Interstate 85 Widening Traffic Analysis Report

I-85 Widening Project MM80 – MM96

Spartanburg and Cherokee Counties

Submitted to:

South Carolina Department of Transportation

Prepared By:

STV Incorporated
140 Stoneridge Drive, Suite 450
Columbia, SC 29210

October 2015

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October 2015

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EXECUTIVE SUMMARY

This report summarizes traffic analyses performed for widening Interstate 85 from two to three lanes in each direction between approximately mile markers 80 and 96.

The analysis includes the existing interchanges at Exits 83, 87, 90, 92, 95, and 96, as well as Exit 82 (an existing northbound exit ramp).

The analysis also includes the existing interchanges at Exits 80 and 100, which are the next full interchanges adjacent to the modified interchanges at Exits 83 and 96.

The study includes the existing northbound off-ramp at Exit 82 and the northbound on-ramp from Gaffney Ferry Road (located north of Exit 96), which are to be eliminated as part of the widening project. The Exit 98 northbound off-ramp to Frontage Road, which is expected to be eliminated in a separate widening project, was also included to assess the effects of its elimination on traffic at Exits 96 and 100.

The interchanges at Exits 80, 90, and 92 have recently been upgraded and no revisions to those interchanges, aside from lengthening the parallel lane lengths of the acceleration/deceleration lanes for the ramps at Exits 90 and 92, are anticipated.

The additional capacity provided by the construction of a third lane in each direction along I-85 will result in LOS results comparable to those experienced under existing conditions. The 2040 Build analysis results indicate that all freeway segments are predicted to operate at LOS B or C during the morning peak hour. During the afternoon peak hour, all freeway segments are projected to operate at LOS D or E. The segments that operate at LOS E are located between Exits 80 and 90 on the south end of the study area, and include the interchanges at Exits 83 and 87.

The analysis shows that those segments operating at LOS E during the afternoon peak hour would operate at LOS D or better with the addition of a fourth lane in each direction on I-85 between Exits 80 and 90. The need for this potential additional widening should be considered and incorporated to the extent possible in this widening project. Incorporating the future need for a fourth lane along these segments should allow for the design and construction of permanent roadway features, such as drainage and retaining walls. This will help to minimize disruption to these features when future widening becomes necessary.

The interchanges at Exits 83, 87, 95 and 96 are expected to be modified to improve their operation and enhance safety. The analysis of the operation of potential improvement alternatives (Exit 83 – Four Build alternatives, Exit 87 – five Build Alternatives, Exit 95 – three

Build Alternatives and Exit 96 – two Build Alternatives) on the ramp termini and adjacent intersections at these interchanges are included in this analysis.

The final build alternative network was identified based on the preferred alternative improvements selected for each interchange. Though traffic operations were a consideration in the evaluation of alternatives, other factors, such as construction costs, business and residential relocations, and environmental impacts were used to identify the preferred alternatives. As outlined in the ***I-85 Widening Environmental Assessment (MM 80 to MM 96)***, the preferred alternatives for the interchange improvements are:

- Exit 83: Alternative 4
- Exit 87: Alternative 5
- Exit 95: Alternative 2
- Exit 96: Alternative 3

The traffic operations analysis of the preferred alternatives identified areas where traffic control improvements were projected to be needed to provide acceptable operating LOS. These include:

Exit 83 – Alternative 4

- Installation of a traffic signal at the intersection of Battleground Road at the southbound ramps is predicted to be warranted between 2035 and 2040.
- The relocated signalized intersection of Battleground Road with Frontage Road may no longer be needed since the northbound off-ramp traffic using the existing signal will be is diverted away from the relocated intersection to the new northbound ramp intersection.

Exit 87 – Alternative 5

- Installation of a traffic signal at the intersection of Green River Road and Cannons Campground Road/Overbrook Drive predicted to be warranted between 2035 and 2040.

Exit 95 – Alternative 2

- Installation of a traffic signal at the intersection of Shelby Highway/Pleasant School Road and Matthew Road is recommended as part of the construction of the interchange to accommodate traffic upon the opening of the improvement.

Exit 97 – Alternative 3

- Installation of traffic signals are recommended at the intersections along Shelby Highway at the northbound and southbound ramps and at Victory Trail Road. The signal installations are predicted to be warranted as follows:
    - Shelby Highway at I-85 SB ramps – signalization required between 2035-2040
    - Shelby Highway at I-85 NB ramps – signalization required between 2030-2035
    - Shelby Highway at Victory Trail Road – signalization required at construction.

I. INTRODUCTION

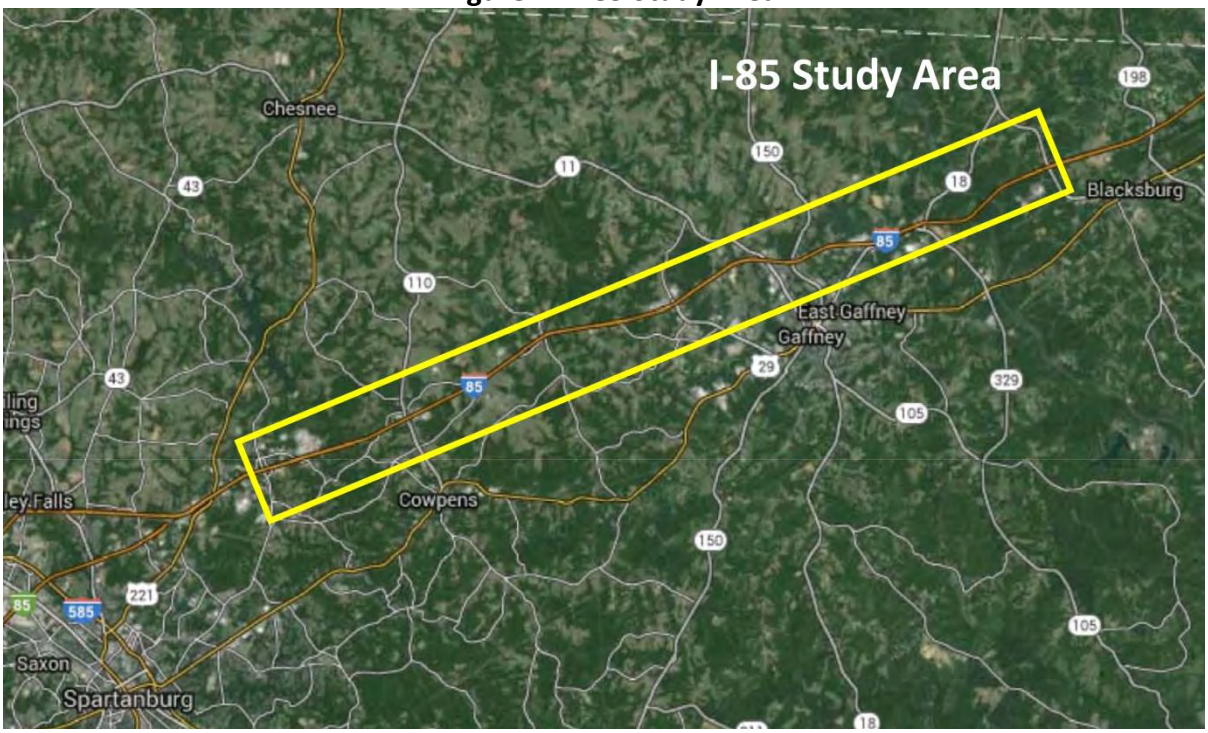
Interstate 85 (I-85) is an important link in the interstate system that runs north-south between Virginia and Alabama for a total of 668 miles. It connects the upstate of South Carolina with the Charlotte, North Carolina and Atlanta, Georgia metropolitan areas. In addition to being a corridor for transporting people and freight between urban areas, I-85 serves other specific needs, including:

- Daily commuting routes for intra- and interstate travelers;
- Access to the UPS Terminal at Exit 95; and,
- Access to Gaffney Premium Outlets at Exit 90.

The South Carolina Department of Transportation (SCDOT) proposes multiple improvements to the I-85 corridor designed to increase capacity, upgrade interchanges to meet design requirements, and expand vertical clearance at overpass bridges. Specifically, SCDOT proposes widening I-85 from four to six lanes from Exit 80 – Gossett Road (S-57) in Spartanburg County to the Broad River Bridge, which is 1.5 miles north of Exit 96 – Shelby Highway in Cherokee County (**Figure 1**). Along the approximately 18-mile project area located within Spartanburg and Cherokee Counties, interchanges at Exit 83 – Battleground Road, Exit 87 – Green River Road, Exit 95 – Pleasant School Road, and Exit 96 – Shelby Highway will be improved to bring them into compliance with design requirements. The frontage road at Exit 90 - Hyatt Street will be reconfigured to improve traffic flow. Lastly, the overpass bridge at Sunny Slope Drive will be replaced by one with greater vertical clearance to meet design standards.

This report summarizes the results of a traffic analysis performed for a study area consisting of Interstate 85 between approximately mile markers 80 and 96. The study area includes existing interchanges located at Exits 83, 87, 90, 92, 95, and 96. An additional northbound exit-only ramp is present in the corridor and is designated as Exit 82. To provide sufficient coverage for addressing modifications to interstate access, the analysis also includes the existing interchanges at Exits 80 and 100, as well as the northbound on-ramp from Gaffney Ferry Road (located north of Exit 96) and the off-ramp to Frontage Road (designated as Exit 98). The study area location is shown in **Figure 1**.

Figure 1 - I-85 Study Area



Interchange improvements are anticipated to be required to upgrade existing interchanges at Exits 83, 87, 95, and 96. No improvements are anticipated at Exit 80. Minor improvements are anticipated to be made to lengthen the acceleration and deceleration lanes at Exits 90 andand 92. The single exit ramps at Exit 82 and the on-ramp from Gaffney Ferry Road are expected to be removed as part of this project. The removal of the single exit ramp at Exit 98 will be addressed in another project, but is referenced in this report as its removal will result in traffic being rerouted to Exit 100.

The traffic analysis also includes ramp termini intersections with arterial roadways at the interchanges along with analysis of adjacent intersections influenced by existing interchange operations or that may be affected by modifications to the interchanges.

II. FREEWAY DESCRIPTION

I-85 is a north-south interstate highway that begins at I-65 in Montgomery, Alabama. From this origin, I-85 runs generally to northeast through Alabama, Georgia, South Carolina, North Carolina and Virginia, where it ends south of Richmond at I-95 in Petersburg, Virginia.

Along its nearly 670 mile length, I-85 provides access to Montgomery, Alabama; Atlanta, Georgia; Greenville and Spartanburg, South Carolina; Charlotte, Greensboro, and Durham, North Carolina; and Petersburg, Virginia.

In South Carolina, I-85 covers about 106 miles, and provides connections to I-385 outside of Greenville, and I-26 outside of Spartanburg. Within the study area, I-85 crosses portions of Spartanburg and Cherokee Counties, and provides access to the towns of Cowpens, Gaffney, East Gaffney and Blacksburg.

In Spartanburg County, interchanges considered in this analysis are located at Exits 80, 82, and 83. The remaining interchanges are located in Cherokee County.

In addition to the roadways crossing I-85 at the interchanges, additional roadways cross I-85 without interchanges at Sunny Slope Road (S-11-131), which is located approximately 1.8 miles north of Exit 83, and Providence Road/Boiling Springs Highway (SC 150), which is located approximately 0.6 miles north of Exit 92,

Number of Lanes

Throughout nearly all of the study area, I-85 currently provides two lanes in each direction.

South of the study area limits, I-85 has four northbound through lanes north of the US 221 interchange (Exit 78). The four lane section of northbound I-85 narrows to three lanes by merging the rightmost lane approximately 1800 feet south of the northbound exit ramp to the Gossett Road interchange (Exit 80). The three lane section then merges to a two lane section beginning approximately at the northbound exit ramp, with the leftmost lane merging in to create a two lane section approximately 350 feet north of the Gossett Road overpass. The northbound on-ramp from Gossett Road merges into a two lane mainline section. From this point, northbound I-85 continues through the study area with two lanes.

Southbound I-85 enters the study area from the north of the Blacksburg Highway interchange (Exit 100) with two southbound lanes. Throughout the study area, the two lane section is maintained, until it is widened from two to three lanes approaching the Gossett Road (Exit 80) southbound off ramp at a point approximately 550 feet north of the ramp gore and about one-half mile from the Gossett Road overpass. I-85 continues southbound with three lanes through the Gossett Road interchange towards the US 221 interchange (Exit 78) where it picks up a fourth lane from the southbound on-ramp from US 221.

Posted Speed Limit

The posted speed limit throughout most of the I-85 study area is 65 miles per hour. The posted speed limit increases to 70 miles per hour in the southern end of the study area beginning approximately 4000 feet north of the Gossett Road (Exit 80) overpass.

Grades

In general, interstate routes can be characterized as having either level, rolling, or mountainous terrain. Along I-85, the interstate grades fluctuate between a maximum -6.32 percent down grade to a maximum 6.00 percent upgrade. Based on these grades, the portion of I-85 within the study area can be characterized as having a *rolling terrain*.

Rest Areas

Existing Rest Areas are located in each direction on I-85 at approximately mile marker 89. These rest areas are currently closed to the public. The general locations of the rest areas are shown in **Figure 2**. The exit to the Rest Area located on the northbound side of I-85 has a posted curve advisory speed of 20 mph at the end of a 900 feet long deceleration lane. The entrance onto northbound I-85 from this rest area includes an acceleration lane of approximately 2,240 feet.

Figure 2 - Existing Rest Areas

There does not appear to be an advisory speed limit posted at the exit to the Rest Area located on southbound I-85. The southbound deceleration lane to the entrance of the Rest Area is approximately 1,245 feet long. The southbound acceleration lane for traffic re-entering I-85 is approximately 1,350 feet.

Frontage Road System

A parallel frontage road system is present at portions of both sides of I-85 throughout the study area. Illustrations of the extent of the frontage road system are shown in **Figure 3** through **Figure 7**.

Northbound Frontage Road System

The frontage road system paralleling the northbound lanes within the study area begins at Gossett Road. Conway Black Road (S-42-1011) runs parallel to the northbound lanes for 0.6 miles before turning to the southeast. For the next two miles, there is no frontage road parallel to northbound I-85. North of Exit 82, Bud Arthur Bridge Road/Frontage Road (S-42- 737/1013) begins running parallel to northbound I-85 for about 0.65 miles before turning to intersect Battleground Road. The northbound off-ramp to Battleground Road at Exit 83 intersects this portion of the Frontage Road system.

North of Exit 83, a portion of Edgefield Road (S-42-1015) runs parallel to northbound I-85 for about 0.25 miles before turning into the on-ramp to northbound I-85. About one-half mile later, Oglesby Lane begins running parallel to northbound I-85 for approximately 0.85 miles. One quarter mile north of where Oglesby Lane stops running parallel to I-85, Cannons Campground Road (S-11-38/234) begins as a parallel frontage road. It continues running generally parallel to I-85 for approximately 1.7 miles, where the northbound off-ramp for Exit 87 intersects Cannons Campground Road before its intersection with S Green River Road (S-11-39). North of Exit 87, the northbound on-ramp departs from Overbrook Drive (S-11-31), which then runs parallel to I-85 for approximately 1.75 miles.

There is no frontage road running parallel to northbound I-85 for the next 1.3 miles approaching Exit 90. North of Exit 90, Windslow Avenue (S-11-659) runs parallel to northbound I-85 for approximately two miles to Exit 92. Cresthaven Drive (S-11-660) runs parallel to I-85 northbound adjacent to the northbound on-ramp for about 0.3 miles. About 0.45 miles later, Hampshire Drive (S-11-443/661) begins running parallel to northbound I-85 for 1.65 miles to Exit 95 (the off-ramp to Hampshire Drive at Exit 95 is located about one mile along this frontage road). North of Exit 95, Shelby Highway (SC 18) runs parallel to northbound I-85 for one mile to Exit 96.

Figure 3 - Frontage Road Locations: Exits 80-83

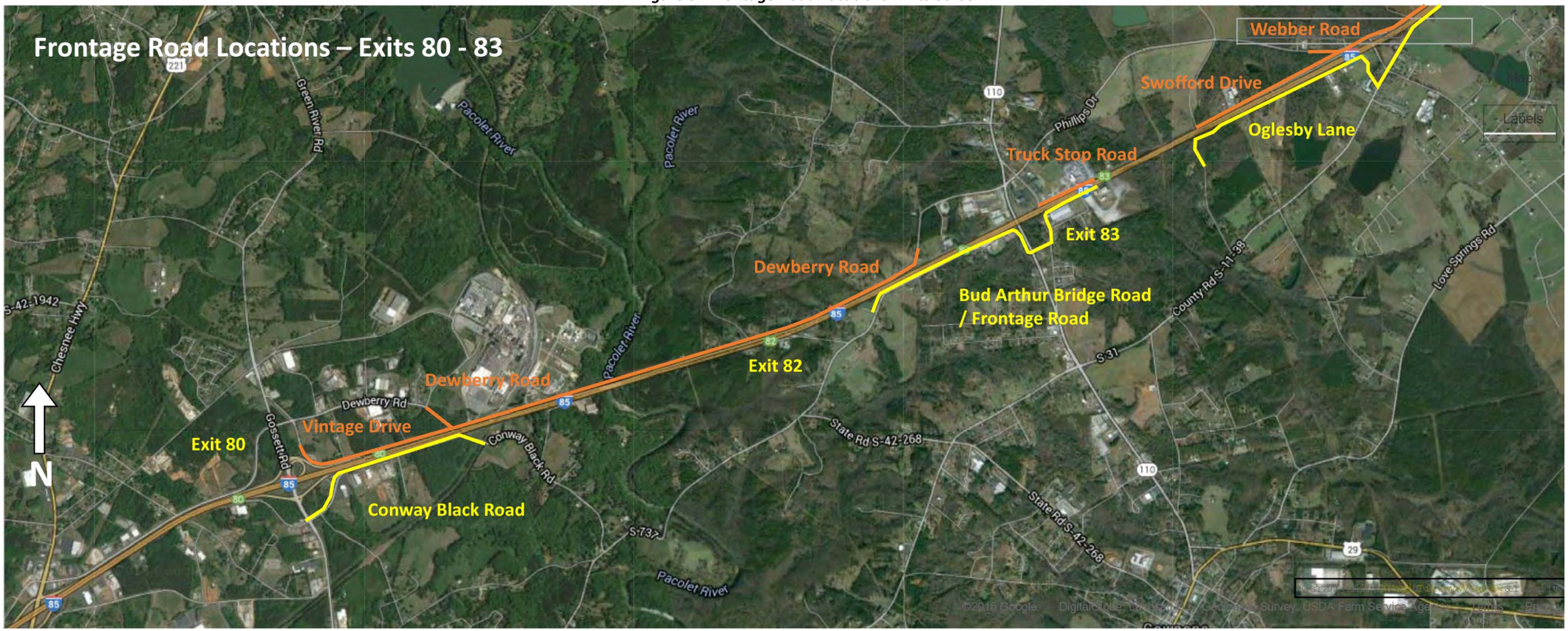


Figure 4 - Frontage Road Locations: Exits 83-87

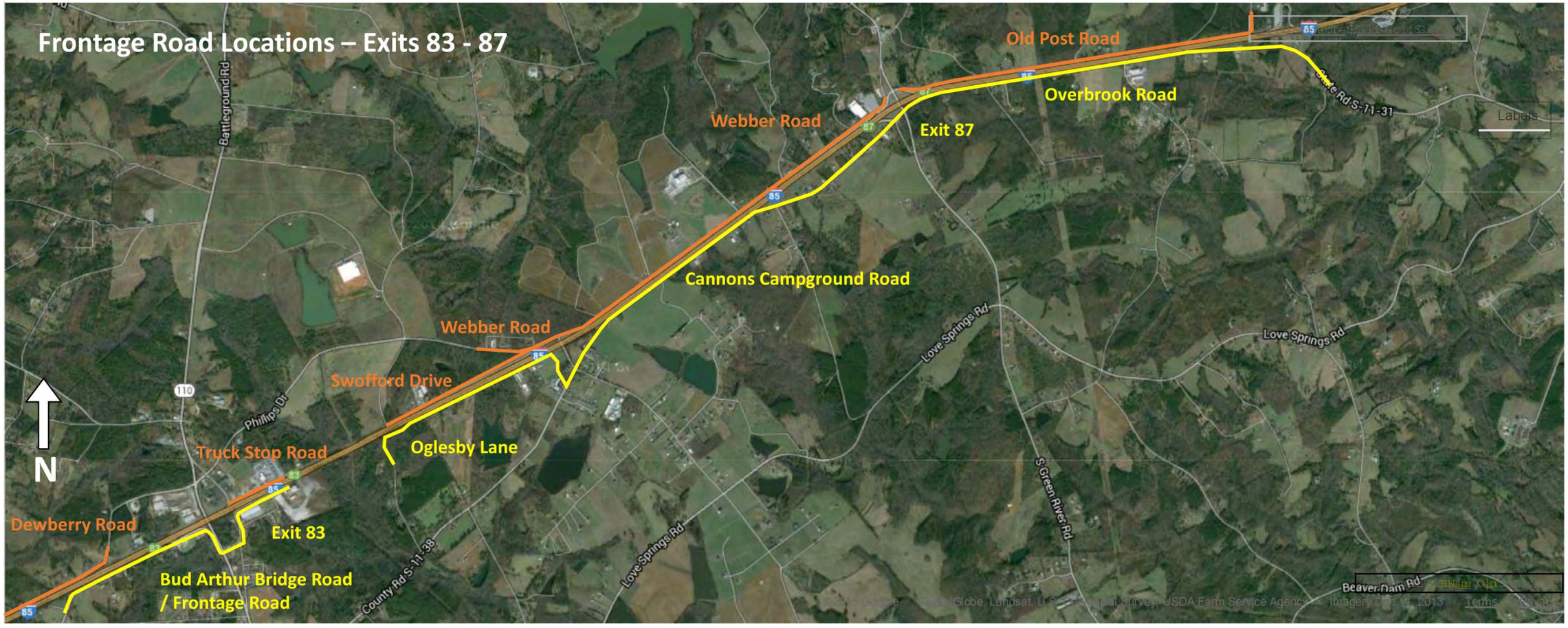


Figure 5 - Frontage Road Locations: Exits 87-92

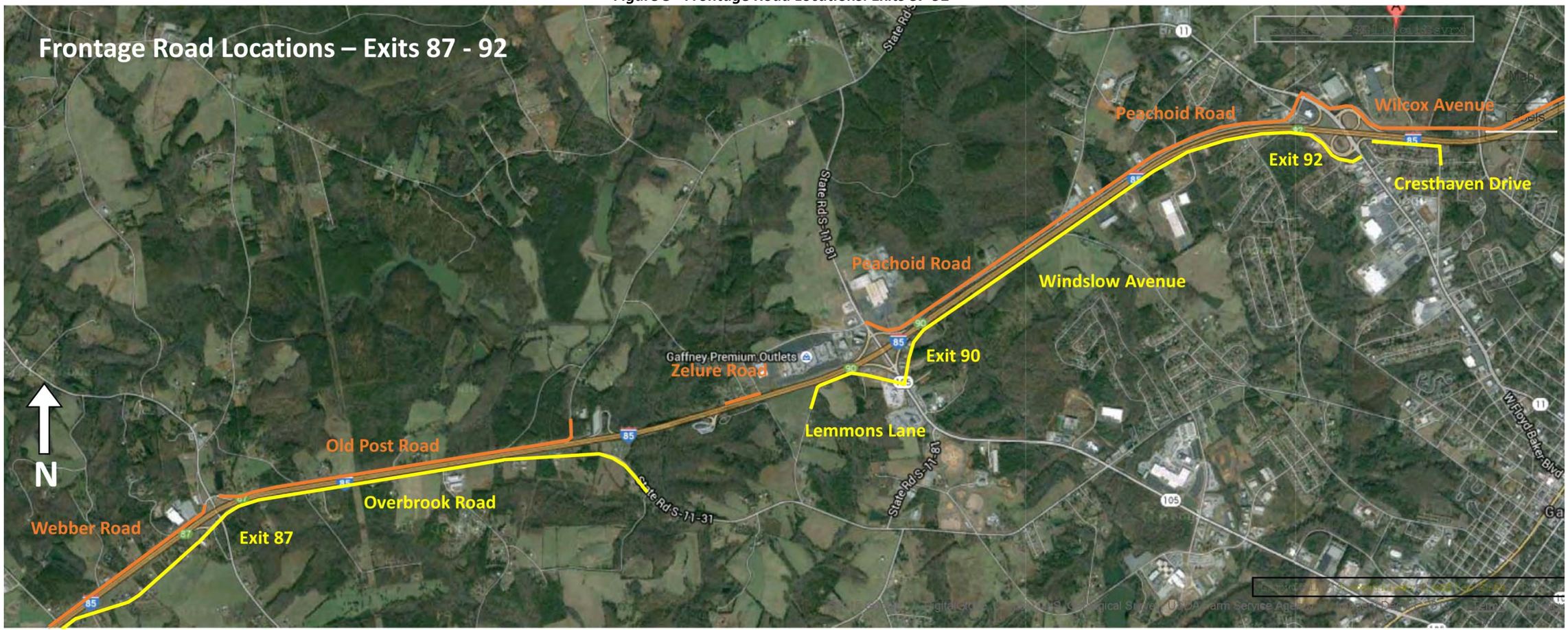


Figure 6 - Frontage Road Locations: Exits 92-96

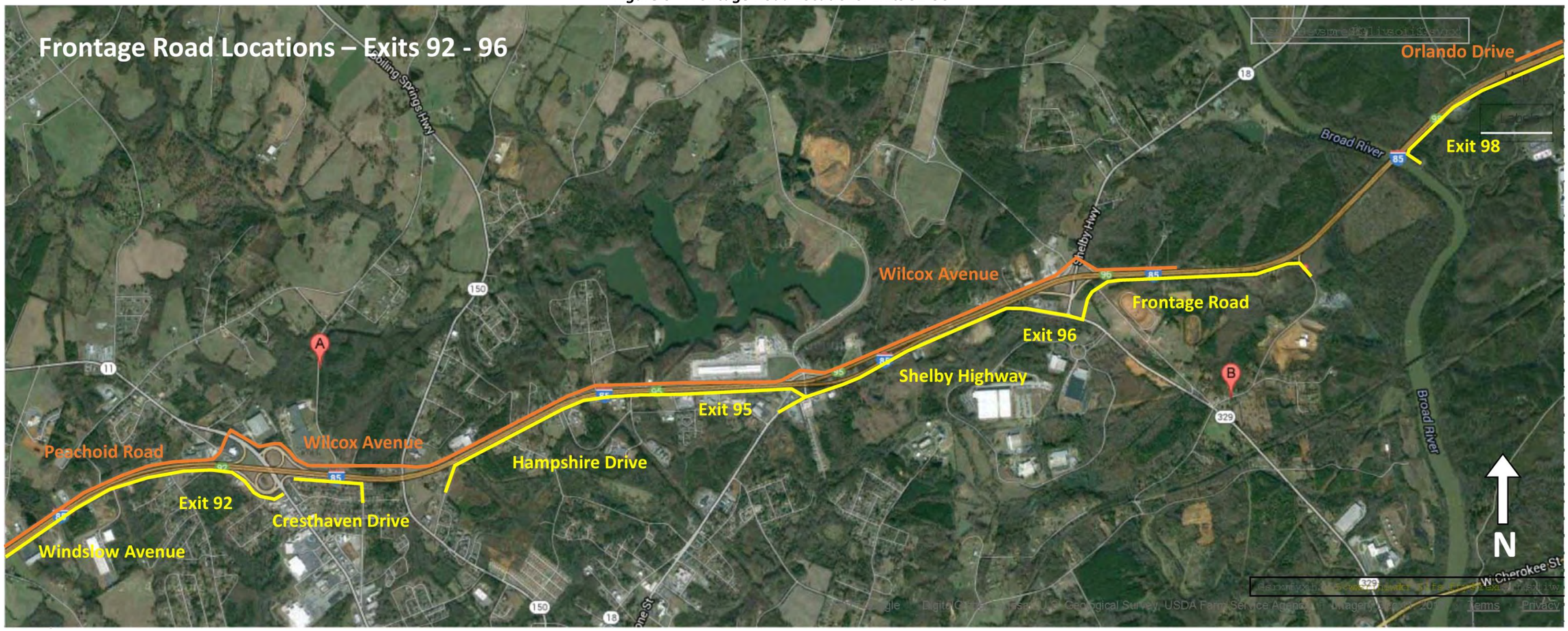
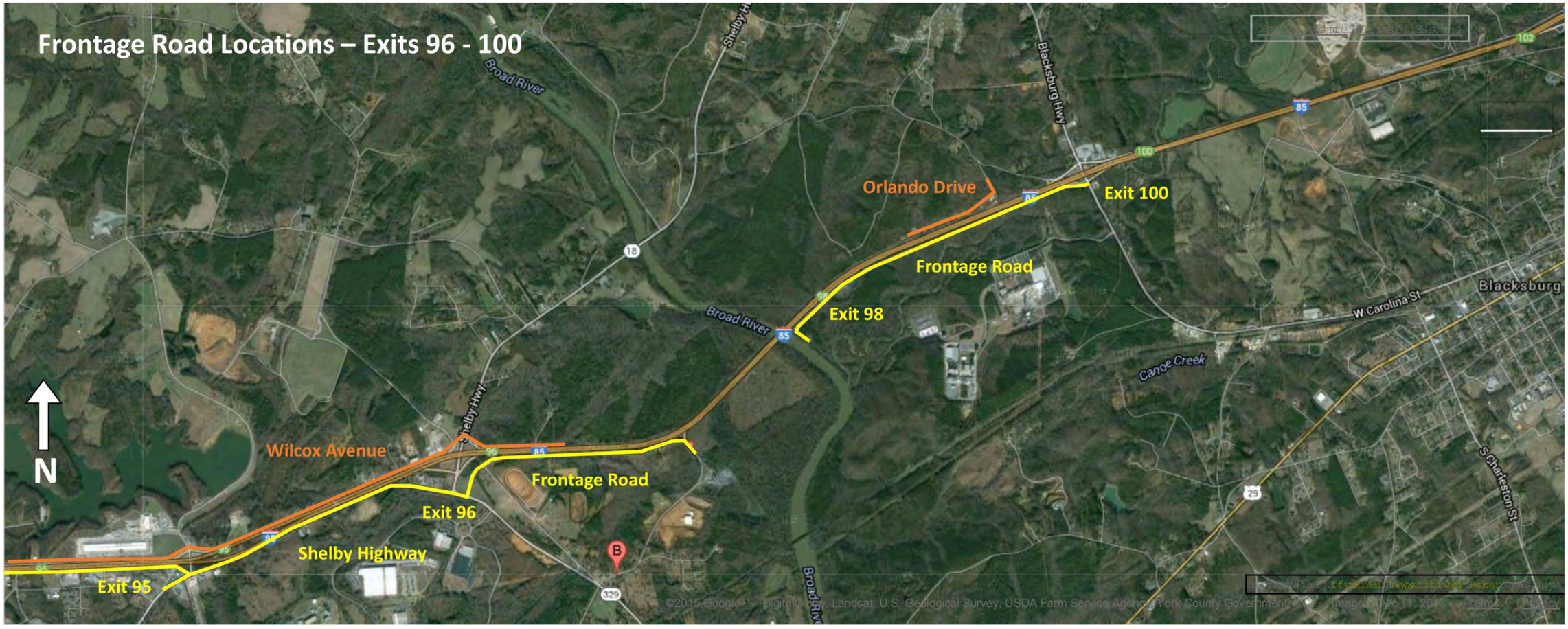


Figure 7 - Frontage Road Locations: Exits 96-100



North of Exit 96, a frontage road (named Frontage Road) begins from the terminus of Windhill Road (S-11-663) and runs parallel to northbound I-85 for approximately 0.9 miles. At this point, the slip on-ramp from Gaffney Ferry Road (S-11-49) intersects I-85 northbound. For 0.6 miles before the crossing of the Broad River, no frontage road is present. North of the bridge over the Broad River, Frontage Road again begins running parallel to northbound I-85. Approximately 0.2 miles north along this portion of I-85 is the location of the Exit 98 off-ramp to the Frontage Road. The Frontage Road extends for a total of about 1.5 miles along northbound I-85 to Exit 100.

Southbound Frontage Road System

Beginning approximately 0.2 miles south of the Exit 100 southbound on-ramp, Orlando Drive runs parallel to southbound I-85 for approximately 0.5 miles before ending in a cul de sac. No frontage road is present next to southbound I-85 for the next 1.9 miles, where Wilcox Avenue (S-11-668) begins. Wilcox Avenue runs parallel to southbound I-85 for approximately 0.3 miles before the southbound off-ramp to Exit 96 begins. South of Exit 96, Wilcox Avenue runs parallel to southbound I-85 for about 1.3 miles to Exit 95. Wilcox Avenue continues running parallel to southbound I-85 south of Exit 95 for about 2.5 miles to Exit 92. South of Exit 92, Peachoid Road (S-11-666) runs parallel to southbound I-85 for approximately 2.1 miles to Exit 90.

South of Exit 90, a short, 0.15 mile long section of Zelure Road begins about 0.4 miles south of the interchange. From there, no frontage road is present next to southbound I-85 for approximately 1.3 miles before Old Post Road (S-11-165/665) begins running parallel to the interstate. Old Post Road runs parallel to southbound I-85 for 1.6 miles before it intersects the southbound off-ramp at Exit 87. South of Exit 87, Webber Road (S-11-665/644) runs parallel to southbound I-85 for about two miles before it bends away to the west at its intersection with Stone Road/Swofford Drive. Swofford Drive (S-11-137) continues running parallel to I-85 for about 0.75 miles before it turns away to the north.

From this point, no frontage road is present for 0.55 miles to the off-ramp for Exit 83. The Exit 83 southbound off-ramp exits directly into Truck Stop Road, a two-way, 0.2 mile long frontage road that ends with the southbound on-ramp to I-85. No frontage road is present for 0.6 miles south of the Exit 83 southbound on-ramp, at which point S-42-2005/Dewberry Road (S-42-868) begins running parallel to southbound I-85 for approximately 2.25 miles. At this point, Dewberry Road turns to the northwest, and the frontage road system continues from its intersection with Vintage Drive. Vintage Drive continues along southbound I-85 for approximately 0.8 miles before turning to the north to intersect with Dewberry Road approximately 450 feet east of Gossett Road.

III. INTERCHANGES

The following interchanges are present within the study area along I-85 or are the next immediately full interchange adjacent to those proposed for modification as part of this project.

- Exit 80 – Gossett Road (S-42-57) – adjacent interchange
- Exit 82 – Bud's Drive (S-42-1012)/Bud Arthur Bridge Road (S-42-737) – northbound off-ramp only
- Exit 83 – Battleground Road (SC 110)
- Exit 87 – Green River Road (S-11-39)
- Exit 90 – Hyatt Street (S-11-81/SC 105)
- Exit 92 – Chesnee Highway/W Floyd Baker Boulevard (SC 11)
- Exit 95 – Pleasant School Road (S-11-82) – no northbound on-ramp
- Exit 96 – Shelby Highway (SC 18)
- Gaffney Ferry Road Slip On-Ramp (S-11-49) – northbound on-ramp only
- Exit 98 – Frontage Road Off-Ramp –northbound off-ramp only
- Exit 100 – Blacksburg Highway (S-11-83) – adjacent interchange

Exits 80, 90, and 92 have on- and off-ramps directly intersecting the crossing roadways. The remaining interchanges have indirect access to the crossing roadways, with some or all of the ramps connecting to streets that then lead to the crossing roadways.

At Exit 83, the northbound off-ramp intersects Frontage Road N, while the northbound on-ramp originates from Edgefield Road. Frontage Road N and Edgefield Road connect to Battleground Road. The southbound off-ramp and on-ramp both connect directly to Truck Stop Road. Traffic to and from the southbound ramps traveling to Battleground Road must use Horry Street and/or Phillips Drive.

At Exit 87, the northbound off-ramp intersects Cannons Campground Road, while the on-ramp departs from Overbrook Drive. These roads connect to Green River Road. The southbound off-ramp intersects Old Post Road before continuing to Green River Road. The southbound on-ramp is reached from Green River Road via Webber Road.

The northbound off-ramp at Exit 95 intersects Hampshire Drive, which continues on to Pleasant School Road. There is no northbound on-ramp at Exit 95. The southbound ramps connect directly to Pleasant School Road.

The northbound ramps at Exit 96 connect directly to Shelby Highway. The southbound ramps intersect and use portions of Wilcox Avenue to travel to/from Shelby Highway.

At Exit 100 (which is the next full access interchange adjacent to the potentially modified Exit 96) the northbound off-ramp intersects Frontage Road before connecting to Blacksburg Highway. The northbound on-ramp connects directly to Blacksburg Highway. The southbound ramps connect directly to two-way roads that intersect Blacksburg Highway. The southbound off-ramp becomes Simper Road, while the southbound on-ramp departs from Crawford Road.

At the existing interchanges located at Exits 83, 87, 95 and 96, driver expectation is violated by ramps either immediately intersecting or entering two-way roadways that continue to the roads crossing over the interstate. In addition to potentially confusing drivers who are confronted by on-coming traffic at these locations, the short two-way ramps also can result in drivers traveling the wrong way onto the off-ramp and entering the freeway.

The following are detailed descriptions of the individual interchanges, including information about ramp lengths, acceleration/deceleration lane lengths, distance between ramps, ramp termini and their traffic control, the intersecting arterial roadways, and existing adjacent intersections.

Exit 80 – Gossett Road (S-42-57)

The Gossett Road interchange is a partial cloverleaf interchange with a loop on-ramp in the northeast quadrant carrying traffic on northbound Gossett Road to southbound I-85. The exit is signed “Gossett Road” in both directions on I-85. While this interchange is not expected to be updated or modified, it is included in this analysis as it is the next full access interchange along I-85 adjacent to an interchange potentially being modified (Exit 83).

The northbound off-ramp is approximately 1,300 feet long, starting as a single lane ramp with a tapered deceleration lane approximately 300 feet long. The off-ramp has no posted advisory speed limit, and widens from a single lane to provide separate channelized left and right turn lanes separated by a concrete island. The left turn lane provides approximately 265 feet of storage upstream of the stop line. The northbound off-ramp left turn movement is controlled by a stop sign, while the right turn is controlled by a yield sign.

The northbound on-ramp is a single lane ramp approximately 1,300 feet long that merges into I-85 with a 1,200 feet long parallel acceleration lane (with a parallel length of approximately 430 feet). The ramp begins with separate lanes accepting the southbound left turn and the northbound right turn traffic from Gossett Road. These movements are separated by a concrete island. No control appears to be provided to either movement where they meet to form the single lane on-ramp.

The northbound off-ramp and on-ramps are separated by approximately 2,530 feet.

The southbound off-ramp is approximately 2,200 feet long. The single lane ramp has a posted 45 mph advisory speed limit, and leaves I-85 with a 270 feet tapered deceleration lane. The single lane ramp widens to provide separate channelized left and right turn lanes separated by a concrete island. The left turn lane provides approximately 215 feet of storage upstream of the stop line. The southbound off-ramp left turn movement is controlled by a stop sign, while the right turn is controlled by a yield sign.

The southbound loop on-ramp carries northbound traffic on Gossett Road to southbound I-85. The loop ramp, which has no posted advisory speed limit, merges into I-85 with a 925 feet long parallel acceleration lane (with a parallel length of approximately 420 feet). The southbound on-ramp carries southbound traffic on Gossett Road onto southbound I-85. The ramp is approximately 2,330 feet long from the point it diverges from Gossett Road to the gore point at the start of the approximately 600 feet long parallel acceleration lane (with a parallel length of about 335'). The distance between the southbound off-ramp and the southbound loop on-ramp is approximately 2,035 feet. The distance between the loop on-ramp and the on-ramp is approximately 1,940 feet. The existing Gossett Road interchange is illustrated in **Figure 8**.

Figure 8 - Exit 80: Existing Interchange Configuration

Gossett Road

Gossett Road is a five lane roadway with a posted 40 mph speed limit in the vicinity of the interchange. The Gossett Road bridge crossing I-85 is six lanes wide. At the northbound ramp intersection, a southbound left turn lane providing approximately 235 feet of vehicle storage and a 240 feet long northbound right turn provide access to the on-ramp. The northbound

right turn movement onto the on-ramp is signed to yield to traffic turning left from southbound Gossett Road. The northbound ramp intersection is shown in **Figure 9**.

Figure 9 - Exit 80: Gossett Road at Northbound Ramps

Between the northbound and southbound ramp intersections, a separate right turn lane approximately 450 feet long is provided on northbound Gossett Road for traffic entering the southbound loop on-ramp.

At the southbound ramp interchange, a separate southbound right turn lane is not provided on Gossett Road for traffic entering the southbound on-ramp. Instead, an acceleration taper approximately 270 feet long is provided. The southbound ramp intersection is shown in **Figure 10**.

Adjacent intersections

Two intersections are located in the vicinity of the interchange. The intersection of Gossett Road with Sha Lane (S-42-784)/Dewberry Road (S-42-868) is located approximately 850 feet north of the southbound off-ramp intersection. The intersection of Abbott Lane (S-42-1008)/Conway Black Road (S-42-1011) is located approximately 615 feet south of the northbound off-ramp intersection.

Figure 10 - Exit 80: Gossett Road at Southbound Ramps

Gossett Road and Sha Lane/Dewberry Road

The intersection of Gossett Road with Sha Lane/Dewberry Road is an unsignalized intersection with the approaches of Sha Lane and Dewberry Road controlled by stop signs. The eastbound approach of Sha Lane consists of a separate left turn lane (with approximately 180 feet of storage) and a shared through-right turn lane. The westbound approach of Dewberry Road has a separate left turn lane with 100 feet of storage and a shared through-right turn lane.

The Gossett Road approaches provide a separate left turn lane, a through lane, and a shared through-right turn lane. The northbound left turn lane provides about 200 feet of storage, while the southbound left turn lane provides about 185 feet of storage. The existing configuration of the Gossett Road intersection with Sha Lane/Dewberry Road is shown in **Figure 11**.

Figure 11 - Exit 80: Gossett Road at Sha Lane/Dewberry Road

Gossett Road and Abbott Lane/Conway Black Road

The intersection of Gossett Road with Abbott Lane/Conway Black Road is an unsignalized intersection with the Abbott Lane and Conway Black Road approaches controlled by stop signs. The eastbound approach of Abbott Lane consists of a separate left turn lane (with approximately 110 feet of vehicle storage) and a shared through-right turn lane. The westbound approach of Conway Black Road provides a separate left turn lane (with about 100 feet of storage) and a shared through-right turn lane.

The Gossett Road approaches provide a separate left turn lane, a through lane, and a shared through-right turn lane. The southbound left turn lane provides about 185 feet of storage, while the northbound left turn lane provides approximately 210 feet of storage. The existing configuration of the Gossett Road intersection with Abbotts Lane/Conway Black Road is shown in **Figure 12**.

Figure 12 - Exit 80: Gossett Road at Abbotts Lane/Conway Black Road

Exit 82 – Bud's Drive (S-42-1012)/Bud Arthur Bridge Road (S-42-737/1013)

This interchange consists solely of a northbound off-ramp, which diverges from I-85 with a 400 feet long parallel deceleration lane (with a parallel length of about 120 feet). The exit is signed "Bud Arthur Bridge Rd". Bud Arthur Bridge Road is located about 1,220 feet downstream from where the off-ramp intersects Buds Drive.

The off-ramp is very short. From the gore to its intersection with Bud's Drive, the single lane ramp length is approximately 360 feet. There is no posted advisory speed limit for the ramp. The existing interchange configuration at Exit 82 is shown in **Figure 13**.

Figure 13 - Exit 82: Existing Interchange Configuration

Buds Drive

Buds Drive is a local two lane road that begins about 1000 feet west of its intersection with the northbound off-ramp. At its intersection with the off-ramp, the eastbound approach of Buds Drive is controlled by a yield sign. Westbound Buds Drive approaching the ramp intersection is separated from the eastbound ramp lane by a grass median, with the crossing controlled by a yield sign. The existing configuration of the northbound off-ramp from I-85 at its intersection with Bud's Drive is shown in **Figure 14**.

Buds Drive continues to the east from its intersection with the off-ramp for approximately 1,220 feet to its terminus at Bud Arthur Bridge Road.

Bud Arthur Bridge Road

Bud Arthur Bridge Road is a two lane roadway that begins southwest of the interchange at Cannons Campground Road. Bud Arthur Bridge Road has a posted speed limit of 30 miles per hour. East of Buds Drive, Bud Arthur Bridge Road continues to the east and has a posted speed limit of 35 miles per hour. Bud Arthur Bridge Road, which is also named "Frontage Road N" on SCDOT maps, intersects with the northbound off-ramp of I-85 at Exit 83.

Adjacent Intersections

In addition to the intersection of the northbound off-ramp with Buds Drive, there is one adjacent intersection in the vicinity of the interchange. The intersection of Buds Drive and Bud

Arthur Bridge Road is located approximately 1,180 feet southeast of the intersection of the off-ramp with Buds Drive.

Figure 14 - Exit 82: Northbound Off-Ramp at Bud's Drive

Buds Drive/Bud Arthur Bridge Road

The intersection of Buds Drive and Bud Arthur Bridge Road is a T-intersection with the Buds Drive approach controlled by a stop sign. Signing directing traffic stopped on the Buds Drive approach to the I-85 and SC 110 to the north via a left turn movement. The existing intersection configuration at Bud's Drive/Bud Arthur Bridge Road is shown in **Figure 15**.

Figure 15 - Exit 82: Bud's Drive at Bud Arthur Bridge Road

Exit 83 – Battleground Road (SC 110)

The Battleground Road interchange is an unconventionally oriented diamond interchange. Both the southbound off- and on-ramps are located on the north side of the interchange. The ramps in both directions are very short, and tie directly into two-way frontage roads running parallel to the mainline freeway lanes. The exit is signed in the northbound and southbound directions with the SC 110 state route shield and the text "Cowpens". The existing interchange configuration at Exit 83 is shown in **Figure 16**.

Figure 16 - Exit 83: Existing Interchange Configuration

The northbound off-ramp, which diverges from northbound I-85 with a 300 feet long tapered deceleration lane, is very short. Two hundred feet separate the gore point to the location where a right turn lane bends to intersect Bud Arthur Bridge Road. It is only approximately 335 feet from the gore point to where westbound Bud Arthur Bridge Road crosses the ramp, and about 430 feet to where the ramp merges with eastbound Bud Arthur Bridge Road. The off-ramp is signed with a 35 mile per hour advisory speed limit. A fireworks and peach/produce stand is located at the ramp intersection with Bud Arthur Bridge Road. The existing configuration of the intersection of the northbound off-ramp from I-85 with Frontage Road/Bud Arthur Bridge Road is shown in **Figure 17**.

Figure 17 - Exit 83: Northbound Off-Ramp at Frontage Road

To intersect Battleground Road, traffic exiting the off-ramp continues east on Bud Arthur Bridge Road running parallel to northbound I-85, before turning 90 degrees to the south then turning another 90 degrees to the east. At the point where it bends to the left, the separation between the centerlines of the Bud Arthur Bridge Road and Battleground Road is approximately 95 feet.

The northbound on-ramp is a single lane ramp that begins at the eastern end of Edgefield Road (S-42-1015), which is a two lane, two-way frontage road that runs parallel to I-85. Traffic entering I-85 on this ramp must travel east from Battleground Road on Bud Arthur Bridge Road, and turn left at the stop sign located at the Bud Arthur Bridge Road intersection with Edgefield Road (designated as S-42-22 at this location). Edgefield Road runs to the north towards I-85, bends 90 degrees to the east (designated as S-42-1015) and runs parallel to northbound I-85 before terminating at the on-ramp. The length of the on-ramp measured from the last driveway on Edgefield Road to the gore point on I-85 is approximately 330 feet. The ramp merges into I-85 with a 400 feet long parallel acceleration lane (with a parallel length of approximately 125 feet).

The northbound off-ramp and on-ramp are separated by approximately 3,650 feet on I-85.

The southbound off-ramp is approximately 300 feet long. The single lane ramp has no posted advisory speed limit. It diverges from southbound I-85 with a 450 feet long parallel deceleration lane (with a parallel length of about 200 feet) and enters directly into Truck Stop Road (S-42-1014), a two-way frontage road that runs parallel to I-85 southbound.

The intersections of the northbound on-ramp with Edgefield Road and the southbound off-ramp with Truck Stop Road are shown in **Figure 18**.

Figure 18 - Exit 83: Northbound On-Ramp and Southbound Off-Ramp Intersections

The southbound on-ramp begins at the intersection of Truck Stop Road and Horry Road (S-42-21). The ramp is very short. The distance between the intersection and the gore on southbound I-85 is about 125 feet. The ramp merges into I-85 southbound with a 500 feet long parallel acceleration lane (with a parallel length of about 100 feet). The intersection of the southbound on-ramp with Horry Road/Truck Stop Road is shown in **Figure 19**.

Figure 19 – Exit 83: Southbound On-Ramp at Horry Road/Truck Stop Road

Traffic wanting to enter southbound I-85 from Battleground Road must travel east on Phillips Drive, turn right on Horry Road, and then turn right onto the on-ramp at the Horry Road intersection with Truck Stop Road. The southbound off-ramp and on-ramp are separated by 1,560 feet along southbound I-85.

Battleground Road

Battleground Road is a two lane roadway with a posted 35 mph speed limit in the vicinity of the interchange. It provides access to the Cowpens National Battlefield, which is located approximately eight miles north of the interchange, as well as the town of Cowpens, which is located approximately two miles south of the interchange.

Truck Stop Road

Truck Stop Road is a two-way, two lane frontage road that begins immediately at the end of the southbound off-ramp, and runs parallel to the west for approximately 1,125 feet to the beginning of the southbound on-ramp at its intersection with Horry Road. Truck Stop Road provides access to a few businesses, including a truck stop/restaurant, a peach stand, and a small free-standing restaurant.

Horry Road

Horry Road provides an important connection in the operation of the Exit 83 interchange. It allows traffic exiting southbound I-85 to reach Battleground Road (via Truck Stop Road). Traffic entering southbound I-85 from Battleground Road must access the on-ramp via Horry Road.

Horry Road begins at Battleground Road, and runs southeast to its terminus at Truck Stop Road. Its only intersection with public streets between its termini is at Phillips Road, approximately 520 feet south of Battleground Road and 330 feet north of Truck Stop Road. Horry Road runs between the church and school facilities of the Mountain View Baptist Church.

Phillips Drive

Phillips Drive is a two lane roadway located east of Battleground Road with a posted speed limit of 25 miles per hour. Phillips Drive continues east and northeast where it becomes Webber Road at the Cherokee County line.

Dewberry Road

Dewberry Road (S-42-2005) is a two-lane roadway located west of Battleground Road with a posted speed limit of 35 miles per hour. Dewberry Road continues west before bending to the south to run parallel and adjacent to southbound I-85 towards Exit 80.

Frontage Road N/Bud Arthur Bridge Road

The roadway depicted on SCDOT maps as Frontage Road N is the extension of Bud Arthur Bridge Road. Street name signs at the various intersections also identify this roadway as Bud Arthur Bridge Road instead of Frontage Road N. Bud Arthur Bridge Road has a posted 35 miles per hour speed limit, and terminates at its intersection with Edgefield Road.

Edgefield Road

Edgefield Road (S-42-22) begins at Battleground Road approximately 1,630 feet south of the intersection of Battleground Road and Frontage Road N/Bud Arthur Bridge Road. Edgefield Road is a two lane roadway with a posted 35 miles per hour speed limit. Traffic traveling northbound on Battleground Road are directed by guide signing to Edgefield Road for access to northbound I-85. North of its intersection with Frontage Road N/Bud Arthur Bridge Road, Edgefield Road bends to the east and continues with the route designation of S-42-1015 from Bud Arthur Bridge Road. The two-way section of Edgefield Road ends at the start of the northbound on-ramp to I-85.

Adjacent intersections

The ramps at Exit 83 do not intersect directly with Battleground Road. Traffic has to travel to and from Battleground Road along frontage roads with active businesses and public roads with institutional developments to reach the interstate ramps.

There are two main intersections along Battleground Road. Its intersection with Philips Drive is located approximately 900 feet north of I-85. Its intersection with Frontage Road N is located approximately 825 feet south of I-85. Other adjacent intersections are the intersections of Truck Stop Road with Horry Road, Horry Road with Phillips Drive, and Edgefield Road with Frontage Road N.

Battleground Road and Horry Road

The intersection of Battleground Road with Horry Road is an unsignalized intersection with the Horry Road approach controlled by a yield sign. No turn lanes are provided on any of the intersection approaches. The intersection of Battleground Road at Horry Road is shown in **Figure 20**.

Figure 20 - Exit 83: Battleground Road and Horry Road

Battleground Road and Phillips Drive/S-42-2005

The intersection of Battleground Road with Phillips Drive/S-42-2005 is an unsignalized intersection with the approaches of Phillips Drive and S-42-2005 controlled by stop signs. The eastbound approach of S-42-2005 consists of a single lane, which flares out to provide an unstriped, de facto right turn lane. The westbound approach of Phillips Drive has a single shared left turn-through-right turn lane.

The northbound approach of Battleground Road provides a single lane, but includes an opportunity for traffic to turn right approximately 100 feet in advance of the Phillips Drive intersection. The southbound approach of Battleground Road provides a single shared left turn-through-right turn lane.

Horry Road and Phillips Drive

The intersection of Horry Road and Phillips Drive is an unsignalized intersection. The Phillips Drive approaches to the intersection are controlled by stop signs. The Horry Road approaches and the westbound Phillips Drive approach each consist of a single lane providing for shared left turn-through-right turn movements. The eastbound approach of Phillips Drive is also a single lane, but right turns to Horry Road (and the I-85 southbound on-ramp) can be made approximately 80 feet ahead of the intersection. The right turn movement is controlled by a Yield sign at Horry Road. The Phillips Drive intersections with Battleground Road and Horry Road are shown in **Figure 21**.

Figure 21 - Exit 83: Phillips Drive at Battleground Road and Horry Road

Truck Stop Road/Horry Road

The intersection of Truck Stop Road and Horry Road is a T-intersection, with Truck Stop Road approaching from the east and Horry Road approaching from the north. The west leg of the intersection is the on-ramp to southbound I-85. Truck Stop Road approaches the intersection as a two-way roadway. A free-flow right turn movement can be made onto Horry Road. Through traffic from Truck Stop Road heading onto the on-ramp is separated from Horry Road traffic heading onto the on-ramp by a triangular grass island. The Truck Stop Road traffic approaching the on-ramp is controlled by a stop sign, which permits the right turn traffic from Horry Road onto the on-ramp to operate as a free-flow movement. Horry Road traffic approaching the intersection splits at the point of the grass island. The left turn movement onto eastbound Truck Stop Road is controlled by a stop sign, while the right turn movement is a free flow movement onto the on-ramp. The existing intersection configuration of Truck Strop Road and Horry Road is shown, along with the southbound on-ramp, in **Figure 19**.

Battleground Road and Bud Arthur Bridge Road

The intersection of Battleground Road with Bud Arthur Bridge Road is a signalized intersection. All four approaches consist of single shared lanes with no separate turn lanes provided. The eastbound approach of Bud Arthur Bridge Road turns 90 degrees from south to east just before its intersection with Battleground Road, leaving only a very short (about 50 feet) section that is perpendicular to Battleground Road.

Bud Arthur Bridge Road and Edgefield Road

The intersection of Bud Arthur Bridge Road (S-42-1015) and Edgefield Road is an unsignalized intersection located approximately 500 feet east of the Bud Arthur Bridge Road intersection with Battleground Road. The Bud Arthur Bridge Road approach to the intersection is controlled by a stop sign. All three approaches to this TT-intersection consist of single shared lanes with no dedicated turn lanes. The existing configuration of the intersections of the Frontage Road/Bud Arthur Bridge Road with both Battleground Road and Edgefield Road are shown in **Figure 22**.

Figure 22 - Exit 83: Frontage Road at Battleground Road and Edgefield Road

Exit 87 – Green River Road (S-11-39)

The Green River Road interchange is a diamond interchange carrying traffic to and from Green River Road (S-11-39). The exit is signed "Green River Road" in both directions on I-85. The existing configuration of the Exit 87 interchange in shown in **Figure 23**.

The northbound off-ramp diverges from northbound I-85 with a 1,200 feet long parallel deceleration lane (with a parallel length that is approximately 670 feet long). The off-ramp is approximately 520 feet long and terminates at its intersection with Cannons Campground Road (S-11-234) and Lindley Road. A slip lane for traffic turning right onto southbound Cannons Campground Road is located approximately415 feet along the off-ramp. The off-ramp has a 30 miles per hour advisory speed limit.

To reach Green River Road, traffic exiting on the off-ramp must turn left onto Cannons Campground Road and travel approximately 315 feet.

Figure 23 - Exit 87: Existing Interchange Configuration

The northbound on-ramp is a single lane ramp that begins on Overbrook Road (S-11-39) approximately 380 feet east of its intersection with Green River Road. The length of the on-ramp measured from the Green River Road intersection is approximately 870 feet to the gore point. From the right turn slip lane on Overbrook Road to the gore point, the length of the dedicated portion of the ramp is about 500 feet. The ramp merges into I-85 with a 620 feet long parallel acceleration lane (with a parallel length of approximately 150 feet).

The northbound off-ramp and on-ramp are separated by approximately 1,720 feet on I-85.

The southbound off-ramp length from the diverging gore point to Green River Road is approximately 690 feet. At approximately 510 feet from the diverging gore, the ramp intersects with Old Post Road (S-11-665). The single lane ramp has a 30 miles per hour posted advisory speed limit. It diverges from southbound I-85 with a 330 feet long parallel deceleration lane (with a parallel length of approximately 100 feet).

