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Georgia Department of Transportation

Traffic Analysis Report

I-285 Ramps at CR 209/Riverside Drive
P.I. No. 0010925

March 2014

Traffic Analysis Report

I-285 Ramps at CR 209/
Riverside Drive

Prepared for:
Georgia Department of Transportation

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

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Executive Summary

Riverside Drive is a well-traveled commuter facility in northern Fulton County within the City of Sandy Springs. Riverside Drive serves as a major access point to Interstate 285 (I-285) for many Cobb County and City of Sandy Spring residents. Riverside Drive also provides connection to one of the few Chattahoochee River crossings in the area via Johnson Ferry Road. Currently the interchange has congestion and queuing issues, primarily during the p.m. peak hour, with significant queuing on the I-285 eastbound off-ramp. Additionally, the most recent five years of historical crash data show that all of the study area intersections (I-285 eastbound ramps, I-285 westbound ramps, and Heards Ferry Road) have experienced crash rates greater than the statewide average crash rates for comparable intersections. The crashes that occur at these intersections not only result in injuries and property damage, but also add nonrecurring congestion to the Riverside Drive corridor as well as to I-285.

The proposed project will convert the current signalized interchange intersections at the ramp termini to roundabouts. Because roundabouts reduce the number of conflict points compared to traditional intersections, this innovative interchange design is expected to provide both safety and operational benefits.

Future year crash rates under no-build and build conditions were predicted for the interchange intersections using the Predictive Method for Urban and Suburban Arterials outlined in Chapter 12 of the 2010 Highway Safety Manual (HSM). The safety analysis shows that the proposed roundabout design will provide significant safety benefits for the interchange, with an approximate crash reduction of 48 percent.

An operational and capacity analysis was completed for the interchange using VISSIM traffic modeling software. The analysis examined operations in the existing year, open year (2015), and design year (2035) under no-build and build conditions. The results show that traffic operations under the roundabout design will significantly improve at the I-285 eastbound ramp and Heards Ferry Road intersections, but will somewhat worsen at the I-285 westbound ramp intersection.

During the p.m. peak period, the roundabout design improves operations for the eastbound off-ramp left turn and worsens operations for the westbound off-ramp right turn. With the roundabouts, the p.m. peak eastbound off-ramp maximum queue is reduced from more than 5,000 feet to 430 feet, and the p.m. peak westbound off-ramp maximum queue is increased from 400 feet to 1,150 feet. The westbound off-ramp queue will be contained within the 950-foot ramp length for most of the 20-year design

life of the project. Before the westbound off-ramp queue is expected to exceed the ramp length, a project consisting of construction of an I-285 westbound auxiliary lane spanning from Roswell Road to Riverside Drive is planned that will contain the ramp spillover. Additionally, the roundabouts will improve operations at the Heards Ferry Road intersection because the signal timing at this intersection will be able to be optimized alone rather than in coordination with the ramp termini intersections.

1. Introduction

The Riverside Drive study corridor is a north-south route located in the City of Sandy Springs in Fulton County, Georgia. Riverside Drive serves as an access route between Interstate 285 (I-285) and the City of Sandy Springs, other cities in northern Fulton County, and Cobb County. This report evaluates existing conditions as well as future build and no-build operations in the vicinity of the interchange of Riverside Drive and I-285. This traffic analysis report summarizes the study area and existing field conditions, describes the proposed improvement, summarizes historical crash data, projects future year crash rates, and evaluates the build concept through an analysis of traffic delay, ramp queues, travel times, and vehicular throughput.

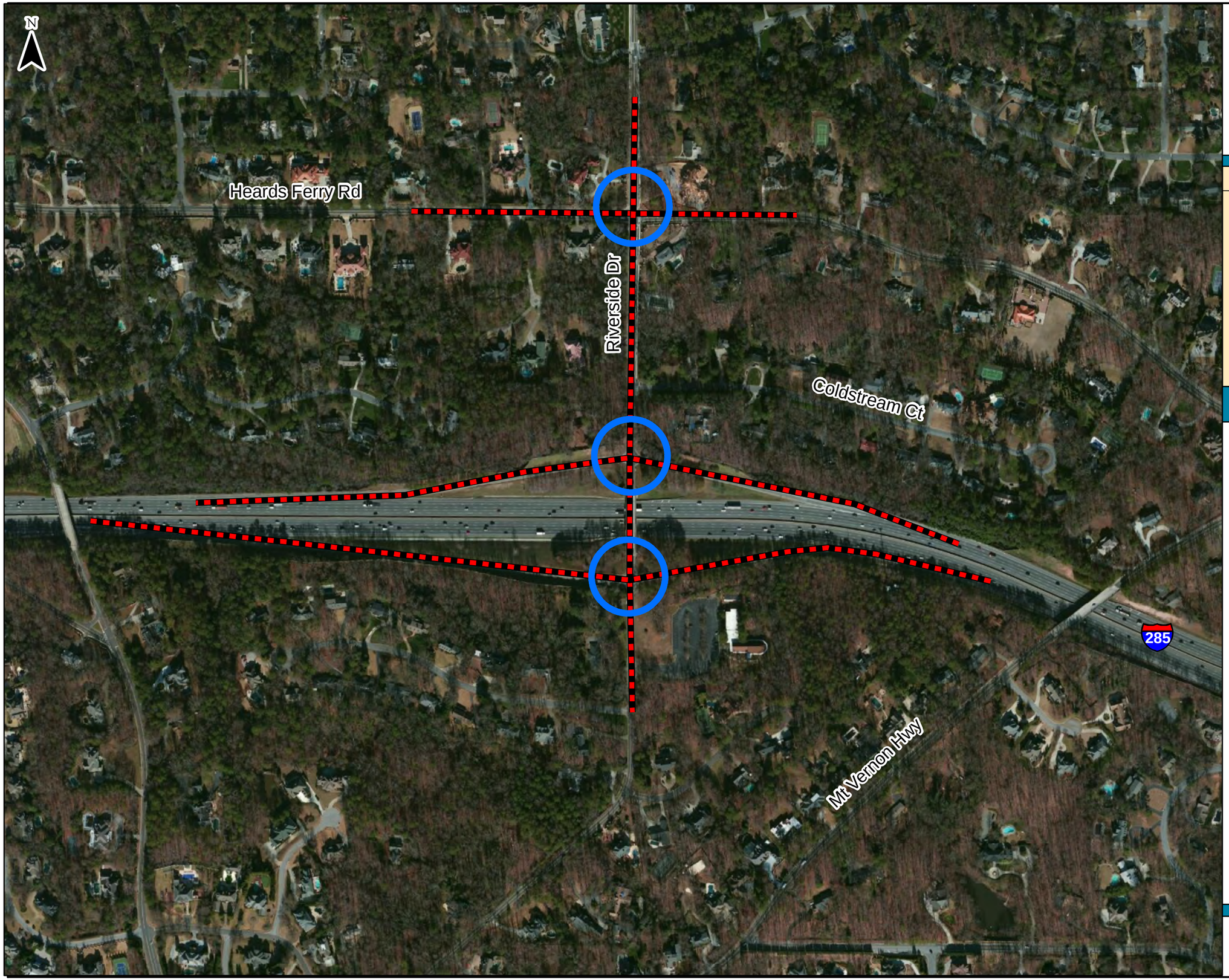
2. Study Area

The project study area includes the Riverside Drive at I-285 interchange. Although this is an interchange project, the intersection of Riverside Drive at Heards Ferry Road is included in the traffic analysis to examine the impacts of the project on this nearby, adjacent intersection. The three intersections within the traffic study area are the two ramp termini intersections (Riverside Drive at I-285 Eastbound and Westbound) and Riverside Drive at Heards Ferry Road.

Figure 1 shows the study area and the study intersections.

Riverside Drive Traffic Analysis Report

P.I. No. 0010925
Fulton County



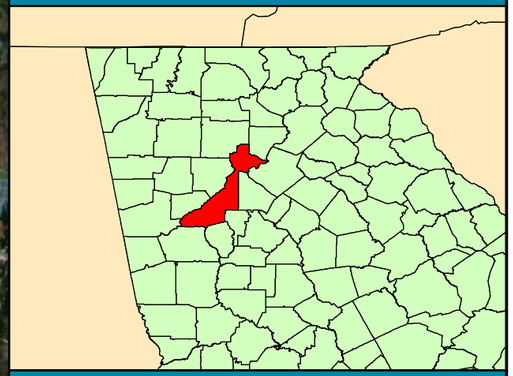


Figure 1: Study Area

Legend

Study Corridor

Study Intersections

0 255 510 1,020 Feet

ARCADIS
Infrastructure, environment, buildings

3. Existing Field Conditions

The Riverside Drive corridor serves a large amount of daily commuters primarily traveling to/from I-285 and exhibits significantly different travel patterns between the a.m. and p.m. peak hours. In the a.m. peak hour, the majority of traffic travels southbound on Riverside Drive and either makes a right turn onto the I-285 westbound on-ramp at the northern ramp intersection or a left turn onto the I-285 eastbound on-ramp at the southern ramp intersection. During the a.m. peak period, moderate queues form on southbound Riverside Drive north of the I-285 interchange.

During the p.m. peak hour, the majority of traffic travels from the I-285 eastbound off-ramp and then turns left onto Riverside Drive to head northbound. Additionally, a moderate amount of traffic comes from the I-285 westbound off-ramp and then makes a right turn onto northbound Riverside Drive. Many p.m. peak hour commuters use the northbound Riverside Drive corridor to access the City of Sandy Springs as well as Cobb County via Johnson Ferry Road, which provides one of the few crossings of the Chattahoochee River in the area. Significant queues develop on the I-285 eastbound off-ramp from the heavy volume of left-turning vehicles accessing northbound Riverside Drive. Heavy queues also form on northbound Riverside Drive originating at the Heards Ferry Road intersection that, at times, extend back to the I-285 westbound ramp intersection. Traffic at the Riverside Drive interchange is also highly dynamic, as it is influenced by the degree of congestion on major adjacent corridors such as I-75 and Georgia 400.

3.1 Traffic Volume

The existing average daily traffic (ADT) volume on Riverside Drive varies from 18,840 north of the Heards Ferry Road intersection to 5,890 south of the I-285 eastbound ramp intersection. Existing peak hour demand volumes were developed for the study area because there is existing unmet demand. Heavy peak hour volumes develop on the corridor from commuters, including 1,090 vehicles per hour (VPH) traveling southbound on Riverside Drive between the Heards Ferry Road and the I-285 westbound ramp intersections during the a.m. peak period, and 1,375 VPH traveling northbound on Riverside Drive between the I-285 westbound ramps and the Heards Ferry Road intersections during the p.m. peak period. Heavy a.m. peak hour turning movements include 595 VPH making the right turn from southbound Riverside Drive to westbound I-285 and 395 VPH making the left turn from southbound Riverside Drive to eastbound I-285. In the p.m. peak hour, heavy turning movements include the

845 VPH making the left turn from I-285 eastbound to northbound Riverside Drive and 335 VPH making the right turn from I-285 westbound to northbound Riverside Drive.

3.2 Future Growth

Moderate growth is expected in the vicinity of the Riverside Drive interchange. To determine the most appropriate growth rate for the area, historical traffic counts and future model estimates were analyzed. The Georgia Department of Transportation (GDOT) provided historical counts from 2000 through 2012 for six locations within the study area as well as historical ramp counts from 2007 to 2012 for the four ramps comprising the interchange. Additionally, the Atlanta Regional Commission (ARC) travel demand model, Plan2040, was analyzed for 2010 and 2040. Based on the available data, a 0.5 percent annual growth rate was used. A technical memorandum detailing the development of traffic volumes is provided in Appendix A.

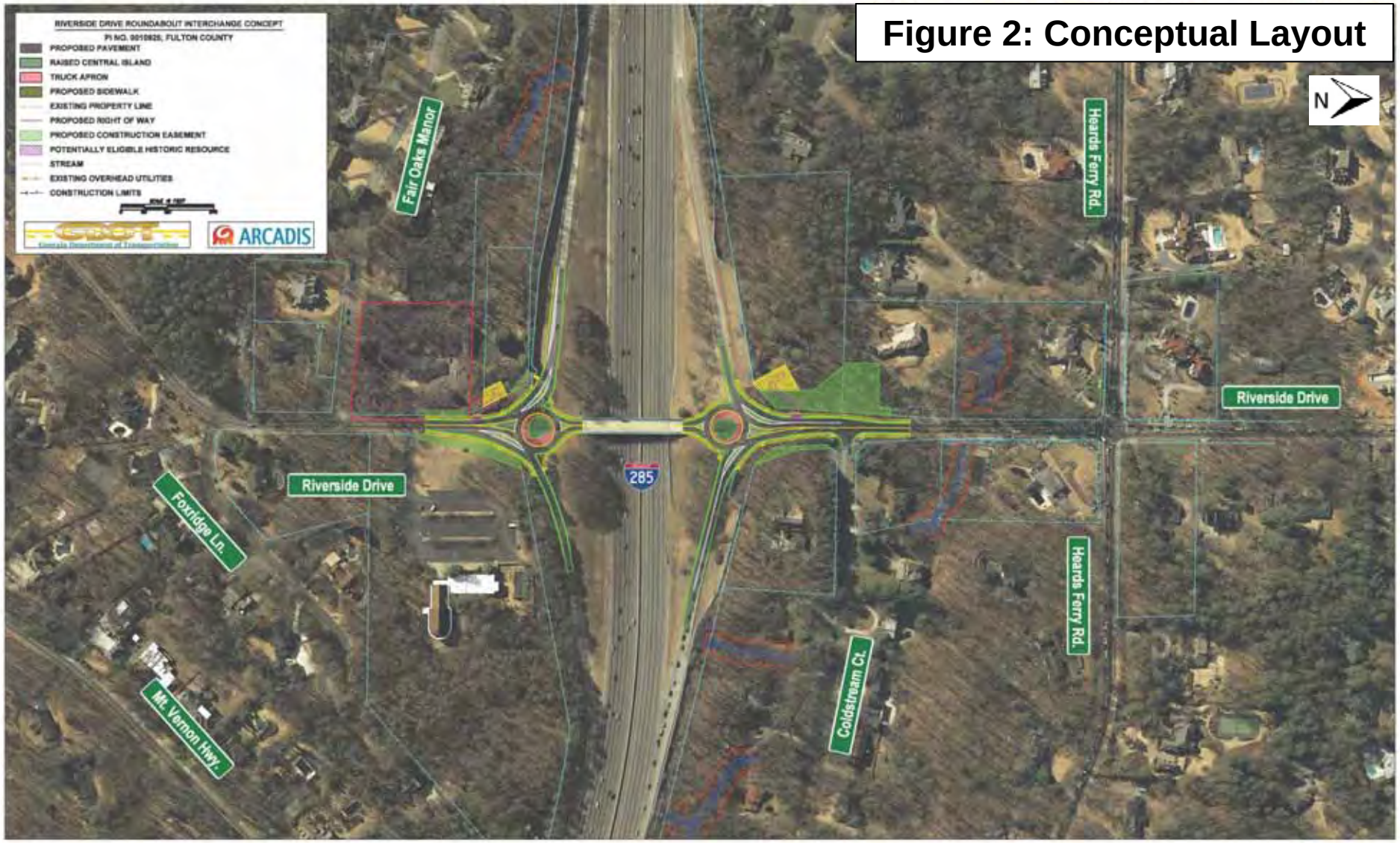
3.3 Volume Approval

Volume diagrams were developed for the intersections of Riverside Drive with Heards Ferry Road, the I-285 westbound ramps, and the I-285 eastbound ramps for the existing year (2012), open year (2015), and design year (2035). GDOT volume approval was granted on November 14, 2013. The approved volume diagrams and volume approval letter are included in Appendix B.

