

I-440/CAPITAL BOULEVARD INTERCHANGE ALTERNATIVES

EXECUTIVE SUMMARY

As a part of its annual Transportation Feasibility and Impact Studies, the Capital Area Metropolitan Planning Organization (CAMPO) seeks to evaluate the interchange of I-440 at Capital Boulevard for improvements to operations, safety, and multi-modal access. Kimley-Horn, in coordination with CAMPO and a steering committee consisting of members from the City of Raleigh and North Carolina Department of Transportation (NCDOT), has completed a study of feasible improvement alternatives at this interchange. This report summarizes the results of the study.

The I-440 at Capital Boulevard interchange currently operates with instances of excessive queuing and delay during the AM and PM peak hours, some of which are caused by issues at the interchange itself while others are related to issues elsewhere in the roadway network. For the purposes of this study, the analysis, recommendations, and functional designs of the proposed alternatives were limited to the I-440/ Capital Boulevard interchange and two signalized intersections along Capital Boulevard on either side of the interchange.

In addition to the operational issues at the interchange, the project team focused on a number of safety issues in the area, such as the short weave distances between loop ramps along both Capital Boulevard southbound and I-440 westbound. Capital Boulevard in this area is also an increasingly difficult place to maneuver for people who bike or walk with little accommodation for bike or pedestrians. Given that it is a heavily utilized transit route with bus stops adjacent to the interchange, the project team identified the importance of developing improvements that accommodate multiple modes of transportation in this area.

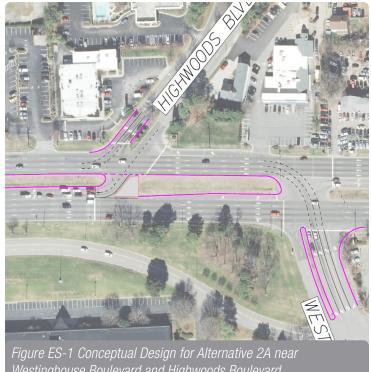
Based on conversations with the project team at the kickoff meeting, it was determined that the goal of this project would be to consider alternatives that would be lower-impact and shorter-term, as opposed to a complete reconstruction of the interchange that would operate for 20 years or more. As a result, the traffic operations analysis, which was completed using TransModeler microsimulation software, included four conditions for each of the alternatives being considered:

- 2016 No Build
- 2016 Build
- 2026 No Build
- 2026 Build

The Kimley-Horn team, in coordination with CAMPO staff, developed five (5) initial alternatives for low-impact improvements within the study area. Following a progress meeting with CAMPO staff and the steering committee, the Kimley-Horn team moved forward with developing detailed analyses and measures of effectiveness for three (3) alternatives, which are referred to here as Alternatives 2A, 2B, and 2D.

The following improvements are proposed as a part of Alternative 2A:

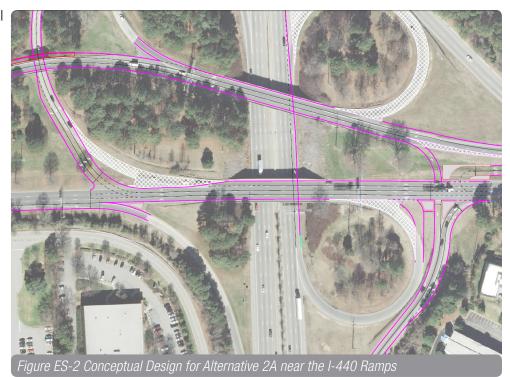
- Convert Highwoods Boulevard to a synchronized street intersection (no left-out from Highwoods Boulevard onto Capital Boulevard)
- Construct dual southbound U-turn lanes at the I-440 westbound off-ramp intersection to accommodate the Highwoods Boulevard synchronized street conversion
- Restripe the inside right-turn lane on Westinghouse Boulevard to provide triple westbound left-turn lanes on that approach
- Realign and signalize the I-440 eastbound to Capital Boulevard northbound ramp



Westinghouse Boulevard and Highwoods Boulevard

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- Remove the I-440 westbound to Capital Boulevard southbound loop ramp and install a traffic signal for the I-440 Westbound to Capital Boulevard ramp, which would be realigned
- Construct an additional southbound through lane along Capital Boulevard to the south of the interchange (to create a receiving lane for the I-440 westbound off-ramp left-turn movement)
- Widen the bridge for Capital Boulevard southbound over the existing I-440 eastbound off-ramp
- Provide continuous sidewalk along northbound Capital Boulevard through the interchange to Highwoods Boulevard, and provide a crosswalk to the west side of Capital Boulevard at Highwoods Boulevard (Note: not shown on conceptual exhibits)



Figures ES-1 and ES-2 provide conceptual exhibits showing the improvements associated with Alternative 2A within the study area.