The southbound on-ramp begins on Webber Road (S-11-665) approximately 640 west of the intersection of Green River Road and Webber Road. The distance from the point where the ramp begins at its intersection on Webber Road to the merging gore point is approximately 310 feet. The total length of the ramp from Green River Road to the gore point, including the two-way section of Webber Road, is approximately 935 feet. The ramp merges into I-85 southbound with a 950 feet long parallel acceleration lane (with a parallel length of about 200 feet).

Traffic wanting to enter southbound I-85 from Green River Road must travel west on Webber Road and continue through the intersection where Webber Road bends to the north before continuing west.

The southbound off-ramp and on-ramp are separated by 1, 420 feet on I-85.

Green River Road

Green River Road is a two lane roadway with a posted 35 mph speed limit in the vicinity of the interchange. South of its intersection with Cannons Campground Road, Green River Road (S-11-39) continues south to its terminus at US 29. North of Cannons Campground Road, Green River Road crosses over I-85, and runs concurrently with Macedonia Road (S-11-59) for approximately 1,800 feet before it separates and continues to the north.

Cannons Campground Road

Cannons Campground Road (S-11-38/234) is a two lane roadway with a posted 45 miles per hour speed limit. From its eastern terminus at Green River Road, Cannons Campground Road runs generally west parallel adjacent to the northbound lanes of I-85 before turning to the southwest and south towards Spartanburg. Traffic exiting northbound I-85 to reach Green River Road must use the off-ramp and turn left onto Cannons Campground Road to reach Green River Road.

Overbrook Drive

Overbrook Road (S-11-31) is a two lane, two-way road with a posted 45 miles per hour speed limit that runs generally parallel to I-85 for about 1.75 miles before bending to the south and southeast towards its terminus at SC 11 in Gaffney. Traffic entering northbound I-85 from Green River Road must turn onto and travel on Overbrook Drive until the on-ramp separates from Overbrook Drive to enter the freeway.

Old Post Road

Old Post Road (S-11-665/165/61) is a two lane, two-way road that begins at Green River Road/Macedonia Road and continues east parallel and adjacent to the southbound lanes of I-85 for about 1.7 miles before turning to the north and northeast to its terminus with Grassy Pond Road near Boiling Springs Highway. The southbound off-ramp intersects Old Post Road approximately 215 feet from Green River Road/Macedonia Road.

Webber Road

Webber Road (S-11-665/644) is a two lane, two-way road with a posted 45 miles per hour speed limit that begins at Green River Road/ Macedonia Road and continues west parallel and adjacent to the southbound lanes of I-85 for about two miles before turning towards the northwest. After crossing Swofford Drive, Webber Road becomes Phillips Drive. Traffic entering southbound I-85 must turn from Green River Road/Macedonia Road and travel approximately 600 feet along Webber Road before the on-ramp separates to enter into the mainline lanes.

Adjacent intersections

The ramps at Exit 87 do not intersect directly with Green River Road. Traffic traveling to and from the interchange have to travel along roads running parallel to the interstate from their intersections with Green River Road.

The two main intersections along Green River Road are its intersections with Old Post Road/Webber Road, which is located approximately 350 feet north of I-85, and with Cannons Campground Road/Overbrook Drive, which is located approximately 215 feet south of I-85.

Old Post Road/Webber Road

The intersection of Green River Road with Old Post Road/Webber Road is an unsignalized intersection with the approaches of Old Post Road and Webber Road controlled by stop signs. All approaches to this intersection consist of a single shared left turn-through-right turn lane.

Southbound Off-Ramp and Old Post Road

The intersection of the southbound off-ramp and Old Post Road is a T-intersection with Old Post Road intersecting the off-ramp at a sharp angle. The westbound approach of Old Post Road is controlled by a stop sign, but no stop line is marked on the pavement. The distance from the Old Post Road intersection to the westbound stop line at Green River Road is approximately two hundred feet. The intersection of Macedonia Road with Webber Road/Old Post Road and the intersection of the southbound off-ramp with Old Post Road is shown in **Figure 24**.

Figure 24 - Exit 87: Macedonia Road with Webber Road/Old Post Road/Southbound Off-Ramp

Cannons Campground Road/Overbrook Drive

The intersection of Green River Road with Cannons Campground Road/Overbrook Drive is an all-way stop sign controlled intersection with overhead flashing red warning beacons and rectangular supplemental stop signs. All four approaches consist of single lanes with no separate turn lanes provided, though the Cannons Campground Road and Overbrook Drive approaches widen to provide sufficient space to separate right turn traffic from other traffic. The existing configuration of the intersection of Cannons Campground Road/Overbrook Road with Green River Road is shown in **Figure 25**.

Figure 25 - Exit 87: Green River Road at Cannons Campground Road/Overbrook Road

Northbound Off-ramp and Cannons Campground Road/Lindley Road

The intersection of the northbound off-ramp and Cannons Campground Road/Lindley Road is a modified four way intersection with the off-ramp approach entering the intersection at a skew. Grass islands separate the off-ramp through and right turn traffic and the northbound and southbound Cannons Campground Road traffic north of the ramp. The right turn from the ramp to westbound Cannons Campground Road and the westbound approach to Cannons Campground Road are controlled by Yield signs. The eastbound approach of Cannons Campground Road and the Lindley Road approach are controlled by stop signs. The existing configuration of the intersection of the northbound off-ramp with Cannons Campground Road and Lindley Road is shown in **Figure 26**.

Figure 26 - Exit 87: Northbound Off-Ramp at Cannons Campground Road

Northbound On-Ramp and Overbrook Drive

The intersection of the northbound on-ramp and Overbrook Drive is a T-intersection with the off-ramp departing from the intersection at a sharp angle. The portion of Overbrook Drive between Green River Road and the northbound on-ramp is a two-way, two lane section approximately 315 feet long. Traffic continuing east on Overbrook Drive turns right on a short, one-way link located approximately 220 feet along this two-way section. The westbound approach of Overbrook Drive is a two lane, two-way road that bends to the north at the start of the northbound on-ramp. Traffic continuing towards Green River Road have to turn left at the stop sign located on this approach. Because of the sharp turn of the approach, the stop sign is not located near the stop line, but is placed in advance on the straight section of the approach. The existing configuration of the intersection of the northbound on-ramp and Overbrook Drive is shown in **Figure 27**.

Figure 27 - Exit 87: Northbound On-Ramp and Overbrook Drive

Southbound On-Ramp and Webber Road

The intersection of Webber Road and the departure of the southbound on-ramp is located approximately 600 feet from the Webber Road intersection with Green River Road. The T-intersection is created by the west approach of Webber Road intersecting the other two roadways at a sharp turn that is controlled by a stop sign. The existing configuration of the southbound on-ramp intersection with Webber Road is shown in **Figure 28**.

Figure 28 - Exit 87: Southbound On-Ramp and Webber Road

Green River Road and Lindley Road

The intersection of Lindley Road with Green River Road is located approximately 1,030 feet south of the intersection of Green River Road and Cannons Campground Road. A T-intersection is created by the west approach of Lindley Road intersecting Green River Road with a sharp turn that is controlled by a stop sign. The existing configuration of the intersection of Green River Road and Lindley Road is shown in **Figure 29**.

Figure 29 - Exit 87: Green River Road and Lindley Road

Exit 90 – Hyatt Street (S-11-81/SC 105)

This interchange is a diamond interchange carrying traffic to and from Hyatt Street. Hyatt Street is designated as S-11-81 north of I-85 and as SC 105 south of I-85. The exit is signed with the SC 105 state route shield and the text "Gaffney" in both directions on I-85. The existing configuration of the Exit 90 interchange is shown in **Figure 30**.

Figure 30 - Exit 90: Existing Interchange Configuration

The northbound off-ramp is approximately 925 feet long, starting as a single lane ramp with a tapered deceleration lane approximately 200 feet long. The off-ramp has a 35 miles per hour posted advisory speed limit, and widens from a single lane to provide a separate left turn lane, a shared left turn-through lane and a separate right turn lane that is separated from the other lanes by a concrete island. The left turn lane provides approximately 280 feet of storage upstream of the stop line. The intersection of the off-ramp with Hyatt Street is controlled by a traffic signal.

The northbound on-ramp is approximately 1,215 feet long. The on-ramp starts as a two-lane ramp which accepts traffic from two southbound left turn lanes that provide 300 feet of storage and the northbound right turn from Hyatt Street. The southbound left turn and northbound right turn movements entering the on-ramp are separated by a concrete island, with the right turn movement yielding to the traffic coming from the dual left turn lanes. The two lane on-ramp narrows to a single lane after about 175 feet. The on-ramp merges into I-85 with a 750 feet long parallel acceleration lane (with a parallel length of approximately 235 feet). The existing configuration of the intersection of the northbound ramps with Hyatt Street is shown in **Figure 31**.

The northbound off-ramp and on-ramp are separated by approximately 1,930 feet along I-85.

Figure 31 - Exit 90: Hyatt Street and Northbound Ramps

The southbound off-ramp is approximately 1,040 feet long. The single lane ramp has a posted 35 mph advisory speed limit, and leaves I-85 with a 400 feet tapered deceleration lane. The single lane ramp widens to provide a separate left turn and shared through-right turn lane. The left turn lane provides approximately 190 feet of storage upstream of the stop line. The intersection of the southbound off-ramp with Hyatt Street is controlled by a traffic signal.

The southbound on-ramp is approximately 1,140 feet long. The on-ramp starts as a two lane on-ramp that narrows to a single lane after about 400 feet. The on-ramp merges into I-85 with a 425 feet long tapered acceleration lane. The ramp begins with separate lanes accepting traffic from two northbound left turn lanes (each with 270 feet of storage) and the southbound right turn traffic from a southbound right turn lane on Hyatt Street that provides about 240 feet of storage. These movements are separated by a concrete island, and the right turn movement to the on-ramp yields to the traffic coming from the dual left turn lanes. The existing configuration of the intersection of Hyatt Street with the southbound ramps is shown in **Figure 32**. The southbound off-ramp and on-ramp are separated by 2,125 feet on I-85.

Figure 32 - Exit 90: Hyatt Street and Southbound Ramps

Hyatt Street

Hyatt Street north of the interchange area is a two lane roadway. Approaching the interchange, Hyatt Street widens to provide four lanes. Within the interchange area, the four lanes are supplemented by turning lanes at intersections. Hyatt Street crosses over I-85 on a six lane bridge, and continues towards Gaffney south of the interchange as a five lane section with a center two-way left turn lane.

At the signalized southbound ramp intersection, crosswalks are provided on all four intersection approaches, but only the crossings of the northbound and southbound approaches of Hyatt Street are controlled by pedestrian signals. Hyatt Street provides dual northbound left turn lanes providing approximately 270 feet of vehicle storage for traffic turning onto the on-ramp to southbound I-85. The southbound approach of Hyatt Street has two through lanes and a channelized right turn lane that extends approximately 165 feet from where it diverges from Hyatt Street to enter the southbound I-85 on-ramp back to the intersection of Nancy Creek Road (S-11-440)/Peachoid Road (S-11-666). The southbound right turn traffic entering the on-ramp yields to traffic turning from the dual northbound left turn lanes.

At the southbound ramp intersection, crosswalks are provided on all but the south intersection approach. Only the north approach crosswalk is controlled by pedestrian signals. Hyatt Street provides dual southbound left turn lanes providing approximately 300 feet of storage. A separate northbound right lane is not present, but right turning traffic can diverge from Hyatt Street beginning at a point approximately 25 feet in advance of the stop line.

Lemmons Lane

Lemmons Lane (S-11-645) is a two lane roadway that intersects Hyatt Street opposite Windslow Road approximately 430 feet south of the northbound ramp intersection. Lemmons Lane runs to the northwest away from Hyatt Street, turns west and runs parallel adjacent to the northbound lanes of I-85 for about 700 feet before turning to the southwest towards its terminus with Overbrook Drive.

Windslow Road

Windslow Road (S-11-659) is a two lane roadway that intersects Hyatt Street opposite Lemmons Lane. Windslow Road runs parallel and adjacent to northbound I-85 between Hyatt Street and its terminus at Chesnee Highway. In the vicinity of the interchange, Windslow Road has a posted 45 miles per hour speed limit.

Peachoid Road

Peachoid Road (S-11-666) is a two lane frontage road that connects Hyatt Street and Chesnee Highway, running parallel and adjacent to southbound I-85. It has a posted 45 miles per hour speed limit. At its intersection with Hyatt Street, Peachoid Road is aligned opposite Nancy Creek Road.

Nancy Creek Road

Nancy Creek Road (S-11-440) is a two lane road that begins at Hyatt Street and runs generally to the west to its nearby terminus at Old Post Road. Access to the Gaffney Premium Outlets and other retail/commercial properties is provided via Nancy Creek Road.

Adjacent intersections

Two intersections are located in the vicinity of the interchange. The intersection of Hyatt Road and Nancy Creek Road/Peachoid Road is located approximately 375 feet north of the southbound off-ramp intersection. The intersection of Lemmons Lane (S-11-645)/Windslow Road (S-11-659) is located approximately 425 feet south of the northbound off-ramp intersection.

Nancy Creek Road/Peachoid Road

The intersection of Hyatt Street with Nancy Creek Road/Peachoid Road is a signalized intersection with crosswalks located on each approach. Pedestrian signals control the crosswalks crossing the north and east approaches.

The southbound approach of Hyatt Street consists of a separate left turn lane, a through lane and a shared through-right turn lane. The left turn lane provides about 215 feet of storage. The northbound approach of Hyatt Street consists of dual left turn lanes providing access to the Gaffney Premium Outlets. The left turn lanes provide approximately 250 feet of storage, extending back to the southbound ramp intersection. A channelized right turn lane for traffic turning onto Peachoid Road begins about 50 feet in advance of the stop line. The eastbound approach of Nancy Creek Road consists of a separate left turn lane (with approximately 250 feet of storage), a separate through lane, and a separate right turn lane (with approximately 210 feet of storage). The westbound approach of Peachoid Road consists of a single shared left turn-through-right turn lane. The existing configuration of the intersection of Hyatt Street with Nancy Creek Road/Peachoid Road is shown in **Figure 33**.

Figure 33 - Exit 90: Hyatt Street and Nancy Creek Road/Peachoid Road

Lemmons Lane/Windslow Road

The intersection of Hyatt Street with Lemmons Lane/Windslow Road is a signalized intersection with crosswalks located on each approach. Pedestrian signals control the crosswalks crossing the Hyatt Street approaches.

The southbound approach of Hyatt Street consists of a separate left turn lane, a through lane and a shared through-right turn lane. The left turn lane provides about 335 feet of storage back to the northbound ramp intersection. The northbound approach of Hyatt Street consists of a separate left turn lane providing approximately 200 feet of storage, a through lane and a shared through-right turn lane. The eastbound approach of Lemmons Lane consists of a single shared left turn-through-right turn lane. The westbound approach of Windslow Road consists

of a shared left turn-through lane and a separate right turn lane providing approximately 65 feet of storage. The existing configuration of the intersection of Hyatt Street with Lemmons Lane/Windslow Road is shown in **Figure 34**.

Figure 34 - Exit 90: Hyatt Street and Lemmons Lane/Windslow Road

Exit 92 – Chesnee Highway/W Floyd Baker Boulevard (SC 11)

This interchange is a partial cloverleaf interchange with loop on-ramps in the northeast and southwest quadrants. The exit is signed "SC 11 To SC 150" using the state route shields, along with the text "Gaffney" and "Boiling Springs N.C." in the northbound direction. In the southbound direction, the SC 11 state route shield is shown along with the text "Chesnee" and "Gaffney". Advanced guide signs are also present for "Spartanburg Community College Cherokee Campus" and "Cherokee Foothills Scenic Highway" in both directions. Additional destination signs include "Limestone College" in the northbound direction, and "Cowpens Battlefield" in the southbound direction. The existing configuration of the Exit 92 interchange is shown in **Figure 35**.

Figure 35 - Exit 92: Existing Interchange Configuration

The northbound off-ramp is approximately 1,500 feet long, starting as a single lane ramp with a parallel deceleration lane approximately 745 feet long (with a parallel length of approximately 235 feet). The off-ramp has a 35 mph posted advisory speed limit, and widens from a single lane to provide separate left and right turn lanes. The left turn lane provides approximately 255 feet of storage upstream of the stop line. The northbound off-ramp intersection is signalized.

The northbound loop on-ramp carries southbound traffic on Chesnee Highway to northbound I-85. The loop ramp is approximately 1,215 feet long, and merges into I-85 with an 860 feet long parallel acceleration lane (with a parallel length of approximately 400 feet).

The northbound on-ramp is a single lane ramp approximately 1,280 feet long that merges into northbound I-85 with a 1,740 feet long parallel acceleration lane (with a parallel length of approximately 330 feet).

Along I-85, the distance between the northbound off-ramp and the northbound loop on-ramp is approximately 965 feet. The distance between the northbound loop on-ramp and the northbound on-ramp is approximately 1,490 feet.

The configuration of the Chesnee Highway intersection with the northbound ramps is shown in **Figure 36**.

Figure 36 - Exit 92: Northbound Ramps

The southbound off-ramp is approximately 1,500 feet long. The single lane ramp has a posted 30 mph advisory speed limit, and leaves I-85 with a 525 feet long parallel deceleration lane (with a parallel length of approximately 200 feet). The single lane ramp widens to provide separate left and right turn lanes. The right turn lane provides approximately 160 feet of storage upstream of the stop line. The southbound off-ramp intersection is controlled by a traffic signal.

The southbound loop on-ramp carries northbound traffic on Chesnee Highway to southbound I-85. The loop ramp is approximately 1,260 feet long, and merges into I-85 with an 850 feet long parallel acceleration lane (with a parallel length of approximately 400 feet). The southbound on-ramp carries southbound traffic on Chesnee Highway onto southbound I-85. The ramp is approximately 1,080 feet long from the point it diverges from Chesnee Highway to the gore point at the start of the approximately 1,000 feet long parallel acceleration lane (with a parallel length of about 275').

On I-85, the distance between the southbound off-ramp and the southbound loop on-ramp is approximately 1,000 feet. The distance between the loop on-ramp and the on-ramp is approximately 1,325 feet. The existing configuration of the intersection of Chesnee Highway with the southbound ramps is shown in **Figure 37**.

Figure 37 - Exit 92: Southbound Ramp

Chesnee Highway/W Floyd Baker Boulevard

Chesnee Highway north of the interchange area is a two lane roadway. Approaching the interchange, Chesnee Highway widens to provide four lanes then six lanes through the interchange area. Within the interchange area, the four lanes are supplemented by turn lanes at intersections. Chesnee Highway crosses over I-85 on a seven lane bridge, and continues towards Gaffney south of the interchange as a five lane section with a center two-way left turn lane. South of the interchange, the roadway is renamed W Floyd Baker Boulevard.

At the signalized northbound ramp intersection, Chesnee Highway provides two southbound through lanes with a separate right turn lane that becomes the northbound loop on-ramp. The right turn lane extends back to the southbound ramp intersection. The northbound approach of Chesnee Highway provides two through lanes and a separate, free-flow right turn lane taking traffic onto the northbound on-ramp. The northbound right turn lane is approximately 275 feet long. Immediately north of the northbound ramp intersection, Chesnee Highway widens to provide three lanes before crossing on the bridge over I-85.

At the signalized southbound ramp intersection, southbound Chesnee Highway widens from two to three through lanes, with the third through lane extending approximately 245 feet upstream of the stop line. The southbound right turn movement onto the southbound on-ramp occurs approximately 510 feet upstream of the stop line, and is created by the addition of a right turn lane to the two southbound through lanes. The right turn lane is approximately 135 feet long. The northbound approach consists of two through lanes at the stop line. A northbound right turn lane allowing traffic to turn right onto the southbound loop on-ramp

diverges from the three northbound lanes crossing the overpass approximately 115 feet in advance of the stop line. This right turn lane provides about 575 feet of storage for turning traffic.

Windslow Road

As described under the Exit 90 section, Windslow Road is a two lane frontage road running between Hyatt Street and Chesnee Highway to the south of I-85.

Peachoid Road

As described under the Exit 90 section, Peachoid Road is a two lane frontage road connecting Hyatt Street and Chesnee Highway to the north of I-85. At its intersection with Chesnee Highway, Peachoid Road is aligned opposite Wilcox Avenue.

Wilcox Avenue

Wilcox Avenue (S-11-668) is a two lane frontage road beginning at Chesnee Highway opposite Peachoid Road and continuing to the east. In addition to Exit 92, Wilcox Avenue connects to Boiling Spring Highway (SC 150), Pleasant School Road (Exit 95) and Shelby Highway (Exit 96), continuing east for approximately 2,500 feet east of Shelby Highway before terminating at a dead end.

Adjacent intersections

Two intersections are located in the vicinity of the interchange. The intersection of Chesnee Highway with Peachoid Road/Wilcox Avenue is located approximately 920 feet north of the signalized southbound off-ramp intersection. The intersection of Windslow Avenue and W Floyd Baker Boulevard is located approximately 220 feet south of the signalized northbound ramp intersection.

Peachoid Road/Wilcox Avenue

The intersection of Chesnee Highway with Peachoid Road/Wilcox Avenue is a signalized intersection. The eastbound approach of Peachoid Road and the westbound approach of Wilcox Avenue both consist of a single shared left turn-through-right turn lane. The westbound approach of Wilcox Avenue runs parallel to Chesnee Highway before taking a 90 degree bend approximately 90 feet from its stop line. The southbound Chesnee Highway approach provides a separate left turn lane (with about 125 feet of storage), a through lane, and a shared through-right turn lane that begins approximately 270 feet upstream of the stop line and provides about 125 feet of storage. The northbound approach of Chesnee Highway consists of a separate left turn lane, a separate through lane and a separate right turn lane. The left turn lane provides about 215 feet of storage. The right turn lane is created by the second northbound through

lane extending back to the southbound ramp intersection. The existing configuration of the intersection of Chesnee Highway with Peachoid Road/Wilcox Avenue is shown in **Figure 38**.

Figure 38 - Exit 92: Chesnee Highway and Peachoid Road/Wilcox Avenue

Windslow Avenue

The intersection of W Floyd Baker Boulevard with Windslow Avenue is an unsignalized intersection with stop sign control on the Windslow Avenue approach to the intersection. The eastbound approach of Windslow Avenue consists of a single shared left turn-through-right turn lane. The southbound W Floyd Baker Boulevard approach provides a through lane and a shared through-right turn lane. The northbound approach of W Floyd Baker Boulevard consists of a three through lanes which become the northbound through lanes and separate right turn lane downstream at the northbound ramp intersection. Left turns from northbound W Floyd Baker Boulevard to Windslow Avenue are made from the center two-way left turn lane separating the northbound and southbound lanes. The existing configuration of the intersection of W Floyd Baker Boulevard with Windslow Avenue is shown in **Figure 39**.

Figure 39 - Exit 92: W Floyd Baker Boulevard (SC 11) and Windslow Avenue

Exit 95 – Pleasant School Road (S-11-82)

This interchange is a partial diamond interchange. In the northbound direction, there is an off-ramp that intersects Hampshire Drive (S-11-661), which continues to the east parallel to I-85 providing access to a number of commercial properties before terminating at a signalized four legged intersection with Shelby Highway (SC 18) and Pleasant School Road. At this intersection, Shelby Highway runs east-west, while Pleasant School Road intersects from the north immediately to the east of the Hampshire Drive approach. There is no northbound on-ramp to I-85 at Exit 95. The southbound ramps form a portion of a conventional diamond interchange, but their intersection with Pleasant School Road is very close to the adjacent intersection of Pleasant School Road and Wilcox Avenue, which is approximately 60 feet north of the Pleasant School Road intersection with the southbound off-ramps.

The exit is signed with the SC 18 state route shield and the text “Gaffney” in the northbound direction and “To Pleasant School Road” with the SC 18 and SC 150 state route shields, “Boiling Springs, N.C.”, and “Gaffney” in the southbound direction. The existing configuration of the Exit 95 interchange is shown in **Figure 40**.

Figure 40 - Exit 95: Existing Interchange Configuration

The northbound off-ramp, which diverges from northbound I-85 approximately 3,440 feet west of the Pleasant School Road overpass, has a posted 40 mph advisory speed limit. The ramp, which is approximately 460 feet long from the diverging gore point to its intersection with Hampshire Drive, has a 450 feet long parallel diverging deceleration lanes (with a parallel length of about 230 feet). There is an opportunity for off-ramp traffic to turn to travel west on Hampshire Drive about 95 feet in advance of the main portion of the ramp's intersection with Hampshire Drive. The total length of the off-ramp from the gore point to its intersection with Hampshire Drive is about 680 feet.

A gas station and a Mr. Waffle restaurant are located adjacent to the off-ramp intersection with Hampshire Drive. The existing configuration of the intersection of the northbound off-ramp with Hampshire Drive is shown in **Figure 41**.

Figure 41 - Exit 95: Northbound Off-Ramp and Hampshire Drive

To intersect Pleasant School Road, traffic exiting the off-ramp must continue eastbound on the two lane, two-way portion of Hampshire Drive, running parallel to northbound I-85, past a number of businesses. At Fatz Drive, Hampshire Drive bends to the southeast where it intersects with Shelby Highway and Pleasant School Road.

The southbound off-ramp is approximately 650 feet long. The single lane ramp has a 35 mph posted advisory speed limit. It diverges from southbound I-85 with a 350 feet long tapered deceleration lane. At its intersection with Pleasant School Road, the southbound off-ramp provides a single shared left turn-through-right turn lane that is controlled by a stop sign. The northbound approach of Pleasant School Road consists of a single uncontrolled lane that provides for left turns onto the southbound on-ramp and through movements for traffic to continue traveling north on Pleasant School Road. Similarly, the southbound approach of Pleasant School Road consists of a single lane that provides for through movements and right turns.

The southbound on-ramp begins at Pleasant School Road and is approximately 600 feet long. The ramp merges into I-85 southbound with a 550 feet long parallel acceleration lane (with a parallel length of about 165 feet). The southbound off-ramp and on-ramp are separated by 1,310 feet on I-85.

The existing configuration of the intersection of Pleasant School Road with the southbound ramps (and with Wilcox Avenue) is shown in **Figure 42**.

Figure 42 - Exit 95: Pleasant School Road and Southbound Ramps

Pleasant School Road

Pleasant School Road (S-11-82) is a two lane roadway that begins at Shelby Highway approximately 560 feet south of the southbound ramp intersection and continues northbound through the interchange area. It continues generally to the north before turning to the west and terminates at Ellis Ferry Road.

Hampshire Drive

Hampshire Drive (S-11-443/661) is a two-way, two lane frontage roadway running adjacent to and parallel to I-85. The northbound off-ramp from I-85 intersects Hampshire Drive approximately 3,440 feet west of the Pleasant School Road overpass. Hampshire Drive has a posted 35 miles per hour speed limit. Hampshire Drive begins west of the interchange at its intersection with Providence Road, and terminates at Shelby Highway aligned immediately to the west of Pleasant School Road.

Matthew Drive (S-11-614)

Matthew Road is a two-way, two lane road that runs parallel to Hampshire Drive between Allison Drive and Shelby Highway. Matthew Drive is located approximately 430 feet to the south of Hampshire Drive, beginning at Allison Drive to the west and ending at Shelby Highway to the east. Suzanna Drive and several business driveways connect Hampshire Drive and Matthew Drive in the vicinity of the northbound off-ramp.

Suzanna Drive

Suzanna Drive is a short local road that connects Hampshire Drive and Matthew Drive.

These roadways (Hampshire Drive, Matthew Drive and Suzanna Drive) are included in the analysis due to the location of the northbound off-ramp and the potential interaction of traffic between these roads. With the existing roadway configuration, it is possible for traffic with destinations to the west and south on Shelby Highway to exit I-85 on the northbound off-ramp and avoid the signal at Hampshire Drive/Shelby Highway by turning right onto Suzanna Drive, left onto Matthew Drive, and right onto Shelby Highway. Providing a northbound off-ramp connection directly to Pleasant School Road would directly affect this traffic.

Shelby Highway

Shelby Highway (SC 18) is the continuation of SC 18. West of Pleasant School Road, SC 18 is named N Limestone Street. N Limestone Street is a four lane road that provides two lanes in each direction as it runs to the southwest into Gaffney. East of Pleasant School Road, Shelby Highway is a two lane roadway that runs east before turning to the north, where it is part of Exit 96. Shelby Highway has a posted 45 miles per hour speed limit.

Wilcox Avenue

As mentioned previously, Wilcox Avenue connects Exit 92, Boiling Spring Highway (SC 150), Pleasant School Road (Exit 95) and Shelby Highway (Exit 96).

Adjacent intersections

The two main intersections along Pleasant School Road adjacent to the interchange are its intersections with Wilcox Avenue and Shelby Highway/Hampshire Drive. The Wilcox Avenue intersection is located adjacent to the southbound ramp intersection, and is offset by approximately 60 feet. The Shelby Highway intersection is located approximately 560 feet south of the southbound ramp intersection.

There are two other intersections that could be affected by the modification of interstate access in this area. To the north of the interchange is the intersection of Pleasant School Road

with the driveway to a UPS distribution facility. This driveway intersection is located approximately 530 feet north of the southbound ramp intersection. This facility generates significant truck traffic which travels through the interchange and the adjacent roadways.

Located on Shelby Highway approximately 1,140 feet west of its intersection with Hampshire Drive and Pleasant School Road is the intersection of Matthew Drive with Shelby Highway. It is possible for traffic exiting I-85 northbound to travel through this intersection to avoid the signalized intersection at Hampshire Drive/Pleasant School Road.

Wilcox Avenue

The intersection of Pleasant School Road and Wilcox Avenue is located approximately 60 feet north of the southbound ramp intersection. In the interchange area, Wilcox Avenue runs adjacent and generally parallel to the interstate and its ramps. The Wilcox Avenue approaches to the intersection are controlled by stop signs. All four approaches provide a single shared lane for left turn-through and right turn movements. The existing configuration of the intersection of Pleasant School Road and Wilcox Avenue is shown (along with the southbound ramp intersections) in **Figure 42**.

Hampshire Drive/Shelby Highway

The intersection of Pleasant School Road with Hampshire Drive and Shelby Highway has an unusual configuration. Both Hampshire Drive and Pleasant School Road intersect Shelby Highway from the north, with the centerline of Hampshire Drive offset approximately 75 feet west of the centerline of Pleasant School Road. The intersection is controlled by a traffic signal, but right turns from Pleasant School Road to westbound Hampshire Drive are controlled by a stop sign within the intersection.

West of the intersection, Shelby Highway/N Limestone Street is a four lane roadway. At the intersection, the inside eastbound through lane on Shelby Highway becomes a dedicated left turn lane for traffic turning to either Hampshire Drive or Pleasant School Road. A local roadway intersects this approach to the intersection immediately west of the stop line.

East of the intersection, Shelby Highway is a two lane roadway. The westbound approach of Shelby Highway at the intersection provides a separate through lane and a shared through-right turn lane, which is added within 100 feet of the stop line.

The southbound approaches of both Hampshire Drive and Pleasant School Road provide a single shared lane for left turn-through-right turn movements. A gas station/convenience store located on the south side of the intersection receives the through movement from these roadway approaches. The existing configuration of the intersection of Hampshire Drive with Shelby Highway (and with Fatz Drive) is shown in **Figure 43**.

Figure 43 - Exit 95: Hampshire Drive at Shelby Highway and at Fatz Drive

Fatz Drive and Shelby Highway

This intersection is an unsignalized T-intersection with the southbound approach of Fatz Drive controlled by a stop sign. The Fatz Drive approach provides a single shared left turn-right turn lane. Shelby Highway provides two through lanes in each direction. At the intersection, the southbound approach lanes of Shelby Highway function as a separate through lane and a shared through-right turn lane, while the northbound approach lanes function as a shared left turn-through lane and a separate through lane. The existing configuration of the intersection of Shelby Highway and Fatz Drive is shown in **Figure 44**.

Figure 44 - Exit 95: Shelby Highway and Fatz Drive

Matthew Drive and Shelby Highway

This intersection is an unsignalized T-intersection with the eastbound approach of Matthew Drive controlled by a stop sign. The Matthew Drive approach provides a single shared left turn--right turn lane. Shelby Highway provides two through lanes in each direction. At the intersection, the southbound approach lanes of Shelby Highway function as a separate through lane and a shared through-right turn lane, while the northbound approach lanes function as a shared left turn-through lane and a separate through lane. The existing configuration of the intersection of Shelby Highway and Matthew Drive is shown in **Figure 45**.

Figure 45 - Exit 95: Shelby Highway and Matthew Drive

UPS Driveway and Pleasant School Road

The UPS facility driveway is located approximately 530 feet north of the southbound ramp intersection. This driveway is the origin/destination of significant truck traffic traveling through the interchange. At the driveway intersection, Pleasant School Road provides a single through lane in each direction, with no separate turn lanes for truck traffic entering the driveway. The UPS driveway is constructed with approximately 33 feet wide inbound and outbound lanes separated by a grass median. These lanes are wide enough to provide two ingress and egress lanes for traffic entering and exiting the facility. The existing configuration of the intersection of Pleasant School Road and the UPS Driveway is shown in **Figure 46**.

Figure 46 - Exit 95: Pleasant School Road and UPS Driveway

Hampshire Drive/Suzanna Drive

This intersection is an unsignalized T-intersection with the northbound approach of Suzanna Drive controlled by a stop sign. The Suzanna Drive approach provides a single shared left turn--right turn lane. Hampshire Drive provides one through lane in each direction. At the intersection, the eastbound approach of Hampshire Dive functions as a shared through-right turn lane, while the westbound approach functions as a shared left turn-through lane.

Matthew Drive/Suzanna Drive

This intersection is an unsignalized T-intersection with the southbound approach of Suzanna Drive controlled by a stop sign. The Suzanna Drive approach provides a single shared left turn--right turn lane. Matthew Drive provides one through lane in each direction. At the intersection, the eastbound approach of Matthew Drive functions as a shared through-right turn lane, while the westbound approach lane functions as a shared left turn-through lane.

The existing configuration of the intersection of Suzanna Drive with Hampshire Drive and with Matthew Drive is shown in **Figure 47**

Figure 47 - Exit 95: Suzanna Drive with Hampshire Drive and Matthew Drive

Exit 96 – Shelby Highway (SC 18)

The Shelby Highway interchange is a diamond interchange carrying traffic to and from Shelby Highway. The northbound exit sign includes the SC 18 state route shield and the text "Shelby", while the southbound exit sign has only the SC 18 state route shield. The existing configuration of the Exit 96 interchange is shown in **Figure 48**.

Figure 48 - Exit 96: Existing Interchange Configuration

The northbound off-ramp is approximately 930 feet long, starting as a single lane ramp with a 750 feet long parallel deceleration lane (with a parallel length of approximately 475 feet). The off-ramp has no posted advisory speed limit. The ramp is not striped for separate turn lanes at its stop sign controlled approach to Shelby Highway, but has a roughly 40 feet long stop line, making it likely that left and right turning traffic has sufficient room to separate themselves.

The northbound on-ramp is approximately 775 feet long. The on-ramp starts at a channelizing island for traffic turning left from southbound Shelby Highway separated by a grass island from traffic turning right from northbound Shelby Highway. The right turn traffic onto the ramp is controlled by a Yield sign. The single lane ramp merges into I-85 with a 550 feet long parallel acceleration lane (with a parallel length of about 185 feet). The northbound off-ramp and on-ramps are separated by approximately 1,720 feet.

The existing configuration of the Shelby Highway intersection with the northbound ramps is shown in **Figure 49**.

Figure 49 - Exit 96: Northbound Ramps

The southbound off-ramp is approximately 650 feet long. The single lane ramp has a posted 35 mph advisory speed limit, and leaves I-85 with a 320 feet long parallel deceleration lane (with a parallel length of about 175 feet). Approximately 275 feet from the diverging gore point, a slip ramp is provided on the ramp for traffic wanting to turn right to travel eastbound on Wilcox Avenue. This opening extends along the off-ramp for approximately 170 feet, at which point the ramp traffic crosses to the right of a grass median to merge with the westbound Wilcox Road approach to its intersection with Shelby Highway. The westbound Wilcox Avenue traffic is controlled by a yield sign at this location. Traffic from Shelby Highway traveling eastbound to Wilcox Avenue pass to the south of the grass median before crossing the off-ramp. The traffic traveling to eastbound Wilcox Avenue is controlled by a yield sign at the crossover with the off-ramp traffic.

At its intersection with Shelby Highway, the combined southbound off-ramp/Wilcox Road approach provides a stop sign controlled single lane for shared left turn-through-right turn movements. The existing configuration of the combined intersection of Shelby Highway with the southbound ramps and Wilcox Avenue is shown in **Figure 50**.

Figure 50 - Exit 96: Shelby Highway and Wilcox Avenue/Southbound Ramps

The southbound on-ramp diverges from Wilcox Avenue approximately 270 feet from the merging gore point. From this point back to Shelby Highway, the shared portion of the on-ramp and Wilcox Avenue is approximately 650 feet long. The total length of the on-ramp, including the overlapping two-way portion of Wilcox Avenue, is approximately 915 feet. The on-ramp merges into I-85 with a 400 feet long parallel acceleration lane (with a parallel length of approximately 140 feet).

The on-ramp begins at Shelby Highway as part of Wilcox Avenue. This two-way, two lane road almost immediately diverges to provide a separate lane to the right of the on-ramp lane for traffic traveling to the west on Wilcox Avenue. Approximately 230 feet from the eastbound stop line of Wilcox Avenue at Shelby Highway, the westbound Wilcox Road lane and the on-ramp lane become separated by a grass median. The on-ramp lane continues for about 220 feet before it is signed to Yield to eastbound Wilcox Road traffic crossing its path and traveling to its left separated by another grass median. Within about 75 feet downstream of the Yield sign, a 120 feet wide median opening that permits the eastbound Wilcox Avenue traffic to cross over begins. Traffic traveling eastbound into this crossover from Wilcox Avenue are controlled by a stop sign. The southbound off-ramp and on-ramp are separated by approximately 1,340 feet.

The existing configuration of the intersection of the southbound on-ramp and Wilcox Avenue is shown in **Figure 51**.

Figure 51 - Exit 96: Southbound On-Ramp/Wilcox Avenue

Shelby Highway

Shelby Highway within the interchange area is a two lane roadway with a posted 35 miles per hour speed limit. The ramp intersections are approximately 870 feet apart.

At the unsignalized intersection that combines Wilcox Avenue and the southbound ramp traffic, all the intersection approaches provide a single shared left turn-through-right turn lane. The Wilcox Avenue approaches are controlled by stop signs.

At the unsignalized northbound ramp intersection, southbound Shelby Highway provides a separate left turn lane (with approximately 130 feet of storage) and a separate through lane. Northbound Shelby Highway provides a wide, single shared through-right turn lane. This lane appears to be able to operate as a de facto separate through and a separate right turn lane for traffic entering the on-ramp to northbound I-85. The northbound right turn movement onto the on-ramp diverges from the northbound lane approximately 75 feet south of where the southbound left turn traffic enters the on-ramp.

South of the northbound ramp intersection, Shelby Highway widens to four lanes approaching the T-intersection with Victory Trail Road (SC 329). At this intersection, Shelby Highway continues to the west, while Victory Trail Road continues to the east.

Victory Trail Road

Victory Trail Road (SC 329) is a two lane roadway that runs to the southeast and south away from Exit 96. Approximately 800 feet south of its intersection with McKowns Mountain Road (S-11-13), Victory Trail Road continues to the south, becoming the continuation of SC 105 (Wilkinsville Highway) which intersects it from the northwest.

Wilcox Avenue

Wilcox Avenue is a two lane frontage road that connects Exit 92, Boiling Spring Highway (SC 150), Pleasant School Road (Exit 95) and Shelby Highway (Exit 96). Approximately 2,500 feet east of Shelby Highway, Wilcox Avenue terminates at a dead end.

Wind Hill Road

Wind Hill Road (S-11-663) is a two lane roadway that connects Victory Trail Road from a point approximately 390 feet east of Shelby Highway to Gaffney Ferry Road near the I-85 northbound on-ramp north of Exit 96. The road is renamed Frontage Road between Speedway Road and Gaffney Ferry Road.

Adjacent Intersections

The intersection of Shelby Highway and Victory Trail Road is located approximately 520 feet south of the northbound off-ramp intersection. The intersection of Wind Hill Road and Victory Trail Road is located approximately 390 feet east of the intersection of Shelby Highway and Victory Trail Road.

Shelby Highway/Victory Trail Road

The unsignalized T-intersection consists of Shelby Highway approaching from the north and west, and Victory Trail Road from the east. Southbound Shelby Highway is controlled by a stop sign, and provides a separate left and right turn lane. The left turn lane provides approximately 200 feet of storage. Going away from the intersection to the north, northbound Shelby Highway has a wide single lane that accommodates traffic turning left from the eastbound leg of Shelby Highway. Approximately 100 feet north of the east/west approaches of the intersection, a short, two-lane section approximately 60 feet in length is striped beginning at a point approximately 45 feet north of where the westbound right turn movement from Victory Trail Road enters northbound Shelby Highway.

The eastbound approach of Shelby Highway provides a separate left turn lane (with approximately 250 feet of storage) and a separate through lane. The westbound approach of Victory Trail Road consists of a separate through lane and a separate right turn lane channelized

with pavement markings. The channelized right turn lane begins approximately 100 feet east of the intersection, and extends through the Wind Hill Road intersection.

Victory Trail Road/Wind Hill Road

This unsignalized T-intersection is located approximately 390 feet east of the Shelby Highway intersection with Victory Trail Road. Wind Hill Road is the southbound approach to the intersection, and is a two-lane local road. Its approach to the intersection provides a single shared lane and is controlled by a stop sign. The eastbound approach to the intersection provides a separate left turn lane (with approximately 250 feet of storage) and a separate through lane. The westbound approach provides a separate through lane and a shared through-right turn lane approximately 180 feet long, which provides the initial separation for the downstream right turn movement onto northbound Shelby Highway. The eastbound and westbound approaches are uncontrolled, free-flowing movements.

The existing configurations of the intersections of Victory Trail Road with Shelby Highway and with Wind Hill Road are shown in **Figure 52**.

Figure 52 - Exit 96: Victory Trail Road at Shelby Highway and Wind Hill Road

Gaffney Ferry Road Northbound On-Ramp

An on-ramp to northbound I-85 from Gaffney Ferry Road (S-11-49) is located approximately one mile north of Exit 96. The distance between the merging gore point on northbound I-85 and where the ramp diverges from the intersection of Gaffney Ferry Road and the Frontage Road is approximately 335 feet. The on-ramp merges into northbound I-85 with a 750 feet long

tapered acceleration lane. The configuration of the existing northbound on-ramp from Gaffney Ferry Road is shown in **Figure 53**.

Figure 53 - Gaffney Ferry Road Northbound On-Ramp Configuration

Gaffney Ferry Road

Gaffney Ferry Road is a two lane roadway that runs generally to the southwest from the on-ramp, crosses Victory Trail Road approximately 0.8 miles southeast of the Victory Trail Road intersection with Shelby Highway, and continues to the southeast to its terminus with River Drive. Gaffney Ferry Road has a posted 35 miles per hour speed limit on the section west of Victory Trail Road.

Immediately south of the start of the on-ramp, Gaffney Ferry Road is intersected by Frontage Road (an extension of Wind Hill Road) from the west, providing another connection for traffic to access the on-ramp from Victory Trail Road in the vicinity of Shelby Highway.

Frontage Road/Wind Hill Road

Frontage Road is a continuation of Wind Hill Road (S-11-663). This two lane roadway begins as Wind Hill Road at its intersection with Victory Trail Road from a point approximately 390 feet east of Shelby Highway at Exit 96. From its intersection with Speedway Road, the roadway is renamed Frontage Road, and continues east, parallel to northbound I-85 for approximately one mile, to Gaffney Ferry Road near the northbound I-85 on-ramp.

Use of the I-85 northbound on-ramp via Gaffney Ferry Road is likely made up from traffic traveling from the south on Victory Trail Road. Using Gaffney Ferry Road to access I-85 reduces

the distance of travel necessary to use the northbound on-ramp at Exit 96. However, there are no signs on Victory Trail Road approaching Gaffney Ferry Road that direct traffic to this ramp.

Closing this on-ramp would cause traffic using the ramp to divert to other ramps in the area. Given the distances involved, the most likely ramp for traffic to divert to is the on-ramp at Exit 96.

Exit 98 - Frontage Road Off-Ramp

Exit 98 consists of a single off-ramp from northbound I-85. This ramp to a Frontage Road has a posted 40 miles per hour advisory speed. The ramp is approximately 260 feet long from its diverging gore point to where it intersects the Frontage Road. The ramp diverges from I-85 with a 430 feet long parallel deceleration lane (with a parallel length of approximately 260 feet). The exit sign contains “Frontage Road”.

The Frontage Road continues east adjacent to and parallel to northbound I-85 towards the Exit 100 interchange. It does not connect to any other roadways.

The existing configuration of the Exit 98 interchange is shown in **Figure 54**.

Figure 54 - Exit 98: Existing Interchange Configuration

Closing this off-ramp would cause traffic using the ramp to divert to other ramps in the area. Given the distances involved, the most likely ramp for traffic to divert to is the off-ramp at Exit 100.

Exit 100 – Blacksburg Highway (S-11-83)

This interchange is a diamond interchange carrying traffic to and from Blacksburg Highway. While this interchange is not expected to be updated or modified, it is included in this analysis as it is the next full access interchange along I-85 adjacent to an interchange potentially being modified (Exit 96)."

The exit is signed "Blacksburg Hwy" and "Blacksburg" in the northbound direction. In the southbound direction, the exit is signed "Blacksburg Hwy" and "Shelby". The existing configuration of the interchange at Exit 100 is shown in **Figure 55**.

Figure 55 - Exit 100: Existing Configuration

The northbound off-ramp is approximately 420 feet long from the diverging gore point to its intersection with Frontage Road/Milliken Road. This intersection is located approximately 170 feet from Blacksburg Highway. The total off-ramp length from the gore point to the stop line at Blacksburg Highway is approximately 620 feet. The northbound off-ramp diverges from I-85 with a 380 feet long parallel deceleration lane (with a parallel length of approximately 150 feet). The off-ramp has a 25 miles per hour posted advisory speed limit. The ramp traffic is uncontrolled at its crossover intersection with Frontage Road/Milliken Road. Both the Frontage Road/Milliken Road approaches at the crossover are controlled by Yield signs.

At its intersection with Blacksburg Highway, the combined Frontage Road/off-ramp approach consists of a stop sign controlled shared left turn-through-right turn lane.

The northbound on-ramp is approximately 840 feet long. The single lane ramp merges into I-85 with a 1,300 feet long parallel acceleration lane (with a parallel length of approximately 675 feet). The northbound off-ramp and on-ramps are separated by approximately 1,440 feet.

The existing configuration of the intersection of the northbound ramps with the Frontage Road and with Blacksburg Highway is shown in **Figure 56**.

Figure 56 - Exit 100: Northbound Ramps with Frontage Road and Blacksburg Highway

The southbound off-ramp is a single lane ramp with a posted 45 mph advisory speed limit. The off-ramp diverges from I-85 with a 200 feet long tapered deceleration lane. Approximately 590 feet from the diverging gore point, the ramp becomes Simper Road: a two lane, two-way roadway. This section of Simper Road/southbound off-ramp extends another 940 feet to its intersection with Blacksburg Highway. Access is provided to businesses located along the Simper Road section of the off-ramp. The total length of the off-ramp, including the two-way Simper Road section, is about 1,535 feet. The configuration of the intersection of the southbound off-ramp with Simper Road is shown in **Figure 57**.

Figure 57 - Exit 100: Southbound Off-Ramp and Simper Road

At its intersection with Blacksburg Highway, the combined southbound off-ramp/Simper Road approach provides a stop sign controlled single lane for shared left turn-through-right turn movements.

The southbound on-ramp begins at Blacksburg Highway as the two-way, two lane Crawford Road. The total length of the southbound on-ramp, including the two-way section of Crawford Road, is approximately 980 feet. The existing configuration of the intersection of Blacksburg Highway with Simper Road/Crawford Road is shown in **Figure 58**.

Figure 58 - Exit 100: Blacksburg Highway and Crawford Road/Simper Road

Approximately 450 feet west of Blacksburg Highway, an unsignalized crossover intersection begins that separates the on-ramp traffic from traffic continuing to the west on Crawford Road. At this point, a grass median separates the westbound Crawford Road and the southbound on-ramp traffic from the eastbound Crawford Road traffic. Traffic continuing west on Crawford Road can turn right about 125 feet from the start of the island, while the location where eastbound Crawford Road traffic crosses the southbound on-ramp traffic is located about 230 feet from the start of the island. At this crossover location, the eastbound Crawford Road traffic is controlled by a yield sign. The on-ramp continues approximately 165 feet before the right turn from eastbound Crawford Road merges into the on-ramp. From this location, the distance to the gore point on southbound I-85 is approximately 100 feet. The on-ramp enters I-85 with a 1,515 feet long parallel acceleration lane (with a parallel length of approximately 1,210 feet).

Beyond this point, the southbound on-ramp continues towards I-85 on a single lane for 170 feet, at which point traffic traveling eastbound on Crawford Road can turn right to enter the on-ramp. This distance from the start of this opening to the southbound merging gore point is approximately 100 feet. The southbound off-ramp and on-ramp are separated by approximately 2,515 feet.

The configuration of the existing intersection of the southbound on-ramp with Crawford Road is shown in **Figure 59**.

Figure 59 - Exit 100: Southbound On-Ramp and Crawford Road

Blacksburg Highway

Blacksburg Highway within the interchange area is a two lane roadway with a posted 35 miles per hour speed limit. The ramp intersections are approximately 470 feet apart.

At the unsignalized intersection that combines the Simper Road/Crawford Road traffic with the southbound ramp traffic, all the intersection approaches provide a single shared left turn-through-right turn lane. The Simper Road and Crawford Road approaches are controlled by stop signs.

At the unsignalized northbound ramp intersection, the eastbound Frontage Road and the northbound and southbound Blacksburg Highway approaches all provide a single shared left turn-through-right turn lane. The Frontage Road approach is controlled by a stop sign.

Frontage Road

Frontage Road begins at Blacksburg Highway and continues to the west running parallel and adjacent to the northbound lanes of I-85. It connects to the Exit 98 off-ramp approximately 1.25 miles to the west. It continues west before bending to run parallel south along the Broad River where it terminates at a building on the river bank.

Simper Road

Simper Road is the approximately 940 feet long section of two-way, two lane roadway that connects the southbound off-ramp to Blacksburg Highway. Six driveways provide access to businesses located to the north side of Simper Road, mixing two-way traffic to/from those businesses with southbound off-ramp traffic.

Crawford Road

Crawford Road is a two lane roadway that begins at Blacksburg Highway and coincides with the southbound on-ramp for approximately 450 feet where, as previously described, Crawford Road separates from the southbound on-ramp. Crawford Road continues to the west and northwest to its terminus at Youngs Grove Road.

IV. DATA COLLECTION

The following data collection activities were performed for the I-85 corridor.

I-85 Mainline Traffic Volume Data

I-85 mainline traffic volume data were obtained from two SCDOT sources. The current and historic average annual daily traffic (AADT) on each of the I-85 segments within the study area were obtained from SCDOT. Hourly count data was obtained from two permanent Automatic Traffic Recording (ATR) stations located within the study area.

Each year, SCDOT produces a database of AADT on segments for state primary and secondary roadways. For each county, a list of the various AADT station numbers, their route designation and number, and the beginning and ending point of the segment are listed along with the AADT for those segments. For interstate routes, separate station numbers are generally assigned to individual freeway segments between interchanges. The SCDOT AADT data available for use in this study includes the annual AADT between the 1996 and 2013 inclusive and is provided in **Appendix A**.

Traffic volume data from two permanent ATR stations within the study area were provided by SCDOT. The two ATR stations are identified by SCDOT as Station P-14 and P-132. Station P-14 is located on I-85 at approximately milepost 88.2 between Exits 87 and 90. Station P-132 is located on I-85 approximately 500 feet to the south of the Frontage Road off-ramp on northbound I-85 designated as Exit 98.

The ATR data at both stations contained all the traffic volumes recorded by the ATR between December 1, 2013 and November 30, 2014.

The AADT data will be used in the development of growth rates used to forecast future traffic. The ATR data will be used to establish the design hour traffic volumes and in the analysis of existing operating conditions for freeway segments and merge and diverge areas in the corridor.

Vehicle Classification Data

Vehicle classification data was provided by SCDOT at ATR Stations P-14 and P-132. The vehicle classification data is used to determine the heavy vehicle (trucks/buses) percentages to be used in the analysis. The P-14 data summarized traffic collected over a seven day period starting Sunday, June 1, 2008 and ending Saturday, June 7, 2008, which was the most recently available vehicle classification data at that count station. Two sets of vehicle classification counts were provided at station P-132. The first set was collected over a six day period starting on Wednesday, March 26, 2014 and ending on Monday, March 31, 2014. The second set of data was provided for a single day: Wednesday, November 12, 2014.
The vehicle classification data summarizes the number of vehicles in 15 separate vehicle classifications. The classifications are as follows:

- Class 1 – Motorcycles
- Class 2 – Cars
- Class 3 – Other 2-Axle, 4-Tire
- Class 4 – Buses
- Class 5 – Single Unit Trucks: 2-Axle, 6 Tire
- Class 6 – Single Unit Trucks: 3 Axle
- Class 7 – Single Unit Trucks: 4 or more Axles
- Class 8 – Single Trailer Trucks: 4 or fewer Axles
- Class 9 – Single Trailer Trucks: 5 Axle
- Class 10 – Single Trailer Trucks: 6 or more Axles
- Class 11 – Multi-Trailer Trucks: 5 or fewer Axles
- Class 12 – Multi-Trailer Trucks: 6 Axle
- Class 13 – Multi-Trailer Trucks: 7 or more Axles
- Class 14 – None
- Class 15 - Other

Class 4 (Buses) and Class 5 (2-Axle, 6 Tire Single Unit Trucks) are classified as Medium Trucks. Classes 6 through 13 are classified as Heavy Trucks.

The vehicle classification data will be used in developing estimates of the truck percentages to be used in the analysis in the corridor.

Turning Movement Counts

Turning movement traffic count data was obtained from SCDOT for a number of ramp termini and other adjacent intersections within the study area. The turning movement count data, which is provided in **Appendix B**, included:

- Exit 80

  - Gossett Road (S-42-57) at Sha Lane (S-42-784)/Dewberry Road (S-42-868) – April 25, 2013
  - Gossett Road (S-42-57) at I-85 Southbound Ramps – April 24, 2013
  - Gossett Road (S-42-57) at I-85 Northbound Ramps – March 28, 2013
  - Gossett Road (S-42-57) at Abbott Lane (S-42-1008)/Conway Black Road (S-42-1011) – April 9, 2013
- Exit 83
  - Battleground Road (S-42-110) at Dewberry Road (S-42-2005)/Phillips Drive – April 2, 2013
  - I-85 Southbound On-Ramp at Truck Stop Road and Horry Road (S-42-21) – April 3, 2013
  - I-85 Northbound Off-Ramp at Bud Arthur Bridge Road (S-42-737/1013) – April 3, 2013
- Exit 87
  - Green River Road (S-11-39) at Webber Road/Old Post Road (S-11-665) – Wednesday, April 24, 2013
  - I-85 Southbound Off-Ramp at Old Post Road (S-11-665) – Thursday, April 25, 2013
  - I-85 Southbound On-Ramp at Webber Road (S-11-665) – Wednesday, April 24, 2013
  - I-85 Northbound Off-Ramp at Cannons Campground Road (S-11-234) – April 24, 2013
  - I-85 Northbound On-Ramp at Overbrook Drive (S-11-31) – Thursday, April 25, 2013
  - Green River Road (S-11-39) at Cannons Campground Road (S-11-234)/Overbrook Drive (S-11-31) – Wednesday, April 24, 2013
- Exit 90
  - Hyatt Street (S-11-81) at Nancy Creek Road (S-11-440)/Peachoid Road (S-11-666) – Tuesday, April 9, 2013
  - I-85 Northbound Ramps at Hyatt Street (SC 105) - Tuesday, April 9, 2013
  - I-85 Southbound Ramps at Hyatt Street (S-11-81) – Wednesday, April 10, 2013
  - Hyatt Street (SC 105) at Lemmons Lane (S-11-645)/Windslow Road (S-11-659) – Tuesday, April 9, 2013
- Exit 92
  - Chesnee Highway (SC 11) at Corona Drive (S-11-668) – Tuesday, March 26, 2013
  - I-85 Southbound Ramps at Chesnee Highway (SC 11) - Wednesday, March 27, 2013
  - I-85 Northbound Ramps at Chesnee Highway (SC 11) – Thursday, March 28, 2013
  - W Floyd Baker Boulevard (SC 11) at Peachtree Market Place Driveway – Thursday, March 28, 2013
  - W Floyd Baker Boulevard (SC 11) at Walton Drive – Thursday, March 28, 2013
  - W Floyd Baker Boulevard (SC 11) at Ellis Ferry Avenue (S-11-566) – Wednesday, March 27, 2013
  - W Floyd Baker Boulevard (SC 11) at Getty's Drive (S-11-437) – Wednesday, March 27, 2013
- Exit 95

  - Pleasant School Road (S-11-82) at Wilcox Avenue (S-11-668) – Wednesday, April 10, 2013
  - I-85 Southbound Ramps at Pleasant School Road (S-11-82) – Wednesday, April 10, 2013
  - I-85 Northbound Off-Ramp at Hampshire Drive (S-11-661) – Wednesday, April 10, 2013
- Exit 96
  - Shelby Highway (SC 18) at I-85 Southbound Off-Ramp/Wilcox Avenue (S-11-688) – Thursday, April 11, 2013
  - I-85 Southbound On-Ramp at Wilcox Avenue (S-11-668) – Thursday, April 11, 2013
  - I-85 Northbound Ramps at Shelby Highway (SC 18) – Thursday, April 11, 2013
  - Shelby Highway (SC 18) at Victory Trail Road (SC 329) – Tuesday, November 30, 2004 and Wednesday, December 1, 2004
- Exit 100
  - Blacksburg Highway (S-11-83) at Simper Road (I-85 Southbound Off-Ramp) – Tuesday, April 16, 2013
  - I-85 Southbound On-Ramp at Crawford Road – Tuesday, April 16, 2013
  - I-85 Northbound Off-Ramp at Frontage Road/Milliken Road (S-11-670) – Tuesday, April 16, 2013
  - Blacksburg Highway (S-11-83) at I-85 Northbound On-Ramp – Tuesday, April 16, 2013

Additional traffic counts were performed to supplement the counts provided by SCDOT. The additional counts were obtained on Thursday, September 25, 2014 at:

- Exit 82
  - I-85 Northbound Off-Ramp at Buds Drive (S-42-1012)
  - Buds Drive (S-42-1012) at Bud Arthur Bridge Road (S-42-737)
- Exit 83
  - I-85 Southbound Off-Ramp at Truck Stop Road/Truck Plaza Drive
  - Phillips Drive and Horry Road (S-42-21)
  - Battleground Road (S-42-110) at Horry Road (S-42-21)
  - Battleground Road (S-42-110) at Bud Arthur Bridge Road (S-42-1013/1015)
  - Bud Arthur Bridge Road (S-42-1015) at Edgefield Road (S-42-22)
  - I-85 Northbound On-Ramp at Edgefield Road (S-42-1015)/Livestock Nutrition Driveway
- Exit 87
  - Webber Road (S-11-665) at Webber Farm Driveway
  - I-85 Southbound On-Ramp at Webber Road (S-11-665)/Orchard Place Expo Driveway
  - South Green River Road (S-11-39) and Lindley Road
- Exit 95
  - Pleasant School Road (S-11-82) and UPS Terminal Driveway
  - Hampshire Drive (S-11-661) and Suzanna Drive

- Matthew Road (S-11-615) and Suzanna Drive)
- Matthew Road (S-11-615) and Shelby Highway (SC 18)
- Hampshire Drive (S-11-661) and Fatz Drive
- Shelby Highway (SC 18) and Fatz Drive
- Shelby Highway (SC 18) at Hampshire Drive (S-11-661)/Pleasant School Road (S-11-82)

- Exit 96
  - I-85 Southbound Off-Ramp at Wilcox Avenue (S-11-688)
  - I-85 Southbound On-Ramp at Wilcox Avenue (S-11-688) Split
  - Shelby Highway (SC 18) at Victory Trail Road (SC 329)
  - Victory Trail Road (SC 329) at Windhill Road (S-11-663)
- Exit 97

- Gaffney Ferry Road (S-11-49) ant Windhill Road (S-11-663)
  - Exit 100
    - I-85 Southbound at Simper Road/Gas Station Driveway
    - I-85 Southbound On-Ramp at Crawford Road Split
    - I-85 Northbound Off-Ramp at Frontage Road/Milliken Road (S-11-670)
    - I-85 Northbound Ramps at Blacksburg Highway (S-11-83)

The turning movement count data will be used in the analysis of intersection operations at ramp intersections and other intersections adjacent to the interchanges.