4. Proposed Improvement

The proposed project (P.I. 0010925) involves conversion of the two ramp termini intersections from signalized intersections to single-lane roundabouts. Because roundabouts reduce the number of intersection conflict points and traveling speeds, the roundabout design is anticipated to reduce the frequency and severity of accidents at the interchange. In addition to safety benefits, operational benefits are expected to accompany the implementation of roundabouts at the ramp termini intersections. The proposed build layout is shown on Figure 2.

Figure 2: Conceptual Layout



5. Safety Analysis

Safety is an important aspect related to development of the Riverside Drive and I-285 interchange. Traffic incidents (crashes) cause congestion, economic loss, and the potential for injuries or loss of life.

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

5.1 Historical Crash Analysis

The latest five years of available crash data were collected from GDOT and analyzed to quantify the frequency, severity, and type of crashes occurring at the intersections of Riverside Drive and the I-285 eastbound ramps, Riverside Drive and the I-285 westbound ramps, and Riverside Drive and Heards Ferry Road. The latest crash data available for the three intersections were for the years 2008 to 2012. The following sections describe the crash rate, crash type, and crash severity analysis of the five years of historical crash data.

5.1.1 Crash Rate Analysis

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

The results presented in the table show that the eastbound ramp intersection and the Heards Ferry Road intersection have exceeded the statewide average crash rate for total, injury, and property damage only (PDO) crashes during 2008 to 2012. Additionally, the westbound ramp intersection has exceeded the statewide average crash rate for total and PDO crashes. The table also shows that fatal crashes are less frequent at the Riverside Drive intersections compared to the statewide average rate; there were no fatal crashes at the study intersections during the five years analyzed.

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

Riverside Drive		2008 – 2012*	2008	2009	2010	2011	2012
		Statewide Average	Actual Crashes	Actual Crashes	Actual Crashes	Actual Crashes	Actual Crashes
Eastbound Ramp Intersection	Total	6.1	6	5	7	4	9
	Fatality	0.0	0	0	0	0	0
	Injury	1.4	1	3	3	1	2
	PDO	4.7	5	2	4	3	7
Westbound Ramp Intersection**	Total	10.0	12	10	6	9	5
	Fatality	0.0	0	0	0	0	0
	Injury	2.1	1	0	1	2	2
	PDO	7.9	11	10	5	7	3
Heards Ferry Road	Total	7.6	1	3	11	11	9
	Fatality	0.0	0	0	0	0	0
	Injury	1.6	0	0	1	2	1
	PDO	6.0	1	3	10	9	8

Source: GDOT Crash Database (2008 – 2012)
*2008 statewide averages were used for years 2009 – 2012.
**This intersection was converted from a stop-controlled intersection to a signalized intersection in 2011.
Red boxes indicate actual crash rates greater than statewide average crash rates.

5.1.2 Crash Type Analysis

The GDOT crash data were also analyzed to determine the frequency of each crash type that occurred at each of the three study intersections. With the exception of one type, “not a collision with a motor vehicle,” the crash types focus on the manner in which the vehicles collided. A crash categorized as “not a collision with a motor vehicle” occurs when a vehicle strikes a fixed object (utility pole, guardrail, curb, structure, etc.), a bicyclist, or a pedestrian, or when the vehicle leaves the roadway. Figures 3 through 5 illustrate the total number and percentage of each type of crash that occurred at the Riverside Drive and I-285 eastbound ramp, Riverside Drive and I-285 westbound ramp, and Riverside Drive and Heards Ferry Road intersections, respectively.

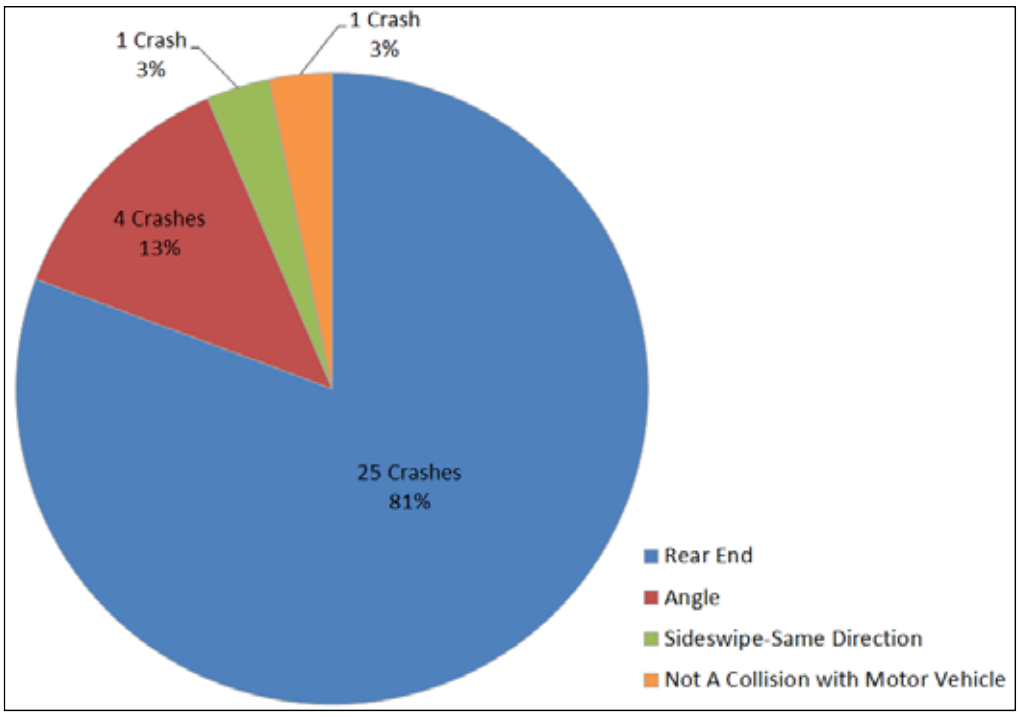


Figure 3 I-285 Eastbound Ramp Intersection Crash Frequency by Crash Type (2008-2012)

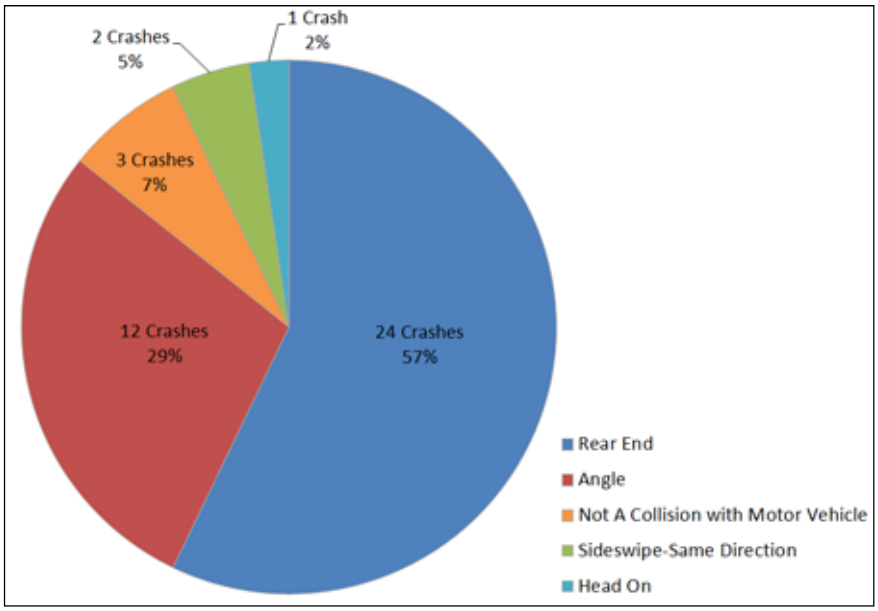


Figure 4 I-285 Westbound Ramp Intersection Crash Frequency by Crash Type (2008 - 2012)

Note: This intersection was converted from a stop-controlled intersection to a signalized intersection in 2011.

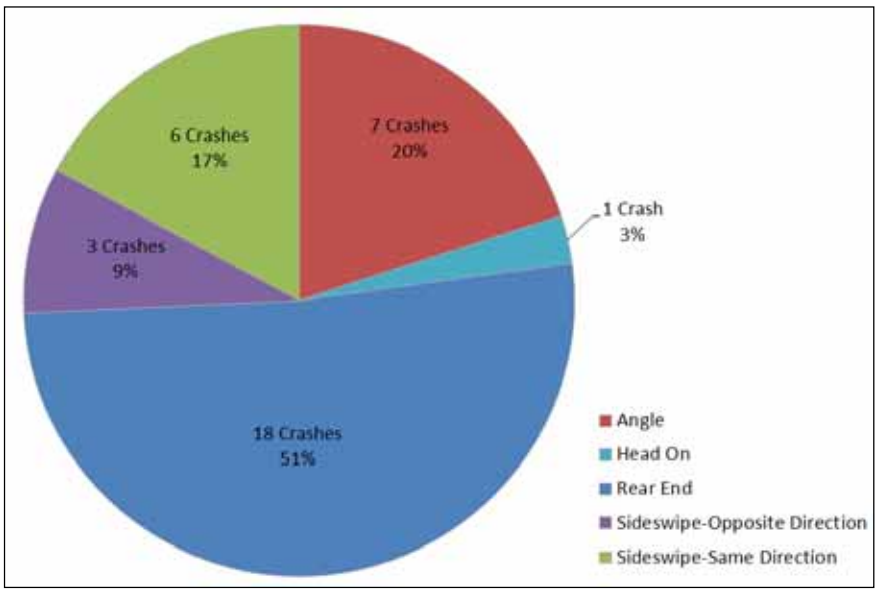


Figure 5 Heards Ferry Road Intersection Crash Frequency by Crash Type (2008 - 2012)

Figures 3 through 5 show that rear-end crashes and angle crashes are the most prevalent crash types at all three intersections along the study corridor. These two types of crashes represent approximately 94 percent of the total crashes that occurred at the I-285 eastbound ramp intersection, approximately 86 percent of the total crashes that occurred at the I-285 westbound ramp intersection, and approximately 71 percent of the total crashes that occurred at the Heards Ferry Road intersection. In general, these two crash types are the most prevalent at signalized intersections.

Figure 5 shows that 17 percent of the crashes that occurred at the Heards Ferry Road intersection were sideswipe – same direction crashes. Sideswipe crashes only accounted for 5 percent of the total crashes that occurred at the I-285 westbound ramp intersection and 3 percent of the total crashes that occurred at the I-285 eastbound ramp intersection. This crash type is common at locations where traffic must weave across lanes to access adjacent land uses.

5.1.3 Crash Severity Analysis

The severity of the crashes was analyzed by calculating the percentage of each type of crash that involved injuries or fatalities. At the study intersections, injuries are common for angle crashes and rear-end crashes. Tables 2 to 4 show the injury rates for each crash type for the three study intersections. Overall, 32 percent of the crashes at the I-285 eastbound ramp intersection involved injuries, 14 percent of the crashes at the I-285 westbound ramp intersection involved injuries, and 11 percent of the crashes at the Heards Ferry Road intersection involved injuries. During the five years of study, no crashes involving fatalities occurred at the study intersections.

Table 2 I-285 Eastbound Ramp Intersection Crash Severity (2008–2012)

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Angle	4	2	50%
Not a Collision With a Motor Vehicle	1	0	0%
Rear End	25	8	32%
Sideswipe - Same Direction	1	0	0%
Total	31	10	32%

Table 3 I-285 Westbound Ramp Intersection Crash Severity (2008–2012)*

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Rear End	24	3	13%
Angle	12	2	17%
Not a Collision With a Motor Vehicle	3	0	0%
Sideswipe - Same Direction	2	1	50%
Head On	1	0	0%
Total	42	6	14%

*This intersection was converted from a stop-controlled intersection to a signalized intersection in 2011.

Table 4 Heards Ferry Road Intersection Crash Severity (2008–2012)

Collision Type	Number of Crashes	Number of Injury Crashes	Percentage of Injury Crashes
Angle	7	1	14%
Head On	1	0	0%
Rear End	18	3	17%
Sideswipe - Opposite Direction	3	0	0%
Sideswipe - Same Direction	6	0	0%
Total	35	4	11%

5.1.4 Historical Crash Summary

The historical crash analysis shows that all three of the study area intersections have had crash rates above the statewide average within the five years of crash data studied. Rear-end and angle crashes were the most prevalent crash types at the intersections and are typically the most common crash types seen at signalized intersections. Crashes of these types have been particularly serious at the I-285 eastbound ramp intersection, where more than one-third of these crashes resulted in injuries. Crashes occurring around the interchange not only have the potential to cause injuries and property damage, but also to cause nonrecurring congestion along the

Riverside Drive and I-285 corridors, which adds to the already present congestion issues. By reducing conflict points, the roundabout design is expected to reduce the number and severity of crashes occurring at the interchange intersections, which will also contribute to reducing nonrecurring congestion.

5.2 Predictive Crash Analysis

To predict the reduction in crash rates that may occur at the Riverside Drive intersections with the I-285 westbound ramps and the I-285 eastbound ramps after their conversion to roundabouts, the Predictive Method for Urban and Suburban Arterials outlined in Chapter 12 of the 2010 Highway Safety Manual (HSM) was followed. The inputs to this method included signalization as the base condition for both ramp intersections, which is the existing condition as well as the no-build condition. Note, however, that the I-285 westbound ramp intersection was converted from stop controlled to signalized in 2011.

The HSM provides safety performance function (SPF) formulas for standard intersection types that use site-specific ADT values as an input. The predicted crashes from the SPFs are further modified to site-specific conditions using crash modification factors (CMFs) for certain geometric design and traffic control features such as the addition of left-turn lanes. Finally, a calibration factor is applied to the predicted crashes that is equal to the number of observed crashes divided by the number of predicted crashes to obtain the final number of predicted crashes.

The HSM methodology was followed to predict the number of multi-vehicle and single-vehicle crashes (separated further into injury/fatality crashes and PDO crashes) that are expected to occur at the two intersections in the 2015 open year and the 2035 design year under no-build conditions. The HSM methodology predicts the number of fatality and injury crashes that will occur as a combined number. However, because no fatalities occurred at the ramp termini intersections during the five years of available crash data, the fatality/injury crash prediction for these intersections is shown as a prediction for injury crashes only.

5.2.1 Crash Reduction

Chapter 12 of the HSM provides crash modification factors to be used to predict the reduction in crash rates expected to accompany conversion of intersections to roundabouts. The HSM provides a crash modification factor of 0.52 (equal to a reduction of 48 percent) for conversion from a signalized intersection to a roundabout.

To calculate the expected number of crashes for the build conditions, the no-build expected crash rates from the HSM methodology were multiplied by the roundabout crash modification factor from the HSM. The results of the HSM predictive method are shown in Table 5 and Table 6.

