	N (1), vph																																																																																
	NE (2), vph																																																																																
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	Entry Volume, vph		0	0	0	0	439	116	0	0																																																																							
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	N	NE	E	SE	S	SW	W	NW																																																																									
# of Entry Flow Lanes	1	0	2	0	0	0	2	0																																																																									
# of Conflict Flow Lanes	2	2	1	2	2	2	1	2																																																																									
		<table border="1"> <thead> <tr> <th>Volume Characteristics</th> <th>N</th> <th>NE</th> <th>E</th> <th>SE</th> <th>S</th> <th>SW</th> <th>W</th> <th>NW</th> </tr> </thead> <tbody> <tr> <td>% Cars</td> <td>89%</td> <td>100%</td> <td>94%</td> <td>100%</td> <td>89%</td> <td>100%</td> <td>94%</td> <td>100%</td> </tr> <tr> <td>% Heavy Vehicles</td> <td>11%</td> <td>0%</td> <td>6%</td> <td>0%</td> <td>11%</td> <td>0%</td> <td>6%</td> <td>0%</td> </tr> <tr> <td>% Bicycles</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td># of Pedestrians (ped/hr)</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>PHF</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> </tr> <tr> <td>F<sub>hv</sub></td> <td>0.903</td> <td>1.000</td> <td>0.947</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>0.947</td> <td>1.000</td> </tr> <tr> <td>F<sub>ped</sub></td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> </tr> </tbody> </table>								Volume Characteristics	N	NE	E	SE	S	SW	W	NW	% Cars	89%	100%	94%	100%	89%	100%	94%	100%	% Heavy Vehicles	11%	0%	6%	0%	11%	0%	6%	0%	% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%	# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0	PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92	F <sub>hv</sub>	0.903	1.000	0.947	1.000	1.000	1.000	0.947	1.000	F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Volume Characteristics	N	NE	E	SE	S	SW	W	NW																																																																									
% Cars	89%	100%	94%	100%	89%	100%	94%	100%																																																																									
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% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%																																																																									
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0																																																																									
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92																																																																									
F <sub>hv</sub>	0.903	1.000	0.947	1.000	1.000	1.000	0.947	1.000																																																																									
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000																																																																									

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	0	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	845	0	0	0	0	0	616	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	883	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	683	0	0	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	845	0	1566	0	0	0	616	0
	Entry flow Lane 1, pcu/h	0	0	883	0	0	0	488	0
	Entry flow Lane 2, pcu/h	845	0	683	0	0	0	129	0
	Conflicting flow, pcu/h	1566	0	0	0	0	0	1728	0

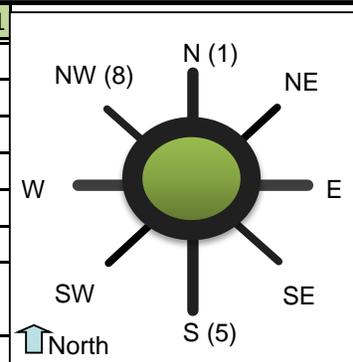
**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
Entry Capacity, veh/h		NA	341	1071	1071	NA	NA	190	190
Entry Flow Rates, veh/h		NA	763	837	647	NA	NA	462	122
V/C ratio		#VALUE!	2.24	0.78	0.60	#VALUE!	#VALUE!	2.43	0.64
Control Delay, s/veh		#VALUE!	591.1	18.1	11.4	#VALUE!	#VALUE!	697.8	50.9
LOS		#VALUE!	F	C	B	#VALUE!	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	1598	220	112	#VALUE!	#VALUE!	1015	99
Approach Delay, LOS		448.6 sec, LOS F		15.2 sec, LOS C		#VALUE!		333.9 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS				#VALUE!				#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
Entry Capacity, veh/h		NA	362	1364	1364	NA	NA	242	242
Entry Flow Rates, veh/h		NA	763	837	647	NA	NA	462	122
V/C ratio		#VALUE!	2.11	0.61	0.47	#VALUE!	#VALUE!	1.91	0.50
Control Delay, s/veh		#VALUE!	532.4	9.8	7.4	#VALUE!	#VALUE!	456.8	31.5
LOS		#VALUE!	F	A	A	#VALUE!	#VALUE!	F	D
95th % Queue (ft)		#VALUE!	1532	118	69	#VALUE!	#VALUE!	864	69
Approach Delay, LOS		404.2 sec, LOS F		8.7 sec, LOS A		#VALUE!		218.4 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS				#N/A				#N/A	

v2.1

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	N (1)	W (7)				
Select Exit Leg for Bypass (TO)	W (7)	S (5)				
Does the bypass have a dedicated receiving lane?	No	Yes				
# of Conflicting Exit Flow Lanes	2	1	2	2	2	2
<b>Volumes</b>						
Entry Leg: Insert Right Turn Volume	235	380				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	456	883				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<b>Volume Characteristics</b>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.90	0.95				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.						
<b>Entry/Conflicting Flows</b>						
Entry Flow	274	422				
Conflicting Critical Flow	456	883				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	742	1200				
Flow Rates of Exiting Traffic, veh/h	247	400				
V/C ratio	0.33	0.35				
Control Delay, sec/pcu	8.9	0.0				
LOS	A	A				
95th % Queue (ft)	41	42				

General & Site Information		v2.1
Analyst:	Nithin Gomez	
Agency/Co:	GS&P	
Date:	8/20/2014	
Project or PI#:		
Year, Peak Hour:	Year 2040 AM Peak	
County/District:	Gwinnett County, GA	
Intersection:	SR 324/Gravel Springs Rd @ I-85 NB Ramps	



Volumes	Entry Legs (FROM)							
	N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)

Lane Designation	No Lane	No Lane			Thru	Right-Thru		
Exit Legs (TO)								
N (1), vph								
NE (2), vph								
E (3), vph					724	406		
SE (4), vph								
S (5), vph								
SW (6), vph								
W (7), vph								
NW (8), vph								
Entry Volume, vph	0	0	0	0	724	406	0	0

	S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)
--	--------	--------	---------	---------	--------	--------	---------	---------

Lane Designation	Left Only	Right only			Left-Thru	Thru		
N (1), vph					350			
NE (2), vph								
E (3), vph					252	678		
SE (4), vph								
S (5), vph								
SW (6), vph								
W (7), vph	280							
NW (8), vph								
Entry Volume, vph	280	0	0	0	602	678	0	0

	N	NE	E	SE	S	SW	W	NW
# of Entry Flow Lanes	0	0	2	0	1	0	2	0
# of Conflict Flow Lanes	2	2	1	2	2	2	1	2

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
% Cars	89%	100%	94%	100%	89%	100%	94%	100%
% Heavy Vehicles	11%	0%	6%	0%	11%	0%	6%	0%
% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92
F <sub>hv</sub>	1.000	1.000	0.947	1.000	0.903	1.000	0.947	1.000
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	389	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	0	0	1255	0	0	0	1033	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	0	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	0	0	326	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	0	0	1255	0	326	0	1422	0
	Entry flow Lane 1, pcu/h	0	0	804	0	326	0	669	0
	Entry flow Lane 2, pcu/h	0	0	451	0	0	0	753	0
	Conflicting flow, pcu/h	0	0	715	0	2677	0	1255	0

**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	524	524	157	NA	305	305
Entry Flow Rates, veh/h		NA	NA	762	427	295	NA	634	714
V/C ratio		#VALUE!	#VALUE!	1.45	0.82	1.88	#VALUE!	2.08	2.34
Control Delay, s/veh		#VALUE!	#VALUE!	236.6	34.6	468.5	#VALUE!	522.9	639.0
LOS		#VALUE!	#VALUE!	F	D	F	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	#VALUE!	987	211	615	#VALUE!	1219	1473
Approach Delay, LOS		#VALUE!		123.5 sec, LOS F		422.3 sec, LOS F		584.4 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#VALUE!		#VALUE!		#VALUE!		#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	667	667	133	NA	389	389
Entry Flow Rates, veh/h		NA	NA	762	427	295	NA	634	714
V/C ratio		#VALUE!	#VALUE!	1.14	0.64	2.21	#VALUE!	1.63	1.83
Control Delay, s/veh		#VALUE!	#VALUE!	103.8	17.7	623.7	#VALUE!	319.7	409.3
LOS		#VALUE!	#VALUE!	F	C	F	#VALUE!	F	F
95th % Queue (ft)		#VALUE!	#VALUE!	629	122	683	#VALUE!	977	1223
Approach Delay, LOS		#VALUE!		56.6 sec, LOS F		475.9 sec, LOS F		367.2 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#N/A		#N/A		#N/A		#N/A	

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	<b>E (3)</b>	<b>S (5)</b>				
Select Exit Leg for Bypass (TO)	<b>N (1)</b>	<b>E (3)</b>				
<b>Does the bypass have a dedicated receiving lane?</b>	<b>No</b>	<b>No</b>				
<b># of Conflicting Exit Flow Lanes</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>Volumes</b>						
Entry Leg: Insert Right Turn Volume	410	530				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	259	1557				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<b>Volume Characteristics</b>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.95	0.90				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
<b>***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.</b>						
<b>Entry/Conflicting Flows</b>						
Entry Flow	455	618				
Conflicting Critical Flow	259	1557				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	826	343				
Flow Rates of Exiting Traffic, veh/h	431	558				
<b>V/C ratio</b>	0.52	1.80				
<b>Control Delay, sec/pcu</b>	11.6	397.9				
LOS	B	F				
<b>95th % Queue (ft)</b>	<b>81</b>	<b>1110</b>				

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		N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)																																																																								
Lane Designation		No Lane	Left Only	SELECT	SELECT	Left-Thru	Thru	SELECT	SELECT																																																																								
Exit Legs (TO)	N (1), vph																																																																																
	NE (2), vph																																																																																
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	SW (6), vph																																																																																
	W (7), vph					0	105																																																																										
	NW (8), vph																																																																																
	Entry Volume, vph	0	235	0	0	525	105	0	0																																																																								
		S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)																																																																								
Lane Designation		No Lane	No Lane	SELECT	SELECT	Thru	Thru	SELECT	SELECT																																																																								
	N (1), vph																																																																																
	NE (2), vph																																																																																
	E (3), vph					832	593																																																																										
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	Entry Volume, vph	0	0	0	0	832	593	0	0																																																																								
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	N	NE	E	SE	S	SW	W	NW																																																																									
# of Entry Flow Lanes	1	0	2	0	0	0	2	0																																																																									
# of Conflict Flow Lanes	2	2	1	2	2	2	1	2																																																																									
		<table border="1"> <thead> <tr> <th>Volume Characteristics</th> <th>N</th> <th>NE</th> <th>E</th> <th>SE</th> <th>S</th> <th>SW</th> <th>W</th> <th>NW</th> </tr> </thead> <tbody> <tr> <td>% Cars</td> <td>87%</td> <td>100%</td> <td>96%</td> <td>100%</td> <td>87%</td> <td>100%</td> <td>96%</td> <td>100%</td> </tr> <tr> <td>% Heavy Vehicles</td> <td>13%</td> <td>0%</td> <td>4%</td> <td>0%</td> <td>13%</td> <td>0%</td> <td>4%</td> <td>0%</td> </tr> <tr> <td>% Bicycles</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td># of Pedestrians (ped/hr)</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>PHF</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> <td>0.95</td> <td>0.92</td> </tr> <tr> <td>F<sub>hv</sub></td> <td>0.888</td> <td>1.000</td> <td>0.958</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>0.958</td> <td>1.000</td> </tr> <tr> <td>F<sub>ped</sub></td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> <td>1.000</td> </tr> </tbody> </table>								Volume Characteristics	N	NE	E	SE	S	SW	W	NW	% Cars	87%	100%	96%	100%	87%	100%	96%	100%	% Heavy Vehicles	13%	0%	4%	0%	13%	0%	4%	0%	% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%	# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0	PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92	F <sub>hv</sub>	0.888	1.000	0.958	1.000	1.000	1.000	0.958	1.000	F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Volume Characteristics	N	NE	E	SE	S	SW	W	NW																																																																									
% Cars	87%	100%	96%	100%	87%	100%	96%	100%																																																																									
% Heavy Vehicles	13%	0%	4%	0%	13%	0%	4%	0%																																																																									
% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%																																																																									
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0																																																																									
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92																																																																									
F <sub>hv</sub>	0.888	1.000	0.958	1.000	1.000	1.000	0.958	1.000																																																																									
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000																																																																									

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	0	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	279	0	0	0	0	0	1569	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	578	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	116	0	0	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	279	0	693	0	0	0	1569	0
	Entry flow Lane 1, pcu/h	0	0	578	0	0	0	916	0
	Entry flow Lane 2, pcu/h	279	0	116	0	0	0	653	0
	Conflicting flow, pcu/h	693	0	0	0	0	0	857	0

**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
	Entry Capacity, veh/h	NA	617	1083	1083	NA	NA	460	460
	Entry Flow Rates, veh/h	NA	248	554	111	NA	NA	877	625
	V/C ratio	#VALUE!	0.40	0.51	0.10	#VALUE!	#VALUE!	1.91	1.36
	Control Delay, s/veh	#VALUE!	11.7	9.3	4.2	#VALUE!	#VALUE!	438.0	200.8
	LOS	#VALUE!	B	A	A	#VALUE!	#VALUE!	F	F
	95th % Queue (ft)	#VALUE!	54	78	9	#VALUE!	#VALUE!	1511	753
	Approach Delay, LOS	9.1 sec, LOS A		8.5 sec, LOS A		#VALUE!		273.2 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	Entry Capacity, veh/h	NA	NA	NA	NA	NA	NA	NA	NA
	Entry Flow Rates, veh/h	NA	NA	NA	NA	NA	NA	NA	NA
	V/C ratio			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	Control Delay, sec/pcu			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	LOS			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	95th % Queue (ft)			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	Approach Delay, LOS			#VALUE!				#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	Left Only	Left-Thru	Thru	No Lane	No Lane	Thru	Thru
	Entry Capacity, veh/h	NA	780	1380	1380	NA	NA	586	586
	Entry Flow Rates, veh/h	NA	248	554	111	NA	NA	877	625
	V/C ratio	#VALUE!	0.32	0.40	0.08	#VALUE!	#VALUE!	1.50	1.07
	Control Delay, s/veh	#VALUE!	8.3	6.4	3.2	#VALUE!	#VALUE!	252.6	82.9
	LOS	#VALUE!	A	A	A	#VALUE!	#VALUE!	F	F
	95th % Queue (ft)	#VALUE!	39	51	7	#VALUE!	#VALUE!	1147	470
	Approach Delay, LOS	7.4 sec, LOS A		5.8 sec, LOS A		#VALUE!		146.5 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
	Entry Capacity, veh/h	NA	NA	NA	NA	NA	NA	NA	NA
	Entry Flow Rates, veh/h	NA	NA	NA	NA	NA	NA	NA	NA
	V/C ratio			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	Control Delay, sec/pcu			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	LOS			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	95th % Queue (ft)			#VALUE!	#VALUE!			#VALUE!	#VALUE!
	Approach Delay, LOS			#N/A				#N/A	

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	N (1)	W (7)				
Select Exit Leg for Bypass (TO)	W (7)	S (5)				
Does the bypass have a dedicated receiving lane?	No	Yes				
# of Conflicting Exit Flow Lanes	2	1	2	2	2	2
<b>Volumes</b>						
Entry Leg: Insert Right Turn Volume	240	345				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	77	578				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<b>Volume Characteristics</b>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.89	0.96				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.						
<b>Entry/Conflicting Flows</b>						
Entry Flow	285	380				
Conflicting Critical Flow	77	578				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	950	1200				
Flow Rates of Exiting Traffic, veh/h	253	364				
V/C ratio	0.27	0.32				
Control Delay, sec/pcu	6.5	0.0				
LOS	A	A				
95th % Queue (ft)	30	36				

General & Site Information		v2.1
Analyst:	Nithin Gomez	
Agency/Co:	GS&P	
Date:	8/20/2014	
Project or PI#:		
Year, Peak Hour:	Year 2040 PM Peak	
County/District:	Gwinnett County, GA	
Intersection:	SR 324/Gravel Springs Rd @ I-85 NB Ramps	

Volumes	Entry Legs (FROM)							
	N1 (1)	N2 (1)	NE1 (2)	NE2 (2)	E1 (3)	E2 (3)	SE1 (4)	SE2 (4)

Lane Designation	No Lane	No Lane			Thru	Right-Thru		
<b>Exit Legs (TO)</b>	N (1), vph							
	NE (2), vph							
	E (3), vph				225	0		
	SE (4), vph							
	S (5), vph							
	SW (6), vph							
	W (7), vph							
	NW (8), vph							
	Entry Volume, vph	0	0	0	0	225	0	0

	S1 (5)	S2 (5)	SW1 (6)	SW2 (6)	W1 (7)	W2 (7)	NW1 (8)	NW2 (8)
--	--------	--------	---------	---------	--------	--------	---------	---------

Lane Designation	Left Only	Right only			Left-Thru	Thru		
N (1), vph					350			
NE (2), vph								
E (3), vph					430	880		
SE (4), vph								
S (5), vph								
SW (6), vph								
W (7), vph	405							
NW (8), vph								
Entry Volume, vph	405	0	0	0	780	880	0	0

	N	NE	E	SE	S	SW	W	NW
<b># of Entry Flow Lanes</b>	0	0	1	0	1	0	2	0
<b># of Conflict Flow Lanes</b>	2	2	1	2	2	2	1	2

Volume Characteristics	N	NE	E	SE	S	SW	W	NW
------------------------	---	----	---	----	---	----	---	----

% Cars	87%	100%	96%	100%	87%	100%	96%	100%
% Heavy Vehicles	13%	0%	4%	0%	13%	0%	4%	0%
% Bicycles	0%	0%	0%	0%	0%	0%	0%	0%
# of Pedestrians (ped/hr)	0	0	0	0	0	0	0	0
PHF	0.95	0.92	0.95	0.92	0.95	0.92	0.95	0.92
F <sub>hv</sub>	1.000	1.000	0.958	1.000	0.888	1.000	0.958	1.000
F <sub>ped</sub>	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Entry/Conflicting Flows		N	NE	E	SE	S	SW	W	NW
Flow to	N (1), pcu/h	0	0	0	0	0	0	385	0
Leg #	NE (2), pcu/h	0	0	0	0	0	0	0	0
	E (3), pcu/h	0	0	248	0	0	0	1442	0
	SE (4), pcu/h	0	0	0	0	0	0	0	0
	S (5), pcu/h	0	0	0	0	0	0	0	0
	SW (6), pcu/h	0	0	0	0	0	0	0	0
	W (7), pcu/h	0	0	0	0	481	0	0	0
	NW (8), pcu/h	0	0	0	0	0	0	0	0
	Entry flow, pcu/h	0	0	248	0	481	0	1827	0
	Entry flow Lane 1, pcu/h	0	0	248	0	481	0	859	0
	Entry flow Lane 2, pcu/h	0	0	0	0	0	0	969	0
	Conflicting flow, pcu/h	0	0	866	0	2075	0	248	0

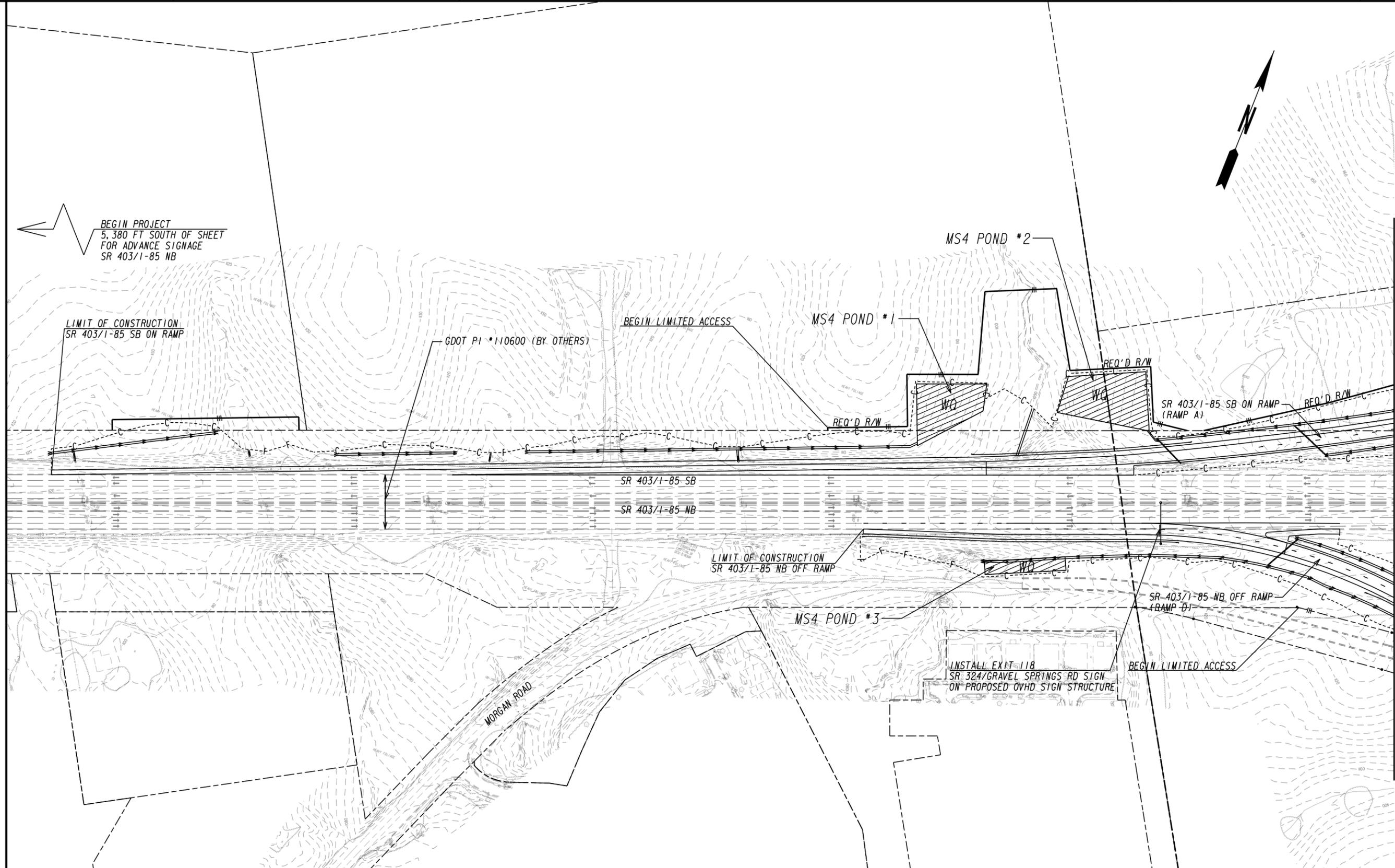
**Results: Approach Measures of Effectiveness**