INRIX Speed Data

SCDOT provided an annual summary of 2013 INRIX speed data for I-85 between Exit 80 and Exit 102. The data was divided by direction, freeway section, weekday (Tuesday through Thursday) or weekend (Friday through Monday) for each hour of the year and is provided in **Appendix C**.

The speed data will be used in the analysis of the corridor and the calibration of the corridor microsimulation model.

Crash Data

Historic crash data was provided from the SCDOT Safety Office. The crash data for the interstate corridor and ramps covered the period from January 2011 through December 2013. For roadways in the vicinity of the interchanges being upgraded (Exits 83, 87, 95 and 96), crash data covered the period from January 2011 through August 2014.

The crash data will be used to perform an accident analysis to identify 'hotspots' with frequent and/or severe history of accident occurrence.

Signal Plans/Timings

There are nine existing traffic signals located at interchange ramp termini intersections or at adjacent intersections. Traffic signal plans were obtained from SCDOT for the existing signal installations at the following locations:

- Exit 83
  - Battleground Road at Bud Arthur Bridge Road
- Exit 90
  - Hyatt Street at Nancy Creek Road/Peachoid Road
  - Hyatt Street at I-85 Southbound Ramps
  - Hyatt Street at I-85 Northbound Ramps
  - Hyatt Street at Lemmons Lane/Windslow Road
- Exit 92
  - Chesnee Highway at Peachoid Road/Wilcox Avenue
  - W Floyd Baker Boulevard at I-85 Southbound Off-Ramp
  - W Floyd Baker Boulevard at I-85 Northbound Off-Ramp
- Exit 95
  - Shelby Highway at Pleasant School Road and Hampshire Drive

The signals adjacent to Exits 83 and 95 are isolated intersections that are not part of a signal system. The signals located along Hyatt Street (at Exit 90) and Chesnee Highway/W Floyd Baker Boulevard (at Exit 92) currently operate as part of signal systems along those arterials. SCDOT provided the current coordinated signal timings plans for these two systems. **Appendix D** includes all existing signal plans and signal timings. The signal plans and signal timings will be used in the analysis of intersections controlled by traffic signals.

V. ANALYSIS

A series of traffic analyses were performed to assess existing and future operations of I-85, the interchange ramps, and intersections located adjacent to the interchange ramp termini. The analyses included:

- An accident analysis for the study area
- A traffic forecasting analysis to estimate future no-build and build condition traffic volumes
- Freeway segment operations analysis for existing, future no-build and future build conditions
- Freeway ramp merge/diverge area analysis for existing, future no-build and future build conditions

- Signalized and unsignalized intersection analysis for existing, future no-build and future build conditions,
- Roundabout analysis, performed as necessary for future build conditions that incorporate roundabouts as a design element

The individual interchanges were modeled using Synchro/SimTraffic to analyze and simulate the arterial and intersection operations and to aid in the development of traffic control and geometric recommendations. Traffic simulation models were created for the entire study area and at individual interchange locations for the existing, future no-build, and future build conditions. The entire study area was modeled using VISSIM, a micro-simulation software, to analyze and simulate the freeway operation.

Accident Analysis

An accident analysis was performed using the crash data obtained for the entire interstate study area corridor. This data included crashes occurring on the interstate and interstate ramps between January 2011 and December 2013. Additional analysis was performed for arterial roadways adjacent to the interstate and its interchanges using crash data covering January 2011 through August 2014.

Crash rates for the study area corridor were obtained from SCDOT for 2013. This data, covering I-85 between mile markers 80 and 96, indicated the crash rate along the interstate route was 108.505 crashes per hundred million vehicle miles traveled. The statewide average interstate crash rate for 2013 was 85.620 crashes per hundred million vehicle miles traveled. The crash rate along the I-85 corridor is approximately 27 percent higher than the average interstate crash rate in the state. Widening the interstate and upgrading the interchanges at Exits 83, 87, 95 and 96 may be effective at reducing the crash rate within the corridor.

The complete *I-85 Widening Project MM 80 – MM 96 Accident Analysis Report*, prepared by Bihl Engineering and dated December 2014 (revised February 2015), is provided as an attachment in **Appendix E**. The following is a brief summary of the findings and conclusions of the analysis. Additional references to the accident analysis data and findings are provided elsewhere in this report as appropriate in support of analysis and conceptual design activities.

- The analysis considered crashes along the entire mainline section of I-85 within the study area.
- The analysis of crashes in the interchange areas was focused specifically at the interchanges anticipated to be modified as part of this widening project. This included Exits 82, 83, 87, 95 and 96.
- Of the 1,019 crashes occurring within the study area during the analysis time period, 902 of the crashes occurred on I-85 or along the I-85 ramps and 117 occurred on the adjacent roadways.

- The most common crash type occurring along I-85 was classified as "collision with fixed object" (358 crashes – 40 percent). The fixed objects included guardrail, median, embankments, bridges and fences. Many of these crashes are likely attributable to insufficient clear zone distances at multiple places throughout the corridor.
- Rear end collisions were the second most prevalent type of accident (247 - 27 percent) and same-direction sideswipe accidents were the third most commonly occurring accident (129 - 14 percent).
- Most of the crashes were classified as "property damage only" accidents, with the following exceptions:
  - 14 percent (125) were classified as "possible injuries"
  - 3 percent (26) were classified as "non-incapacitating injuries"
  - Less than 1 percent (7 total) were classified as "incapacitating injuries", with two of those accidents occurring on adjacent roadways and not the mainline
  - Less than 1 percent (6 total) involved fatalities.
- The fatal accidents that took place in the study area (I-85 and the surrounding roadways) included the following:
  - #105 - a collision with the median barrier in the vicinity of Exit 82 (northbound at mile marker 82.322)
  - #322 - a pedestrian fatality northbound at mile marker 90.555
  - #360 - an angle accident in the vicinity of the Exit 92 northbound on-ramp (mile marker 92.179)
  - #472 - a head-on collision northbound near the Gaffney Ferry Road on-ramp (mile marker 97.196)
  - #717 - a collision with a fence in the vicinity of Exit 83 (southbound at mile marker 85.489)
  - #741 - a head-on collision in the vicinity of Exit 83 (southbound at mile marker 83.857)
  - #S32 - a pedestrian fatality on Hampshire Drive north of the northbound off-ramp at Exit 95 (mile marker 1.440)
  - After the original accident analysis report was completed in December 2014, an additional fatal crash, a head-on collision, occurred at mile marker 92.94 (north of Providence Road).
- The incapacitating injury accidents that took place in the study area (I-85 and the surrounding roadways) included the following:
  - #118 - a "no collision with motor vehicle" accident with an unknown sequence of events in the vicinity of Exit 82 (northbound at mile marker 82.83)
  - #123 – a rear end collision accident in the vicinity of Exit 82 (northbound at mile marker 82.935)
  - #423 - a collision with guardrail northbound at mile marker 95.273
  - #901 – an angle accident southbound at mile marker 80.058
  - #682 - a collision with the median barrier southbound at mile marker 87.112
  - #606 - an angle accident southbound at mile marker 91.078

  - #589 - an angle accident southbound at mile marker 92.139
  - #S72, #S65 - two angle accidents on the Pleasant School Road overpass at the Exit 95 interchange
- The geometric conditions of the merge and diverge areas at the interchanges, short on- and off-ramp distances, and the connection between ramps and the adjacent roadway system contribute to the frequency of accidents at some locations. It is likely that combinations of these factors violate drivers' expectations and create confusion, particularly for drivers who are unfamiliar with the area. Ramp locations with a high number of crashes include:
  - Exit 82 northbound off-ramp
  - Exit 83 southbound on-ramp
  - Exit 90 northbound on-ramp
  - Exit 96 northbound off-ramp
  - Exit 96 northbound on-ramp
  - Gaffney Ferry Road northbound on-ramp (north of Exit 96)
- Approximately half of the 117 crashes occurring on the adjacent roadways took place on the roadways surrounding Exit 95.
- Unusual or unexpected intersection designs at the frontage road intersections with interstate ramps, along with limitations of sight distance along arterial roadways may also lead to driver confusion and contribute to the occurrence of crashes.

Traffic Volumes

I-85 Traffic Volume Data – Average Annual Daily Traffic

Average annual daily traffic volumes (AADT) were obtained from SCDOT for the most recently available data set (2013) for the seven freeway segments within the study area. Each segment has an associated AADT count station number associated with it. The current AADT for the seven freeway segments are summarized in **Table 1**.

Table 1 - 2013 AADT for I-85 Freeway Segments

I-85 Segment Number	I-85 Segment Description	2013 AADT
Segment 1	I-85 (Exit 80 to Exit 83) FROM S- 57 TO SC 110 SPARTANBURG COUNTY STA 2331	58,600
Segment 2	I-85 (Exit 83 to Exit 87) FROM SC 110 TO S- 39 (CHEROKEE) SPARTANBURG COUNTY STA 2333	55,500
Segment 3	I-85 (Exit 87 to Exit 90) FROM S- 39 TO SC 105, S- 81 CHEROKEE COUNTY STA 2335	54,800
Segment 4	I-85 (Exit 90 to Exit 92) FROM SC 105, S- 81 TO SC 11 CHEROKEE COUNTY STA 2337	48,600
Segment 5	I-85 (Exit 92 to Exit 95) FROM SC 11 TO S- 82 CHEROKEE COUNTY STA 2339	48,300
Segment 6	I-85 (Exit 95 to Exit 96) FROM S- 82 TO SC 18 CHEROKEE COUNTY STA 2341	46,400
Segment 7	I-85 (Exit 96 to Exit 100) FROM SC 18 TO S- 83 CHEROKEE COUNTY STA 2343	43,200

Throughout the I-85 segments, the AADT decreases to the north within the corridor, with the volume of the northernmost segment (43,200 vehicles per day) approximately 75 percent of the volume on the southernmost segment (58,600 vehicles per day).

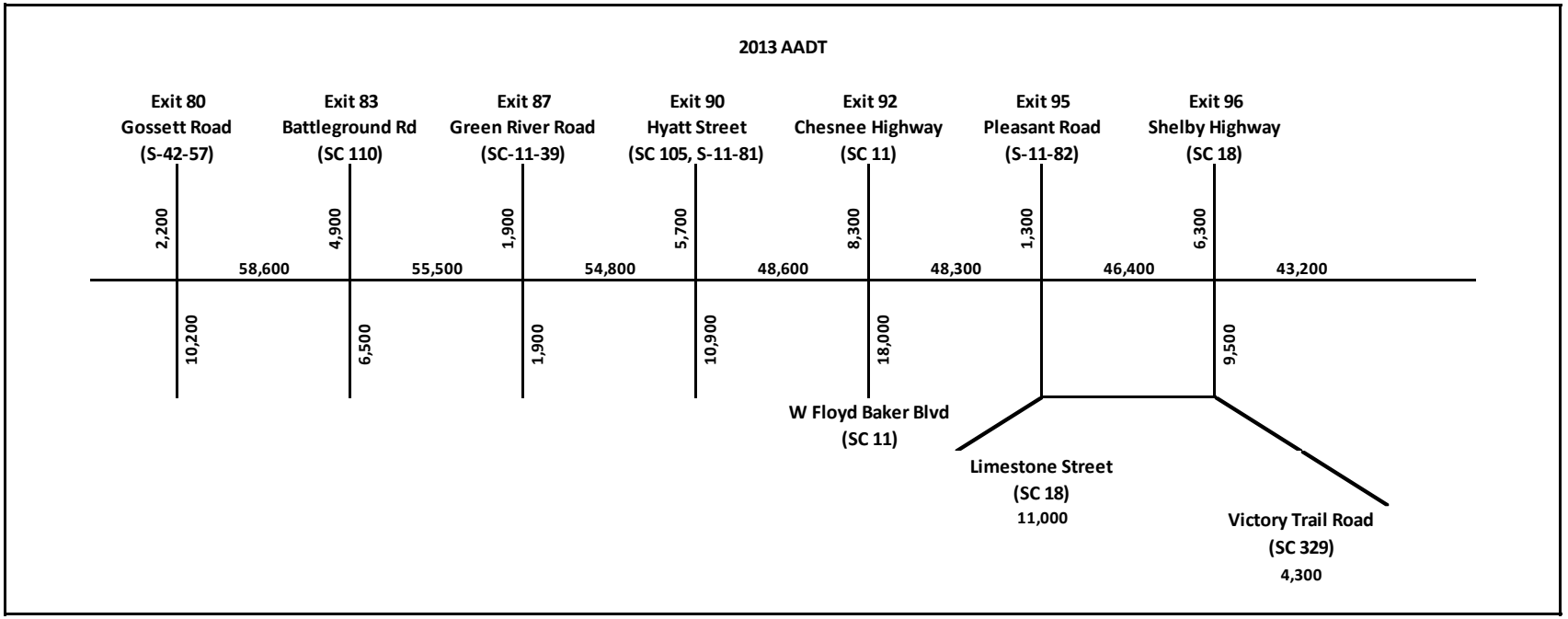
AADT were also obtained for the arterial roadways with interchanges with I-85. The AADT for the 17 arterial roadway segments are summarized in **Table 2**.

Table 2 - 2013 AADT for Arterial Segments

Arterial Segment Number	Arterial Segment Description	2013 AADT
Segment 1	S-42-57 (Gossett Road (Exit 80)) FROM US 221 TO I- 85 SPARTANBURG COUNTY STA 563	2,200
Segment 2	S-42-57 (Gossett Road (Exit 80)) FROM I- 85 TO S- 31 SPARTANBURG COUNTY STA 565	10,200
Segment 3	SC 110 (SC 110 (Exit 83)) FROM I- 85 TO County Line - CHEROKEE SPARTANBURG COUNTY STA 255	4,900
Segment 4	SC 110 (SC 110 (Exit 83)) FROM US 29, S- 566 TO I- 85 SPARTANBURG COUNTY STA 253	6,500
Segment 5	S-11-39 (Green River Road (Exit 87)) FROM S- 59, L- 1042 TO US 29 CHEROKEE COUNTY STA 405	1,900
Segment 6	S-11-81 (Hyatt Streeet (Exit 90)) FROM L- 1427 TO I- 85 CHEROKEE COUNTY STA 357	5,700
Segment 7	SC 105 (Hyatt Streeet (Exit 90)) FROM S- 467 TO I- 85 CHEROKEE COUNTY STA 261	10,900
Segment 8	SC 11 (Chesnee Highway (Exit 92)) FROM S- 61 TO I- 85 CHEROKEE COUNTY STA 177	8,300
Segment 9	SC 11 (W Floyd Baker Blvd (Exit 92)) FROM I- 85 TO S- 566 CHEROKEE COUNTY STA 179	18,000
Segment 10	S-11-82 (Pleasant School Road (Exit 95)) FROM S- 71 TO I- 85 CHEROKEE COUNTY STA 443	1,300
Segment 11	SC 18 (Limestone Street) FROM SC 18 CON, S- 793, L- 767 TO SC 329 CHEROKEE COUNTY STA 211	11,000
Segment 12	SC 18 (Shelby Highway (Exit 96)) FROM I- 85 TO S- 800 CHEROKEE COUNTY STA 215	6,300
Segment 13	SC 18 (Shelby Highway (Exit 96)) FROM SC 329 TO I- 85 CHEROKEE COUNTY STA 213	9,500
Segment 14	SC 329 (Victory Trail Road (Exit 96)) FROM US 29 TO SC 18 CHEROKEE COUNTY STA 317	4,300
Segment 15	S-11-83 (Blacksburg Highway (Exit 100)) FROM I- 85 TO S- 245, L- 245 CHEROKEE COUNTY STA 153	3,900
Segment 16	S-11-83 (Blacksburg Highway (Exit 100)) FROM S- 351 TO I- 85 CHEROKEE COUNTY STA 151	2,700

The 2013 AADT in the study area are depicted schematically in **Figure 60**.

Figure 60 - 2013 Study Area AADT



I-85 Traffic Volume Data – Existing Design Hour Volumes

Traffic volume data from SCDOT permanent Automatic Traffic Recording (ATR) stations were provided by SCDOT for use in developing the design hour volumes for the mainline I-85 segments in the study area. The two ATR stations within the study area include Station P-14 and P-132. Station P-14 is located on I-85 at approximately milepost 88.2 between Exits 87 and 90. This section also corresponds to SCDOT's AADT Station 2335 (Freeway Segment 3 in **Table 1**). Station P-132 is located on I-85 approximately 500 feet to the south of the Frontage Road off-ramp on northbound I-85 designated as Exit 98. This section corresponds to SCDOT's AADT Station 2343 (Freeway Segment 7 in **Table 1**).

The ATR data at both stations contained all the traffic volumes recorded by the ATR between December 1, 2013 and November 30, 2014. This data was analyzed to be able to identify a two-way design hour volume, the percentage of the design hour to the AADT (k-factor) and the directional split between northbound and southbound traffic (D-factor). Typical values sometimes chosen for the design hour include the 10th, 30th and 100th highest hours of traffic.

The ATR station data was analyzed to identify the 10th, 30th, and 100th highest hours of traffic volumes at each station location for the following conditions:

1. Two-way volume (each hour, each day);
2. Two-way AM volume (7:00 AM to 10:00 AM, each day)
3. Two-way PM volume(4:00 to 7:00 PM, each day)
4. Two-way weekday volume (each hour, Tuesday-Thursday);
5. Two-way weekday AM volume (7:00 AM to 10:00 AM, Tuesday-Thursday);
6. Two-way weekday PM Peak Period Volume (4:00 to 7:00 PM, Tuesday-Thursday).

The 100th highest hours of two-way traffic volumes for each hour and each day at ATR Stations P-14 and P-132 are included as part of an attachment in **Appendix F**.

Typically, the 30th highest hour is selected for the design hourly volume (DHV). This hour generally falls at or near the inflection point of a graph of the highest volumes where the change in volumes becomes less pronounced and more consistent, with the steep curve depicting larger changes in volumes flattening to a more gradual curve indicating more consistent reductions in volume. Graphs of the 200 highest volumes at stations P-14 and P-132, along with indications of the 10th, 30th and 100th highest hourly volumes are shown in **Figures 61** and **62**.

Figure 61 - Graph of Station P-14 Highest Hourly Volumes

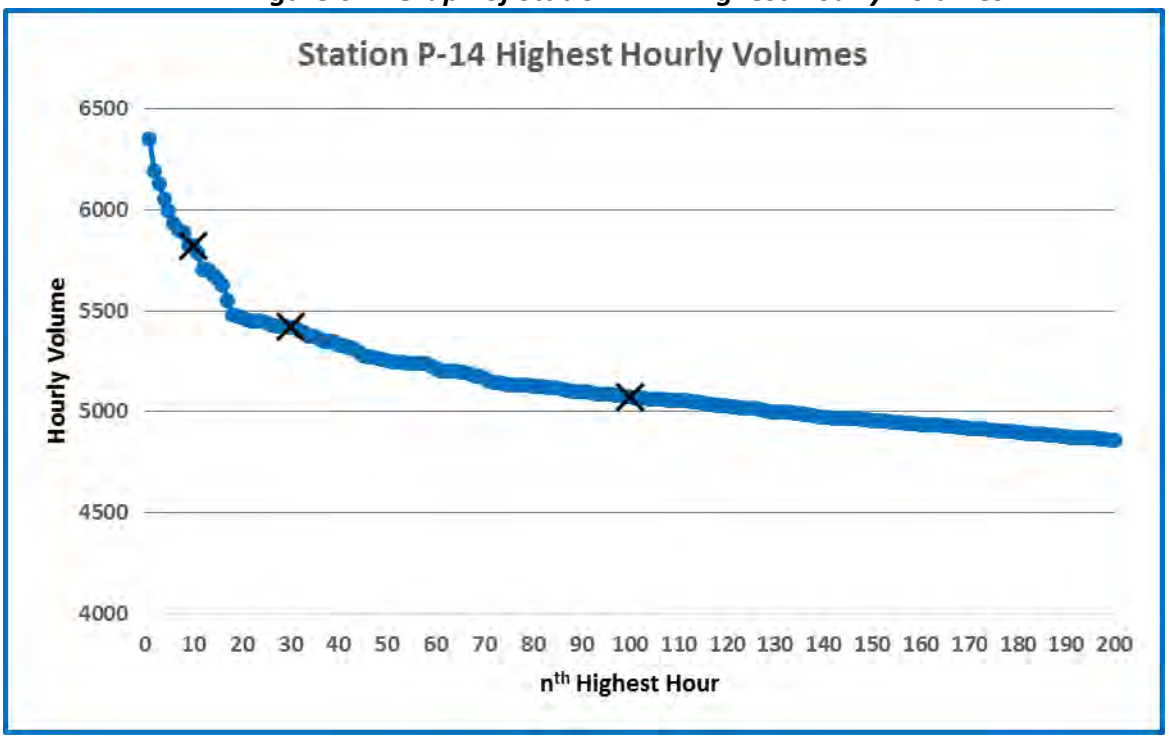
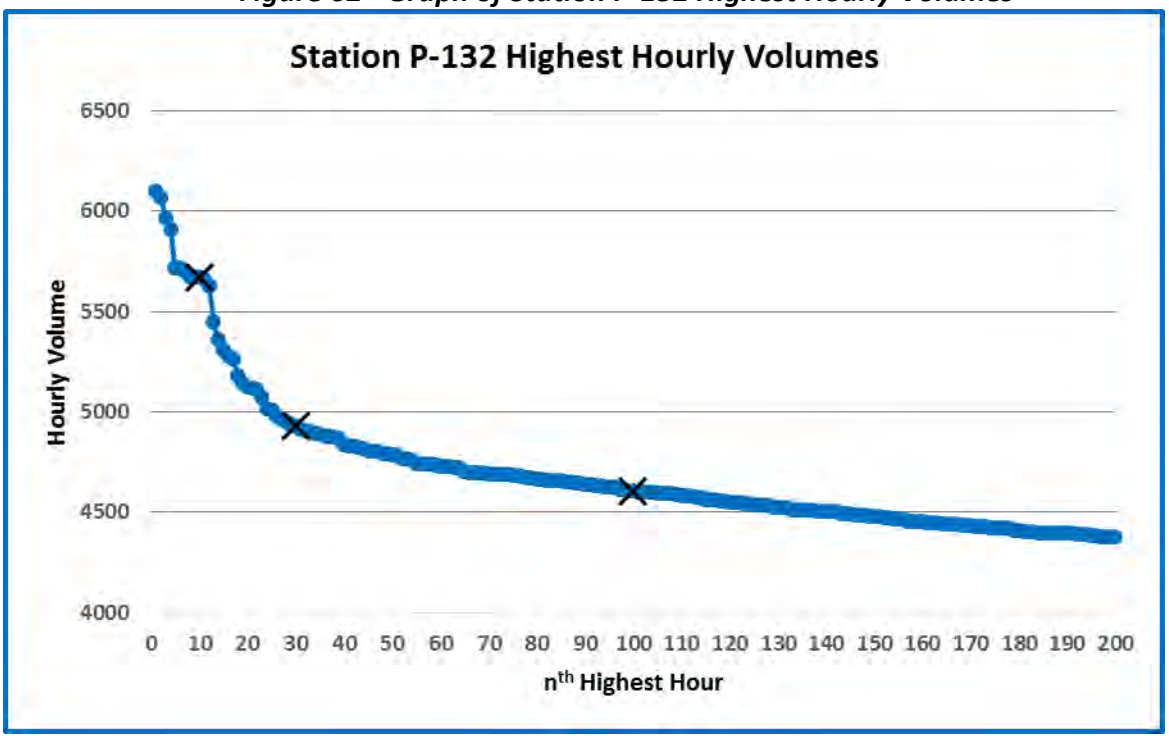


Figure 62 - Graph of Station P-132 Highest Hourly Volumes



Based on this data, the 30th highest design hour was chosen for use in the analysis for the PM Peak Hour mainline I-85 volume on the segments where the ATR are located.

To provide for the analysis of a comparable AM Peak Hour design volumes, the 100 highest hours occurring during the morning peak hour period between 7:00 AM and 10:00 AM were identified, and the 30th highest hour was selected to represent the AM Peak Hour mainline I-85 volume on the segments where ATR are located. The 100th highest hours of two-way traffic volumes during the morning peak period (7:00 to 10:00 AM) for each day at ATR Stations P-14 and P-132 are also included as part of an attachment in **Appendix F**.

The 30th highest annual ATR Volumes that will be used for the AM and PM design hour analysis are summarized in **Table 3**. These volumes include the design hour northbound and southbound volumes at each ATR station location, the segment AADT and the resulting K and D factors.

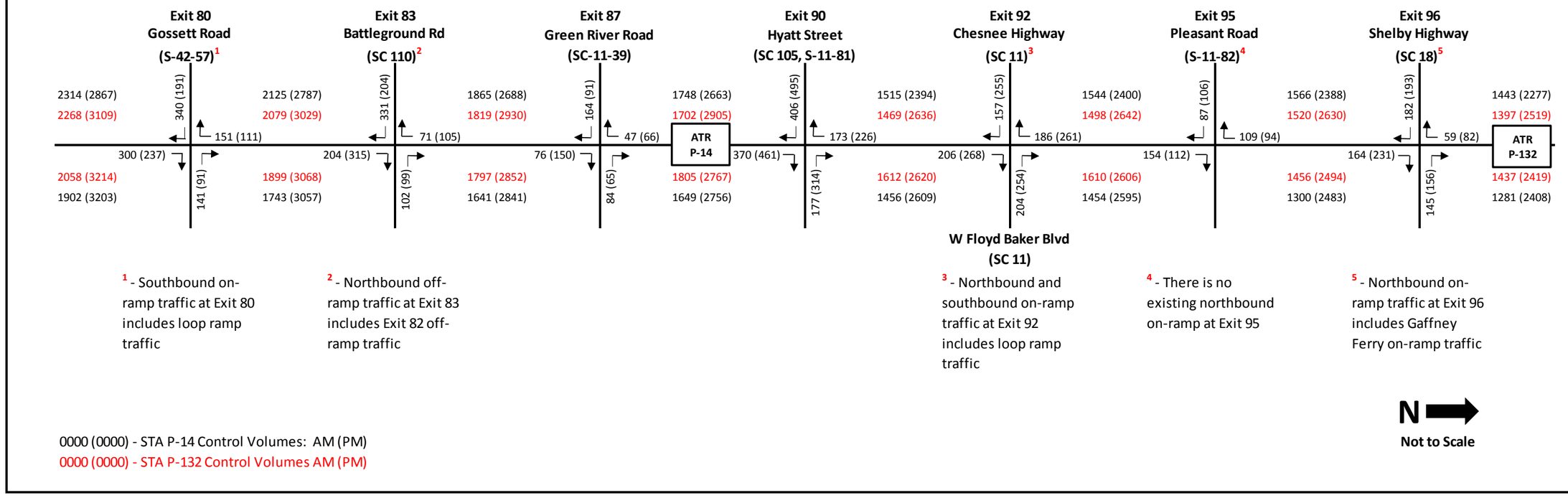
Table 3 - 30th Highest AM and PM Volumes

30th Highest Annual ATR Volumes						
ATR Station	AM Design Hour			PM Design Hour		
	NB	SB	TOTAL	NB	SB	TOTAL
ATR Station P-14	1,649	1,748	3,397	2,756	2,663	5,419
AADT 54,800	D = 51.5% SB		K = 6.2%	D = 50.9% NB		K = 9.9%
ATR Station P-132	1,409	1,397	2,806	2,412	2,519	4,931
AADT 43,200	D = 50.2% NB		K = 6.5%	D = 51.1% SB		K = 11.4%

The I-85 ramp volumes at the study area interchanges were developed based on the peak hour turning movement count data for each ramp intersection with the adjacent street network. The morning and afternoon peak hour volumes on the off- and on-ramp approaches to the intersections were used to establish the existing design peak hour ramp volumes.

Using the I-85 ramp volumes, the design hour volumes for each mainline segment were estimated using the 30th highest annual ATR volumes on the segments. Two sets of estimated freeway segment volumes were generated. The first used the 30th highest ATR volume from station P-14 as a "control" volume for AM and PM design hours. Starting with this volume along the segment located between Exits 87 to 90, the on-and off-ramp volumes were added and subtracted from the mainline volumes as appropriate throughout the study area to derive the design hour volumes for the other freeway segments. The second set of freeway segment volumes were derived holding the P-132 ATR station AM and PM design hours as the control volume for the segment located between Exits 96 to 100. These volumes are illustrated in **Figure 63**, with the P-14 ATR volumes shown in black and the P-132 ATR volumes shown in red.

Figure 63 - 2013 Ramp and Mainline Volume Comparison



The two sets of freeway volumes were compared. The highest volumes throughout the system were obtained by using the P-132 ATR design hour volumes as the control for the northbound morning and afternoon design hours and the southbound afternoon design hours. The P-14 ATR design hour volumes were highest only for the southbound morning design hour volumes.

The existing design hour volumes used in the analysis of the existing corridor are shown in **Figures 64 - 66**.

Figure 64 - Existing Design Hour Volumes (Exits 80-83)

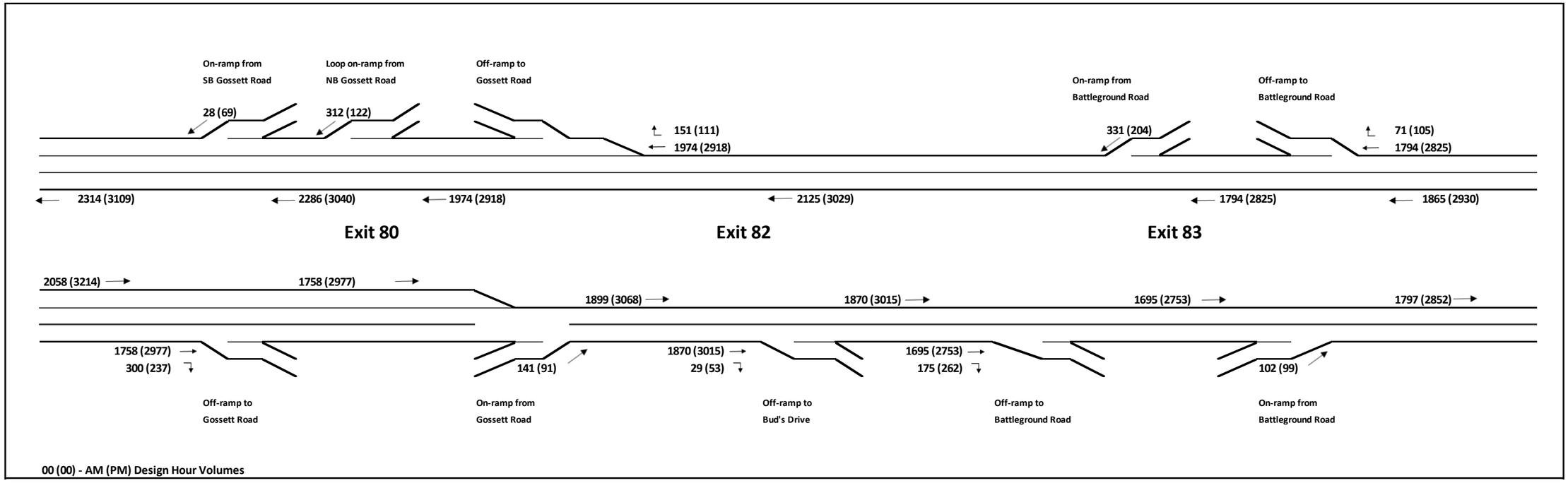


Figure 65 - Existing Design Hour Volumes (Exits 87-92)

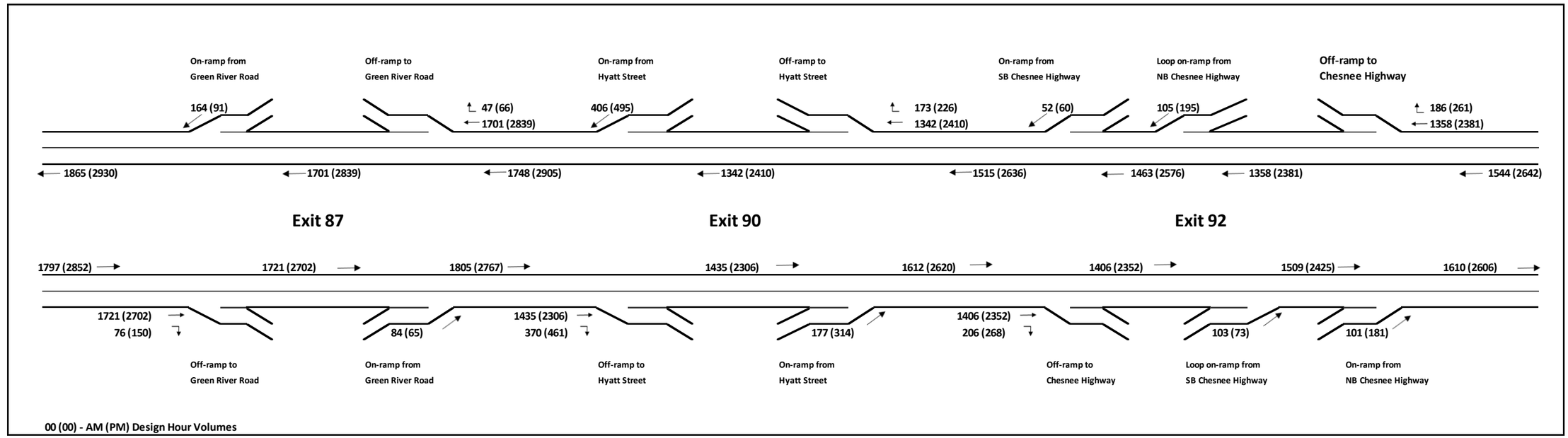
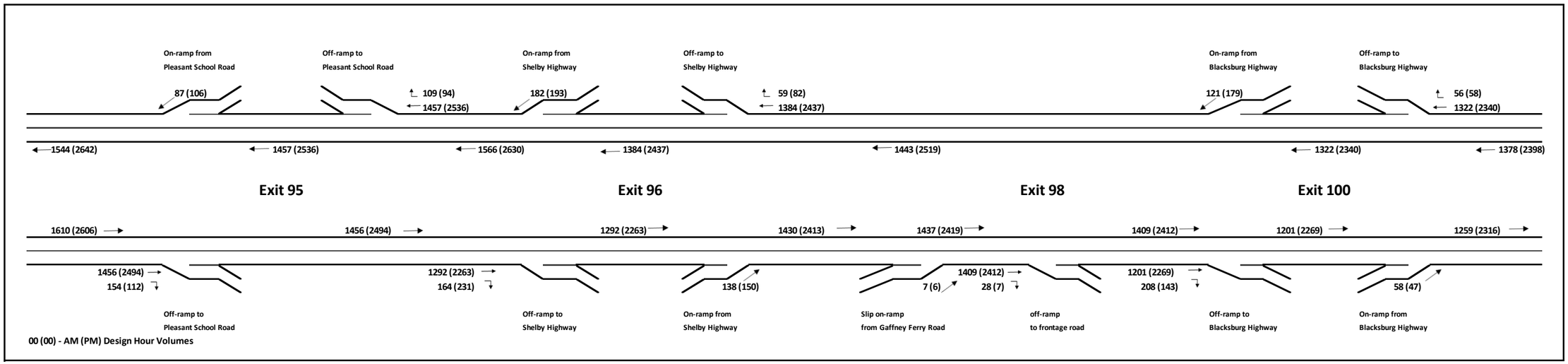


Figure 66 - Existing Design Hour Volumes (Exits 95-100)



Truck Percentages

Truck percentages were derived from the vehicle classification data provided by SCDOT at ATR Stations P-14 and P-132. The vehicle classification data is used to determine the heavy vehicle (trucks/buses) percentages to be used in the analysis. The P-14 data summarized traffic collected over a seven day period starting Sunday, June 1, 2008 and ending Saturday, June 7, 2008, which was the most recently available vehicle classification data at that count station. Two sets of vehicle classification counts were provided at station P-132. The first set was collected over a six day period starting on Wednesday, March 26, 2014 and ending on Monday, March 31, 2014. The second set of data was provided for a single day: Wednesday, November 12, 2014. The weekday truck percentage data are summarized in **Table 4**.

Table 4 - Observed Weekday Truck Percentages

I-85 Vehicle Classification Data Location	Date	Weekday Truck Percent		
		Peak	Off-Peak	Total
ATR 0014 (CHEROKEE COUNTY STA 2335)	Jun-2008	15.3%	22.2%	20.4%
ATR 0132 (CHEROKEE COUNTY STA 2343)	Mar-2014	14.5%	20.9%	19.3%
ATR 0132 (CHEROKEE COUNTY STA 2343)	Nov-2014	23.8%	30.2%	28.7%

Upon review of this data, and based upon concurrence with SCDOT, it was agreed that 25 percent would be used as the truck percentage throughout the analysis.

Traffic Projections

The growth rate of traffic within the corridor was estimated using two procedures. The first procedure evaluated the annual rate of change for the AADT between 1996 and 2013 for each freeway segment based on the SCDOT AADT station data. The second procedure evaluated the traffic assignments of the freeway segments in the South Carolina Statewide Travel Demand Model (SCSWM) 2010 and 2040 base networks.

AADT Evaluation

An evaluation of the historic AADT volumes for each of the segments within the study area was performed. The average annual rate of change in AADT on each of the segments was calculated for:

- The last five years of data available (2009 – 2013)
- The last ten years of data available (2004 – 2013).
- The last 18 years of available data (1996 – 2013)

The 2013, 2009, 2004 and 1996 AADT for each of the segments are shown in **Table 5**.

Table 5 - Historic Freeway Segment AADT

I-85 Segment Number	I-85 Segment Description	2013 AADT	2009 AADT	2004 AADT	1996 AADT
Segment 1	I-85 (Exit 80 to Exit 83) FROM S- 57 TO SC 110 SPARTANBURG COUNTY STA 2331	58,600	56,400	55,100	43,600
Segment 2	I-85 (Exit 83 to Exit 87) FROM SC 110 TO S- 39 (CHEROKEE) SPARTANBURG COUNTY STA 2333	55,500	53,600	52,500	44,000
Segment 3	I-85 (Exit 87 to Exit 90) FROM S- 39 TO SC 105, S- 81 CHEROKEE COUNTY STA 2335	54,800	52,800	51,600	43,700
Segment 4	I-85 (Exit 90 to Exit 92) FROM SC 105, S- 81 TO SC 11 CHEROKEE COUNTY STA 2337	48,600	49,300	47,700	41,000
Segment 5	I-85 (Exit 92 to Exit 95) FROM SC 11 TO S- 82 CHEROKEE COUNTY STA 2339	48,300	50,100	48,600	41,500
Segment 6	I-85 (Exit 95 to Exit 96) FROM S- 82 TO SC 18 CHEROKEE COUNTY STA 2341	46,400	48,500	47,100	38,400
Segment 7	I-85 (Exit 96 to Exit 100) FROM SC 18 TO S- 83 CHEROKEE COUNTY STA 2343	43,200	46,900	45,600	39,500

The annual average rate of change in the AADT is shown in **Table 6**.

Table 6 - Average Annual Percentage Change in AADT

I-85 Segment Number	I-85 Segment Description	2009-2013 Annual Rate (%)	2004-2013 Annual Rate (%)	1996-2013 Annual Rate (%)
Segment 1	I-85 (Exit 80 to Exit 83) FROM S- 57 TO SC 110 SPARTANBURG COUNTY STA 2331	0.77	0.62	1.66
Segment 2	I-85 (Exit 83 to Exit 87) FROM SC 110 TO S- 39 (CHEROKEE) SPARTANBURG COUNTY STA 2333	0.70	0.56	1.30
Segment 3	I-85 (Exit 87 to Exit 90) FROM S- 39 TO SC 105, S- 81 CHEROKEE COUNTY STA 2335	0.75	0.60	1.27
Segment 4	I-85 (Exit 90 to Exit 92) FROM SC 105, S- 81 TO SC 11 CHEROKEE COUNTY STA 2337	-0.29	0.19	0.95
Segment 5	I-85 (Exit 92 to Exit 95) FROM SC 11 TO S- 82 CHEROKEE COUNTY STA 2339	-0.73	-0.06	0.85
Segment 6	I-85 (Exit 95 to Exit 96) FROM S- 82 TO SC 18 CHEROKEE COUNTY STA 2341	-0.88	-0.15	1.06
Segment 7	I-85 (Exit 96 to Exit 100) FROM SC 18 TO S- 83 CHEROKEE COUNTY STA 2343	-1.63	-0.54	0.50

The average annual five-year rate of change in the segment volumes based on the AADT ranged from -1.63 to 0.77 percent per year. The average annual ten-year rate of change in the segment volumes ranged from -0.54 to 0.62 percent per year. In these time periods, traffic in the three southernmost segments of the study area between exits 80 and 90 averaged less than one percent growth per year. The annual growth was generally declining in the northernmost segments.

The average annual growth rate between 1996 and 2013 was assessed. The average rate of growth was positive throughout the corridor, ranging from 0.5 to 1.30 percent per year, with the exception of the southernmost segment, which experienced an average annual rate of growth of 1.66 percent.

The annual percentage change in the AADT were reviewed for each segment. Between 1997 and 2007, the AADT on each segment tended to increase in every year, with generally three or fewer instances where the AADT was lower than the previous year's AADT. Over the six years beginning in 2008, which coincided with the recession and downturn in the national economy, the AADT on individual segments decreased in three to five of the six years. The average annual growth rate in AADT on the study area freeway segments since the start of the 2008 recession ranges from -1.84 percent to 0.09 percent per year.

Beginning in 2008, the AADT on all of the segments has only twice slightly exceeded the 2007 AADT. For the segment between Exits 80 and 83, the 2007 AADT (58,300) was exceeded only in 2010 (58,400) and in 2013 (58,600). On all other segments, the 2007 AADT was higher than the subsequent AADT from 2008 through 2013.

Despite the recent trends, the historic data since 1996 indicates that it not likely for traffic growth to remain flat or in decline in the I-85 corridor through 2040.

SCSWM Projection Evaluation

Traffic assignments for the 2010 and 2040 base SCSWM networks were obtained from the model. The average annual growth rate for each of the segments was calculated as shown in **Table 7**.

Table 7 - Statewide Model Projection Growth Rates

I-85 Segment Number	I-85 Segment Description	2010 SCSWM Projection	2040 SCSWM Projection	2010-2040 Annual Rate (%)
Segment 1	I-85 (Exit 80 to Exit 83) FROM S- 57 TO SC 110 SPARTANBURG COUNTY STA 2331	70,100	96,000	1.02
Segment 2	I-85 (Exit 83 to Exit 87) FROM SC 110 TO S- 39 (CHEROKEE) SPARTANBURG COUNTY STA 2333	62,100	88,500	1.15
Segment 3	I-85 (Exit 87 to Exit 90) FROM S- 39 TO SC 105, S- 81 CHEROKEE COUNTY STA 2335	62,500	88,800	1.14
Segment 4	I-85 (Exit 90 to Exit 92) FROM SC 105, S- 81 TO SC 11 CHEROKEE COUNTY STA 2337	57,100	79,500	1.07
Segment 5	I-85 (Exit 92 to Exit 95) FROM SC 11 TO S- 82 CHEROKEE COUNTY STA 2339	60,200	84,400	1.10
Segment 6	I-85 (Exit 95 to Exit 96) FROM S- 82 TO SC 18 CHEROKEE COUNTY STA 2341	61,700	82,500	0.94
Segment 7	I-85 (Exit 96 to Exit 100) FROM SC 18 TO S- 83 CHEROKEE COUNTY STA 2343	62,700	71,400	0.42

The projected SCSWM growth rates on the individual segments ranged from between 0.42 and 1.14 percent per year.

A proposed average annual growth rate was estimated based on a comparison of the AADT average annual growth rates (for 1996 and 2013) and the SCSWM average annual growth rates for each of the segments. This proposed growth rate would be applied to all mainline, ramp and arterial turning movement volumes within the study area to generate the design year peak hour volumes for use in the alternatives analysis. In setting the growth rate, an annual percentage that is comparable to, but higher than the observed growth rates is often desirable so a conservative analysis of future traffic conditions may be attained.

A comparison of the growth rates derived from the historic AADT data and the SCSWM projections is shown in **Table 8**. Many of the segments in the study area had estimated growth rates exceeding 1.0 percent per year. Several of the rates estimated using the historic data exceeded 1.25 percent per year. Only the growth rate for the southernmost segment (between Exits 80 and 83) exceeded 1.5 percent per year based on the historic AADT, while the SCSWM projected rate for this segment was approximately 1.0 percent per year. ***Based on these estimates, an average annual growth rate of 1.5 percent per year was selected to be applied to develop the design year volumes throughout the study area.*** An annual growth rate of 1.5 percent per year would provide a conservative estimate of future traffic volumes on all freeway segments in the study area.

Table 8 - Comparison of Growth Rate Projections

I-85 Segment Number	I-85 Segment Description	1996-2013 Annual Rate (%)	2010-2040 SCSWM Annual Rate (%)	Projected Annual Growth Rate (%)
Segment 1	I-85 (Exit 80 to Exit 83) FROM S- 57 TO SC 110 SPARTANBURG COUNTY STA 2331	1.66	1.02	1.50
Segment 2	I-85 (Exit 83 to Exit 87) FROM SC 110 TO S- 39 (CHEROKEE) SPARTANBURG COUNTY STA 2333	1.30	1.15	1.50
Segment 3	I-85 (Exit 87 to Exit 90) FROM S- 39 TO SC 105, S- 81 CHEROKEE COUNTY STA 2335	1.27	1.14	1.50
Segment 4	I-85 (Exit 90 to Exit 92) FROM SC 105, S- 81 TO SC 11 CHEROKEE COUNTY STA 2337	0.95	1.07	1.50
Segment 5	I-85 (Exit 92 to Exit 95) FROM SC 11 TO S- 82 CHEROKEE COUNTY STA 2339	0.85	1.10	1.50
Segment 6	I-85 (Exit 95 to Exit 96) FROM S- 82 TO SC 18 CHEROKEE COUNTY STA 2341	1.06	0.94	1.50
Segment 7	I-85 (Exit 96 to Exit 100) FROM SC 18 TO S- 83 CHEROKEE COUNTY STA 2343	0.50	0.42	1.50

I-85 Traffic Volume Data – 2040 Design Hour Volumes

The 1.5 percent per year growth rate was applied to the freeway and ramp traffic to develop projections of the 2040 Design Hour Traffic Volumes. The estimated freeway segment AADT for the 2040 Design Year using this growth rate is summarized in **Table 9**.

Table 9 - Estimated 2040 Freeway Segment AADT

I-85 Segment Number	I-85 Segment Description	2013 AADT	Projected Annual Growth Rate	Estimated 2040 AADT
Segment 1	I-85 (Exit 80 to Exit 83) FROM S- 57 TO SC 110 SPARTANBURG COUNTY STA 2331	58,600	1.5%	87,600
Segment 2	I-85 (Exit 83 to Exit 87) FROM SC 110 TO S- 39 (CHEROKEE) SPARTANBURG COUNTY STA 2333	55,500	1.5%	83,000
Segment 3	I-85 (Exit 87 to Exit 90) FROM S- 39 TO SC 105, S- 81 CHEROKEE COUNTY STA 2335	54,800	1.5%	81,900
Segment 4	I-85 (Exit 90 to Exit 92) FROM SC 105, S- 81 TO SC 11 CHEROKEE COUNTY STA 2337	48,600	1.5%	72,600
Segment 5	I-85 (Exit 92 to Exit 95) FROM SC 11 TO S- 82 CHEROKEE COUNTY STA 2339	48,300	1.5%	72,200
Segment 6	I-85 (Exit 95 to Exit 96) FROM S- 82 TO SC 18 CHEROKEE COUNTY STA 2341	46,400	1.5%	69,400
Segment 7	I-85 (Exit 96 to Exit 100) FROM SC 18 TO S- 83 CHEROKEE COUNTY STA 2343	43,200	1.5%	64,600

The 2040 design hour volumes for the study area are shown in **Figures 67 - 69**.

Figure 67 - 2040 Design Hour Volumes (Exits 80-83)

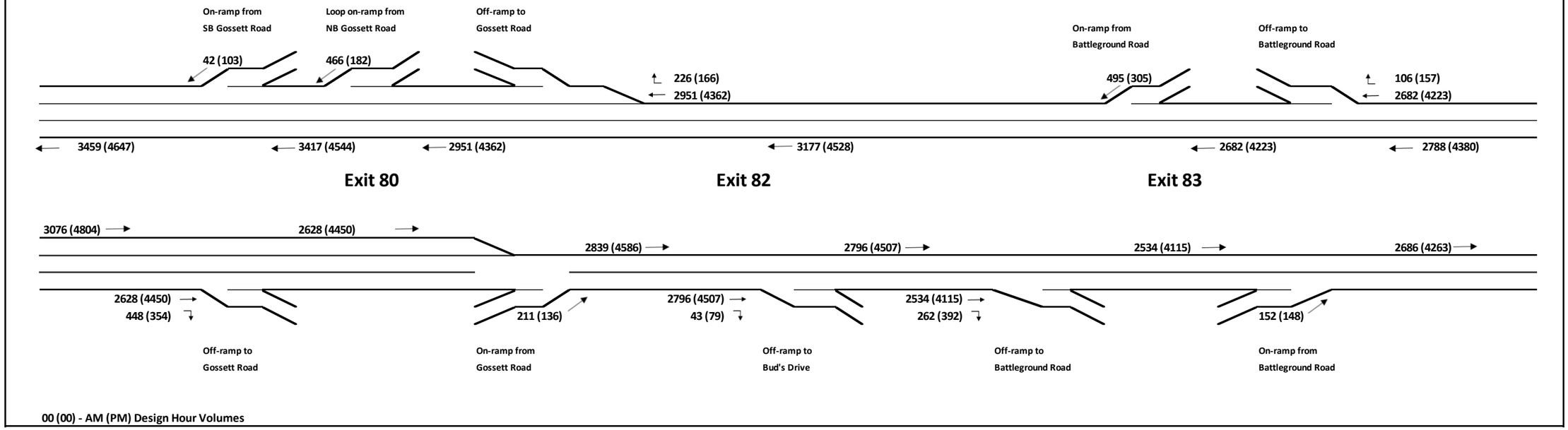


Figure 68 - 2040 Design Hour Volumes (Exits 87-92)

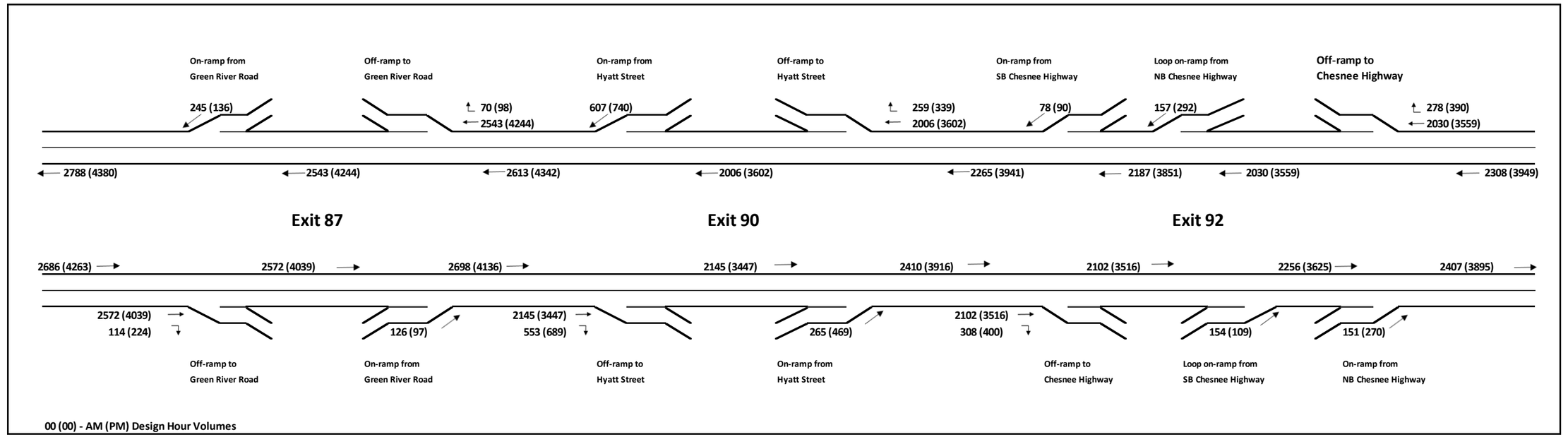
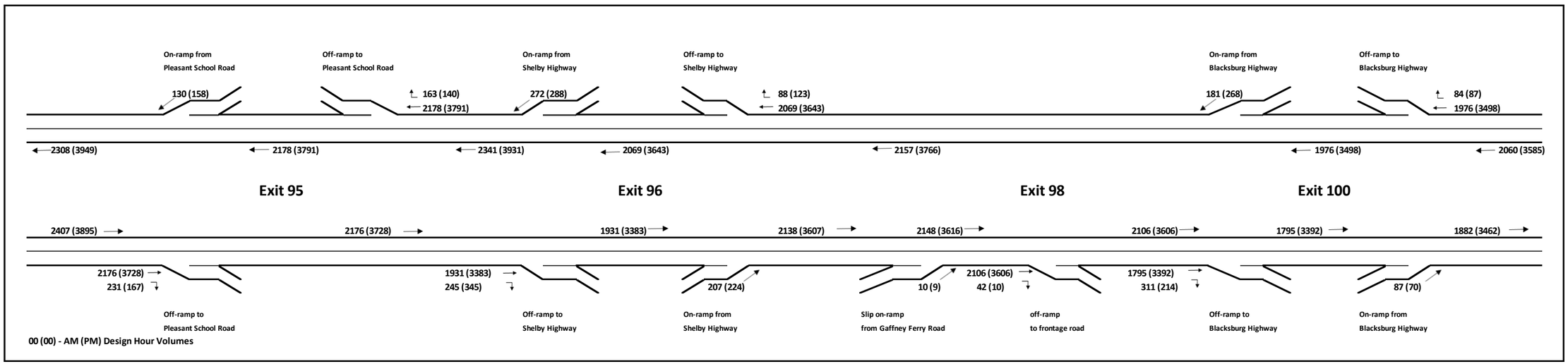


Figure 69 - 2040 Design Hour Volumes (Exits 95-100)



Intersection Traffic Volume Data – Existing Peak Hour Volumes

The turning movement traffic count data obtained from SCDOT and from the additional counts were evaluated and reviewed. The morning and afternoon peak hour volumes at each of the ramp termini and the adjacent intersections at each interchange were identified and the traffic balanced between intersections. The balanced morning and afternoon peak hour volumes for the interchanges are shown in **Figures 70** through **78**.