Table 5 Riverside Drive and I-285 Westbound Ramp Intersection Predicted Crash Rates and Percentage of Crash Reduction

Crash Type	Open Year (2015)			Design Year (2035)		
	No-Build	Build	Percent Reduction	No-Build	Build	Percent Reduction
Total Predicted Crashes	9.59	4.99	48%	10.90	5.67	48%
Predicted Injury Crashes	3.08	1.60	48%	3.53	1.84	48%
Predicted PDO Crashes	6.51	3.39	48%	7.37	3.83	48%

Table 6 Riverside Drive and I-285 Eastbound Ramp Intersection Predicted Crash Rates and Percentage of Crash Reduction

Crash Type	Open Year (2015)			Design Year (2035)		
	No-Build	Build	Percent Reduction	No-Build	Build	Percent Reduction
Total Predicted Crashes	6.40	3.33	48%	7.27	3.78	48%
Predicted Injury Crashes	1.94	1.01	48%	2.21	1.15	48%
Predicted PDO Crashes	4.47	2.32	48%	5.06	2.63	48%

5.2.2 Crash Reduction Cost Savings

According to GDOT, injury crashes can be associated with an average cost value of $955,500, and PDO crashes can be associated with an average cost value of $27,300. Using these average cost values and the predicted crash rate and crash reduction information presented in Tables 5 and 6 above, the cost savings in crash reductions in open year 2015 and design year 2035 from no-build to build conditions were

calculated. Using this information, the total expected crash reduction cost savings for the two ramp termini intersections is approximately $2.4 million in open year 2015 and approximately $2.8 million in design year 2035. Assuming a linear increase in crash reduction cost savings over the life of the project, the conversion of the ramp termini intersections from signalized intersections to roundabouts is expected to save approximately $52.4 million over the 20-year life of the project.

6. Traffic Analysis

A detailed traffic analysis was completed for existing, no-build, and build conditions using Synchro 8, SIDRA 5.1, and VISSIM 6 modeling software tools. Synchro was used to develop the signal timings using existing field timings provided by the City of Sandy Springs and then optimizing the signal timings for all future no-build year scenarios. Synchro is not able to easily evaluate overall network performance for innovative designs such as roundabouts; therefore, SIDRA and VISSIM were used to analyze interchange operations under build conditions. SIDRA is specifically designed to evaluate roundabout performance, while VISSIM allows flexibility in developing a network, which makes it easy to evaluate alternatives such as roundabouts.

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

6.1 Capacity Analysis

The initial roundabout capacity analysis was completed using SIDRA 5.1. SIDRA cannot capture the system-level analysis necessary for this project. Therefore, VISSIM was used as the primary analysis tool. The SIDRA reports are available in Appendix C for reference.

Using VISSIM 6, a network capacity analysis was completed to analyze how the interchange roundabout design will operate as an interconnected system as well as to compare between no-build and build conditions. The existing year VISSIM networks were calibrated to existing conditions using turning movement volumes and simulation visualization. Future year networks were based on the calibrated existing networks, with the roundabout design at the two ramp termini intersections added to the build scenario models. The VISSIM analysis was completed using a five-run, multi-run simulation.

VISSIM records the delay experienced by each vehicle as it approaches an intersection during the simulation. The approach delay results were used to calculate

overall intersection delay based on guidance provided by the Highway Capacity Manual (HCM). Intersection delay from the HCM can be associated with a level of service (LOS) or a grade assigned to an intersection based on its capacity operations. Table 7 shows the average delay associated with each LOS.

Table 7 Level of Service Ranges

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

The results of the VISSIM capacity analysis are presented in Table 8, which shows the delay and LOS at each of the study area intersections under the various scenarios.

Table 8 Intersection Delay and Level of Service

Intersection	A.M. Peak Hour					P.M. Peak Hour				
	Existing Year (2012)	Open Year (2015)		Design Year (2035)		Existing Year (2012)	Open Year (2015)		Design Year (2035)	
		No-Build	Build	No-Build	Build		No-Build	Build	No-Build	Build
I-285 Eastbound Ramps	35.5 (LOS D)	44.8 (LOS D)	5.3 (LOS A)	47.6 (LOS D)	6.2 (LOS A)	202.9 (LOS F)	219.6 (LOS F)	8.6 (LOS A)	224.2 (LOS F)	10.9 (LOS B)
I-285 Westbound Ramps	25.0 (LOS C)	23.8 (LOS C)	5.4 (LOS A)	60.4 (LOS E)	6.1 (LOS A)	28.4 (LOS C)	11.9 (LOS B)	17.9 (LOS B)	17.7 (LOS B)	63.3 (LOS E)
Heards Ferry Road	38.6 (LOS D)	35.2 (LOS C)	24.6 (LOS C)	95.6 (LOS F)	33.6 (LOS C)	66.2 (LOS E)	36.3 (LOS D)	31.3 (LOS C)	147.2 (LOS F)	47.5 (LOS D)

I-285 Eastbound Ramp Intersection Summary

- Under existing conditions, this intersection operates at an LOS D during the a.m. peak period and at an LOS F during the p.m. peak period.

- Under the no-build alternative, this intersection is expected to operate at an LOS D during the a.m. peak period and at an LOS F during the p.m. peak period in open year 2015 as well as in design year 2035.

- Under build conditions, this intersection will experience a reduction in delay and will operate at an LOS B or better throughout the design life. This improvement is primarily due to the fact that the roundabout design greatly improves operations for the heavy eastbound off-ramp left-turn movement.

I-285 Westbound Ramp Intersection Summary

- Under existing conditions, this intersection operates at an LOS C during both the a.m. and p.m. peak periods.

- Under the no-build alternative, this intersection is expected to operate at an LOS E during the a.m. peak period by design year 2035.

    - The reason the results show open year no-build conditions improving over existing conditions for this intersection is because field timings were used for the existing analysis and optimized timings were used for the no-build analysis. Combined with the low study area growth rate and close open year, the existing and open year traffic volumes are similar, which further leads to the unexpected decrease in LOS from existing to open year no-build conditions.

    - Additionally, the p.m. peak period results for this intersection show a better LOS in the design year no-build scenario than in the existing conditions. The minimal growth in no-build LOS during the 20-year time period from the open year to the design year is attributed to the bottleneck at the I-285 eastbound ramp intersection. This bottleneck has caused the amount of vehicles from the heavy I-285 eastbound off-ramp left-turn movement that are able to reach the I-285 westbound ramp intersection to reach its maximum, limiting the increase in throughput at this intersection from the open year to the design year.

- Under build conditions, this intersection will improve to LOS A during the a.m. peak period for both the open year and the design year. During the 2035 p.m. peak period, this intersection will operate at LOS E compared to LOS B under no-build conditions.

- The increase in delay under build conditions during the p.m. peak period is primarily caused by the improved operations for the eastbound left-turn movement, which limits the gaps available to vehicles making the westbound right-turn movement due to the increased throughput of vehicles from the eastbound ramp heading north on Riverside Drive.

Heards Ferry Road Intersection Summary

- Under existing conditions, the Heards Ferry Road intersection performs at an LOS D during the a.m. peak period and at an LOS E during the p.m. peak period

- Under the no-build alternative, the Heards Ferry Road intersection is expected to perform at an LOS F during both peak periods by design year 2035.

- Under build conditions in design year 2035, the Heards Ferry Road intersection is expected to improve to an LOS C during the a.m. peak period and to an LOS D during the p.m. peak period. This improvement is primarily due to the fact that Heards Ferry Road is able to operate as a standalone intersection in terms of signal timing under build conditions compared with being tied to the two ramp termini signals under existing and no-build conditions.

6.2 Off-Ramp Queue Analysis

In addition to intersection performance, ramp queues were analyzed to evaluate the impact the ramp intersections might have on the mainline freeway traffic. Table 9 shows the maximum ramp queue results from VISSIM for each of the I-285 off-ramps.

Table 9 Maximum Ramp Queue Lengths (feet)

Ramp	A.M. Peak Hour					P.M. Peak Hour				
	Existing Year (2012)	Open Year (2015)		Design Year (2035)		Existing Year (2012)	Open Year (2015)		Design Year (2035)	
		No-Build	Build	No-Build	Build		No-Build	Build	No-Build	Build
I-285 Eastbound Off-Ramp (~1,850 feet)*	396	541	105	2,919	135	3,931	5,303	275	5,309	431
I-285 Westbound Off-Ramp (~950 feet)*	202	167	110	1,163	137	266	201	567	405	1,155

*Distance to existing painted gore

I-285 Eastbound Off-ramp Summary

- Queues on this ramp currently extend well beyond the ramp length of approximately 1,850 feet during the p.m. peak period.
- Under no-build conditions, the maximum ramp queue is expected to exceed the ramp length during the a.m. peak period by design year 2035.
- Under build conditions, maximum ramp queues are expected to significantly improve in both the a.m. and p.m. peak periods so that the queue is no longer exceeding the ramp length in open year 2015 or in design year 2035.
- As discussed in the capacity analysis section, this build condition ramp queue improvement is primarily attributed to improved operations for the heavy eastbound left-turn movement.

I-285 Westbound Off-ramp Summary

- In existing conditions, maximum queues on this ramp are minimal and do not come close to exceeding the ramp length of approximately 950 feet.
- Under no-build conditions, the maximum queue on the westbound off-ramp is expected to exceed the ramp length during the a.m. peak period by design year 2035.

- The results show that the maximum queue on this off-ramp decreases from existing to open year no-build conditions due to the difference between using field and optimized signal timings and the low growth rate.

- Under build conditions, the westbound off-ramp maximum queue is expected to improve during the a.m. peak period so that it will no longer exceed the ramp length by design year 2035. However, the maximum queue during the p.m. peak period is expected to exceed the ramp length by 2026.

- As described in the capacity analysis section, the p.m. peak period decrease in eastbound off-ramp queues and increase in westbound off-ramp queues are caused by the interaction between the operations of the heavy eastbound left-turn movement and the heavy westbound right-turn movement. The improved operation for the eastbound left-turn movement limits the amount of gaps available to vehicles making the westbound right-turn movement and increases the queue on the westbound off-ramp.

- The westbound off-ramp queue spillover will be able to be contained by a planned project (P.I. 713230) consisting of an I-285 westbound auxiliary lane spanning between Roswell Road and Riverside Drive. The auxiliary lane project is programmed to be completed between 2020 and 2030.

6.3 Travel Time Analysis

To better evaluate the overall operations of the interchange, a travel time analysis was completed for key movements using VISSIM. Travel times for both peak periods were determined for vehicles traveling to I-285 eastbound and westbound from Riverside Drive north of Heards Ferry Road as well as for vehicles traveling to Riverside Drive north of Heards Ferry Road from I-285 eastbound and westbound.

The a.m. and p.m. travel time segment results are summarized below and on Figures 6 and 7:

- The results of the travel time analysis show a decrease in travel times between existing conditions and open year no-build conditions. This decrease is due to the difference between using field timings for existing conditions and optimized timings for open year no-build conditions as well as due to the small growth rate.

- The travel time results show that in both the a.m. and p.m. peak periods, the travel times under build conditions for vehicles accessing I-285 from Riverside Drive remain the same or improve slightly compared to no-build conditions.

- For vehicles traveling to Riverside Drive north of Heards Ferry Road from I-285 eastbound, travel times significantly improve from no-build to build conditions for both peak periods.

- For vehicles traveling to Riverside Drive north of Heards Ferry Road from I-285 westbound, travel times remain the same or improve slightly from no-build to build conditions during the a.m. peak period, but increase significantly from no-build to build conditions during the p.m. peak period.

- During the p.m. peak period, the decrease in travel times for vehicles exiting I-285 eastbound and the increase in travel times for vehicles exiting I-285 westbound are primarily caused by improved operations for the I-285 eastbound off-ramp left turn and the worsened operations for the I-285 westbound off-ramp right turn due to the build roundabout design.

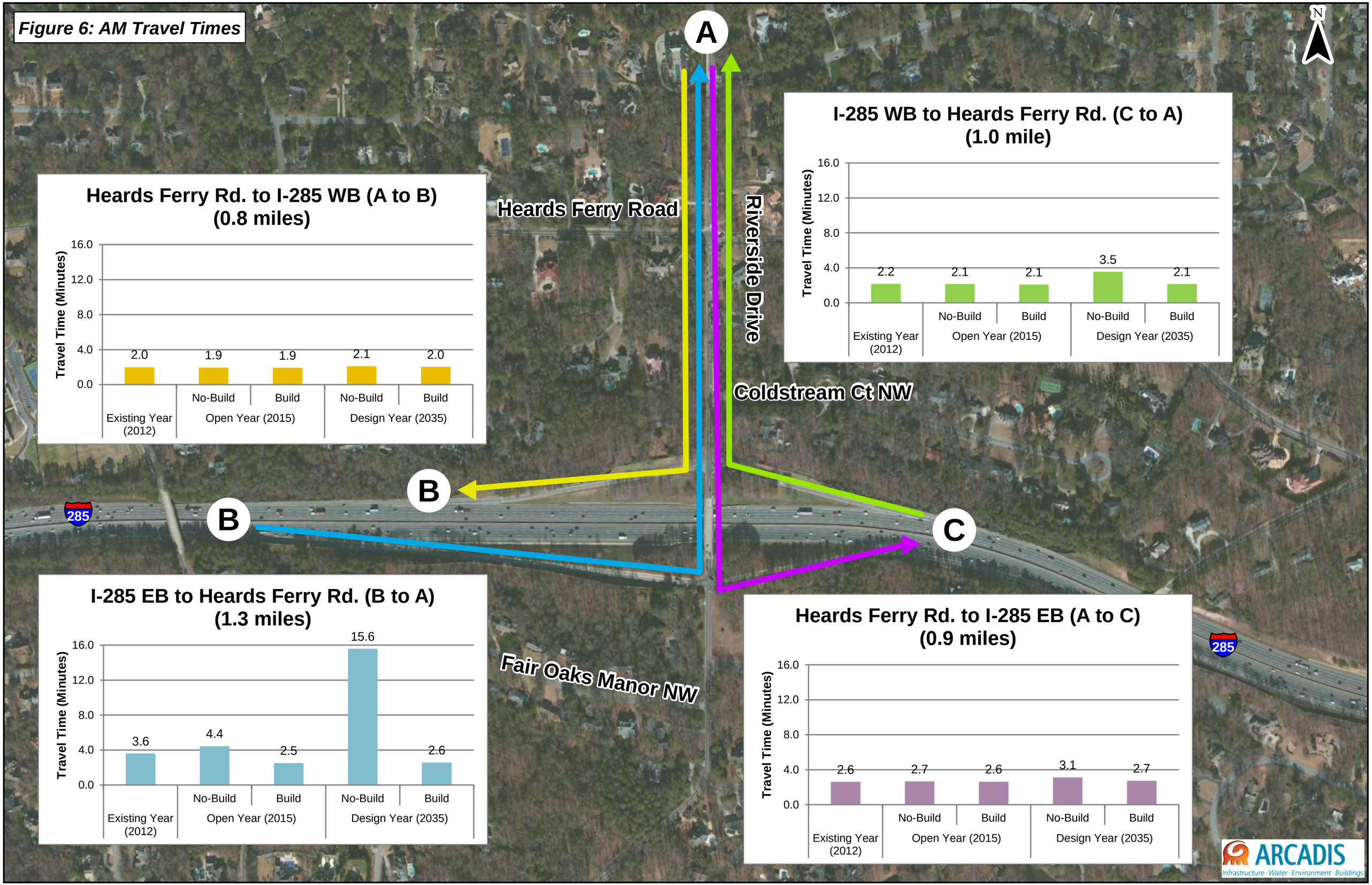
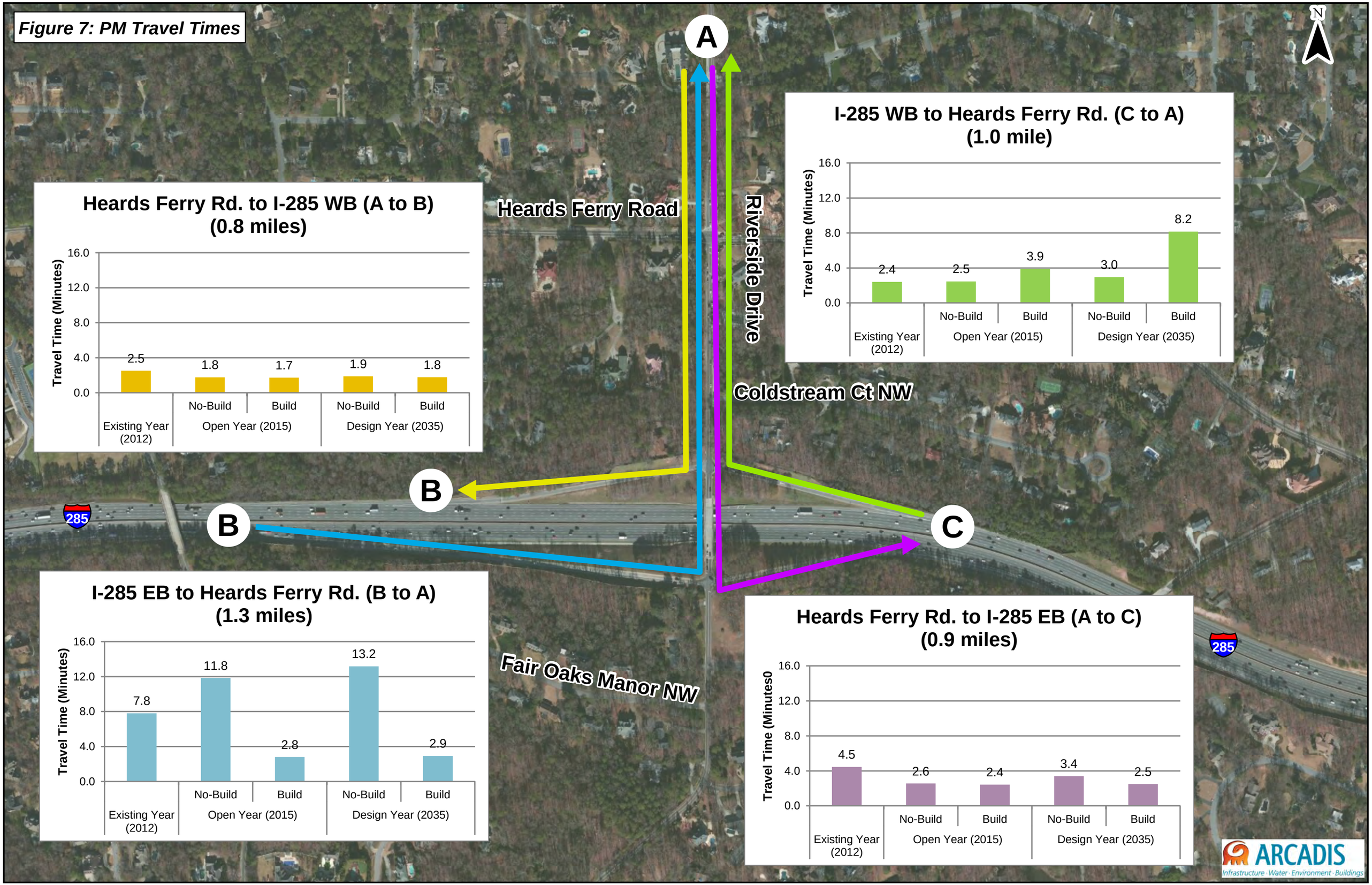