HCM 2010 Model (build yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	590	590	235	NA	845	845
Entry Flow Rates, veh/h		NA	NA	237	0	427	NA	823	928
V/C ratio		#VALUE!	#VALUE!	0.40	0.00	1.82	#VALUE!	0.97	1.10
Control Delay, s/veh		#VALUE!	#VALUE!	12.1	6.1	420.5	#VALUE!	46.7	82.2
LOS		#VALUE!	#VALUE!	B	A	F	#VALUE!	E	F
95th % Queue (ft)		#VALUE!	#VALUE!	50	0	830	#VALUE!	423	640
Approach Delay, LOS		#VALUE!		58.9 sec, LOS F		528.8 sec, LOS F		65.6 sec, LOS F	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#VALUE!		#VALUE!		#VALUE!		#VALUE!	
Calibrated Model (future yr)		N		E		S		W	
Lane Designations		No Lane	No Lane	Thru	Right-Thru	Left Only	Right only	Left-Thru	Thru
Entry Capacity, veh/h		NA	NA	721	721	225	NA	1077	1077
Entry Flow Rates, veh/h		NA	NA	237	0	427	NA	823	928
V/C ratio		#VALUE!	#VALUE!	0.33	0.00	1.90	#VALUE!	0.76	0.86
Control Delay, s/veh		#VALUE!	#VALUE!	9.1	5.0	456.7	#VALUE!	17.0	24.1
LOS		#VALUE!	#VALUE!	A	A	F	#VALUE!	C	C
95th % Queue (ft)		#VALUE!	#VALUE!	38	0	859	#VALUE!	203	301
Approach Delay, LOS		#VALUE!		58.3 sec, LOS F		540.9 sec, LOS F		20.8 sec, LOS C	
		NE		SE		SW		NW	
Lane Designations		0	0	0	0	0	0	0	0
Entry Capacity, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
Entry Flow Rates, veh/h		NA	NA	NA	NA	NA	NA	NA	NA
V/C ratio				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Control Delay, sec/pcu				#VALUE!	#VALUE!			#VALUE!	#VALUE!
LOS				#VALUE!	#VALUE!			#VALUE!	#VALUE!
95th % Queue (ft)				#VALUE!	#VALUE!			#VALUE!	#VALUE!
Approach Delay, LOS		#N/A		#N/A		#N/A		#N/A	

v2.1

<b>Bypass Lane Merge Point Analysis (if applicable)</b>						
<b>Bypass Characteristics</b>	<b>Bypass #1</b>	<b>Bypass #2</b>	<b>Bypass #3</b>	<b>Bypass #4</b>	<b>Bypass #5</b>	<b>Bypass #6</b>
Select Entry Leg from Bypass (FROM)	<b>E (3)</b>	<b>S (5)</b>				
Select Exit Leg for Bypass (TO)	<b>N (1)</b>	<b>E (3)</b>				
<b>Does the bypass have a dedicated receiving lane?</b>	<b>No</b>	<b>No</b>				
<b># of Conflicting Exit Flow Lanes</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<i>Volumes</i>						
Entry Leg: Insert Right Turn Volume	845	805				
Exit Leg: <b>(Select Input Method)</b>	Default	Default				
Lane Flow in Exit Leg***	257	1216				
Sum of inner circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Sum of outer circulatory flow lane to exit leg (leg bypass merges into)	N/A	N/A	N/A	N/A	N/A	N/A
Critical Lane Flow (Manual) in Exit Leg***						
<i>Volume Characteristics</i>						
PHF (Entry Leg)	0.95	0.95				
F <sub>HV</sub> (Entry Leg)	0.96	0.89				
F <sub>ped</sub>	1.00	1.00				
PHF (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
F <sub>HV</sub> (Exit Leg)***	N/A	N/A	N/A	N/A	N/A	N/A
<b>***Volume Characteristics are already taken into account for Default method ONLY. Insert Values above if Manual method.</b>						
<i>Entry/Conflicting Flows</i>						
Entry Flow	930	956				
Conflicting Critical Flow	257	1216				
<b>Bypass Lane Results</b>						
Entry Capacity of Bypass, veh/h	837	428				
Flow Rates of Exiting Traffic, veh/h	891	849				
V/C ratio	1.06	2.23				
Control Delay, sec/pcu	71.4	583.3				
LOS	F	F				
95th % Queue (ft)	573	2001				

Attachment 9- Concept Level  
Hydrology Study for MS4  
Permit

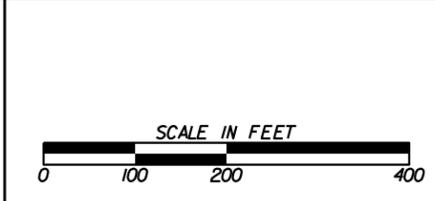


EXISTING R/W & PROPERTY LINE	----
REQUIRED R/W LINE	=====
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨▨▨▨
EASEMENT FOR CONSTR OF SLOPES	▧▧▧▧
EASEMENT FOR CONSTR OF DRIVES	▩▩▩▩

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	====
R/W AND LIMIT OF ACCESS	====



GRESHAM  
SMITH AND  
PARTNERS



REVISION DATES

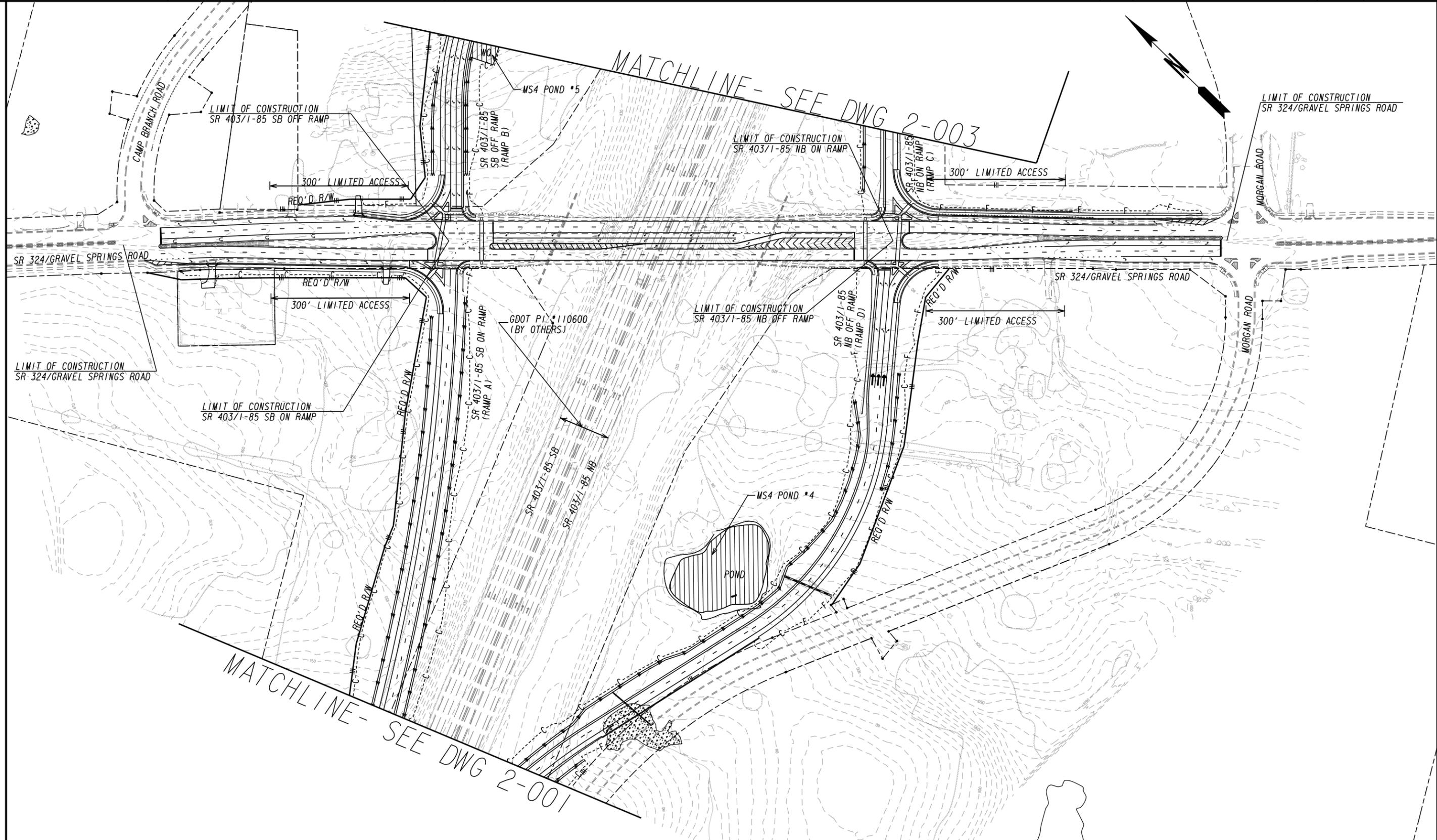
STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION

OFFICE: PROGRAM DELIVERY

**CONCEPT LEVEL HYDROLOGY  
STUDY FOR MS4 PERMIT**

SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE  
PI: 0012698 COUNTY: GWINNETT

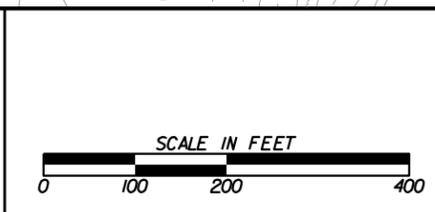
DRAWING No.  
**2-001**



EXISTING R/W & PROPERTY LINE	----
REQUIRED R/W LINE	=====
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨▨▨▨
EASEMENT FOR CONSTR OF SLOPES	▧▧▧▧
EASEMENT FOR CONSTR OF DRIVES	▩▩▩▩

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	====
R/W AND LIMIT OF ACCESS	====

GRESHAM  
SMITH AND  
PARTNERS



REVISION DATES

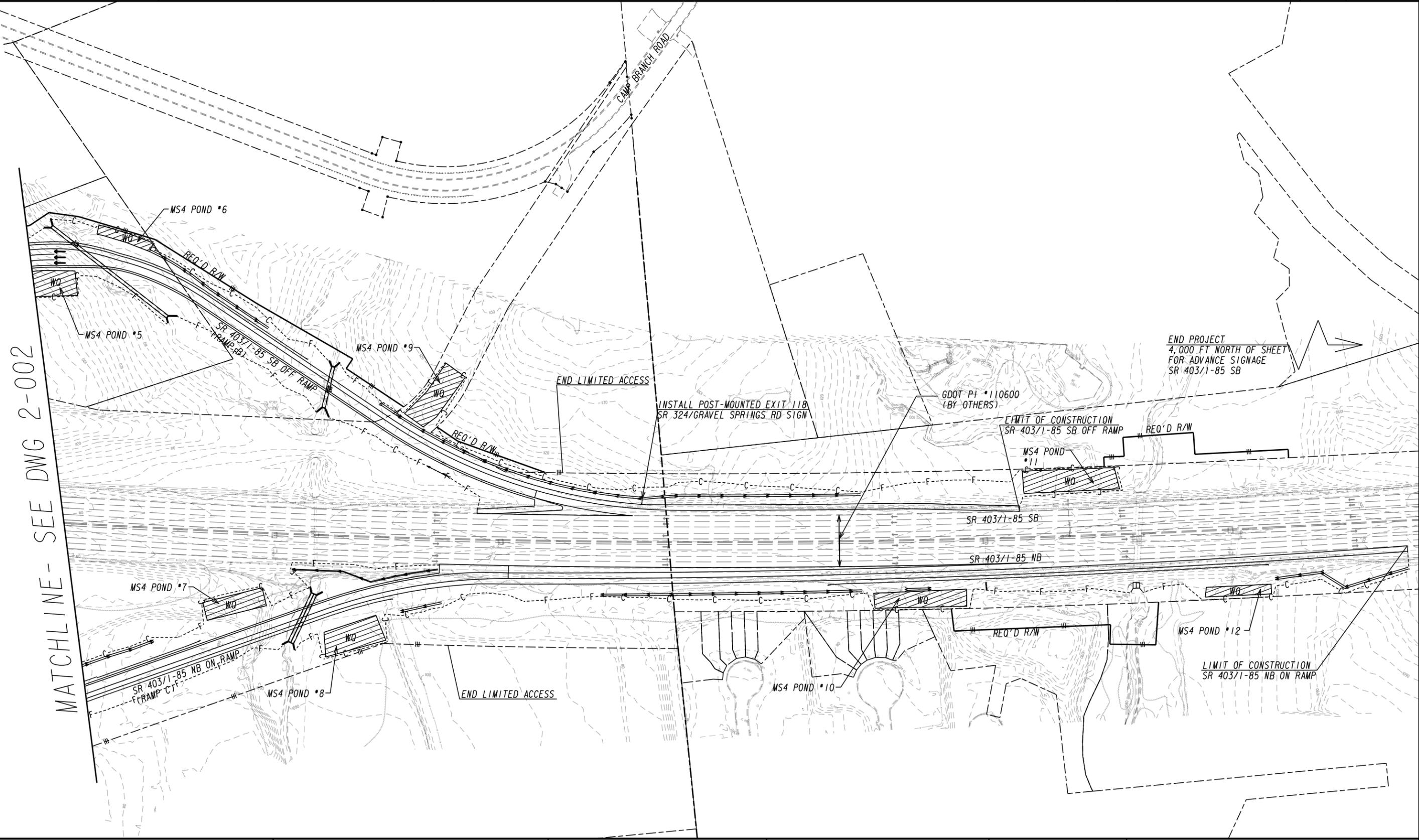
STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION

OFFICE: PROGRAM DELIVERY

**CONCEPT LEVEL HYDROLOGY  
STUDY FOR MS4 PERMIT**

SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE  
PI: 0012698 COUNTY: GWINNETT

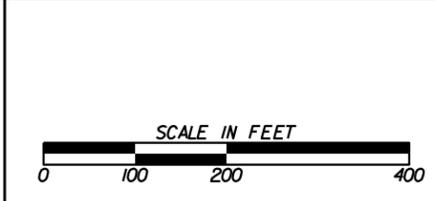
DRAWING No.  
**2-002**



EXISTING R/W & PROPERTY LINE	----
REQUIRED R/W LINE	=====
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨▨▨▨
EASEMENT FOR CONSTR OF SLOPES	▧▧▧▧
EASEMENT FOR CONSTR OF DRIVES	▩▩▩▩

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	=====
R/W AND LIMIT OF ACCESS	=====


**GRESHAM  
SMITH AND  
PARTNERS**



REVISION DATES

STATE OF GEORGIA  
 DEPARTMENT OF TRANSPORTATION  
 OFFICE: PROGRAM DELIVERY  
**CONCEPT LEVEL HYDROLOGY  
STUDY FOR MS4 PERMIT**  
 SR 403/INTERSTATE 85 AT SR 324/  
 GRAVEL SPRINGS ROAD INTERCHANGE  
 PI: 0012698 COUNTY: GWINNETT

DRAWING No.  
**2-003**

Attachment 10- Preliminary  
Pavement Type Evaluation and  
Selection Reports

**DEPARTMENT OF TRANSPORTATION  
STATE OF GEORGIA**

---

**INTERDEPARTMENTAL CORRESPONDENCE**

**FILE** PI No. 0012698 **OFFICE** Materials & Testing  
SR 324 at I-85/SR 403 Forest Park, Georgia  
Gwinnet County **DATE** December 8, 2014  
*D.E.T. For*

**FROM** Charles A. Hasty, P.E., State Materials Engineer

**TO** Albert Shelby, Office of Program Delivery  
Attention: Charles Robinson, Project Manager

**SUBJECT** **Preliminary Pavement Evaluation Summary**  
I-85/ SR 403 at SR 324/Gravel Springs Road Interchange

As requested, a Preliminary Pavement Evaluation Summary has been performed on the aforementioned project. The results of this work are attached.

If additional information is needed, please contact James Turner of the Geotechnical Environmental Pavement Bureau at (404) 608-4776.

CAH: SJW/NAW/JHT

Attachments

- Preliminary Pavement Evaluation Summary
- Full-Depth Flexible Design – SR324
- Full-Depth Flexible Design – Ramps
- Full-Depth Rigid Design - Ramps
- Project Location Map

cc: Brent Cook, P.E., District Engineer, Gainesville  
Matt Needham, Area Engineer, Gainesville

File

**PRELIMINARY PAVEMENT EVALUATION SUMMARY**  
**For**  
**I-85/ SR 324 Interchange, Gwinnett County**  
**PI No. 0012698**

**1. LOCATION / DESCRIPTION**

This project proposes four new ramps to create a new location, full access diamond interchange with the existing overpass of (non-controlled access) SR 324/Gravel Springs Road over (controlled access) I-85/SR 403. The interchange will be situated between the existing SR 20/Buford Drive and Hamilton Mill Road interchanges at MP 118 within Gwinnet County. The proposal includes widening SR 324 to include turn lanes for the access ramps.

**Station to Station**

No station numbers have been established for this project.

**Location**

SR 324  
I-85/SR 403

**2. PAVEMENT CONDITION SUMMARY**

**SR 324**

The existing pavement on this roadway is in excellent visual condition within the limits of the project. A visual inspection of the roadway was performed on October 23, 2014.

**3. PAVEMENT RECOMMENDATION SUMMARY**

The full-depth pavement recommendation is shown in Section 4: *Full-Depth Section*. No overlay recommendations are provided at this time.

**4. FULL-DEPTH SECTION**

This section is recommended for the widening on SR 324.

<b>Full-Depth Construction for Widening of SR 324</b>				
<b>Pay Item Number</b>	<b>Material</b>	<b>Course</b>	<b>Thickness</b>	<b>Spread Rate</b>
402-3130	12.5 mm Superpave	Surface	1.5 inches	165 lbs/yd <sup>2</sup>
402-3190	19 mm Superpave	Binder	2 inches	220 lbs/yd <sup>2</sup>
402-3121	25 mm Superpave	Asphalt Base	6 inches	660 lbs/yd <sup>2</sup>
310-1001	Graded Aggregate Base	Base	10 inches	N/A

The following full-depth pavement alternatives are recommended for the ramps at the proposed I-85/SR 324 interchange.

<b>Full-Depth for New Construction – PCC Option I-85/SR 324 Ramps (0+00 to 5+00)</b>				
<b>Pay Item Number</b>	<b>Material</b>	<b>Course</b>	<b>Thickness</b>	<b>Spread Rate</b>
430-0210	Plain PC Concrete Pavement	Surface	11.0 inches	N/A
402-3190	19 mm Superpave	Interlayer	3 inches	330 lbs/yd <sup>2</sup>
310-1001	Graded Aggregate Base	Base	12 inches	N/A

- Or -

<b>Full-Depth for New Construction – Asphalt Option I-85/SR 324 Ramps (0+00 to 5+00)</b>				
<b>Pay Item Number</b>	<b>Material</b>	<b>Course</b>	<b>Thickness</b>	<b>Spread Rate</b>
402-4510	12.5 mm Superpave Polymer Modified	Surface	1.5 inches	165 lbs/yd <sup>2</sup>
402-3190	19 mm Superpave	Binder	2 inches	220 lbs/yd <sup>2</sup>
402-3121	25 mm Superpave	Asphalt Base	9 inches	990 lbs/yd <sup>2</sup>
310-1001	Graded Aggregate Base	Base	12 inches	N/A

#### **5. OVERLAY SECTIONS**

There is no overlay recommendation for this project.

#### **6. CORES**

Cores have not been recovered on this project. Therefore, no core information is available at this time.

#### **7. PAVEMENT DISTRESSES**

No pavement distresses were encountered during the field investigation of this project.

#### **8. COPACES**

COPACES ratings are based on a visual survey of surface distresses of the pavement. In 2014, the average rating for SR 324 from MP 2.32 to MP 3.06 was 100.

**9. OTHER INFORMATION**

- This is a preliminary pavement evaluation request. No core samples were recovered during the field work of these projects.
- The pavement design recommendations may be revised if updated traffic data is available at the time a complete pavement evaluation work is being performed.
- The existing pavement distress information was based on the site visit from October 2014.

**Reported By: James Turner**

**Reviewed By:**



**A. J. Jubran, P. E.**  
*State Pavement Engineer*

## Flexible Pavement Design Analysis

<b>PI Number</b>	0012698	<b>County(s)</b>	Gwinnett
<b>Project Number</b>	N/A	<b>Design Name</b>	SR 324 Widening
<b>Project Description</b>	SR 324/ Gravel Springs Road at I-85/ SR 403		

Traffic Data (AADTs are one-way)					Miscellaneous Data		
<b>Initial Design Year</b>	2020	<b>Initial AADT, VPD</b>	16,300	<b>24 Hour Truck %</b>	6.00	<b>Lanes in one direction</b>	2
<b>Final Design Year</b>	2040	<b>Final AADT, VPD</b>	13,400	<b>SU Truck %</b>	5.00	<b>Curb &amp; Gutter/Barrier</b>	Yes
		<b>Mean AADT, VPD</b>	14,850	<b>MU Truck %</b>	1.00		

Design Data					
<b>Lane Distribution Factor (%)</b>	70.00	<b>Soil Support Value</b>	2.50	<b>Single Unit ESAL</b>	0.40
<b>Terminal Serviceability Index</b>	2.50	<b>Regional Factor</b>	1.80	<b>Multiple Unit ESAL</b>	1.50
		<b>User Defined 18-KIP ESAL</b>	0.00	<b>Calculated 18-KIP ESAL</b>	0.58
<b>Non-Standard Value Comment</b>					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	LDF (%)	Vehicle Type	Volume (%)	ESAL Factor	Daily ESAL
14,850	70.00	Single Unit Truck	5.00	0.40	208
		Multi Unit Truck	1.00	1.50	156
<b>Total Daily ESALs</b>					364
<b>Total Design Period ESALs</b>					2,657,200

Proposed Flexible Full Depth Pavement Structure				
Course	Material	Thickness (inches)	Structural Coefficient	Structural Value
Course 1	12.5 mm Superpave, Polymer Modified	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	10.00	0.1600	1.60
<b>Required SN</b>	5.31	<b>Proposed pavement is 4.41% Underdesigned</b>		<b>Proposed SN</b>
				5.08

<b>Design Remarks</b>	Turn Lane
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<b>Prepared By</b>	Jacob Walker, Nathan Wilson, CE 2	10/27/2014 3:54 PM
		<b>Date</b>
<b>Recommended By</b>	State Roadway Design Engineer	<b>Date</b>
<b>Approved By</b>	State Pavement Engineer	<b>Date</b>

## Rigid Pavement Design Analysis

PI Number	0012698	County(s)	Gwinnett		
Project Number	N/A	Design Name	SR 324 Ramps		
Project Description	SR 324/ Gravel Springs Road at I-85/ SR 403				
Section Location	SR 324 at I 85			Type Section	JPCP
Begin Section Station	0	End Section Station	500	Section Length	500

Traffic Data (AADTs are one-way)					Miscellaneous Data		
Initial Design Year	2020	Initial AADT, VPD	4,675	24 Hour Truck %	21.00	Lanes in one direction	2
Final Design Year	2040	Final AADT, VPD	10,175	SU Truck %	3.00	Curb & Gutter/Barrier	No
		Mean AADT, VPD	7,425	MU Truck %	18.00	Interstate	Yes

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	LDF (%)	Vehicle Type	Volume (%)	ESAL Factor	Daily ESAL
7,425	90	Other Vehicles	79.00	0.004	22
		Single Unit Truck	3.00	0.500	101
		Multi Unit Truck	18.00	2.680	3,224
<b>Total Daily ESALs</b>					3,347
<b>Total Design Period ESALs</b>					24,433,100

Design Data							
Terminal Serviceability Index (P <sub>t</sub> )	2.50	Working Stress (psi)	450	Modulus of Elasticity (psi)	3,200,000		
Soil Support Value	2.50	Subgrade Modulus (k)	130	Subbase Modulus (k <sub>s</sub> )	225	Subbase Modulus (k <sub>sub</sub> )	280
Trial Depth of PCC Pavement (inches)			11.00	Calculated Stress from Equation (psi)			485.91
% Overstressed		7.98	% Underdesigned		7.39	Balanced Thickness (inches)	11.47
Non-Standard Value Comment							

Proposed Rigid Pavement Structure	
Material	Thickness (inches)
JPCP - Jointed Portland Cement Concrete Pavement	11.00
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	
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Prepared By \_\_\_\_\_ 12/8/2014 3:20 PM  
 Jacob Walker, Nathan Wilson, CE 2 \_\_\_\_\_ Date

Recommended By \_\_\_\_\_  
 State Roadway Design Engineer \_\_\_\_\_ Date

Approved By \_\_\_\_\_  
 State Pavement Engineer \_\_\_\_\_ Date

## Flexible Pavement Design Analysis

<b>PI Number</b>	0012698	<b>County(s)</b>	Gwinnett
<b>Project Number</b>	N/A	<b>Design Name</b>	SR 324 Ramps
<b>Project Description</b>	SR 324/ Gravel Springs Road at I-85/ SR 403		

Traffic Data (AADTs are one-way)					Miscellaneous Data		
<b>Initial Design Year</b>	2020	<b>Initial AADT, VPD</b>	4,675	<b>24 Hour Truck %</b>	21.00	<b>Lanes in one direction</b>	2
<b>Final Design Year</b>	2040	<b>Final AADT, VPD</b>	10,175	<b>SU Truck %</b>	3.00	<b>Curb &amp; Gutter/Barrier</b>	No
		<b>Mean AADT, VPD</b>	7,425	<b>MU Truck %</b>	18.00		

Design Data					
<b>Lane Distribution Factor (%)</b>	90.00	<b>Soil Support Value</b>	2.50	<b>Single Unit ESAL</b>	0.40
<b>Terminal Serviceability Index</b>	2.50	<b>Regional Factor</b>	1.80	<b>Multiple Unit ESAL</b>	1.50
		<b>User Defined 18-KIP ESAL</b>	0.00	<b>Calculated 18-KIP ESAL</b>	1.34
<b>Non-Standard Value Comment</b>					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	LDF (%)	Vehicle Type	Volume (%)	ESAL Factor	Daily ESAL
7,425	90.00	Single Unit Truck	3.00	0.40	81
		Multi Unit Truck	18.00	1.50	1,805
<b>Total Daily ESALs</b>					1,886
<b>Total Design Period ESALs</b>					13,767,800