Turning movement volumes for the 2040 design year were derived by applying the 1.5 percent annual growth rate to the existing turning movement volumes at the various intersections. The 2040 estimated peak hour turning movement volumes shown on the existing (no-build) network at each interchange are shown in **Figures 79** to **87**.

Figure 70 – Existing Peak Hour Turning Movement Volumes: Exit 80

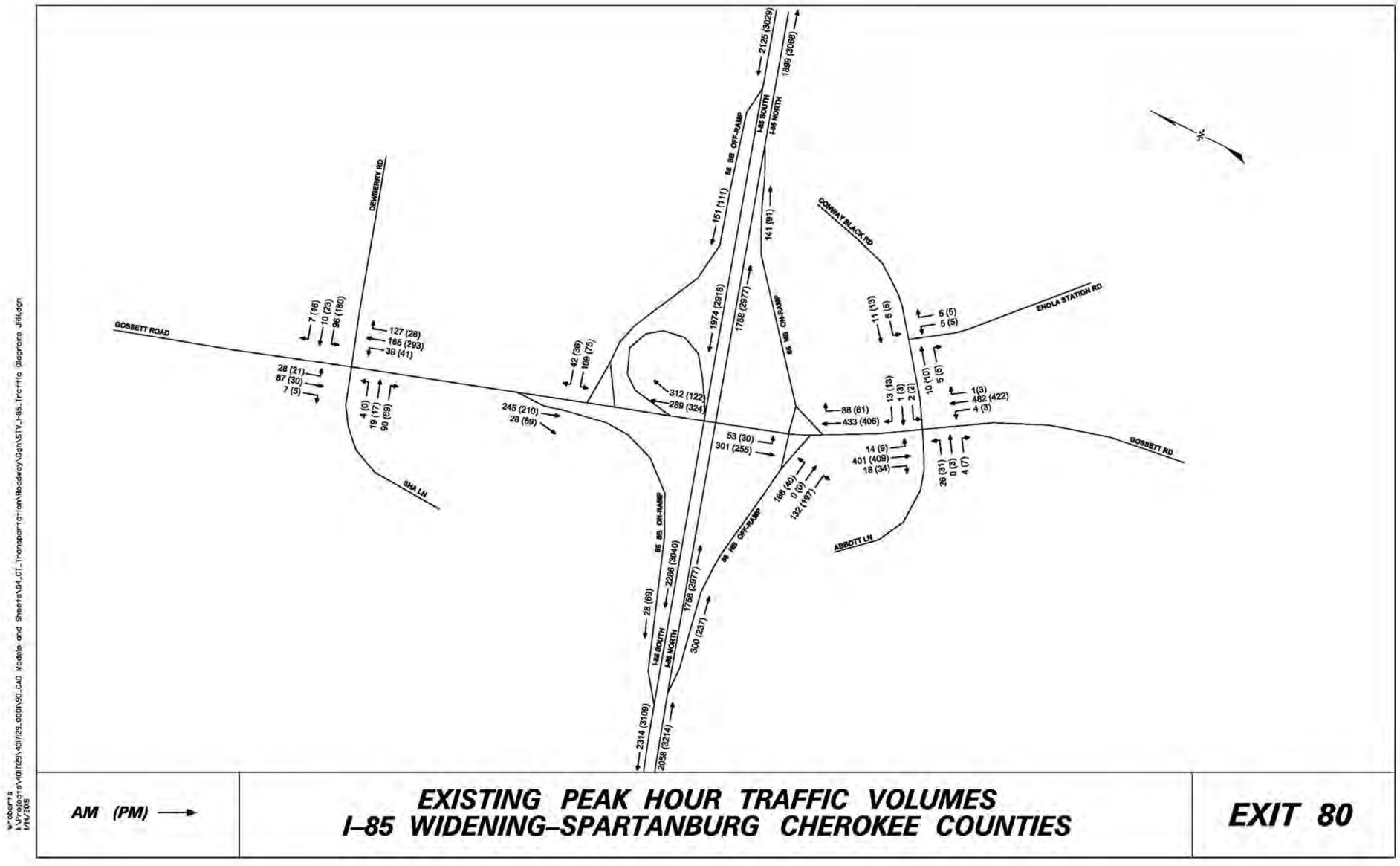


Figure 71 - Existing Peak Hour Turning Movement Volumes: Exit 82

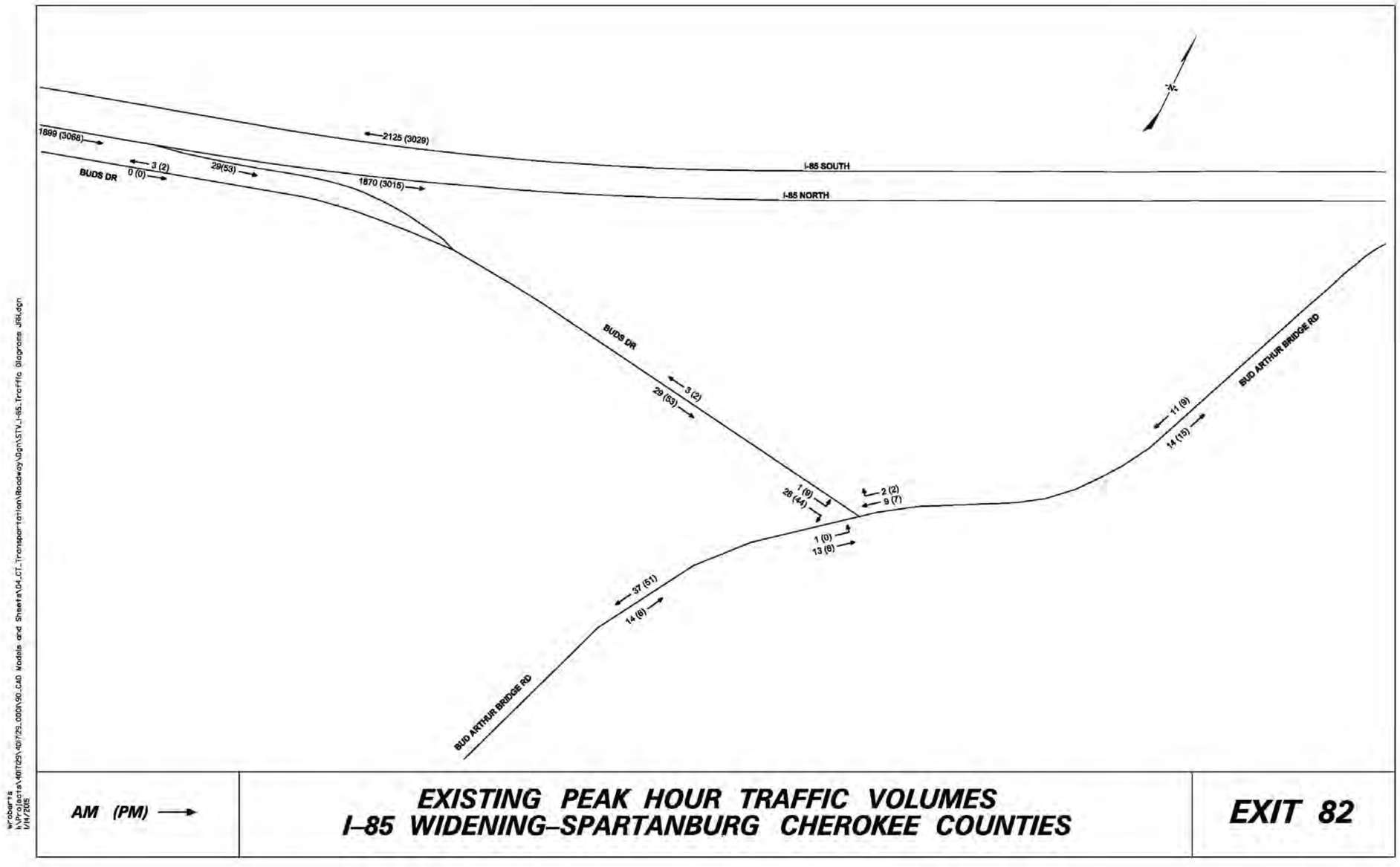


Figure 72 - Existing Peak Hour Turning Movement Volumes: Exit 83

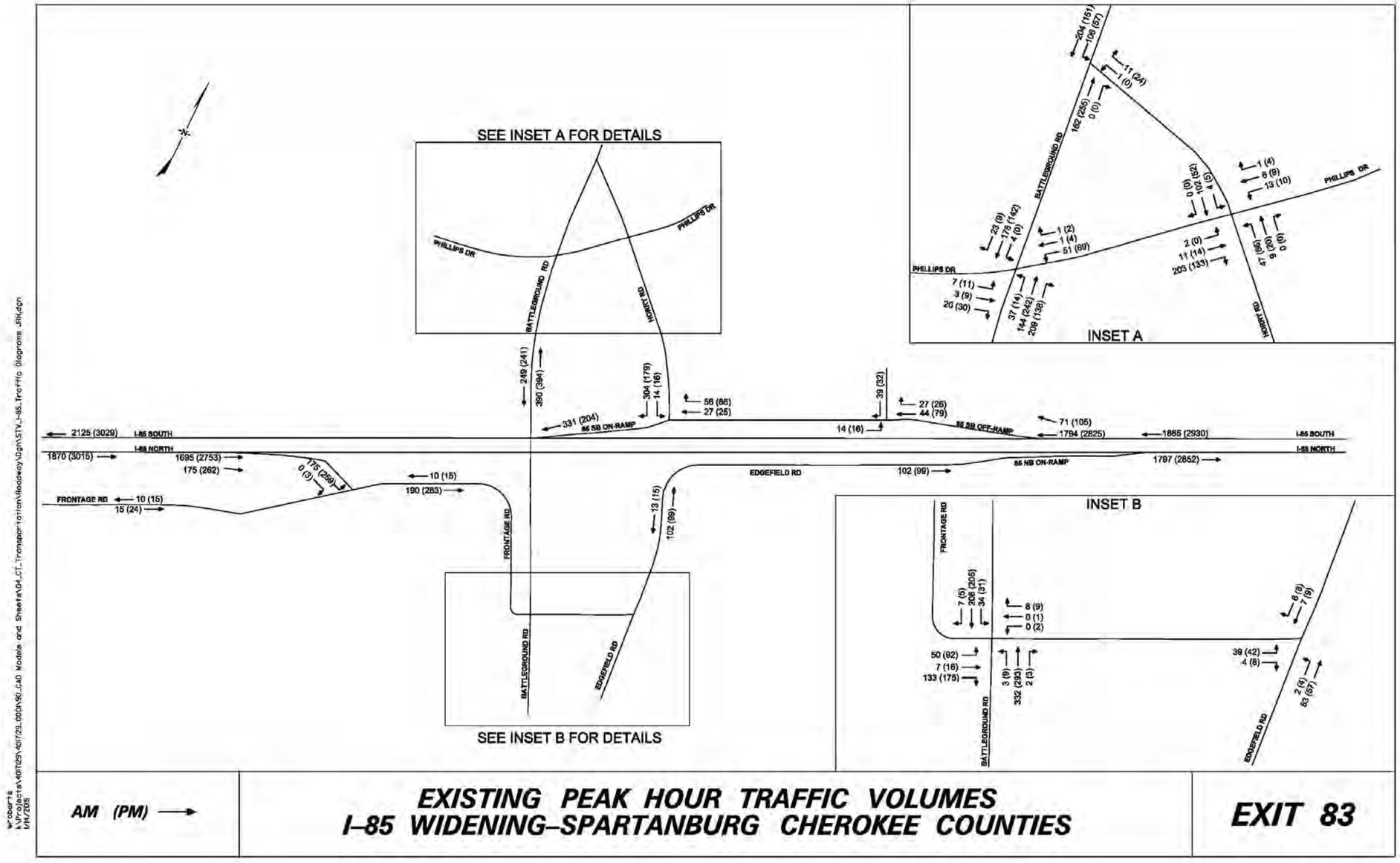


Figure 73 - Existing Peak Hour Turning Movement Volumes: Exit 87

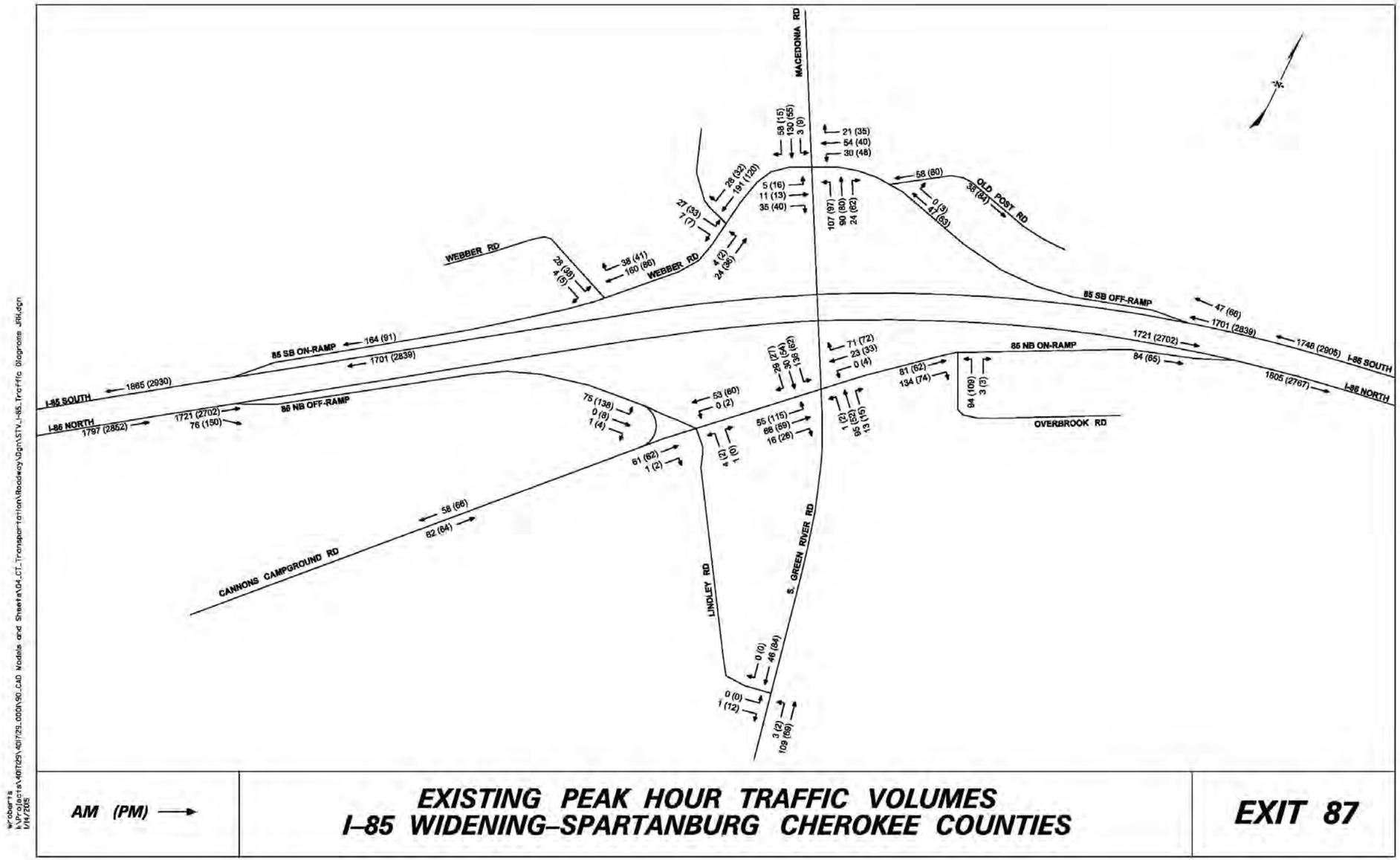


Figure 74 - Existing Peak Hour Turning Movement Volumes: Exit 90

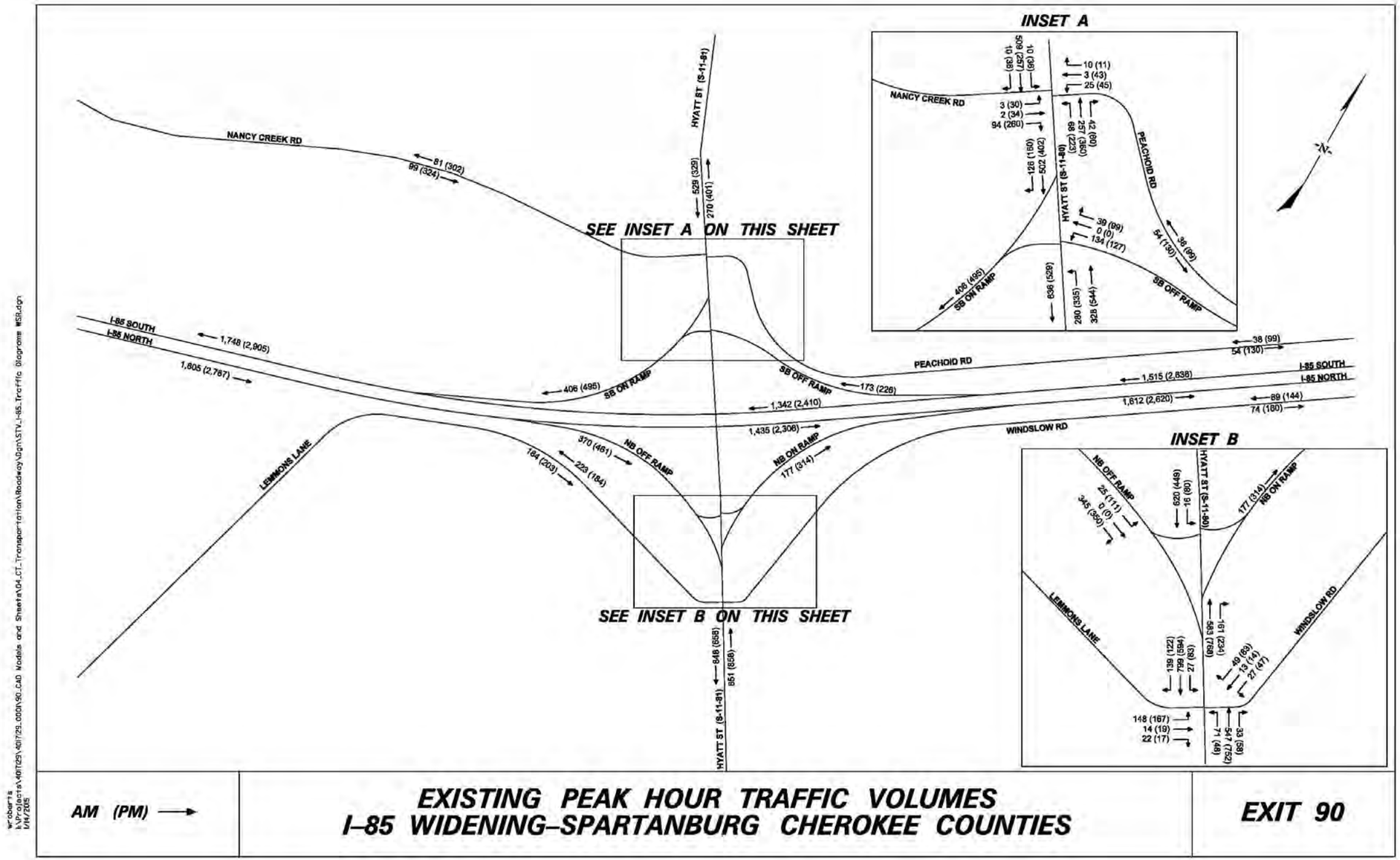


Figure 75 - Existing Peak Hour Turning Movement Volumes: Exit 92

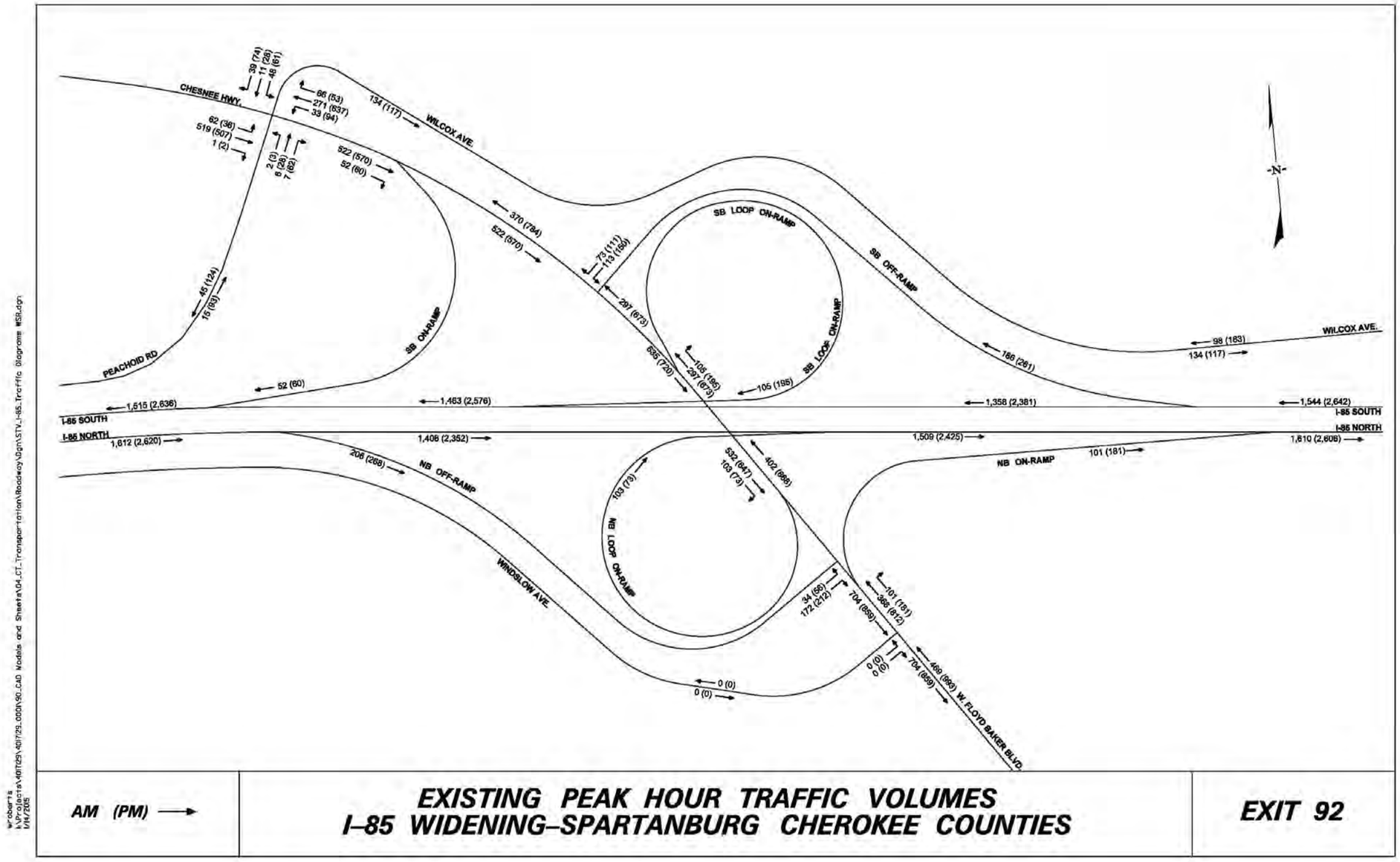


Figure 76 - Existing Peak Hour Turning Movement Volumes: Exit 95

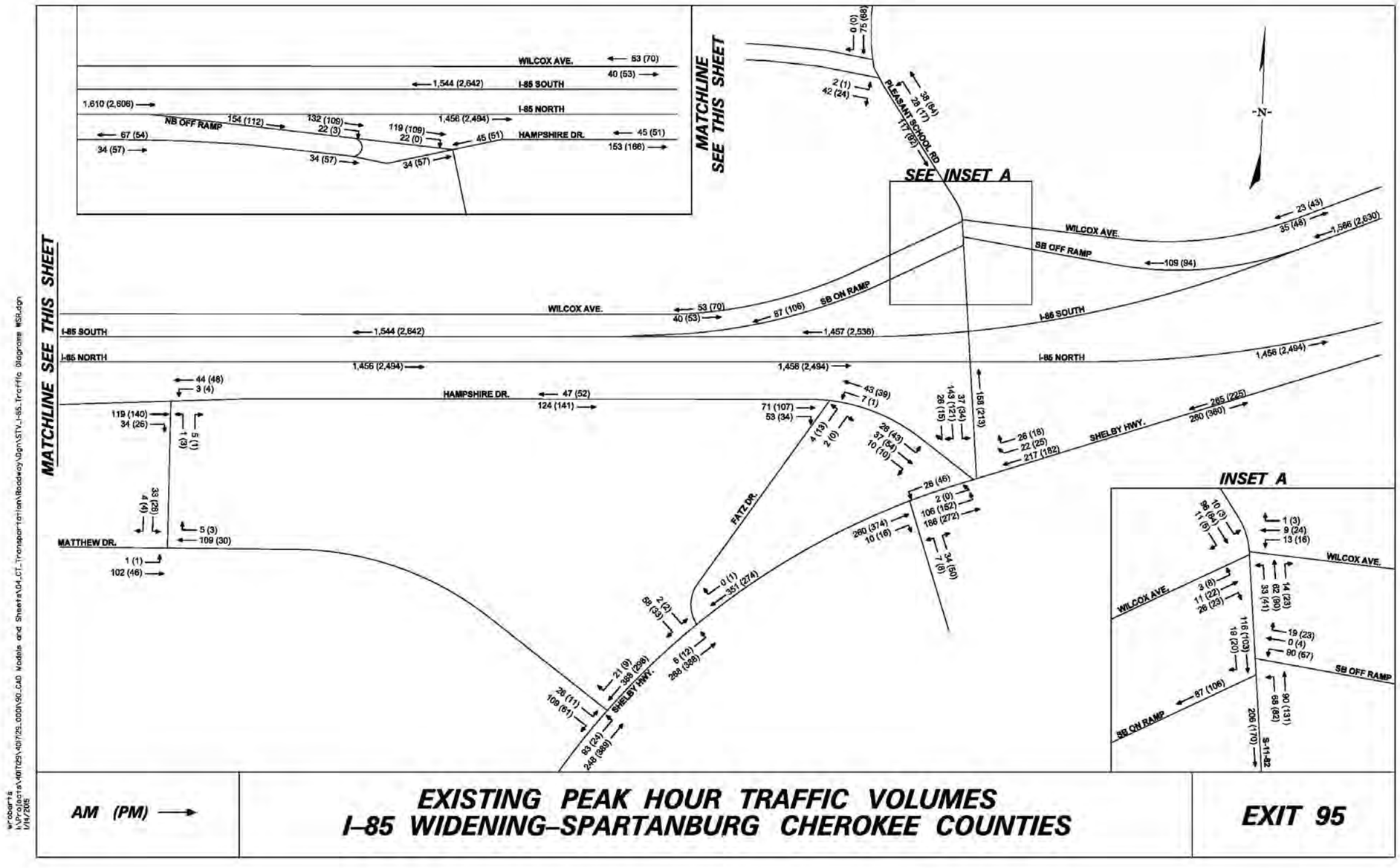


Figure 77 - Existing Peak Hour Turning Movement Volumes: Exit 96

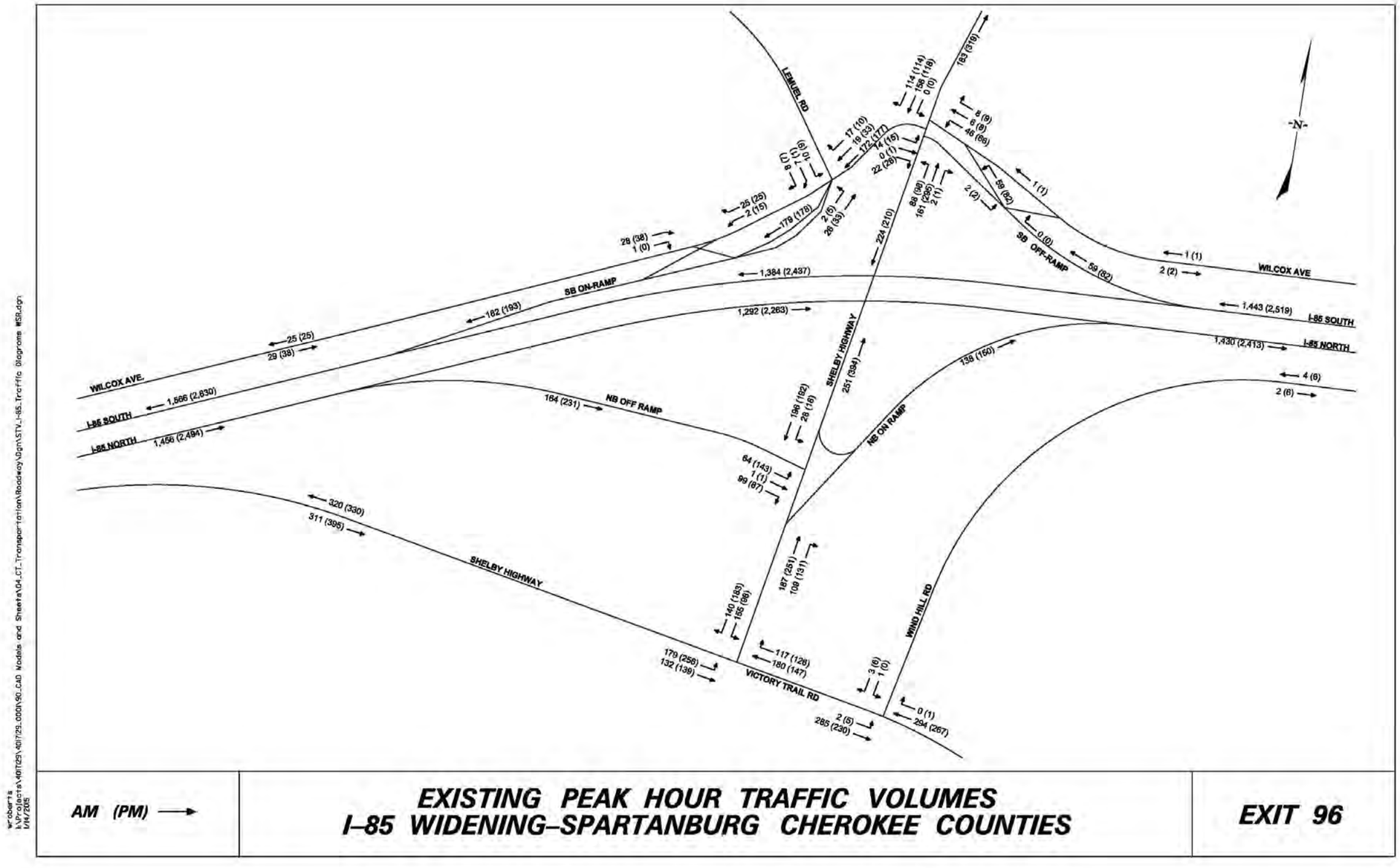


Figure 78 - Existing Peak Hour Turning Movement Volumes: Exit 100

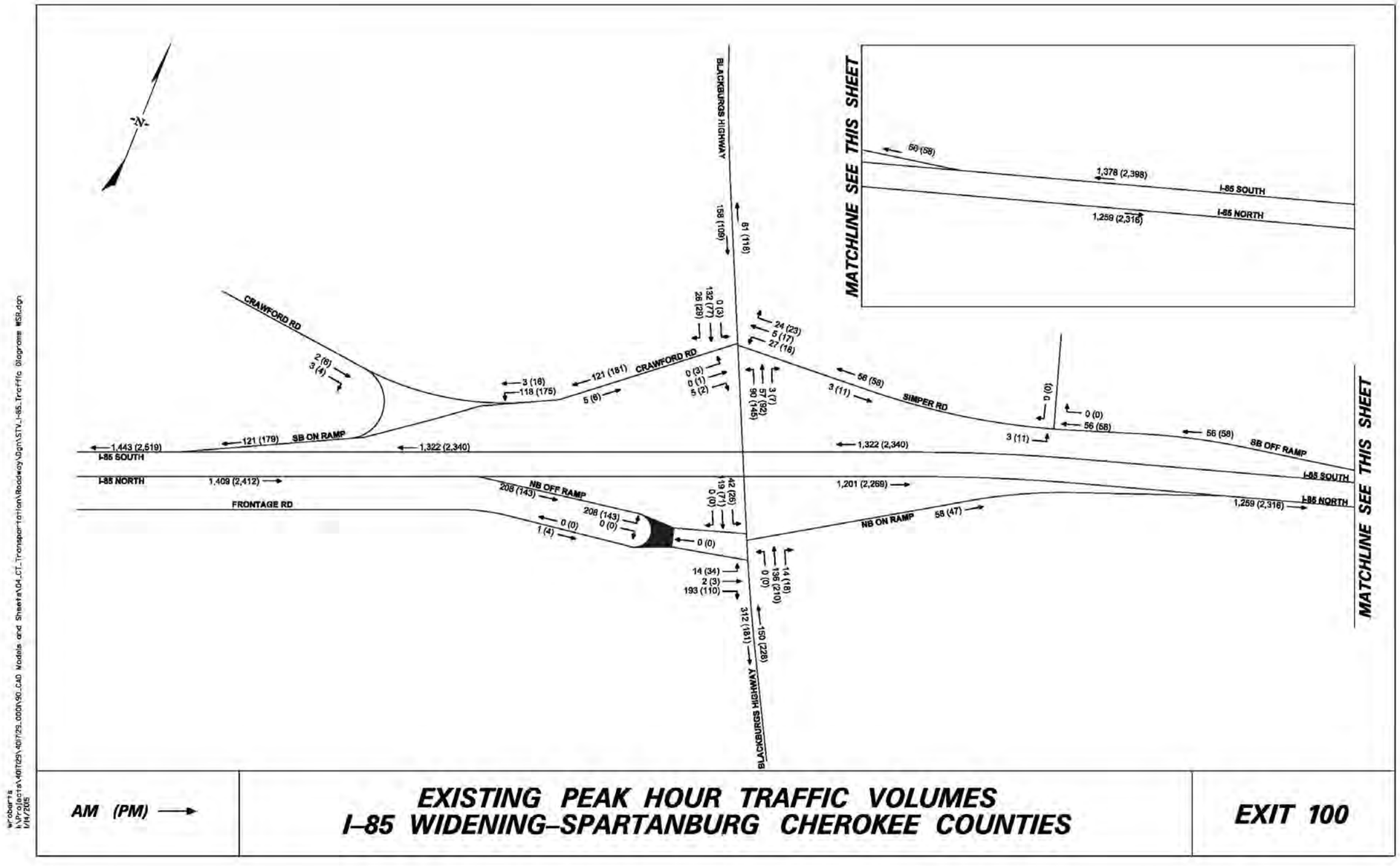


Figure 79 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 80

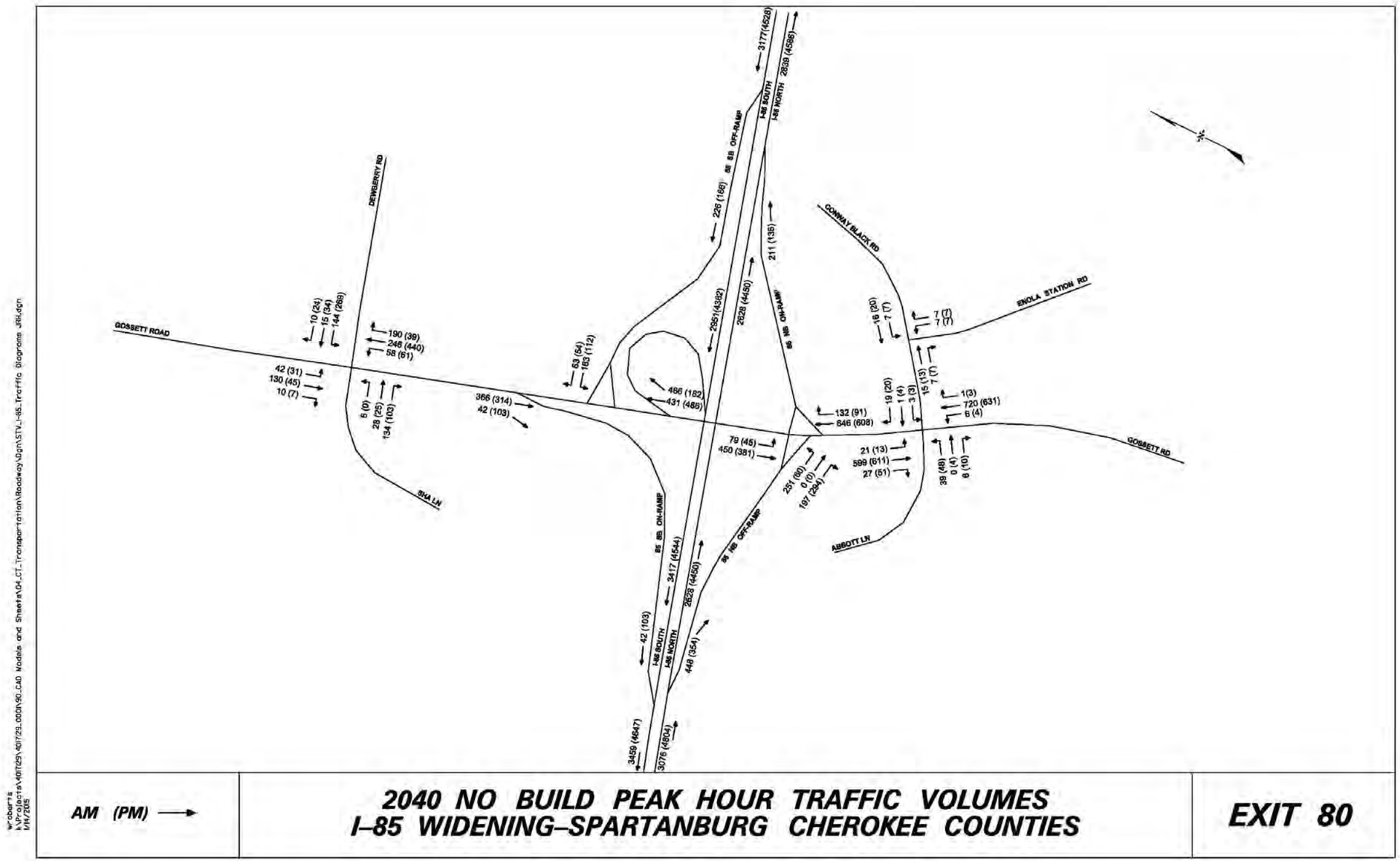


Figure 80 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 82

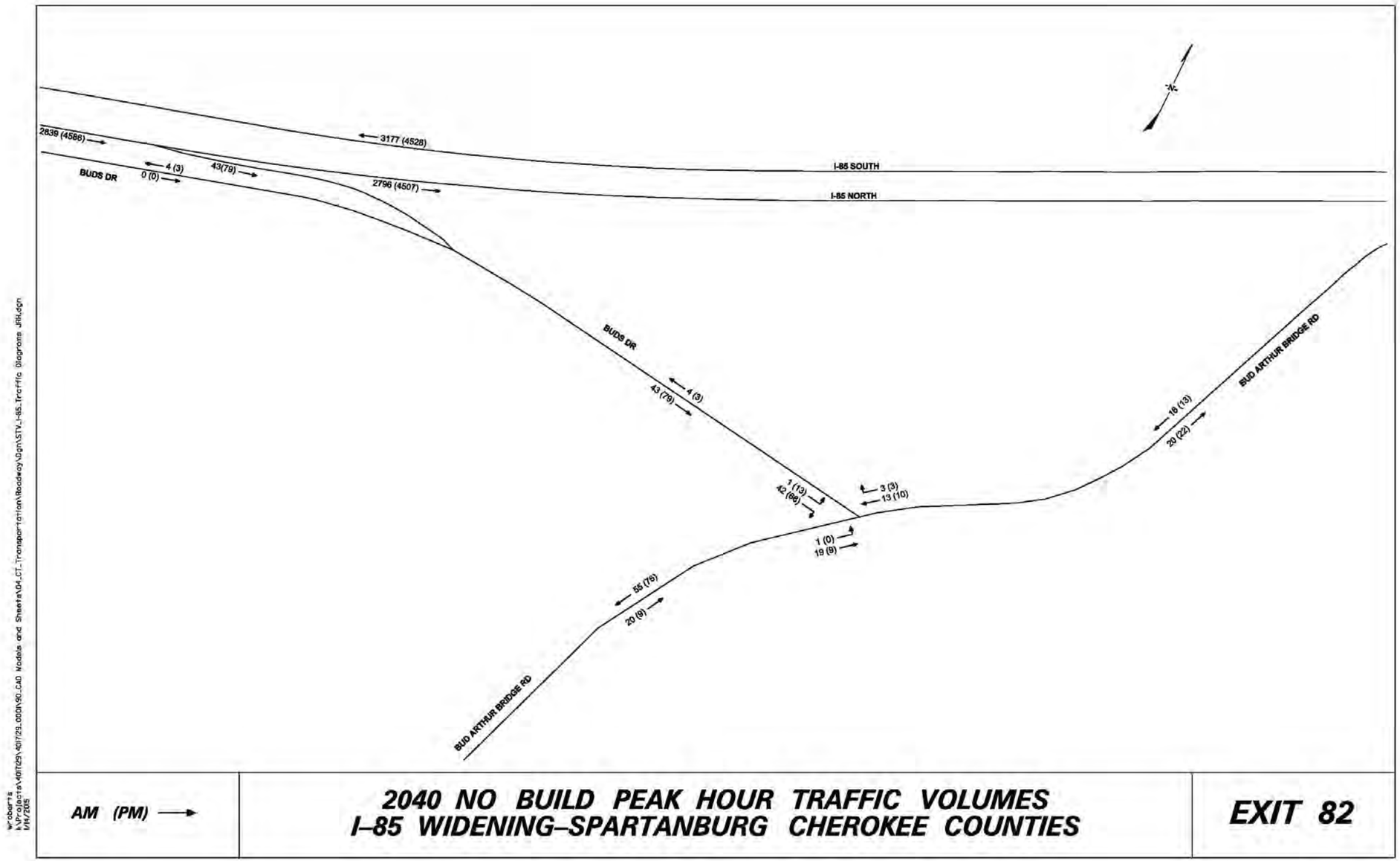


Figure 81 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 83

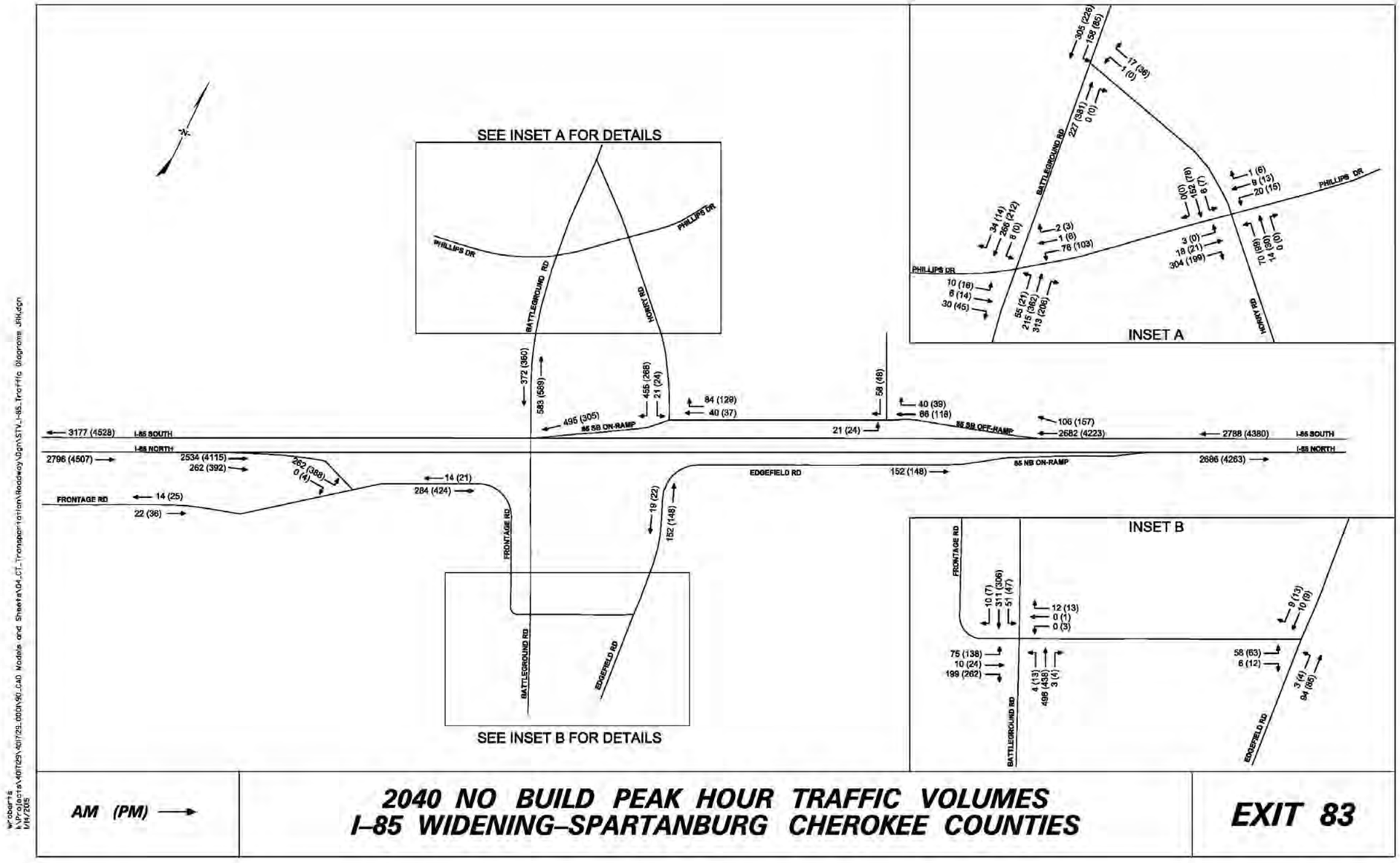


Figure 82 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 87

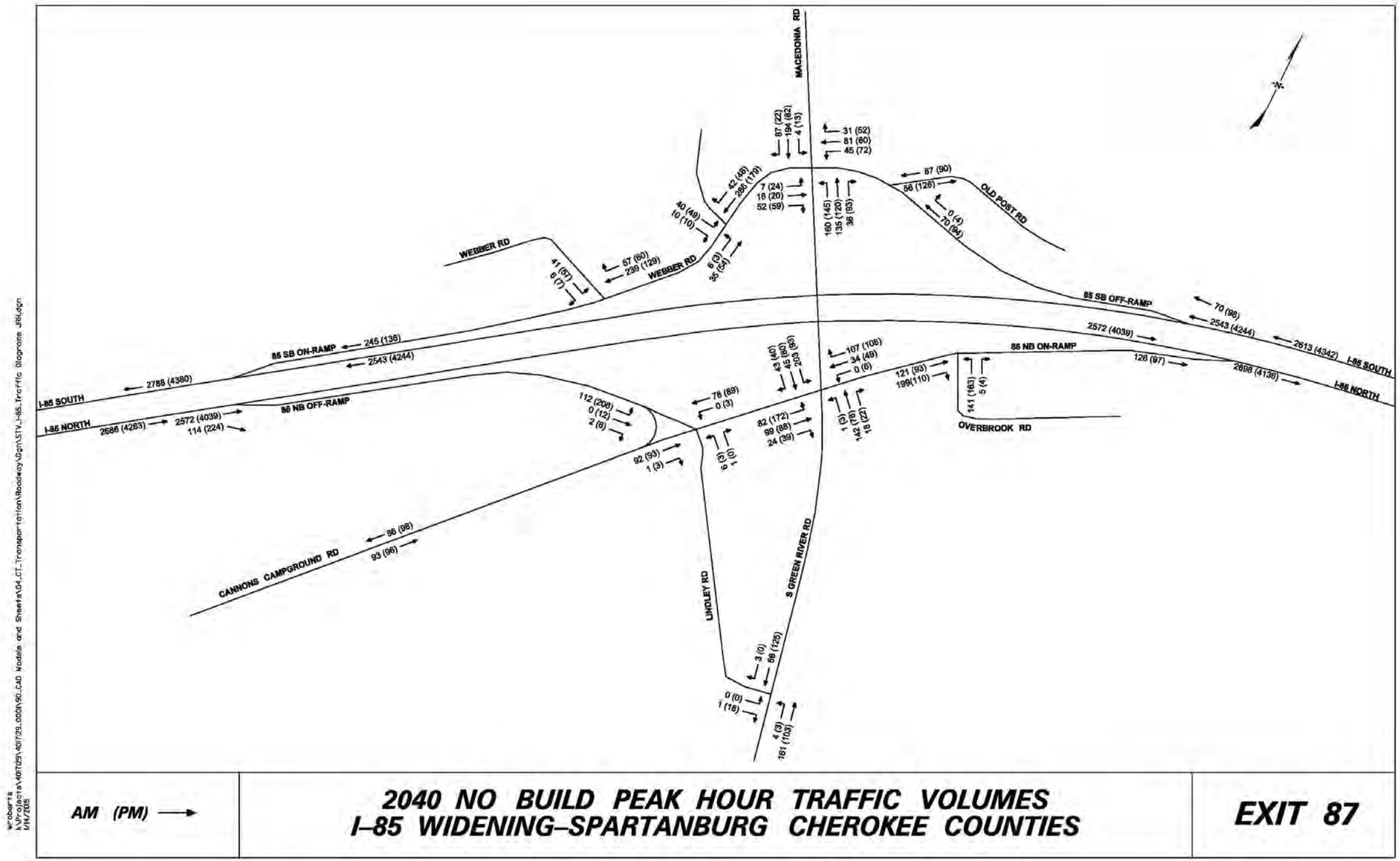


Figure 83 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 90

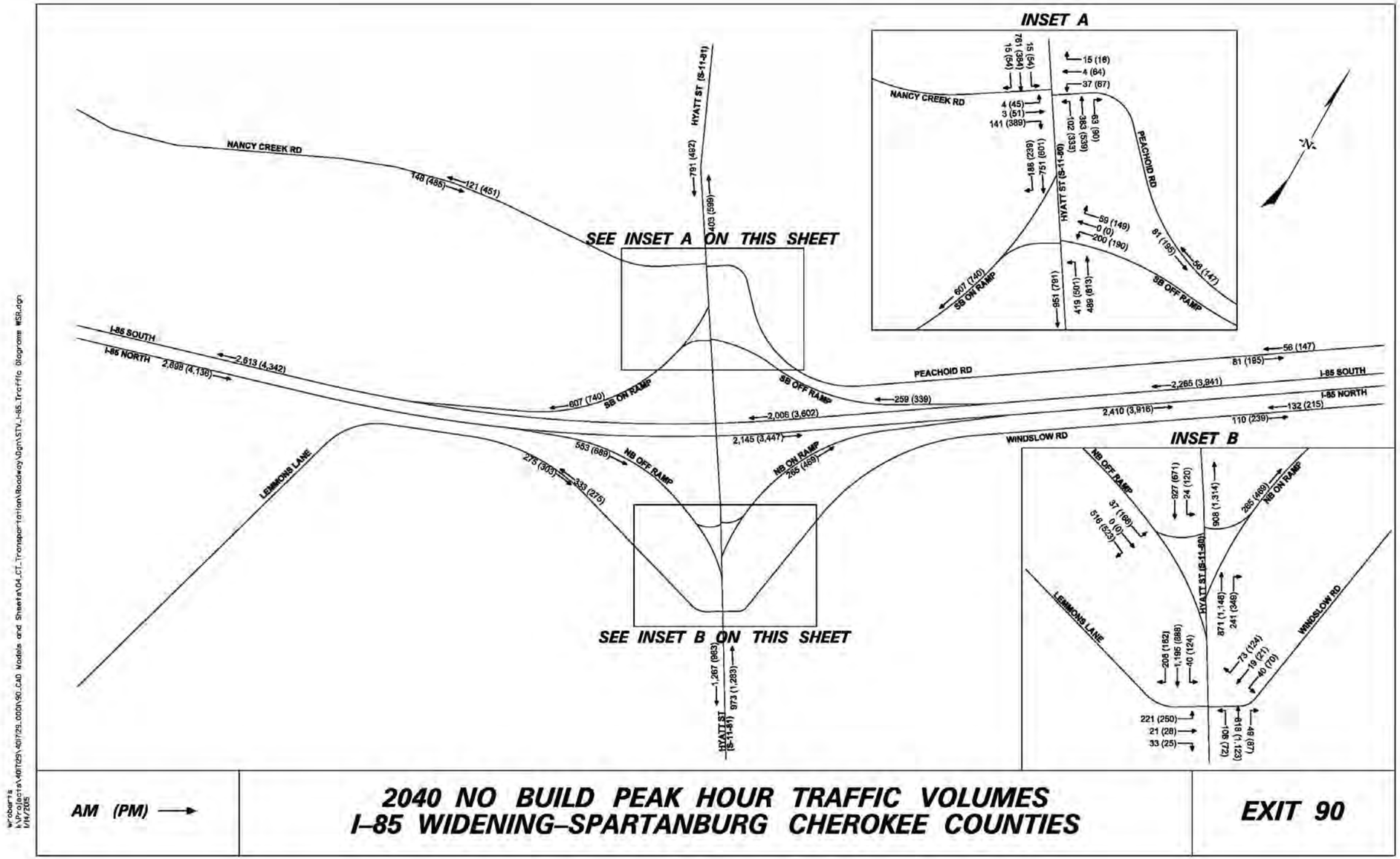


Figure 84 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 92

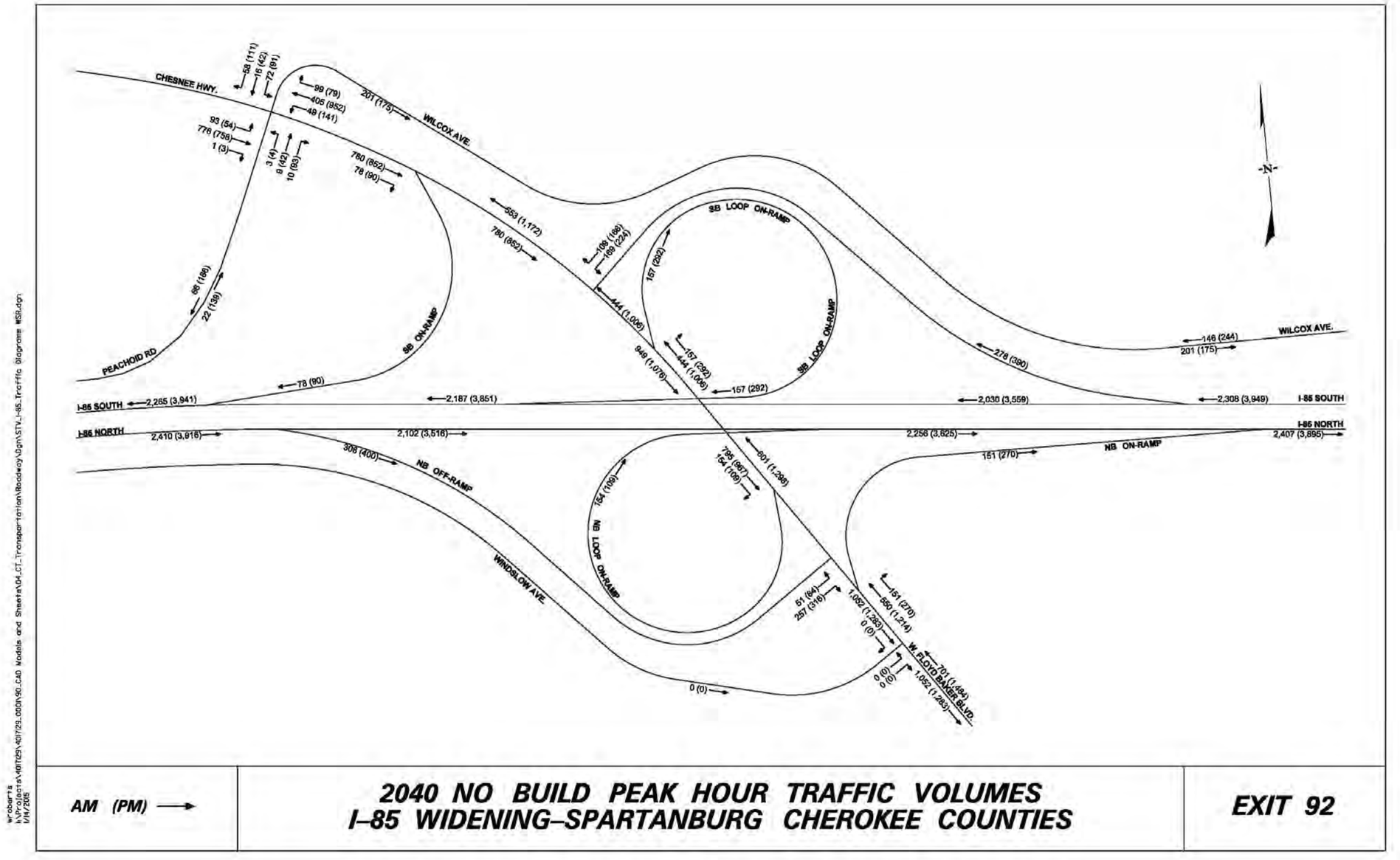


Figure 85 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 95

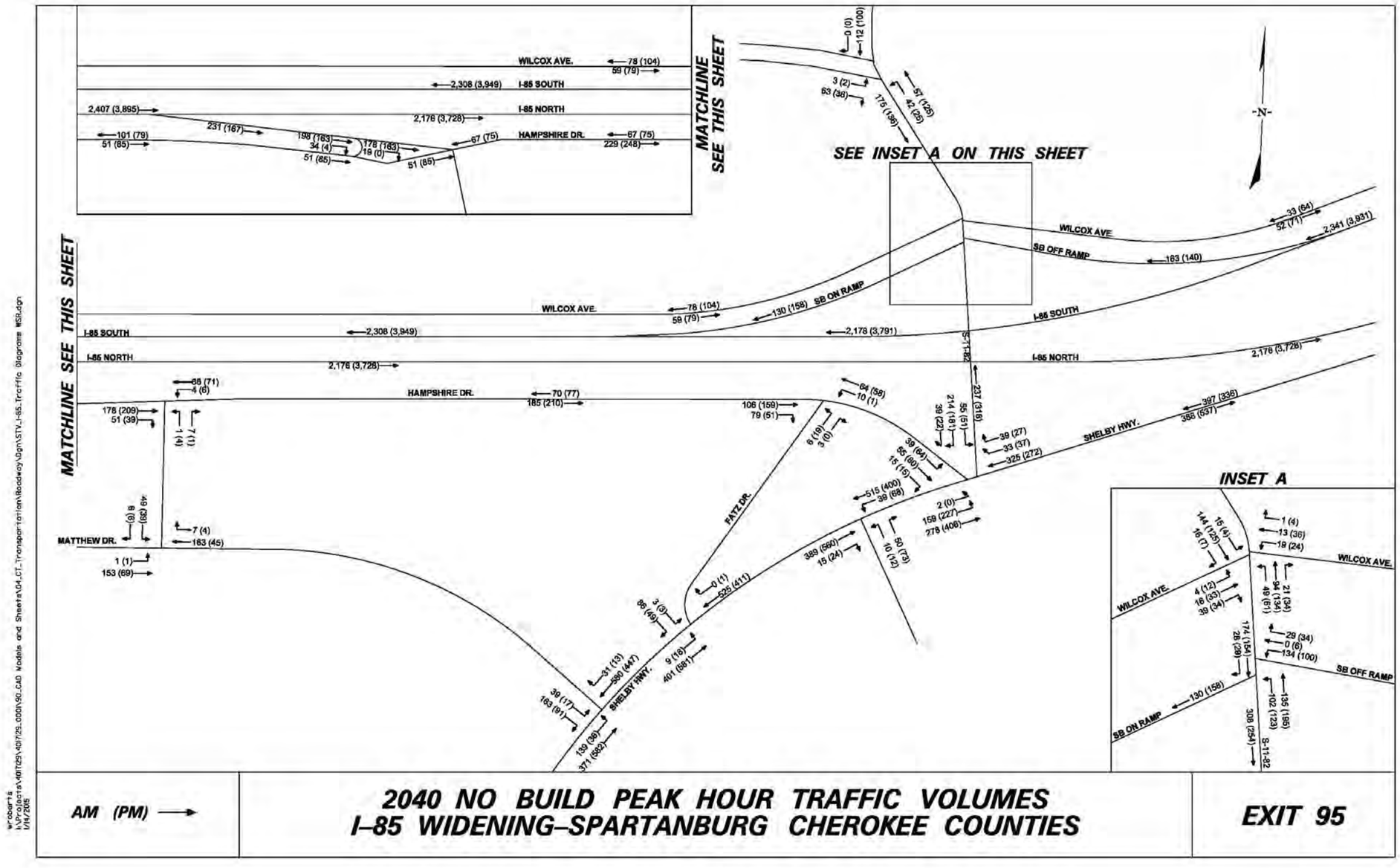


Figure 86 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 96

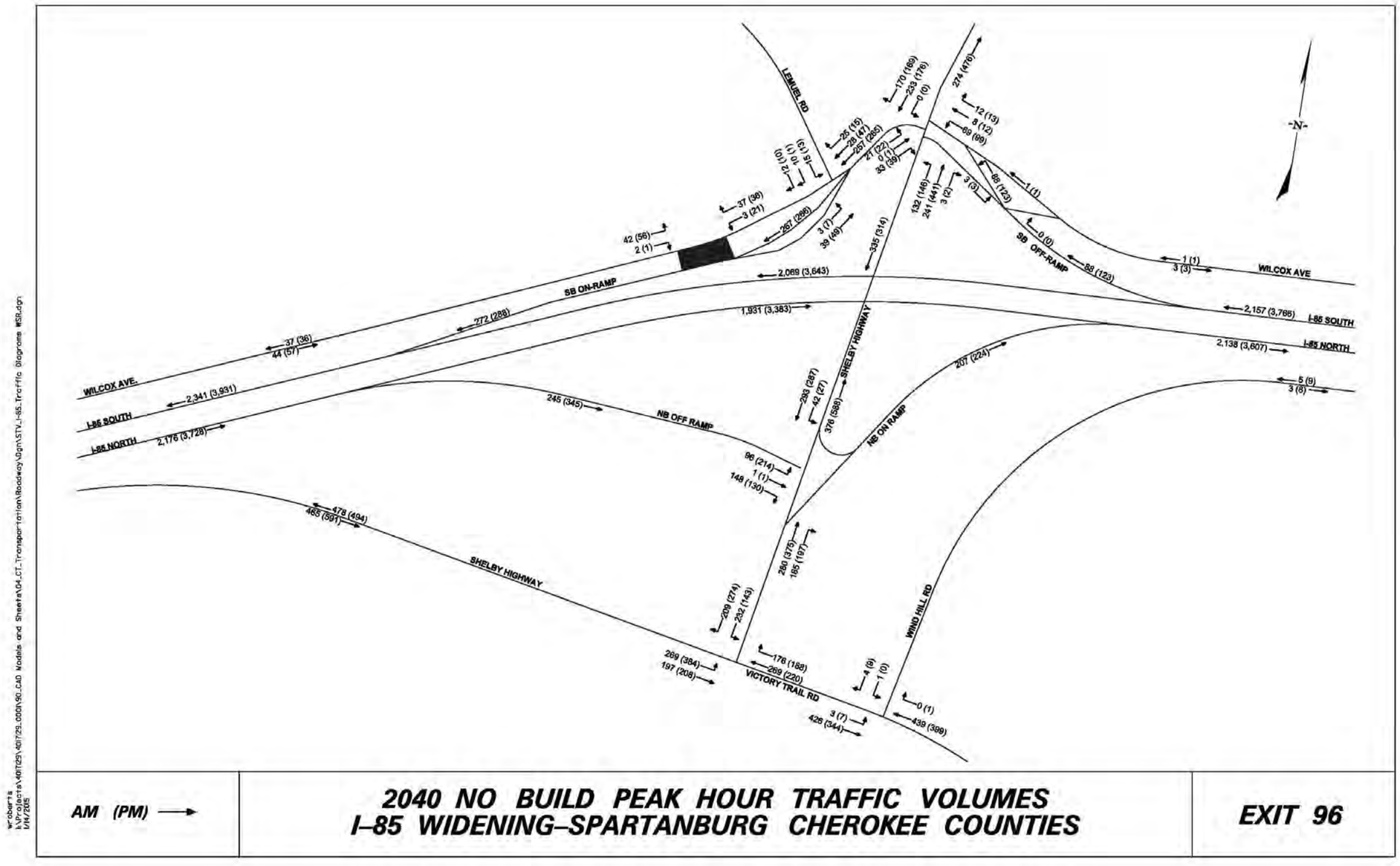
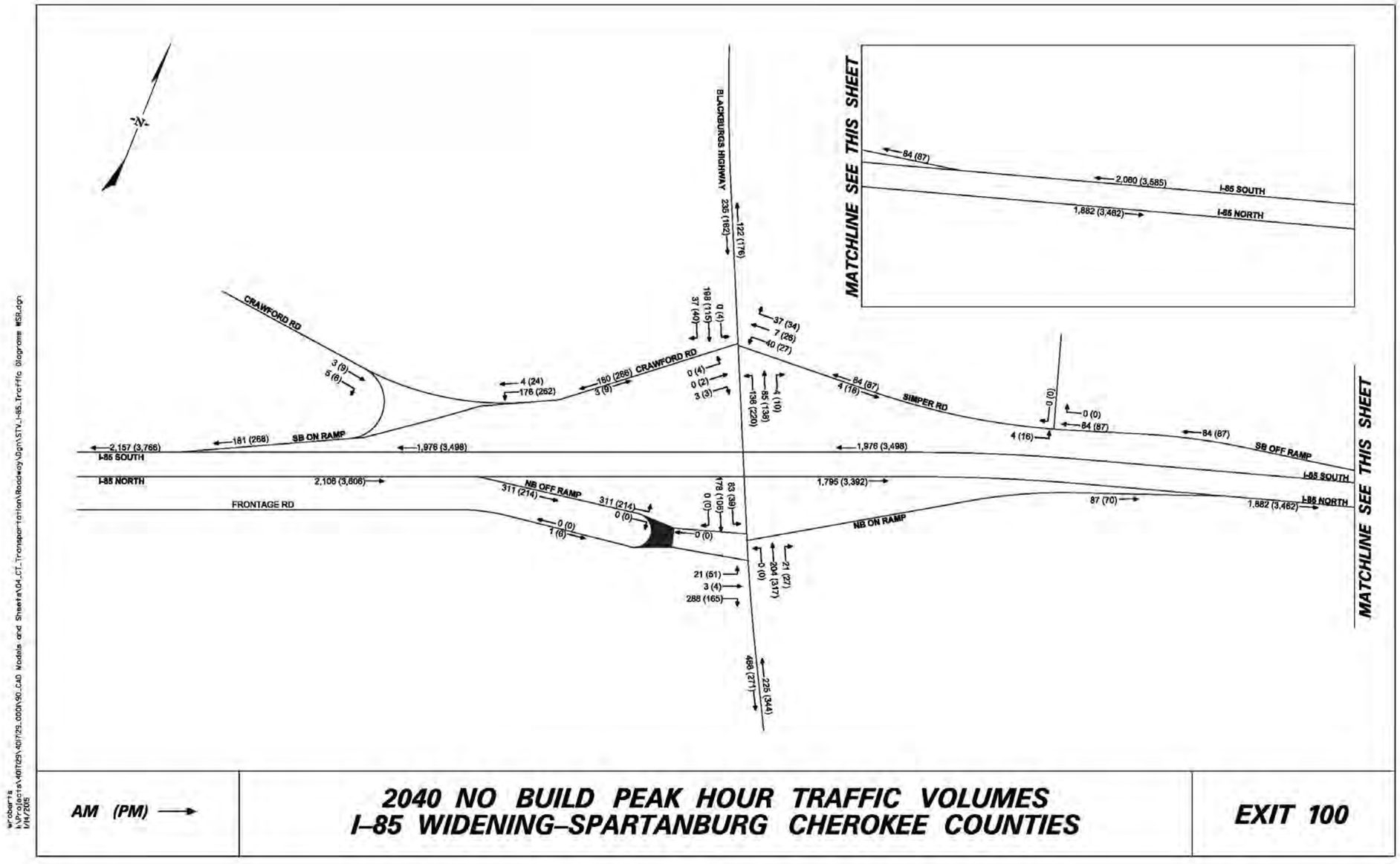


Figure 87 - 2040 Estimated Peak Hour Turning Movement Volumes: Exit 100



INRIX Speed Data

SCDOT provided travel speed data based on INRIX travel time data. The data provided by SCDOT is a summary of the average 2013 travel speeds for each hour of the day along the various segments of I-85 within the study area. The data is provided for the northbound and southbound directions, and separated into weekday (Tuesday, Wednesday, and Thursday) and weekend (Friday, Saturday, Sunday, and Monday) periods.

Graphs were created for each direction and time period based on the format developed by SCDOT. The graphs depict a speed profile along the interstate in the chosen direction of travel and can clearly depict the time periods and locations where recurring congestion causes a drop of travel speed. The average annual travel speeds for the morning (7 to 9 AM) and afternoon (4 to 6 PM) peak periods in each direction for the weekdays and weekend days are shown in **Figure 88** through **Figure 91**.

The data plotted on the graphs indicate that travel speeds throughout the corridor during the peak periods are generally near the posted speed limit, and no locations of recurring congestion resulting in a pronounced drop in travel speed are present.

Figure 88 - I -85 Northbound Weekday Speed Profiles

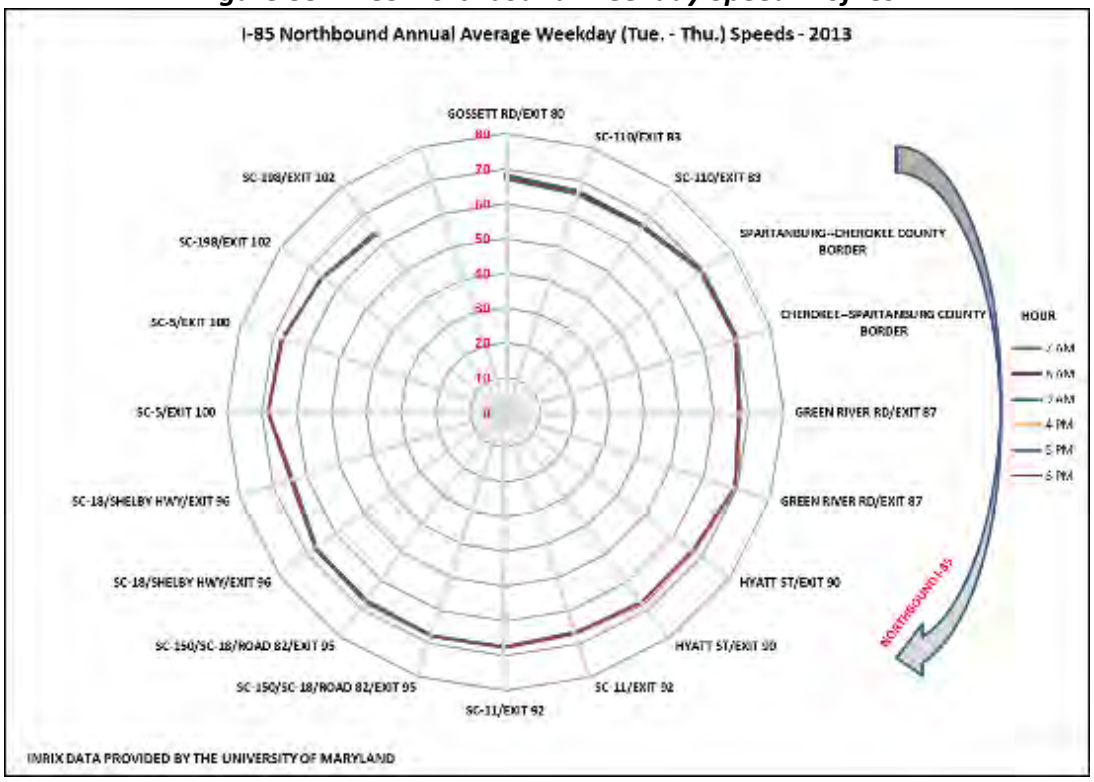


Figure 89 - I-85 Southbound Weekday Speed Profiles

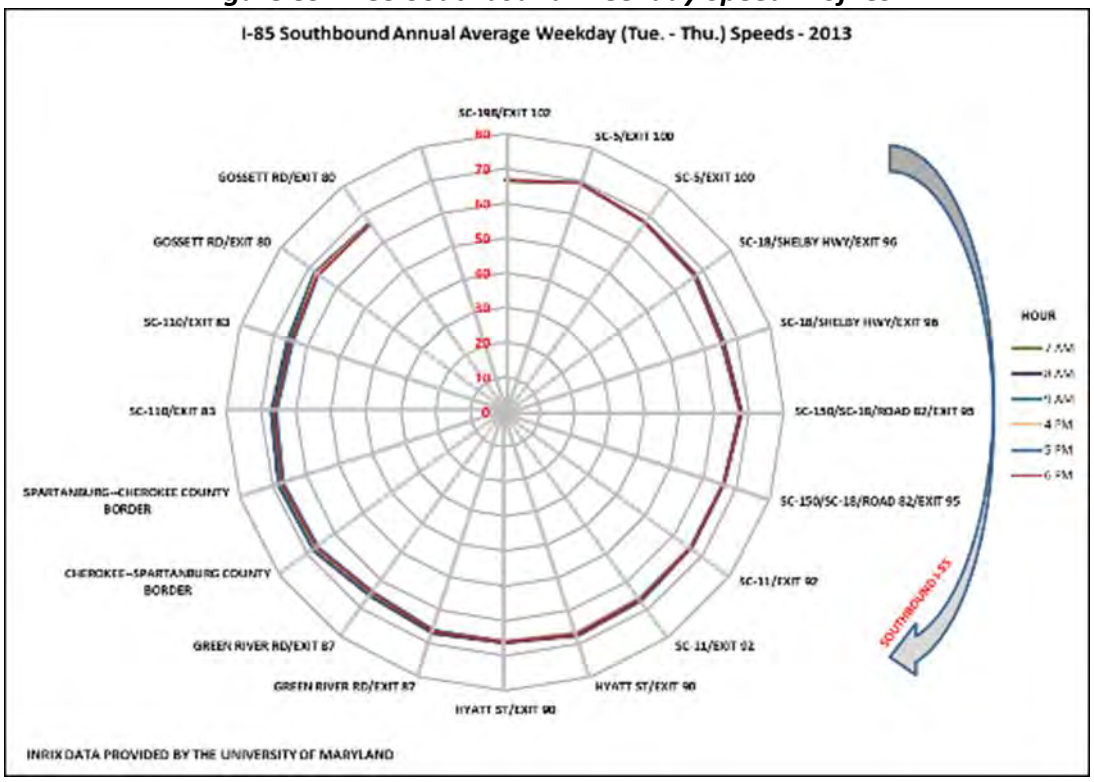


Figure 90 - I-85 Northbound Weekend Speed Profiles

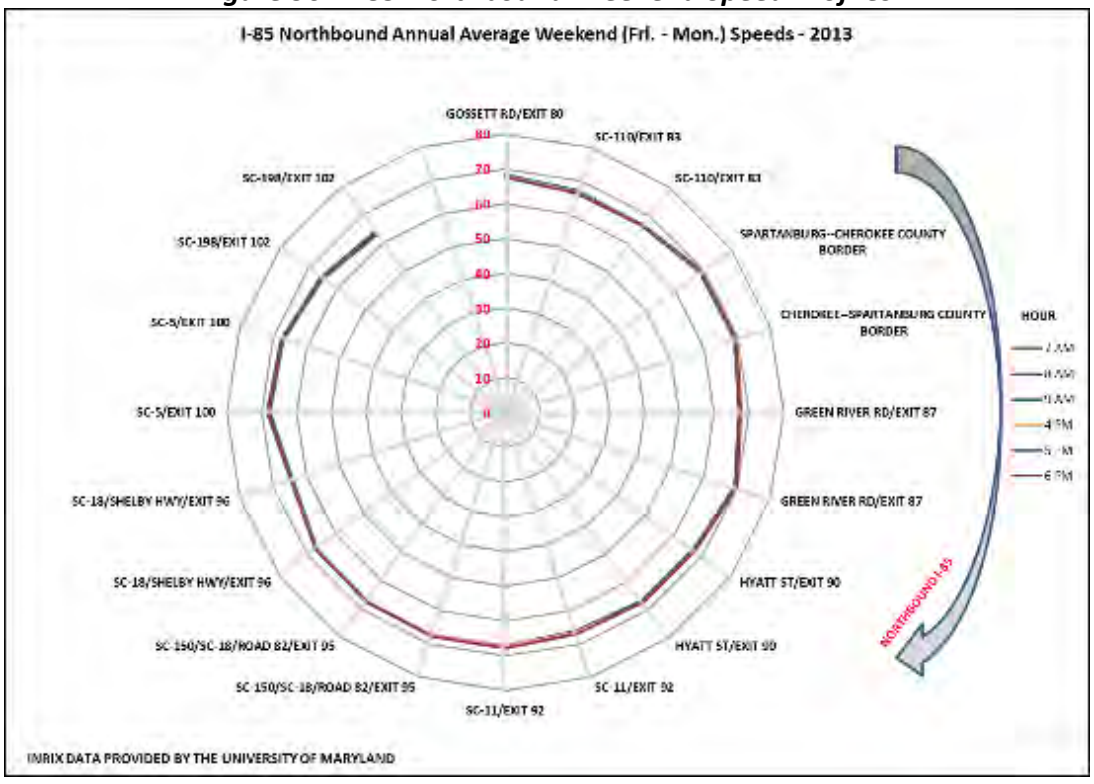
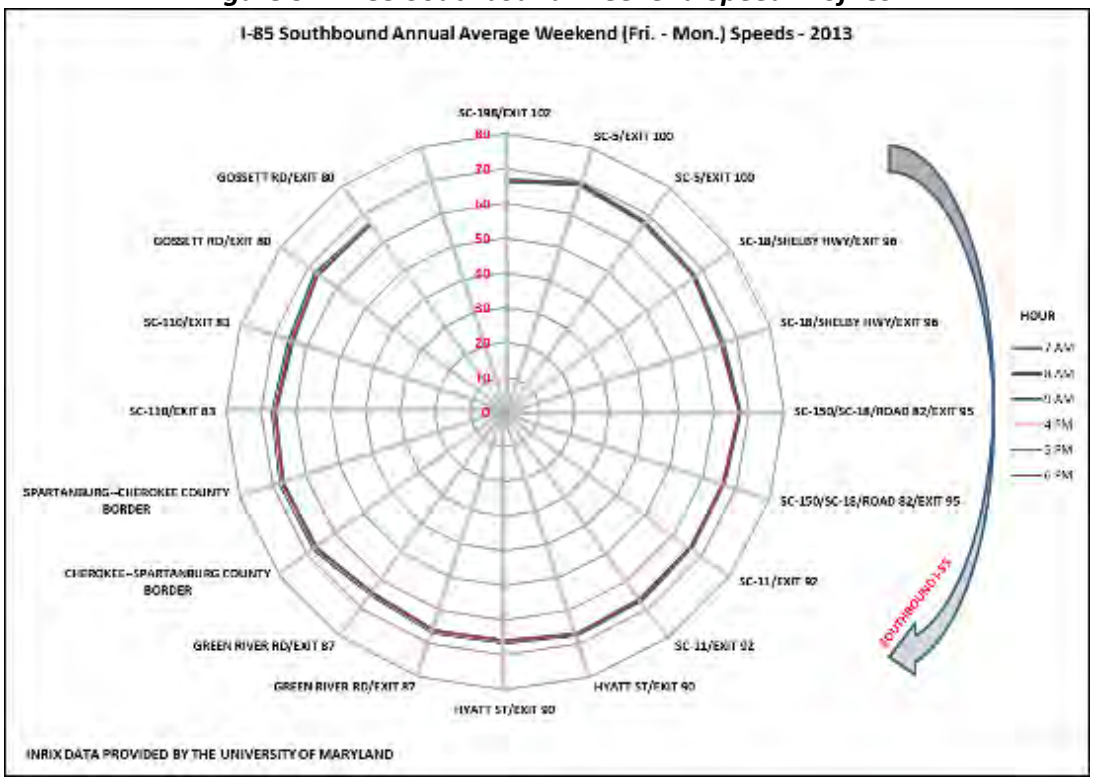


Figure 91 - I-85 Southbound Weekend Speed Profiles



Capacity Analysis

A series of capacity analyses were performed based on the methodologies and guidelines contained in the Transportation Research Board's publication ***HCM 2010 Highway Capacity Manual*** (HCM). Various software analysis and simulation packages based on the HCM were used in performing the analyses. These included:

a. McTrans' *HCS 2010* (Version 6.3)
   - Freeway Segments
   - Ramp Merge/Diverge Areas
   - Weaving Segments

b. Trafficware's *Synchro* (Version 8.0.806.61)
   - Unsignalized Intersections
   - Signalized Intersections

c. PTV's *VISSIM* (Version 7.00-05)
   - Network Simulation
   - Freeway Segments
   - Ramp Merge/Diverge Areas

Level of Service Criteria

The analysis methodologies contained in the HCM for the various facility types and users describe the operational conditions in terms of a Level of Service (LOS). The HCM defines LOS as
"…a quality measure describing operations conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. Six LOS are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions and the driver's perception of those conditions. Safety is not included in the measures that establish service levels."

The following discussions and tables describe the HCM LOS criteria for the freeway segments, ramp merge/diverge segments, weaving segments, unsignalized intersections and signalization intersections.

Freeway Segments

The HCM characterizes the capacity of a basic freeway segment *"…by three performance measures: density in passenger cars per mile per lane (pc/mi/ln), space mean speed in miles per hour (mi/h), and the ratio of demand flow rate to capacity (v/c). Each of these measures is an indication of how well traffic is being accommodated by the basic freeway segment."* **Table 10** shows the HCM LOS criteria for basic freeway segments. LOS F occurs when either the segment density exceeds 45 pc/mi/ln or when the segment v/c ratio exceeds 1.0 (regardless of the segment density).

Table 10 - Freeway Segment LOS Criteria

Basic Freeway Segments	
LOS	Density (pc/mi/ln)
A	< 11
B	> 11-18
C	> 18-26
D	> 26-35
E	> 35-45
F	> 45 v/c > 1.0

Weaving Segments

Weaving segments occur where two or more streams of traffic traveling in the same direction are able to cross each other without traffic control devices. This typically occurs where a merge segment is followed by a diverge segment within a relative short distance (usually less than

2,800 feet). The LOS of a weaving segment is also related to the density of the segment. Regardless of the density, the weaving segment is considered to operate at LOS F when the v/c exceeds 1.0. **Table 11** shows the HCM LOS criteria for Freeway Weaving Segments.

Table 11 - Weaving Segment LOS Criteria

Freeway Weaving Segments	
LOS	Density (pc/mi/ln)
A	< 10
B	> 10-20
C	> 20-28
D	> 28-35
E	> 35
F	v/c > 1.0

Ramp Merge and Diverge Areas

Ramp-freeway junctions occur when merging maneuvers occur (on-ramps) or when diverging maneuvers occur (off-ramps). The operation of these merge and diverge areas are affected by a number of factors, including the operation of the adjacent freeway segment and the proximity and flow on adjacent ramps. Typically, the influence area of the ramps is 1,500 feet upstream of a diverge point and downstream from a merge point. As with freeway segments and weaving segments, the LOS of a merge or diverge area is related to the density of the segment. Regardless of the density, the merge or diverge areas are considered to operate at LOS F when the freeway demand exceeds the capacity of the upstream freeway segment (at diverge areas) or the downstream freeway segment (at merge areas), as well as when the ramp demand exceeds the ramp capacity. **Table 12** shows the HCM LOS criteria for Ramp Merge and Diverge areas.

Table 12 - Merge/Diverge LOS Criteria

Ramp Merge and Diverge Areas	
LOS	Density (pc/mi/ln)
A	< 10
B	> 10-20
C	> 20-28
D	> 28-35
E	> 35
F	v/c > 1.0

Unsignalized Intersections

The LOS for unsignalized intersections is based on the average control delay per vehicle. Since major street traffic is seldom controlled by stops signs (except at intersections with all-way stop control or in special circumstances), major street traffic generally will experience virtually no delay. Most of the delay will be encountered by traffic on approaches controlled by stop signs.

Under certain conditions, delay will also be encountered by left turning traffic on the major street waiting for appropriate sized gaps in the opposing traffic flow to complete their turn. Therefore, the delay experienced by stop controlled movements and major street left turns, rather than the entire average intersection delay, are used to identify the critical LOS at these intersections. **Table 13** shows the HCM LOS criteria for unsignalized intersections.

Table 13 - Unsignalized Intersection LOS Criteria

Unsignalized Intersections	
LOS	Control Delay (sec/vehicle)
A	< 10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

Signalized Intersections

The LOS for signalized intersections is based on the average control delay per vehicle. LOS can be identified for the entire intersection, individual intersection approaches, and each movement/lane-group. **Table 14** shows the HCM LOS criteria for signalized intersections.

Table 14 - Signalized Intersection LOS Criteria

Signalized Intersections	
LOS	Control Delay (sec/vehicle)
A	< 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

a. <u>HCS Analysis</u>

The analysis of basic freeway segments within the study area were performed for existing conditions, future (2040) no-build conditions and future (2040) build conditions. The following criteria were identified through discussions with SCDOT and used for various inputs within the freeway segment analysis:

- The 30th highest hour volumes based on the P-132 ATR count station data, balanced through the system, were used for the freeway segment mainline volumes.
- To develop future (2040) traffic volumes, a 1.5 percent annual growth rate was applied to existing volumes in the study area.
- A peak hour factor of 0.90 was used for freeway segments and ramp areas.

- The proportion of trucks and buses traveling on the freeway segments and ramp movements, based on SCDOT data, is 25 percent.
- Based on the grades through the study area, the terrain was selected as "Rolling", instead of "Level" or "Mountainous".
- Free-flow speed was set at the posted speed limit along the segment.

Basic Freeway Segment Analysis

The existing condition and 2040 no-build condition analyses were performed using the existing number of freeway lanes present on the segments within the study area. The 2040 build condition analysis was performed assuming I-85 would provide three lanes in each direction on all segments within the study area. The Basic Freeway Segment Analysis outputs are provided in **Appendix G** and a summary of results is shown in **Table 15**.

Several northbound freeway segments present in the existing and 2040 no-build alternatives were combined for the 2040 build analysis. The segments were combined because the existing northbound off-ramps to Bud's Drive (Exit 82) and to Frontage Road (Exit 98), and the northbound on-ramp from Gaffney Ferry Road (Exit 97) are planned to be eliminated as part of the widening project. This results in combining the northbound freeway segments between Exits 80, 82, and 83 in the existing and 2040 no-build alternative into a single freeway segment between Exits 80 and 83. Similarly, the existing northbound segments between Exit 96, 97, 98, and 100 are combined into a single segment between Exits 96 and 100.

Table 15 - Freeway Segment Capacity Analysis Results

Basic Freeway Segment Analysis Results													
		AM Peak Hour						PM Peak Hour					
		2014 Existing		2040 No-Build		2040 Build		2014 Existing		2040 No-Build		2040 Build	
Direction	Segment	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density
NB	Exit 80-82	C	22.3	E	38.3	C[1]	22.3	E	44.8	F	1531.4	E[1]	43.1
NB	Exit 82-83	C	22.0	E	37.3			E	43.1	F	592.1		
NB	Exit 83-87	C	21.1	D	34.8	C	21.0	E	38.6	F	201.6	E	38.4
NB	Exit 87-90	C	21.2	E	35.0	C	21.1	E	36.6	F	149.5	E	36.4
NB	Exit 90-92	C	18.9	D	29.6	C	18.9	D	33.4	F	102.8	D	33.2
NB	Exit 92-95	C	18.9	D	29.5	C	18.9	D	33.2	F	99.7	D	33.0
NB	Exit 95-96	B	17.1	C	26.0	B	17.8	D	31.0	F	80.8	D	32.5
NB	Exit 96-97	B	16.8	C	25.4	B[2]	16.8	D	29.6	F	70.7	D[2]	29.6
NB	Exit 97-98	B	16.9	C	25.6			D	29.7	F	71.4		
NB	Exit 98-100	B	16.6	C	25.0			D	29.6	F	70.7		
SB	Exit 100-96	B	17.0	C	25.7	B	16.9	D	31.5	F	84.5	D	31.3
SB	Exit 96-95	C	18.4	D	28.4	C	18.3	D	33.6	F	105.1	D	33.4
SB	Exit 95-92	C	18.1	D	27.9	C	18.1	D	33.9	F	108.0	D	33.7
SB	Exit 92-90	B	17.8	D	28.4	B	17.7	D	33.8	F	106.6	D	33.6
SB	Exit 90-87	C	20.5	D	33.3	C	20.5	E	40.0	F	257.3	E	39.7
SB	Exit 87-83	C	21.9	E	37.1	C	21.8	E	40.7	F	296.1	E	40.4
SB	Exit 83-80	C	25.2	F	48.5	C	25.2	E	43.5	F	708.2	E	43.2

[1] - Exit 82 northbound off-ramp removed in 2040 Build Condition; segment runs between Exits 80 and 83

[2] - On-ramp from Gaffney Ferry Road (Exit 97) and off-ramp to Frontage Road (Exit 98) removed in the 2040 Build Condition; segment runs between Exits 96 and 100

The analysis results for the freeway segments, summarized in **Table 15**, indicate the following:

2014 Existing Conditions

Using the design hour volumes for the morning and afternoon peak hours, the analysis results indicate that:

- During the morning peak hour, all freeway segments operate at LOS B or C
- During the afternoon peak hour, all freeway segments operate at LOS D or E. The segments that operate at LOS E are located between Exits 80 and 90 on the south end of the study area, and include the interchanges at Exits 83 and 87.

2040 No-Build Conditions

With traffic volumes projected to increase within the corridor at an annual rate of 1.5 percent per year, and if I-85 is not widened, the increased traffic volumes traveling on the existing interstate capacity will result in increased density and reductions of freeway segment LOS.

- During the morning peak hour:
  - The northbound freeway segments north of Exit 95 and the southbound freeway segment north of Exit 96 will operate at LOS C
  - The northbound freeway segments between Exits 83 and 95 (with the exception of the segment between Exits 87 and 90) will operate at LOS D;
  - The southbound freeway segments between Exits 96 and 87 will operate at LOS D
  - The northbound freeway segments between Exits 80 and 90 (with the exception of the segment between Exits 83 and 87), and the southbound freeway segment between Exits 87 and 83 will operate at LOS E
  - The southbound freeway segment between Exits 83 and 80 will operate at LOS F.
- During the afternoon peak hour:
  - All freeway segments in both directions between Exits 80 and 100 are expected to operate at LOS F.

2040 Build Conditions

The additional capacity provided by the construction of a third lane in each direction along I-85 will result in substantial improvement in LOS compared to the 2040 No-Build condition, with LOS results comparable to those experienced under existing conditions. The 2040 Build analysis results indicate that:

- During the morning peak hour, all freeway segments operate at LOS B or C
- During the afternoon peak hour, all freeway segments operate at LOS D or E. The segments that operate at LOS E are located between Exits 80 and 90 on the south end of the study area, and include the interchanges at Exits 83 and 87.

Analysis of Year Capacity is Reached

For the freeway segments projected to operate at LOS E under the 2040 Build Conditions, an analysis was performed to estimate which year the segment LOS would transition from LOS D to LOS E. The results of the analysis are shown in **Table 16**.

Table 16 - Year Capacity is Reached

Direction	Segment	Last Year at LOS D
NB	Exit 80-83	2031
NB	Exit 83-87	2036
NB	Exit 87-90	2036
SB	Exit 90-87	2035
SB	Exit 87-83	2034
SB	Exit 83-80	2032

The analysis results shown in **Table 16** indicate that the three southernmost segments (between exits 80 and 90) are likely to transition from LOS D to LOS E between 2031 and 2036. Should growth in freeway traffic average at or above 1.5 percent annually through that time period, it is likely that a fourth lane will be needed in each direction on I-85 along these segments. With the addition of a fourth lane in each direction on I-85 between Exits 80 and 90, the LOS on those segments would improve to LOS C or better during the 2040 morning peak hour and to LOS D or better during the afternoon peak hour.

The need for this potential additional widening should be considered and incorporated into the extent possible in this widening project. Incorporating the future need for a fourth lane along these segments should allow for the design and construction of permanent roadway features, such as drainage and retaining walls. This will help to minimize disruption to these features when future widening becomes necessary.

Ramp Merge Analysis

The Ramp Merge Analyses outputs are provided in **Appendix H** and the summary results are shown in **Table 17**.

Table 17 - Ramp Merge Capacity Analysis Results

Freeway Merge Analysis Results													
		AM Peak Hour						PM Peak Hour					
	Merge	2014 Existing		2040 No-Build		2040 Build		2014 Existing		2040 No-Build		2040 Build	
Direction	Location	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density
NB	Exit 80	C	20.2	D	31.2	B	18.7	D	34.3	F	52.2	D	31.1
NB	Exit 83	C	22.0	D	34.6	B	17.0	E	36.7	F	53.4	D	28.5
NB	Exit 87	C	22.9	D	33.4	B	18.8	D	34.4	F	50.6	D	29.1
NB	Exit 90	B	19.5	D	28.8	B	18.5	D	31.1	F	46.1	D	29.7
NB	Exit 92 Loop	B	17.8	C	26.5	B	14.6	D	28.8	F	43.0	C	24.5
NB	Exit 92	B	15.0	C	24.3	B	14.1	C	26.6	F	41.7	C	25.3
NB	Exit 95	n/a	n/a	n/a	n/a	B[1]	15.9	n/a	n/a	n/a	n/a	C[1]	27.4
NB	Exit 96	B	18.7	C	26.9	B	13.1	D	30.4	F	44.4	C	23.8