Figure 6: AM Travel Times
A
B
B
C
Heards Ferry Road
Riverside Drive
Coldstream Ct NW
Fair Oaks Manor NW
285
285
N
Heards Ferry Rd. to I-285 WB (A to B)
(0.8 miles)
Travel Time (Minutes)
16.0
12.0
8.0
4.0
0.0
2.0
1.9
1.9
2.1
2.0
Existing Year (2012)
No-Build
Build
Open Year (2015)
No-Build
Build
Design Year (2035)
I-285 WB to Heards Ferry Rd. (C to A)
(1.0 mile)
Travel Time (Minutes)
16.0
12.0
8.0
4.0
0.0
2.2
2.1
2.1
3.5
2.1
Existing Year (2012)
No-Build
Build
Open Year (2015)
No-Build
Build
Design Year (2035)
I-285 EB to Heards Ferry Rd. (B to A)
(1.3 miles)
Travel Time (Minutes)
16.0
12.0
8.0
4.0
0.0
3.6
4.4
2.5
15.6
2.6
Existing Year (2012)
No-Build
Build
Open Year (2015)
No-Build
Build
Design Year (2035)
Heards Ferry Rd. to I-285 EB (A to C)
(0.9 miles)
Travel Time (Minutes)
16.0
12.0
8.0
4.0
0.0
2.6
2.7
2.6
3.1
2.7
Existing Year (2012)
No-Build
Build
Open Year (2015)
No-Build
Build
Design Year (2035)
ARCADIS
Infrastructure · Water · Environment · Buildings

Figure 7: PM Travel Times



6.4 Vehicular Throughput

In addition to improving safety and reducing delays, providing better access to the interstate is a key indicator of the benefits of a project and is often quantified by vehicle throughput. The VISSIM results show that the a.m. peak period vehicular throughput is expected to increase by 1 percent in the open year and by 7 percent in the design year from no-build to build conditions. In the p.m. peak period, vehicular throughput is expected to increase by 16 percent in the open year and by 17 percent in the design year from no-build to build conditions. These results show that the build roundabout design significantly increases the amount of vehicles that are able to access I-285 from Riverside Drive as well as access Riverside Drive from I-285. Table 10 shows the total throughput for each analysis scenario.

Table 10 Network Throughput

Scenario			Total Vehicles in Network	Percent Change
A.M. Peak	Existing Year (2012)		2,244	N/A
	Open Year (2015)	No-Build	2,260	1%
		Build	2,285	
	Design Year (2035)	No-Build	2,341	7%
		Build	2,506	
P.M. Peak	Existing Year (2012)		2,229	N/A
	Open Year (2015)	No-Build	2,153	16%
		Build	2,508	
	Design Year (2035)	No-Build	2,267	17%
		Build	2,658	

7. Conclusion

Riverside Drive serves as an access route to/from I-285 for commuters living in northern Fulton County as well as in Cobb County. The proposed project will convert the two interchange ramp termini intersections from signalized intersections to roundabouts for the purpose of improving safety and operations. The roundabout design is expected to decrease the number of crashes at the interchange intersections by approximately 48 percent. The reduction in crashes will have the benefits of decreasing injuries, property damage, crash-related costs, and nonrecurring

congestion. In addition to safety benefits, the roundabout design is expected to improve overall delay, ramp queues, travel times, and vehicular throughput at two of the three study area intersections in all future year scenarios. The I-285 westbound ramp intersection will experience more delays compared to no-build conditions, which results in westbound ramp queues that exceed the available ramp storage length by approximately 2026. However, a planned project consisting of an auxiliary lane on I-285 westbound spanning from the interchange at Roswell Road to the Riverside Drive interchange (P.I. 713230) is expected to be completed before 2030 and will contain this queue spillover. Additionally, overall vehicular throughput at the interchange is expected to increase under build conditions.

Appendix A

Volume Development Methodology

ARCADIS U.S., Inc.
2410 Paces Ferry Road
Suite 400
Atlanta
Georgia 30339
Tel 770.431.8666
Fax 770.435.2666

MEMO

To:
Rhonda Niles, GDOT Office of Planning

Copies:
Abby F. Ebodaghe, GDOT Office of Planning
Marlo Clowers, GDOT Office of Innovative Program Delivery
Shamir Poudel, ARCADIS
Kate Colberg, ARCADIS

From:
Sujith Racha, PE, PTOE

Date:
October 31, 2013

ARCADIS Project No.:
GADT0201.0141

Subject:
P.I. No. 0010925 (I-285 Ramps at CR 209/Riverside Drive) Traffic Volumes
Fulton County, Georgia

ARCADIS U.S., Inc. (ARCADIS) conducted a growth trend analysis and a study of existing traffic counts to develop traffic volumes for the I-285 Ramps at CR 209/Riverside Drive project, P.I. No. 0010925, in Fulton County, Georgia. The sections below summarize the growth rate analysis methodology and findings, the K and D factor determination, and the proposed methodology for volume development.

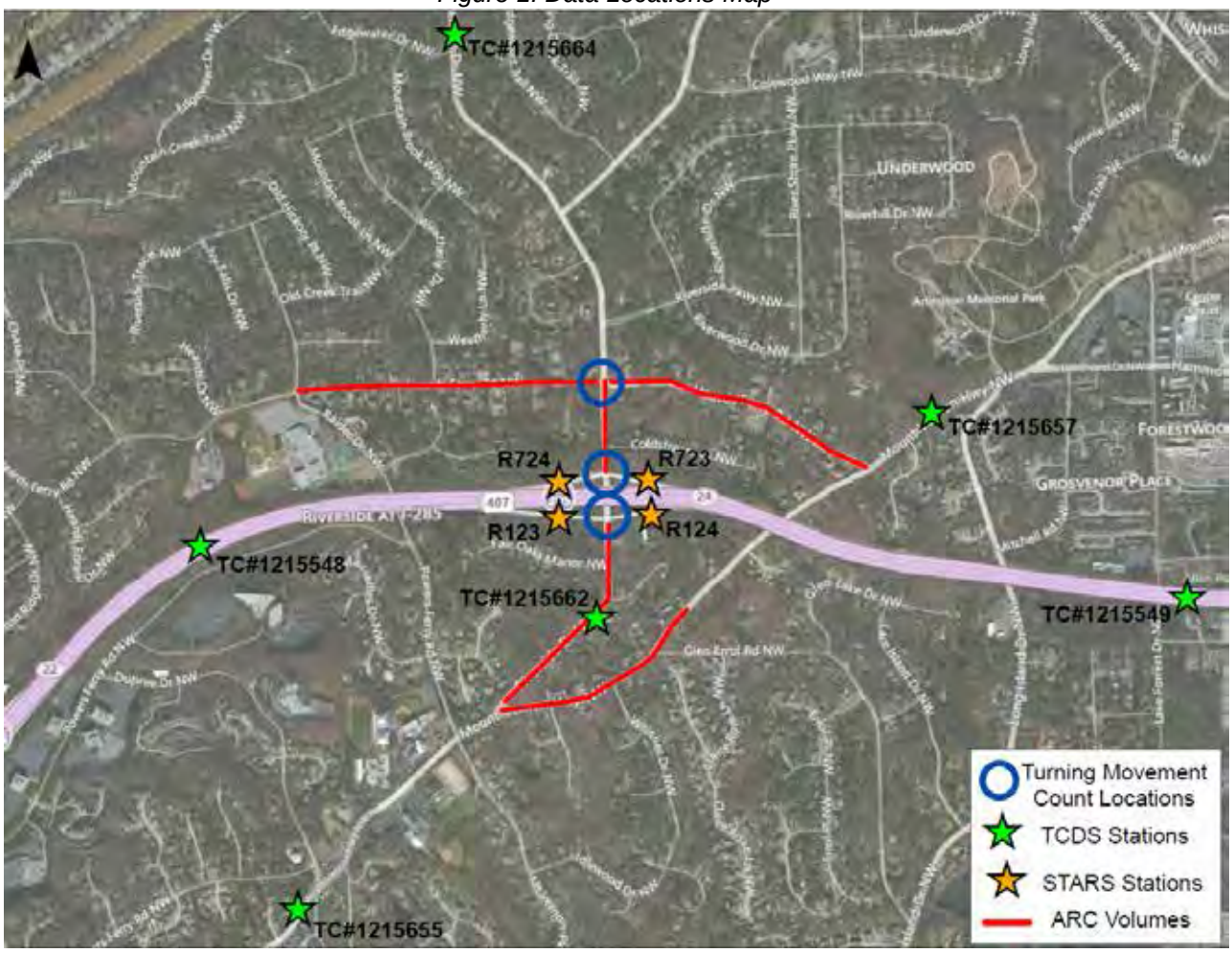
Data Collection

Traffic Counts Data

ARCADIS collected AM and PM turning movement counts at three intersections within the Riverside Drive project study area: Riverside Drive & Heards Ferry, Riverside Drive & I-285 Westbound Ramps, and Road Riverside Drive & I-285 Eastbound Ramps. These turning movement counts were collected on Tuesday, November 8th, 2011. The locations of these intersections are shown in Figure 1 below (represented as blue circles). Tube counts within the Riverside Drive project area were also collected as part of the data collection effort. Forty-eight hour arterial tube counts with classifications were collected on Riverside Drive south of I-285 on Wednesday-Thursday, February 1-2, 2012, on Riverside Drive north of I-285 on Wednesday-Thursday, January 18-19, 2012, and on Riverside Drive north of Heards Ferry Road, Heards Ferry Road west of Riverside Drive, and Heards Ferry road east of Riverside Drive on Tuesday-Wednesday, October 22-23, 2013. Forty-eight hour interstate tube counts with classifications were

collected on I-285 westbound at Riverside Drive on Tuesday-Wednesday, November 15-16, 2011, and on I-285 eastbound at Riverside Drive on Tuesday-Wednesday, November 8-9, 2011. Forty-eight hour ramp tube counts with classifications were collected on the two I-285 eastbound/Riverside Drive ramps and the I-285 westbound on-ramp from Riverside Drive on Wednesday-Thursday, January 18-19, 2012 and on the I-285 westbound off-ramp to Riverside Drive on Wednesday-Thursday, February 1-2, 2012.

Figure 1: Data Locations Map



Queue Data Collection

In an effort to increase traffic volume accuracy, queue data was collected at both Riverside Drive/I-285 ramp intersections during the PM peak period on Thursday, September 19, 2013 and Tuesday, October 1, 2013 and during the AM peak period on Thursday, September 26, 2013 and Tuesday, October 1, 2013. The increase in queues over the course of the peak hours were observed for the northbound and southbound approaches to the Riverside Drive/Heards Ferry Road intersection, for the southbound and westbound approaches to the Riverside Drive/I-285 westbound ramps intersection, and for the northbound and eastbound approaches to the Riverside Drive/I-285 eastbound ramps intersection. Table 1 below shows the average increase in queues that were observed during the peak hours for each approach. Due

to the high volume of queue increase that occurs in the study area, particularly in the PM peak hour, ARCADIS proposes adding these queue increases to the corresponding peak hour turning movement counts (collected in November 2011) in order to account for the total intersection demand rather than the intersection throughput.

Table 1: Peak Hour Queue Increase Data

Intersection	Approach	AM Peak Queue Increase	PM Peak Queue Increase
Heards Ferry Rd. Intersection	Northbound Riverside Approach	14	7
	Southbound Riverside Approach	6	0
Westbound Ramp Intersection	Southbound Riverside Approach	3	4
	Westbound Off-ramp Approach	11	10
Eastbound Ramp Intersection	Northbound Riverside Approach	1	33
	Eastbound Off-ramp Approach	2	128

Accompanying this memo, ARCADIS is submitting existing DHV and ADT volume diagrams that use the raw count data collected in November 2011 as the basis for volume development. In addition to those two volume diagrams, ARCADIS is also submitting one existing DHV volume diagram that uses the November 2011 counts *plus* the queue increase counts as the basis for volume development – an existing demand DHV. Both of these existing DHV volume diagrams are submitted to aid in the review and approval of the volume development methodology and existing volume diagrams. Additionally, open (2015) and design (2035) year DHV and ADT volume diagrams are being submitted. The basis for development and the annual growth rate used are described in the following section.

Growth Rate Determination

To determine the appropriate growth rate to use for this project area, data was obtained from three sources: the Georgia Department of Transportation (GDOT) Traffic Count Database System (TCDS), GDOT State Traffic and Report Statistics (STARS), and the Atlanta Regional Commission's (ARC) Travel Demand Model. The sections below discuss the findings from each of these sources.