Proposed Flexible Full Depth Pavement Structure				
Course	Material	Thickness (inches)	Structural Coefficient	Structural Value
Course 1	12.5 mm Superpave, Polymer Modified	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
		8.00	0.3000	2.40
Course 4	Graded Aggregate Base	12.00	0.1600	1.92
<b>Required SN</b>	6.61	<b>Proposed pavement is 4.67% Underdesigned</b>		<b>Proposed SN</b>
				6.30

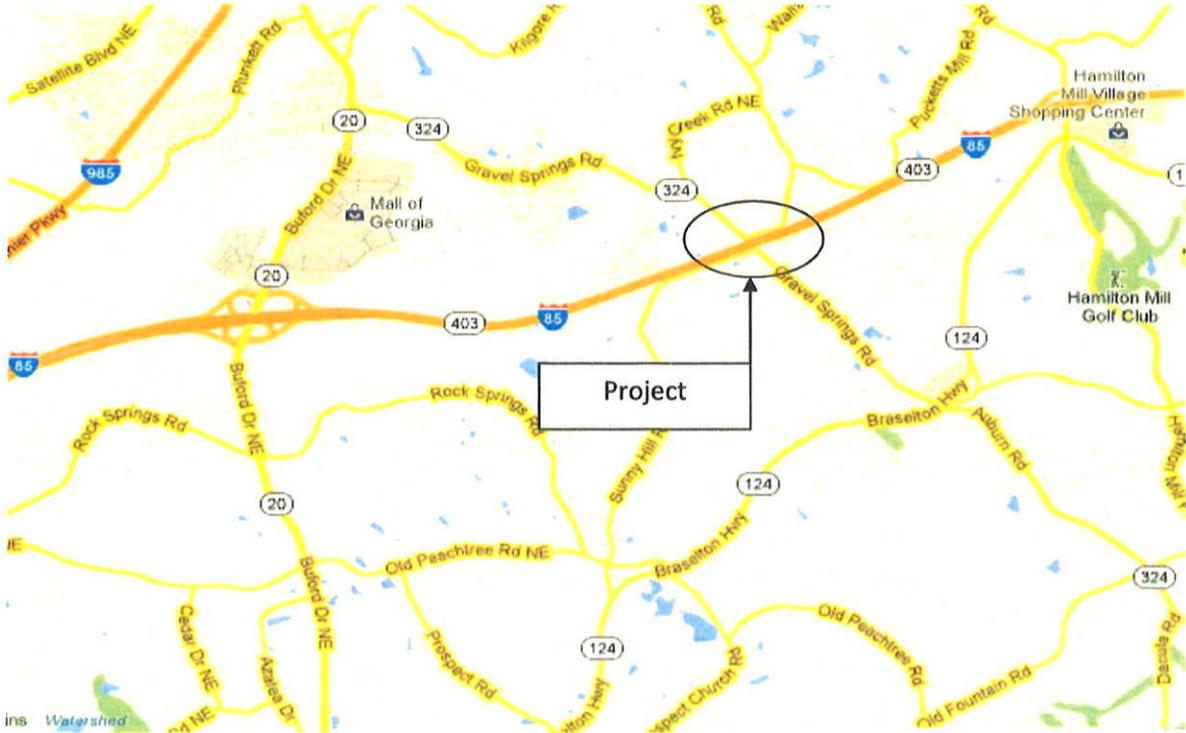
<b>Design Remarks</b>	Asphalt Ramp
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Prepared By \_\_\_\_\_ 10/27/2014 3:56 PM  
Jacob Walker, Nathan Wilson, CE 2 Date

Recommended By \_\_\_\_\_  
State Roadway Design Engineer Date

Approved By \_\_\_\_\_  
State Pavement Engineer Date

**PROJECT LOCATION MAP**



**Gravel Springs Road / SR 324 @ I-85/SR 403 Interchange)**

**Georgia Department of Transportation PI # 0012698**

**Gwinnett County Department of Transportation Project Number F-0782-01**

**DEPARTMENT OF TRANSPORTATION  
STATE OF GEORGIA**

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**INTERDEPARTMENTAL CORRESPONDENCE**

**FILE** PI 0012698 Gwinnett  
SR 324 at I-85/SR 403

**OFFICE** Materials & Testing  
Forest Park, Georgia

**DATE** December 8, 2014

*J. E. T. For*

**FROM** Charles A. Hasty, P.E., State Materials Engineer

**TO** Albert V. Shelby, State Program Delivery Engineer  
Attention: Charles Robinson, Project Manager

**SUBJECT** **Preliminary Pavement Type Selection Report**  
SR 324 at I-85 / SR 403 Interchange

The Office of Materials and Testing (OMAT) has completed a Life Cycle Cost Analysis and Preliminary Pavement Type Selection (PTS) Report for the above referenced project.

**Project Description and Location**

This project proposes four new ramps to create a new location, full access diamond interchange with the existing overpass of (non-controlled access) SR 324/Gravel Springs Road over (controlled access) I-85/SR 403. The interchange will be situated between the existing SR 20/Buford Drive and Hamilton Mill Road interchanges at MP 118 within Gwinnet County.

**Pavement Design Alternatives Considered**

The LCCA analyzed the costs of the project by comparing two alternative pavement solutions for the ramps. Alternative A uses reconstruction with full-depth Hot Mix Asphalt (HMA) pavement. Alternative B uses reconstruction with full-depth Jointed Plain Concrete (JPC) pavement. Widening for SR 324 should consist of HMA to match existing pavement.

**Pavement Type Recommendation**

The LCCA analysis concludes that is no clear preferred alternative for the new construction of SR 324 ramps at I-85 / SR 403. This project is a candidate for alternate bidding. This analysis considered the economics of construction costs, mobilization costs, long term pavement performance, maintenance costs and other factors over the analysis period. The alternatives considered are listed in Table 1.

**Table 1: Pavement Design Alternatives**

Design Alternatives	Profile	Drainage Surface	Surface	Intermediate (Binder)	Base	Sub-base
<b>Alternative A, (Full-Depth HMA)</b>	Ramps	---	12.5 mm Superpave Polymer Modified (1.50")	19 mm Superpave (2.00")	25 mm Superpave (9.00")	Graded Aggregate Base (12.00")
<b>Alternative B, (Full-Depth PCC)</b>	Ramps	---	PCC (11.00")	19 mm Superpave (3.00")	---	Graded Aggregate Base (12.00")

**LCCA Factors**

The LCCA is based on the following:

- The deterministic approach to LCCA based on the guidelines in the following document:
  - Federal Highway Administration Publication No. FHWA-SA-98-079, "Life-Cycle Cost Analysis in Pavement Design."
- The analysis periods were 40 years and 50 years. Recommendations were based on the 40-year analysis.
- Staging costs and durations for staging were *not* considered.
- A discount Rate of 4 %.
- The service life prior to first major maintenance activities were as follows:
  - 10 years for Asphaltic Concrete Pavements (AC)
  - 20 years for Portland Cement Concrete Pavements (PCC)
- Average Plant Production rates determined from historical project information within the Georgia Department of Transportation as follows:
  - Asphalt Concrete plant production rate of 200 tons per hour.
  - Ready Mix Concrete plant production rate of 6000 square yards per day in addition to the following:
    - A 4000 linear feet of paving for a 12-foot wide lane
    - A 2500 linear feet of paving for a 24-foot wide lane

Table 2 summarizes the total Agency Costs:

**Table 2: Agency Costs**

<b>Design Alternates</b>	<b>Agency Costs</b>		<b>Total Costs</b>
	<b>Initial Agency Costs (A)</b>	<b>Future Maintenance Costs (B)</b>	<b>(A)+ (B)</b>
<b>Alternative A, Full-Depth HMA</b>	\$1,335,074	\$265,103	\$1,600,177
<b>Alternative B, Full-Depth PCC</b>	\$1,554,718	\$244,584	\$1,799,302

Table 3 summarizes the total User Costs:

**Table 3: User Costs**

<b>Design Alternates</b>	<b>User Costs</b>		<b>Total Costs</b>
	<b>Initial User Costs (A)</b>	<b>Future User Costs (B)</b>	<b>(A) + (B)</b>
<b>Alternative A, Full-Depth HMA</b>	\$0	\$4,456	\$4,456
<b>Alternative B, Full-Depth PCC</b>	\$0	\$1,485	\$1,485

Table 4 summarizes the Total Scores and Ranking from the Decision Matrix. The scores were determined from the LCCA using a 40-year Analysis Period.

**Table 4: Total Score**

<b>Design Alternates</b>	<b>Rank</b>	<b>Total Score</b>
<b>Alternative A, Full-Depth HMA</b>	1	90.0
<b>Alternative B, Full-Depth PCC</b>	2	89.4

Copies of the project report summary can be obtained upon request from the Geotechnical Environmental Pavement Bureau.

If additional information is needed, please contact James Turner of the Geotechnical Environmental Pavement Bureau at (404) 608-4776.

CAH: JHT

Attachments

- Full Depth HMA Design
- Full Depth JPC Design
- Decision Matrix
- Project Location Map

## Flexible Pavement Design Analysis

<b>PI Number</b>	0012698	<b>County(s)</b>	Gwinnett
<b>Project Number</b>	N/A	<b>Design Name</b>	SR 324 Ramps
<b>Project Description</b>	SR 324/ Gravel Springs Road at I-85/ SR 403		

Traffic Data (AADTs are one-way)						Miscellaneous Data	
<b>Initial Design Year</b>	2020	<b>Initial AADT, VPD</b>	4,675	<b>24 Hour Truck %</b>	21.00	<b>Lanes in one direction</b>	2
<b>Final Design Year</b>	2040	<b>Final AADT, VPD</b>	10,175	<b>SU Truck %</b>	3.00	<b>Curb &amp; Gutter/Barrier</b>	No
		<b>Mean AADT, VPD</b>	7,425	<b>MU Truck %</b>	18.00		

Design Data					
<b>Lane Distribution Factor (%)</b>	90.00	<b>Soil Support Value</b>	2.50	<b>Single Unit ESAL</b>	0.40
<b>Terminal Serviceability Index</b>	2.50	<b>Regional Factor</b>	1.80	<b>Multiple Unit ESAL</b>	1.50
		<b>User Defined 18-KIP ESAL</b>	0.00	<b>Calculated 18-KIP ESAL</b>	1.34
<b>Non-Standard Value Comment</b>					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	LDF (%)	Vehicle Type	Volume (%)	ESAL Factor	Daily ESAL
7,425	90.00	Single Unit Truck	3.00	0.40	81
		Multi Unit Truck	18.00	1.50	1,805
<b>Total Daily ESALs</b>					1,886
<b>Total Design Period ESALs</b>					13,767,800

Proposed Flexible Full Depth Pavement Structure				
Course	Material	Thickness (inches)	Structural Coefficient	Structural Value
Course 1	12.5 mm Superpave, Polymer Modified	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
		8.00	0.3000	2.40
Course 4	Graded Aggregate Base	12.00	0.1600	1.92
<b>Required SN</b>	6.61	<b>Proposed pavement is 4.67% Underdesigned</b>		<b>Proposed SN</b>
				6.30

<b>Design Remarks</b>	Asphalt Ramp
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**Prepared By** \_\_\_\_\_ 10/27/2014 3:56 PM  
Jacob Walker, Nathan Wilson, CE 2 **Date**

**Recommended By** \_\_\_\_\_  
State Roadway Design Engineer **Date**

**Approved By** \_\_\_\_\_  
State Pavement Engineer **Date**

## Rigid Pavement Design Analysis

PI Number	0012698	County(s)	Gwinnett
Project Number	N/A	Design Name	SR 324 Ramps
Project Description	SR 324/ Gravel Springs Road at I-85/ SR 403		
Section Location	SR 324 at I 85	Type Section	JPCP
Begin Section Station	0	End Section Station	500
		Section Length	500

Traffic Data (AADTs are one-way)					Miscellaneous Data		
Initial Design Year	2020	Initial AADT, VPD	4,675	24 Hour Truck %	21.00	Lanes in one direction	2
Final Design Year	2040	Final AADT, VPD	10,175	SU Truck %	3.00	Curb & Gutter/Barrier	No
		Mean AADT, VPD	7,425	MU Truck %	18.00	Interstate	Yes

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	LDF (%)	Vehicle Type	Volume (%)	ESAL Factor	Daily ESAL
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		Single Unit Truck	3.00	0.500	101
		Multi Unit Truck	18.00	2.680	3,224
<b>Total Daily ESALs</b>					3,347
<b>Total Design Period ESALs</b>					24,433,100

Design Data							
Terminal Serviceability Index (P <sub>t</sub> )	2.50	Working Stress (psi)	450	Modulus of Elasticity (psi)	3,200,000		
Soil Support Value	2.50	Subgrade Modulus (k)	130	Subbase Modulus (k <sub>s</sub> )	225	Subbase Modulus (k <sub>sub</sub> )	280
Trial Depth of PCC Pavement (inches)			11.00	Calculated Stress from Equation (psi)			485.91
% Overstressed		7.98	% Underdesigned		7.39	Balanced Thickness (inches)	11.47
Non-Standard Value Comment							

Proposed Rigid Pavement Structure	
Material	Thickness (inches)
JPCP - Jointed Portland Cement Concrete Pavement	11.00
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	
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Prepared By	Jacob Walker, Nathan Wilson, CE 2	12/8/2014 3:20 PM
		Date
Recommended By	State Roadway Design Engineer	Date
		Date
Approved By	State Pavement Engineer	Date
		Date

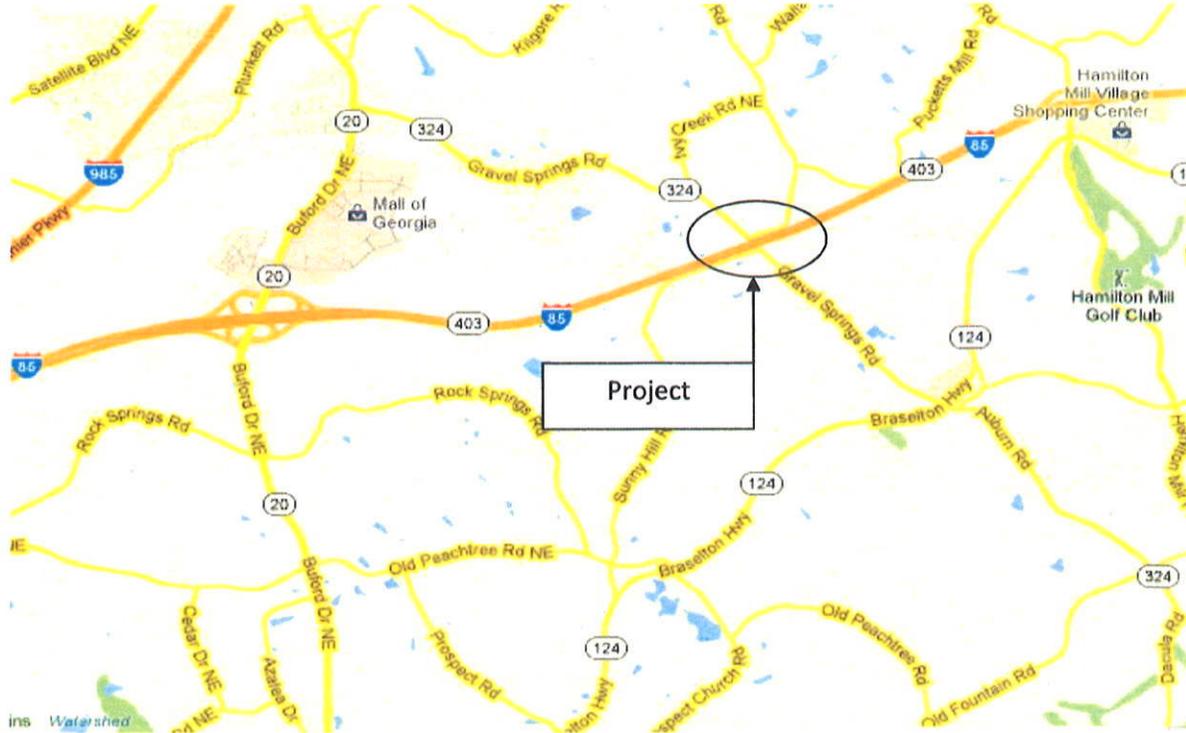
DECISION MATRIX

Relative Importance	DECISION FACTOR										Total Score	Rank
	Initial Construction Agency Costs	Maintenance Costs (nominal / discounted)	Annualized Agency Costs (LCC)	Annualized User Costs (LCC)	Salvage Value	Expected Life (Rehabilitation Frequency)	Construction (production rate - initial days)	Ease of Repairing / Maintaining (production rate - rehab days)	Constructibility / Traffic Control (Lifts)	Proven Design in Agency		
	50%	25%	5%	5%	2%	2%	2%	2%	2%	5%		
<b>ALTERNATIVE A-HMA Full Depth Mainline</b>	1.00 50.0	0.92 23.1	1.00 5.0	0.33 1.7	0.00 0.0	0.50 1.0	1.00 2.0	0.33 0.7	0.80 1.6	1.00 5.0	90.0	1
<b>ALTERNATIVE B-PCC Full Depth Mainline</b>	0.86 42.9	1.00 25.0	0.89 4.4	1.00 5.0	0.00 0.0	1.00 2.0	0.50 1.0	1.00 2.0	1.00 2.0	1.00 5.0	89.4	2

P.I. Number: 0012698

County: Gwinnett

### PROJECT LOCATION MAP



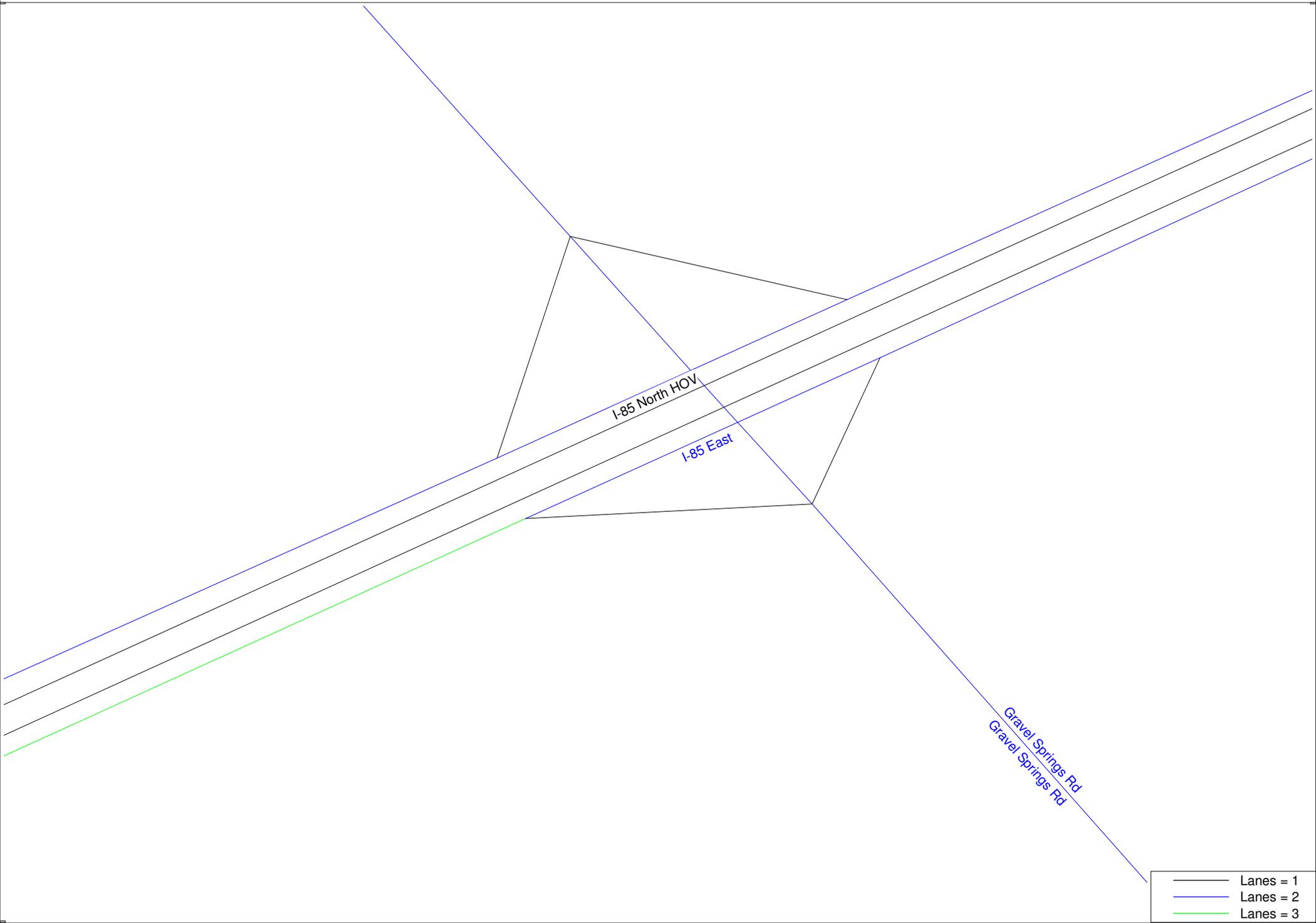
***Gravel Springs Road / SR 324 @ I-85/SR 403 Interchange)***

***Georgia Department of Transportation PI # 0012698***

***Gwinnett County Department of Transportation Project Number F-0782-01***

Attachment 11- Conforming  
Plan's Network Schematics  
Showing Thru Lanes

# ARC 2030 Highway Network I-85 N Interchange at Gravel Springs Rd



# Attachment 12- Minutes of Concept Meetings



G R E S H A M  
S M I T H   A N D  
P A R T N E R S

## **INITIAL CONCEPT TEAM MEETING NOTES**

### **Gravel Springs Road/ SR 324 at I-85/SR 403 Interchange GDOT PI #0012698**

Gwinnett County Project No. F-0782-01  
GS&P Project 27757.05

MEETING DATE:    April 25, 2014

PARTICIPANTS:    Charles Robinson – Georgia DOT, Office of Program Delivery (GDOT)  
                          John Ray – Gwinnett County DOT (GCDOT)  
                          Lewis Cooksey – Gwinnett County DOT (GCDOT)  
                          Vince Edwards – Gwinnett County DOT (GCDOT)  
                          Alan Chapman – Gwinnett County DOT (GCDOT)  
                          Hank Collins – MAAI  
                          Chris Parypinski – MAAI  
                          L.N. Manchi – MAAI  
                          Eric Rickert – GS&P  
                          Jody Braswell – GS&P

DISCUSSION:        I-85/SR 324 INTERCHANGE-CONCEPT COORDINATION

A meeting was held for this project to introduce the GDOT Project Manager to the project and to the work and planning that has previously been performed by Gwinnett County DOT.

1. GDOT noted that while this project will have FHWA oversight, it will be done with less oversight under the new Projects of Division Interest (PODI) guidelines. A Traffic Management Plan will also be required for the Concept Report.
2. GDOT mentioned that the project's schedule should allow six months for the approval of traffic. GDOT also recommended that the project's PIOH should wait until the traffic is approved, but the Concept Team Meeting could proceed without it. Lastly, GDOT stated that the project schedule for the Environmental Assessment document should be 27 months.
3. GDOT suggested a concept team meeting be held in June or July.
4. GS&P noted that design variances will be needed from GDOT pertaining to the proposed raised median opening spacing's as these will be less than the 1000 ft. GDOT minimum lengths. These locations include between Camp Branch Road and the southbound ramp terminals, between the northbound and southbound ramp terminals, and between the northbound ramp terminals and Morgan Road.

**Design Services For The Built Environment**

2325 Lakeview Parkway, Suite 400 / Alpharetta, Georgia 30009-1976 / Phone 770.754.0755 / [www.gspnet.com](http://www.gspnet.com)

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MEETING MINUTES

Gravel Springs Road/ SR 324 at I-85/SR 403 Interchange

GDOT PI #0012698

Gwinnett County Project No. F-0782-01

GS&P Project 27757.05

5. The project schedule shows let to construction in July 2018. The traffic analysis should reflect a 2020 opening year and 2040 design year.
6. GDOT and GCDOT requested that GS&P provide an updated parcel count (Post meeting note: 11 parcels including limited access would need to be acquired).
7. GDOT and GCDOT also requested that GS&P verify that the environmental study limits and proposed right of way reflect the proposed MS4 facilities.
8. GS&P mentioned the exit ramp signage will extend beyond the primary construction limits, but will need to be included in the environmental study area. MAAI will coordinate with GDOT/OES to determine how to handle these impacts. It was mentioned that signage locations with the I-85/SR403 Managed/HOT lane project should be coordinated as well.
9. GCDOT and MAAI asked GS&P to relay to the surveyor that they locate the center of the stream features needed for permits.
10. Gwinnett County stated that they will decide on whether lighting would be included as part of the project.
11. GDOT and MAAI suggested that a coordination meeting with GDOT PI #110600, the I-85/SR 403 managed/HOT lane project, would be beneficial.
12. GCDOT stated that either they or GDOT will do the utility coordination, which is to be decided.
13. GDOT stated that Project Framework Agreement (PFA) will not be required for this project.