NB	Exit 97	B	17.9	C	26.3	n/a[2]	n/a	D	29.6	F	43.8	n/a[2]	n/a
SB	Exit 100	B	12.9	C	21.3	B	12.3	C	25.6	F	40.2	C	24.4
SB	Exit 96	C	21.1	D	30.1	B	15.1	D	33.8	F	49.0	C	26.8
SB	Exit 95	C	20.2	D	29.2	B	14.3	D	33.2	F	48.7	C	26.4
SB	Exit 92 Loop	B	17.3	C	25.8	B	14.1	D	30.3	F	45.2	C	26.4
SB	Exit 92	B	17.1	C	26.0	B	15.0	D	30.5	F	45.9	C	27.2
SB	Exit 90	C	22.5	D	32.3	C	22.5	E	36.1	F	52.5	D	34.9
SB	Exit 87	C	21.3	D	32.1	B	19.8	D	34.2	F	51.3	D	31.1
SB	Exit 83	C	26.8	F	38.8	C	23.4	E	37.9	F	55.5	D	32.7

[1] - Exit 95 northbound on-ramp does not currently exist; will be added as part of the interchange improvement

[2] - On-ramp from Gaffney Ferry Road (Exit 97) removed in the 2040 Build Condition

The analysis results for the ramp merge areas, summarized in **Table 17**, indicate the following:

2014 Existing Conditions

Using the design hour volumes for the morning and afternoon peak hours, the analysis results indicate that:

- During the morning peak hour, all ramp merge areas operate at LOS B or C.
- During the afternoon peak hour,
  - the merge areas for the northbound on-ramp at Exit 92 and for the southbound on-ramp at Exit 100 operate at LOS C
  - the merge areas for the northbound and southbound on-ramps at Exit 83, and the southbound on-ramp at Exit 90 operate at LOS E
  - the remaining on-ramps operate at LOS D

2040 No-Build Conditions

With traffic volumes projected to increase within the corridor at an annual rate of 1.5 percent per year, and if I-85 is not widened, the increased traffic volumes traveling on the existing interstate capacity will result in increased density and will reduce of merge area LOS.

- During the morning peak hour:
  - The merge areas for the northbound on-ramps north of Exit 92 (including the northbound loop ramp at Exit 92) and the southbound on-ramps at Exit 92 (including the southbound loop ramp) and at Exits 90 and 87 will operate at LOS C.

  - The northbound on-ramps at Exits 80, 83, 87 and 90, and the southbound on-ramps at Exits 96, 95, 90 and 87 will operate at LOS D;
  - The southbound on ramp at Exit 83 will operate at LOS F
- During the afternoon peak hour:
  - All on-ramps in both directions at all interchanges between Exits 80 and 100 inclusive are expected to operate at LOS F.

2040 Build Conditions

The additional capacity provided by the construction of a third lane in each direction along I-85 will lower densities in the ramp merge areas, resulting in substantial improvement in LOS compared to the 2040 No-Build condition, with LOS results comparable to those experienced under existing conditions. The 2040 Build analysis results indicate that:

- During the morning peak hour, on-ramp merge areas operate at LOS B or C
- During the afternoon peak hour, all ramp merge areas operate at LOS C or D.

If a fourth lane is constructed in each direction on I-85 between Exits 80 and 90 to improve the 2040 Build condition LOS along those freeway segments, the LOS of the respective merge areas would similarly improve. With the addition of a fourth lane in each direction, the merge areas between Exits 80 and 90 would improve to LOS B during the 2040 morning peak hour and LOS C or better during the afternoon peak hour.

Ramp Diverge Analysis

The Ramp Diverge Analyses are also provided in **Appendix H** and the summary results are shown in **Table 18**.

Table 18 - Ramp Diverge Capacity Analysis Results

Freeway Diverge Analysis Results													
		AM Peak Hour						PM Peak Hour					
	Merge	2014 Existing		2040 No-Build		2040 Build		2014 Existing		2040 No-Build		2040 Build	
Direction	Location	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density
NB	Exit 82	C	25.6	E	38.0	n/a[1]	n/a	E	41.0	F	60.9	n/a[1]	n/a
NB	Exit 83	C	26.1	E	38.3	C	25.3	E	41.2	F	60.8	E	37.6
NB	Exit 87	B	17.1	D	28.7	B	18.8	D	30.9	F	49.5	C	27.2
NB	Exit 90	C	26.2	E	37.9	C	26.8	E	38.8	F	56.8	E	36.3
NB	Exit 92	B	18.7	D	29.2	B	17.8	D	32.0	F	49.0	D	28.1
NB	Exit 95	C	21.4	D	31.8	C	21.7	D	34.4	F	51.4	D	31.6
NB	Exit 96	B	16.6	C	26.1	C	20.7	D	30.3	F	46.5	D	31.7
NB	Exit 98	B	19.3	D	28.6	n/a[2]	n/a	D	32.2	F	47.9	n/a[2]	n/a
NB	Exit 100	B	19.3	D	28.5	C	20.7	D	32.5	F	48.2	D	30.6
SB	Exit 96	C	20.3	D	29.7	B	19.5	D	34.5	F	50.9	D	30.8
SB	Exit 95	C	21.7	D	31.9	C	21.1	E	35.7	F	52.8	D	31.8
SB	Exit 92	B	19.8	D	29.9	B	19.5	D	34.2	F	51.4	D	30.8
SB	Exit 90	C	20.6	D	30.4	C	21.2	E	35.3	F	52.4	D	32.7
SB	Exit 87	C	24.3	E	35.6	C	21.3	E	39.4	F	58.3	E	32.5
SB	Exit 83	C	24.7	E	36.8	C	21.4	E	38.7	F	57.8	D	31.6
SB	Exit 80	C	21.1	D	28.9	D	28.9	C	27.6	E	38.1	E	38.1

[1] - Exit 82 northbound off-ramp is removed in the 2040 Build Condition

[2] - Exit 98 northbound off-ramp is removed in the 2040 Build Condition

The analysis results for the ramp diverge areas, summarized in **Table 18**, indicate the following:

2014 Existing Conditions

Using the design hour volumes for the morning and afternoon peak hours, the analysis results indicate that:

- During the morning peak hour, all ramp diverge areas at the off-ramps operate at LOS B or C
- During the afternoon peak hour,
  - the diverge areas for the southbound off-ramp at Exit 80 operates at LOS C
  - the diverge areas for the northbound off ramps at Exits 87, north of the Exit 92 off-ramp, and the southbound off-ramp at Exits 96 and 92 operate at LOS D
  - the diverge areas for the northbound off-ramps at Exits 82, 83 and 90, and the southbound off-ramps at Exits 95, 90, 87, and 83 operate at LOS E

2040 No-Build Conditions

With traffic volumes projected to increase within the corridor at an annual rate of 1.5 percent per year, and if I-85 is not widened, the increased traffic volumes traveling on the existing interstate capacity will result in increased density and will reduce the diverge area LOS at the off-ramps.

- During the morning peak hour:
  - The northbound off-ramp at Exit 96 will operate at LOS C
  - The diverge areas for the northbound off-ramps at Exits 82, 83 and 90, and the southbound off-ramps at Exits 87 and 83 will operate at LOS E.

  - The remaining off-ramps are expected to operate at LOS D
- During the afternoon peak hour:
  - All on-ramps in both at all interchanges between Exits 80 and 100 inclusive are expected to operate at LOS F, with the exception of the southbound off-ramp at Exit 80, which is expected to operate at LOS E.

2040 Build Conditions

The additional capacity provided by the construction of a third lane in each direction along I-85 will lower densities in the ramp diverge areas, resulting in substantial improvement in LOS compared to the 2040 No-Build condition, with LOS results comparable to those experienced under existing conditions. The 2040 Build analysis results indicate that:

- During the morning peak hour, all of the off-ramp diverge areas operate at LOS B or C, with the exception of the southbound off-ramp at Exit 80, which will operate at LOS D.
- During the afternoon peak hour, all ramp diverge areas are expected to operate at LOS D, with the exception of the northbound off-ramps at Exits 83 and 90 and the southbound off-ramps at Exits 87 and 80, which are expected to operate at LOS E.

If a fourth lane is constructed in each direction on I-85 between Exits 80 and 90 to improve the 2040 Build condition LOS along those freeway segments, the LOS of the respective diverge areas would similarly improve. With the addition of a fourth lane in each direction, the diverge areas between Exits 80 and 90 would improve to LOS C or better during the 2040 morning peak hour and LOS D or better during the afternoon peak hour.

b. Intersection Analysis

Capacity analyses for the signalized and unsignalized intersections at the interchanges within the study area were performed. Analyses were performed for existing conditions (existing traffic, intersection traffic control and geometry), 2040 No-Build conditions (2040 traffic, and existing intersection traffic control and geometry), and 2040 Build conditions (2040 traffic and modified intersection traffic control and geometry).

For unsignalized intersections, the intersection operation is represented by the worst approach delay and LOS of all the stop sign controlled approaches to the intersection. For signalized intersections, the intersection operation is represented by the intersection delay and LOS.

At some intersections, there are atypical intersection geometry and/or traffic control which are not compatible with HCM methodologies and procedures. No LOS or delay can be estimated at these atypical intersections.

For the intersections located where no modifications are anticipated at the existing interchanges (Exits 80, 90, 92 and 100), the 2040 No-Build and 2040 Build condition analysis results will be identical since no changes in intersection capacity will be made.

Where the existing interchanges are proposed to be modified as part of the widening project (Exit 83, 87, 95, and 96), the capacity analysis results for the 2040 Build condition alternatives can be found within the section for each of those individual interchanges.

Existing Conditions and 2040 No-Build Intersection Analysis

The results of the unsignalized and signalized intersection capacity analyses for existing conditions and the 2040 No-Build conditions are shown in **Table 19**. Specific details concerning the results of the intersection capacity analyses can be found in the discussion for each of the individual interchanges. The HCM intersection capacity outputs for each intersection are provided in **Appendix I**.

In general, with the forecast increases in traffic and without improvements to the intersections, delay in the 2040 No-Build analyses can be expected to higher than delay during the Existing Conditions analyses. In some cases, the increases in delay may still result in acceptable LOS being obtained. In other cases, the increases in delay may result in LOS E or LOS F conditions. When these results occur, it may be necessary to provide additional capacity (such as constructing separating left and/or right turn lanes) and/or changes in the traffic control (such as installing traffic signals) to reduce delay and improve the LOS.

Table 19 - Intersection Capacity Analysis Results

Intersection #	Intersection Name	2014 Base Conditions				2040 Base Conditions			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Exit 80									
8001	Gossett Road at Sha Lane*	C	20.3	E	39.0	F	96.0	F	476.1
8002	Gossett Road at I-85 SB ramps*	B	15.0	B	13.1	D	34.0	C	20.4
8003	Gossett Road at I-85 NB ramps*	D	27.6	B	11.2	F	293.1	B	14.6
8004	Gossett Road at Abbott Lane*	B	15.0	B	14.4	C	22.5	C	21.4
Exit 82									
8201	Buds Drive at I-85 NB off-ramp*	A	9.5	B	10.6	A	9.8	B	11.3
8202	Buds Drive at Arthur Bridge Road*	A	8.5	A	8.6	A	8.6	A	8.7
Exit 83									
8301	Battleground Road (SC 110) at Horry Road (S-42-9725)*	A	9.9	A	10.0	B	10.8	B	11.2
8302	Battleground Road (SC 110) at Phillips Drive*	C	16.7	C	19.9	D	31.7	F	68.1
8303	Phillips Drive at Horry Road*	B	12.2	B	11.6	C	16.8	B	14.5
8304	Truck Stop Road/Horry Road at I-85 SB on ramp*	B	12.1	A	8.1	E	38.3	A	9.8
8305	Truck Stop Road at I-85 SB off ramp*	A	9.5	A	9.1	A	9.8	A	9.5
8306	Frontage Road N at I-85 NB off-ramp*	B	13.8	C	18.0	C	18.8	D	33.0
8307	Battleground Road (SC 110) at Frontage Road N (S-42-737)	A	8.1	A	9.7	B	11.5	B	15.1
8308	Frontage Road N at Edgefield Road*	A	9.5	A	9.2	A	10.0	A	9.5
8309	Edgefield Road at I-85 NB on-ramp*	A	9.1	A	9.1	A	9.5	A	9.5
Exit 87									
8701	Webber Road at I-85 SB on-ramp*	A	9.9	A	9.3	B	10.9	A	9.8
8702	Webber Road at Lemon's Farm Entrance*	B	10.3	A	9.7	B	11.8	B	10.5
8703	S Green River Road (S-11-39) at Webber Road*	C	18.4	B	13.8	F	64.0	C	23.8
8704	Old Post Road at I-85 SB off-ramp*	B	10.3	B	11.0	B	11.3	B	12.7
8705	Lindley Road at Cannons Campground Road/I-85 NB off-ramp**	-	-	-	-	-	-	-	-
8706	S Green River Road (S-11-39) at Overbrook Drive (S-11-31)*	B	10.9	A	9.8	C	19.1	B	13.8
8707	Overbrook Drive at I-85 NB on-ramp*	A	9.9	A	9.7	B	10.9	B	10.6
8708	S Green River Road (S-11-39) at Lindley Road*	A	8.6	A	9.0	A	8.7	A	9.3
Exit 90									
9001	Hyatt Street (S-11-81) at Peachoid Road (S-11-666)/Nancy Creek Road (S-11-440)	B	11.6	B	18.2	B	12.9	B	19.6
9002	Hyatt Street (S-11-81) at I-85 SB ramps	B	16.3	B	15.5	B	19.4	B	18.1
9003	Hyatt Street (SC 105) at I-85 NB ramps	A	2.8	A	7.1	A	3.4	A	8.9
9004	Hyatt Street (SC 105) at Lemmons Lane (S-11-645)/Windslow Road (S-11-659)	B	12.7	B	14.6	C	30.1	C	24.3
Exit 92									
9201	Chesnee Highway (SC 11) at Peachoid Road (S-11-666)/Wilcox Avenue (S-11-668)	B	10.1	B	15.7	B	13.3	D	38.6
9202	Chesnee Highway (SC 11) at I-85 SB ramps	A	8.9	A	8.6	A	9.2	B	11.5
9203	Chesnee Highway (SC 11) at I-85 NB ramps	A	8.9	A	8.3	B	12.0	B	13.6
9204	Chesnee Highway (SC 11) at Windslow Avenue*	A	0.0	A	0.0	A	0.0	A	0.0
Exit 95									
9501	Hampshire Drive at I-85 NB off-ramp*	B	12.0	B	12.1	B	14.7	C	15.2
9502	Hampshire Drive at Suzanna Drive*	A	9.6	A	9.7	B	10.2	B	10.5
9503	Hampshire Drive at Fatz Road*	A	9.6	A	9.6	B	10.2	B	10.2
9504	Suzanna Drive at Matthew Road*	B	10.9	A	9.0	B	13.0	A	9.4
9505	Shelby Highway (SC 18) at Matthew Road*	C	15.5	B	10.5	F	56.4	B	12.7
9506	SC 18 at Fatz Drive*	B	10.2	A	9.7	B	11.8	B	10.6
9507	Pleasant School Road (S-11-82) at UPS Driveway*	A	9.1	A	9.5	A	9.6	A	10.0
9508	Pleasant School Road (S-11-82) at Wilcox Avenue*	B	11.9	B	12.0	B	14.6	B	15.0
9509	Pleasant School Road (S-11-82) at SB ramps*	B	13.5	B	14.7	C	21.7	D	27.8
9510	Shelby Highway (SC 18)/Hampshire Drive at Pleasant School Road (S-11-82)	B	14.3	B	15.0	C	20.2	C	21.5
Exit 96									
9601	Wilcox Avenue at I-85 southound on-ramp*	A	10.0	B	10.2	B	11.1	B	11.5
9602	Wilcox Avenue at Lemeul Road**	-	-	-	-	-	-	-	-
9603	Shelby Highway (SC 18) at Wilcox Avenue*	B	14.8	C	19.7	C	24.7	F	62.4
9604	Wilcox Avenue at I-85 SB off-ramp**	-	-	-	-	-	-	-	-
9605	Shelby Highway (SC 18) at I-85 NB ramps*	B	13.5	C	17.2	C	24.0	F	73.3
9606	Shelby Highway (SC 18) at Victory Trail Road (SC 329)*	C	19.2	C	21.1	F	144.4	F	193.1
9607	Victory Trail Road (SC 329) at Wind Hill Road*	B	11.1	A	9.9	B	12.7	B	10.6
Exit 100									
1001	Crawford Road at I-85 SB on ramp*	A	9.2	A	9.9	A	9.6	B	10.9
1002	Blacksburg Highway at Crawford Road/Simper Road*	B	11.2	B	13.1	B	14.1	C	19.4
1003	Simper Road at I-85 SB off ramp*	A	7.6	A	7.4	A	7.7	A	7.4
1004	Frontage Road at I-85 NB off ramp*	C	18.7	B	11.9	D	29.8	B	14.1
1005	Blacksburg Highway at I-85 NB on ramp*	B	11.0	B	10.9	B	14.6	B	13.9

* Unsignalized intersection; worst approach LOS and delay reported.

** Unique intersection geometry under all Conditions incompatible with HCM 2000; LOS and delay not reported.

Exit 80 – Gossett Road (S-42-57)

The analysis results for the existing and 2040 No-Build conditions at Exit 80 for the Gossett Road (S-42-57) interchange intersections are illustrated in **Figure 92**.

Figure 92 - Exit 80 Intersection LOS Summary

Existing Conditions

Under the existing conditions at Exit 80, the stop sign controlled approaches of Gossett Road at its intersections with the southbound off-ramp, northbound off-ramp and Abbott Lane/Conway Black Road operate at LOS D or better during the morning and afternoon peak hours.

At this intersection of Gossett Road with Sha Lane/Dewberry Road, the stop sign controlled approaches operate at LOS C or better during the morning peak hour. However, the westbound approach of Dewberry Lane operates at LOS E during the afternoon peak hour. This is a result of the delay experienced by traffic waiting to turn left from Dewberry Road onto southbound Gossett Road.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The stop sign controlled approaches of Gossett Road at its intersections with the southbound off-ramp and at Abbott Lane/Conway Black Road will continue to operate at LOS D or better during the morning and afternoon peak hours.

At the Gossett Road intersection with the northbound off-ramp, the off-ramp approach is projected to operate at LOS B during the afternoon peak hour, but will operate at LOS F during the morning peak hour. The westbound approach of Dewberry Road is projected to operate at LOS F during both peak hours. In both instances, the poor operation is attributed to delay encountered by left turning traffic on these approaches.

The operation of the Gossett Road intersections with Sha Lane/Dewberry Road and the northbound off-ramp may require capacity or traffic control improvements, such as the installation of a traffic signal, to provide acceptable LOS during the 2040 No-Build operating conditions.

Exit 82 – Bud's Drive (S-42-1012)/Bud Arthur Bridge Road (S-42-737/1013)

The analysis results for the existing and 2040 No-Build conditions at Exit 82 for the Bud's Drive (S-42-1012) interchange intersections are illustrated in **Figure 93**.

Figure 93 - Exit 82 Intersection LOS Summary

Under the existing conditions at Exit 82, the yield and/or the stop sign controlled approaches at the unsignalized intersections operates at an acceptable LOS B or better during both the morning and afternoon peak hours due to low volumes. However, the unusual geometry, coupled with the short off-ramp length, could increase the potential for accidents to occur.

Existing Conditions

The stop sign controlled approach of Bud's Drive at its intersections with the Bud Arthur Bridge Road operates at LOS A during the morning and afternoon peak hours. *No improvements are necessary to provide acceptable LOS under existing conditions.*

2040 No-Build Conditions

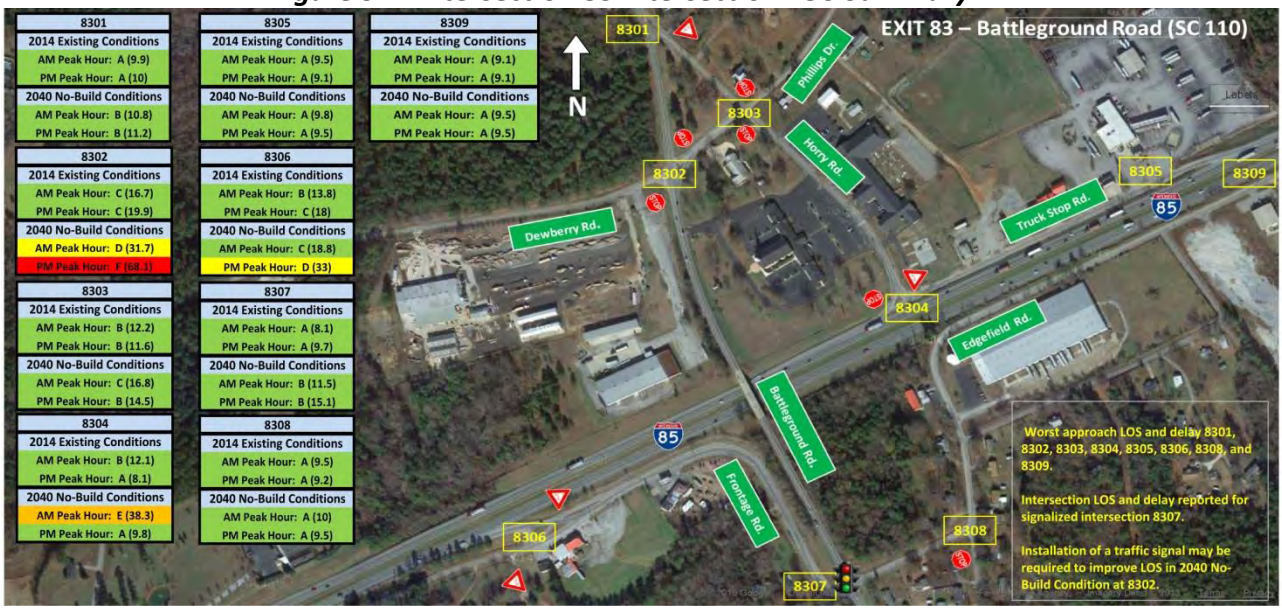
With the forecast increases in traffic and without improvements to the intersections, delay increases slightly on the stop sign controlled approach of Bud's Drive at its intersections with the Bud Arthur Bridge Road. However, this approach is expected to continue to operate at LOS A during the morning and afternoon peak hours.