Georgia Department of Transportation Historical Traffic Counts

Historical traffic data, obtained from the GDOT TCDS and the GDOT STARS databases, were evaluated first. Six traffic count stations (from TCDS) located near the study area were chosen for analysis and are listed below:

- Station 1215664 – Riverside Dr. north of River Valley Road
- Station 1215662 – Riverside Dr. south of Foxridge Lane
- Station 1215655 – Mount Vernon Hwy. south of Powers Ferry Road
- Station 1215657 – Mount Vernon Hwy. north of Heards Ferry Road
- Station 1215548 – I-285 west of Powers Ferry Rd. /Raider Drive
- Station 1215549 – I-285 east of Lake Forrest Drive

Additionally, ramp counts (from STARS) for the four ramp stations at the Riverside Drive interchange with I-285 were also studied and are listed below:

- R123 – I-285 eastbound off-ramp to Riverside Drive
- R124 – I-285 eastbound on-ramp from Riverside Drive
- R723 – I-285 westbound off-ramp to Riverside Drive
- R724 – I-285 westbound on-ramp from Riverside Drive

Figure 1 above shows the locations of these six TCDS stations (shown as green stars) and four STARS ramp stations (shown as orange stars) relative to the intersection turning movement count locations (shown as blue circles). The historical count data for the six TCDS stations are presented in Table 2 below, which shows counts from 2000 to 2012. The historical count data for the four STARS ramp stations are presented in Table 3 below, which shows counts from 2007 to 2012.

Table 2: GDOT TCDS Historical Daily Traffic Counts

Location	Year	Volume	Growth	Location	Year	Volume	Growth
Station 1215664: Riverside Dr. (north of River Valley Rd.)	2012	4,670	-61%	**Station 1215662: Riverside Dr. (south of Foxridge Ln.)**	2012	5,020	-1%
	2011	11,870	0%		2011	5,050**	7%
	2010	11,880	0%		2010	4,730**	-19%
	2009	11,860	-2%		2009	5,830	-2%
	2008	12,100	-1%		2008	5,950	-1%
	2007	12,170	-15%		2007	5,980	-8%
	2006	14,270	3%		2006	6,490**	2%
	2005	13,830	3%		2005	6,360	3%
	2004	13,430	20%		2004	6,180	2%
	2003	11,230	-53%		2003	6,070	17%
	2002	23,884	6%		2002	5,196	-20%
	2001	22,500	3%		2001	6,500	-2%
	2000	21,800			2000	6,600	
Station 1215655: Mt. Vernon Hwy. (south of Powers Ferry Rd.)	2012	2,820	-1%	**Station 1215657: Mt. Vernon Hwy. (north of Heards Ferry Rd.)**	2012	11,450	-1%
	2011	2,840	0%		2011	11,510	0%
	2010	2,840	0%		2010	11,520	0%
	2009	2,830	-34%		2009	11,500	-6%
	2008	4,270	38%		2008	12,250	-6%
	2007	3,090	264%		2007	13,010	21%
	2006	850	-80%		2006	10,720	-24%
	2005	4,230	1%		2005	14,100	1%
	2004	4,190	2%		2004	13,960	0%
	2003	4,120	-2%		2003	13,960	98%
	2002	4,215	-2%		2002	7,066	5%
	2001	4,300	0%		2001	6,700	-27%
	2000	4,300			2000	9,200	
Station 1215548: I-285 (west of Powers Ferry Rd./Raider Dr.)	2012	214,280	-1%	**Station 1215549: I-285 (east of Lake Forrest Dr.)**	2012	213,050	-1%
	2011	216,680	2%		2011	215,710	1%
	2010	212,290	8%		2010	212,810	8%
	2009	195,770	2%		2009	196,540	2%
	2008	192,110	-3%		2008	192,430	-3%
	2007	198,300**	0%		2007	198,840**	1%
	2006	197,440	1%		2006	196,750	0%
	2005	195,920**	-13%		2005	197,270	-10%
	2004	224,630	2%		2004	218,720	2%
	2003	220,660	-5%		2003	214,850	-6%
	2002	232,279	0%		2002	228,570	0%
	2001	231,700	2%		2001	228,000	2%
	2000	227,600			2000	224,000	

Note: Many of these counts are estimated values
** indicates actual volumes

Table 3: GDOT Ramps Historical Daily Traffic Counts

Location	Year	Volume	Growth	Location	Year	Volume	Growth
R123: I-285 eastbound off-ramp to Riverside Dr.	2012	5,840	-1%	**R124: I-285 eastbound on-ramp from Riverside Dr.**	2012	4,920	3%
	2011	5,880	-1%		2011	4,760	-8%
	2010	5,950	0%		2010	5,180	-4%
	2009	5,950*	0%		2009	5,420*	-2%
	2008	5,950	-10%		2008	5,520	
	2007	6,640			2007	N/A	
R723: I-285 westbound off-ramp to Riverside Dr.	2012	4,950	10%	**R724: I-285 westbound on-ramp from Riverside Dr.**	2012	6,250	7%
	2011	4,480	-1%		2011	5,850	3%
	2010	4,520	4%		2010	5,690	1%
	2009	4,340*	-2%		2009	5,640*	-5%
	2008	4,430			2008	5,920	-6%
	2007	N/A			2007	6,270	

* indicates estimated volume

From the TCDS station volumes and growth rate percentages shown previously in Table 2, it can be seen that there are often large jumps up and down in the average daily volumes passing each station from year to year. These jumps in volumes are due to the fact that many of these average daily volume values are actually estimated values. Due to the estimated nature of many of the GDOT TCDS counts, these counts were not used in the average annual growth rate calculation. Instead, STARS ramp data was used to calculate an average annual growth rate for the study area - although it was noted that some of the yearly volumes from the STARS data are estimated values as well. Table 4 below shows the average annual growth trends for the four STARS ramp stations for the years 2007 through 2012. The overall average annual growth rate from the historical GDOT data is negative 0.6 percent.

Table 4: Average Annual Growth by Count Location

Station	Average Annual Growth Rate
R123: I-285 eastbound off-ramp to Riverside Dr.	-2.4%
R124: I-285 eastbound on-ramp from Riverside Dr.	-2.7%
R723: I-285 westbound off-ramp to Riverside Dr.	2.9%
R724: I-285 westbound on-ramp from Riverside Dr.	0.0%

Atlanta Regional Commission Travel Demand Model

To gain additional knowledge of growth in the area, ARCADIS also studied ARC's regional travel demand model. In addition to population and employment growth, ARC's model also includes travel pattern changes due to new facilities and capacity improvements. Table 5 below shows the annual growth rates between 2010 and 2020, 2010 and 2030, and 2010 and 2040 calculated from the regional demand model volumes for five locations within and near the study area (named in the table). The locations of the five ARC volume data corridors relative to the other data locations are shown in Figure 1 and are represented

as red lines. The ARC data analysis averaged the annual growth rates between 2010 and 2040 for each of the five data locations which are: 1.4 percent, 0.2 percent, 1.2 percent, 1.9 percent, and negative 0.4 percent. The average of these 2010 to 2040 annual growth rates, excluding the one negative growth rate value, is 1.1 percent.

Table 5: Atlanta Regional Commission (ARC) Travel Demand Model Growth

Location	Year	Volume	Growth since 2010
Riverside Dr. (south of I-285)	2010	8,982	
	2020	10,590	1.7%
	2030	9,870	0.5%
	2040	13,451	1.4%
Riverside Dr. (north of I-285)	2010	19,616	
	2020	20,582	0.5%
	2030	19,622	0.0%
	2040	20,878	0.2%
Mt. Vernon Rd. (south of I-285)	2010	5,709	
	2020	7,367	2.6%
	2030	8,058	1.7%
	2040	8,112	1.2%
Heards Ferry Rd. (west of Riverside Dr.)	2010	8,003	
	2020	9,896	2.1%
	2030	11,909	2.0%
	2040	13,888	1.9%
Heards Ferry Rd. (east of Riverside Dr.)	2010	5,433	
	2020	6,963	2.5%
	2030	4,940	-0.5%
	2040	4,873	-0.4%

Recommendations

ARCADIS believes that the negative growth rate from the GDOT counts is not a realistic representation of the actual traffic volume trend in the area and that the small growth rate of 1.1 percent from the ARC travel demand model is closer to the future growth rate that would be expected for the area. Based on these observations, ARCADIS recommends averaging these two values and using a growth rate of 0.5 percent for this project. This small growth rate is realistic and can be attributed to the mostly built-out residential nature of the study area. Because the 0.5 percent growth rate is small and there was not much increase in traffic volumes between 2012 and 2013, ARCADIS recommends using the intersection counts collected in November 2011 and January/February 2012 (plus the queue increase volumes collected in 2013) as existing 2012 traffic volumes. ARCADIS then recommends using a growth rate of 0.5 percent to project the 2015 open year and the 2035 design year traffic volumes.

Traffic Characteristics

In addition to determining an appropriate growth rate, an analysis was completed to determine the truck percentages, K-factors, and D-factors for the study area.

Truck Percentage Calculation

For each tube count location and day, the single-unit and combination truck percentages were calculated for the peak hours and for the full day and then the highest of these values were used as the final truck percentage. The Riverside Drive truck percentage is the highest percentage calculated from the three Riverside Drive tube count locations: Riverside Drive south of I-285, Riverside Drive north of I-285, and Riverside Drive north of Heards Ferry Road. For I-285, the truck percentage was calculated by averaging the truck percentages calculated for the two I-285 tube count locations: I-285 westbound at Riverside Drive and I-285 eastbound at Riverside Drive. For each of the ramps, the highest truck percentage calculated from the tube counts collected on that ramp was used. The calculated Riverside Drive truck percentages are 6.5 percent single-unit trucks during peak hours, 2 percent combination trucks during peak hours, 7 percent single-unit trucks for 24-hours, and 1 percent combination trucks for 24-hours. The combination truck percentages are low on Riverside Drive because large trucks are prohibited from using this corridor. For I-285, the calculated truck percentages are 2 percent single-unit trucks during peak hours, 3 percent combination trucks during peak hours, 2 percent single-unit trucks for 24-hours, and 5 percent combination trucks for 24-hours. Additionally, the calculated truck percentages for each of the four ramps are shown on the attached volume diagrams.

K-Factor Calculation

K-factors were calculated using the tube counts collected on Riverside Drive north and south of I-285 and on I-285 west and east of Riverside Drive. In addition to the tube counts collected by ARCADIS, hourly count data was also obtained from GDOT TCDS count stations 1215664 (Riverside Drive north of River Valley Road) and 1215662 (Riverside Drive south of Foxridge Lane). The ARCADIS count data yielded an average k-factor of 8.5 for the two Riverside Drive locations and an average k-factor of 6.9 for the two I-285 locations. The GDOT TCDS data yielded a k-factor of 9.8 for the two Riverside Drive locations. For Riverside Drive, the average k-factors from the two data sources were averaged and rounded to a k-factor of 9.0 and, for I-285, the k-factor was rounded to 7.0.

Directional Factor (D) Calculation

Two different directional factors, D, were developed for the project study area. Table 6 shows the AM and PM directional factors for Riverside Drive and for I-285.

Table 6: Directional Factors for Study Area Roadways

Location	AM Peak Hour	PM Peak Hour
Riverside Drive (NB/SB)	0.49/0.51	0.51/0.49
I-285 (EB/WB)	0.53/0.47	0.49/0.51

Because the projected growth rate for the study area is small, the previously described K-factors, D-factors, and growth rate will be used for both the no-build and build conditions in the future year scenarios.

Summary

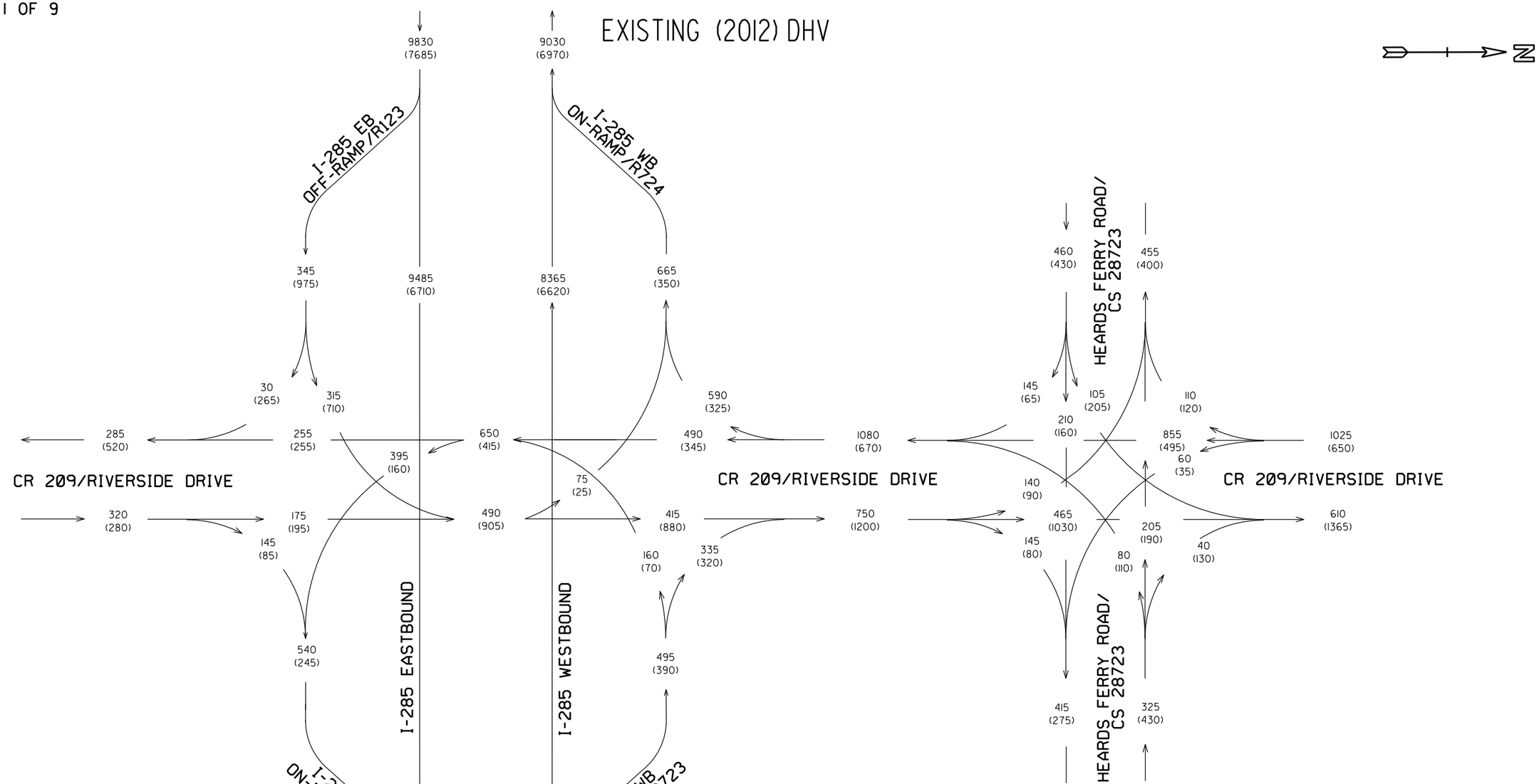
ARCADIS completed a growth rate analysis using available GDOT TCDS and STARS traffic counts as well as projected volumes from ARC's travel demand model. The analysis determined that a growth rate of 0.5 percent is expected to occur in the project area for the foreseeable future. This growth rate is realistic for the project study area because it is a mostly built-out residential area that is expected to experience only slight increases in traffic due to development in the greater vicinity of the study area. Because the growth rate is small, the intersection counts collected in November 2011 and January/February 2012 (plus the queue increase volumes) are used as existing 2012 traffic volumes. Then the growth rate of 0.5 percent is used to project these existing 2012 volumes to the 2015 open year and the 2035 design year. Additionally, the traffic characteristics analysis determined that a k-factor of 9.0 should be used for Riverside Drive and that a k-factor of 7.0 should be used for I-285. The calculated growth rate and k-factors will be used to develop volumes for the no-build as well as the build conditions for the open year 2015 and the design year 2035.