*This represents our understanding of the items discussed at this meeting. If you have any questions or comments concerning any of the information contained herein, please contact me.*

Prepared by: Eric Rickert  
Project Engineer

Copy      Participants  
            File



G R E S H A M  
S M I T H   A N D  
P A R T N E R S

## **CONCEPT TEAM MEETING NOTES**

### **Gravel Springs Road/ SR 324 at I-85/SR 403 Interchange GDOT PI #0012698**

Gwinnett County Project No. F-0782-01  
GS&P Project 27757.05

MEETING DATE: December 3, 2014

PARTICIPANTS: Charles Robinson – Georgia DOT, Office of Program Delivery (GDOT-OPD)  
Kim Coley – Georgia DOT, Office of Planning (GDOT)  
Shane Giles – Georgia DOT, D1 Traffic Operations (GDOT)  
Kim Byers – Georgia DOT, D1 Right of Way (GDOT)  
Steve Sander – Georgia DOT, Office of Engineering Services (GDOT)  
Harold D. Mull – Georgia DOT, D1 Construction (GDOT)  
Matt Needham – Georgia DOT, D1 Construction (GDOT)  
Nathaniel O'Kelley – Georgia DOT, D1 Utilities (GDOT)  
Brent Cook – Georgia DOT, D1 District Engineer (GDOT)  
Darrell Richardson – Georgia DOT, Office of Program Management (GDOT)  
John Payne – Keck & Wood/ City of Buford Natural Gas  
John Ray – Gwinnett County DOT (GCDOT)  
Lewis Cooksey – Gwinnett County DOT (GCDOT)  
Derrick Kemp – Gwinnett County Dept. of Water Resources (GCDWR)  
Tony Harris – Gwinnett County Dept. of Water Resources (GCDWR)  
Hank Collins – Moreland Altobelli Associates, Inc. (MAAI)  
Chris Parypinski – Moreland Altobelli Associates, Inc. (MAAI)  
Eric Rickert – Gresham, Smith & Partners (GS&P)  
Jody Braswell – Gresham, Smith & Partners (GS&P)

DISCUSSION: I-85/SR 324 INTERCHANGE-CONCEPT TEAM MEETING

A concept team meeting was held for the SR 324 at I-85/ SR 403 Interchange Improvement Concept at the GDOT District 1 Office.

Charles Robinson (GDOT Project Manager) welcomed everyone to the meeting and then proceeded with brief introductions. Mr. Robinson then turned the meeting over to the design consultants, Gresham Smith & Partners, to review the draft concept report and concept layout. GS&P began by discussing the project's recommended concept layout and reviewed the content of the draft concept report.

1. GDOT-OPD and GS&P noted that this project has been in coordination and will continue to coordinate with the PI #110600, the overlapping I-85 Managed-HOT Lane project, design team regarding sign locations and laneage.

**Design Services For The Built Environment**

2325 Lakeview Parkway, Suite 300 / Alpharetta, Georgia 30009-1976 / Phone 770.754.0755 / [www.gspnet.com](http://www.gspnet.com)

C:\Users\Rickere\Desktop\0012698\_CTM minutes.docx



CONCEPT TEAM MEETING NOTES  
Gravel Springs Road/ SR 324 at I-85/SR 403 Interchange  
GDOT PI #0012698  
Gwinnett County Project No. F-0782-01  
GS&P Project 27757.05  
Page 2

2. GDOT-OPD noted that this project will not require full oversight from FHWA (exempt). However, it may potentially be deemed 'A Project of Division Interest' after concept approval.
3. GDOT-OPD stated that both a Preliminary Pavement Evaluation Report and Preliminary Pavement Type Selection Report had been requested from GDOT OMR.
4. It was mentioned that design variances may potentially be needed from GDOT pertaining to the proposed raised median opening spacing's as these will be less than the recently updated 1000 ft. GDOT minimum lengths. These locations include between Camp Branch Road and the southbound ramp terminals, between the northbound and southbound ramp terminals, and between the northbound ramp terminals and Morgan Road. GDOT District 1-Traffic Operations responded that if a design variance (as well as the signal permit) is submitted, it would need to be supported by modeling to support that the level of service (LOS) and corresponding queue lengths of each roadway would be acceptable. Traffic files could be provided to GDOT to create these models. Brent Cook noted that this issue was discussed when he was in District Traffic Operations and it was agreed that GDOT could accept the spacing due to the physical and environmental constraints on SR 324.
5. It was agreed that Gwinnett County would handle the utility coordination, but GDOT would assist with permits for relocations.
6. It was agreed that a Subsurface Utilities Engineering (SUE) survey wasn't required for the project. However, GCDWR did state that they had recently relocated both 16 inch and 48 inch diameter water lines as part of the previous SR 324 bridge overpass project. GCDWR submitted the permit for these water lines which included the depths to avoid a potentially conflict, but it would be acceptable to place fill on top of them (though a casing may be needed for the 48 inch diameter line). Keck and Wood added that the City of Buford has a gas line along the recently realigned Camp Branch Road and beneath I-85.
7. GDOT District 1-Right of Way commented that both temporary (including driveway) and permanent easements should be anticipated in the concept report.
8. GDOT-OPD stated that a Categorical Exclusion environmental document may be permissible instead of an Environmental Assessment. This would need to be determined at the monthly GDOT OES/FHWA meeting, likely in January 2015. Ryan Perry will be GDOT OES' NEPA Specialist assigned to this project.



CONCEPT TEAM MEETING NOTES

Gravel Springs Road/ SR 324 at I-85/SR 403 Interchange

GDOT PI #0012698

Gwinnett County Project No. F-0782-01

GS&P Project 27757.05

Page 3

9. GDOT-District 1 mentioned that dowels were placed on the recently constructed SR 324 overpass bridge deck to anchor the raised median at the request of GDOT Bridge Design. Removing these dowels from the bridge deck will require coordination with GDOT Bridge Design and a bridge layout. GDOT District 1-Construction provided the as-built dowel spacing information to the design team. The Bridge Office sign-off should be added to the concept report.
10. GDOT-District 1 recommended that the Environmental Mitigation task under the Project activities be shown as 'to be determined' instead of 'not applicable'. Further, GDOT suggested that a contingency cost should be shown for Environmental Mitigation in concept report's Cost Estimate Summary.
11. GCDOT noted that the concept report is anticipated to be approved in May 2015 and thanked everyone's efforts in accelerating this date. GCDOT also added that they would fully support accelerating the other project milestones as well.
12. GDOT-OPD would like to meet with GDOT Design Policy to review the conceptual MS4 locations. GS&P stated as soon as additional utility information was added to the concept layout, they would be ready to schedule that meeting.
13. A 404 permit is anticipated to be required for the project, and the box in the permits chart should be checked.
14. During the field visit, it was suggested to reduce the length of the SR 324 EB right turn lane at the I-85 SB ramp terminal to minimize impacts to an existing residence.

*This represents our understanding of the items discussed at this meeting. If you have any questions or comments concerning any of the information contained herein, please contact me.*

Prepared by: Eric Rickert, P.E.  
Senior Project Engineer

Copy      Participants  
File

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**From:** Hoenig, Andrew <ahoenig@dot.ga.gov>  
**Sent:** Tuesday, September 16, 2014 11:17 AM  
**To:** 'John.Ray@gwinnettcountry.com'; 'Lewis.Cooksey@gwinnettcountry.com';  
'Alan.Chapman@gwinnettcountry.com'; Rickert, Eric; hcollins@maai.net;  
cparypinski@maai.net; Robinson, Charles A.; Braswell, Jody; chweber@hntb.com  
**Cc:** dhannon@hntb.com; Barron, Karlene; Jackson, Lillian W; VanMeter, Darryl  
**Subject:** I-85 Express Coordination with Gwinnett

**Categories:** Filed by Newforma

Everyone –

In lieu of minutes, please see the below action items from our coordination meeting held September 12.

- PIOH meetings scheduled for September 29 (@ Gwinnett Center) and October 2 (@ Braselton Community Room) from 5-7p
  1. Gwinnett County to bring a representative to both, mostly to answer questions on Gravel Springs Road project
- HNTB to ensure adequate span length is provided over taper lane for overhead sign at Sta 1395+00
- HNTB to provide GS&P with updated dgn files of I-85 project
- Gwinnett County to work with GDOT on additional outreach opportunities around the PIOH meetings [COMPLETED]
- GDOT to send 2013 and 2014 PIOH responses to Gwinnett County, especially where Gravel Springs Road was/ is mentioned
- GDOT to meet with Russell McMurry regarding possible flex lane project south of future McGinnis Ferry Road project [COMPLETED]
  1. We pointed out that we are already adding an aux lane from Old Peachtree to SR 317 (or what *will be* the CD lane to McGinnis Ferry) under our project in order to keep the same number of GP lanes. This eliminates the need for Gwinnett County to add another interstate lane. Gwinnett should ensure their traffic model incorporates this & concurs.

Thanks everyone,

**- C. Andrew Hoenig, P.E., DBIA**

**Project Manager**

**GDOT, Office of Innovative Delivery**

**P: (404)-631-1757**

**M: (404)-985-4377**

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Georgia DOT partners with Georgia Commute Options to promote commute alternatives in metro Atlanta. Get more by driving less. Save money, reduce stress and have time to work, rest or relax while someone else drives. Find out more at 1-877-9GA-OPTIONS (1-877-942-6784) or visit us at <http://www.dot.ga.gov>; follow us on <http://www.facebook.com/GeorgiaCommuteOptions>, or <http://www.facebook.com/GeorgiaDOT> and <http://twitter.com/gadepoftrans>

# Attachment 13- Transportation Management Plan

## TRAFFIC MANAGEMENT PLAN

### EXECUTIVE SUMMARY

I-85/SR 403 at Gravel Springs Road/SR 324 Interchange  
Gwinnett County, GDOT PI #0012698

This summarizes the Transportation Management Plan (TMP) for the project: I-85/SR 403 at Gravel Springs Road/SR 324 Interchange, GDOT PI #0012698. This job, being done in conjunction with Gwinnett County, involves construction of a new interchange at the existing overpass of Gravel Springs Road/SR 324 over I-85/SR 403. The existing Gravel Springs Road/SR 324 overpass roadway and bridge will be retained with ramp terminal intersection improvements. Four new location diamond ramps will be constructed from Gravel Springs Road/SR 324 that taper onto the existing I-85/SR 403 travel lanes.

This project is considered "significant" since it is an interstate project that occupies a location for more than three days with either intermediate or continuous lane closures. The TMP consists of a Temporary Traffic Control (TTC) plan, Transportation Operations (TO), and Public Information (PI) components.

A TTC plan is included in the project's construction plans and describes the measures to be used for facilitating road users through the work zone or an incident area. The TTC plan is consistent with GDOT policies, guidelines and standards, and meets the provisions of Part 6 of the Manual on Uniform Traffic Control Devices (MUTCD).

The TTC for this project includes use of outside shoulder closures on I-85/SR 403. Short term travel lane shifts onto a portion of the inside paved shoulders on I-85/SR 403 will also be used. Both of these will create greater separation between the through traffic and facilitate construction of the ramp tapers and advanced overhead signage. Temporary concrete traffic barriers will be used to further separate traffic from the construction activities. The ramp terminal intersection improvements on Gravel Springs Road/SR 324 can be constructed without the usage of lane closures, though any work that interfaces with the travel lanes will only occur during non-peak travel times.

The TO component of the TMP includes the identification of strategies that will be used to mitigate impacts of the work zone on the operation and management of the transportation system within the work zone impact area. The TO component of this project includes the required placement of temporary signs, temporary pavement markings, and changeable message signs as outlined in the project's TTC and special provisions. The PI component of the TMP includes communication strategies that seek to inform affected road users, the general public, area residences and businesses, and appropriate public and transportation entities about the project, the expected work zone impacts and the changing conditions on the project. This includes traveler information strategies. The scope of the PI component was determined by the project characteristics and the public information and outreach strategies identified through the traffic management strategy matrix. Public information and outreach for this project will include: placement of changeable message signs, news releases of construction project activities prior to and during the start of construction, the GDOT web site, and message boards.

The project's CES database includes the appropriate pay items and provisions for implementing the TMP, specifically the pay items include:

## TRAFFIC MANAGEMENT PLAN

### EXECUTIVE SUMMARY

I-85/SR 403 at Gravel Springs Road/SR 324 Interchange  
Gwinnett County, GDOT PI #0012698

Attenuators

Construction Signs (as a part of Traffic Control)

Changeable Message Signs

Temporary Concrete Traffic Barrier, GDOT Std. 4960

Temporary pavement markings (as a part of Traffic Control)

In addition to the work zone-specific Public Information activities, GDOT provides general work zone information to the public through various outlets. These include, among other things, publication of a statewide work zone map and work zone driving safety tips, posting of current work zone locations and conditions to the internet, promotion of Work Zone Safety Awareness Week, and advertisement of work zone safety-related messages via radio, television and, billboards. Through these efforts, GDOT positively influences work zone safety and mobility, as motorists gain access to information they need to plan their trips and become more work zone conscious.

Attachment 14- Approved  
Project Interchange  
Justification Report

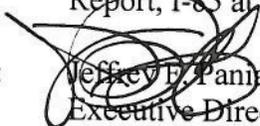


U.S. Department  
of Transportation  
**Federal Highway  
Administration**

# Memorandum

Subject: **ACTION:** Georgia, Interchange Justification  
Report, I-85 at SR-324, Gwinnett County

Date: January 10, 2012

From:   
Jeffrey E. Panfili  
Executive Director

In Reply Refer To:  
HIPA-20

To: Mr. Rodney N. Barry  
Division Administrator  
Atlanta, GA

We have reviewed the Interchange Justification Report (IJR) submitted on December 6 to construct a new service interchange on I-85 at State Route 324 (Gravel Springs Road) in the Atlanta metropolitan area. This new interchange will provide additional access to the Interstate System for a developing area of Gwinnett County.

Based on our review, the proposed modifications are acceptable. An Environmental Assessment will be conducted for this project with an anticipated start in early 2012. Final approval may be given upon successful completion of the Environmental Assessment, provided the scope and design of this proposed project is consistent with the design that was included in the December 6 IJR and the approved environmental document. This approval is subject to reevaluation if significant changes occur in the final design or if the construction is delayed (as specified in 23 CFR 771.129).

Should you have any questions, please contact Mr. Michael Matzke at 202-366-4658.

JAN 20 2012  
~~JAN 02 2012~~ <sup>MS</sup>

***Interchange Justification Report  
I-85 at SR 324 (Gravel Springs Road)***

***Georgia Department of Transportation  
and  
Gwinnett County***

***Prepared for:***

***Georgia Department of Transportation  
and  
Federal Highway Administration***

***Prepared by:***

***Moreland Altobelli Associates Inc.***

***October 10, 2011***

## EXECUTIVE SUMMARY

This Interchange Justification Report (IJR) serves to provide justification and documentation of the need for additional access to Interstate 85 at SR 324 (Gravel Springs Road) in Gwinnett County, Georgia. This proposed project consists of the construction of a compressed diamond interchange on I-85 at SR 324 (Gravel Springs Road). Additionally, Morgan Road would be relocated to accommodate the proposed interchange ramps. Furthermore, the proposed interchange would be designed so that it would not preclude the future projects to provide interchange access on I-85 at Sugarloaf Parkway Extension Phase II (from SR 316 to SR 20/Mall of Georgia Parkway) and a potential future managed lane interchange. The two new interchanges at SR 324 and Sugarloaf Parkway Extension Phase II would function as a single interchange using shared collector-distributor roads. Gwinnett County, the project sponsor, firmly supports the project plan to provide access at this location on I-85.

Gwinnett County Department of Transportation personnel first initiated the proposed transportation improvement in the year 1999 when it was noticed that there was a traffic capacity problem along SR 324 at some of its major intersections. It was identified that there was a need to widen SR 324 to provide sufficient capacity and provide adequate turn lanes at the major street intersections.

In 2005, Gwinnett County employed a consultant to conduct a traffic study of this same geographic area and to establish the feasibility for a possible new interchange at I-85/SR 324. The Georgia Department of Transportation's (GDOT's) Office of Urban Design, Division of Preconstruction, and the Federal Highway Administration (FHWA) reviewed the feasibility information in October 2005 and advised Gwinnett County that the County could roll the feasibility data and analyses into an IJR. The IJR was authorized by GDOT's Office of Planning on July 17, 2006 (See letter in Appendix A: Correspondence) under the Transportation Improvement Program (TIP) project reference number GW-AR-926.

The analyses conducted as part of this study assessed the need and purpose of the proposed I-85/SR 324 interchange as well as its potential impacts on I-85, the local street network, and the local environment. The operational analysis that was performed used forecasted travel demand volumes extracted from the calibrated Gwinnett Sub-area model, which was based on the Atlanta Regional Commission's (ARC's) 20-County Regional Travel Demand model. The Sub-area model included I-85 mainline segments from the I-985 interchange to the Hamilton Mill Road interchange. Crossroads and other local streets were included in the analysis as necessary to ensure that each alternative considered had the capability to collect and redistribute traffic to and from the I-85 interchanges at SR 20 or Hamilton Mill Road.

The proposed I-85/SR 324 interchange was evaluated for its consistency with the adopted local and regional comprehensive plans and their comprehensive transportation plans. Additionally, the study area was evaluated for the presence of environmental resources or concerns that may pose potential

environmental impacts, which may require mitigation in order for the proposed project to advance to construction.

This study concludes that the proposed I-85/SR 324 interchange can be fully supported at the local, state, and federal levels as it satisfies the Federal Highway Administration (FHWA) policy guidelines for new interstate access points, as detailed in Interstate System 23 CFR 630, and contains the requisite state and federal analyses associated with the preparation of IJR. The benefits of the proposed interchange include improved transportation access to the interstate highway system, improved traffic operations on the local roadway network, and enhanced economic development opportunities.

Gwinnett County and its cities have experienced rapid growth in the past two decades. Between the years 1990 and 2009, population increased from 352,910 to approximately 808,167 persons, or approximately 129%, according to the U.S. Bureau of the Census. According to the Georgia Department of Labor, the County had approximately 322,000 jobs in the year 2009. To support this level of growth, the County has experienced rapid low-density development patterns, which has contributed to the increased traffic congestion. By 2030, the County anticipates a population of 1,019,166 residents and approximately 516,000 jobs within its boundaries, as stipulated in their 2030 Unified Plan. These projections constitute a 26% increase in population from 2009 and a 60% increase in employment opportunities. Much of the County's anticipated growth is expected to occur in the northern portion of the county, including the Cities of Buford and Suwanee, and the IJR's study area. In these growth areas, vacant land and underdeveloped land parcels would be developed or redeveloped, respectively (*citation: Gwinnett County's CTP and the 2030 Unified Plan adopted in 2008*).

The Gwinnett County 2030 Comprehensive Transportation Plan (CTP), published in June 2008, indicates 79.7% of commuters drive alone for work trips and 14.1% carpool. The data also indicate that 0.8% of commuters take some form of public transportation, 0.8% walked, 0.8% traveled by some other means, and 3.8% worked from home (U.S. Bureau of the Census, 2000 data). In 2000, Gwinnett County's average commute travel time was approximately 31 minutes. During that same time period, the proportion of commuters with travel times less than 30 minutes decreased while those exceeding 60 minutes increased. The number of commuters with travel times between 30 and 59 minutes stayed the same.

The traffic benefits of providing the additional access to I-85 can be realized without generating a need for any additional improvements along the I-85 mainline, and may significantly reduce the frequency and severity of traffic crashes along I-85. The proposed project may have some minor impacts on adjacent environmental resources, but should not preclude compliance with the National Environmental Policy Act (NEPA). However, an Environmental Assessment (EA) document would be prepared after FHWA preliminary approval of the IJR is received, and the EA would include a final determination of the

anticipated direct effects of construction of the new interchange as well as the indirect and cumulative project impacts.

Below are brief descriptions of the three alternatives considered in this study. Each alternative was analyzed under 2015 and 2035 conditions. If the alternative was studied under 2015 traffic conditions, it is designated by the letter “A” and if the alternative was studied under the 2035 traffic conditions it is designated by the letter “B”.

**Alternative 1** is the No-Build Alternative, which consists of the existing roadway network plus planned/programmed roadway improvements in ARC’s TIP 2008-2013 and 2030 RTP. Notably, Alternative 1B includes the construction of Sugarloaf Parkway Extension Phases 2 and 3 from Peachtree Industrial Boulevard to SR 316 with an interchange at I-85.

**Alternative 2** is the I-85/SR 324 Interchange Alternative, which consists of the construction of a compressed-diamond interchange at I-85/SR 324 (Gravel Springs Road), the relocation of Morgan Road plus planned/programmed roadway improvements in ARC’s TIP 2008-2013 and 2030 RTP. Because of the close proximity of the Sugarloaf Parkway Interchange at I-85, the SR 324 Interchange in Alternative 2B includes collector-distributor roads between the two interchanges.

**Alternative 3** is the Surface Street Improvements Alternative, which consists of constructing proposed surface street improvements that are not currently planned or programmed plus all planned/programmed projects in ARC’s TIP 2008-2013 and 2030 RTP.

The evaluation of the alternatives focused on three criteria: interstate spacing compliance and vehicular access, potential environmental impacts, and implementation costs.

#### Interstate Spacing Compliance and Access

The build alternative for the I-85/SR 324 interchange would meet the minimum interstate spacing requirements according to the *Policy of Geometric Design of Highways and Streets* design standards published by the American Association of State Highway Transportation Officials (AASHTO). However, the I-85/SR 324 interchange would not meet the average spacing requirement by one-tenth of a mile. The operational impact of the interchange spacing for these proposed interchanges was evaluated using a network traffic simulation program, CORSIM. The simulation illustrated that the spacing would present no problem for the safe operation of traffic on I-85 and the interchanges. Both GDOT Urban Design and FHWA concurred with these findings.

### Environmental Impacts

Each build alternative has some level of environmental impact. The degree of impact and the adversity of those impacts would be one consideration that should be taken into account when determining the preferred alternative.

Alternative 2A and 2B, as discussed in Section 3.0: Environmental Screening, has potentially only minor environmental impacts. However, Alternative 3B is anticipated to have many more environmental impacts due to the construction of many new projects potentially requiring significant right of way. The environmental impacts of Alternative 3B may still result in a Finding of No Significant Impacts.

### Benefit-Costs Analysis

The engineering, right-of-way, and construction costs were determined for the build alternative: Alternative 2B: I-85/SR 324 Interchange and Alternative 3B: Surface Street Improvements.

Table 13: Summary of Project Costs for Build Alternatives presents the project implementation costs associated with Alternative 2B: I-85/SR 324 Interchange and Alternative 3B: Surface Street Improvements. The detailed cost estimate of Alternative 2B is included in Appendix C.