No improvements should be necessary to provide acceptable LOS during the 2040 No-Build operating conditions at these intersections.

Exit 83 – Battleground Road (SC 110)

The analysis results for the existing and 2040 No-Build conditions at Exit 83 for the Battleground Road (SC 110) interchange intersections are illustrated in **Figure 94**.

Figure 94 - Intersection 83 Intersection LOS Summary



Existing Conditions

Under the existing conditions at Exit 83, the signalized intersection of Battleground Road with Frontage Road operates at LOS A during both peak hours. The yield and/or the stop sign controlled approaches at the remaining unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

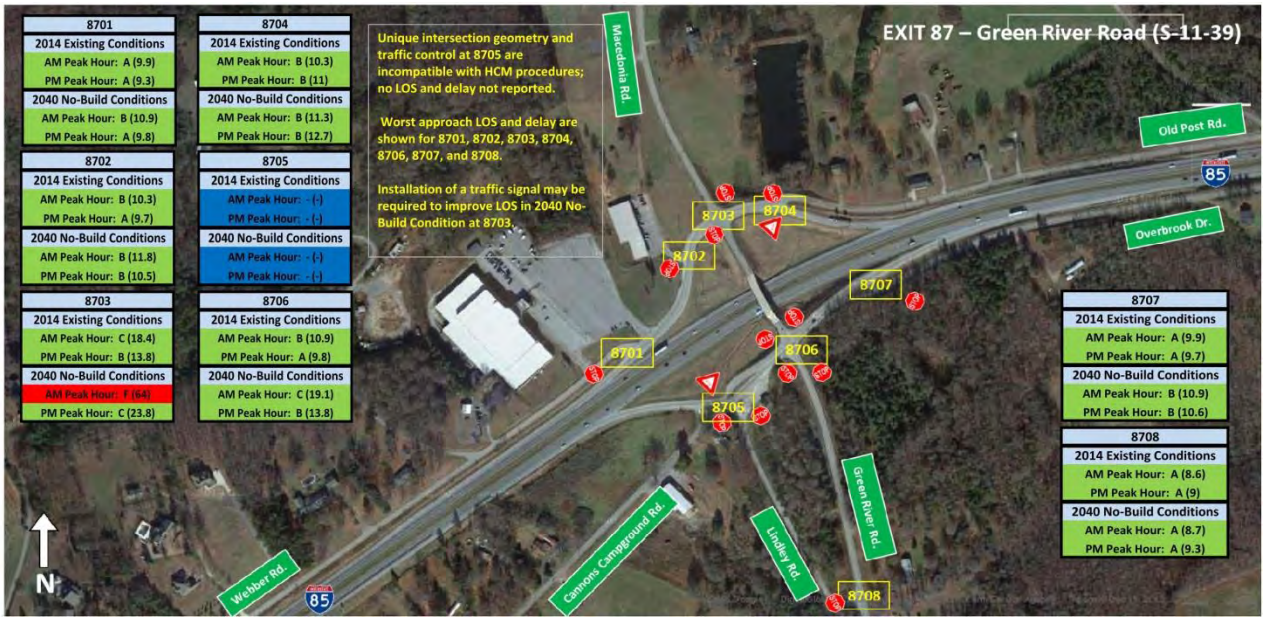
With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The signalized intersection of Battleground Road with Frontage Road is projected to operate at LOS B during both peak hours. The yield and/or the stop sign controlled approaches at the remaining unsignalized intersections are anticipated to operate at LOS D or better during the morning and afternoon peak hours, with the exception of the westbound approach of Phillips Drive at Battleground Road, which is projected to operate at LOS F during the afternoon peak hour.

The intersection of Phillips Drive and Battleground Road may require capacity or traffic control improvements, such as the installation of a traffic signal, to provide acceptable LOS during the 2040 No-Build operating conditions.

Exit 87 – Green River Road (S-11-39)

The analysis results for the existing and 2040 No-Build conditions at Exit 87 for the Green River Road (S-11-39) interchange intersections are illustrated in **Figure 95**.

Figure 95 - Exit 87 Intersection LOS Summary



Existing Conditions

Under the existing conditions at Exit 87, the atypical intersection configuration and traffic control at the intersection of the northbound off-ramp with Cannons Campground Road/Lindley Road is not incompatible with HCM analysis procedures, so delay and LOS cannot

be reported for either the existing or 2040 No-Build conditions. The yield and/or the stop sign controlled approaches at the remaining unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The yield and/or the stop sign controlled approaches at the unsignalized intersections are anticipated to operate at LOS C or better during the morning and afternoon peak hours, with the exception of the westbound approach of Old Post Road at Green River Road, which is projected to operate at LOS F during the afternoon peak hour.

The intersection of Green River Road and Webber Road/Old Post Road may require capacity or traffic control improvements, such as the installation of a traffic signal, to provide acceptable LOS during the 2040 No-Build operating conditions.

Exit 90 – Hyatt Street (S-11-81/SC 105)

The analysis results for the existing and 2040 No-Build conditions at Exit 90 for the Hyatt Street (S-11-81/SC 105) interchange intersections are illustrated in **Figure 96**.

Figure 96 - Exit 90 Intersection LOS Summary

Existing Conditions

The signalized intersections at the Exit 90 interchange area operate at LOS B or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The signalized intersections at the Exit 90 interchange area operate at LOS C or better during the morning and afternoon peak hours.

No improvements should be necessary to provide acceptable LOS during the 2040 No-Build operating conditions at these intersections.

Exit 92 – Chesnee Highway/W Floyd Baker Boulevard (SC 11)

The analysis results for the existing and 2040 No-Build conditions at Exit 92 for the Hyatt Street (SC 11) interchange intersections are illustrated in **Figure 97**.

Figure 97 - Exit 92 Intersection LOS Summary

Existing Conditions

The signalized intersections at the Exit 92 interchange area operate at LOS B or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

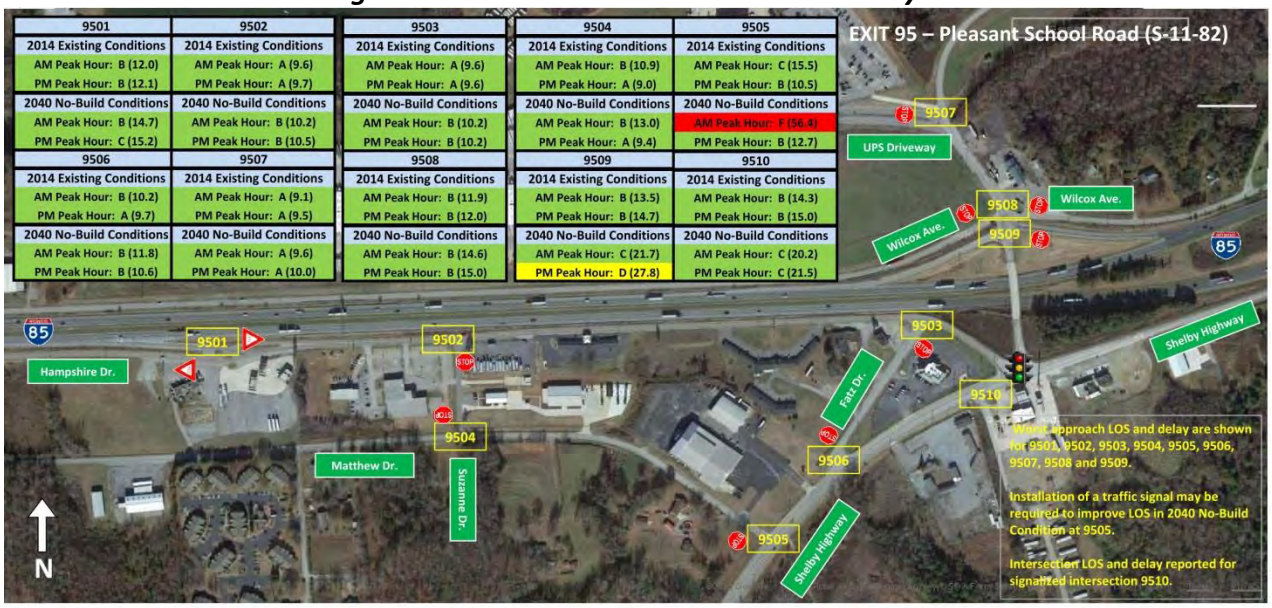
With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The signalized intersections at the Exit 90 interchange area operate at LOS D or better during the morning and afternoon peak hours.

No improvements should be necessary to provide acceptable LOS during the 2040 No-Build operating conditions at these intersections.

Exit 95 – Pleasant School Road (S-11-82)

The analysis results for the existing and 2040 No-Build conditions at Exit 95 for the Pleasant School Road (S-11-82) interchange intersections are illustrated in **Figure 98**.

Figure 98 - Exit 95 Intersection LOS Summary



Existing Conditions

Under the existing conditions at Exit 95, the signalized intersection of Pleasant School Road with Shelby Highway/Hampshire Drive operates at LOS B during both peak hours. The stop sign controlled approaches at the remaining unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The signalized intersection of

Battleground Road with Frontage Road is projected to operate at LOS C or better during both peak hours. The yield and/or the stop sign controlled approaches at the remaining unsignalized intersections are anticipated to operate at LOS D or better during the morning and afternoon peak hours, with the exception of the eastbound approach of Matthew Road at Shelby Highway, which is projected to operate at LOS F during the morning peak hour.

The intersection of Shelby Highway and Matthew Road may require capacity or traffic control improvements, such as the installation of a traffic signal, to provide acceptable LOS during the 2040 No-Build operating conditions.

Exit 96 – Shelby Highway (SC 18)

The analysis results for the existing and 2040 No-Build conditions at Exit 96 for the Shelby Highway (SC 18) interchange intersections are illustrated in **Figure 99**.

Figure 99 - Exit 96 Intersection LOS Summary

Existing Conditions

Under the existing conditions at Exit 96, the atypical intersection configuration and traffic control at the intersection of the Wilcox Avenue intersections with Lemuel Road and the southbound off-ramp are incompatible with HCM analysis procedures, so delay and LOS cannot be reported for either the existing or 2040 No-Build conditions. The yield and/or the stop sign controlled approaches at the remaining unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. During the morning peak hour, the yield and/or the stop sign controlled approaches at the remaining unsignalized intersections are anticipated to operate at LOS C or better except at the Shelby Highway intersection with Victory Trail Road, where the southbound approach of Shelby Highway is projected to operate at LOS F.

During the afternoon peak hour, only the southbound approach of Wind Hill Road at Victory Trail Road will operate at an acceptable LOS. The westbound approach of Wilcox Avenue to Shelby Highway, the northbound off-ramp approach to Shelby Highway, and the southbound Shelby Highway approach to Victory Trail Road are all projected to operate at LOS F.

The Shelby Highway intersections with Wilcox Avenue, the northbound off-ramp and Victory Trail Road may require capacity or traffic control improvements, such as the installation of a traffic signal, to provide acceptable LOS during the 2040 No-Build operating conditions.

Gaffney Ferry Road Slip On-Ramp

The unsignalized intersection of the northbound on-ramp from Gaffney Ferry Road carries low volumes. While it was not analyzed as part of this analysis, it is referenced here since the on-ramp is intended to be removed as part of the widening project.

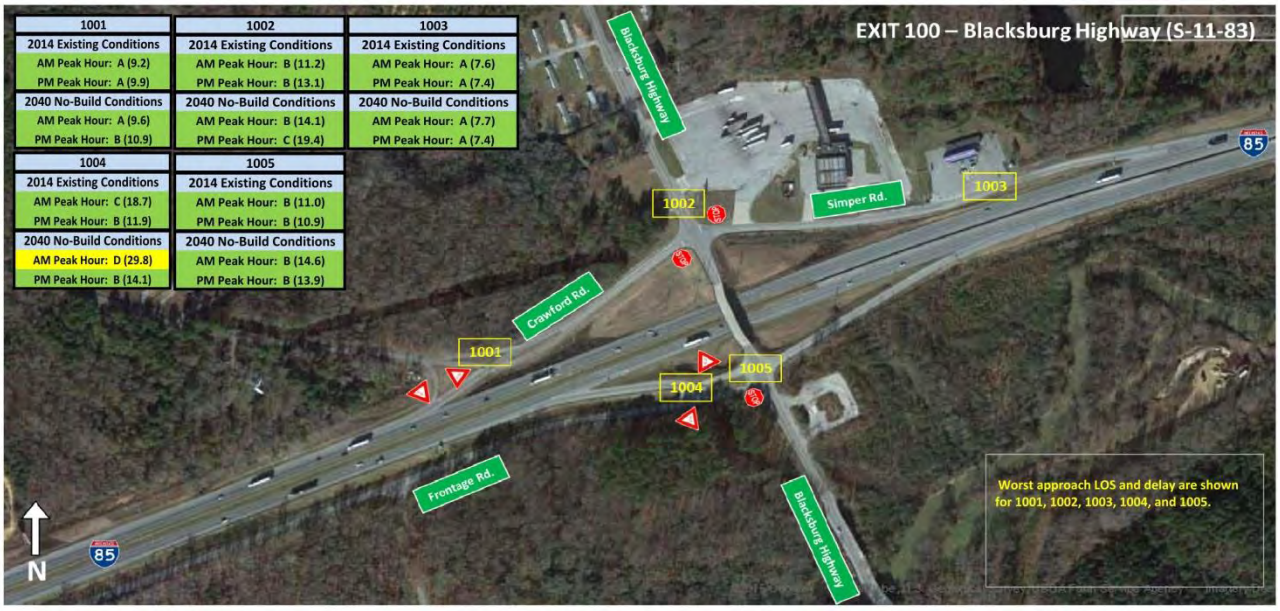
Exit 98 - Frontage Road Off-Ramp

The unsignalized intersection of the northbound off-ramp to Frontage Road at Exit 98 carries low volumes. While it was not analyzed as part of this analysis, it is referenced mentioned here since the off-ramp is intended to be removed as part of the widening project.

Exit 100 – Blacksburg Highway (S-11-83)

The analysis results for the existing and 2040 No-Build conditions at Exit 100 for the Blacksburg Highway (S-11-83) interchange intersections are illustrated in **Figure 100**.

Figure 100 - Exit 100 Intersection LOS Summary



Existing Conditions

Under the existing conditions at Exit 100, the yield and/or stop sign controlled approaches at the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours.

No improvements are necessary to provide acceptable LOS under existing conditions.

2040 No-Build Conditions

With the forecast increases in traffic and without improvements to the intersections, delay can be expected to increase on the intersection approaches. The yield and/or the stop sign controlled approaches at the remaining unsignalized intersections are anticipated to operate at LOS C or better during the morning and afternoon peak hours.

No improvements should be necessary to provide acceptable LOS during the 2040 No-Build operating conditions at these intersections.

Where the existing interchanges are proposed to be modified as part of the widening project (Exit 83, 87, 95, and 96), the capacity analysis results for the 2040 Build condition alternatives can be found within the section for each of those individual interchanges.

2040 Build Intersection Analysis

The results of the unsignalized and signalized intersection capacity analyses for the 2040 Build conditions are shown in **Table 20**. **Table 21** summarizes the storage length and queuing for 2040 Build conditions. Specific details concerning the results of the intersection capacity

analyses can be found in the discussion for each of the individual interchanges which are proposed to be modified as part of the widening project (Exit 83, 87, 95, and 96) . The queuing intersection outputs for each intersection are provided in **Appendix J**.

Table 20 - Intersection Capacity Analysis Results - 2040 Base vs 2040 Build

Intersection #	Intersection Name	2040 Base Conditions				2040 Build Conditions [Alternative 1]				2040 Build Conditions [Alternative 2]				2040 Build Conditions [Alternative 3]				2040 Build Conditions [Alternative 4]				2040 Build Conditions [Alternative 5]			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Exit 83																									
8301	Battleground Road (SC 110) at Horry Road (S-42-9725)*	B	10.8	B	11.2	intersection removed.																			
8302	Battleground Road (SC 110) at Phillips Drive*	D	31.7	F	68.1	E	38.4	D	32.1	C	18.7	C	15.6	C	18.7	C	16.4	E	38.4	D	32.1				
8303	Phillips Drive at Horry Road*	C	16.8	B	14.5	A	9.6	A	9.6	B	10.3	A	9.6	A	9.6	A	9.6	A	9.6	A	9.6				
8304	Truck Stop Road/Horry Road at I-85 SB on ramp*	E	38.3	A	9.8	intersections removed.																			
8305	Truck Stop Road at I-85 SB off ramp	A	9.8	A	9.5																				
8306	Frontage Road N at I-85 NB off-ramp*	C	18.8	D	33.0																				
8307	Battleground Road (SC 110) at Frontage Road N (S-42-737)**	B	11.5	B	15.1	A	3.5	A	3.8	intersection combined with I-85 NB ramps.				B	13.1	B	13.9	intersection combined with I-85 NB ramps.							
8308	Frontage Road N at Edgefield Road*	A	10.0	A	9.5	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0				
8309	Edgefield Road at I-85 NB on-ramp	A	9.5	A	9.5	intersection removed.																			
8310	Battleground Road (SC 110) at I-85 SB ramps*	intersections added under Build Conditions.				F	69.3	F	52.8	C	21.9	C	18.9	D	25.6	C	20.4	F	68.7	F	52.8				
8311	Battleground Road (SC 110) at I-85 NB ramps*					B	14.2	C	16.2	C	22.4	D	27.6	B	13.4	C	15.2	C	22.4	D	28.0				
8312	Phillips Drive at Unnamed Roadway*					A	8.8	A	8.9	intersections only in Alternatives 1 and 4.								A	8.8	A	8.9				
8313	Unnamed Roadway at Unnamed Roadway*					A	7.2	A	7.2									A	7.2	A	7.2				
8314	Frontage Road N at Unnamed Roadway*					A	0.0	A	0.0	intersection only in Alternatives 1, 3, and 4.				A	0.0	A	0.0	A	0.0	A	0.0				
8315	Battleground Road (SC 110) at Edgefield Road					intersection only in Alternatives 2, 3, and 4.				A	3.2	A	3.3	A	3.2	A	3.3	A	3.2	A	3.3				
8316	Edgefield Road at Unnamed Roadway*					intersection only in Alternatives 2 and 4.				A	8.9	A	8.7	intersection only in Alternatives 2 and 4.				A	8.9	A	8.9				
Exit 87																									
8701	Webber Road at I-85 SB on-ramp*	B	10.9	A	9.8	intersections removed.																			
8702	Webber Road at Lemon's Farm Entrance*	B	11.8	B	10.5																				
8703	S Green River Road (S-11-39) at Webber Road*	F	64.0	C	23.8	D	25.2	C	19.5	E	43.1	C	21.8	C	15.7	B	13.8	C	20.7	B	14.7	C	16.3	B	13.9
8704	Old Post Road at I-85 SB off-ramp*	B	11.3	B	12.7	intersections removed.																			
8705	Lindley Road at Cannons Campground Road/I-85 NB off-ramp	intersection incompatible with HCM 2000.																							
8706	S Green River Road (S-11-39) at Overbrook Drive (S-11-31)*	C	19.1	B	13.8	F	52.6	D	32.8	F	52.6	D	32.8	F	52.6	D	32.8	F	52.6	D	32.8	F	52.6	D	32.8
8707	Overbrook Drive at I-85 NB on-ramp	B	10.9	B	10.6	intersections removed.																			
8708	S Green River Road (S-11-39) at Lindley Road*	A	8.7	A	9.3																				
8709	Macedonia Road (S-11-39) at I-85 SB ramps*	intersections added under Build Conditions.				B	14.0	B	14.2	B	11.6	B	11.5	B	11.7	B	12.2	B	11.7	B	12.2	B	11.7	B	12.2
8710	S Green River Road (S-11-39) at I-85 NB ramps*					B	15.0	C	17.2	B	11.4	B	12.6	B	12.2	B	13.4	B	12.2	B	13.4	B	12.2	B	13.4
8711	Cannons Campground Road at Unnamed Roadway*					A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0
8712	Webber Road at Vernie Road*					A	9.6	A	9.8	A	9.6	A	9.8	A	9.6	A	9.8	A	9.6	A	9.8	A	9.6	A	9.8
8713	Webber Road at Unnamed Roadway*					intersection only in Alternatives 2, 3, and 4.				A	8.7	A	8.9	A	8.7	A	8.9	A	8.7	A	8.9	intersection only in Alternatives 2, 3, and 4.			
8714	Old Post Road at Malone Road*					intersection only in Alternatives 2, 4, and 5.				B	10.6	A	9.2	intersection only in Alternatives 2, 4, and 5.				A	9.8	A	9.2	A	9.3	A	9.8
8715	Old Post Road at Unnamed Roadway*					intersection only in Alternatives 3 and 4.								A	9.3	A	9.8	A	9.3	A	9.8	A	9.3	A	9.8
8716	Macedonia Road (S-11-39) at N Green River Road*					intersection only in Alternatives 3 and 5.								B	12.8	B	10.2	intersection only in Alternatives 3 and 5.				B	12.6	B	10.6
Exit 95																									
9501	Hampshire Drive at I-85 NB off-ramp	B	14.7	C	15.2	intersection removed.																			
9502	Hampshire Drive at Suzanna Drive*	B	10.2	B	10.5	A	8.8	A	9.4	A	10.0	A	9.4												
9503	Hampshire Drive at Fatz Road*	B	10.2	B	10.2	intersection removed.																			
9504	Suzanna Drive at Matthew Road*	B	13.0	A	9.4	B	11.7	A	9.4	C	15.9	B	11.1												
9505	Shelby Highway (SC 18) at Matthew Road***	F	56.4	B	12.7	F	62.3	C	15.6	F	7,063.8	F	636.7												
9506	Shelby Highway (SC 18) at Fatz Drive*	B	11.8	B	10.6	C	16.9	C	19.5	intersection removed.															
9507	Pleasant School Road (S-11-82) at UPS Driveway*	A	9.6	A	10.0	intersection removed.																			
9508	Pleasant School Road (S-11-82) at Wilcox Avenue*	B	14.6	B	15.0	B	12.7	B	12.4	B	12.3	B	12.4												
9509	Pleasant School Road (S-11-82) at I-85 SB ramps*	C	21.7	D	27.8	C	15.3	C	15.9	C	20.4	C	22.7												
9510	Shelby Highway (SC 18) at Pleasant School Road (S-11-82)	C	20.2	C	21.5	B	11.0	B	11.7	intersection combined with Matthew Road.															
9511	Pleasant School Road (S-11-82) at I-85 NB ramps*	intersections added under Build Conditions.				B	14.6	B	14.2	B	14.4	B	14.2												
9512	Wilcox Avenue at North UPS Driveway*					A	9.5	A	10.0	A	9.6	B	10.1												
9513	Wilcox Avenue at South UPS Driveway*					A	9.8	B	10.9	intersection combined with North Driveway.															
9514	Pleasant School Road at Gas Station Access Point*					C	16.0	C	15.5	intersection only in Alternative 1.															
Exit 96																									
9601	Wilcox Avenue at I-85 southound on-ramp	B	11.1	B	11.5	intersection removed.																			
9602	Wilcox Avenue at Lemeul Road*	intersection incompatible with HCM 2000.				A	9.4	A	9.6	A	9.4	A	9.3	A	9.4	A	9.3								
9603	Shelby Highway (SC 18) at Wilcox Avenue*	C	24.7	F	62.4	C	17.9	C	21.6	C	17.9	C	21.6	C	17.9	C	21.6								
9604	Wilcox Avenue at I-85 SB off-ramp	intersection incompatible with HCM 2000.				intersection removed.																			
9605	Shelby Highway (SC 18) at I-85 NB ramps*	C	24.0	F	73.3	D	25.9	F	113.3	D	25.9	F	113.3	D	26.0	F	114.0								
9606	Shelby Highway (SC 18) at Victory Trail Road (SC 329)*	F	144.4	F	193.1	F	190.7	F	105.3	F	112.7	E	45.8	F	230.1	F	299.9								
9607	Victory Trail Road (SC 329) at Wind Hill Road*	B	12.7	B	10.6	B	12.8	B	13.6	intersection removed.															
9608	Shelby Highway (SC 18) at I-85 SB ramps*	intersection added under Build Conditions.				D	27.6	F	66.8	D	27.6	F	66.8	D	27.6	F	66.8								

* Unsignalized intersection; worst approach LOS and delay reported.

** Unsignalized intersection under *2040 Build Conditions [Alternative 2]* only; worst approach LOS and delay reported.

*** Signalized intersection under *2040 Build Conditions with Improvements* only; worst approach LOS and delay reported otherwise.

Table 21 – 2040 Build Intersection Queue Lengths

Intersection #	Intersection Name	Movement	95th Percentile Queue Length (ft)																								Available Storage Length (ft)		
			2040 Base Conditions		2040 Build Conditions [Alternative 1]						2040 Build Conditions [Alternative 2]						2040 Build Conditions [Alternative 3]						2040 Build Conditions [Alternative 4]								
					without Improvements		Improved Option A		Improved Option B		without Improvements		Improved Option A		Improved Option B		without Improvements		Improved Option A		Improved Option B		without Improvements		Improved Option A		Improved Option B				
			AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	without Improvements	Improved Option A	Improved Option B
Exit 83																															
8302	Battleground Road (SC 110) at Phillips Drive	NBL	storage bay added under Build Conditions.		5	0	5	0			5	0					5	0											100	100	
		SBL			0	0	0	0			0	0					0	0											100	100	
8307	Battleground Road (SC 110) at Frontage Road N (S-42-737)	SBL			0	5	0	5			only in Alternative 1.						intersection combined with I-85 NB ramps.												100	100	
		EBR			only in Alternative 2.						0	0																	150	150	
8310	Battleground Road (SC 110) at I-85 SB ramps[1]	NBL	intersection added under Build Conditions.		25	15	165	70			25	15					25	15											100	100	
		WBR			0	0	30	30			only in Alternative 1.						only in Alternative 1.												150	150	
8311	Battleground Road (SC 110) at I-85 NB ramps	NBL			only in Alternative 3.						only in Alternative 3.						0	0											100	100	
		SBL			5	5	5	5			5	5					5	5											100	100	
		EBL			20	40	20	45			only in Alternative 1.						only in Alternative 1.												150	150	
		EBR			only in Alternative 3.						only in Alternative 3.						0	0											150	150	
		WBL															75	135											150	150	
8315	Battleground Road (SC 110) at Edgefield Road	SBL	only in Alternatives 2 and 3.								0	5					0	5											100	100	
Exit 87																															
8706	S Green River Road (S-11-39) at Overbrook Drive (S-11-31)[2]	EBL	storage bay added under Improved Option A Conditions.				55	45	storage bay added under Improved Option A Conditions.				55	45	storage bay added under Improved Option A Conditions.		55	45	storage bay added under Improved Option A Conditions.				55	45	added under Improved Option A Conditions.		-	150	-	
		WBR					0	0					0	0			0	0					0	0			-	150	-	
8709	Macedonia Road (S-11-39) at I-85 SB ramps	NBL	intersection added under Build Conditions.		10	5	10	5	10	5	only in Alternatives 1, 3, and 4.						10	5	10	5	10	5	10	5	10	5	10	5	150	150	150
		SBL			only in Alternative 2.						10	5	10	5	10	5	only in Alternative 2.												-	150	150
8710	S Green River Road (S-11-39) at I-85 NB ramps	NBL									0	0	0	0	0	0													-	150	150
		SBL			5	5	5	5	5	5	only in Alternatives 1, 3, and 4.						5	5	5	5	5	5	5	5	5	5	5	5	150	150	150
Exit 95																															
9505	Shelby Highway (SC 18) at Matthew Road[2]	NBL	storage bay added under Build Conditions.		25	5	25	5	60	15	15	5			140	35													150		150
		SBL			only in Alternative 2.						10	15			80	80													150		150
		EBL			added under Option A.		60	10	added under Option A.		80	50			30	20													150		150
		WBL			only in Alternative 2.						(err)	640			255	140													150		300
9506	Shelby Highway (SC 18) at Fatz Drive	EBL			0	0	0	0	0	0	only in Alternative 1.				only in Alternative 1.														150		150
9508	Pleasant School Road (S-11-82) at Wilcox Avenue	NBL			5	5	5	5	5	5	5	5			5	5													150		150
		SBL			0	0	0	0	0	0	0	0			0	0													150		150
		EBL			0	5	0	5	0	5	0	5			0	5													150		150
		WBL			5	5	5	5	5	5	5	5			5	5													150		150
9509	Pleasant School Road (S-11-82) at I-85 SB ramps	NBL			5	10	5	10	5	10	5	10			5	10													150		150
9510	Shelby Highway (SC 18)/Hampshire Drive at Pleasant School Road (S-11-82)	SBL			80	120	80	120	80	120	combined with Matthew Road.				combined with Matthew Road.														200		200
		EBL			150	195	150	195	150	195																			200		200
9511	Pleasant School Road (S-11-82) at I-85 NB ramps	SBL	added under Build.		0	0	0	0	0	0	0	0			0	0													150		150
Exit 96																															
9603	Shelby Highway (SC 18) at Wilcox Avenue	NBL	storage bay added under Build Conditions.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							150	150	150
		SBL			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							150	150	150
		EBL			5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10							150	150	150
		WBL			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							150	150	150
9605	Shelby Highway (SC 18) at I-85 NB ramps[2]	SBL	5	0	5	0	5	0	20	20	5	0	5	0	20	20	5	0	5	0	20	20							130 (150) [100][4]	130 (150) [100][4]	130 (150) [100][4]
		EBL	storage bay added under Build Conditions.		added under Option A.		30	110	added under Option A.		30	110	added under Option A.				30	110	added under Option A.										-	200	200
9606	Shelby Highway (SC 18) at Victory Trail Road (SC 329)[3]	NBR			only in Alternative 2.						0	0	30	30	30	30	only in Alternative 2.												200	200	200
		NBL			only in Alternative 3.												30	20	145	115	155	140							150	150	150
		SBL	355	355	425	260	115	80	115	80	20	15	120	65	120	65	only in Alternatives 1 and 2.												250 (150)[5]	250 (150)[5]	250 (150)[5]
		EBL	20	40	20	30	85	110	85	110	only in Alternatives 1 and 3.						375	545	105	150	125	175							275 (150)[5]	275 (150)[5]	275 (150)[5]
		WBL	added under Build.		only in Alternative 2.						360	195	135	90	135	90	only in Alternative 2.												150	150	150
9608	Shelby Highway (SC 18) at I-85 SB ramps[2]	NBL	intersection added under Build Conditions.		10	10	10	10	35	45	10	10	10	10	35	45	10	10	10	10	35	45							150 (100)[6]	150 (100)[6]	150 (100)[6]
		WBL			added under Option A.		25	75	added under Option A.				25	75	added under Option A.				25	75	added under Option A.								-	100	100

[1] Intersection signalized under *2040 Build Conditions: Improved Option A.*

[2] Intersection signalized under *2040 Build Conditions: Improved Option B.*

[3] Intersection signalized under *2040 Build Conditions: Improved Option A* and *Improved Option B.*

[4] Storage length changes between *2040 Base Conditions, 2040 Build Conditions [Alternatives 1 and 3]* (shown in parentheses) and *2040 Build Conditions [Alternative 2]* (shown in brackets).

[5] Storage length changes between *2040 Base Conditions* and *2040 Build Conditions* (shown in parentheses).

[6] Storage length changes between *2040 Build Conditions [Alternatives 1 and 3]* and *2040 Build Conditions [Alternative 2]* (shown in parentheses).

Exit 80 – Gossett Road (S-42-57)

The interchange at Gossett Road is not expected to be modified as part of this project. Therefore, the results of the 2040 Build analyses for the unsignalized intersections within the Exit 80 interchange area will be the same as the results of the 2040 No-Build analyses (see **Figure 91**).

Exit 82 – Bud's Drive (S-42-1012)/Bud Arthur Bridge Road (S-42-737/1013)

The northbound off-ramp to Bud's Drive is anticipated to be removed as part of this project. With the removal of the off-ramp, the intersection of Bud's Drive with the off-ramp will cease to exist.

The removal of the off-ramp should reduce the small volume of traffic traveling on Bud's Drive to Bud Arthur Bridge Road. This reduction in traffic should also reduce delay on the stop sign controlled approach of Bud's Drive at this intersection. Since this approach operates at LOS A under existing conditions and is expected to continue operate at LOS A under the 2040 No-Build conditions (see Figure 92), no improvements are anticipated to be necessary at this intersection.

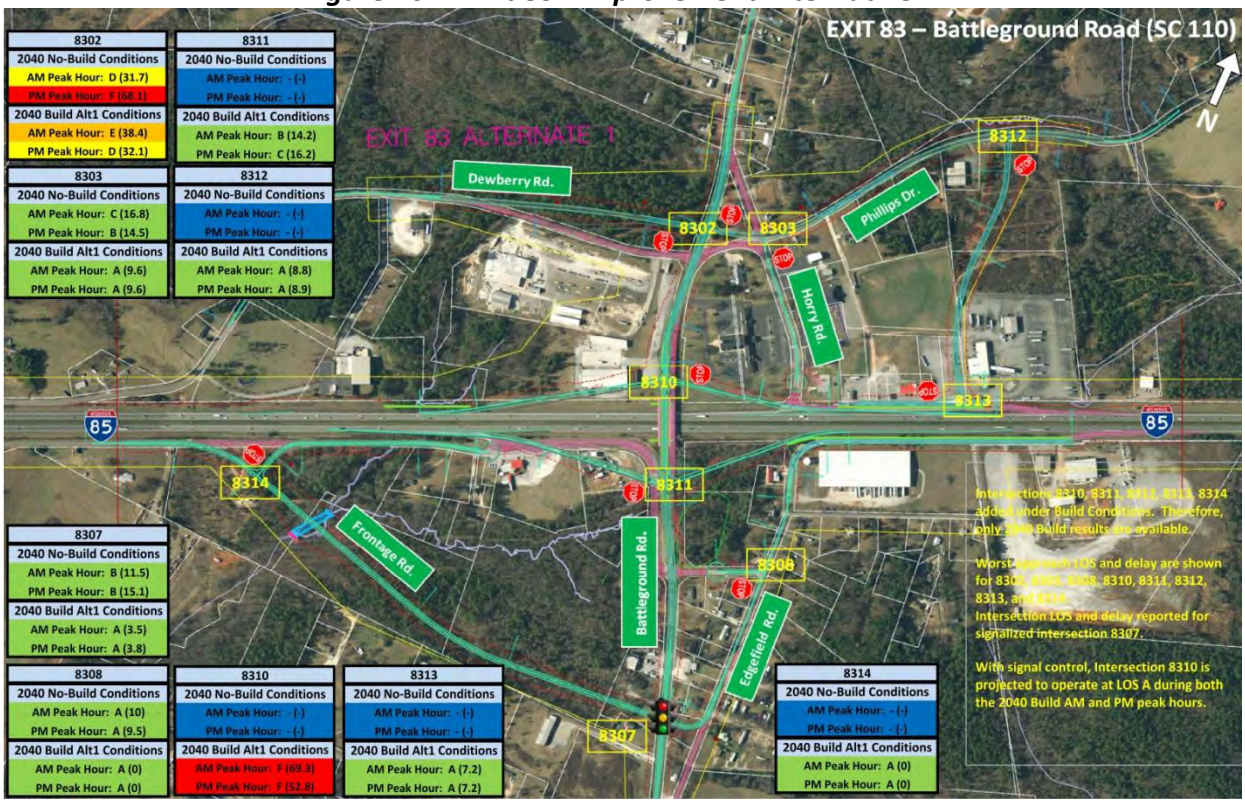
Exit 83 – Battleground Road (SC 110)

The Battleground Road interchange is expected to be modified as part of the I-85 widening project. 2040 Build analyses for the intersections within the Exit 83 interchange area were performed for four alternatives.

Alternative 1

The conceptual design of Alternative 1 is shown in **Figure 101**.

Figure 101 - Exit 83: Improvement Alternative 1



Alternative 1 replaces the existing Exit 83 interchange with a diamond interchange. Other elements of the alternative concept include:

- Eliminating the intersections of
  - Battleground Road and Horry Road
  - Truck Stop Road and the southbound off-ramp
  - Truck Stop Road and Horry Road/southbound on-ramp
  - Frontage Road and the northbound off-ramp
  - Edgefield Road and the northbound on-ramp
- Relocating and adjusting the alignment of the approaches at the intersection of Battleground Road with Dewberry Road/Phillips Drive to the north to increase the spacing between that intersection and the southbound ramp intersection
- Placing a cul de sac on the south end of Horry Road
- Creating a new connection between Phillips Drive and Truck Stop Road to provide alternative access to the businesses fronting Truck Stop Road
- Relocating the Frontage Road intersection to the south to increase spacing between that intersection and the northbound ramp intersection.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized with the exception of the relocated intersection of the Frontage Road to the south along Battleground Road, which is an existing signalized intersection.

In Alternative 1, the signalized intersection of Battleground Road with Frontage Road operates at LOS A during both peak hours. With the creation of the diamond ramps, this signal may no longer be needed since the northbound off-ramp traffic currently using the Frontage Road to reach Battleground Road is diverted away from this intersection to the new northbound ramp intersection, reducing the minor street volumes. The stop sign controlled approaches at the remaining unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours, with the exception of the westbound approach of Phillips Road at Battleground Drive, which operates at LOS D during both peak hours, and the new southbound off-ramp intersection with Battleground Road, which operates at LOS F during the morning peak hour and LOS E during the afternoon peak hour.

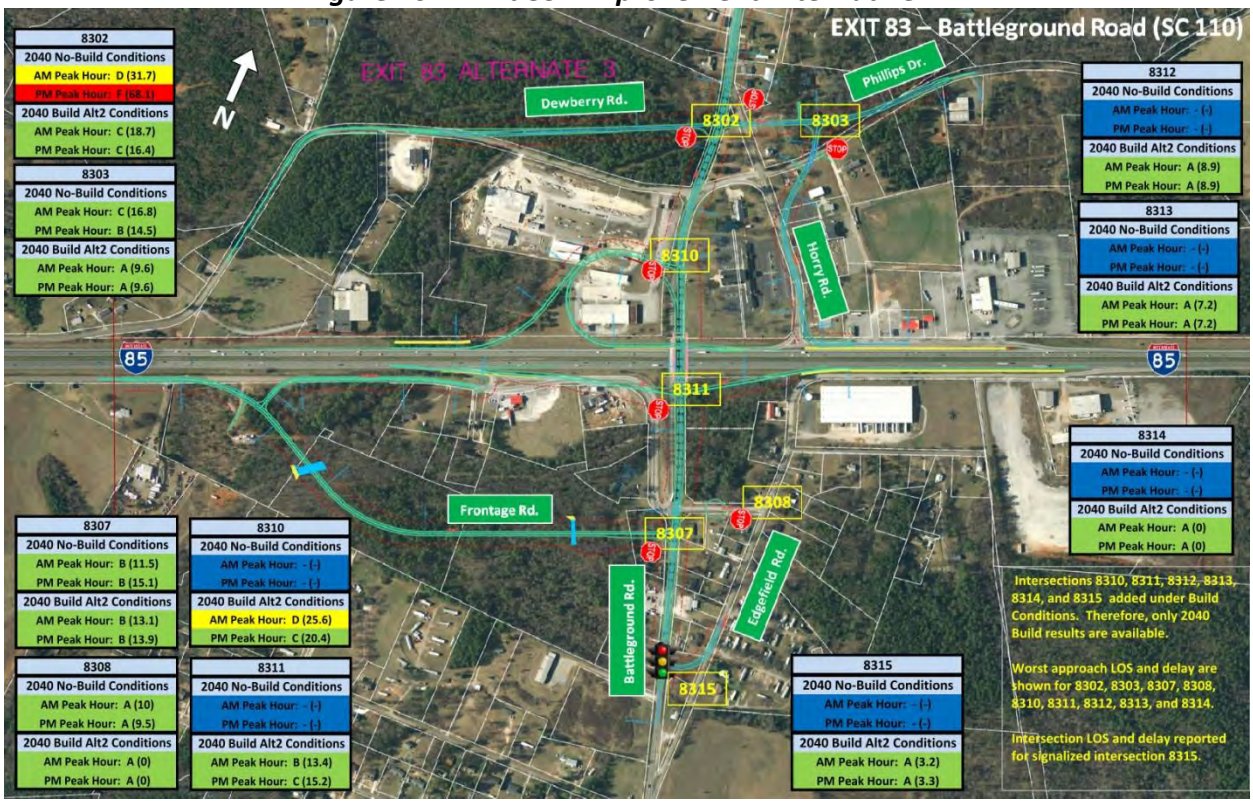
Based on the results of this analysis,

- *the signal at the Frontage Road intersection with Battleground Road may no longer be required; the Frontage Road approaches may be able to be placed under stop sign control provided sufficient sight distance is available*
- *the intersection of the southbound ramps with Battleground Road will likely require signalization to obtain acceptable peak hour LOS*
- *the intersection of Phillips Drive and Battleground Road may require signalization*

Alternative 2

The conceptual design of Alternative 2 is shown in **Figure 102**.

Figure 102 - Exit 83: Improvement Alternative 2



Alternative 2 replaces the existing Exit 83 interchange with a partial cloverleaf interchange, with a southbound loop off-ramp located in the northwest quadrant of the interchange. Other elements of the alternative concept include:

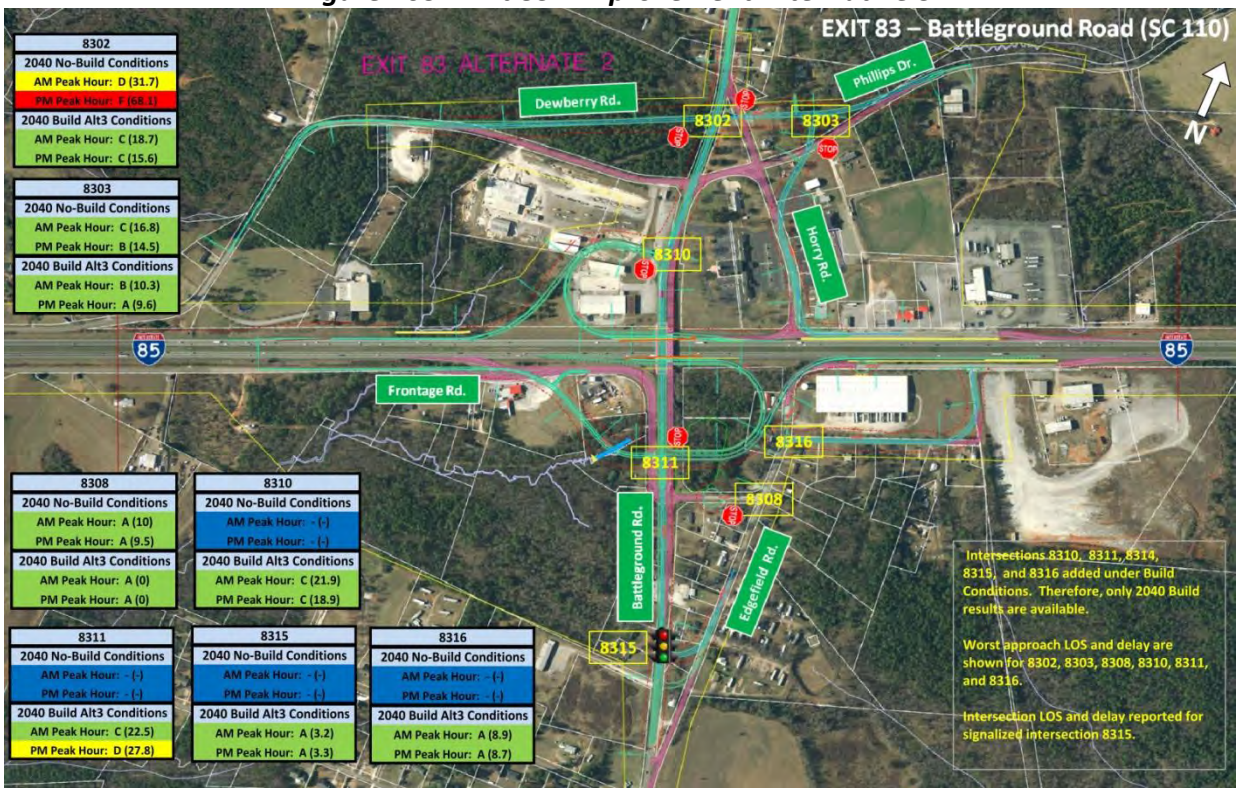
- Eliminating the intersections of
  - Battleground Road and Horry Road
  - Truck Stop Road and the southbound off-ramp
  - Truck Stop Road and Horry Road/southbound on-ramp
  - Frontage Road and the northbound off-ramp
  - Edgefield Road and the northbound on-ramp
- Relocating and adjusting the alignment of the approaches at the intersection of Battleground Road with Dewberry Road/Phillips Drive to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches at the intersection of Phillips Drive and Horry Road
- Placing a cul de sac on the south end of Horry Road
- Creating a new connection between Phillips Drive and Truck Stop Road to provide alternative access to the businesses fronting Truck Stop Road
- Relocating and separating the Frontage Road intersection to the south to increase spacing between that intersection and the northbound ramp intersection. This would create offset T-intersections separated by approximately **800** feet.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized. The analysis result indicate that the stop sign controlled approaches at the unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours.

Alternative 3

The conceptual design of Alternative 3 is shown in **Figure 103**.

Figure 103 - Exit 83: Improvement Alternative 3



Alternative 3 replaces the existing Exit 83 interchange with a partial cloverleaf interchange, with a northbound loop off-ramp located in the southeast quadrant of the interchange, and a southbound loop off-ramp located in the northwest quadrant of the interchange. Other elements of the alternative concept include:

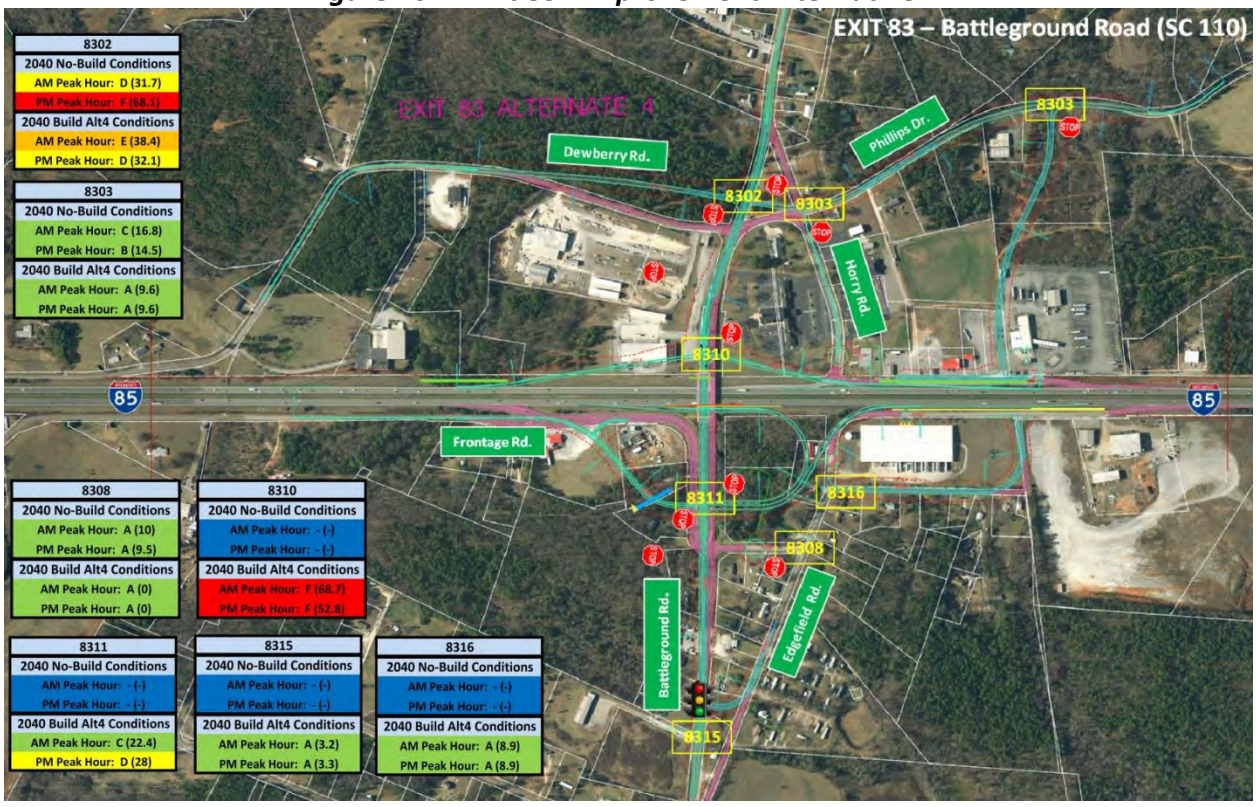
- Eliminating the intersections of
  - Battleground Road and Horry Road
  - Truck Stop Road and the southbound off-ramp
  - Truck Stop Road and Horry Road/southbound on-ramp
  - Frontage Road and the northbound off-ramp
  - Edgefield Road and the northbound on-ramp

- Relocating and adjusting the alignment of the approaches at the intersection of Battleground Road with Dewberry Road/Phillips Drive to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches at the intersection of Phillips Drive and Horry Road
- Curving Horry Road into Truck Stop Road to provide access to the businesses fronting Truck Stop Road
- Relocating and separating the Frontage Road intersection so that the west approach of Frontage Road would connect opposite the northbound loop off-ramp while the east approach of Frontage Road would be offset to the south by approximately **1,250** feet to create a separate T-intersection.

Alternative 4

The conceptual design of Alternative 4 is shown in **Figure 104**.

Figure 104 - Exit 83: Improvement Alternative 4



Alternative 4 replaces the existing Exit 83 interchange with a partial cloverleaf interchange, with a northbound loop off-ramp located in the southeast quadrant of the interchange. Other elements of the alternative concept include:

- Eliminating the intersections of

  - Battleground Road and Horry Road
  - Truck Stop Road and the southbound off-ramp
  - Truck Stop Road and Horry Road/southbound on-ramp
  - Frontage Road and the northbound off-ramp
  - Edgefield Road and the northbound on-ramp
- Relocating and adjusting the alignment of the approaches at the intersection of Battleground Road with Dewberry Road/Phillips Drive to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches at the intersection of Phillips Drive and Horry Road
- Placing a cul de sac on the south end of Horry Road
- Creating a new connection between Phillips Drive and Truck Stop Road to provide alternative access to the businesses fronting Truck Stop Road
- Relocating and separating the Frontage Road intersection so that the west approach of Frontage Road would connect opposite the northbound loop off-ramp while the east approach of Frontage Road would be offset to the south by approximately **1,250** feet to create a separate T-intersection.

In Alternative 4, the signalized intersection of Battleground Road with Frontage Road operates at LOS A during both peak hours. With the creation of the ramps, this signal may no longer be needed since the northbound off-ramp traffic currently using the Frontage Road to reach Battleground Road is diverted away from this intersection to the new northbound ramp intersection, reducing the minor street volumes. The stop sign controlled approaches at the unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours, with the exception of the westbound approach of Phillips Road at Battleground Drive, which operates at LOS E during the morning peak hour and LOS D during the afternoon peak hour, and the new southbound off-ramp intersection with Battleground Road, which operates at LOS F during the both peak hours.

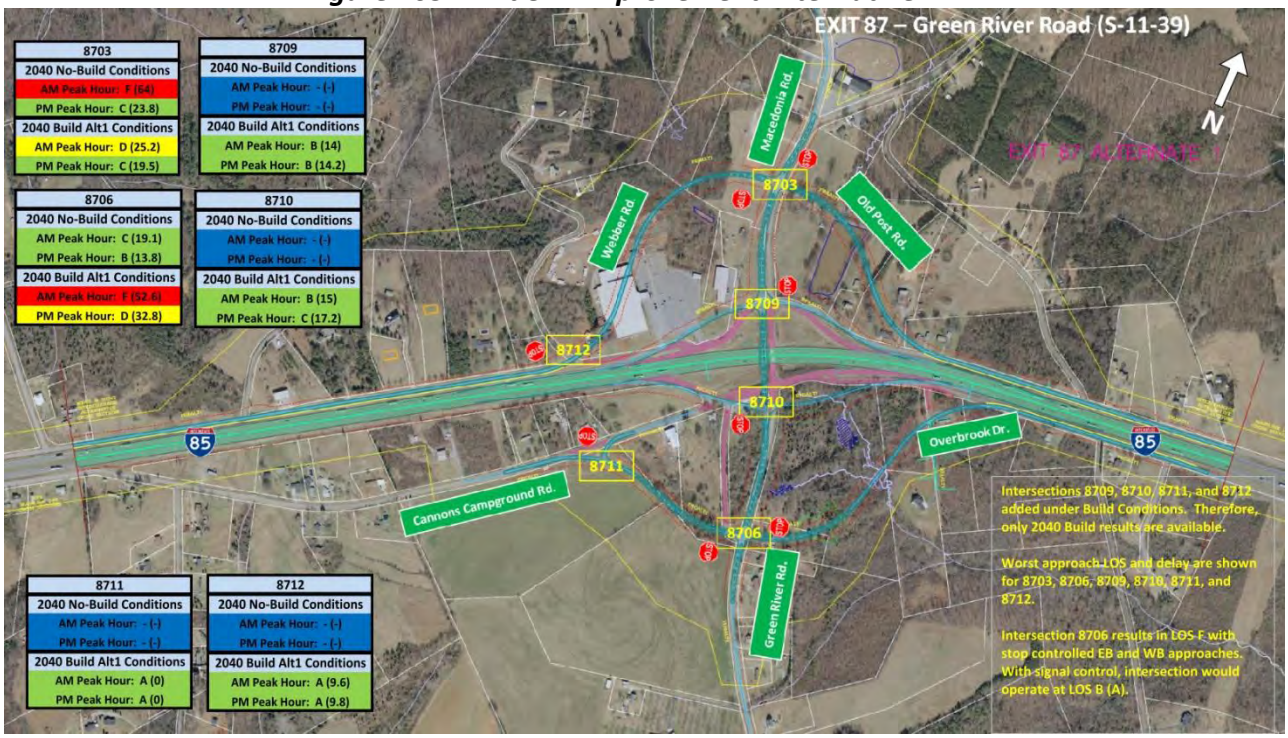
Exit 87 – Green River Road (S-11-39)

The Green River Road interchange is expected to be modified as part of the I-85 widening project. 2040 Build analyses for the intersections within the Exit 87 interchange area were performed for five alternatives.

Alternative 1

The conceptual design of Alternative 1 is shown in **Figure 105**.

Figure 105 - Exit 87: Improvement Alternative 1



Alternative 1 replaces the existing Exit 87 interchange with a diamond interchange. Other elements of the alternative concept include:

- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Webber Road/Old Post Road to the north to increase the spacing between that intersection and the southbound ramp intersection
- relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Cannons Campground Road/Overbrook Drive to increase the spacing between that intersection and the northbound ramp intersection

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

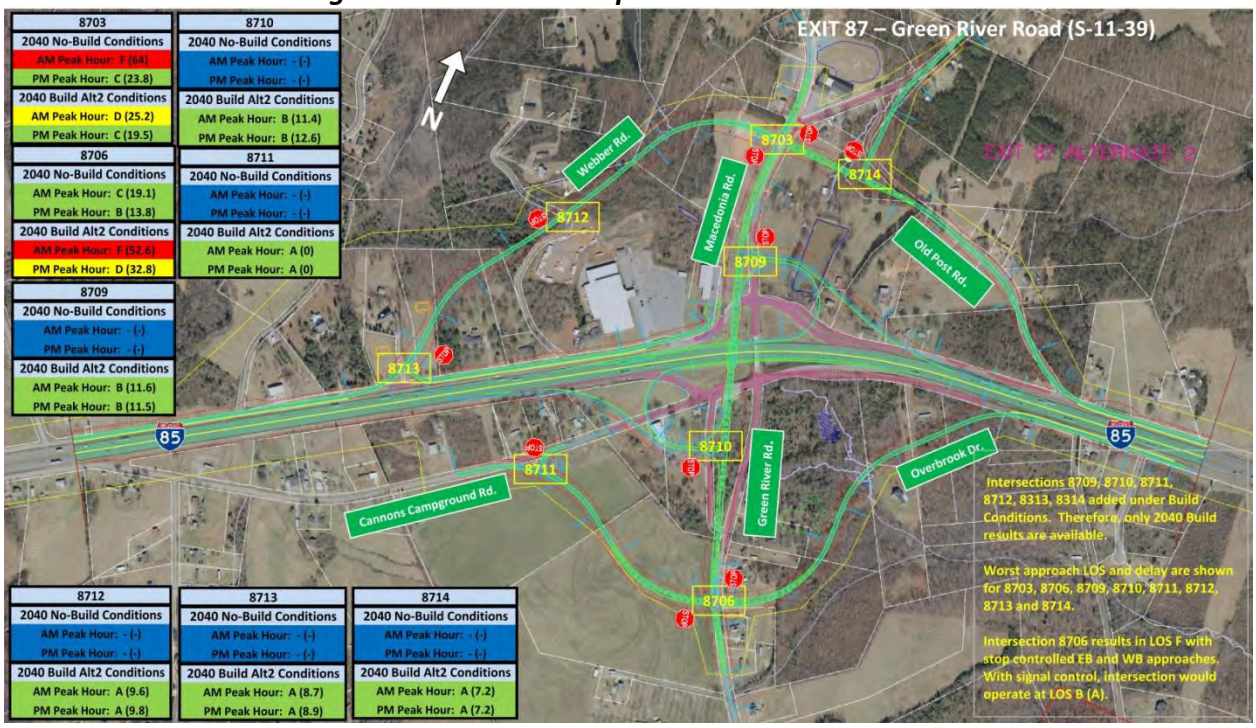
In Alternative 1, the stop sign controlled approaches of the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours, with the exception of the eastbound approach of Cannons Campground Road to Green River Road, which operates at LOS F during the morning peak hour.