ARCADIS developed existing (2012), open (2015), and design (2035) year volumes using the above information – see attached volume diagrams.

Appendix B

Approved Volume Diagrams

EXISTING (2012) DHV



TRUCK PERCENTAGES			
LOCATION	PK HR T%	S.U. %	COMB %
RIVERSIDE DR	8.5%	6.5%	2% **
I-285	5%	2%	3%
R123	2.5%	2%	0.5%
R124	10%	9%	1%
R723	4%	3%	1%
R724	3%	2.5%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

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

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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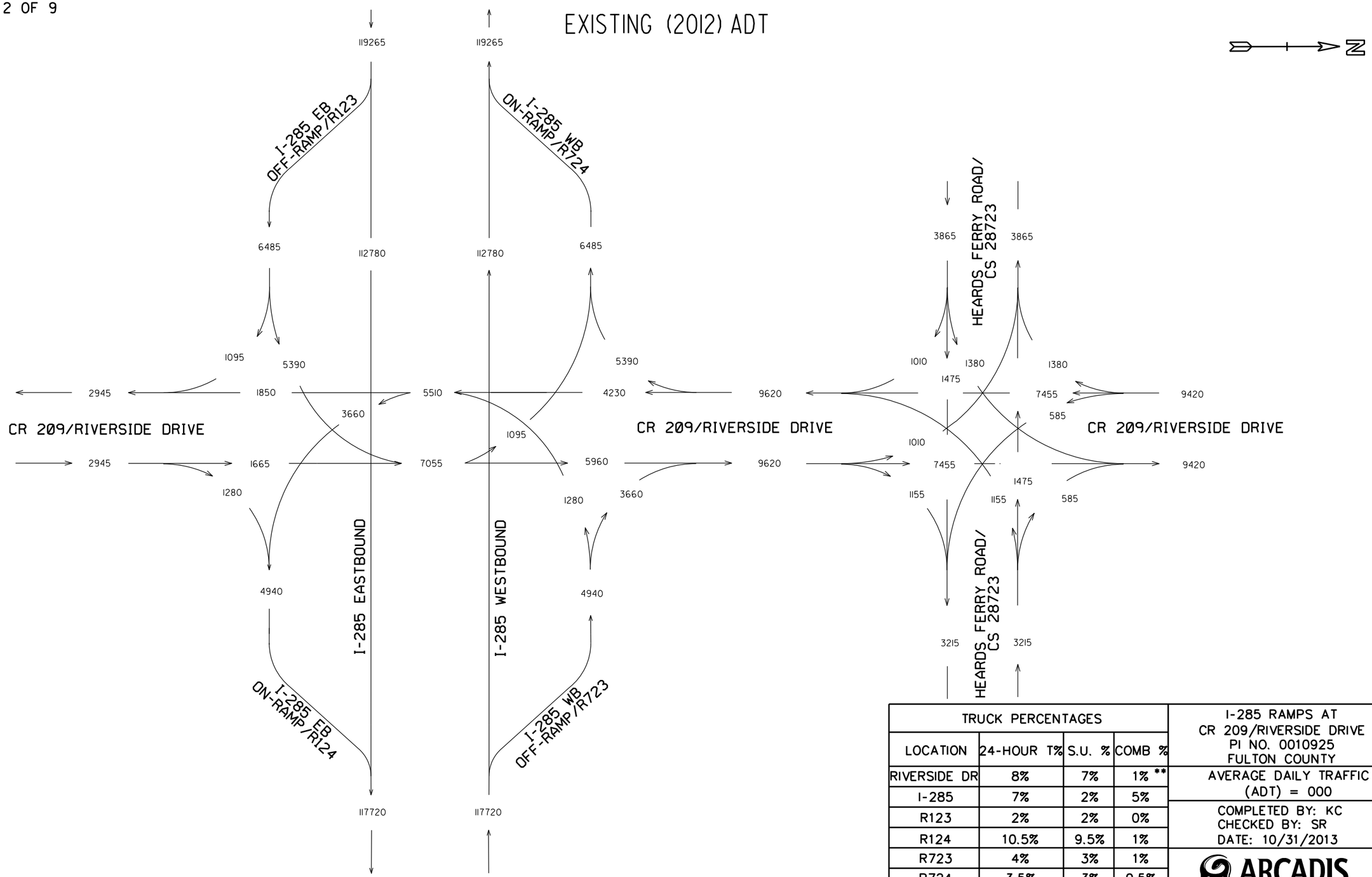
EXISTING (2012) ADT



TRUCK PERCENTAGES			
LOCATION	24-HOUR T%	S.U. %	COMB %
RIVERSIDE DR	8%	7%	1% **
I-285	7%	2%	5%
R123	2%	2%	0%
R124	10.5%	9.5%	1%
R723	4%	3%	1%
R724	3.5%	3%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

AVERAGE DAILY TRAFFIC
(ADT) = 000

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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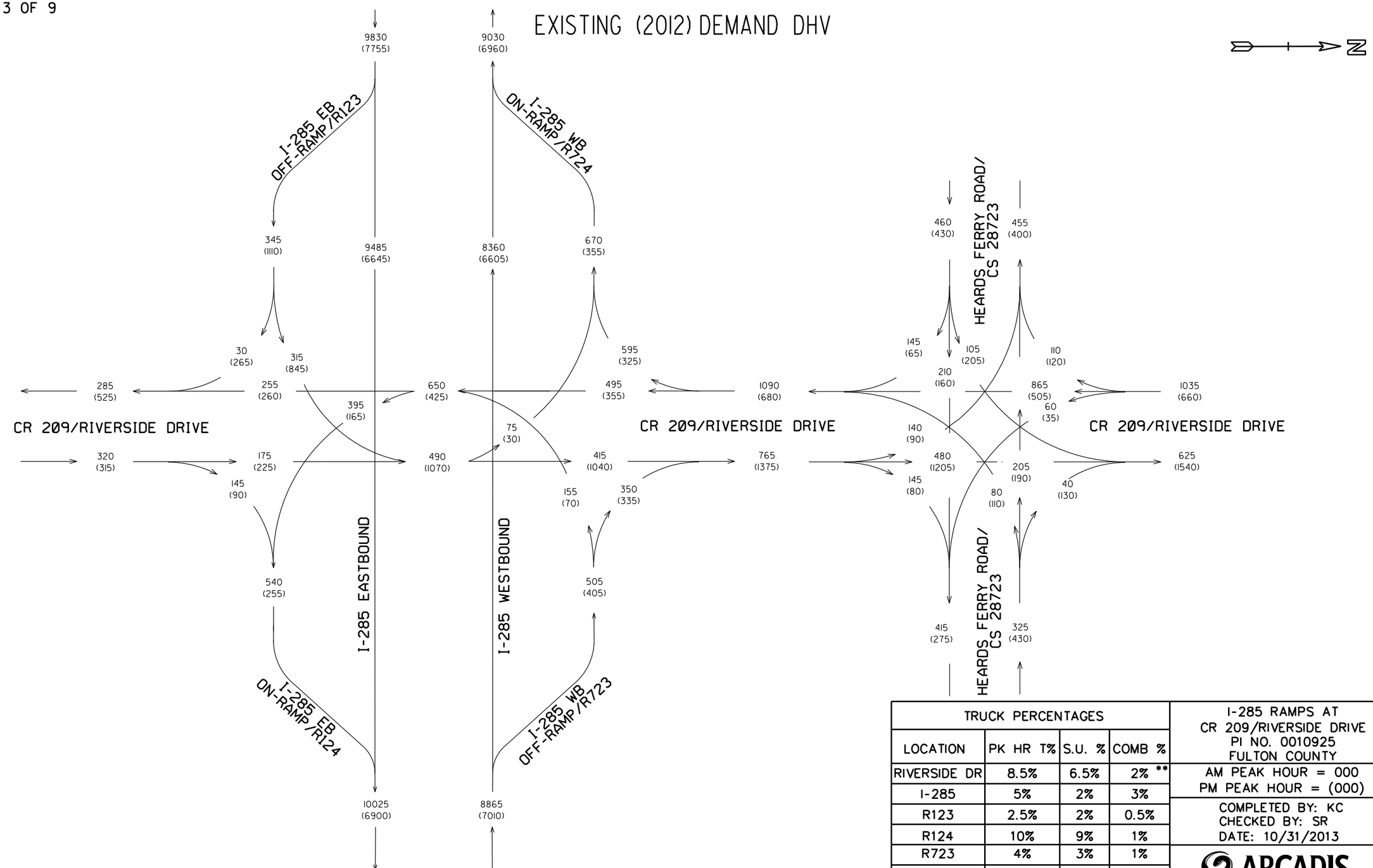
EXISTING (2012) DEMAND DHV



TRUCK PERCENTAGES			
LOCATION	PK HR T%	S.U. %	COMB %
RIVERSIDE DR	8.5%	6.5%	2% **
I-285	5%	2%	3%
R123	2.5%	2%	0.5%
R124	10%	9%	1%
R723	4%	3%	1%
R724	3%	2.5%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

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

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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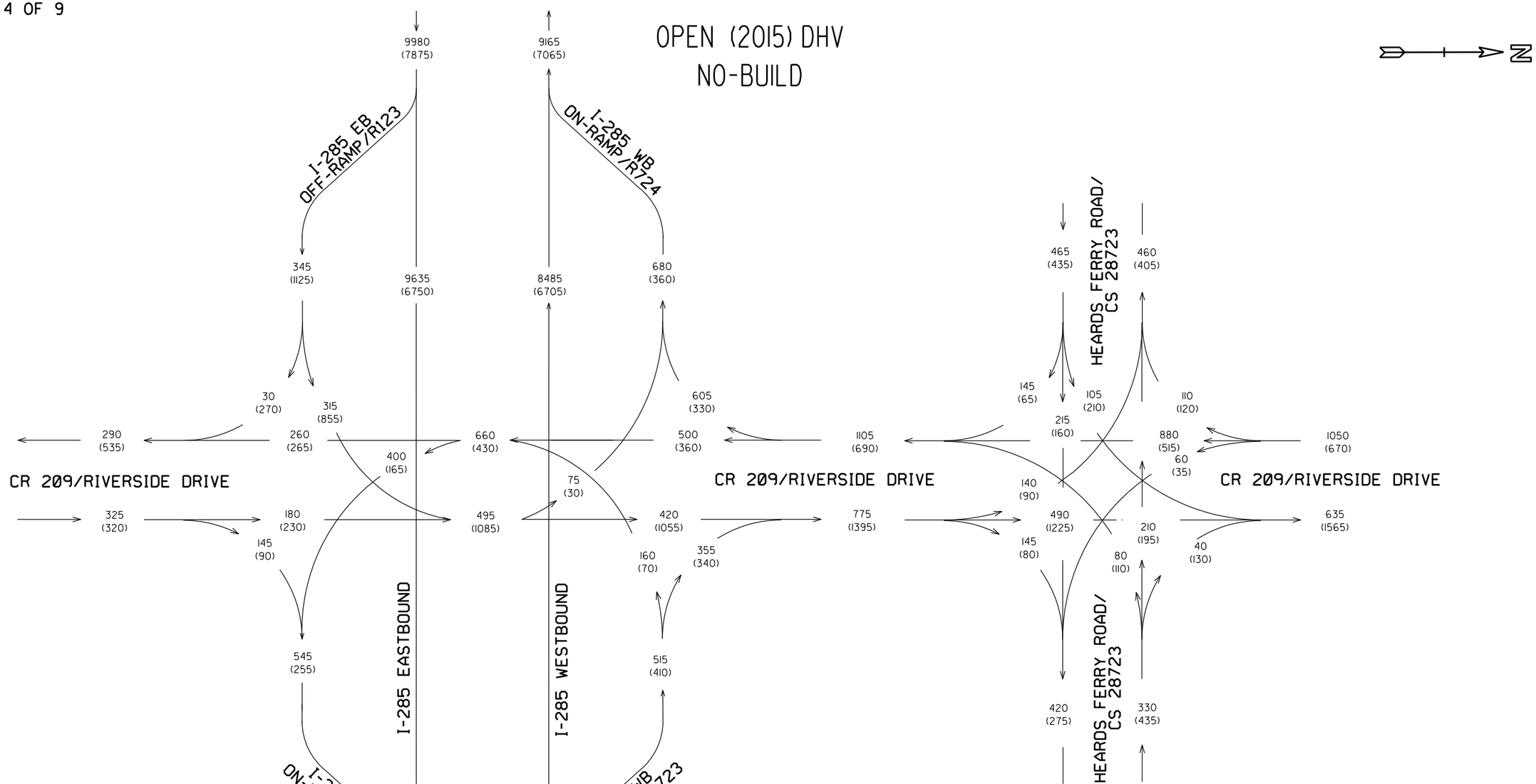
OPEN (2015) DHV
NO-BUILD



TRUCK PERCENTAGES			
LOCATION	PK HR T%	S.U. %	COMB %
RIVERSIDE DR	8.5%	6.5%	2% **
I-285	5%	2%	3%
R123	2.5%	2%	0.5%
R124	10%	9%	1%
R723	4%	3%	1%
R724	3%	2.5%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

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

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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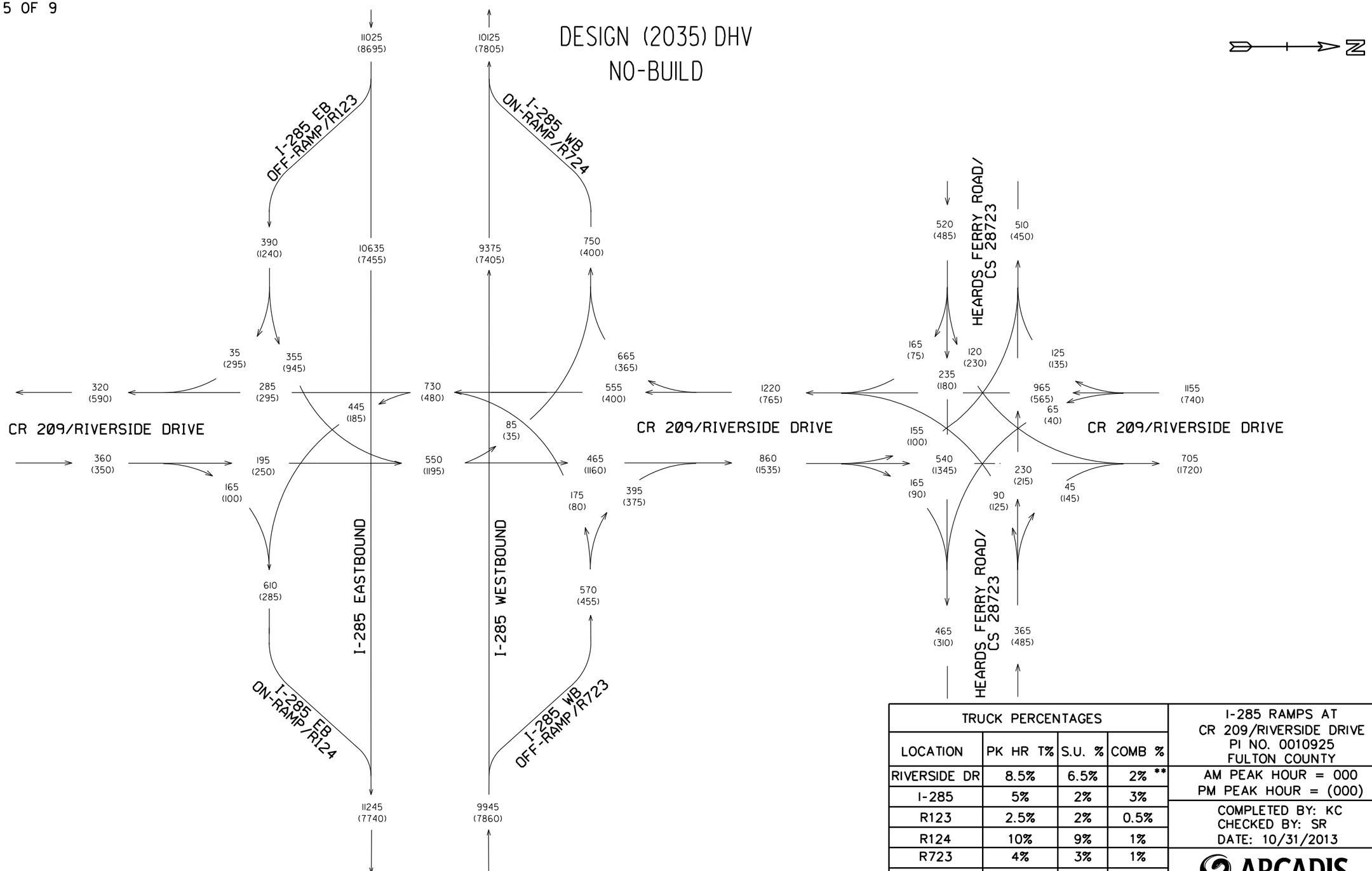
SHEET 5 OF 9