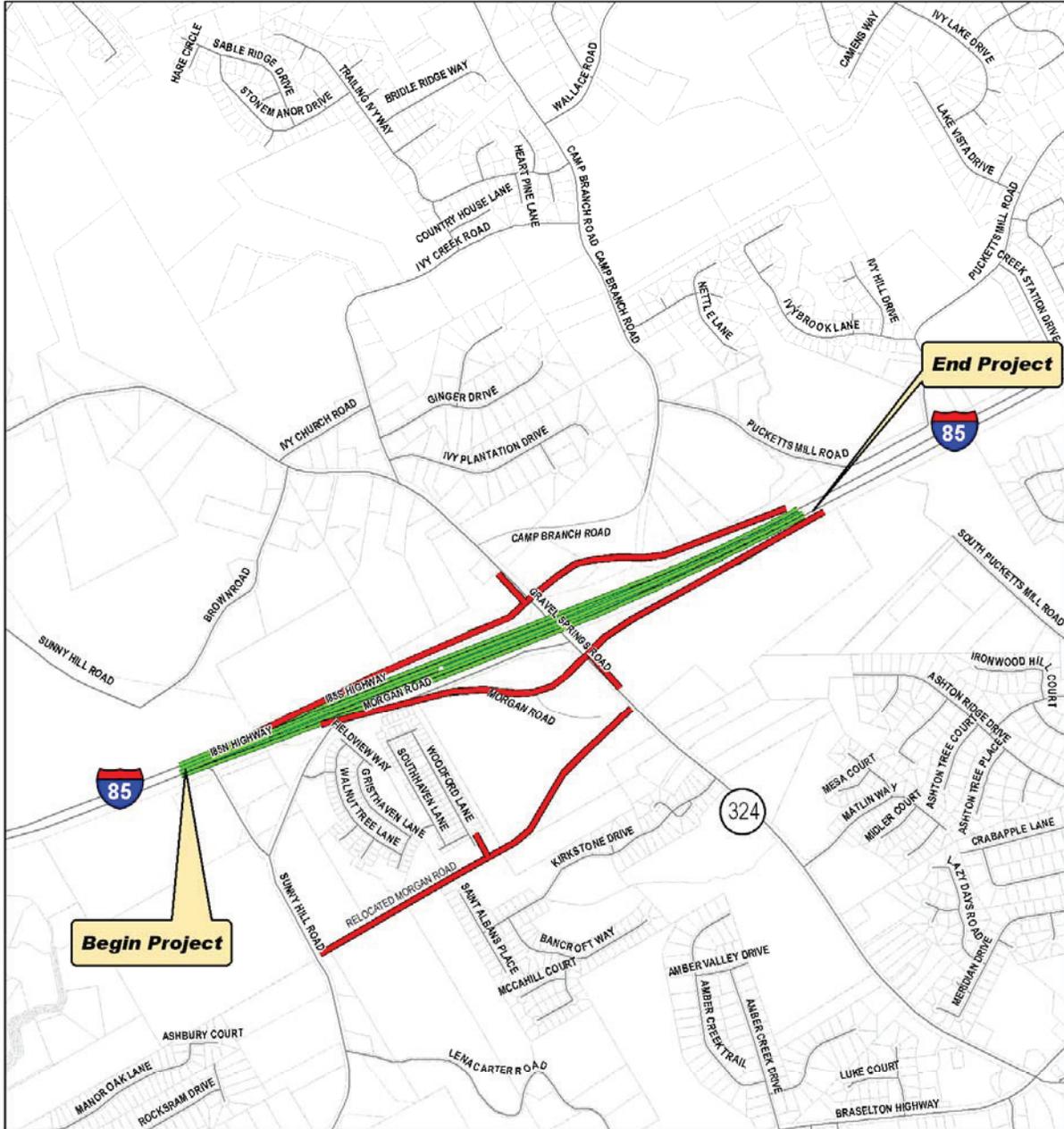
<b>Summary of Project Costs</b>		
<b>Costs</b>	<b>Alternative 2B SR 324 Interchange</b>	<b>Alternative 3B Surface Street Improvements</b>
Engineering	\$650,000	\$ 3,158,645
Right-of-Way	\$21,186,000	\$41,909,175
Utilities	\$250,000	\$4,000,000
Construction	\$9,242,085	\$39,483,160
<b>Total Project Costs</b>	<b>\$31,328,085</b>	<b>\$88,550,980</b>

A benefit-cost evaluation was conducted for the year 2035 with the new I-85/Sugarloaf Parkway Extension II in both Alternative 2B and Alternative 3B. The new interchange project of I-85 at Sugarloaf Parkway Extension II would include collector-distributor roadways between the Sugarloaf Parkway Extension II interchange and the SR 324 interchange, which were not included in these costs.

Alternative 2B benefit-cost analysis resulted in a 1.27 ratio; and for Alternative 3B, the benefit-cost ratio was calculated to be 0.36. Alternative 2B provided a shorter route for motorists to reach I-85 and Alternative 2B was approximately a third of the cost of Alternative 3B. In summary, the preferred alternative is Alternative 2B, which provides the most benefits at the lowest overall costs.

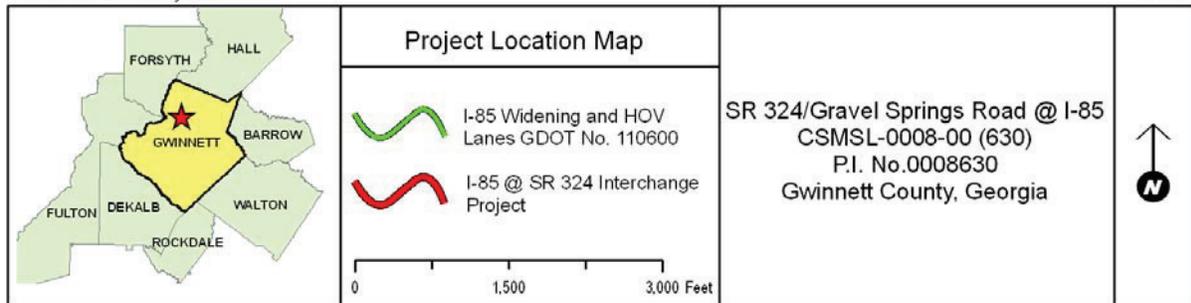
The proposed I-85/SR 324 interchange concept layout is shown on the following page.

# Concept Layout



Source: Gwinnett County GIS

11-19-08



Attachment 15- SR 324/Gravel  
Springs Road over I-85/SR 403  
Bridge Inventory Data Listing

# Bridge Inventory Data Listing



Parameters: Bridge Serial Num

Structure ID:135-5244-0		Gwinnett		SUFF. RATING: 85.00	
<b>Location &amp; Geography</b>			<b>Signs &amp; Attachments</b>		
<b>Structure ID:</b>	135-5244-0	*104 Highway System:	0	225 Expansion Joint Type:	15
200 Bridge Information:	02	*26 Functional Classification:	12	242 Deck Drains:	0
*6A Feature Int:	I-85	*204 Federal Route Type:	S No: 00998	243 Parapet Location:	0
*6B Critical Bridge:	0	105 Federal Lands Highway:	0	Height:	0.00
*7A Route No Carried:	SR00324	*110 Truck Route:	0	Width:	0.00
*7B Facility Carried:	MT Gravel Springs Rd	206 School Bus Route:	1	238 Curb Height:	1
9 Location:	4.5 Miles SE of Buford	217 Benchmark Elevation:	0000.00	Curb Material:	1
2 Dot District:	1	218 Datum:	0	239 Handrail	1 1
207 Year Photo:	2013	*19 Bypass Length:	04	*240 Median Barrier Rail:	0
*91 Inspection Frequency:	24 Date: 11/14/2013	*20 Toll:	3	241 Bridge Median Height:	1
92A Fract Crit Insp Freq:	0 Date: 02/01/1901	*21 Maintanance:	01	* Bridge Median Width:	32
92B Underwater Insp Freq:	0 Date: 02/01/1901	*22 Owner:	01	230 Guardrail Loc. Dir. Rear:	5
92C Other Spc. Insp Freq:	0 Date: 02/01/1901	*31 Design Load:	6	Fwr:	2
* 4 Place Code:	00000	37 Historical Significance:	5	Oppo. Dir. Rear:	5
*5 Inventory Route(O/U):	1	205 Congressional District:	07	Oppo. Fwr:	2
Type:	3	27 Year Constructed:	1964	244 Aproach Slab	3
Designation:	1	106 Year Reconstructed:	2012	224 Retaining Wall:	7
Number:	00324	33 Bridge Median	2	233Posted Speed Limit:	45
Direction:	0	34 Skew:	23	236 Warning Sign:	0.00
*16 Latitude:	34 - 03.7998 HMMS Prefix:SR	35 Structure Flared:	0	234 Delineator:	1.00
*17 Longitude:	83 - 56.8175 HMMS Suffix:324	38 Navigation Control:	N	235 Hazard Boards:	0
	MP: 2.45	213 Special Steel Design:	0	237 Utilities Gas:	00
98 Border Bridge:	000 % Shared:00	267 Type of Paint:	5	Water:	00
99 ID Number:	0000000000000000	*42 Type of Service On:	5	Electric:	00
*100 STRAHNET:	0	Type of Service Under:	1	Telephone:	22
12 Base Highway Network:	1	214 Movable Bridge:	0	Sewer:	00
13A LRS Inventory Route:	13510	203 Type Bridge:	E - O - M - O	247 Lighting Street:	0
13B Sub Inventory Route:	0	259 Pile Encasement	0	Navigation:	0
*101 Parallel Structure:	N	*43 Structure Type Main:	4 02	Aerial:	0
*102 Direction of Traffic:	2	45 No.Spans Main:	003	*248 County Continuity No.:	00
*264 Road Inventory Mile Post:	002.42	44 Structure Type Appr:	0 00		
*208 Inspection Area:	07 Initials: JMC	46 No Spans Appr:	000		
Engineer's Initials:	jpd	226 Bridge Curve Horz	0 Vert: 1.00		
* Location ID No:	135-00324D.002.45E	111 Pier Protection	0		
		107 Deck Structure Type:	1		
		108 Wearing Structure Type:	1		
		Membrane Type:	0		
		Deck Protection:	0		

# Bridge Inventory Data Listing



Parameters: Bridge Serial Num

9

Structure ID:135-5244-0

Programming Data		Measurements:				
201 Project No:	BRST0-0998-00(001)/142285	*29 ADT	077950	Year:2010	65 Inventory Rating Method:	1
202 Plans Available:	3	109 %Trucks:	8		63 Operating Rating Method:	1
249 Prop Proj No:	00000000000000000000000000000000	* 28 Lanes On:	04	Under:04	66 Inventory Type:	2 Rating: 42
250 Approval Status:	7100	210 No. Tracks On:	0	Under:0	64 Operating Type:	2 Rating: 70
251 PI Number:	0000000	* 48 Max. Span Length	0173		231 Calculated Loads:	
252 Contract Date:	04/02/2009	* 49 Structure Length:	466		H-Modified:	21 0
260 Seismic No:	00000	51 Br. Rwdy. Width	56.00		HS-Modified:	30 0
75 Type Work:	00 0	52 Deck Width:	102.40		Type 3:	33 0
94 Bridge Imp. Cost:	\$1,078	* 47 Tot. Horiz. Cl:	88		Type 3s2:	40 0
95 Roadway Imp. Cost:	\$108	50 Curb / Sidewalk Width	6.00 / 6.00		Timber:	37 0
96 Total Imp Cost:	\$1618	32 Approach Rdwy. Width	056		Piggyback:	40 0
76 Imp Length:	001598	*229 Shoulder Width:			261 H Inventory Rating:	23
97 Imp Year:	2013	Rear Lt:	2.00	Type:1 Rt:2.00	262 H Operating Rating	39
114 Fureur ADT:	116925	Fwd. Lt:	2.00	Type:1 Rt:2.00	67 Structural Evaluation:	8
		Pavement Width:			58 Deck Condition:	8
		Rear:	24.00	Type: 2	59 Superstructure Condition:	8
			24.00	Type: 2	* 227 Collision Damage:	0
		Intersaction Rear:	1	Fwd: 1	60A Substructure Condition:	8
		36Safety Features Br. Rail:	1		60B Scour Condition:	N
		Transition:	1		60C Underwater Condition	N
		App. G. Rail:	1		71 Waterway Adequacy:	N
		App. Rail End:	1		61 Channel Protection Cond.:	N
		53 Minimum Cl. Over:	99' 99 "		68 Deck Geometry:	6
		Under: H	18' 07"		69 UnderClr. Horz/Vert:	9
		*228 Minimum Vertical Cl			72 Appr. Alignment:	8
		Act. Odm Dir.:	99' 99"		62 Culvert:	N
		Oppo. Dir:	99' 99"		<b>Posting Data</b>	
		Posted Odm. Dir:	00' 00"		70 Bridge Posting Required	5
		Oppo. Dir:	00' 00"		41 Struct Open, Posted, CL:	A
		55 Lateral Undercl. Rt:	H 22.40		* 103 Temporary Structure:	0
		56 Lateral Undercl. Lt:	22.50		232 Posted Loads	
		*10 Max Min Vert Cl:	99' 99" Dir:3		H-Modified:	21
		39 Nav Vert Cl:	000 Horiz:0000		HS-Modified:	30
		116 Nav Vert Cl Closed:	000		Type 3:	33
		245 Deck Thickness Main	8.40		Type 3s2:	40
		Deck Thick Approach:	8.40		Timber:	37
		246 Overlay Thickness:	0.00		Piggyback	40
		212 Year Last Painted:	Sup:2012 Sub:0000		253 Notification Date:	02/01/1901
					258 Fed Notify Date:	02/01/1901

Attachment 16- TUDI vs. SPUI  
Comparison Discussion and SR  
324/Gravel Springs Road  
intersection queueing analysis

Attachment 16- SR 324/Gravel  
Springs Road over I-85/SR 403  
Single Point Urban  
Interchange (SPUI) vs. Tight  
Urban Diamond Interchange  
(TUDI)  
GDOT Email Summary  
Discussion

## **Concept Report Email Summary of Questions and Responses**

Tight Urban Diamond Interchange versus Single Point Urban Interchange

### **Question from Office of Program Delivery, Albert V. Shelby, III, State Program Delivery Engineer**

Question for Traffic Ops: Would a SPUI operationally work better than the tight urban diamond with signal spacing closer than normal?"

### **Response from Office of Traffic Operations, Paul Denard, P.E., P.T.O.E.:**

Please place this email and the attachments in the project concept files for documentation on the intersection spacing issues. The memo states that there should be no issues with queue lengths; however this statement is contingent on the shorter cycle used for the signal timings at the intersections in their study. It should be noted that longer cycle lengths (120 seconds or above) may cause queuing issues that could result in issues at this corridor as conceptualized.

The SPUI (single point urban interchange) would combine two signals at a diamond interchange (tight urban or conventional) down to one signal. From a conceptual standpoint, reducing the number of signals at the interchange would create more distance between the interchange and any adjacent signals. However, there would need to be an operational analysis to determine if the SPUI alternative would function more efficiently (total delay, average queues, travel time, etc) than the TUDI alternative.

**Robinson, Charles A.**

RESPONSE

**From:** DeNard, Paul  
**Sent:** Wednesday, December 31, 2014 3:32 PM  
**To:** Werho, Ken  
**Cc:** Olson, David W; Giles, Shane; Zehngraff, Scott E.; Robinson, Charles A.  
**Subject:** FW: PI #00012698, SR324@I-85 interchange-intersection spacing analysis  
**Attachments:** 0012698 Attachment #1 - Traffic Analysis Worksheets.pdf; 0012698 Attachment #2 - intersection spacing+left storage display.pdf; 0012698 Attachment 12b.pdf

Ken,

Please place this email and the attachments in the project concept files for documentation on the intersection spacing issues. The memo states that there should be no issues with queue lengths; however this statement is contingent on the shorter cycle used for the signal timings at the intersections in their study. It should be noted that longer cycle lengths (120 seconds or above) may cause queuing issues that could result in issues at this corridor as conceptualized. Please let me know if we need to comment anything else. Thanks,

**Paul DeNard, PE, PTOE**

State Traffic Operations Manager  
Georgia Department of Transportation  
404-635-2843 (Office) 404-805-8016 (Cell)

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**From:** Robinson, Charles A.  
**Sent:** Wednesday, December 24, 2014 10:00 AM  
**To:** DeNard, Paul; Giles, Shane; Olson, David W  
**Cc:** Thomas, Chester G.  
**Subject:** FW: PI #00012698, SR324@I-85 interchange-intersection spacing analysis

Hello All,

Please see the email below and the attachments from Gwinnett County regarding the proposed signal spacing concerns discussed at the concept team meeting for the above referenced project.

Can you please review the attachments and email below and let me know if you have any comments or need any additional information?

Sincerely,

**Charles A. Robinson**

Project Manager  
Georgia Department of Transportation  
Office of Program Delivery  
One Georgia Center  
600 West Peachtree Street, Floor 25  
Atlanta, GA 30308  
Office: (404) 631-1439  
Mobile: (404) 985-0720  
Fax: (404) 631-1588  
[chrobinson@dot.ga.gov](mailto:chrobinson@dot.ga.gov)

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**From:** Rickert, Eric [[mailto:eric\\_rickert@gspnet.com](mailto:eric_rickert@gspnet.com)]  
**Sent:** Tuesday, December 23, 2014 4:43 PM  
**To:** Robinson, Charles A.  
**Cc:** VAX-BraswellJ(SMTP); Gomez, Nithin; [Lewis.Cooksey@gwinnettcounty.com](mailto:Lewis.Cooksey@gwinnettcounty.com); 'John.Ray@gwinnettcounty.com'  
**Subject:** RE: PI #00012698, SR324@I-85 interchange-intersection spacing analysis

Charles,

Attached is the revised intersection queueing analysis report that has been updated to reflect the addition of a raised median on the SR 324 bridge.

Regards,

**Eric J. Rickert**, P.E.

**GRESHAM, SMITH AND PARTNERS**  
[P] 678.518.3682

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**From:** Rickert, Eric  
**Sent:** Friday, December 12, 2014 10:06 AM  
**To:** Robinson, Charles A.  
**Cc:** Braswell, Jody; 'John.Ray@gwinnettcounty.com'; 'hcollins@maai.net' ([hcollins@maai.net](mailto:hcollins@maai.net)) ([hcollins@maai.net](mailto:hcollins@maai.net)); Gomez, Nithin; 'lewis.cooksey@gwinnettcounty.com'  
**Subject:** PI #00012698, SR324@I-85 interchange-intersection spacing analysis

Charles,

As we discussed earlier this week, I'm attaching our intersection queueing analysis report for the four intersections along SR 324 (Camp Branch Road, I-85 SB Ramp Terminals, I-85 NB Ramp Terminals and Morgan Road) in the proximity of the proposed interchange for your review. This report shows that the expected left turning storage queues at these intersections are sufficiently accommodated by the storage bays provided. Therefore, despite the intersection spacings being less than 1000 ft. (but in excess of 660 ft.), the proposed interchange design is not expected to have left turn spillback issues which could impact the SR 324/ Gravel Springs Rd arterial operation.

The GDOT Design Policy Manual states the following in Section 7.3: *"GDOT has adopted 1,000-ft. as the preferred minimum spacing between median openings in urban areas, and 1320-ft. as the preferred minimum spacing between median openings in rural areas. In urban areas, median openings may be spaced less than 1,000-ft., and greater than 660-ft. if it can be demonstrated that left turning volumes are nominal."* Therefore, based on this GDOT guidance, the findings of the attached intersection queueing analysis report, and the project's urban land use, we do not think a formal design variance is needed for the intersection spacings. However, as we discussed, please confirm this with the GDOT Offices of Design Policy & Support and/or Traffic Operations.

Regards,

**Eric J. Rickert**, P.E.

Transportation Services

**GRESHAM, SMITH AND PARTNERS**  
*Architecture, Engineering, Interiors, Planning*

2325 Lakeview Pkwy., Suite 300  
Alpharetta, GA 30009-7940  
[P] 678.518.3682

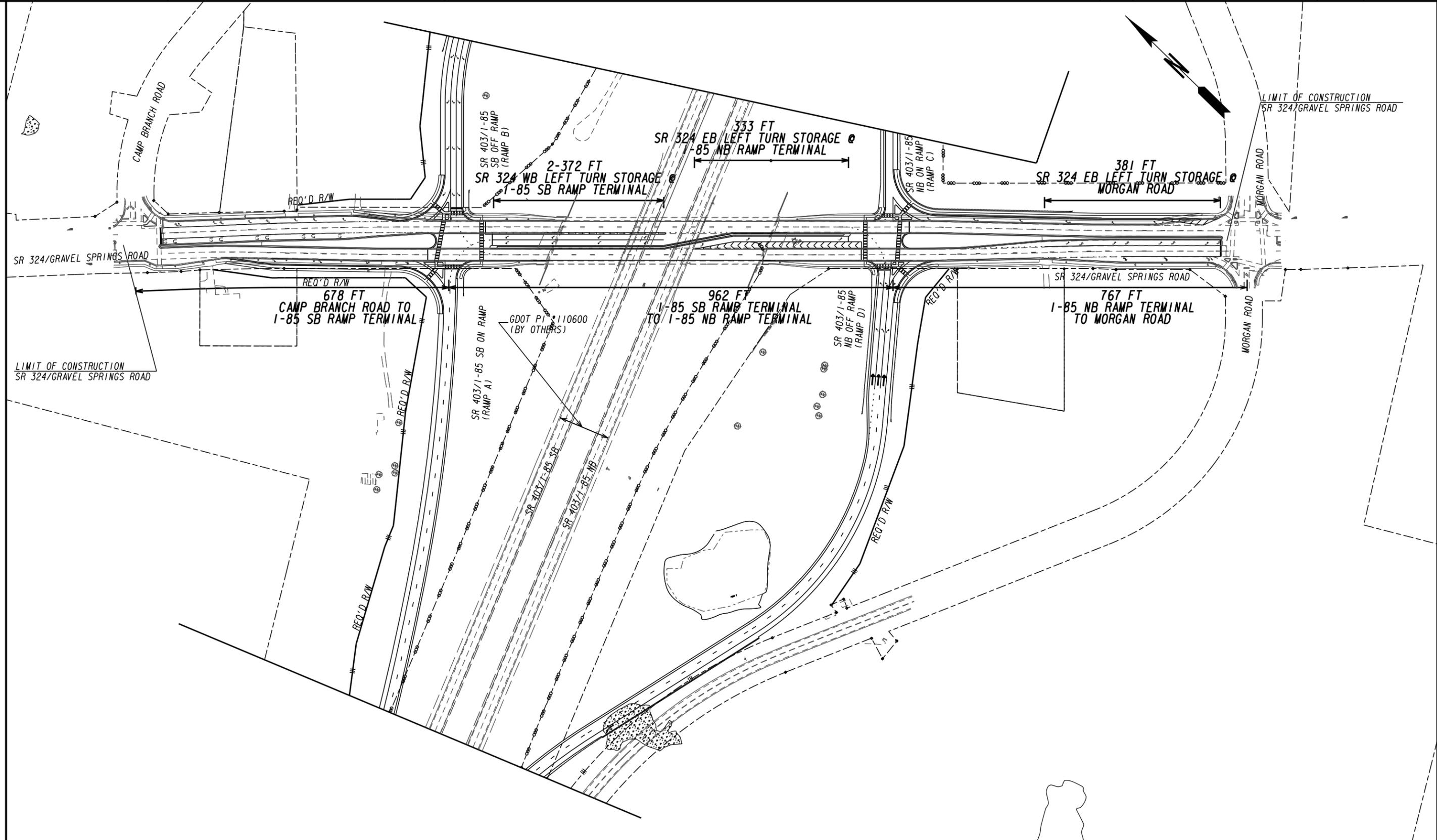
[www.gspnet.com](http://www.gspnet.com)

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During inclement winter weather, Georgia DOT commits to achieve and maintain passable road conditions on two lanes of interstates first and then state routes from the most heavily traveled to the least traveled. The Department urges travelers to exercise caution, be patient, and call 511 for updated information on roadway conditions before getting on the road during a winter weather event. Visit us at <http://www.dot.ga.gov/winterweather>; or follow us on <http://www.facebook.com/GeorgiaDOT> and <http://twitter.com/gadepoftrans>



EXISTING R/W & PROPERTY LINE	---
REQUIRED R/W LINE	—
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨
EASEMENT FOR CONSTR OF SLOPES	▩
EASEMENT FOR CONSTR OF DRIVES	▧

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	—
R/W AND LIMIT OF ACCESS	—



G R E S H A M  
S M I T H A N D  
P A R T N E R S



REVISION DATES	

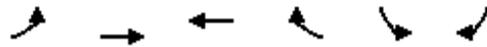
STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION  
OFFICE: PROGRAM DELIVERY  
**SR 324 MEDIAN OPNG. SPACINGS/ LEFT TURN LENGTHS**  
SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE  
PI: 0012698  
COUNTY: GWINNETT

DRAWING No.  
**1-000**

Queues

1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014

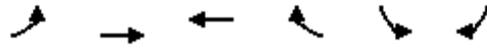


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	11	695	1132	400	447	68
v/c Ratio	0.06	0.36	0.59	0.40	0.83	0.13
Control Delay	15.5	15.0	4.8	1.1	47.6	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.5	15.0	4.8	1.1	47.6	10.6
Queue Length 50th (ft)	3	135	44	0	289	12
Queue Length 95th (ft)	16	213	108	0	365	37
Internal Link Dist (ft)		1504	611		1393	
Turn Bay Length (ft)	425			400	125	125
Base Capacity (vph)	174	1920	1920	1002	686	639
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	0.06	0.36	0.59	0.40	0.65	0.11