Based on the results of this analysis, the stop sign controlled eastbound approach of Cannons Campground Road would need to provide a separate left turn lane and a shared through-right turn lane to operate at LOS D or better during the morning peak hour. If the intersection of Green River Road and Cannons Campground Road were signalized, the intersection would operate at LOS B or better during the peak hours.

Alternative 2

The conceptual design of Alternative 2 is shown in **Figure 106**.

Figure 106 - Exit 87: Improvement Alternative 2



Alternative 2 replaces the existing Exit 87 interchange with a partial cloverleaf interchange with a southbound loop on-ramp located in the northeast quadrant and a northbound loop on-ramp located in the southwest quadrant of the interchange. Other elements of the alternative concept include:

- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Webber Road/Old Post Road to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Cannons Campground Road/Overbrook Drive to the south to increase the spacing between that intersection and the northbound ramp intersection
- Eliminating the intersection of Green River Road and Macedonia Road, and realigning the Malone Road intersection with Green River Road

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

In Alternative 2, the stop sign controlled approaches of the unsignalized intersections operate at LOS E or better during the morning and afternoon peak hours, with the exception of the

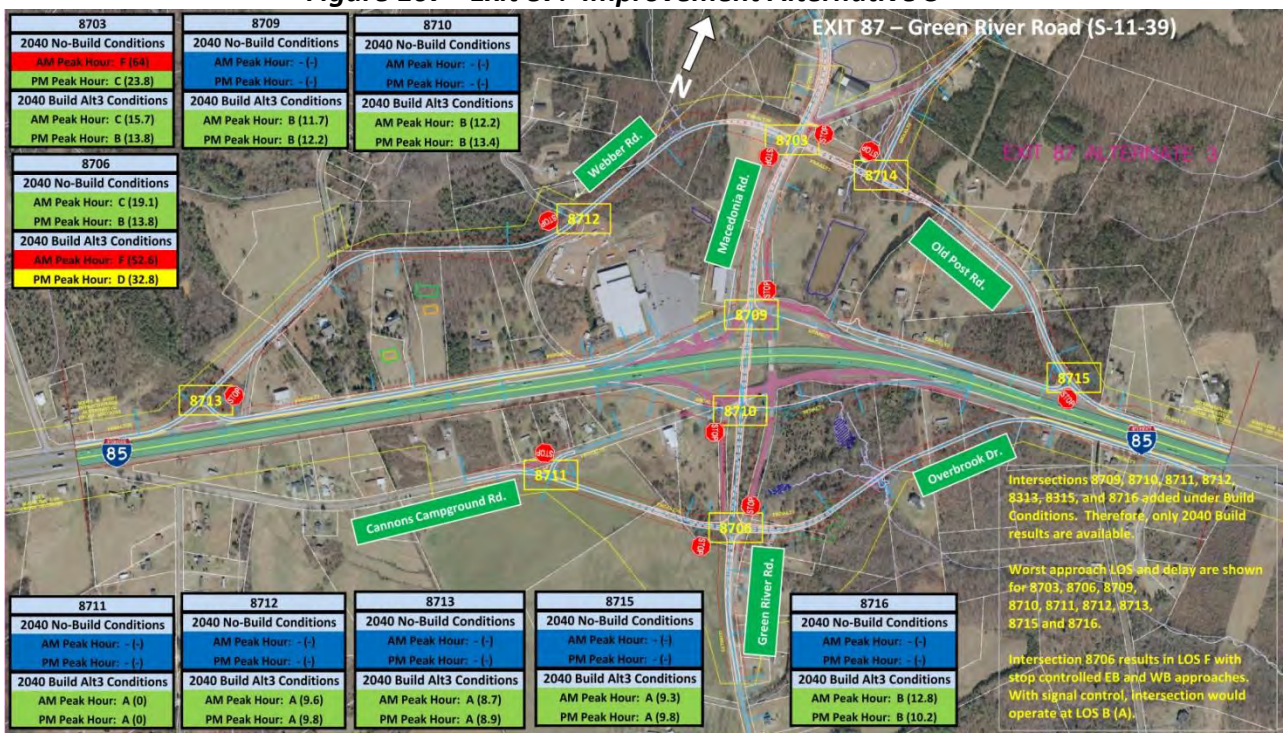
eastbound approach of Cannons Campground Road to Green River Road, which operates at LOS F during the morning peak hour.

Based on the results of this analysis, the stop sign controlled eastbound approach of Cannons Campground Road would need to provide a separate left turn lane and a shared through-right turn lane to operate at LOS D or better during the morning peak hour. If the intersection of Green River Road and Cannons Campground Road were signalized, the intersection would operate at LOS B or better during the peak hours.

Alternative 3

The conceptual design of Alternative 3 is shown in **Figure 107**.

Figure 107 - Exit 87: Improvement Alternative 3



Alternative 3 replaces the existing Exit 87 interchange with a diamond interchange. Alternative 3 is similar to Alternative 1 in that Alternative 3 provides for:

- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Webber Road/Old Post Road to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Cannons Campground Road/Overbrook Drive to increase the spacing between that intersection and the northbound ramp intersection

The primary difference between Alternatives 1 and 3 is Alternative 1 reroutes Webber Road east of the interchange to the relocated intersection of Webber Road/Old Post Road with Green River Road, while Alternative 3 reroutes Webber Road traffic east of the interchange to Malone Road, which then intersects Green River Road.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

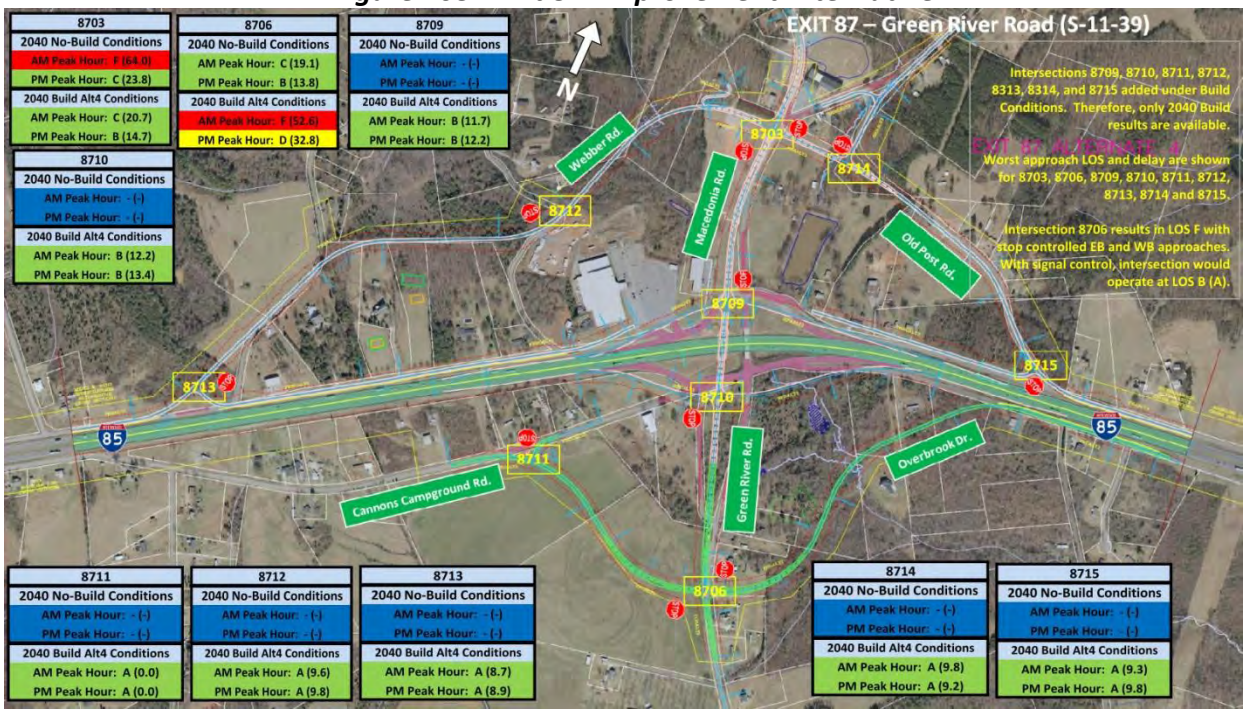
In Alternative 3, the stop sign controlled approaches of the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours, with the exception of the eastbound approach of Cannons Campground Road to Green River Road, which operates at LOS F during the morning peak hour.

Based on the results of this analysis, the stop sign controlled eastbound approach of Cannons Campground Road would need to provide a separate left turn lane and a shared through-right turn lane to operate at LOS D or better during the morning peak hour. If the intersection of Green River Road and Cannons Campground Road were signalized, the intersection would operate at LOS B or better during the peak hours.

Alternative 4

The conceptual design of Alternative 4 is shown in **Figure 108**.

Figure 108 - Exit 87: Improvement Alternative 4



Alternative 4 replaces the existing Exit 87 interchange with a diamond interchange. Alternative 4 is similar to Alternatives 1 and 3 in that Alternative 4 provides for:

- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Webber Road/Old Post Road to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Cannons Campground Road/Overbrook Drive to increase the spacing between that intersection and the northbound ramp intersection

Alternative 4 is also similar to Alternative 2 in that it eliminates the intersection of Green River Road and Macedonia Road, and realigns the Malone Road intersection with Green River Road.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

In Alternative 4, the stop sign controlled approaches of the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours, with the exception of the eastbound approach of Cannons Campground Road to Green River Road, which operates at LOS F during the morning peak hour.

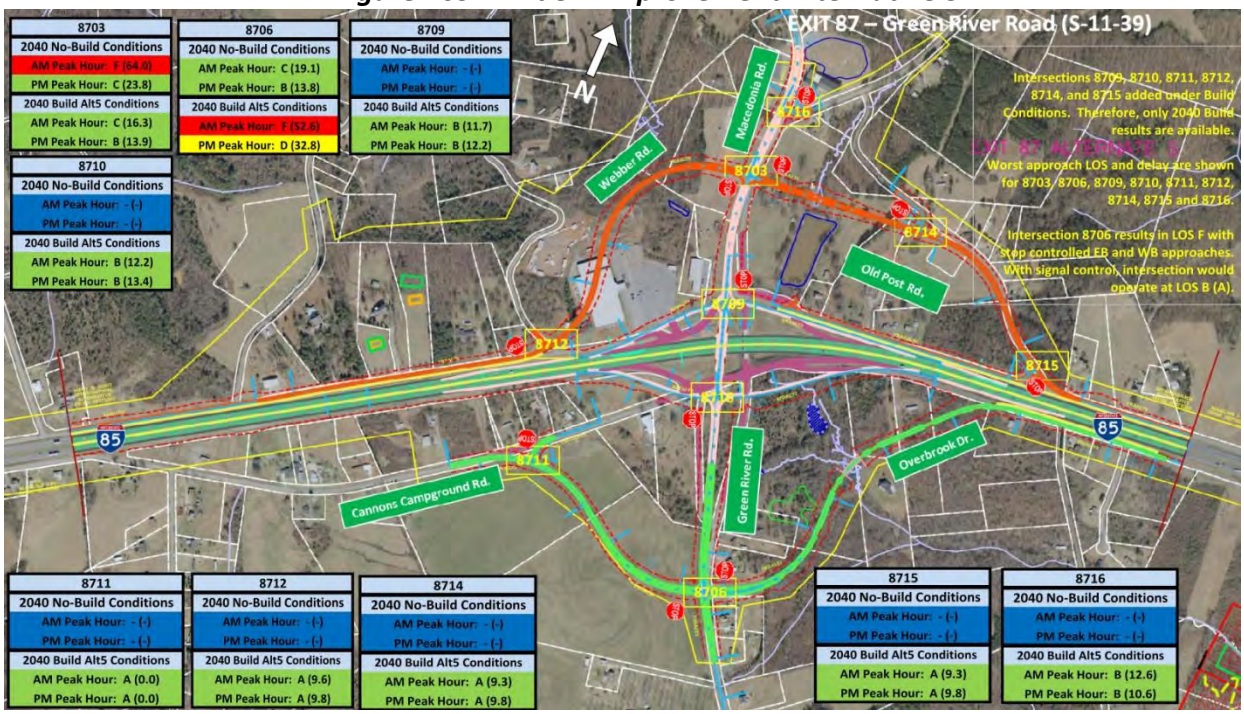
Based on the results of this analysis, the stop sign controlled eastbound approach of Cannons Campground Road would need to provide a separate left turn lane and a shared through-right

turn lane to operate at LOS D or better during the morning peak hour. If the intersection of Green River Road and Cannons Campground Road were signalized, the intersection would operate at LOS B or better during the peak hours.

Alternative 5

The conceptual design of Alternative 5 is shown in **Figure 109**.

Figure 109 - Exit 87: Improvement Alternative 5



Alternative 5 (a combination of Alternatives 1 and 4) replaces the existing Exit 87 interchange with a diamond interchange. Other elements of the alternative concept include:

- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Webber Road/Old Post Road to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Cannons Campground Road/Overbrook Drive to increase the spacing between that intersection and the northbound ramp intersection
- Eliminating the intersection of Green River Road and Macedonia Road, and realigning the Malone Road intersection with Green River Road to avoid the pond and minimize impacts to the wetland and stream north of the pond.

Based on the results of this analysis, the stop sign controlled eastbound approach of Cannons Campground Road would need to provide a separate left turn lane and a shared through-right

turn lane to operate at LOS D or better during the morning peak hour. If the intersection of Green River Road and Cannons Campground Road were signalized, the intersection would operate at LOS B or better during the peak hours.

Exit 90 – Hyatt Street (S-11-81/SC 105)

The interchange at Hyatt Street is not expected to be modified as part of this project. Therefore, the results of the 2040 Build analyses for the intersections within the Exit 90 interchange area will be the same as the results of the 2040 No-Build analyses (see **Figure 95**).

In the accident analysis, the northbound on-ramp merging area onto I-85 was identified as one of the ramp locations with a high number of crashes. As part of the widening design, the northbound on-ramp from Exit 90 will be converted from a tapered acceleration lane to a parallel acceleration lane, and lengthened from 750 feet to 1000 feet. These design improvements are intended to enhance safety by facilitating the merging of on-ramp traffic into northbound I-85 mainline traffic over a longer distance.

Exit 92 – Chesnee Highway/W Floyd Baker Boulevard (SC 11)

The interchange at Chesnee Highway is not expected to be modified as part of this project. However, improvements will be made to increase the parallel lane lengths for the acceleration and deceleration lanes at the interchange. These improvements include increasing the parallel lane length:

- for the southbound off-ramp deceleration lane from 200 feet to 300 feet,
- for the southbound loop on-ramp acceleration lane from 850 feet to 1,220 feet,
- for the southbound on-ramp acceleration lane from 275 feet to 400 feet,
- for the northbound off-ramp deceleration lane from 235 feet to 400 feet,
- for the northbound loop on-ramp acceleration lane from 860 feet to 1,220 feet,
- for the northbound on-ramp acceleration lane from 330 feet to 400 feet.

However, these modifications to the ramp acceleration/deceleration lane lengths will not affect the intersection operations. Therefore, the results of the 2040 Build analyses for the intersections within the Exit 92 interchange area will be the same as the results of the 2040 No-Build analyses (see **Figure 96**).

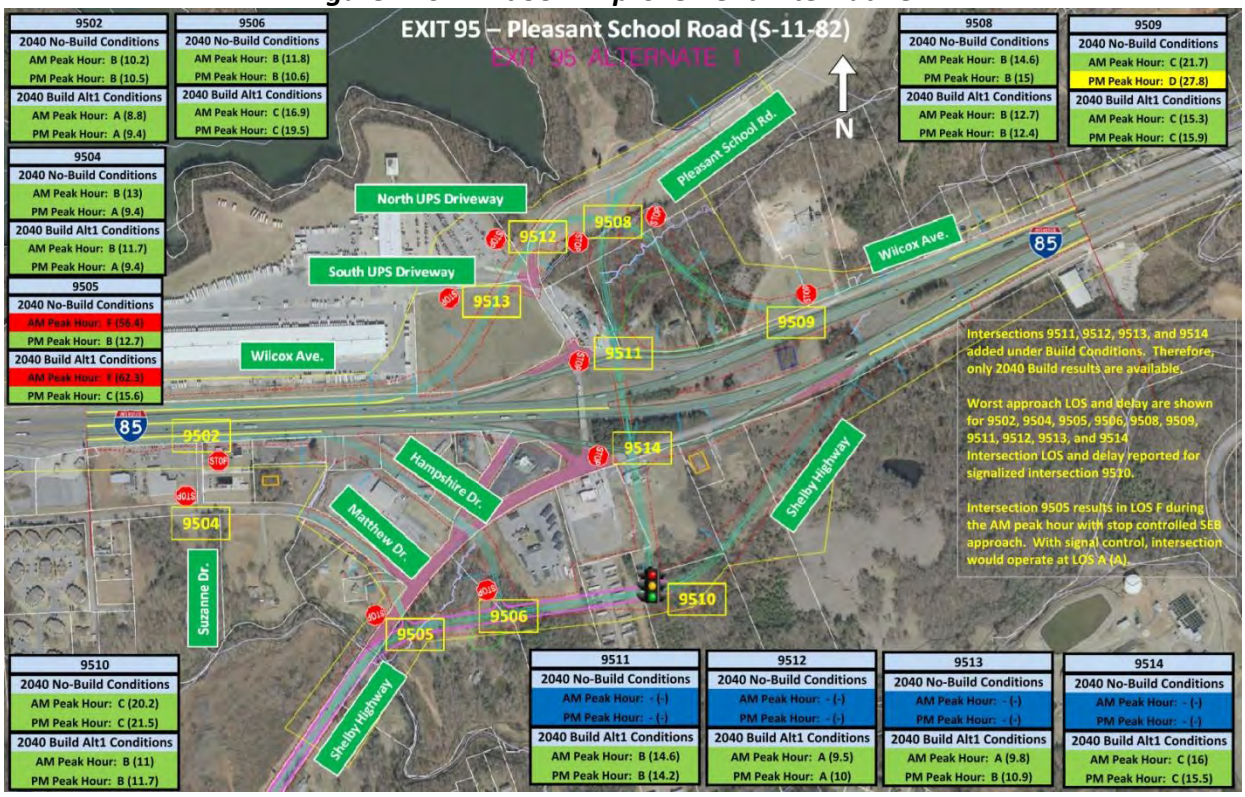
Exit 95 – Pleasant School Road (S-11-82)

The Pleasant School Road interchange is expected to be modified as part of the I-85 widening project. 2040 Build analyses for the intersections within the Exit 95 interchange area were performed for two alternatives.

<u>Alternative 1</u>

The conceptual design of Alternative 1 is shown in **Figure 110**.

Figure 110 - Exit 95: Improvement Alternative 1



Alternative 1 replaces the existing Exit 95 interchange with a diamond interchange. Other elements of the alternative concept include:

- Constructing a northbound on-ramp
- Realigning Pleasant School Road
- Relocating and adjusting the alignment of the approaches at the intersection of Pleasant School Road with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment Shelby Highway and its intersections with Matthew Drive, Hampshire Drive and Pleasant School Road to increase the spacing between the Pleasant School Road intersections with Shelby Highway and the northbound ramp intersection

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized with the exception of the relocated intersection of the Pleasant School Road and Shelby Highway, which is an existing signalized intersection.

In Alternative 1, the signalized intersection of Pleasant School Road and Shelby Highway operates at LOS B during both peak hours. The stop sign controlled approaches at the

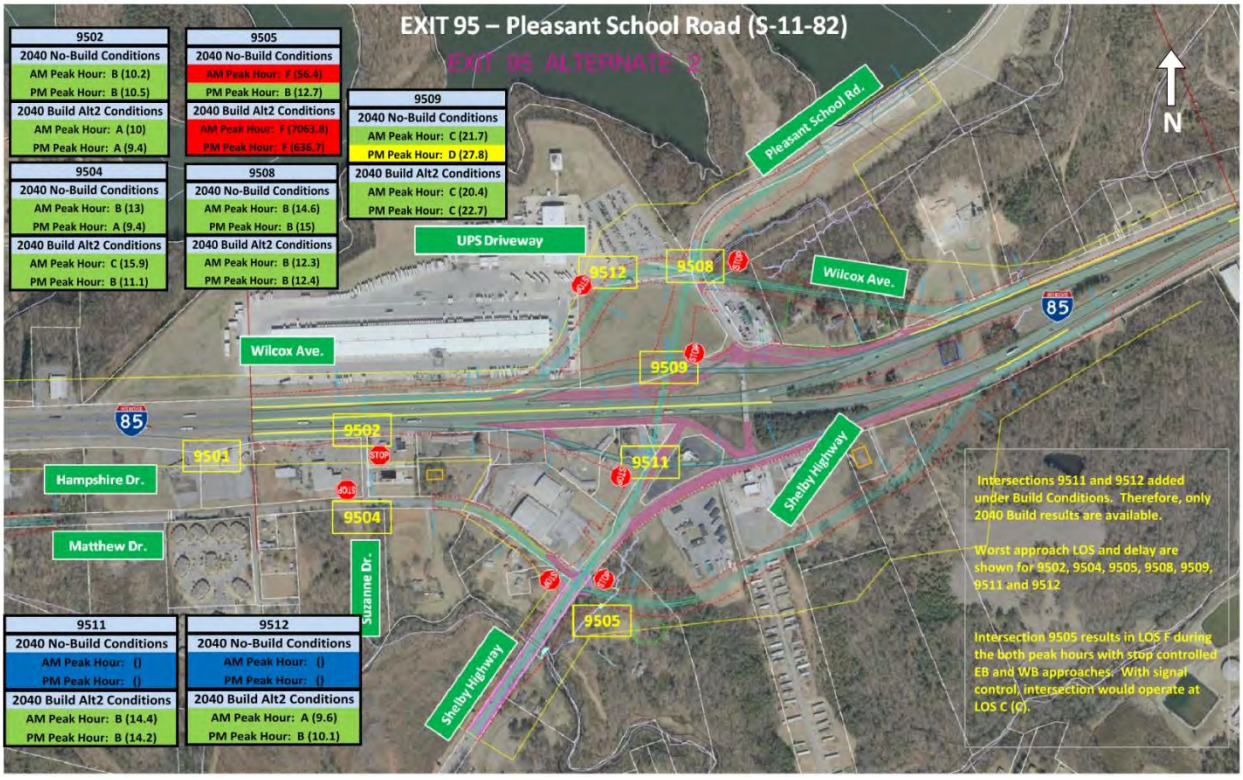
remaining unsignalized intersections operate at LOS C or better during the morning and afternoon peak hours, with the exception of the Matthew Drive approach to Shelby Highway, which operates at LOS F during the morning peak hour.

Based on the results of this analysis, the stop sign controlled approach of Matthew Drive at Shelby Highway would need to provide separate left and right turn lanes to operate at LOS D or better during the morning peak hour. If the intersection of Matthew Drive and Shelby Highway were signalized, the intersection would operate at LOS A during both peak hours.

Alternative 2

The conceptual design of Alternative 2 is shown in **Figure 111**.

Figure 111 - Exit 95: Improvement Alternative 2



Alternative 2 replaces the existing Exit 95 interchange with a diamond interchange. Other elements of the alternative concept include:

- Constructing a northbound on-ramp
- Realigning Pleasant School Road
- Relocating and adjusting the alignment of the approaches at the intersection of Pleasant School Road with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection

- Relocating and adjusting the alignment Shelby Highway and its intersections to eliminate its intersection with Hampshire Drive to increase the spacing between the Pleasant School Road intersections with Shelby Highway and the northbound ramp intersection

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

In Alternative 2, the stop sign controlled approaches at the unsignalized intersections operate at LOS B or better during the morning and afternoon peak hours, with the exception of the relocated intersection of Pleasant School Road with Shelby Highway and Matthew Drive. At this intersection, the stop sign controlled approaches of Matthew Drive and Shelby Highway are projected to operate at LOS F during the both peak hours.

Based on the results of this analysis, the unsignalized intersection of Pleasant School Road with Matthew Drive/Shelby Highway would likely require signalization. With signalization, the intersection could be expected to operate at LOS C during both peak hours.

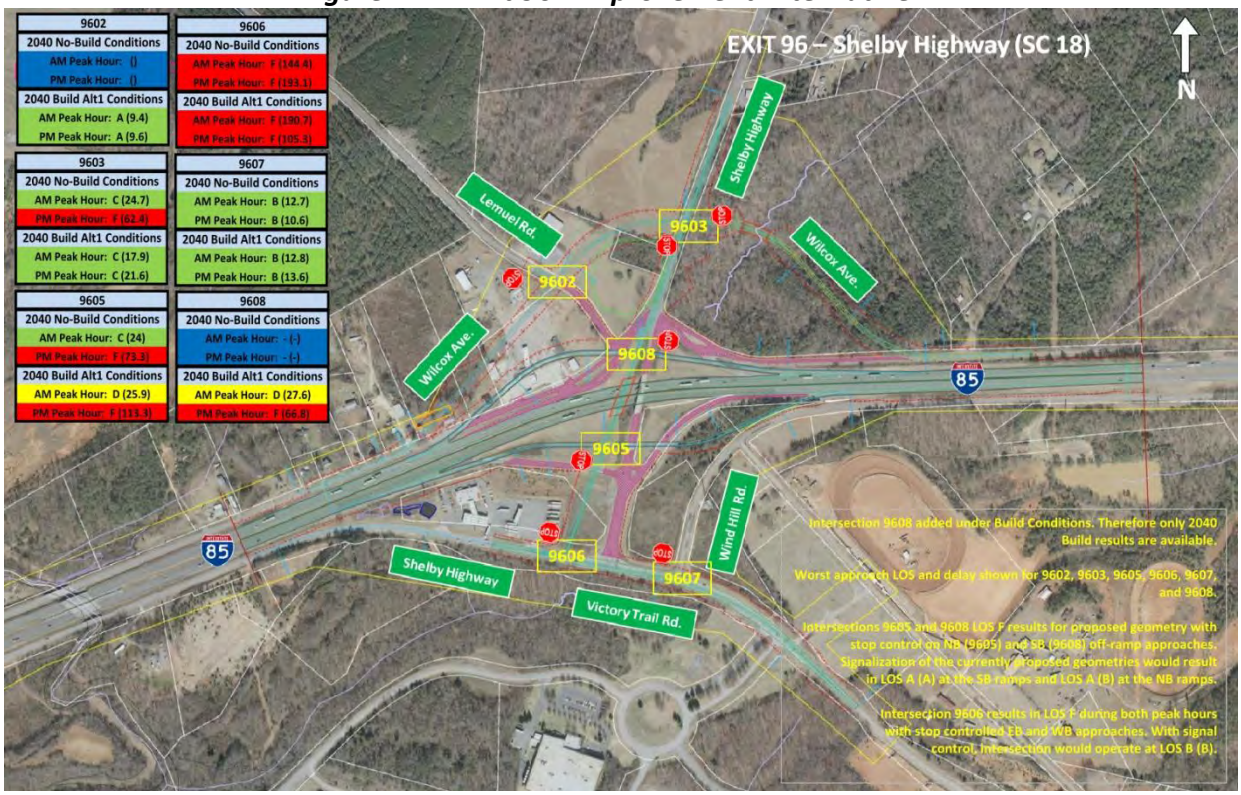
Exit 96 – Shelby Highway (SC 18)

The Shelby Highway interchange is expected to be modified as part of the I-85 widening project. 2040 Build analyses for the intersections within the Exit 96 interchange area were performed for three alternatives.

Alternative 1

The conceptual design of Alternative 1 is shown in **Figure 112**.

Figure 112 - Exit 96: Improvement Alternative 1



Alternative 1 replaces the existing Exit 96 interchange with a diamond interchange. Other elements of the alternative concept include:

- Realigning Shelby Highway over I-85
- Relocating and adjusting the alignment of the approaches at the intersection of Shelby Highway with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment Shelby Highway and Victory Trail Road.

Alternative 1 maintains the continuity of Victory Trail Road east and Shelby Highway west of the interchange area. The north approach of Shelby Highway at its intersection with Victory Trail Road is controlled by a stop sign, while the east and west approaches are free-flowing.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

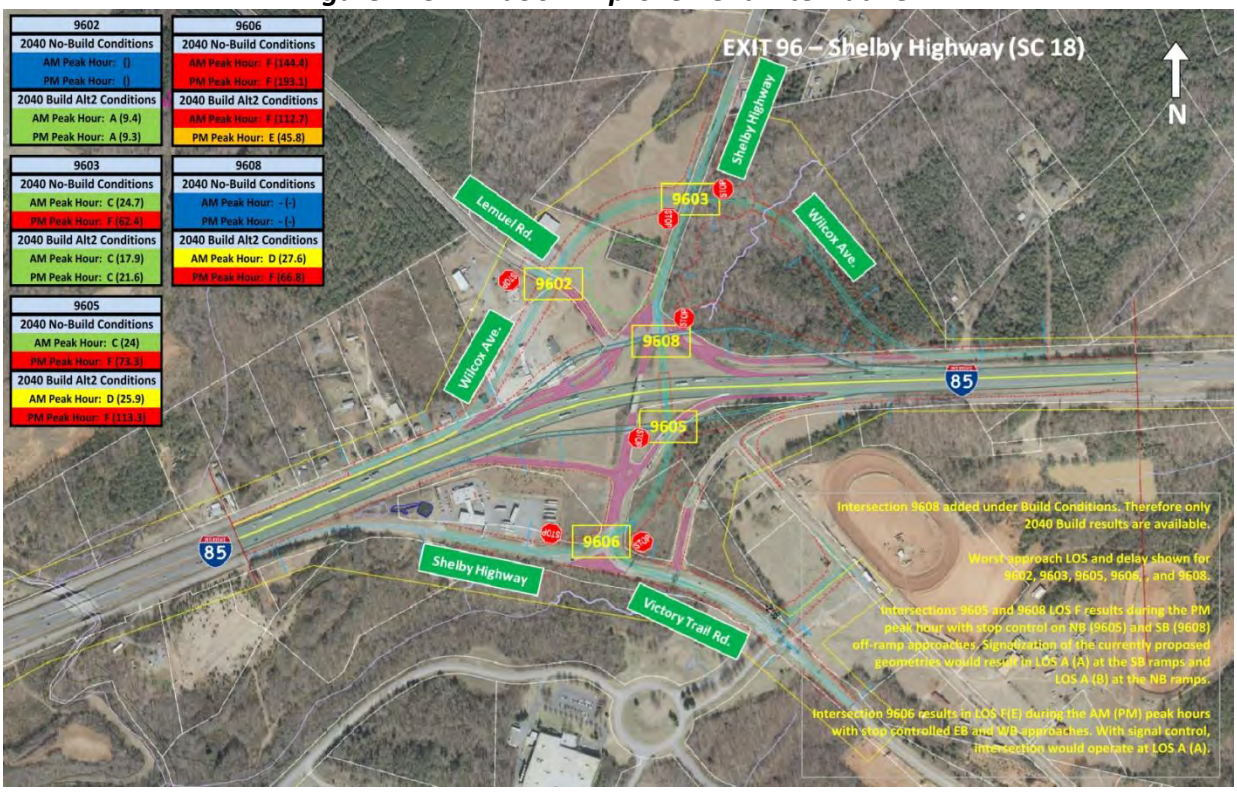
In Alternative 1, the stop sign controlled approaches of the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours, with the exception of the northbound and southbound off-ramp approaches, which operate at LOS F during the afternoon peak hour, and the southbound approach of Shelby Highway at Victory Trail Road, which operates at LOS F during both peak hours.

Based on the results of this analysis, the stop sign controlled approaches of the eastbound and westbound off-ramps would have to be modified to provide separate left turn lanes, and a second through lane must be provided in each direction on Shelby Highway through the interchange area to achieve LOS C and D on the southbound off-ramp approach during the morning and afternoon peak hours respectively, and LOS B and C on the northbound off-ramp approach during the morning and afternoon peak hours respectively. Widening Shelby Highway in the interchange area could be avoided by installing traffic signals at the northbound and southbound ramp intersections. This would result in the signalized intersections at both locations operating at LOS B or better during both peak hours. Signalization is also required to achieve acceptable LOS at the intersection of Shelby Highway and Victory Trail Road. With signal control, this intersection would operate at LOS B during both peak hours.

Alternative 2

The conceptual design of Alternative 2 is shown in **Figure 113.**

Figure 113 - Exit 96: Improvement Alternative 2



Alternative 2 replaces the existing Exit 96 interchange with a diamond interchange. Other elements of the alternative concept include:

- Realigning Shelby Highway over I-85

- Relocating and adjusting the alignment of the approaches at the intersection of Shelby Highway with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment Shelby Highway and Victory Trail.

While similar to Alternative 1, Alternative 2 differs in that Shelby Highway is continuous with the Victory Trail Road approach creating the stop sign controlled approach to the intersection.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

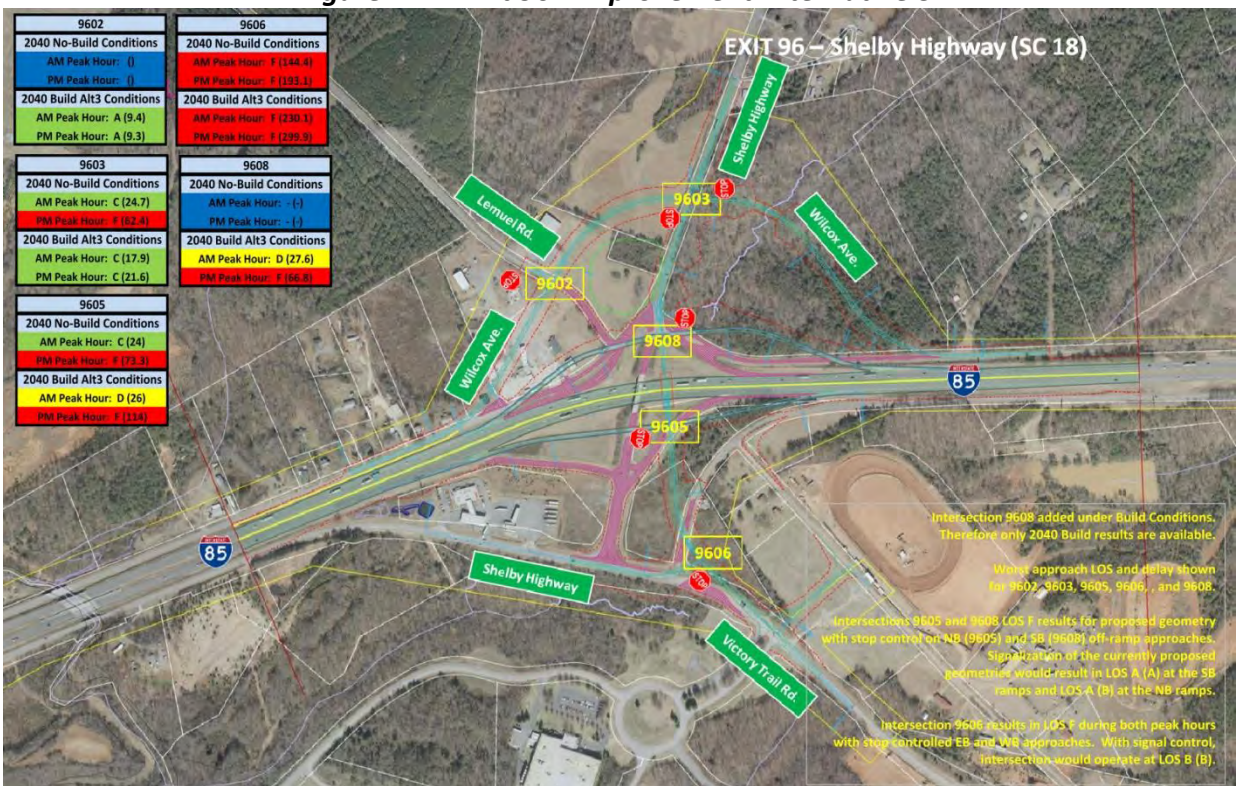
In Alternative 2, the stop sign controlled approaches of the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours, with the exception of the northbound and southbound off-ramp approaches, which operate at LOS F during the afternoon peak hour, and the southbound approach of Shelby Highway at Victory Trail Road, which operates at LOS F during the morning peak hour and LOS E during the afternoon peak hour.

Based on the results of this analysis, the stop sign controlled approaches of the eastbound and westbound off-ramps would have to be modified to provide separate left turn lanes, and a second through lane must be provided in each direction on Shelby Highway through the interchange area to achieve LOS C and D on the southbound off-ramp approach during the morning and afternoon peak hours respectively, and LOS B and C on the northbound off-ramp approach during the morning and afternoon peak hours respectively. Widening Shelby Highway in the interchange area could be avoided by installing traffic signals at the northbound and southbound ramp intersections. This would result in the signalized intersections at both locations operating at LOS B or better during both peak hours. Signalization is also required to achieve acceptable LOS at the intersection of Shelby Highway and Victory Trail Road. With signal control, this intersection would operate at LOS A during both peak hours.

Alternative 3

The conceptual design of Alternative 3 is shown in **Figure 114**.

Figure 114 - Exit 96: Improvement Alternative 3



Alternative 3 replaces the existing Exit 96 interchange with a diamond interchange. Other elements of the alternative concept include:

- Realigning Shelby Highway over I-85
- Relocating and adjusting the alignment of the approaches at the intersection of Shelby Highway with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment Shelby Highway and Victory Trail.

While similar to Alternatives 1 and 2, Alternative 3 differs in that Victory Trail Road is continuous with the portion of Shelby Highway crossing over I-85. In this alternative, the west approach of Shelby Highway is controlled by a stop sign.

The intersection analyses were performed assuming all the intersections in the interchange area would be unsignalized.

In Alternative 3, the stop sign controlled approaches of the unsignalized intersections operate at LOS D or better during the morning and afternoon peak hours, with the exception of the northbound and southbound off-ramp approaches, which operate at LOS F during the afternoon peak hour, and the southbound approach of Shelby Highway at Victory Trail Road, which operates at LOS F during both peak hours.

Based on the results of this analysis, the stop sign controlled approaches of the eastbound and westbound off-ramps would have to be modified to provide separate left turn lanes, and a second through lane must be provided in each direction on Shelby Highway through the interchange area to achieve LOS C and D on the southbound off-ramp approach during the morning and afternoon peak hours respectively, and LOS B and C on the northbound off-ramp approach during the morning and afternoon peak hours respectively. Widening Shelby Highway in the interchange area could be avoided by installing traffic signals at the northbound and southbound ramp intersections. This would result in the signalized intersections at both locations operating at LOS B or better during both peak hours. Signalization is also required to achieve acceptable LOS at the intersection of Shelby Highway and Victory Trail Road. With signal control, this intersection would operate at LOS B during both peak hours.

Gaffney Ferry Road Slip On-Ramp

As part of this widening project, the existing northbound on-ramp from Gaffney Ferry Road will be removed. The unsignalized intersection of the northbound on-ramp from Gaffney Ferry Road will be eliminated, and is not analyzed as part of the 2040 Build condition alternatives.

Exit 98 - Frontage Road Off-Ramp

As part of a subsequent widening project, the existing northbound off-ramp to Frontage Road at Exit 98 is expected to be removed. The unsignalized intersection of the northbound off-ramp with Frontage Road will be eliminated, and is not analyzed as part of the 2040 Build condition alternatives.

Exit 100 – Blacksburg Highway (S-11-83)

The interchange at Blacksburg Highway is not expected to be modified as part of this project. Therefore, the results of the 2040 Build analyses for the unsignalized intersections within the Exit 100 interchange area will be the same as the results of the 2040 No-Build analyses (see **Figure 99**).

c. VISSIM Network Analysis

VISSIM, a microscopic behavior-based multi-purpose traffic simulation program, was used to analyze the existing, no-build, and final build alternative freeway networks. VISSIM simulates traffic operations on freeway segments and provides traffic operational data such as vehicle delay, density, travel speeds, travel times, and queuing at ramp terminals on freeway networks. This software has the ability to evaluate each individual vehicle for every model time step in the simulation and then assigns the appropriate behavior logic according to the traffic operations that the particular vehicle encounters. The microscopic simulation model was developed for the 18-mile interstate section of the project and was based on a calibrated base model for the area.

There are several limitations of using HCS, which is a macroscopic, deterministic model that uses HCM methodologies. The HCS analysis may show differing conditions than existing operations and conditions in the field because it does not consider upstream and downstream traffic impacts and is unable to model interactions between the two. The HCS model is a spot check at a certain location; therefore upstream and downstream operations are not taken into consideration and have no effect on the analyses. This is not the case for actual conditions, as upstream or downstream congestion may have direct impacts at a specific segment causing a ripple effect. The VISSIM simulation model evaluated each segment by taking into consideration vehicle interaction and driver behaviors, as well as the operation impacts for both the upstream and downstream traffic conditions.

Building Base Model Network and Calibration

The existing AM and PM VISSIM base models for the 18-mile study area of I-85 were developed based on Bing aerial images. In addition, Synchro was used to input existing signal timing information into the network for the arterial intersections. Each simulation was run for one hour with 20 minutes of seeding time to load the network. The number of simulation runs was based on the process described in the Federal Highway Administration (FHWA) Traffic Analysis Toolbox and summarized as part of an attachment in **Appendix K**. The average speed of each simulation run was used as a basis for determining the number of required repetitions, with a confidence level of 95 percent and a confidence interval of 5 mph. It was calculated that the model would need to be run with 10 repetitions each for both the AM and PM peak periods.

The driver behavior parameters were used to control the interaction of vehicles through the network during the simulation models. Both the car-following and lane-change models in VISSIM use an extensive range of parameters. Some of these may be adapted by the user to change basic driving behavior. VISSIM uses five driving behavior models, of which two were used in the base model; Urban (motorized) and Freeway (free lane selection). The Urban (motorized) parameters were used to model the arterials within the network and were based on the Wiedemann 74 model. The Freeway (free lane selection) parameters were used to model the freeway and ramps within the network and were based on the Wiedemann 99 model. The Wiedemann 74 and Wiedemann 99 models include parameters which can be

calibrated based on the data collected. Default values were used in developing the base model. Modifications were then made to the parameters during calibration and are summarized in **Table 22**.

Table 22 - Coding and Calibration Assumptions

Parameter	Existing Conditions
Number of Simulation Runs	Based on Formula (13) in Appendix B of the FHWA Traffic Operations Analysis Toolbox: Volume III, 10 runs will be sufficient.
Seeding Time	Based on the time it would take a vehicle to travel from one end of the network to the other, the seed time will be 20 minutes (1200 seconds).
Freeway Driver Behavior Parameters	
Look-Ahead Distance	The maximum is between 800 to 1,500 feet.
Look-Back Distance	The maximum is between 400 to 800 feet.
Safety Distance Reduction Factor	Ranges from 0.60 to 0.20.
Freeway Speed	S-Curves were used in calibration for the model.
Cooperative Lane Change	Maximum collision time ranges from 10 to 5 seconds.
General Behavior	Free Lane Selection
CC0	Default - Didn't Change
CC1	Default - Didn't Change
CC2-CC9	Default - Didn't Change
Other Parameters	
Lane Change Distance	Ranges from 600 to 5,000 feet.

As shown in **Table 22**, seeding times of 20 minutes were used and each peak hour VISSIM model was run for one hour. A total of 10 simulations were run prior to averaging and processing the output data. Since INRIX data only provides average speed per segment, VISSIM travel time outputs were converted to speed and compared to existing speeds. The existing AM and PM peak hour VISSIM models were calibrated to be within 5 mph of the INRIX measured speeds. **Table 23** provides a summary of the speed calibration for each segment in both the north- and southbound direction under the AM and PM peak hour VISSIM models.

Table 23 - Speed Calibration Summary - VISSIM Existing Network

Travel Time Segment			INRIX Measured (MPH)	VISSIM (MPH)	Difference (MPH)	% Change (<15%)
From	To	Distance (Miles)				
AM Peak Hour			Northbound			
Exit 80	Exit 83	3.1	66.8	68.2	1.4	2%
Exit 83	Exit 86	2.9	67.3	67.6	0.3	0%
Exit 86	Exit 90	2.8	66.9	67.6	0.7	1%
Exit 90	Exit 92	2.0	66.4	67.7	1.4	2%
Exit 92	Exit 95	1.6	67.5	67.9	0.4	1%
Exit 95	Exit 96	1.1	66.8	67.7	0.9	1%
Exit 96	Exit 99	3.0	68.0	68.2	0.2	0%
AM Peak Hour			Southbound			
Exit 99	Exit 96	2.9	67.2	68.2	0.9	1%
Exit 96	Exit 95	1.0	67.6	67.8	0.2	0%
Exit 95	Exit 92	2.2	66.1	66.6	0.5	1%
Exit 92	Exit 90	2.0	67.5	67.3	-0.3	0%
Exit 90	Exit 86	2.8	67.0	67.7	0.7	1%
Exit 86	Exit 83	2.9	67.9	67.6	-0.3	0%
Exit 83	Exit 80	3.2	67.9	67.4	-0.5	-1%
PM Peak Hour			Northbound			
Exit 80	Exit 83	3.1	65.9	66.0	0.1	0%
Exit 83	Exit 86	2.9	67.3	65.4	-1.9	-3%
Exit 86	Exit 90	2.8	67.0	65.0	-2.0	-3%
Exit 90	Exit 92	2.0	66.7	65.2	-1.4	-2%
Exit 92	Exit 95	1.6	67.7	66.1	-1.6	-2%
Exit 95	Exit 96	1.1	67.4	66.2	-1.2	-2%
Exit 96	Exit 99	3.0	68.2	66.4	-1.8	-3%
PM Peak Hour			Southbound			
Exit 99	Exit 96	2.9	67.0	66.9	-0.1	0%
Exit 96	Exit 95	1.0	67.4	65.4	-2.0	-3%
Exit 95	Exit 92	2.2	66.0	65.9	0.0	0%
Exit 92	Exit 90	2.0	67.0	65.3	-1.7	-3%
Exit 90	Exit 86	2.8	66.0	64.8	-1.2	-2%
Exit 86	Exit 83	2.9	66.3	65.3	-0.9	-1%
Exit 83	Exit 80	3.2	66.5	65.9	-0.6	-1%

Note: The FHWA requires modeled travel times to be within 15% or 1 minute of field-measured travel times in >85% of all cases to consider the model calibrated.

In addition to travel time calibration, FHWA criteria requires the individual link flows of the modeled volume during both the AM and PM network models be calibrated to be within 5 percent of the observed volume. The GEH statistic is a universal measure to compare

simulation input and output data. The GEH output tables for each segment and ramp are also provided as an attachment in **Appendix K**.

Existing and No-Build Network Conditions

The existing condition and 2040 no-build condition VISSIM analysis was performed using the existing number of freeway lanes present on the segments within the study area, similar to the HCS analysis. The only difference between the existing conditions and No-Build networks is the input volumes. The 2040 no-build condition volumes were developed using the 1.5 percent annual growth rate in traffic.

The densities for the I-85 segments were obtained from the VISSIM output files. In VISSIM, density is calculated as vehicles per mile per lane (veh/mi/ln), while the Highway Capacity Manual (HCM) uses passenger cars per mile per lane (pc/mi/ln). The difference between the two measures is that the HCM adjusts the vehicles per mile per lane density by applying "passenger-car equivalent" factors to convert the number of trucks and other heavy vehicles to an equivalent number of passenger cars. For example, assuming the rolling terrain encountered in this corridor, HCM would convert each truck or bus to the equivalent of 2.5 passenger cars.

As mentioned previously, the Highway Capacity Manual (HCM), a macroscopic/deterministic model, while VISSIM is microscopic behavior-based multi-purpose traffic simulation program. VISSIM, therefore, accounts for the interaction between the passenger cars and other types of vehicles in the traffic stream while HCM does not. In VISSIM, the density is calculated at each time step of the simulation, for the entire peak hour, over a number of iterations, it is considered to be a more accurate measure of the density.

Typically, the density outputs from VISSIM are considered to be equivalent to the HCM thresholds (pc/mi/ln) to report the mainline LOS. However, the outputs (volume and speed) from VISSIM analysis were post processed to calculate the HCM equivalent density. This was done by obtaining the VISSIM outputs by vehicle type and then converting the heavy vehicles to HCM passenger car equivalents.

Basic Freeway Segment Analysis

The Basic Freeway Segment Analysis outputs are provided in **Appendix K** and a summary of results is shown in **Table 24**.

Table 24 - Freeway Segment Capacity Analysis VISSIM Results

Segment	Existing Conditions				No Build Conditions			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]
Northbound								
Exit 80-82	C	22.1	D	31.5	D	34.1	E	42.2
Exit 82-83	C	22.1	D	31.5	D	34.1	E	40.1
Exit 83-87	C	20.9	D	29.6	D	32.0	E	38.2
Exit 87-90	C	20.6	D	28.6	D	31.9	E	36.8
Exit 90-92	B	17.7	D	26.3	D	27.3	D	33.5
Exit 92-95	B	16.9	C	25.2	C	25.8	D	32.4
Exit 95-96	B	15.3	C	24.2	C	23.8	D	31.0
Exit 96-97	B	14.8	C	23.2	C	22.6	D	30.3
Exit 97-98	B	14.8	C	23.0	C	22.4	D	29.9
Exit 98-100	B	14.6	C	23.0	C	22.1	D	29.9
Southbound								
Exit 100-96	B	16.7	C	25.5	D	26.0	F	50.3
Exit 96-95	B	17.8	D	27.1	D	28.1	F	47.6
Exit 95-92	B	17.7	D	26.8	D	27.5	E	41.6
Exit 92-90	B	16.4	D	26.0	C	25.0	E	41.7
Exit 90-87	B	17.9	D	28.5	D	27.6	E	41.4
Exit 87-83	C	18.7	D	28.2	D	28.9	E	40.2
Exit 83-80	C	21.3	D	29.0	D	33.1	E	42.0

[1] Per Highway Capacity Manual 2010 criteria.

[2] Density expressed as passanger cars/per mile/per lane.

The analysis results for the freeway segments, summarized in **Table 24**, indicate the following:

2014 Existing Conditions

Using the design hour volumes for the morning and afternoon peak hours, the analysis results indicate that:

- During the morning peak hour, all freeway segments operate at LOS B or C
- During the afternoon peak hour, all freeway segments operate at LOS C or D.

2040 No-Build Conditions

With traffic volumes projected to increase within the corridor at an annual rate of 1.5 percent per year, and if I-85 is not widened, the increased traffic volumes traveling on the existing interstate capacity will result in increased density and reductions of freeway segment LOS.

- During the morning peak hour:
  - All freeway segments operate at LOS C or D. All ramps achieve a GEH statistic of 5 percent or lower.
  - The northbound freeway segments between of Exit 92 and Exit 100 operate at LOS C, while the freeway segments between Exit 80 and Exit 92 operate at LOS D.
  - The southbound freeway segments operate at LOS D, except for the freeway segment between Exit 92 and Exit 90 which operates at LOS C.
- During the afternoon peak hour:
  - The northbound freeway segments between Exit 80 and Exit 90 operate at LOS E while the freeway segments between Exit 90 and 100 operate at LOS D.
  - The southbound freeway segments between Exit 100 and 95 operate at LOS F while the remaining segments between Exit 95 and 80 operate at LOS E.

The reason the southbound freeway segments between Exits 100 and 95 operate at LOS F during the afternoon peak hour is largely due to the operation of the merge and diverge areas at Exit 96, which operate at LOS F during the afternoon peak hour. This, in turn, has an adverse effect on the operation of the upstream freeway segments, resulting in increased density along the segments which correlate to LOS F conditions.

It should be noted that the GEH statistic, during the afternoon peak hour, for the southbound freeway segment at Exit 90 and for all northbound freeway segments are above 5 percent. This indicates that all the input volumes are not being processed in the simulation and are unable to enter the network. Within VISSIM, the vehicles that are unable to enter the network within the simulation period are defined as “latent demand”. .

Based on the 2040 volumes, the latent demand for the No-Build PM model is approximately 1,900 vehicles. Because the latent demand does not enter the network, the downstream locations simulate less traffic than the projected volume. The VISSIM results, which are based on simulations involving only the vehicles that can enter the network, do not include the latent demand. Therefore, the results shown in **Table 24** (and the subsequent tables summarizing the VISSIM results for the merge and diverge areas) represent a “best case”. Were the latent demand able to enter the network, densities would increase beyond those shown in the tables, with a potential change in LOS to LOS F. In order to accommodate the latent demand, additional capacity is needed to accommodate the projected volumes. This supports the need for widening the interstate from two to three lanes, along with other improvements under future conditions.

Ramp Merge Analysis

The Ramp Merge Analyses outputs are provided in **Appendix L** and the summary results are shown in **Table 25**.

Table 25 - Ramp Merge Capacity Analysis VISSIM Results

Segment	Existing Conditions				No Build Conditions			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]
Northbound								
Exit 80	C	20.8	D	30.4	D	32.3	F	50.2
Exit 83	C	20.4	D	28.8	D	31.3	E	38.2
Exit 87	C	20.1	D	28.1	D	31.8	E	36.5
Exit 90	B	16.5	C	25.5	D	26.5	D	34.4
Exit 92 Loop	B	15.9	C	23.3	C	24.0	D	29.4
Exit 92	B	16.7	C	24.5	C	25.2	D	31.5
Exit 95	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exit 96	B	14.4	C	22.5	C	22.0	D	29.2
Exit 97	B	14.7	C	23.0	C	22.4	D	29.7
Southbound								
Exit 100	B	16.2	C	24.7	C	25.0	E	40.8
Exit 96	B	16.3	C	25.8	C	25.5	F	77.6
Exit 95	B	17.1	C	26.0	D	26.8	E	41.2
Exit 92	B	16.8	C	24.9	C	25.3	E	38.6
Exit 92 Loop	B	16.5	C	25.8	C	25.0	E	40.7
Exit 90	B	16.4	D	29.9	D	27.0	F	71.8
Exit 87	B	16.6	D	27.8	C	25.7	E	41.4
Exit 83	C	20.6	D	29.3	E	36.6	F	64.8

[1] Per Highway Capacity Manual 2010 criteria.

[2] Density expressed as passanger cars/per mile/per lane.

The analysis results for the ramp merge areas, summarized in **Table 25**, indicate the following:

2014 Existing Conditions

Using the design hour volumes for the morning and afternoon peak hours, the analysis results indicate that:

- During the morning peak hour, all ramp merge areas operate at LOS B or C.
- During the afternoon peak hour, all ramp merge areas operate at LOS C or D.

2040 No-Build Conditions

With traffic volumes projected to increase within the corridor at an annual rate of 1.5 percent per year, and if I-85 is not widened, the increased traffic volumes traveling on the existing interstate capacity will result in increased density and will reduce the merge area LOS. Based on the VISSIM simulation:

- During the morning peak hour:
  - The northbound merge areas operate at LOS C or D. All ramps achieve a GEH statistic of 5 percent or lower.
  - The southbound merge areas operate at LOS C or D with the exception of Exit 83 where the on-ramp is expected to operate at LOS E.
- During the afternoon peak hour:
  - The northbound merge areas operate at LOS D or E with the exception of Exit 80 where the merge area is expected to operate at LOS F.
  - The southbound merge areas operate at LOS E or F.

It should be noted that, during the PM peak hour, the northbound on-ramp at Exit 80 cannot process any vehicles onto the mainline due to a limited acceleration lane and lack of gaps to merge onto the interstate, and operates at LOS F. In the southbound direction, the on-ramps at Exits 96, 90 and 83 also operate at LOS F. Therefore, volumes actually merging onto the interstate in the VISSIM simulation are lower than the 2040 No-Build input volumes. This in turn reduces the volume of traffic simulated on the downstream freeway segments, resulting in lower densities. These segments are projected to operate at LOS E with the lower simulated volumes and densities. Under the projected increase in volume (including the latent demand that does not enter the network), the densities would increase and the corresponding LOS could change to LOS F. In order to accommodate the projected demand (as well as the simulated latent demand), additional capacity is needed on I-85. This supports the need for widening I-85 and for providing other improvements under future conditions.

Ramp Diverge Analysis

The Ramp Diverge Analyses are also provided in **Appendix L** and the summary results are shown in **Table 26**.

The analysis results for the ramp diverge areas, summarized in **Table 26**, indicate the following:

<u>2014 Existing Conditions</u>

Using the design hour volumes for the morning and afternoon peak hours, the analysis results indicate that:

- During the morning peak hour, all ramp merge areas operate at LOS B or C.
- During the afternoon peak hour, all ramp merge areas operate at LOS C or D.

Table 26 - Ramp Diverge Capacity Analysis VISSIM Results

Segment	Existing Conditions				No Build Conditions			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]
Northbound								
Exit 82	C	21.5	D	30.7	D	34.1	E	39.1
Exit 83	C	21.8	D	31.0	D	33.9	E	39.7
Exit 87	C	19.4	D	26.9	D	30.0	D	34.3
Exit 90	B	17.1	D	27.1	D	28.3	F	48.2
Exit 92	B	14.6	C	22.0	C	22.4	D	27.8
Exit 95	B	15.3	C	24.3	C	23.9	D	31.5
Exit 96	B	13.0	C	21.1	C	20.1	D	26.8
Exit 98	B	14.6	C	23.0	C	22.2	D	29.9
Exit 100	B	12.9	C	22.3	C	20.1	D	29.3
Southbound								
Exit 96	B	16.7	C	25.6	D	26.6	F	70.2
Exit 95	B	17.3	D	26.5	D	27.7	E	41.2
Exit 92	B	17.7	C	24.1	D	28.2	E	36.6
Exit 90	C	19.0	D	29.6	D	28.6	F	47.8
Exti 87	B	17.2	D	28.1	D	27.1	E	41.5
Exit 83	C	18.3	D	27.1	D	29.6	E	41.2
Exit 80	B	18.0	C	21.1	D	26.6	D	28.5

[1] Per Highway Capacity Manual 2010 criteria.