DESIGN (2035) DHV
NO-BUILD



TRUCK PERCENTAGES			
LOCATION	PK HR T%	S.U. %	COMB %
RIVERSIDE DR	8.5%	6.5%	2% **
I-285	5%	2%	3%
R123	2.5%	2%	0.5%
R124	10%	9%	1%
R723	4%	3%	1%
R724	3%	2.5%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

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

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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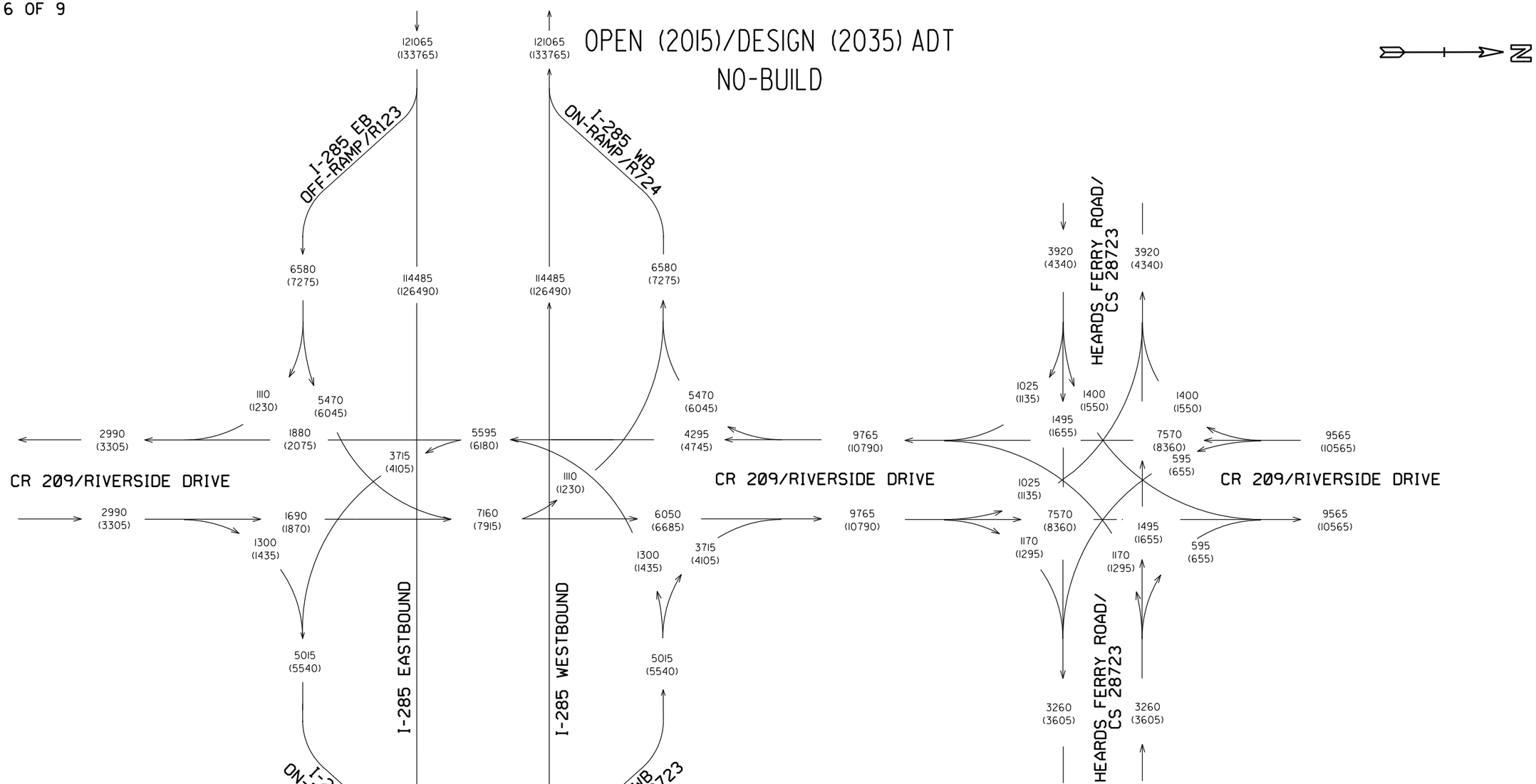
OPEN (2015)/DESIGN (2035) ADT
NO-BUILD



TRUCK PERCENTAGES			
LOCATION	24-HOUR T%	S.U. %	COMB %
RIVERSIDE DR	8%	7%	1% **
I-285	7%	2%	5%
R123	2%	2%	0%
R124	10.5%	9.5%	1%
R723	4%	3%	1%
R724	3.5%	3%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

2015 ADT = 000
2035 ADT = (000)

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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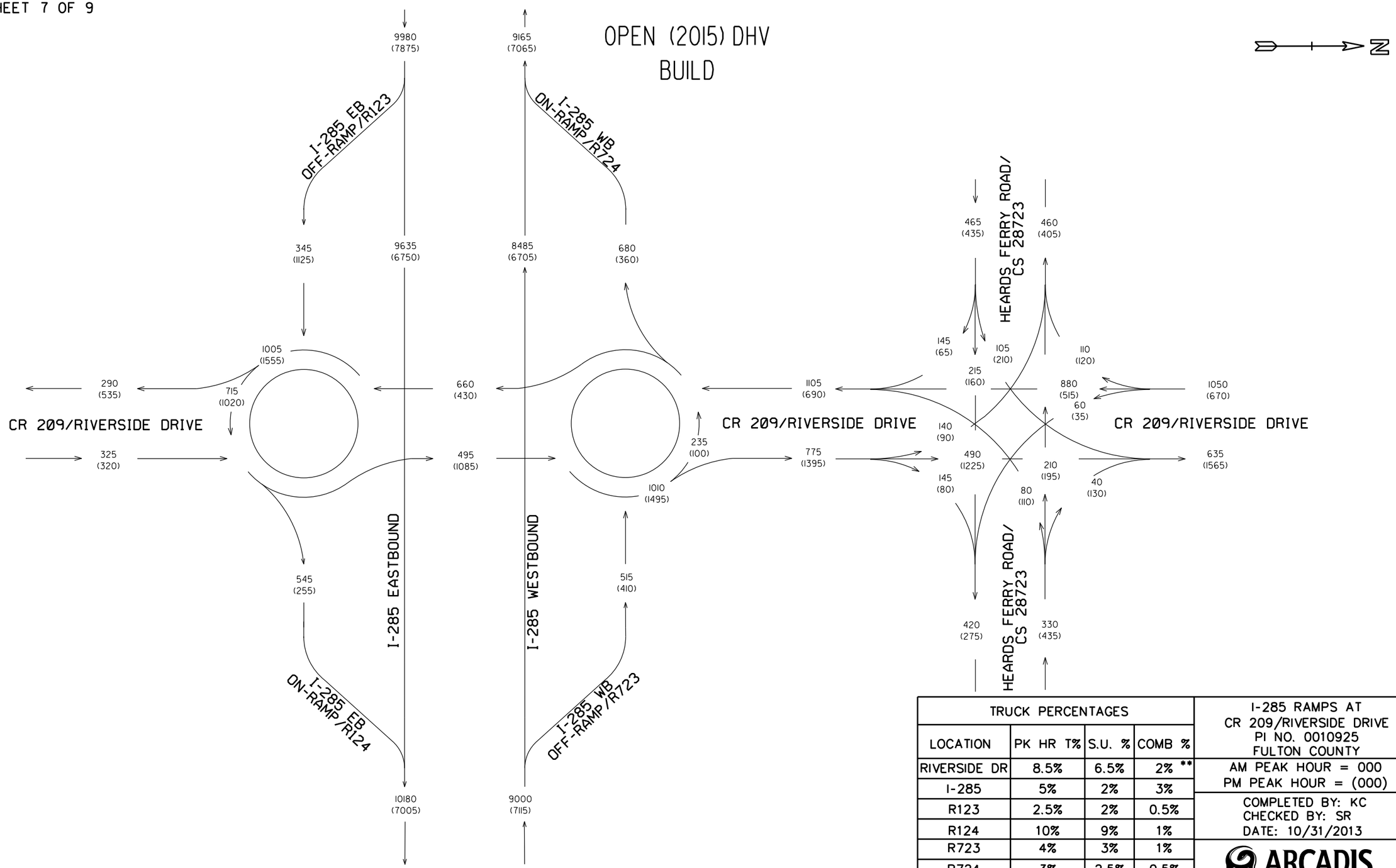
OPEN (2015) DHV BUILD



TRUCK PERCENTAGES			
LOCATION	PK HR T%	S.U. %	COMB %
RIVERSIDE DR	8.5%	6.5%	2% **
I-285	5%	2%	3%
R123	2.5%	2%	0.5%
R124	10%	9%	1%
R723	4%	3%	1%
R724	3%	2.5%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

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

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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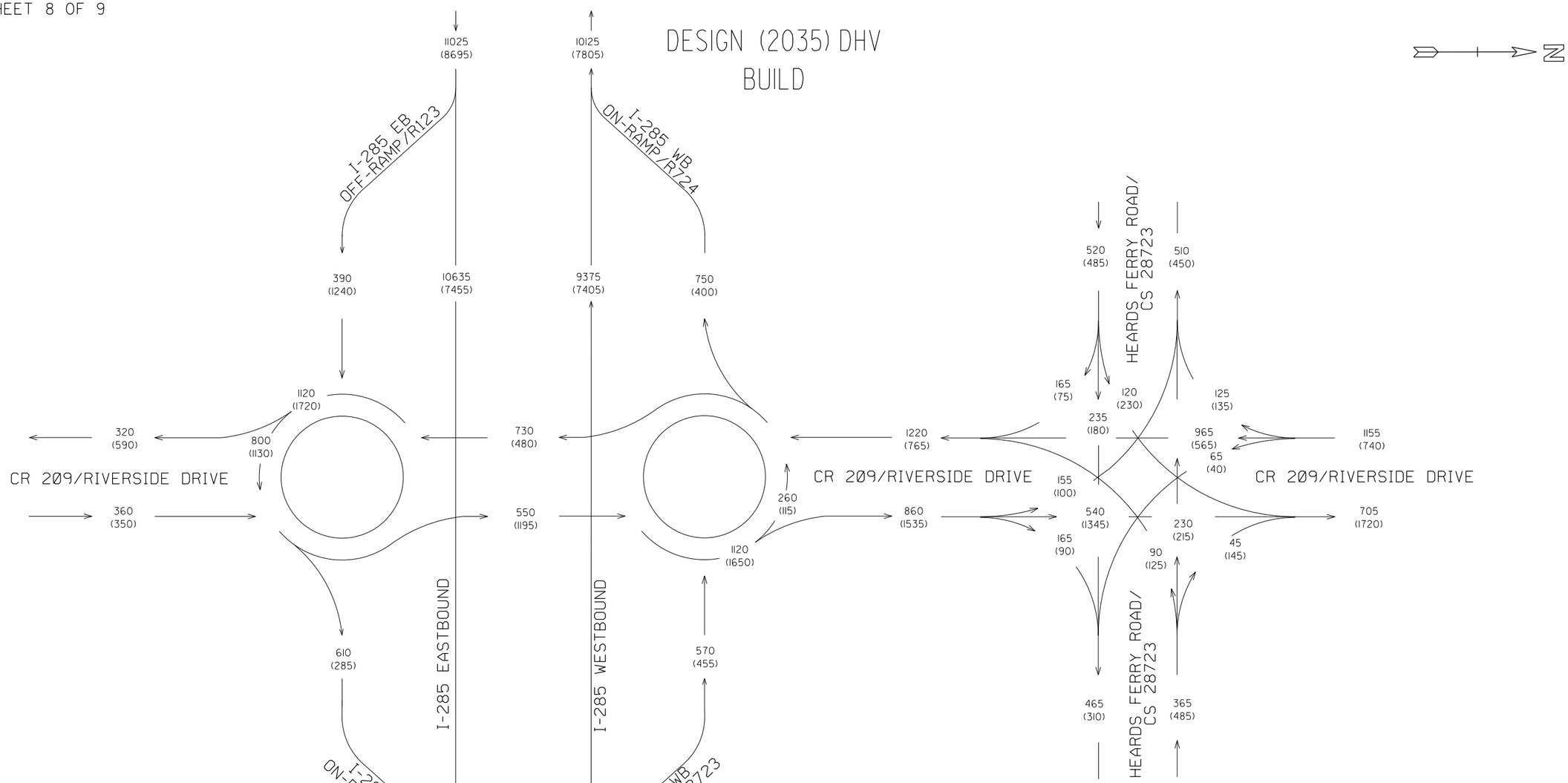
SHEET 8 OF 9

DESIGN (2035) DHV
BUILD



TRUCK PERCENTAGES			
LOCATION	PK HR T%	S.U. %	COMB %
RIVERSIDE DR	8.5%	6.5%	2% **
I-285	5%	2%	3%
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** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

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

COMPLETED BY: KC
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DATE: 10/31/2013