Intersection Summary

HCM 2010 Signalized Intersection Summary  
 1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Volume (veh/h)	10	660	1075	380	425	65		
Number	5	2	6	16	7	14		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	172.7	179.2	179.2	172.7	172.7	172.7		
Adj Flow Rate, veh/h	11	695	1132	0	447	0		
Adj No. of Lanes	1	2	2	1	1	1		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Percent Heavy Veh, %	10	6	6	10	10	10		
Cap, veh/h	340	1935	1935	834	495	442		
Arrive On Green	0.57	0.57	1.00	0.00	0.30	0.00		
Sat Flow, veh/h	459	3495	3495	1468	1645	1468		
Grp Volume(v), veh/h	11	695	1132	0	447	0		
Grp Sat Flow(s),veh/h/ln	459	1703	1703	1468	1645	1468		
Q Serve(g_s), s	1.0	10.1	0.0	0.0	23.9	0.0		
Cycle Q Clear(g_c), s	1.0	10.1	0.0	0.0	23.9	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	340	1935	1935	834	495	442		
V/C Ratio(X)	0.03	0.36	0.59	0.00	0.90	0.00		
Avail Cap(c_a), veh/h	340	1935	1935	834	827	738		
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	0.82	0.00	1.00	0.00		
Uniform Delay (d), s/veh	8.7	10.7	0.0	0.0	30.7	0.0		
Incr Delay (d2), s/veh	0.2	0.5	1.1	0.0	8.0	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.1	4.9	0.3	0.0	11.9	0.0		
LnGrp Delay(d),s/veh	8.9	11.2	1.1	0.0	38.8	0.0		
LnGrp LOS	A	B	A		D			
Approach Vol, veh/h		706	1132		447			
Approach Delay, s/veh		11.2	1.1		38.8			
Approach LOS		B	A		D			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		76.5		33.5		76.5		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		52.0		46.0		52.0		
Max Q Clear Time (g_c+I1), s		12.1		25.9		2.0		
Green Ext Time (p_c), s		10.5		1.7		10.9		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			11.6					
HCM 2010 LOS			B					

Queues

2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014



Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	1016	221	463	1447	200	137
v/c Ratio	0.56	0.26	0.76	0.55	0.57	0.57
Control Delay	14.6	2.7	61.1	1.0	52.4	27.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.6	2.7	61.1	1.0	52.4	27.5
Queue Length 50th (ft)	208	18	182	29	70	32
Queue Length 95th (ft)	249	34	m177	m28	104	92
Internal Link Dist (ft)	611			854		
Turn Bay Length (ft)		175	400		275	275
Base Capacity (vph)	1812	859	680	2653	688	387
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	0.56	0.26	0.68	0.55	0.29	0.35

Intersection Summary

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

HCM 2010 Signalized Intersection Summary  
 2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑↑		↑
Volume (veh/h)	0	965	210	440	1375	0	0	0	0	190	0	130
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0.0	179.2	171.2	171.2	179.2	0.0				171.2	0.0	171.2
Adj Flow Rate, veh/h	0	1016	0	463	1447	0				200	0	0
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	0	6	11	11	6	0				11	0	11
Cap, veh/h	0	1873	800	540	2671	0				280	0	129
Arrive On Green	0.00	1.00	0.00	0.34	1.00	0.00				0.09	0.00	0.00
Sat Flow, veh/h	0	3495	1455	3163	3495	0				3163	0	1455
Grp Volume(v), veh/h	0	1016	0	463	1447	0				200	0	0
Grp Sat Flow(s),veh/h/ln	0	1703	1455	1581	1703	0				1581	0	1455
Q Serve(g_s), s	0.0	0.0	0.0	12.9	0.0	0.0				5.8	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	12.9	0.0	0.0				5.8	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1873	800	540	2671	0				280	0	129
V/C Ratio(X)	0.00	0.54	0.00	0.86	0.54	0.00				0.72	0.00	0.00
Avail Cap(c_a), veh/h	0	1873	800	771	2671	0				805	0	370
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	0.82	0.00	0.09	0.09	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.0	0.0	0.0				41.8	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.9	0.0	0.7	0.1	0.0				3.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.2	0.0	5.6	0.0	0.0				2.7	0.0	0.0
LnGrp Delay(d),s/veh	0.0	0.9	0.0	30.7	0.1	0.0				45.3	0.0	0.0
LnGrp LOS		A		C	A					D		
Approach Vol, veh/h		1016			1910						200	
Approach Delay, s/veh		0.9			7.5						45.3	
Approach LOS		A			A						D	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	22.1	73.6		14.3		95.7						
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	23.0	45.0		24.0		74.0						
Max Q Clear Time (g_c+I1), s	14.9	2.0		7.8		2.0						
Green Ext Time (p_c), s	1.2	17.4		0.6		19.6						
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			7.8									
HCM 2010 LOS			A									
<b>Notes</b>												
User approved pedestrian interval to be less than phase max green.												

Queues

3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	295	921	1821	95	89	132
v/c Ratio	0.64	0.33	1.05	0.12	0.35	0.56
Control Delay	34.3	3.9	53.4	1.7	51.2	17.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.3	3.9	53.4	1.7	51.2	17.5
Queue Length 50th (ft)	165	32	~724	0	31	0
Queue Length 95th (ft)	295	170	#881	m8	55	57
Internal Link Dist (ft)		854	699			
Turn Bay Length (ft)	400			200	400	1000
Base Capacity (vph)	460	2763	1742	788	688	420
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	0.64	0.33	1.05	0.12	0.13	0.31

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

HCM 2010 Signalized Intersection Summary  
 3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 					
Volume (veh/h)	280	875	0	0	1730	90	85	0	125	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	171.2	179.2	0.0	0.0	179.2	171.2	171.2	0.0	171.2			
Adj Flow Rate, veh/h	295	921	0	0	1821	0	89	0	0			
Adj No. of Lanes	1	2	0	0	2	1	2	0	1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95			
Percent Heavy Veh, %	11	6	0	0	6	11	11	0	11			
Cap, veh/h	321	2794	0	0	2171	928	148	0	68			
Arrive On Green	0.23	1.00	0.00	0.00	0.64	0.00	0.05	0.00	0.00			
Sat Flow, veh/h	1630	3495	0	0	3495	1455	3163	0	1455			
Grp Volume(v), veh/h	295	921	0	0	1821	0	89	0	0			
Grp Sat Flow(s),veh/h/ln	1630	1703	0	0	1703	1455	1581	0	1455			
Q Serve(g_s), s	8.2	0.0	0.0	0.0	37.6	0.0	2.5	0.0	0.0			
Cycle Q Clear(g_c), s	8.2	0.0	0.0	0.0	37.6	0.0	2.5	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	321	2794	0	0	2171	928	148	0	68			
V/C Ratio(X)	0.92	0.33	0.00	0.00	0.84	0.00	0.60	0.00	0.00			
Avail Cap(c_a), veh/h	367	2794	0	0	2171	928	841	0	387			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.81	0.81	0.00	0.00	0.66	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	21.1	0.0	0.0	0.0	12.7	0.0	42.2	0.0	0.0			
Incr Delay (d2), s/veh	22.0	0.3	0.0	0.0	2.7	0.0	3.9	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.8	0.1	0.0	0.0	18.3	0.0	1.2	0.0	0.0			
LnGrp Delay(d),s/veh	43.2	0.3	0.0	0.0	15.5	0.0	46.1	0.0	0.0			
LnGrp LOS	D	A			B		D					
Approach Vol, veh/h		1216			1821			89				
Approach Delay, s/veh		10.7			15.5			46.1				
Approach LOS		B			B			D				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		99.8			16.5	83.3		10.2				
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0				
Max Green Setting (Gmax), s		74.0			13.0	55.0		24.0				
Max Q Clear Time (g_c+I1), s		2.0			10.2	39.6		4.5				
Green Ext Time (p_c), s		25.8			0.3	11.3		0.2				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				14.5								
HCM 2010 LOS				B								

Queues

4: SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	10	896	135	21	1714	5	167	26	5	5	16
v/c Ratio	0.08	0.36	0.12	0.06	0.70	0.00	0.74	0.09	0.02	0.02	0.06
Control Delay	6.2	4.6	1.5	6.2	11.4	0.0	61.6	17.1	34.8	34.6	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.2	4.6	1.5	6.2	11.7	0.0	61.6	17.1	34.8	34.6	5.7
Queue Length 50th (ft)	1	56	0	4	316	0	113	3	3	3	0
Queue Length 95th (ft)	m10	243	31	14	483	0	177	26	13	13	11
Internal Link Dist (ft)		699			1271			1085		623	
Turn Bay Length (ft)	365		225	365		225	100		100		100
Base Capacity (vph)	122	2456	1125	381	2456	1096	304	371	298	403	366
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	211	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.36	0.12	0.06	0.76	0.00	0.55	0.07	0.02	0.01	0.04

Intersection Summary

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

HCM 2010 Signalized Intersection Summary

4: SR 324/Gravel Springs Rd

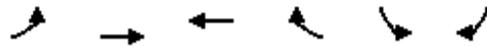
9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	860	130	20	1645	5	160	5	20	5	5	15
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	177.6	179.2	177.6	177.6	179.2	177.6	177.6	177.6	190.0	177.6	177.6	177.6
Adj Flow Rate, veh/h	10	896	0	21	1714	0	167	5	21	5	5	0
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	7	6	7	7	6	7	7	7	7	7	7	7
Cap, veh/h	196	2491	1104	504	2491	1104	268	44	186	248	263	224
Arrive On Green	1.00	1.00	0.00	0.73	0.73	0.00	0.15	0.15	0.15	0.15	0.15	0.00
Sat Flow, veh/h	270	3406	1509	590	3406	1509	1340	299	1255	1315	1776	1509
Grp Volume(v), veh/h	10	896	0	21	1714	0	167	0	26	5	5	0
Grp Sat Flow(s),veh/h/ln	270	1703	1509	590	1703	1509	1340	0	1554	1315	1776	1509
Q Serve(g_s), s	1.4	0.0	0.0	1.0	27.2	0.0	12.1	0.0	1.4	0.3	0.2	0.0
Cycle Q Clear(g_c), s	28.6	0.0	0.0	1.0	27.2	0.0	12.4	0.0	1.4	1.8	0.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.81	1.00		1.00
Lane Grp Cap(c), veh/h	196	2491	1104	504	2491	1104	268	0	230	248	263	224
V/C Ratio(X)	0.05	0.36	0.00	0.04	0.69	0.00	0.62	0.00	0.11	0.02	0.02	0.00
Avail Cap(c_a), veh/h	196	2491	1104	504	2491	1104	405	0	389	382	445	378
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.94	0.94	0.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	5.3	0.0	0.0	3.7	7.2	0.0	41.6	0.0	36.8	37.6	36.3	0.0
Incr Delay (d2), s/veh	0.5	0.4	0.0	0.2	1.6	0.0	2.4	0.0	0.2	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.0	0.2	12.9	0.0	4.7	0.0	0.6	0.1	0.1	0.0
LnGrp Delay(d),s/veh	5.8	0.4	0.0	3.9	8.8	0.0	44.0	0.0	37.0	37.6	36.3	0.0
LnGrp LOS	A	A		A	A		D		D	D	D	
Approach Vol, veh/h		906			1735			193			10	
Approach Delay, s/veh		0.4			8.8			43.0			37.0	
Approach LOS		A			A			D			D	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		89.2		20.8		89.2		20.8				
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0				
Max Green Setting (Gmax), s		73.0		25.0		73.0		25.0				
Max Q Clear Time (g_c+I1), s		30.6		3.8		29.2		14.4				
Green Ext Time (p_c), s		20.5		0.6		20.8		0.5				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			8.5									
HCM 2010 LOS			A									

Queues

1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	205	1495	658	563	663	58
v/c Ratio	0.70	0.89	0.39	0.55	0.96	0.09
Control Delay	40.2	36.1	26.6	9.0	60.0	7.3
Queue Delay	0.0	3.3	0.0	0.1	0.0	0.0
Total Delay	40.2	39.4	26.6	9.2	60.0	7.3
Queue Length 50th (ft)	123	547	203	121	481	4
Queue Length 95th (ft)	#255	#671	270	211	#727	29
Internal Link Dist (ft)		1504	611		1393	
Turn Bay Length (ft)	425			400	125	125
Base Capacity (vph)	292	1686	1686	1015	710	664
Starvation Cap Reductn	0	0	0	60	0	0
Spillback Cap Reductn	0	120	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.95	0.39	0.59	0.93	0.09

Intersection Summary

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

HCM 2010 Signalized Intersection Summary  
 1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations	↶	↷	↷	↶	↶	↶		
Volume (veh/h)	195	1420	625	535	630	55		
Number	5	2	6	16	7	14		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	175.9	182.7	182.7	175.9	175.9	175.9		
Adj Flow Rate, veh/h	205	1495	658	0	663	0		
Adj No. of Lanes	1	2	2	1	1	1		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Percent Heavy Veh, %	8	4	4	8	8	8		
Cap, veh/h	410	1687	1687	727	690	616		
Arrive On Green	0.49	0.49	0.97	0.00	0.41	0.00		
Sat Flow, veh/h	730	3563	3563	1495	1675	1495		
Grp Volume(v), veh/h	205	1495	658	0	663	0		
Grp Sat Flow(s),veh/h/ln	730	1736	1736	1495	1675	1495		
Q Serve(g_s), s	24.0	45.6	1.0	0.0	45.2	0.0		
Cycle Q Clear(g_c), s	25.0	45.6	1.0	0.0	45.2	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	410	1687	1687	727	690	616		
V/C Ratio(X)	0.50	0.89	0.39	0.00	0.96	0.00		
Avail Cap(c_a), veh/h	410	1687	1687	727	728	650		
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	0.90	0.00	1.00	0.00		
Uniform Delay (d), s/veh	22.3	27.2	0.9	0.0	33.6	0.0		
Incr Delay (d2), s/veh	4.3	7.3	0.6	0.0	23.6	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	5.3	23.5	0.6	0.0	25.3	0.0		
LnGrp Delay(d),s/veh	26.6	34.5	1.5	0.0	57.2	0.0		
LnGrp LOS	C	C	A		E			
Approach Vol, veh/h		1700	658		663			
Approach Delay, s/veh		33.6	1.5		57.2			
Approach LOS		C	A		E			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		65.7		54.3		65.7		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		57.0		51.0		57.0		
Max Q Clear Time (g_c+I1), s		47.6		47.2		3.0		
Green Ext Time (p_c), s		7.0		1.1		18.9		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			31.7					
HCM 2010 LOS			C					

Queues

2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014



Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	2058	142	216	1195	179	111
v/c Ratio	0.96	0.16	0.53	0.43	0.57	0.45
Control Delay	20.0	2.6	36.5	7.0	58.1	14.9
Queue Delay	5.1	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	2.6	36.5	7.0	58.1	14.9
Queue Length 50th (ft)	320	5	80	150	69	0
Queue Length 95th (ft)	m#1008	m11	m110	305	104	53
Internal Link Dist (ft)	611			854		
Turn Bay Length (ft)		175	400		275	275
Base Capacity (vph)	2140	912	406	2769	619	374
Starvation Cap Reductn	38	0	0	0	0	0
Spillback Cap Reductn	74	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.16	0.53	0.43	0.29	0.30

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

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

HCM 2010 Signalized Intersection Summary  
 2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑↑		↑
Volume (veh/h)	0	1955	135	205	1135	0	0	0	0	170	0	105
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0.0	182.7	168.1	168.1	182.7	0.0				168.1	0.0	168.1
Adj Flow Rate, veh/h	0	2058	0	216	1195	0				179	0	0
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	0	4	13	13	4	0				13	0	13
Cap, veh/h	0	2329	959	238	2795	0				248	0	114
Arrive On Green	0.00	1.00	0.00	0.15	1.00	0.00				0.08	0.00	0.00
Sat Flow, veh/h	0	3563	1429	3107	3563	0				3107	0	1429
Grp Volume(v), veh/h	0	2058	0	216	1195	0				179	0	0
Grp Sat Flow(s),veh/h/ln	0	1736	1429	1553	1736	0				1553	0	1429
Q Serve(g_s), s	0.0	0.0	0.0	7.1	0.0	0.0				5.9	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	7.1	0.0	0.0				5.9	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2329	959	238	2795	0				248	0	114
V/C Ratio(X)	0.00	0.88	0.00	0.91	0.43	0.00				0.72	0.00	0.00
Avail Cap(c_a), veh/h	0	2329	959	238	2795	0				715	0	329
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	0.30	0.00	0.70	0.70	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	43.8	0.0	0.0				46.9	0.0	0.0
Incr Delay (d2), s/veh	0.0	1.7	0.0	26.8	0.3	0.0				3.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.5	0.0	3.9	0.1	0.0				2.6	0.0	0.0
LnGrp Delay(d),s/veh	0.0	1.7	0.0	70.6	0.3	0.0				50.8	0.0	0.0
LnGrp LOS		A		E	A					D		
Approach Vol, veh/h		2058			1411						179	
Approach Delay, s/veh		1.7			11.1						50.8	
Approach LOS		A			B						D	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	14.0	91.7		14.3		105.7						
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	8.0	70.0		24.0		84.0						
Max Q Clear Time (g_c+I1), s	9.1	2.0		7.9		2.0						
Green Ext Time (p_c), s	0.0	36.2		0.5		39.3						
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			7.7									
HCM 2010 LOS			A									
<b>Notes</b>												
User approved pedestrian interval to be less than phase max green.												

Queues

3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	200	2037	1179	126	232	474
v/c Ratio	0.80	0.96	0.74	0.18	0.26	1.00
Control Delay	41.4	14.4	27.1	3.0	33.5	77.1
Queue Delay	0.0	3.4	0.0	0.0	0.0	0.5
Total Delay	41.4	17.8	27.1	3.0	33.5	77.6
Queue Length 50th (ft)	65	77	419	2	71	317
Queue Length 95th (ft)	m85	m#94	504	m13	105	#544
Internal Link Dist (ft)		854	699			
Turn Bay Length (ft)	400			200	400	1000
Base Capacity (vph)	261	2111	1591	709	903	474
Starvation Cap Reductn	0	7	0	0	0	0
Spillback Cap Reductn	0	52	0	0	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.99	0.74	0.18	0.26	1.00

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

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

HCM 2010 Signalized Intersection Summary  
 3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	190	1935	0	0	1120	120	220	0	450	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	168.1	182.7	0.0	0.0	182.7	168.1	168.1	0.0	168.1			
Adj Flow Rate, veh/h	200	2037	0	0	1179	0	232	0	0			
Adj No. of Lanes	1	2	0	0	2	1	2	0	1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95			
Percent Heavy Veh, %	13	4	0	0	4	13	13	0	13			
Cap, veh/h	378	2677	0	0	2227	917	316	0	146			
Arrive On Green	0.13	1.00	0.00	0.00	0.64	0.00	0.10	0.00	0.00			
Sat Flow, veh/h	1601	3563	0	0	3563	1429	3107	0	1429			
Grp Volume(v), veh/h	200	2037	0	0	1179	0	232	0	0			
Grp Sat Flow(s),veh/h/ln	1601	1736	0	0	1736	1429	1553	0	1429			
Q Serve(g_s), s	4.0	0.0	0.0	0.0	17.4	0.0	6.9	0.0	0.0			
Cycle Q Clear(g_c), s	4.0	0.0	0.0	0.0	17.4	0.0	6.9	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	378	2677	0	0	2227	917	316	0	146			
V/C Ratio(X)	0.53	0.76	0.00	0.00	0.53	0.00	0.73	0.00	0.00			
Avail Cap(c_a), veh/h	492	2677	0	0	2227	917	1149	0	529			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.25	0.25	0.00	0.00	0.85	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	7.0	0.0	0.0	0.0	9.2	0.0	41.3	0.0	0.0			
Incr Delay (d2), s/veh	0.3	0.5	0.0	0.0	0.8	0.0	3.3	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.7	0.2	0.0	0.0	8.4	0.0	3.1	0.0	0.0			
LnGrp Delay(d),s/veh	7.3	0.5	0.0	0.0	10.0	0.0	44.5	0.0	0.0			
LnGrp LOS	A	A			A		D					
Approach Vol, veh/h		2237			1179			232				
Approach Delay, s/veh		1.1			10.0			44.5				
Approach LOS		A			A			D				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		104.4			12.3	92.1		15.6				
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0				
Max Green Setting (Gmax), s		73.0			13.0	54.0		35.0				
Max Q Clear Time (g_c+I1), s		2.0			6.0	19.4		8.9				
Green Ext Time (p_c), s		36.1			0.3	23.9		0.8				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			6.8									
HCM 2010 LOS			A									

Queues

4: SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	16	2271	250	59	1106	11	207	58	11	5	5
v/c Ratio	0.05	0.91	0.22	1.00	0.44	0.01	0.85	0.20	0.05	0.02	0.02
Control Delay	2.7	6.8	0.1	147.3	7.9	0.6	76.7	34.1	39.6	38.8	0.2
Queue Delay	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.7	7.6	0.1	147.3	7.9	0.6	76.7	34.1	39.6	38.8	0.2
Queue Length 50th (ft)	2	173	0	~49	177	0	153	29	7	3	0
Queue Length 95th (ft)	m2	m184	m1	#95	218	2	#270	68	24	15	0
Internal Link Dist (ft)		699			1271			1085		623	
Turn Bay Length (ft)	365		225	365		225	100		100		100
Base Capacity (vph)	294	2496	1154	59	2496	1103	270	319	257	358	326
Starvation Cap Reductn	0	64	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.93	0.22	1.00	0.44	0.01	0.77	0.18	0.04	0.01	0.02

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

HCM 2010 Signalized Intersection Summary

4: SR 324/Gravel Springs Rd

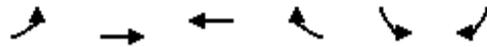
9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	2135	235	55	1040	10	195	5	50	10	5	5
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	179.2	182.7	179.2	179.2	182.7	179.2	179.2	179.2	190.0	179.2	179.2	179.2
Adj Flow Rate, veh/h	16	2271	0	59	1106	0	207	5	53	11	5	0
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	4	6	6	4	6	6	6	6	6	6	6
Cap, veh/h	352	2512	1103	176	2512	1103	293	23	244	243	310	263
Arrive On Green	1.00	1.00	0.00	0.72	0.72	0.00	0.17	0.17	0.17	0.17	0.17	0.00
Sat Flow, veh/h	488	3471	1524	158	3471	1524	1352	133	1410	1289	1792	1524
Grp Volume(v), veh/h	16	2271	0	59	1106	0	207	0	58	11	5	0
Grp Sat Flow(s),veh/h/ln	488	1736	1524	158	1736	1524	1352	0	1544	1289	1792	1524
Q Serve(g_s), s	0.7	0.0	0.0	19.1	15.0	0.0	17.4	0.0	3.7	0.9	0.3	0.0
Cycle Q Clear(g_c), s	15.7	0.0	0.0	19.1	15.0	0.0	17.7	0.0	3.7	4.6	0.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.91	1.00		1.00
Lane Grp Cap(c), veh/h	352	2512	1103	176	2512	1103	293	0	267	243	310	263
V/C Ratio(X)	0.05	0.90	0.00	0.33	0.44	0.00	0.71	0.00	0.22	0.05	0.02	0.00
Avail Cap(c_a), veh/h	352	2512	1103	176	2512	1103	339	0	319	287	371	315
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.16	0.16	0.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	1.4	0.0	0.0	7.1	6.5	0.0	47.1	0.0	41.3	43.2	39.8	0.0
Incr Delay (d2), s/veh	0.0	1.0	0.0	5.0	0.6	0.0	5.6	0.0	0.4	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.4	0.0	1.1	7.3	0.0	7.0	0.0	1.6	0.3	0.1	0.0
LnGrp Delay(d),s/veh	1.4	1.0	0.0	12.1	7.1	0.0	52.7	0.0	41.7	43.3	39.8	0.0
LnGrp LOS	A	A		B	A		D		D	D	D	
Approach Vol, veh/h		2287			1165			265			16	
Approach Delay, s/veh		1.0			7.3			50.3			42.2	
Approach LOS		A			A			D			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		93.9		26.1		93.9		26.1				
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0				
Max Green Setting (Gmax), s		84.0		24.0		84.0		24.0				
Max Q Clear Time (g_c+I1), s		17.7		6.6		21.1		19.7				
Green Ext Time (p_c), s		46.4		0.9		44.8		0.4				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			6.7									
HCM 2010 LOS			A									

Queues

1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	5	658	637	247	253	68
v/c Ratio	0.01	0.29	0.28	0.23	0.73	0.19
Control Delay	7.8	8.0	5.1	2.3	48.3	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	8.0	5.1	2.3	48.3	8.2
Queue Length 50th (ft)	1	81	64	8	151	0
Queue Length 95th (ft)	6	138	162	67	215	31
Internal Link Dist (ft)		1504	611		1393	
Turn Bay Length (ft)	425			400	125	125
Base Capacity (vph)	461	2274	2274	1062	689	656
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	0.01	0.29	0.28	0.23	0.37	0.10