[2] Density expressed as passanger cars/per mile/per lane.

2040 No-Build Conditions

With traffic volumes projected to increase within the corridor at an annual rate of 1.5 percent per year, and if I-85 is not widened, the increased traffic volumes traveling on the existing interstate capacity will result in increased density and will reduce the diverge area LOS.

- During the morning peak hour:
  - The northbound off-ramps between Exit 92 and Exit 100 will operate at LOS C
  - The diverge areas for the northbound off-ramps at Exits 82, 83, 87 and 90 will operate at LOS D
  - All southbound off-ramps are expected to operate at LOS D
- During the afternoon peak hour:
  - The diverge areas for the northbound off-ramps at Exits 87, 92, 95, 96, 98 and 100 and the southbound off-ramp at Exit 80 will operate at LOS D
  - The diverge areas for the northbound off-ramps at Exit 90, and the southbound off-ramp at Exits 90 and 96 will operate at LOS F.

- All other off-ramps are expected to operate at LOS E

It should be noted that, during the PM peak hour, the northbound freeway volume approaching the off-ramp at Exit 80 on the three northbound lanes of I-85 is 4,804 vehicles. Based on HCM methodologies, the maximum desirable flow rate entering a three-lane diverge influence area is 4,400 vehicles. Therefore, the volume of traffic approaching Exit 80 is itself causing a bottleneck, contributing to the vehicles excluded from the simulation (latent demand). This reduces the volume of the 2040 No-Build input volumes entering the simulation. Similarly, the diverge areas operating at LOS F at Exit 90 (in both directions) and southbound at Exit 96 create comparable bottlenecks that impede the volume of traffic in the network downstream of these locations. The volumes simulated are lower than the projected volumes, which results in lower density. In order to accommodate the projected demand (as well as the simulated latent demand), additional capacity is needed on I-85. This supports the need to widen I-85 and provide other improvements under future conditions.

VI. FINAL PREFERRED ALTERNATIVE NETWORK CONDITIONS

The final build alternative network was identified based on the preferred alternative improvements selected for each interchange. Though traffic operations were a consideration in the evaluation of alternatives, other factors, such as construction costs, business and residential relocations, and environmental impacts were used to identify the preferred alternatives. As outlined in the ***I-85 Widening Environmental Assessment (MM 80 to MM 96)***, the preferred alternatives for the interchange improvements are as follows

- Exit 83: Alternative 4 was recommended as the preferred alternative for reasons which include:
  - the second lowest estimated construction cost,
  - the least impact to streams,
  - the fewest business relocations and impacts
  - removal of truck and other traffic from Horry Road
  - no direct impacts to Mountain View Baptist Church and its facilities
- Exit 87: Alternative 5 was recommended as the preferred alternative, though it has the highest estimated construction cost for reasons which include:
  - construction costs within $1 million of other alternatives
  - better constructability
  - fewer residential relocations and community disruptions
  - preservation of the Macedonia Community Park
  - no wetland impacts and least impact to streams
- Exit 95: Alternative 2 was recommended as the preferred alternative of the two alternatives for reasons which include:
  - constructability
  - fewer business and residential relocations

  - significantly lower noise and stream impacts
- Exit 96: Alternative 3 was recommended as the preferred alternative of the three alternatives for reasons which include:
  - lower construction costs
  - better constructability
  - no wetland impacts or residential relocations

Interchange Intersection Analysis

Capacity analyses for the signalized and unsignalized intersections of the preferred alternatives were performed for the 2040 Final Build conditions which included the 2040 traffic volume and modified intersection traffic control and geometry to the interchanges at Exit 83, Exit 87, Exit 95, and Exit 96. The traffic operations analysis of the preferred alternatives identified areas where traffic control improvements were projected to be needed to provide acceptable operating LOS.

As stated in the previous section, for unsignalized intersections, the intersection operation is represented by the worst approach delay and LOS of all the stop sign controlled approaches to the intersection. For signalized intersections, the intersection operation is represented by the intersection delay and LOS. At some intersections, there are atypical intersection geometry and/or traffic control which are not compatible with HCM methodologies and procedures. No LOS or delay can be estimated at these atypical intersections. The results of the unsignalized and signalized intersection capacity analyses for the 2040 Final Build conditions compared to the 2040 No Build conditions are shown in **Table 27**. **Table 28** summarizes the preferred alternative storage length and queuing for 2040 Final Build conditions. Specific details concerning the results of the intersection capacity analyses can be found in the discussion for each of the preferred individual interchange alternative (Exit 83, 87, 95, and 96). The queuing intersection outputs for each intersection are provided in **Appendix J**.

Where signalization may be required at intersections projected to operate at LOS F under the 2040 Final Build Conditions, an analysis was performed to estimate the predicted year each intersection would transition from LOS E to LOS F. The results of the analysis can be found in the discussion for each of the preferred individual interchange alternative.

Table 27 – Intersection Capacity Analysis - 2040 Base vs 2040 Final Build

Intersection #	Intersection Name	2040 Base Conditions				2040 Build Conditions [Final]			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Exit 83									
8301	Battleground Road (SC 110) at Horry Road (S-42-9725)*	B	10.8	B	11.2	intersection removed.			
8302	Battleground Road (SC 110) at Phillips Drive*	D	31.7	F	68.1	E	38.4	D	32.3
8303	Phillips Drive at Horry Road*	C	16.8	B	14.5	A	9.6	A	9.6
8304	Truck Stop Road/Horry Road at I-85 SB on ramp*	E	38.3	A	9.8	intersections removed.			
8305	Truck Stop Road at I-85 SB off ramp	intersection incompatible with HCM 2000.							
8306	Frontage Road N at I-85 NB off-ramp*	C	18.8	D	33.0				
8307	Battleground Road (SC 110) at Frontage Road N (S-42-737)	B	11.5	B	15.1	intersection combined with I-85 NB ramps.			
8308	Frontage Road N at Edgefield Road*	A	10.0	A	9.5	A	0.0	A	0.0
8309	Edgefield Road at I-85 NB on-ramp	intersection incompatible with HCM 2000.				intersection removed.			
8310	Battleground Road (SC 110) at I-85 SB ramps	intersections added under Build Conditions.				B	15.3	B	10.5
8311	Battleground Road (SC 110) at I-85 NB ramps*					C	22.4	D	28.0
8312	Phillips Drive at Unnamed Roadway*					A	8.8	A	8.9
8313	Unnamed Roadway at Unnamed Roadway*					A	7.2	A	7.2
8314	Frontage Road N at Unnamed Roadway*					A	0.0	A	0.0
8315	Battleground Road (SC 110) at Edgefield Road					A	3.4	A	3.4
8316	Edgefield Road at Unnamed Roadway*					A	8.9	A	8.9
Exit 87									
8701	Webber Road at I-85 SB on-ramp*	B	10.9	A	9.8	intersections removed.			
8702	Webber Road at Lemon's Farm Entrance*	B	11.8	B	10.5				
8703	S Green River Road (S-11-39) at Webber Road*	F	64.0	C	23.8	C	24.9	C	18.0
8704	Old Post Road at I-85 SB off-ramp*	B	11.3	B	12.7	intersections removed.			
8705	Lindley Road at Cannons Campground Road/I-85 NB off-ramp	intersection incompatible with HCM 2000.							
8706	S Green River Road (S-11-39) at Overbrook Drive (S-11-31)**	C	19.1	B	13.8	A	8.3	A	8.7
8707	Overbrook Drive at I-85 NB on-ramp	intersection incompatible with HCM 2000.				intersections removed.			
8708	S Green River Road (S-11-39) at Lindley Road*	A	8.7	A	9.3				
8709	Macedonia Road (S-11-39) at I-85 SB ramps*	intersections added under Build Conditions.				B	14.0	B	14.2
8710	S Green River Road (S-11-39) at I-85 NB ramps*					B	15.0	C	17.2
8711	Cannons Campground Road at Unnamed Roadway*					A	0.0	A	0.0
8712	Webber Road at Vernie Road*					A	9.6	A	9.8
8714	Old Post Road at Malone Road*					A	9.3	A	9.8
8715	Old Post Road at Unnamed Roadway*					A	9.3	A	9.8
8716	Macedonia Road (S-11-39) at N Green River Road*					A	12.6	A	10.6
Exit 95									
9501	Hampshire Drive at I-85 NB off-ramp	intersection incompatible with HCM 2000.				intersection removed.			
9502	Hampshire Drive at Suzanna Drive*	B	10.2	B	10.5	A	10.0	A	9.4
9503	Hampshire Drive at Fatz Road*	B	10.2	B	10.2	intersection removed.			
9504	Suzanna Drive at Matthew Road*	B	13.0	A	9.4	C	15.9	B	11.1
9505	Shelby Highway (SC 18) at Matthew Road**	F	56.4	B	12.7	C	29.9	C	20.3
9506	Shelby Highway (SC 18) at Fatz Drive*	B	11.8	B	10.6	intersections removed.			
9507	Pleasant School Road (S-11-82) at UPS Driveway*	A	9.6	A	10.0				
9508	Pleasant School Road (S-11-82) at Wilcox Avenue*	B	14.6	B	15.0	B	12.3	B	12.4
9509	Pleasant School Road (S-11-82) at I-85 SB ramps*	C	21.7	D	27.8	C	20.4	C	22.7
9510	Shelby Highway (SC 18) at Pleasant School Road (S-11-82)	C	20.2	C	21.5	intersection combined with Matthew Road.			
9511	Pleasant School Road (S-11-82) at I-85 NB ramps*	intersections added under Build Conditions.				B	14.3	B	13.8
9512	Wilcox Avenue at North UPS Driveway*					A	9.6	B	10.1
Exit 96									
9601	Wilcox Avenue at I-85 southound on-ramp	intersections incompatible with HCM 2000.				intersection removed.			
9602	Wilcox Avenue at Lemeul Road*					A	9.4	A	9.3
9603	Shelby Highway (SC 18) at Wilcox Avenue*	C	24.7	F	62.4	C	17.9	C	21.7
9604	Wilcox Avenue at I-85 SB off-ramp	intersection incompatible with HCM 2000.				intersection removed.			
9605	Shelby Highway (SC 18) at I-85 NB ramps**	C	24.0	F	73.3	B	13.5	B	17.8
9606	Shelby Highway (SC 18) at Victory Trail Road (SC 329)**	F	144.4	F	193.1	C	20.3	C	24.0
9607	Victory Trail Road (SC 329) at Wind Hill Road*	B	12.7	B	10.6	intersection removed.			
9608	Shelby Highway (SC 18) at I-85 SB ramps**	intersection added under Build Conditions.				A	7.8	B	10.2

* Unsignalized intersection; worst approach LOS and delay reported.

** Unsignalized intersection under *2040 Base Conditions* only; worst approach LOS and delay reported.

Table 28 – 2040 Final Build Intersection Queue Lengths

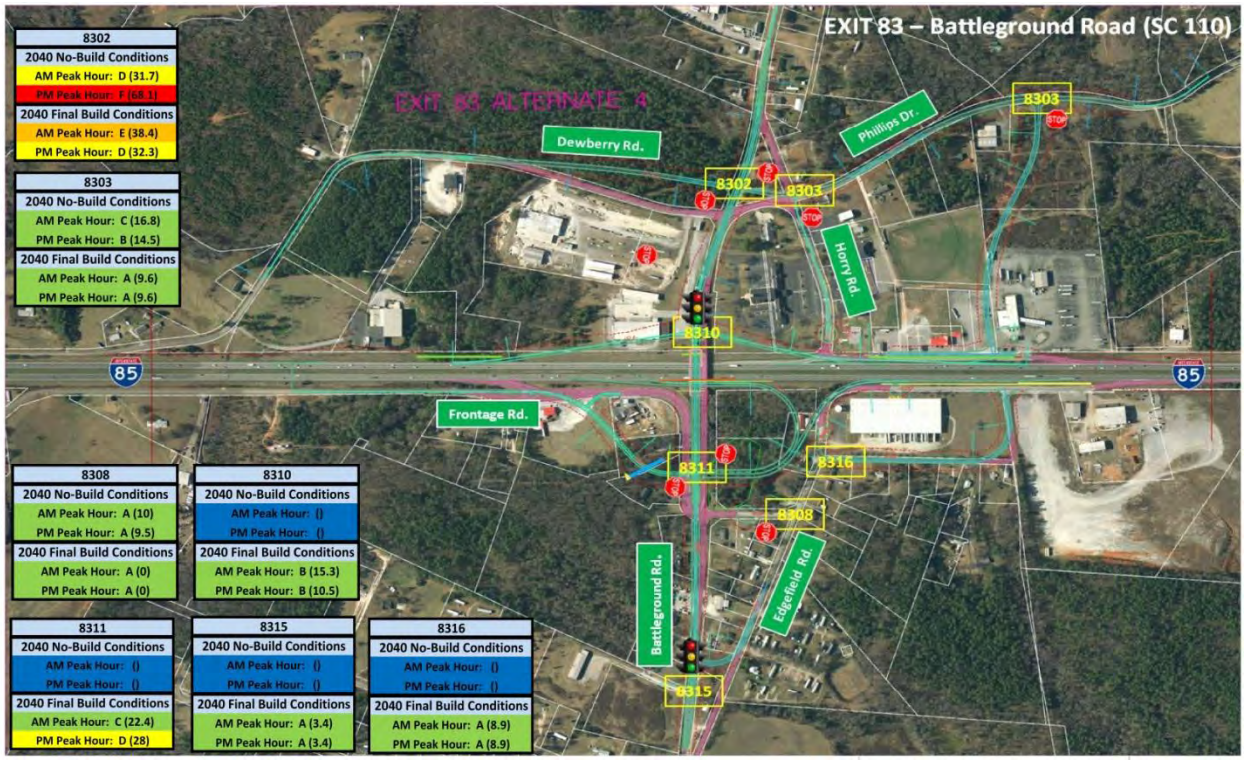
Intersection #	Intersection Name	Movement	95th Percentile Queue Length (ft)				Available Storage Length (ft)
			2040 Base Conditions		2040 Build Conditions [Final]		
			AM Peak	PM Peak	AM Peak	PM Peak	
Exit 83							
8302	Battleground Road (SC 110) at Phillips Drive	NBL	storage bay added under Build Conditions.		5	0	100
		SBL			0	0	100
8310	Battleground Road (SC 110) at I-85 SB ramps	NBL	intersection added under Build Conditions.		120	50	200
		WBR			10	20	150
8311	Battleground Road (SC 110) at I-85 NB ramps	NBL			0	0	100
		SBL			5	5	100
		WBL			80	140	150
8315	Battleground Road (SC 110) at Edgefield Road	SBL			0	5	100
Exit 87							
8703	S Green River Road (S-11-39) at Webber Road	NBL	storage bay added under Build Conditions.		5	5	200
		WBL			35	20	200
8706	S Green River Road (S-11-39) at Overbrook Drive (S-11-31)	SBL			40	30	200
		EBL			25	30	200
		WBR			15	15	150
8709	Macedonia Road (S-11-39) at I-85 SB ramps	NBL	intersection added under Build Conditions.		10	5	150
8710	S Green River Road (S-11-39) at I-85 NB ramps	SBL			5	5	150
Exit 95							
9505	Shelby Highway (SC 18) at Matthew Road	NBL	storage bay added under Build Conditions.		85	30	150
		SBL			65	65	150
		EBL			40	40	100
		WBL			275	180	300
9508	Pleasant School Road (S-11-82) at Wilcox Avenue	NBL			5	5	150
		SBL			0	0	150
		EBL			0	5	150
		WBL			5	5	150
9509	Pleasant School Road (S-11-82) at I-85 SB ramps	NBL			5	10	150
9511	Pleasant School Road (S-11-82) at I-85 NB ramps	SBL	intersection added.		0	0	150
Exit 96							
9603	Shelby Highway (SC 18) at Wilcox Avenue	NBL	storage bay added under Build Conditions.		0	0	150
		SBL			0	0	150
		EBL			5	10	150
		WBL			0	0	150
9605	Shelby Highway (SC 18) at I-85 NB ramps	SBL	5	0	20	20	130 (150)[1]
9606	Shelby Highway (SC 18) at Victory Trail Road (SC 329)	NBL	storage bay added.		105	95	150
		EBL	20	40	155	215	275 (150)[1]
9608	Shelby Highway (SC 18) at I-85 SB ramps	NBL	intersection added.		30	50	150

[1] Storage length changes between *2040 Base Conditions* and *2040 Build Conditions* (shown in parentheses).

Exit 83 – Battleground Road (SC 110)

The 2040 Build alternative for the intersections within the Exit 83 interchange area were performed for four alternatives. Alternative 4 was chosen as the preferred alternative. It replaces the existing Exit 83 interchange with a partial cloverleaf interchange, with a northbound loop off-ramp located in the southeast quadrant of the interchange. The final Preferred Alternative for Exit 83 is depicted in **Figure 115**.

Figure 115 - Exit 83: Preferred Alternative



Other elements of the alternative concept include:

- Eliminating the intersections of
  - Battleground Road and Horry Road
  - Truck Stop Road and the southbound off-ramp
  - Truck Stop Road and Horry Road/southbound on-ramp
  - Frontage Road and the northbound off-ramp
  - Edgefield Road and the northbound on-ramp
- Relocating and adjusting the alignment of the approaches at the intersection of Battleground Road with Dewberry Road/Phillips Drive to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches at the intersection of Phillips Drive and Horry Road
- Placing a cul de sac on the south end of Horry Road

- Creating a new connection between Phillips Drive and Truck Stop Road to provide access to the businesses fronting Truck Stop Road
- Relocating and separating the Frontage Road intersection so that the west approach of Frontage Road would connect opposite the northbound loop off-ramp while the east approach of Frontage Road would be offset to the south by approximately **1,250** feet to create a separate T-intersection.

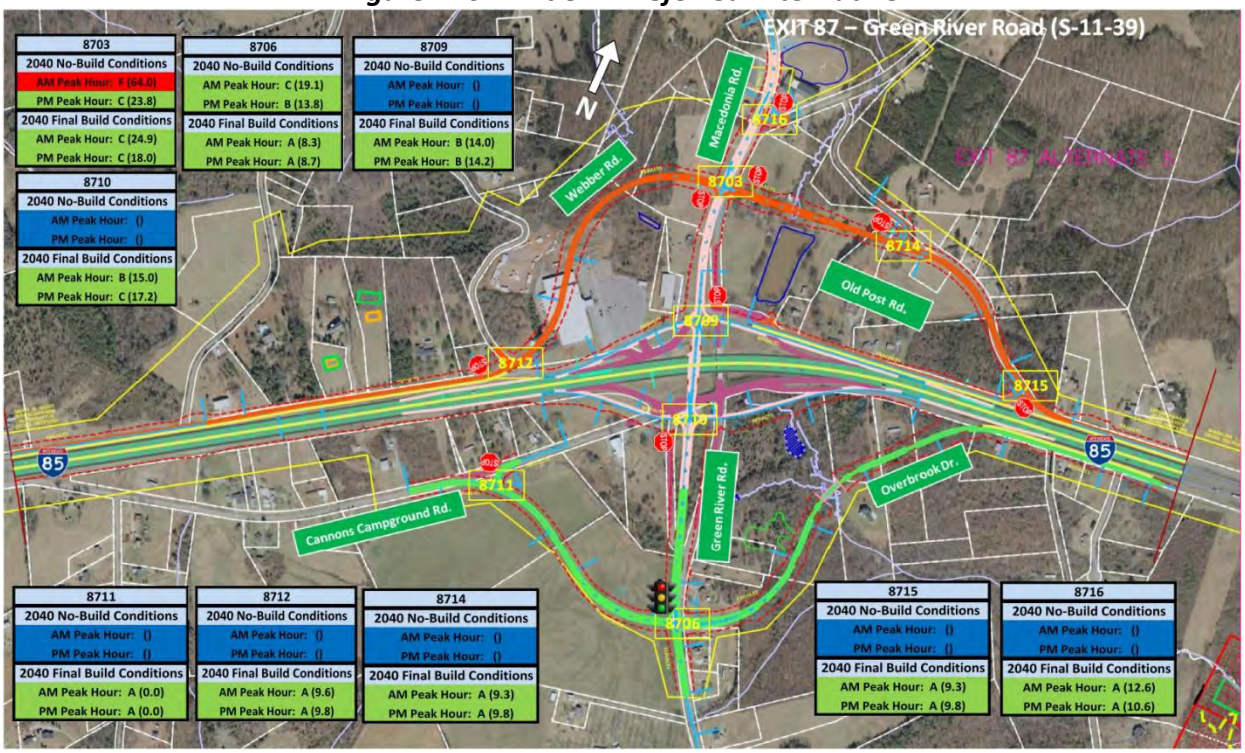
The results of the analysis of this interchange indicate that the intersection of Battleground Road at the southbound ramps will be required to be signalized for the preferred alternative of Exit 83. Based on the projected growth in traffic volumes, the signal installation is predicted to be warranted between 2035 and 2040 when the delay at this intersection would transition from LOS E to LOS F on the westbound approach. Under signal control, the intersection is forecast to operate at LOS B or better during the morning and afternoon peak hours.

The signalized intersection of Battleground Road with Frontage Road operates at LOS A during both peak hours. With the creation of the ramps, this signal may no longer be needed since the northbound off-ramp traffic currently using the Frontage Road to reach Battleground Road is diverted away from this intersection to the new northbound ramp intersection, reducing the minor street volumes.

Exit 87 – Green River Road (S-11-39)

The 2040 Build alternative for the intersections within the Exit 87 interchange area were performed for five alternatives. Alternative 5 (a combination of Alternatives 1 and 4) was chosen as the preferred alternative. It replaces the existing Exit 87 interchange with a diamond interchange. The final Preferred Alternative for Exit 87 is depicted in **Figure 116**.

Figure 116 - Exit 87: Preferred Alternative



Other elements of the alternative concept include:

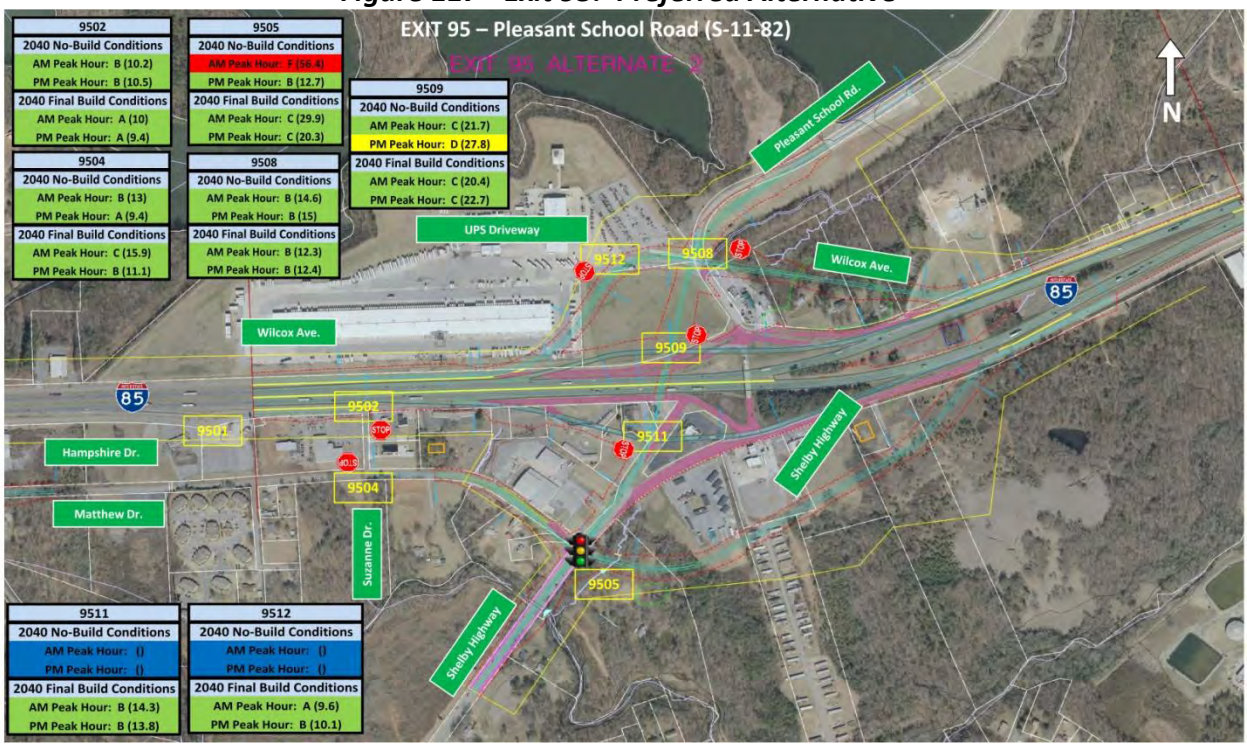
- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Webber Road/Old Post Road to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment of the approaches of the intersection of Green River Road with Cannons Campground Road/Overbrook Drive to increase the spacing between that intersection and the northbound ramp intersection
- Eliminating the intersection of Green River Road and Macedonia Road, and realigning the Malone Road intersection with Green River Road to avoid the pond and minimize impacts to the wetland and stream north of the pond.

The results of the analysis of this interchange indicate the intersection of Green River Road and Cannons Campground Road/Overbrook Drive will be required to be signalized for the preferred alternative of Exit 87. Based on the projected growth in traffic volumes, the signal installation is predicted to be warranted between 2035 and 2040 when the delay at this intersection would transition from LOS E to LOS F on the eastbound approach. Under signal control, the intersection is forecast to operate at LOS A during the morning and afternoon peak hours.

Exit 95 – Pleasant School Road (S-11-82)

The 2040 Build alternative for the intersections within the Exit 95 interchange area were performed for two alternatives. Alternative 2 was chosen as the preferred alternative. It replaces the existing Exit 95 interchange with a diamond interchange, and provides for a northbound on-ramp that is not present at the existing interchange. The final Preferred Alternative for Exit 95 is depicted in **Figure 117**.

Figure 117 - Exit 95: Preferred Alternative



Other elements of the alternative concept include:

- Constructing a northbound on-ramp
- Realigning Pleasant School Road
- Relocating and adjusting the alignment of the approaches at the intersection of Pleasant School Road with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment Shelby Highway and its intersections to eliminate its intersection with Hampshire Drive to increase the spacing between the Pleasant School Road intersections with Shelby Highway and the northbound ramp intersection

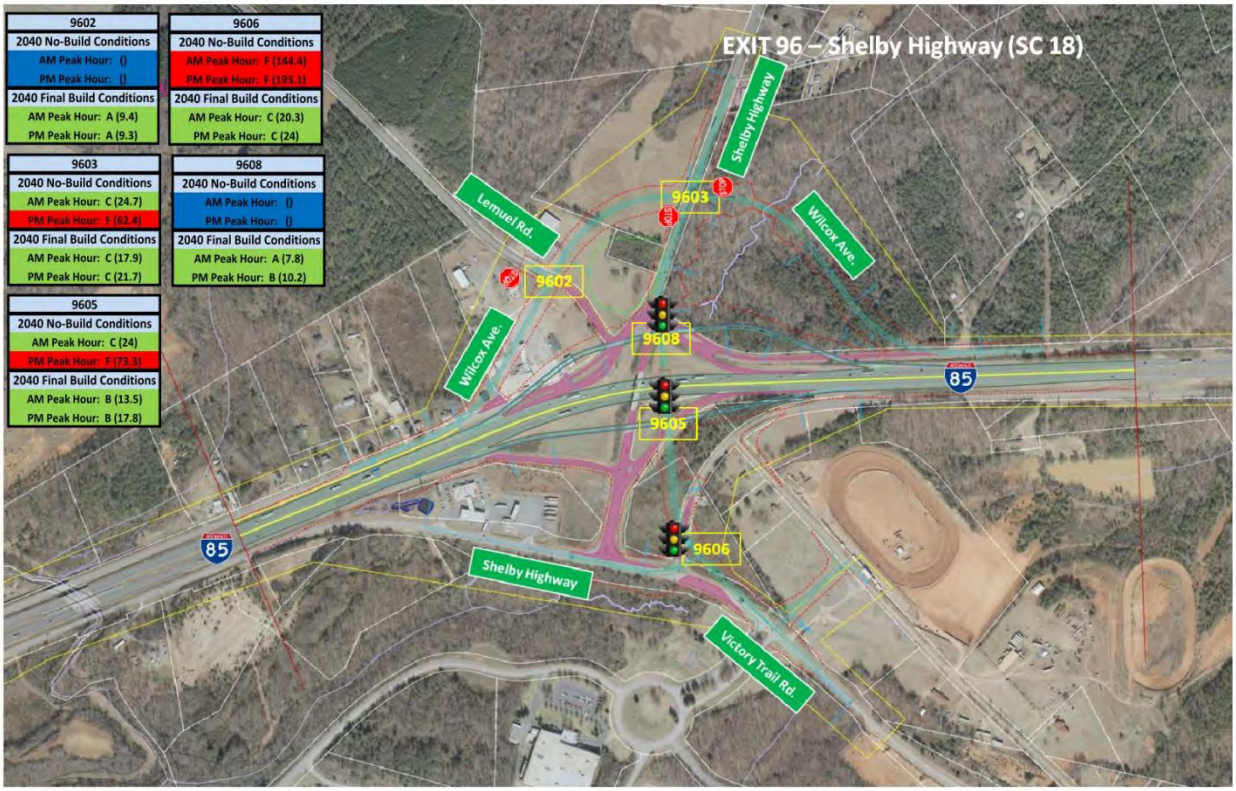
The results of the analysis of this interchange indicate that the intersection of Shelby Highway/Pleasant School Road and Matthew Road will be required to be signalized for the preferred alternative of Exit 95. The signal installation should be installed as part of the

construction of the interchange and be operational upon opening of the improvement. Without signalization, the westbound approach to the intersection would operate at LOS F. With signalization, the intersection is forecast to operate at LOS C during the morning and afternoon peak hours.

Exit 96 – Shelby Highway (SC 18)

The 2040 Build alternative for the intersections within the Exit 96 interchange area were performed for three alternatives. Alternative 3 was chosen as the preferred alternative. It replaces the existing Exit 96 interchange with a diamond interchange. While similar to Alternatives 1 and 2, the Alternative 3 differs in that Victory Trail Road is continuous with the portion of Shelby Highway crossing over I-85. In this alternative, the west approach of Shelby Highway for Exit 95 is controlled by a stop sign depicted in **Figure 118**.

Figure 118 - Exit 96: Preferred Alternative



Other elements of the alternative concept include:

- Realigning Shelby Highway over I-85
- Relocating and adjusting the alignment of the approaches at the intersection of Shelby Highway with Wilcox Avenue to the north to increase the spacing between that intersection and the southbound ramp intersection
- Relocating and adjusting the alignment Shelby Highway and Victory Trail.

The results of the analysis of this interchange indicate the stop sign controlled approaches to the unsignalized intersections along Shelby Highway at the northbound and southbound ramps and at Victory Trail Road were projected to operate at LOS F during the afternoon peak hours. Based on the projected growth in traffic volumes, the signal installations are predicted to be warranted as follows:

- Shelby Highway at I-85 SB ramps – signalization required between 2035-2040
- Shelby Highway at I-85 NB ramps – signalization required between 2030-2035
- Shelby Highway at Victory Trail Road – signalization required at Build

Under the preferred alternative of Exit 96, the signalization of the three intersections would result in LOS C or better during both the morning and afternoon peak hours. Signalization of these intersections would also likely avoid providing a four lane section of Shelby Highway in the interchange area to attain acceptable LOS at the stop sign controlled approaches of these intersections.

VISSIM Network Analysis

The Final Build AM and PM VISSIM models for the 18-mile study area of I-85 were developed by modifying the 2040 No-Build models to incorporate the widening of I-85 from two to three lanes in each direction as well as the preferred alternatives for each interchange. Synchro was used to input the recommended signal timing information into the network for the arterial intersections. Each simulation was run for one hour with 20 minutes of seeding time to load the network. 10 repetitions were used for both the AM and PM peak periods.

Basic Freeway Segment Analysis

The Basic Freeway Segment Analysis outputs for the Final Build conditions are provided in **Appendix K** and a summary of results compared to Existing and No Build conditions is shown in **Table 29**.

With the widening of I-85 to accommodate the projected increase in traffic volume within the corridor, the increased traffic volumes traveling on the widened interstate capacity will result in

most segment densities in the 2040 Build condition being comparable to those in existing conditions. However, several segments are projected to experience increased densities and worse LOS than those experienced under existing conditions, even with the widening to three lanes.

Table 29 – Final Freeway Segment Capacity Analysis VISSIM Results

Segment	Existing Conditions				No Build Conditions				Build Conditions			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]
Northbound												
Exit 80-82	C	18.8	D	31.5	D	29.0	F	45.2	C	18.7	D	30.9
Exit 82-83	C	18.8	D	31.5	D	29.1	F	46.4	n/a	n/a	n/a	n/a
Exit 83-87	B	17.9	D	29.6	D	27.4	E	37.3	C	18.0	D	28.2
Exit 87-90	B	17.7	D	28.6	D	27.4	E	36.2	C	18.0	D	27.5
Exit 90-92	B	15.4	D	26.3	C	23.7	D	33.1	B	15.5	C	25.2
Exit 92-95	B	14.8	C	25.2	C	22.6	D	32.1	B	15.0	C	24.4
Exit 95-96	B	13.5	C	24.2	C	20.9	D	30.7	B	14.8	C	25.3
Exit 96-97*	B	13.0	C	23.2	C	19.9	D	30.2	C	19.7	E	41.4
Exit 97-98	B	13.0	C	23.0	C	19.8	D	29.7	n/a	n/a	n/a	n/a
Exit 98-100*	B	12.8	C	23.0	C	19.5	D	29.8	C	20.0	E	36.3
Southbound												
Exit 100-96	B	14.3	C	25.5	C	22.3	F	53.2	C	22.4	E	41.2
Exit 96-95	B	15.4	D	27.1	C	24.2	F	47.9	B	15.9	D	26.4
Exit 95-92	B	15.3	D	26.8	C	23.7	E	40.4	A	10.1	D	32.6
Exit 92-90	B	14.3	D	26.0	C	21.8	E	39.6	B	14.3	C	25.8
Exit 90-87	B	15.9	D	28.5	C	24.6	E	41.1	A	4.5	D	28.3
Exit 87-83	B	16.8	D	28.2	C	25.9	E	40.2	B	16.7	D	28.0
Exit 83-80	C	19.2	D	29.0	D	29.8	E	41.5	C	18.8	D	28.5

[1] Per Highway Capacity Manual 2010 criteria.
[2] Density expressed as passanger cars/per mile/per lane.
*Build Scenario has 3 lanes from 96 to old 97 and two lanes from old 97 to 100.

The analysis results for the ramp merge areas, summarized in **Table 29**, indicate the following:

- Under Build conditions during the morning peak hour:
  - All freeway segments operate at LOS C or better. All ramps achieve a GEH statistic of 5 percent or lower.
- Under Build conditions during the afternoon peak hour:
  - The northbound freeway segments between Exit 96 and Exit 100 operate at LOS E while the freeway segments between Exit 80 and 90 operate at LOS D. The remaining segments between Exit 90 and Exit 96 operate at LOS C.
  - The southbound freeway segment between Exit 100 and 96 operates at LOS E while the remaining segments between Exit 95 and 80 operate at LOS D or better.

It should be noted that under the Build conditions, I-85 is not widened between old Exit 97 and Exit 100 and remains at two lanes in both the northbound and southbound directions.

Ramp Merge Analysis

The summary of the Ramp Merge Analyses results for the Build condition, compared to the Existing and No-Build conditions are shown in **Table 30**. The outputs for the Final Build condition analyses are provided in **Appendix L**.

With the widening of I-85 to accommodate the projected increase in traffic volume within the corridor, the increased traffic volumes in most merge areas in the 2040 Build condition will have densities comparable to those in existing conditions. However, several merge areas are projected to experience increased densities and worse LOS than those experienced under existing conditions, even with the widening to three lanes.

Table 30 – Final Ramp Merge Capacity Analysis VISSIM Results

Segment	Existing Conditions				No Build Conditions				Build Conditions			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]
Northbound												
Exit 80	B	17.6	D	30.4	D	27.5	F	52.0	B	17.9	D	30.4
Exit 83	B	17.4	D	28.8	D	26.7	E	37.2	C	18.5	D	27.8
Exit 87	B	17.2	D	28.1	D	27.3	E	35.6	B	17.8	D	27.1
Exit 90	B	14.2	C	25.5	C	22.9	D	34.4	B	15.4	C	24.1
Exit 92 Loop	B	13.8	C	23.3	C	20.9	D	29.1	B	14.6	C	22.6
Exit 92	B	14.6	C	24.5	C	22.2	D	31.2	B	14.9	C	24.0
Exit 95	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	B	14.6	C	23.4
Exit 96	B	12.7	C	22.5	C	19.4	D	29.2	C	18.9	C	23.7
Exit 97	B	13.0	C	23.0	C	19.8	D	29.7	n/a	n/a	n/a	n/a
Southbound												
Exit 100	B	13.9	C	24.7	C	21.4	E	41.0	C	21.4	E	40.7
Exit 96	B	13.9	C	25.8	C	21.9	F	84.9	B	16.4	C	25.5
Exit 95	B	14.8	C	26.0	C	23.1	E	39.4	B	16.4	D	27.2
Exit 92	B	14.6	C	24.9	C	22.0	E	38.4	B	14.7	D	27.3
Exit 92 Loop	B	14.4	C	25.8	C	21.9	E	40.3	B	13.8	D	26.3
Exit 90	B	14.3	D	29.9	C	23.6	F	71.4	B	15.8	E	35.9
Exit 87	B	14.9	D	27.8	C	23.0	E	40.4	B	11.2	D	27.8
Exit 83	C	18.6	D	29.3	D	33.0	F	61.3	C	19.4	D	28.4

[1] Per Highway Capacity Manual 2010 criteria.
[2] Density expressed as passanger cars/per mile/per lane.

The analysis results for the ramp merge areas, summarized in **Table 30**, indicate the following:

- Under Build conditions during the morning peak hour:

  - The northbound and southbound merge areas operate at LOS B or C. All ramps achieve a GEH statistic of 5 percent or lower.
- Under Build conditions during the afternoon peak hour:
  - The northbound merge areas operate at LOS C or D.
  - The southbound merge areas operate at LOS C or D with the exception of Exit 100 and Exit 90 where the merge areas are expected to operate at LOS E.

It should be noted that under the Build conditions, I-85 is not widened in the southbound merge area at Exit 100 and remains at two lanes.

Ramp Diverge Analysis

The summary of the Ramp Diverge Analyses results for the Build condition, compared to the Existing and No-Build conditions are shown in **Table 31**. The outputs for the Final Build condition analyses are provided in **Appendix L**.

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With the widening of I-85 to accommodate the projected increase in traffic volume within the corridor, the increased traffic volumes in most diverge areas in the 2040 Build condition will have densities comparable to those in existing conditions. However, several merge areas are projected to experience increased densities and worse LOS than those experienced under existing conditions.

Table 31 – Final Ramp Diverge Capacity Analysis VISSIM Results

Segment	Existing Conditions				No Build Conditions				Build Conditions			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]	LOS[1]	Density[2]
Northbound												
Exit 82	C	18.3	D	30.7	D	29.1	E	43.6	n/a	n/a	n/a	n/a
Exit 83	C	18.5	D	31.0	D	28.9	E	45.3	C	19.1	D	29.8
Exit 87	B	16.6	D	26.9	C	25.7	D	33.7	B	16.9	D	26.1
Exit 90	B	14.7	D	27.1	C	24.5	F	47.9	C	20.7	C	25.9
Exit 92	B	12.7	C	22.0	C	19.5	D	27.4	B	13.5	C	22.0
Exit 95	B	13.4	C	24.3	C	21.1	D	31.1	B	15.3	C	24.4
Exit 96	B	11.4	C	21.1	B	17.7	D	26.7	B	14.5	D	27.9
Exit 98	B	12.9	C	23.0	C	19.6	D	29.6	n/a	n/a	n/a	n/a
Exit 100	B	11.4	C	22.3	B	17.8	D	29.3	C	20.6	D	33.3
Southbound												
Exit 96	B	14.3	C	25.6	C	22.7	F	76.6	B	16.2	D	26.3
Exit 95	B	14.9	D	26.5	C	23.9	E	41.6	A	9.4	C	25.8
Exit 92	B	15.4	C	24.1	C	24.5	E	36.1	B	15.9	D	27.8
Exit 90	B	16.6	D	29.6	C	25.0	E	44.6	B	14.4	C	24.3
Exti 87	B	15.4	D	28.1	C	24.2	E	40.9	C	18.7	D	27.8
Exit 83	B	16.4	D	27.1	D	26.5	E	41.2	B	17.6	D	26.5
Exit 80	B	16.2	C	21.1	C	24.0	D	28.4	B	17.7	D	28.9

[1] Per Highway Capacity Manual 2010 criteria.
[2] Density expressed as passanger cars/per mile/per lane.

The analysis results for the ramp merge areas, summarized in **Table 31**, indicate the following:

- Under Build conditions during the morning peak hour:
  - The northbound and southbound off-ramps operate at LOS C or better.
- Under Build conditions during the afternoon peak hour:
  - The diverge areas for the northbound off-ramps at Exits 83, 87, 96, and 100 will operate at LOS D. All remaining northbound off-ramps will operate at LOS C.
  - The diverge areas for all the southbound off-ramps with the exception of Exit 95 and Exit 90 will operate at LOS C. The remaining southbound diverge areas will operate at LOS C.

VII. CONCLUSIONS AND RECOMMENDATIONS

Data obtained for this study from SCDOT includes:

- Average Annual Daily Traffic (AADT) volumes for freeway segments and arterials between 1996 and 2013.
- Traffic volumes from permanent Automatic Traffic Recording (ATR) stations P-14 (between Exits 87 and 90) and P-132 (north of Exit 96)
- Vehicle classification volumes from ATR stations P-14 and P-132
- Turning movement counts for morning (7-9 AM) and afternoon (4-6 PM) peak periods at most of the ramp termini and adjacent intersections
- 2013 INRIX speed data for I-85 between Exits 80 and 102
- Historic crash data for the interstate corridor from January 2011 through December 2013
- Historic crash data in the vicinity of the interchanges to be upgraded (Exits 83, 87, 95, 96) from January 2011 through August 2014.
- Signal plans and signal timings for the nine existing traffic signals at ramp termini and adjacent intersections

Additional turning movement counts were collected to supplement the SCDOT turning movement counts and to provide coverage for the adjacent intersections potentially affected by the modification of Exits 83, 87, 95, and 96.

Analyses performed for the study include:

- An accident analysis for the study area
- A traffic forecasting analysis to estimate future no-build and build condition traffic volumes
- Freeway segment operations analysis for existing, future no-build and future build conditions
- Freeway ramp merge/diverge area analysis for existing, future no-build and future build conditions
- Signalized and unsignalized intersection analysis for existing, future no-build and future build conditions,
- Roundabout analysis, if necessary for future build conditions that incorporate roundabouts as a design element
- Microsimulation analysis of the interchange intersections using Synchro/SimTraffic
- Microsimulation analysis of the study area network using VISSIM

Some of the findings of the accident analysis include:

- 1,019 crashes within the study area, with 902 crashes along I-85 or its ramps and 117 on adjacent roadways
- The three most prevalent crash types were
    - Collisions with fixed objects - 358 crashes (40 percent)

  - Rear end collisions - 247 crashes (27 percent)
  - Same direction sideswipes – 129 crashes (14 percent)
- Most crashes were classified as property damage only. The crashes that were not property damage only included
  - Possible injury crashes – 125 (14 percent)
  - Non-incapacitating injury crashes – 26 (three percent)
  - Incapacitating injury crashes – 7 (less than one percent)
  - Fatal crashes – 6 (less than one percent)
- The geometric conditions of the merge and diverge areas at the interchanges, short on- and off-ramp distances, and the connection between ramps and the adjacent roadway system contribute to the frequency of accidents at some locations. It is likely that combinations of these factors violate drivers' expectations and create confusion, particularly for drivers who are unfamiliar with the area.
- Approximately half of the 117 crashes occurring on the adjacent roadways took place on the roadways surrounding Exit 95.

The INRIX speed data indicated that the annual average morning and afternoon peak period speeds in the corridor are generally near the posted speed limit, with no locations of recurring congestions.

The following criteria, as outlined in the Data Collection section of the report, were used for inputs for the analysis of freeway segments, merge and diverge ramp areas, and signalized and unsignalized intersections for the existing, future no-build and future build conditions:

- The 30th highest hour volumes based on the P-132 ATR count station data, balanced through the system, were used for the freeway segment mainline volumes.
- To develop future (2040) traffic volumes, a 1.5 percent annual growth rate was applied to existing volumes in the study area.
- A peak hour factor of 0.90 was used for freeway segments and ramp areas.
- The proportion of trucks and buses traveling on the freeway segments and ramp movements, based on SCDOT data, is 25 percent.
- Based on the grades through the study area, the terrain was set as "Rolling", instead of "Level" or "Mountainous".
- Free-flow speed was set at the posted speed limit along the segment.

For the 2014 Existing Conditions

- Freeway segments operate near capacity in both directions between Exits 80 and 90 during the afternoon peak hour
- Ramp merge conditions operate near capacity during the afternoon peak hour at the northbound on-ramp at Exit 83, and the southbound on-ramps at Exits 83 and 90

- Ramp diverge conditions operate near capacity during the afternoon peak hour for the off-ramps at Exits 82, 83, and 90 in the northbound direction and at Exits 83, 87, 90, and 95 in the southbound direction.
- Intersection operations approach capacity only at the unsignalized intersection of Gossett Road and Sha Lane (Exit 80) during the afternoon peak hour.

For the 2040 No-Build conditions

- Freeway segments
    - operate near capacity northbound between Exits 80 and 83 and between Exits 87 and 90; and southbound between Exits 87 and 83 during the morning peak hour
    - operate over capacity southbound between Exits 83 and 80 during the morning peak hour
    - operate over capacity at all Exits in both directions during the afternoon peak hour
- Ramp merge conditions operate over capacity during the morning peak hour at the southbound on-ramp from Exit 83, and for all on-ramps at all interchanges during the afternoon peak hour.
- Ramp diverge conditions
    - operate near capacity during the morning peak hour in the northbound direction for the off-ramps at Exits 82, 83, and 90, and in the southbound direction at Exit 83 and 87
    - operate near capacity during the afternoon peak hour in the southbound direction at Exit 80, and operate over capacity in both directions at all other locations
- Intersection operations
    - Are near capacity during the morning peak hour at the intersection of Truck Stop Road/Horry Road at the I-85 southbound on-ramp (Exit 83)
    - Are over capacity during the morning peak hour at
        - Gossett Road and Sha Lane (Exit 80) and may require signalization
        - Gossett Road and I-85 northbound ramps (Exit 80) and may require signalization
        - Green River Road and Webber Road (Exit 87)
        - Shelby Highway and Matthew Road (Exit 95)
        - Shelby Highway and Victory Trail Road (Exit 96)
    - Are over capacity during the afternoon peak hour at
        - Gossett Road and Sha Lane (Exit 80)
        - Battleground Road and Phillips Drive (Exit 83)
        - Shelby Highway and Wilcox Road (Exit 96)
        - Shelby Highway and I-85 northbound ramps (Exit 96)
        - Shelby Highway and Victory Trail Road (Exit 96)

- The following intersections may require capacity improvements and/or signalization to improve their operation for the 2040 No-Build conditions.
    - Gossett Road and Sha Lane (Exit 80)
    - Gossett Road and I-85 northbound ramps (Exit 80)
    - Battleground Drive and Phillips Road (Exit 83)
    - Green River Road and Webber Road/Old Post Road (Exit 87)
    - Shelby Highway and Matthew Road (Exit 95)
    - Shelby Highway and Wilcox Avenue (Exit 96)
    - Shelby Highway and I-85 northbound off-ramp (Exit 96)
    - Shelby Highway and Victory Trail Road (Exit 96)

For the 2040 Build conditions

- Freeway segments operate near capacity in both directions between Exits 80 and 90 during the afternoon peak hour.
- The individual freeway segments between Exits 80 and 90 were estimated to be approaching capacity between 2031 and 2036. With the projected growth rate, it may be necessary to provide a fourth through lane in each direction along these segments. The need for this potential widening should be considered and incorporated into the design and construction to minimize future disruption when the future widening becomes necessary. These freeway segments, which are projected to operate at LOS E after the widening to three lanes, are projected to operate at LOS D or better with the addition of a fourth lane.
- Ramp merge conditions operate under capacity in both directions for all on-ramps during both peak hours.
- Ramp diverge conditions operate near capacity during the afternoon peak in the northbound direction at Exits 83 and 90, and in the southbound direction at Exits 80 and 87. The diverge areas operating near capacity are predicted to operate at LOS D or better with the addition of a fourth lane in each direction between Exits 80 and 90.
- Intersection operations varied between alternatives. In all alternatives, the intersections were presumed to operate with stop sign control on the minor street approaches.
    - Exit 83 Alternative 1 (Diamond Interchange)
        - A signal may no longer be needed at the intersection of Battleground Road with the relocated Frontage Road provided sufficient sight distance is available
        - Signals may be needed at
            - Battleground Road and I-85 southbound ramps
            - Battleground Road and Phillips Drive
    - Exit 83 Alternative 2 (Southbound loop off-ramp in northwest interchange quadrant)
        - A signal may be needed at the intersection of Battleground Road and Edgefield Road

- Exit 83 Alternative 3 (Northbound loop off-ramp in the southeast quadrant and southbound loop off-ramp in the northwest quadrant)
  - A signal may be needed at the intersection of Battleground Road and Edgefield Road
- Exit 83 Alternative 4 (Diamond Interchange and a northbound loop off-ramp located in the southeast quadrant of the interchange)
  - A signal may no longer be needed at the intersection of Battleground Road with the relocated Frontage Road provided sufficient sight distance is available
  - Signals may be needed at
    - Battleground Road and I-85 southbound ramps
    - Battleground Road and Phillips Drive
- Exit 87 Alternative 1 (Diamond interchange)
  - The intersection of Green River Road and Cannons Campground Road would either need to be signalized, or provide a separate eastbound left turn lane and shared through-right turn lane if unsignalized.
- Exit 87 Alternative 2 (Loop on-ramps in the southwest and northeast quadrants)
  - The intersection of Green River Road and Cannons Campground Road would either need to be signalized, or provide a separate eastbound left turn lane and shared through-right turn lane if unsignalized.
- Exit 87 Alternative 3 (Diamond Interchange)
  - The intersection of Green River Road and Cannons Campground Road would either need to be signalized, or provide a separate eastbound left turn lane and shared through-right turn lane if unsignalized.
- Exit 87 Alternative 4 (Diamond interchange)
  - The intersection of Green River Road and Cannons Campground Road would either need to be signalized, or provide a separate eastbound left turn lane and shared through-right turn lane if unsignalized.
- Exit 87 Alternative 5 (Diamond interchange – Combination of Alt 1 and Alt 4)
  - The intersection of Green River Road and Cannons Campground Road would either need to be signalized, or provide a separate eastbound left turn lane and shared through-right turn lane if unsignalized.
- Exit 95 Alternative 1 (Diamond Interchange with Shelby Highway relocated to the south and Pleasant School Road relocated to the east)
  - The relocated intersection of Matthew Drive at Shelby Highway would either need to be signalized or provide separate left and right turn lanes on the Matthew Drive approach if unsignalized.
- Exit 95 Alternative 2 (Diamond interchange with Shelby Highway relocated to the south and Pleasant School Road relocated to the west)
  - The four way intersection with Matthew Drive created by the realignment of Shelby Highway and Pleasant School Road would require signalization.

- Exit 96 Alternative 1 (Diamond interchange with Shelby Highway shifted slightly west)
  - If the northbound and southbound ramp intersections are to be unsignalized,
    - Separate left turn lanes would need to be provided on the northbound and southbound ramp approaches to Shelby Highway
- Exit 96 Alternative 2 (Diamond intersection with Shelby Highway pushed slightly east and the Shelby Highway/Victory Trail Road intersection realigned).
  - If the northbound and southbound ramp intersections are to be unsignalized,
    - Separate left turn lanes would need to be provided on the northbound and southbound ramp approaches to Shelby Highway
    - A second through lane would need to be provided in each direction on Shelby Highway within the interchange area
  - Widening Shelby Highway within the interchange area could be avoided by installing traffic signals at the northbound and southbound ramp intersections.
  - Signalization is required at the intersection of Shelby Highway and Victory Trail Road
- Exit 96 Alternative 3 (Diamond interchange with Shelby Highway pushed slightly east and the Shelby Highway/Victory Trail Road intersection realigned).
  - If the northbound and southbound ramp intersections are to be unsignalized,
    - Separate left turn lanes would need to be provided on the northbound and southbound ramp approaches to Shelby Highway
    - a second through lane would need to be provided in each direction on Shelby Highway within the interchange area
  - Widening Shelby Highway within the interchange area could be avoided by installing traffic signals at the northbound and southbound ramp intersections.
  - Signalization is required at the intersection of Shelby Highway and Victory Trail Road

- The VISSIM network simulation analysis shows:
  - During the 2040 No-Build afternoon peak hour simulations, bottlenecks within the system, such as along northbound I-85 approaching Exit 80, create extensive latent demand – vehicles that cannot enter the simulation network. Approximately 1,900 vehicles per hour are unable to enter and travel through the network during the 2040 No-Build afternoon peak hour simulations. Because the simulations can only measure traffic entering the network, the effect of the additional latent demand is not measured. The amount of traffic simulated downstream of the bottlenecks that create the latent demand is also

reduced. Combined, the resulting densities without the latent demand are lower than the fully loaded network, which falsely provides a "better" level of service.

- Recognizing the full demand is not being modeled, during the 2040 No-Build afternoon peak hour,
  - The northbound freeway segments between Exits 80 and 90 operate near capacity
  - The southbound freeway segments between Exits 80 and 95 operate near capacity
  - The southbound freeway segments between Exits 95 and 100 operate over capacity. This is attributed to the effect of congestion within the merge and diverge areas of Exit 96, which adversely affects traffic along these segments.
  - The northbound merge (on-ramp) areas are near capacity at Exits 83 and 87 and over capacity at Exit 80
  - The southbound merge (on-ramp) areas are over capacity at Exits 83, 90, and 96 and near capacity at the remaining interchanges
  - The northbound diverge (off-ramp) areas are near capacity at Exits 82 and 83, and over capacity at Exit 90
  - The southbound diverge (off-ramp) areas are under capacity at Exit 80, over capacity at Exits 90 and 96 and near capacity at the remaining interchanges.
- To accommodate the latent demand, additional capacity is required along I-85, supporting the need for widening the interstate from two to three lanes in each direction.

Based on VISSIM results of the 2040 Final Build Network, the widening of I-85 to accommodate the projected increase in traffic volume within the corridor will result in most segment densities in the 2040 Build condition being comparable to those in existing conditions. However, several segments are projected to experience increased densities and worse LOS than those experienced under existing conditions, even with the widening to three lanes.

The final build alternative network analyzed was based on the preferred alternative improvements selected for each interchange. The alternatives at each interchange were evaluated and the preferred alternative was selected based on factors such as construction costs, business and residential relocations, and environmental impacts in addition to consideration of traffic operations.

Exit 83 – Alternative 4

- Based on the analysis of this interchange, the intersection of Battleground Road at the southbound ramps was recommended to be signalized. Based on the projected growth in traffic volumes, the signal installation is predicted to be warranted between 2035 and 2040 when the delay on the westbound approach transitions from LOS E to LOS F.

Under signal control, the intersection is forecast to operate at LOS B or better during the 2040 morning and afternoon peak hours.

- The signalized intersection of Battleground Road with Frontage Road operates at LOS A during both peak hours. This intersection is a relocation of an existing signal controlled intersection and may no longer be needed in Alternative 4 since the northbound off-ramp traffic currently is diverted away from the relocated intersection to the new northbound ramp intersection, reducing the minor street volumes.

Exit 87 – Alternative 5

- Based on the analysis of this interchange, the intersection of Green River Road and Cannons Campground Road/Overbrook Drive was recommended to be signalized. Based on the projected growth in traffic volumes, the signal installation is predicted to be warranted between 2035 and 2040 when the delay on the eastbound approach transitions from LOS E to LOS F. Under signal control, the intersection is forecast to operate at LOS A during the 2040 morning and afternoon peak hours.

Exit 95 – Alternative 2

- Based on the analysis of this interchange, the intersection of Shelby Highway/Pleasant School Road and Matthew Road was recommended to be signalized as part of the construction of the interchange. Without signalization, the westbound approach of the intersection would operate at LOS F. With signalization, the intersection is forecast to operate at LOS C during the morning and afternoon peak hours.

Exit 97 – Alternative 3

- Based on the analysis of this interchange, the unsignalized intersections along Shelby Highway including the northbound and southbound ramps and at Victory Trail Road were projected to operate at LOS F during the afternoon peak hours. Based on the projected growth in traffic volumes, the signal installations are predicted to be warranted as follows:
    - Shelby Highway at I-85 SB ramps – signalization required between 2035-2040
    - Shelby Highway at I-85 NB ramps – signalization required between 2030-2035
    - Shelby Highway at Victory Trail Road – signalization required at Build

  The signalization of the three intersections would result in an operation of LOS C or better during the morning and afternoon peak hours.