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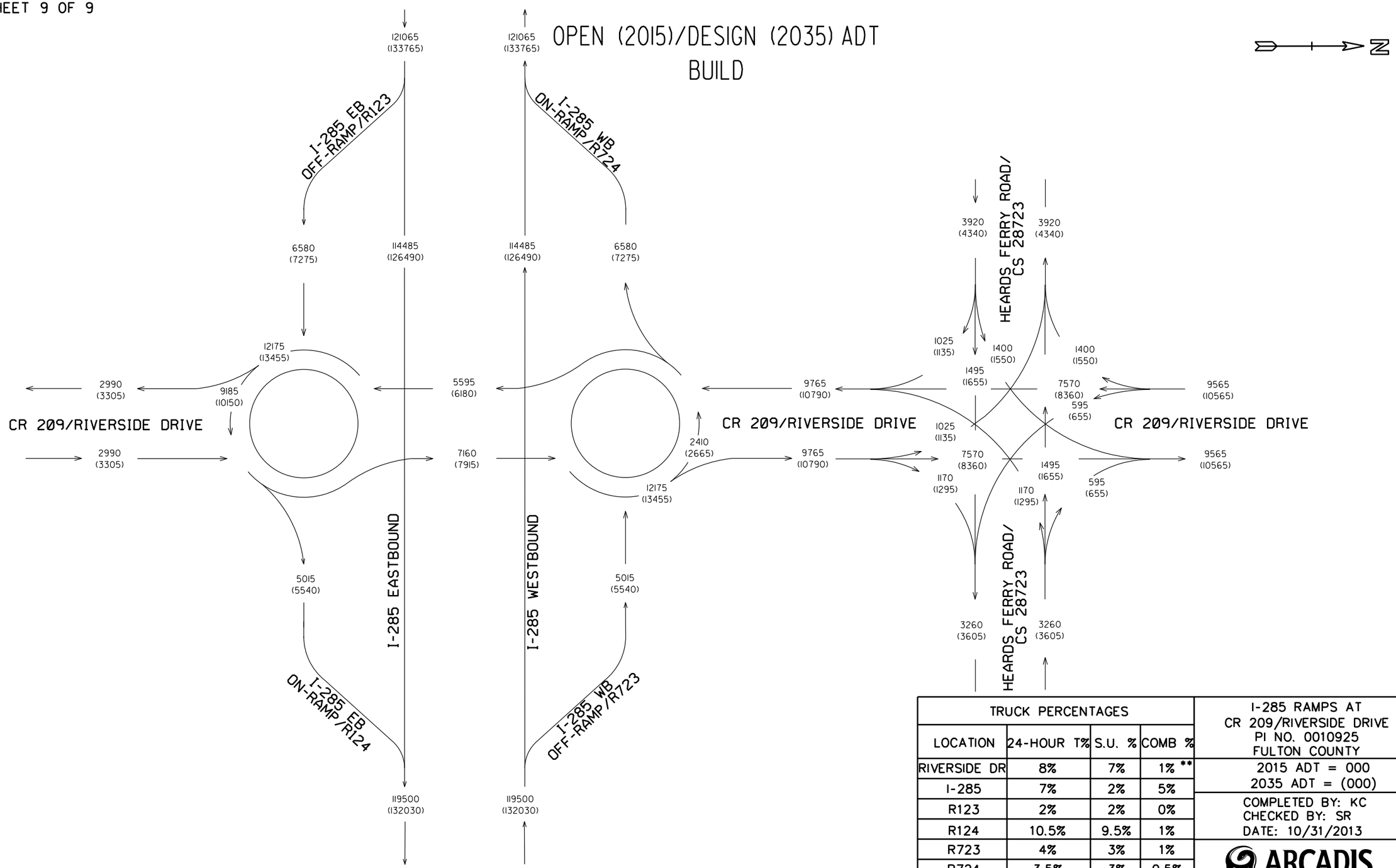
OPEN (2015)/DESIGN (2035) ADT
BUILD



TRUCK PERCENTAGES			
LOCATION	24-HOUR T%	S.U. %	COMB %
RIVERSIDE DR	8%	7%	1% **
I-285	7%	2%	5%
R123	2%	2%	0%
R124	10.5%	9.5%	1%
R723	4%	3%	1%
R724	3.5%	3%	0.5%
** LARGE TRUCKS PROHIBITED			

I-285 RAMPS AT
CR 209/RIVERSIDE DRIVE
PI NO. 0010925
FULTON COUNTY

2015 ADT = 000
2035 ADT = (000)

COMPLETED BY: KC
CHECKED BY: SR
DATE: 10/31/2013

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Department of Transportation
State of Georgia

INTERDEPARTMENT CORRESPONDENCE

FILE Fulton County
P.I. # 0010925

OFFICE Planning

DATE November 14, 2013

FROM Cynthia L. VanDyke, State Transportation Planning Administrator

TO Darryl D. VanMeter, State Innovative Program Delivery Engineer
Attention: Marlo Clowers, P.E.

SUBJECT **Design Traffic Review** for I-285 RAMPS @ CR 209/RIVERSIDE DRIVE.

We have reviewed the consultant's Design Traffic data for the above project. The Design Traffic is approved.

If you have any questions concerning this information, please contact Rhonda Niles at (404) 631-1924.

CLV/RFN

Appendix C

SIDRA Results/Reports

SIDRA 5.1 Results

The preliminary build roundabout capacity analysis was completed using SIDRA 5.1. The SIDRA analysis uses roundabout geometry inputs and peak hour volumes to determine the intersection delay based on guidance provided by the Highway Capacity Manual (HCM). Intersection delay from the HCM can be associated with a level of service (LOS) or a grade given to an intersection based on its capacity operations. Table 1 shows the average delay associated with each LOS.

Table 1: Level of Service Ranges

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

The LOS and delay results from the SIDRA analysis are summarized in Table 2 below. The SIDRA analysis shows that both ramp termini intersections are expected to be performing at an acceptable level of service in all future year scenarios with the exception of the I-285 eastbound off-ramps intersection in the design year 2035 PM peak hour.

Table 2: SIDRA LOS & Delay Results

Intersection	AM Peak Hour		PM Peak Hour	
	Open Year (2015)	Design Year (2035)	Open Year (2015)	Design Year (2035)
I-285 EB Ramps	10.4 (LOS B)	11.5 (LOS B)	23.2 (LOS C)	44.2 (LOS D)
I-285 WB Ramps	7.3 (LOS A)	8.1 (LOS A)	12.1 (LOS B)	25.7 (LOS C)

The capabilities of SIDRA 5.1 only allow the two roundabouts to be analyzed individually instead of as an interconnected system, which limits the reliability of the SIDRA capacity analysis results.

MOVEMENT SUMMARY

Site: I-285 EB Ramps Roundabout

I-285 EB Ramps - Open Year AM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
8	T	200	8.5	0.298	10.5	LOS B	2.1	55.4	0.85	0.84	29.6
18	R	161	8.5	0.329	7.7	LOS A	0.9	24.8	0.58	0.63	30.6
Approach		361	8.5	0.329	9.3	LOS A	2.1	55.4	0.73	0.75	30.0
North: Riverside Drive											
7	L	444	8.5	0.467	10.6	LOS B	0.0	0.0	0.00	0.80	20.3
4	T	289	8.5	0.467	4.1	LOS A	0.0	0.0	0.00	0.33	26.2
Approach		733	8.5	0.467	8.0	LOS A	0.0	0.0	0.00	0.62	22.0
West: I-285 EB Off-ramp											
5	L	350	2.5	0.428	17.1	LOS B	3.1	80.3	0.82	0.91	25.3
12	R	33	2.5	0.029	6.2	LOS A	0.1	3.7	0.43	0.50	29.9
Approach		383	2.5	0.428	16.1	LOS B	3.1	80.3	0.79	0.88	25.7
All Vehicles		1478	6.9	0.467	10.4	LOS B	3.1	80.3	0.38	0.72	26.4

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 WB Ramps Roundabout

I-285 WB Ramps Open Year AM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
3	L	83	8.5	0.362	10.6	LOS B	0.0	0.0	0.00	0.95	20.3
8	T	467	8.5	0.362	4.1	LOS A	0.0	0.0	0.00	0.37	26.2
Approach		550	8.5	0.362	5.1	LOS A	0.0	0.0	0.00	0.46	24.9
East: I-285 WB Off-ramp											
1	L	178	4.0	0.245	15.3	LOS B	1.4	36.0	0.68	0.83	22.3
16	R	394	4.0	0.377	8.0	LOS A	2.5	64.6	0.67	0.70	25.8
Approach		572	4.0	0.377	10.3	LOS B	2.5	64.6	0.67	0.74	24.5
North: Riverside Drive											
4	T	556	8.5	0.604	8.0	LOS A	5.7	152.7	0.75	0.72	25.8
14	R	672	8.5	0.567	6.0	LOS A	5.1	135.2	0.44	0.48	27.0
Approach		1228	8.5	0.604	6.9	LOS A	5.7	152.7	0.58	0.59	26.4
All Vehicles		2350	7.4	0.604	7.3	LOS A	5.7	152.7	0.47	0.60	25.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 EB Ramps Roundabout

I-285 EB Ramps Open Year PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
8	T	256	8.5	0.764	43.6	LOS D	9.8	260.5	1.00	1.34	19.8
18	R	100	8.5	0.176	5.9	LOS A	0.4	11.5	0.36	0.49	31.2
Approach		356	8.5	0.764	33.0	LOS C	9.8	260.5	0.82	1.10	22.1
North: Riverside Drive											
7	L	183	8.5	0.304	10.6	LOS B	0.0	0.0	0.00	0.87	20.3
4	T	294	8.5	0.304	4.1	LOS A	0.0	0.0	0.00	0.35	26.2
Approach		478	8.5	0.304	6.6	LOS A	0.0	0.0	0.00	0.55	23.3
West: I-285 EB Off-ramp											
5	L	950	2.5	0.938	33.2	LOS C	25.8	657.4	1.00	1.53	20.1
12	R	300	2.5	0.262	6.6	LOS A	1.6	40.0	0.51	0.58	29.6
Approach		1250	2.5	0.938	26.8	LOS C	25.8	657.4	0.88	1.30	21.7
All Vehicles		2083	4.9	0.938	23.2	LOS C	25.8	657.4	0.67	1.09	21.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 WB Ramps Roundabout

I-285 WB Ramps Open Year PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
3	L	33	8.5	0.794	10.6	LOS B	0.0	0.0	0.00	1.00	20.3
8	T	1172	8.5	0.794	4.1	LOS A	0.0	0.0	0.00	0.38	26.2
Approach		1206	8.5	0.794	4.3	LOS A	0.0	0.0	0.00	0.40	26.0
East: I-285 WB Off-ramp											
1	L	78	4.0	0.247	32.1	LOS C	1.6	40.4	0.94	0.98	15.9
16	R	378	4.0	0.740	47.3	LOS D	11.9	308.0	1.00	1.53	11.9
Approach		456	4.0	0.740	44.7	LOS D	11.9	308.0	0.99	1.44	12.5
North: Riverside Drive											
4	T	400	8.5	0.332	5.0	LOS A	2.4	64.7	0.40	0.45	27.7
14	R	367	8.5	0.296	5.2	LOS A	1.9	49.5	0.19	0.43	28.3
Approach		767	8.5	0.332	5.1	LOS A	2.4	64.7	0.30	0.44	27.9
All Vehicles		2428	7.7	0.794	12.1	LOS B	11.9	308.0	0.28	0.61	20.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 EB Ramps Roundabout

I-285 EB Ramps Design Year AM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
8	T	217	8.5	0.364	12.2	LOS B	2.7	71.1	0.92	0.91	28.9
18	R	183	8.5	0.386	8.2	LOS A	1.1	30.1	0.62	0.67	30.5
Approach		400	8.5	0.386	10.3	LOS B	2.7	71.1	0.78	0.80	29.6
North: Riverside Drive											
7	L	494	8.5	0.516	10.6	LOS B	0.0	0.0	0.00	0.80	20.3
4	T	317	8.5	0.516	4.1	LOS A	0.0	0.0	0.00	0.33	26.2
Approach		811	8.5	0.516	8.1	LOS A	0.0	0.0	0.00	0.62	22.0
West: I-285 EB Off-ramp											
5	L	394	2.5	0.517	20.5	LOS C	4.7	119.4	0.89	1.04	24.0
12	R	39	2.5	0.035	6.3	LOS A	0.2	4.5	0.45	0.51	29.8
Approach		433	2.5	0.517	19.2	LOS B	4.7	119.4	0.85	1.00	24.4
All Vehicles		1644	6.9	0.517	11.5	LOS B	4.7	119.4	0.41	0.76	25.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 WB Ramps Roundabout

I-285 WB Ramps Design Year AM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
3	L	94	8.5	0.402	10.6	LOS B	0.0	0.0	0.00	0.95	20.3
8	T	517	8.5	0.402	4.1	LOS A	0.0	0.0	0.00	0.37	26.2
Approach		611	8.5	0.402	5.1	LOS A	0.0	0.0	0.00	0.46	24.9
East: I-285 WB Off-ramp											
1	L	194	4.0	0.283	16.1	LOS B	1.7	42.6	0.72	0.86	21.9
16	R	439	4.0	0.435	8.6	LOS A	3.0	77.9	0.72	0.75	25.5
Approach		633	4.0	0.435	10.9	LOS B	3.0	77.9	0.72	0.78	24.2
North: Riverside Drive											
4	T	617	8.5	0.691	10.1	LOS B	8.2	217.8	0.85	0.85	24.9
14	R	739	8.5	0.630	6.3	LOS A	6.2	165.6	0.51	0.51	26.6
Approach		1356	8.5	0.691	8.0	LOS A	8.2	217.8	0.66	0.66	25.8
All Vehicles		2600	7.4	0.691	8.1	LOS A	8.2	217.8	0.52	0.64	25.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 EB Ramps Roundabout

I-285 EB Ramps Design Year PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
8	T	278	8.5	0.890	68.5	LOS E	14.4	385.1	1.00	1.55	15.9
18	R	111	8.5	0.198	6.0	LOS A	0.5	13.1	0.39	0.50	31.2
Approach		389	8.5	0.890	50.6	LOS D	14.4	385.1	0.82	1.25	18.5
North: Riverside Drive											
7	L	206	8.5	0.339	10.6	LOS B	0.0	0.0	0.00	0.87	20.3
4	T	328	8.5	0.339	4.1	LOS A	0.0	0.0	0.00	0.35	26.2
Approach		533	8.5	0.339	6.6	LOS A	0.0	0.0	0.00	0.55	23.3
West: I-285 EB Off-ramp											
5	L	1050	2.5	1.082	72.7	LOS E	54.0	1376.8	1.00	2.53	13.3
12	R	328	2.5	0.294	6.9	LOS A	1.8	46.0	0.55	0.61	29.4
Approach		1378	2.5	1.082	57.0	LOS E	54.0	1376.8	0.89	2.08	15.2
All Vehicles		2300	4.9	1.082	44.2	LOS D	54.0	1376.8	0.67	1.58	16.4

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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MOVEMENT SUMMARY

Site: I-285 WB Ramps Roundabout

I-285 WB Ramps Design Year PM Peak
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Riverside Drive											
3	L	39	8.5	0.874	10.6	LOS B	0.0	0.0	0.00	1.00	20.3
8	T	1289	8.5	0.874	4.1	LOS A	0.0	0.0	0.00	0.38	26.2
Approach		1328	8.5	0.874	4.3	LOS A	0.0	0.0	0.00	0.40	25.9
East: I-285 WB Off-ramp											
1	L	89	4.0	0.361	46.3	LOS D	2.6	66.9	1.00	1.06	12.8
16	R	417	4.0	1.031	131.3	LOS F	32.3	832.1	1.00	2.34	5.5
Approach		506	4.0	1.031	116.3	LOS F	32.3	832.1	1.00	2.12	6.1
North: Riverside Drive											
4	T	444	8.5	0.377	5.2	LOS A	2.9	76.9	0.45	0.47	27.4
14	R	406	8.5	0.326	5.3	LOS A	2.1	57.2	0.21	0.43	28.1
Approach		850	8.5	0.377	5.2	LOS A	2.9	76.9	0.34	0.45	27.7
All Vehicles		2683	7.7	1.031	25.7	LOS C	32.3	832.1	0.29	0.74	14.5

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

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