Intersection Summary

HCM 2010 Signalized Intersection Summary  
 1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Volume (veh/h)	5	625	605	235	240	65		
Number	5	2	6	16	7	14		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	172.7	179.2	179.2	172.7	172.7	172.7		
Adj Flow Rate, veh/h	5	658	637	0	253	0		
Adj No. of Lanes	1	2	2	1	1	1		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Percent Heavy Veh, %	10	6	6	10	10	10		
Cap, veh/h	572	2196	2196	947	308	275		
Arrive On Green	0.64	0.64	1.00	0.00	0.19	0.00		
Sat Flow, veh/h	731	3495	3495	1468	1645	1468		
Grp Volume(v), veh/h	5	658	637	0	253	0		
Grp Sat Flow(s),veh/h/ln	731	1703	1703	1468	1645	1468		
Q Serve(g_s), s	0.2	6.1	0.0	0.0	10.5	0.0		
Cycle Q Clear(g_c), s	0.2	6.1	0.0	0.0	10.5	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	572	2196	2196	947	308	275		
V/C Ratio(X)	0.01	0.30	0.29	0.00	0.82	0.00		
Avail Cap(c_a), veh/h	572	2196	2196	947	968	864		
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	0.95	0.00	1.00	0.00		
Uniform Delay (d), s/veh	4.5	5.6	0.0	0.0	27.9	0.0		
Incr Delay (d2), s/veh	0.0	0.4	0.3	0.0	5.5	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.0	2.9	0.1	0.0	5.2	0.0		
LnGrp Delay(d),s/veh	4.6	5.9	0.3	0.0	33.3	0.0		
LnGrp LOS	A	A	A		C			
Approach Vol, veh/h		663	637		253			
Approach Delay, s/veh		5.9	0.3		33.3			
Approach LOS		A	A		C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		80.6		19.4		80.6		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		46.0		42.0		46.0		
Max Q Clear Time (g_c+I1), s		8.1		12.5		2.0		
Green Ext Time (p_c), s		6.1		0.9		6.2		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			8.1					
HCM 2010 LOS			A					

Queues

2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014



Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	584	400	837	647	763	247
v/c Ratio	0.66	0.60	0.91	0.31	0.90	0.43
Control Delay	33.1	6.7	25.0	1.1	49.5	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.1	6.7	25.0	1.1	49.5	6.3
Queue Length 50th (ft)	190	50	134	3	237	0
Queue Length 95th (ft)	251	31	m150	m3	#337	57
Internal Link Dist (ft)	611			854		
Turn Bay Length (ft)		175	400		275	275
Base Capacity (vph)	879	672	947	2076	883	585
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	0.66	0.60	0.88	0.31	0.86	0.42

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

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

HCM 2010 Signalized Intersection Summary  
 2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑↑		↑
Volume (veh/h)	0	555	380	795	615	0	0	0	0	725	0	235
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0.0	179.2	171.2	171.2	179.2	0.0				171.2	0.0	171.2
Adj Flow Rate, veh/h	0	584	0	837	647	0				763	0	0
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	0	6	11	11	6	0				11	0	11
Cap, veh/h	0	883	377	924	2086	0				838	0	385
Arrive On Green	0.00	0.52	0.00	0.10	0.20	0.00				0.26	0.00	0.00
Sat Flow, veh/h	0	3495	1455	3163	3495	0				3163	0	1455
Grp Volume(v), veh/h	0	584	0	837	647	0				763	0	0
Grp Sat Flow(s),veh/h/ln	0	1703	1455	1581	1703	0				1581	0	1455
Q Serve(g_s), s	0.0	12.3	0.0	25.7	15.8	0.0				22.9	0.0	0.0
Cycle Q Clear(g_c), s	0.0	12.3	0.0	25.7	15.8	0.0				22.9	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	883	377	924	2086	0				838	0	385
V/C Ratio(X)	0.00	0.66	0.00	0.91	0.31	0.00				0.91	0.00	0.00
Avail Cap(c_a), veh/h	0	883	377	969	2086	0				904	0	416
HCM Platoon Ratio	1.00	2.00	2.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	0.92	0.00	0.39	0.39	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	20.4	0.0	42.9	21.5	0.0				34.9	0.0	0.0
Incr Delay (d2), s/veh	0.0	3.6	0.0	5.1	0.2	0.0				12.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	6.1	0.0	11.9	7.5	0.0				11.4	0.0	0.0
LnGrp Delay(d),s/veh	0.0	24.0	0.0	48.0	21.6	0.0				47.5	0.0	0.0
LnGrp LOS		C		D	C					D		
Approach Vol, veh/h		584			1484						763	
Approach Delay, s/veh		24.0			36.5						47.5	
Approach LOS		C			D						D	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	34.6	33.4		31.9		68.1						
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	30.0	24.0		28.0		60.0						
Max Q Clear Time (g_c+I1), s	27.7	14.3		24.9		17.8						
Green Ext Time (p_c), s	1.0	3.7		1.0		5.7						
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			36.9									
HCM 2010 LOS			D									
<b>Notes</b>												
User approved pedestrian interval to be less than phase max green.												

Queues

3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	368	979	1189	432	295	558
v/c Ratio	1.07	0.50	1.00	0.59	0.31	1.08
Control Delay	90.8	3.3	51.0	5.8	28.2	90.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.8	3.3	51.0	5.8	28.2	90.2
Queue Length 50th (ft)	~221	61	401	73	74	~343
Queue Length 95th (ft)	m#324	m41	#553	28	110	#552
Internal Link Dist (ft)		854	699			
Turn Bay Length (ft)	400			200	400	1000
Base Capacity (vph)	345	1975	1192	732	946	518
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	1.07	0.50	1.00	0.59	0.31	1.08

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

HCM 2010 Signalized Intersection Summary  
 3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	350	930	0	0	1130	410	280	0	530	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	171.2	179.2	0.0	0.0	179.2	171.2	171.2	0.0	171.2			
Adj Flow Rate, veh/h	368	979	0	0	1189	0	295	0	0			
Adj No. of Lanes	1	2	0	0	2	1	2	0	1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95			
Percent Heavy Veh, %	11	6	0	0	6	11	11	0	11			
Cap, veh/h	420	2463	0	0	1745	746	402	0	185			
Arrive On Green	0.04	0.24	0.00	0.00	0.51	0.00	0.13	0.00	0.00			
Sat Flow, veh/h	1630	3495	0	0	3495	1455	3163	0	1455			
Grp Volume(v), veh/h	368	979	0	0	1189	0	295	0	0			
Grp Sat Flow(s),veh/h/ln	1630	1703	0	0	1703	1455	1581	0	1455			
Q Serve(g_s), s	8.2	19.4	0.0	0.0	21.0	0.0	7.2	0.0	0.0			
Cycle Q Clear(g_c), s	8.2	19.4	0.0	0.0	21.0	0.0	7.2	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	420	2463	0	0	1745	746	402	0	185			
V/C Ratio(X)	0.88	0.40	0.00	0.00	0.68	0.00	0.73	0.00	0.00			
Avail Cap(c_a), veh/h	544	2463	0	0	1745	746	1183	0	544			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.51	0.51	0.00	0.00	0.75	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	17.7	15.8	0.0	0.0	14.6	0.0	33.7	0.0	0.0			
Incr Delay (d2), s/veh	6.8	0.2	0.0	0.0	1.6	0.0	2.6	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	8.9	9.2	0.0	0.0	10.1	0.0	3.3	0.0	0.0			
LnGrp Delay(d),s/veh	24.5	16.1	0.0	0.0	16.3	0.0	36.3	0.0	0.0			
LnGrp LOS	C	B			B		D					
Approach Vol, veh/h		1347			1189			295				
Approach Delay, s/veh		18.4			16.3			36.3				
Approach LOS		B			B			D				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		83.8			16.9	66.9		16.2				
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0				
Max Green Setting (Gmax), s		58.0			17.0	35.0		30.0				
Max Q Clear Time (g_c+I1), s		21.4			10.2	23.0		9.2				
Green Ext Time (p_c), s		13.2			0.8	7.5		1.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				19.4								
HCM 2010 LOS				B								

Queues

4: SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	10	1339	172	26	1375	5	208	31	10	10	21
v/c Ratio	0.06	0.58	0.16	0.14	0.60	0.00	0.76	0.09	0.04	0.03	0.06
Control Delay	4.2	5.1	0.8	9.9	11.3	0.0	53.8	13.2	28.4	28.2	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.2	5.1	0.8	9.9	11.3	0.0	53.8	13.2	28.4	28.2	5.9
Queue Length 50th (ft)	1	119	1	5	226	0	125	3	5	5	0
Queue Length 95th (ft)	m2	m166	m9	21	361	0	189	24	17	17	12
Internal Link Dist (ft)		699			1271			1085		623	
Turn Bay Length (ft)	365		225	365		225	100		100		100
Base Capacity (vph)	179	2292	1072	189	2292	1026	373	453	366	497	446
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.58	0.16	0.14	0.60	0.00	0.56	0.07	0.03	0.02	0.05

Intersection Summary

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

HCM 2010 Signalized Intersection Summary

4: SR 324/Gravel Springs Rd

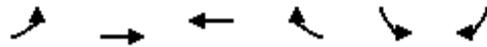
9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	1285	165	25	1320	5	200	5	25	10	10	20
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	177.6	179.2	177.6	177.6	179.2	177.6	177.6	177.6	190.0	177.6	177.6	177.6
Adj Flow Rate, veh/h	10	1339	0	26	1375	0	208	5	26	10	10	0
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	7	6	7	7	6	7	7	7	7	7	7	7
Cap, veh/h	254	2310	1024	344	2310	1024	323	46	241	303	330	281
Arrive On Green	1.00	1.00	0.00	0.68	0.68	0.00	0.19	0.19	0.19	0.19	0.19	0.00
Sat Flow, veh/h	375	3406	1509	388	3406	1509	1334	249	1297	1309	1776	1509
Grp Volume(v), veh/h	10	1339	0	26	1375	0	208	0	31	10	10	0
Grp Sat Flow(s),veh/h/ln	375	1703	1509	388	1703	1509	1334	0	1547	1309	1776	1509
Q Serve(g_s), s	0.8	0.0	0.0	2.0	19.3	0.0	13.4	0.0	1.5	0.6	0.4	0.0
Cycle Q Clear(g_c), s	20.1	0.0	0.0	2.0	19.3	0.0	13.8	0.0	1.5	2.0	0.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.84	1.00		1.00
Lane Grp Cap(c), veh/h	254	2310	1024	344	2310	1024	323	0	288	303	330	281
V/C Ratio(X)	0.04	0.58	0.00	0.08	0.60	0.00	0.64	0.00	0.11	0.03	0.03	0.00
Avail Cap(c_a), veh/h	254	2310	1024	344	2310	1024	497	0	490	474	562	478
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.64	0.64	0.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	3.2	0.0	0.0	4.9	7.7	0.0	35.1	0.0	29.9	30.7	29.5	0.0
Incr Delay (d2), s/veh	0.2	0.7	0.0	0.4	1.1	0.0	2.1	0.0	0.2	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.2	0.0	0.3	9.3	0.0	5.1	0.0	0.6	0.2	0.2	0.0
LnGrp Delay(d),s/veh	3.4	0.7	0.0	5.3	8.8	0.0	37.3	0.0	30.1	30.8	29.5	0.0
LnGrp LOS	A	A		A	A		D		C	C	C	
Approach Vol, veh/h		1349			1401			239				20
Approach Delay, s/veh		0.7			8.8			36.3				30.1
Approach LOS		A			A			D				C
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		77.5		22.5		77.5		22.5				
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0				
Max Green Setting (Gmax), s		60.0		28.0		60.0		28.0				
Max Q Clear Time (g_c+I1), s		22.1		4.0		21.3		15.8				
Green Ext Time (p_c), s		20.4		0.9		20.6		0.7				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			7.5									
HCM 2010 LOS			A									

Queues

1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



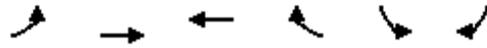
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	237	1479	11	316	353	47
v/c Ratio	0.28	0.67	0.01	0.30	0.82	0.11
Control Delay	11.3	15.9	10.6	3.9	53.7	8.4
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	11.3	16.0	10.6	3.9	53.7	8.4
Queue Length 50th (ft)	70	327	1	0	234	0
Queue Length 95th (ft)	136	487	m5	97	315	27
Internal Link Dist (ft)		1504	611		1393	
Turn Bay Length (ft)	425			400	125	125
Base Capacity (vph)	835	2198	2198	1062	546	520
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	109	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.71	0.01	0.30	0.65	0.09

Intersection Summary

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

HCM 2010 Signalized Intersection Summary  
 1: SR 324/Gravel Springs Rd & Camp Branch Rd

9/13/2014



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Volume (veh/h)	225	1405	10	300	335	45		
Number	5	2	6	16	7	14		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	175.9	182.7	182.7	175.9	175.9	175.9		
Adj Flow Rate, veh/h	237	1479	11	0	353	0		
Adj No. of Lanes	1	2	2	1	1	1		
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Percent Heavy Veh, %	8	4	4	8	8	8		
Cap, veh/h	918	2222	2222	957	395	353		
Arrive On Green	0.64	0.64	0.64	0.00	0.24	0.00		
Sat Flow, veh/h	1320	3563	3563	1495	1675	1495		
Grp Volume(v), veh/h	237	1479	11	0	353	0		
Grp Sat Flow(s),veh/h/ln	1320	1736	1736	1495	1675	1495		
Q Serve(g_s), s	7.7	25.9	0.1	0.0	19.8	0.0		
Cycle Q Clear(g_c), s	7.8	25.9	0.1	0.0	19.8	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	918	2222	2222	957	395	353		
V/C Ratio(X)	0.26	0.67	0.00	0.00	0.89	0.00		
Avail Cap(c_a), veh/h	918	2222	2222	957	623	556		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	0.89	0.00	1.00	0.00		
Uniform Delay (d), s/veh	7.7	10.9	6.3	0.0	35.8	0.0		
Incr Delay (d2), s/veh	0.7	1.6	0.0	0.0	10.1	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	2.9	12.8	0.1	0.0	10.2	0.0		
LnGrp Delay(d),s/veh	8.4	12.5	6.3	0.0	45.9	0.0		
LnGrp LOS	A	B	A		D			
Approach Vol, veh/h		1716	11		353			
Approach Delay, s/veh		11.9	6.3		45.9			
Approach LOS		B	A		D			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		81.1		28.9		81.1		
Change Period (Y+Rc), s		6.0		6.0		6.0		
Max Green Setting (Gmax), s		62.0		36.0		62.0		
Max Q Clear Time (g_c+I1), s		27.9		21.8		2.1		
Green Ext Time (p_c), s		9.8		1.1		10.6		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			17.7					
HCM 2010 LOS			B					

Queues

2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014



Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	1500	363	553	111	247	253
v/c Ratio	0.91	0.46	0.76	0.04	0.62	0.63
Control Delay	29.5	3.7	34.2	7.4	51.8	12.6
Queue Delay	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay	29.6	3.7	34.2	7.4	51.8	12.6
Queue Length 50th (ft)	538	14	124	13	86	0
Queue Length 95th (ft)	#702	27	262	24	122	73
Internal Link Dist (ft)	611			854		
Turn Bay Length (ft)		175	400		275	275
Base Capacity (vph)	1640	788	727	2643	676	509
Starvation Cap Reductn	5	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	0.92	0.46	0.76	0.04	0.37	0.50

Intersection Summary

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

HCM 2010 Signalized Intersection Summary  
 2: SR 324/Gravel Springs Rd & I-85 SB Ramps

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑↑		↑
Volume (veh/h)	0	1425	345	525	105	0	0	0	0	235	0	240
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0.0	182.7	168.1	168.1	182.7	0.0				168.1	0.0	168.1
Adj Flow Rate, veh/h	0	1500	0	553	111	0				247	0	0
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	0	4	13	13	4	0				13	0	13
Cap, veh/h	0	1776	731	608	2672	0				327	0	151
Arrive On Green	0.00	1.00	0.00	0.33	1.00	0.00				0.11	0.00	0.00
Sat Flow, veh/h	0	3563	1429	3107	3563	0				3107	0	1429
Grp Volume(v), veh/h	0	1500	0	553	111	0				247	0	0
Grp Sat Flow(s),veh/h/ln	0	1736	1429	1553	1736	0				1553	0	1429
Q Serve(g_s), s	0.0	0.0	0.0	16.4	0.0	0.0				7.4	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	16.4	0.0	0.0				7.4	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1776	731	608	2672	0				327	0	151
V/C Ratio(X)	0.00	0.84	0.00	0.91	0.04	0.00				0.75	0.00	0.00
Avail Cap(c_a), veh/h	0	1776	731	646	2672	0				776	0	357
HCM Platoon Ratio	1.00	2.00	2.00	1.67	1.67	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	0.65	0.00	0.97	0.97	0.00				1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	31.5	0.0	0.0				41.8	0.0	0.0
Incr Delay (d2), s/veh	0.0	3.4	0.0	16.0	0.0	0.0				3.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.8	0.0	8.3	0.0	0.0				3.4	0.0	0.0
LnGrp Delay(d),s/veh	0.0	3.4	0.0	47.5	0.0	0.0				45.3	0.0	0.0
LnGrp LOS		A		D	A					D		
Approach Vol, veh/h		1500			664						247	
Approach Delay, s/veh		3.4			39.6						45.3	
Approach LOS		A			D						D	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	24.8	69.0		16.1		93.9						
Change Period (Y+Rc), s	6.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	20.0	48.0		24.0		74.0						
Max Q Clear Time (g_c+I1), s	18.4	2.0		9.4		2.0						
Green Ext Time (p_c), s	0.4	9.6		0.7		9.8						
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				17.7								
HCM 2010 LOS				B								
<b>Notes</b>												
User approved pedestrian interval to be less than phase max green.												

Queues

3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	368	1379	237	889	426	847
v/c Ratio	0.96	1.02	0.26	0.86	0.28	1.12
Control Delay	41.2	40.7	29.7	16.8	16.5	94.8
Queue Delay	0.0	0.0	0.0	1.6	0.0	0.0
Total Delay	41.2	40.7	29.7	18.4	16.5	94.8
Queue Length 50th (ft)	92	~550	75	243	86	~657
Queue Length 95th (ft)	m#131	m#630	m107	m#392	119	#900
Internal Link Dist (ft)		854	699			
Turn Bay Length (ft)	400			200	400	1000
Base Capacity (vph)	383	1356	915	1031	1549	759
Starvation Cap Reductn	0	0	0	48	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.96	1.02	0.26	0.90	0.28	1.12

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

HCM 2010 Signalized Intersection Summary  
 3: I-85 NB Ramps & SR 324/Gravel Springs Rd

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 		 					
Volume (veh/h)	350	1310	0	0	225	845	405	0	805	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	168.1	182.7	0.0	0.0	182.7	168.1	168.1	0.0	168.1			
Adj Flow Rate, veh/h	368	1379	0	0	237	0	426	0	0			
Adj No. of Lanes	1	2	0	0	2	1	2	0	1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95			
Percent Heavy Veh, %	13	4	0	0	4	13	13	0	13			
Cap, veh/h	696	2215	0	0	1494	615	571	0	263			
Arrive On Green	0.08	0.43	0.00	0.00	0.43	0.00	0.18	0.00	0.00			
Sat Flow, veh/h	1601	3563	0	0	3563	1429	3107	0	1429			
Grp Volume(v), veh/h	368	1379	0	0	237	0	426	0	0			
Grp Sat Flow(s),veh/h/ln	1601	1736	0	0	1736	1429	1553	0	1429			
Q Serve(g_s), s	8.0	20.9	0.0	0.0	2.8	0.0	8.7	0.0	0.0			
Cycle Q Clear(g_c), s	8.0	20.9	0.0	0.0	2.8	0.0	8.7	0.0	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	696	2215	0	0	1494	615	571	0	263			
V/C Ratio(X)	0.53	0.62	0.00	0.00	0.16	0.00	0.75	0.00	0.00			
Avail Cap(c_a), veh/h	696	2215	0	0	1494	615	2536	0	1167			
HCM Platoon Ratio	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.37	0.37	0.00	0.00	0.87	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	8.3	13.0	0.0	0.0	11.7	0.0	26.0	0.0	0.0			
Incr Delay (d2), s/veh	0.3	0.5	0.0	0.0	0.2	0.0	2.0	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.4	10.1	0.0	0.0	1.4	0.0	3.9	0.0	0.0			
LnGrp Delay(d),s/veh	8.6	13.4	0.0	0.0	11.9	0.0	28.0	0.0	0.0			
LnGrp LOS	A	B			B		C					
Approach Vol, veh/h		1747			237			426				
Approach Delay, s/veh		12.4			11.9			28.0				
Approach LOS		B			B			C				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		91.6			14.0	77.6		18.4				
Change Period (Y+Rc), s		6.0			6.0	6.0		6.0				
Max Green Setting (Gmax), s		43.0			8.0	29.0		55.0				
Max Q Clear Time (g_c+I1), s		22.9			10.0	4.8		10.7				
Green Ext Time (p_c), s		7.6			0.0	8.1		1.6				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				15.1								
HCM 2010 LOS				B								

Queues

4: SR 324/Gravel Springs Rd

9/13/2014



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	21	1920	309	74	878	16	255	74	16	5	5
v/c Ratio	0.06	0.81	0.27	1.12	0.37	0.02	0.90	0.22	0.06	0.01	0.01
Control Delay	3.4	5.9	0.1	175.6	8.1	1.0	77.2	27.1	34.9	34.0	0.0
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.4	6.2	0.1	175.6	8.1	1.0	77.2	27.1	34.9	34.0	0.0
Queue Length 50th (ft)	3	206	0	~61	128	0	175	29	9	3	0
Queue Length 95th (ft)	m3	m191	m0	#113	163	4	#320	70	28	13	0
Internal Link Dist (ft)		699			1271			1085		623	
Turn Bay Length (ft)	365		225	365		225	100		100		100
Base Capacity (vph)	362	2367	1136	66	2367	1049	294	354	277	390	355
Starvation Cap Reductn	0	76	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.84	0.27	1.12	0.37	0.02	0.87	0.21	0.06	0.01	0.01

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

HCM 2010 Signalized Intersection Summary

4: SR 324/Gravel Springs Rd

9/13/2014

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	1805	290	70	825	15	240	5	65	15	5	5
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	179.2	182.7	179.2	179.2	182.7	179.2	179.2	179.2	190.0	179.2	179.2	179.2
Adj Flow Rate, veh/h	21	1920	0	74	878	0	255	5	69	16	5	0
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	4	6	6	4	6	6	6	6	6	6	6
Cap, veh/h	414	2367	1039	219	2367	1039	344	22	298	279	372	316
Arrive On Green	1.00	1.00	0.00	0.68	0.68	0.00	0.21	0.21	0.21	0.21	0.21	0.00
Sat Flow, veh/h	605	3471	1524	223	3471	1524	1352	104	1435	1271	1792	1524
Grp Volume(v), veh/h	21	1920	0	74	878	0	255	0	74	16	5	0
Grp Sat Flow(s),veh/h/ln	605	1736	1524	223	1736	1524	1352	0	1539	1271	1792	1524
Q Serve(g_s), s	0.6	0.0	0.0	17.1	11.7	0.0	20.0	0.0	4.3	1.2	0.2	0.0
Cycle Q Clear(g_c), s	12.3	0.0	0.0	17.1	11.7	0.0	20.3	0.0	4.3	5.5	0.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.93	1.00		1.00
Lane Grp Cap(c), veh/h	414	2367	1039	219	2367	1039	344	0	319	279	372	316
V/C Ratio(X)	0.05	0.81	0.00	0.34	0.37	0.00	0.74	0.00	0.23	0.06	0.01	0.00
Avail Cap(c_a), veh/h	414	2367	1039	219	2367	1039	362	0	340	296	396	337
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	1.0	0.0	0.0	8.2	7.3	0.0	42.2	0.0	35.8	38.1	34.2	0.0
Incr Delay (d2), s/veh	0.0	0.3	0.0	4.2	0.4	0.0	7.5	0.0	0.4	0.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.1	0.0	1.3	5.6	0.0	8.2	0.0	1.9	0.4	0.1	0.0
LnGrp Delay(d),s/veh	1.0	0.3	0.0	12.4	7.8	0.0	49.8	0.0	36.2	38.2	34.2	0.0
LnGrp LOS	A	A		B	A		D		D	D	C	
Approach Vol, veh/h		1941			952			329			21	
Approach Delay, s/veh		0.3			8.2			46.7			37.2	
Approach LOS		A			A			D			D	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		81.5		28.5		81.5		28.5				
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0				
Max Green Setting (Gmax), s		74.0		24.0		74.0		24.0				
Max Q Clear Time (g_c+I1), s		14.3		7.5		19.1		22.3				
Green Ext Time (p_c), s		32.4		1.1		31.1		0.2				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			7.6									
HCM 2010 LOS			A									

Traffic Operations  
Response

**Robinson, Charles A.**

---

**From:** Werho, Ken  
**Sent:** Wednesday, February 11, 2015 8:51 AM  
**To:** Phillips, Kim  
**Cc:** Heath, Andrew; Zehngraff, Scott E.; Shelby, Albert; Robinson, Charles A.; Peters, Dave  
**Subject:** RE: PI# 0012698 Gwinnett I-85/SR 403 @ SR 324 Interchange

Kim,

See below.

***Ken Werho***

Ga. Department of Transportation  
Office of Traffic Operations  
935 E. Confederate Ave., Bldg. 24  
Atlanta, Ga. 30316  
404-635-2859  
kwerho@dot.ga.gov

---

**From:** DeNard, Paul  
**Sent:** Tuesday, February 10, 2015 5:04 PM  
**To:** Werho, Ken  
**Cc:** Zehngraff, Scott E.  
**Subject:** RE: PI# 0012698 Gwinnett I-85/SR 403 @ SR 324 Interchange

Ken,

Please add this to our official response.

“Question for Traffic Ops: Would a SPUI operationally work better than the tight urban diamond with signal spacing closer than normal?”

Answer: The SPUI (single point urban interchange) would combine two signals at a diamond interchange (tight urban or conventional) down to one signal. From a conceptual standpoint, reducing the number of signals at the interchange would create more distance between the interchange and any adjacent signals. However, there would need to be an operational analysis to determine if the SPUI alternative would function more efficiently (total delay, average queues, travel time, etc) than the TUDI alternative.

**Paul DeNard, PE, PTOE**  
State Traffic Operations Manager  
Georgia Department of Transportation  
404-635-2843 (Office) 404-805-8016 (Cell)

---

**From:** Zehngraff, Scott E.  
**Sent:** Monday, February 09, 2015 10:04 AM  
**To:** DeNard, Paul  
**Subject:** Fwd: PI# 0012698 Gwinnett I-85/SR 403 @ SR 324 Interchange

Attachment 17- Approved  
Design Variance for 200 ft.  
Access Control on SR  
324/Gravel Springs Road in  
NW, SW, and SE quadrants



G R E S H A M  
S M I T H   A N D  
P A R T N E R S

January 23, 2015

Brent Story, P.E.  
State Design Policy Engineer  
Georgia Department of Transportation  
600 West Peachtree Street, 26<sup>th</sup> Floor  
Atlanta, Georgia 30308

**Subject: Request for Approval of Design Variance  
P.I. #0012698, Gwinnett County  
Gwinnett County Dept. of Transportation Project F-0782-01  
I-85/SR 403 at SR 324/Gravel Springs Road Interchange Project**

### **Project Description**

Georgia Department of Transportation PI No. 0012698/Gwinnett County Department of Transportation Project F-0782 proposes to (1) improve transportation access to and from the interstate highway system, (2) reduce in crash frequency and severity on Interstate I-85 in the vicinity of the proposed project area, (3) improve traffic operations on the local roadway network, and (4) enhance economic development opportunities by constructing an interchange on Interstate 85/ SR 403 with SR 324/ Gravel Springs Road in Gwinnett County. Interstate 85/ SR 403 is a four lane roadway with a 64 ft. depressed median with a 65 mph speed limit. SR 324/ Gravel Springs Road, which is posted for a 45 mph speed limit and crosses over Interstate 85/SR 403, was recently constructed by a separate GDOT project to be a four lane roadway with a raised median on a new overpass bridge. There is presently no connection between these two roadways.

The project will consist of four new ramps to create a new location, full access diamond interchange with the existing overpass of (non-controlled access) SR 324/ Gravel Springs Road over (controlled access) I-85/SR 403. The interchange will be situated between the existing SR 20/Buford Drive and Hamilton Mill Road interchanges at MP 118 within Gwinnett County.

The southbound entrance ramp (Ramp A) will have two through lanes that converge to a single through lane prior to merging onto I-85/SR403. The southbound exit and northbound entrance ramps (Ramps B and C, respectively) will each have a single through lane. The northbound exit ramp (Ramp D) will have two through lanes diverging from I-85/SR 403. One of these lanes will be received from an auxiliary lane constructed by the proposed I-85 managed 'HOT' lanes project, GDOT PI #110600, prior to this project.

**Design Services For The Built Environment**

2325 Lakeview Parkway, Suite 300 / Alpharetta, Georgia 30009-7940 / Phone 770.754.0755 /  
[www.greshamsmith.com](http://www.greshamsmith.com)



Request for Approval of Design Variance  
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The intersection of SR 324/ Gravel Springs Road with the southbound ramp terminals will consist of dual left turn lanes onto both I-85/SR 403 SB and SR 324/ Gravel Springs Road EB. Dedicated right turn lane will be provided onto SR 324/ Gravel Springs Road WB and I-85/SR 403 SB. The intersection of SR 324/ Gravel Springs Road with the northbound ramp terminals will consist of dual left turn lanes onto SR 324/ Gravel Springs Road WB. A single turn lane will accommodate the I-85/SR 403 NB movements. Dedicated right turn lane will be provided onto SR 324/ Gravel Springs Road EB and I-85/SR 403 NB. Traffic signals would be placed at both of these intersections.

**Features Requiring Design Variance**

The proposed full access control length proposed along SR 324/ Gravel Springs Road outside of the proposed interchange’s ramp terminal radii returns in the northwest, southwest and southeast quadrants is 200 ft. This will entail a minor realignment of two residential driveways on the interchange’s west side in order to achieve this 200 ft. access control length. However, the *GDOT Design Policy Manual* stipulates in Section 3.5.2 that “*For projects that involve an Interstate interchange, (new construction or reconstruction), (full) access control should be established ...At a minimum, (full) access control shall not be less than 300-ft. This distance is measured from the radius return of the ramp termini with the intersecting route.*”

**Current and Future Traffic Data**

Roadway	Current Year (2014)	Open Year (2020)	Design Year (2040)	24 Hour Truck Percentage
Gravel Springs Road/ SR 324	20,550	31,125	25,125	6%
I-85 SB/SR403 On Ramp (Ramp A)	N/A	4,675	10,175	N/A
I-85/SR403 SB Off Ramp (Ramp B)	N/A	3,200	8,500	N/A
I-85/SR403 NB On Ramp (Ramp C)	N/A	3,200	8,500	N/A
I-85/SR403 NB Off Ramp (Ramp D)	N/A	4,675	10,175	N/A
I-85/SR 403 Mainline	72,850	77,340	107,290	21%

See Attachment #2 for the crash data.



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**Why Current Standard Criteria Cannot be Met**

- The I-85/SR 403 SB ramp terminal radius return would 'land lock' the residence in the northwest quadrant of the interchange with a 300 ft. long access control limit and result in a displacement and total take of the parcel. The south side of the parcel borders SR 324/ Gravel Springs Road from the northwest corner of the existing Interstate 85/ SR 403 right of way/ access control to a property corner approximately 400 ft. to the west. This frontage also contains the parcel's sole driveway which is 150 ft. long from the front of the residence to SR 324/ Gravel Springs Road. The new proposed interchange's SB ramp terminal radius return will be placed 160 ft. to the west within the parcel, placing the western property corner within the 300 ft. minimum access control limit required by GDOT. A back corner of the parcel does front Camp Branch Road for 85 ft., but this would entail constructing a 600 ft. circuitous driveway behind the residence and severely hamper site circulation.
- The I-85/SR 403 SB ramp terminal radius return would 'land lock' the residence in the southwest quadrant of the interchange with a 300 ft. long access control limit and result in a displacement. The north side of the parcel borders SR 324/ Gravel Springs Road from the southwest corner of the existing Interstate 85/ SR 403 right of way/ access control to a property corner approximately 470 ft. to the west. This frontage also contains the parcel's sole driveway which is 330 ft. long from the front of the residence to SR 324/ Gravel Springs Road. The new proposed interchange's SB ramp terminal radius return will be placed 250 ft. to the west within the parcel, placing the western property corner within the 300 ft. minimum access control limit required by GDOT. This parcel's SR 324/ Gravel Springs Road frontage is bisected by a smaller parcel and resumes 210 ft. to the west for a distance of 520 ft. (990 ft. total), but a driveway relocation to this western frontage would be a circuitous 850 ft. length and severely hamper site circulation.
- The I-85/SR 403 NB ramp terminal radius return would 'land lock' the residence in the southeast quadrant of the interchange with a 300 ft. long access control limit and result in a displacement and total take of the parcel. The north side of the parcel borders SR 324/ Gravel Springs Road from 276 ft. east of the southeast corner of the existing Interstate 85/ SR 403 right of way to a property corner approximately 231 ft. to the east. This frontage also contains the parcel's sole driveway access and connects to SR 324/ Gravel Springs Road. The new proposed interchange NB ramp terminal radius return will be placed 230 ft. to the east, placing the eastern property corner within the 300 ft. minimum access



Request for Approval of Design Variance  
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control limit required by GDOT. There are no other roadway access options for this parcel.

### **Cost to Meet Standard Criteria**

- For the affected parcel in the northwest quadrant of the interchange, the estimated acquisition cost for the entire parcel is \$1,600,000 and \$40,000 for the displacement of the existing residence if access to SR 324/ Gravel Springs Road is completely eliminated. Conversely, if the residence was retained and the driveway were realigned behind the house over 600 ft. to Camp Branch Road, the estimated cost would be \$100,000 in additional construction and design with an additional \$270,000 in right of way damages. Reducing the recommended limit of access along the west side of I-85/SR 403 along SR 324/ Gravel Springs Road's north side to 200 feet allows for only a minor relocation of the driveway and retains access to the parcel with an estimated required right of way cost of \$530,000 and \$10,000 in additional construction.
- For the affected parcel in the southwest quadrant of the interchange, the estimated acquisition cost for the eastern portion of the parcel is \$1,500,000 and \$40,000 for the displacement of the existing residence if access to SR 324/ Gravel Springs Road is completely eliminated along the property's east side. Conversely, if the residence was retained and the driveway were realigned to the western portion of the property's access to SR 324/ Gravel Springs Road, the estimated cost would be \$120,000 in additional construction and design with an additional \$270,000 in right of way damages. Reducing the recommended limit of access along the west side of I-85/SR 403 along SR 324/ Gravel Springs Road's south side to 200 feet allows for only a minor relocation of the driveway and retains access to the parcel's east side with an estimated required right of way cost of \$820,000 and \$10,000 in additional construction.
- For the affected parcel in the southeast quadrant of the interchange, the estimated acquisition cost for the entire parcel is \$350,000 and \$40,000 for the displacement of the existing residence if access to SR 324/ Gravel Springs Road is completely eliminated. Reducing the recommended limit of access along the east side of I-85/SR 403 along SR 324/ Gravel Springs Road's south side to 200 feet allows for retaining the existing driveway, thus providing access to the parcel and a required right of way cost of \$90,000.



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### **Mitigation Proposed**

A raised median has been previously constructed on SR 324/ Gravel Springs Road in front of the proposed driveway access locations in the three quadrants seeking a variance. Therefore, only right-in/right-out access will be allowed at the driveways with the left and 'U' turning movements being consolidated at the median opening locations. Further, the 200 ft. access control lengths proposed in the interchange's northwest, southwest, and southeast quadrants exceed the 100 ft. access control minimum length for urban interchanges recommended from AASHTO's *A Policy on Design Standards Interstate System-January 2005 Edition*.

Lastly, the overall interchange project will provide a substantial public benefit by improving access to I-85/SR 403 for Gwinnett County residents and businesses, reduce the crash frequency and severity on Interstate I-85 in the vicinity of the proposed project area, improve traffic operations on the local roadway network, and enhance economic development opportunities.

### **Recommendation**

A 200 ft. access control length is proposed along SR 324/ Gravel Springs Road in the interchange's northwest, southwest, and southeast quadrants outside of the ramp terminal radii returns. This will allow continued access to these parcels and the residences that are located within them without significant impacts to the site circulation. Further, the 200 ft. access control length will reduce the overall cost for this project from one to two million dollars by avoiding the acquisition of the entire parcels, displacements of the residences, increased right of way damages or elongated driveway relocations. Lastly, the proposed 200 ft. access control lengths in the three quadrants are along a roadway whose left turn access is currently and will continue to be controlled by a raised median. Based on the information contained in this request, Gresham, Smith and Partners in conjunction with the Gwinnett County Department of Transportation recommends the approval of this variance.



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- 1. The proposed full access control length proposed along SR 324/ Gravel Springs Road's north side outside of the proposed interchange's western ramp terminal radius return in the northwest quadrant is 200 ft. versus a 300 ft. minimum access control limit required by the *GDOT Design Policy Manual*.

Recommend: [Signature] 1/26/2015  
Eric J. Rickert, P.E.-Engineer of Record Date

Concur: [Signature] 2/23/2015  
GDOT Director of Engineering Date

Approve: [Signature] 2.24.15  
GDOT Chief Engineer Date

- 2. The proposed full access control length proposed along SR 324/ Gravel Springs Road's south side outside of the proposed interchange's western ramp terminal radius return in the southwest quadrant is 200 ft. versus a 300 ft. minimum access control limit required by the *GDOT Design Policy Manual*.

Recommend: [Signature] 1/26/2015  
Eric J. Rickert, P.E.-Engineer of Record Date

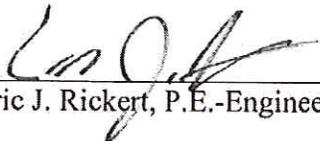
Concur: [Signature] 2/23/2015  
GDOT Director of Engineering Date

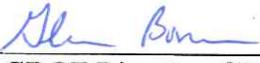
Approve: [Signature] 2.24.15  
GDOT Chief Engineer Date

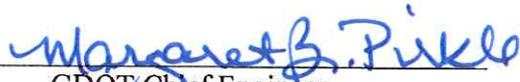


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3. The proposed full access control length proposed along SR 324/ Gravel Springs Road's south side outside of the proposed interchange's eastern ramp terminal radius return in the southeast quadrant is 200 ft. versus a 300 ft. minimum access control limit required by the *GDOT Design Policy Manual*.

Recommend:  1/26/2015  
Eric J. Rickert, P.E.-Engineer of Record Date

Concur:  2/23/2015  
GDOT Director of Engineering Date

Approve:  2.24.15  
GDOT Chief Engineer Date

Attachments:

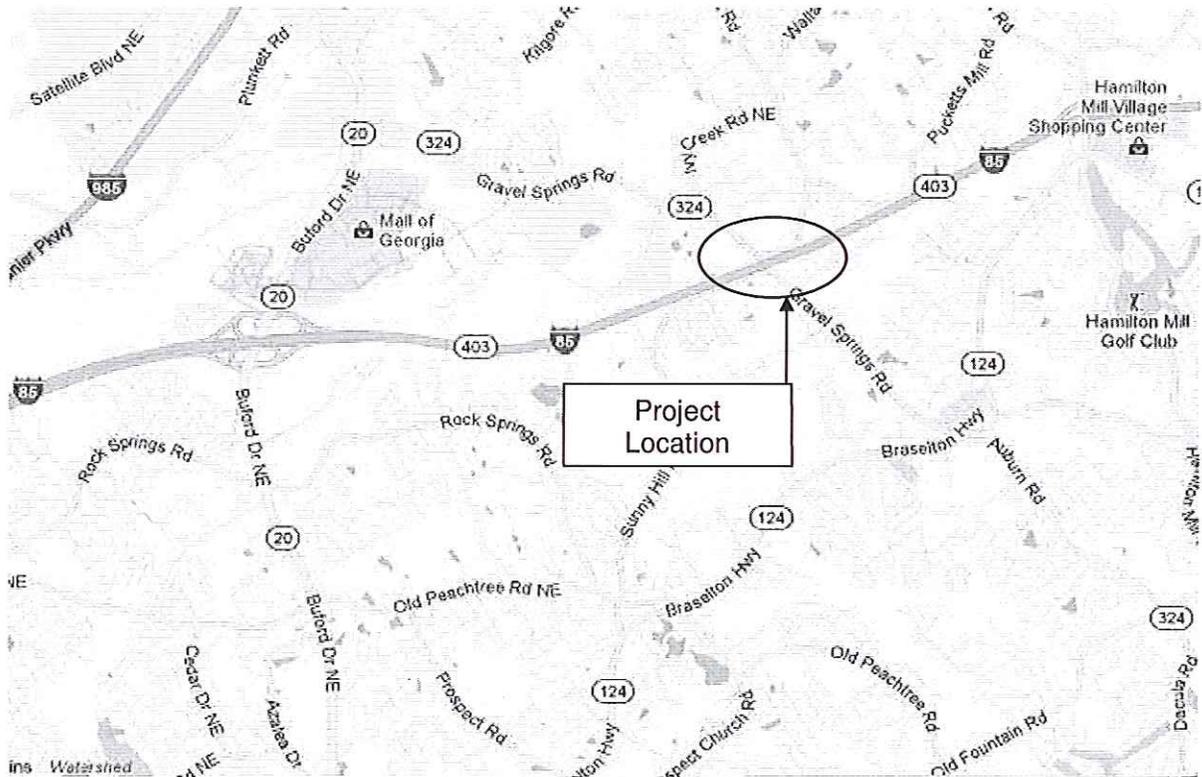
1. Location Map
2. Crash Summary
3. Display showing access control limits on SR 324 (Gravel Springs Road) at the proposed interchange

Copy File  
Lewis Cooksey, Gwinnett County Department of Transportation  
Albert Shelby, GDOT Office of Program Delivery



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### Attachment #1-Location Map



**Gravel Springs Road / SR 324 @ I-85/SR 403 Interchange**

**Georgia Department of Transportation PI # 0012698**

**Gwinnett County Department of Transportation Project Number F-0782-01**



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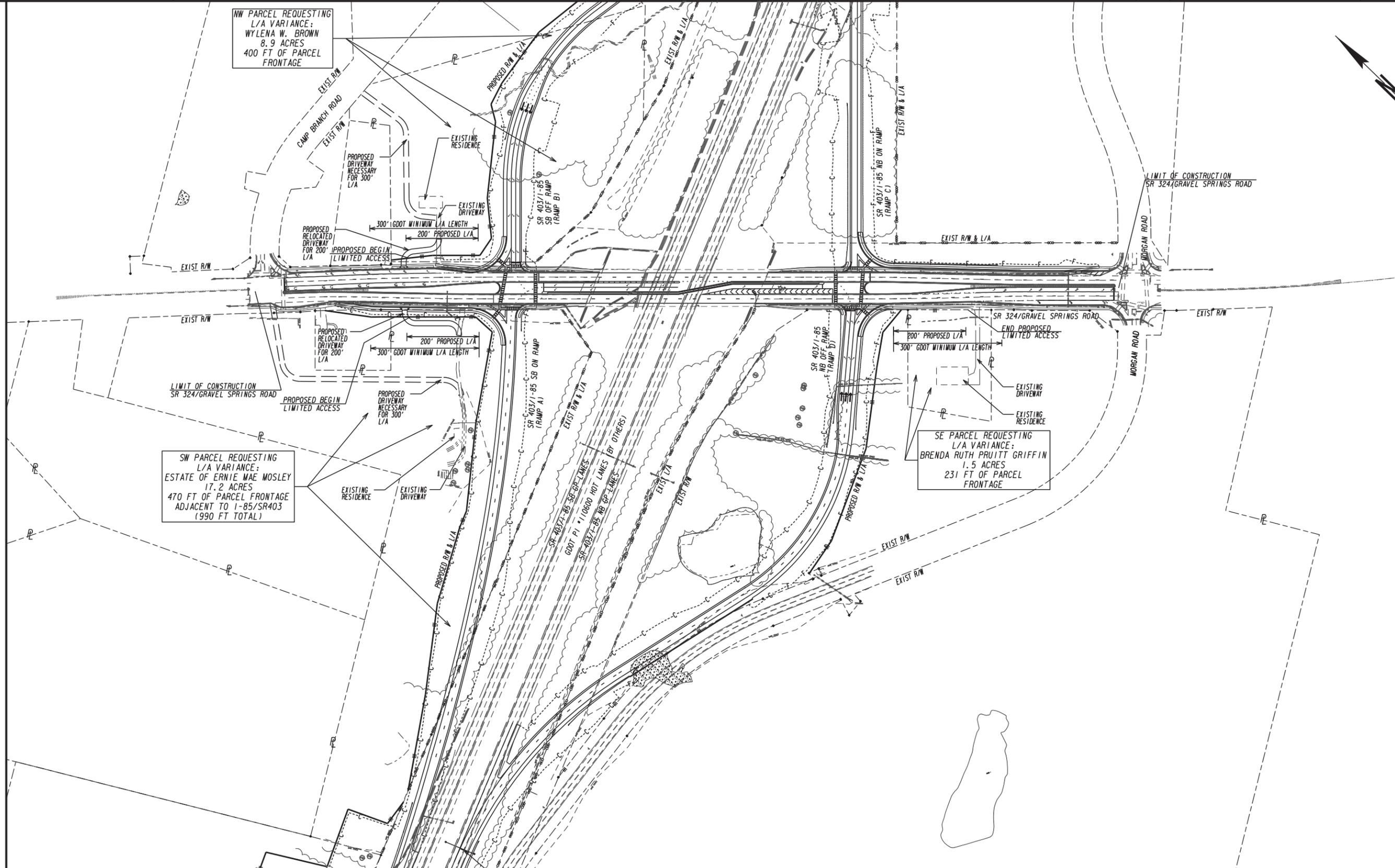
**Attachment #2-Crash Analysis of SR 324 from Camp Branch Road to Morgan Road, Gwinnett County from Years 2007 to 2013**

Year	Crash Type						Total Crashes
	Angle	Head On	Rear End	Sideswipe-Same Direction	Sideswipe-Opposite Direction	Not A Collision With Motor Vehicle	
2007	9	0	7	1	2	6	25
2008	8	1	3	2	0	3	17
2009	9	0	9	1	0	7	26
2010	10	1	6	0	1	5	24
2011	6	1	6	0	0	2	15
2012	6	0	5	0	0	3	14
2013	10	1	5	1	0	3	20
Total	58	4	41	5	3	29	141

Year	Severity			Total Crashes
	PDO	Injury	Fatal	
2007	17	8	0	25
2008	14	3	0	17
2009	16	10	0	26
2010	19	5	0	24
2011	14	1	0	15
2012	11	3	0	14
2013	11	8	1	20
Total	102	38	1	141

Year	Road Surface				Total Crashes
	Dry	Wet	Icy	Other	
2007	18	7	0	0	25
2008	13	4	0	0	17
2009	21	5	0	0	26
2010	14	4	3	0	24
2011	15	0	0	0	15
2012	14	0	0	0	14
2013	13	7	0	0	20
Total	108	27	3	0	141

Year	Lighting			Total Crashes
	Daylight	Dark-Lighted	Dark-Not Lighted	
2007	12	1	9	25
2008	8	3	4	17
2009	20	1	3	26
2010	11	0	12	24
2011	9	0	6	15
2012	10	2	2	14
2013	11	1	7	20
Total	81	8	43	141

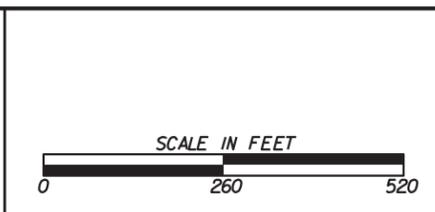


EXISTING R/W & PROPERTY LINE	---
REQUIRED R/W LINE	—
CONSTRUCTION LIMITS	-C-F-
EASEMENT FOR CONSTRUCTION & MAINTENANCE OF SLOPES	▨
EASEMENT FOR CONSTR OF SLOPES	▩
EASEMENT FOR CONSTR OF DRIVES	▣

BEGIN LIMIT OF ACCESS	.....BLA
END LIMIT OF ACCESS	.....ELA
LIMIT OF ACCESS	—
R/W AND LIMIT OF ACCESS	—



GRESHAM  
SMITH AND  
PARTNERS



REVISION DATES

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION

OFFICE: PROGRAM DELIVERY

**ACCESS CONTROL VARIANCE DISPLAY**

SR 403/INTERSTATE 85 AT SR 324/  
GRAVEL SPRINGS ROAD INTERCHANGE

PI: 0012698  
COUNTY: GWINNETT

DRAWING No.	1-000
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