Other than the improvement listed below, the proposed Alternative 2B improvements are the same as those in Alternative 2A:

• Construct a free-flow U-turn connection for southbound Capital Boulevard to accommodate the Highwoods Boulevard synchronized street conversion (instead of dual U-turn lanes at the I-440 westbound off-ramp)

Figure ES-3 provides a conceptual exhibit showing the improvements associated with Alternative 2B near the I-440 ramps.

Other than the improvements listed below, the proposed Alternative 2D improvements are the same as those in Alternative 2A:

- Install a traffic signal for the I-440
 Westbound to Capital Boulevard
 northbound ramp, which would be
 realigned
- Keep the I-440 westbound to Capital Boulevard southbound loop ramp and construct an additional southbound through lane along Capital Boulevard to the south of the interchange (to eliminate a weave for the I-440 westbound to Capital Boulevard southbound movement)
- Widen the bridge for Capital Boulevard southbound over the existing I-440 eastbound off-ramp

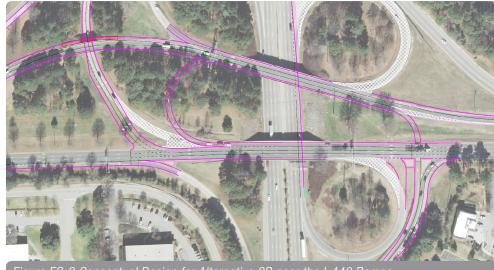
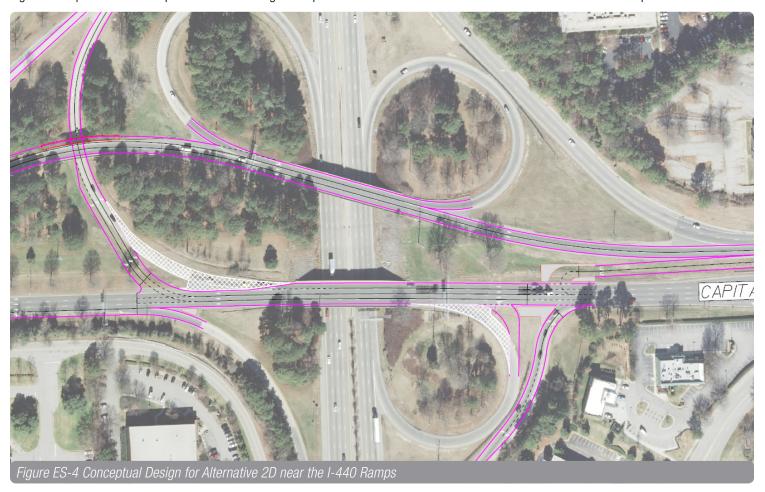


Figure ES-3 Conceptual Design for Alternative 2B near the I-440 Ramps

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Figure ES-4 provides a conceptual exhibit showing the improvements associated with Alternative 2D near the I-440 ramps.



Alternatives 2A, 2B, and 2D were then compared to the interchange alternative that was developed by NCDOT Congestion Management through the SPOT 4.0 Prioritization process in 2014. The SPOT 4.0 alternative includes the reconstruction of the I-440/Capital Boulevard interchange and the conversion of the existing Westinghouse Boulevard and Highwoods Boulevard intersections to a square-loop interchange with Capital Boulevard.

Based on a discussion of the measures of effectiveness for each of the alternatives, which are provided in detail in Section 5.3, the project team concluded that it would be most beneficial to move forward to functional design for two final alternatives: 2A and 2B. These alternatives, when compared to Alternative 2D and the SPOT alternative, are projected to provide a significant network-wide benefit at relatively low cost. Based on the measures and discussions of Alternative 2D, it was determined that the most beneficial set of improvements at the interchange should include the removal of the I-440 westbound to Capital Boulevard southbound loop ramp. Based on the analysis, the removal of the loop ramp significantly improves operations along mainline I-440 westbound in 2026, and the benefit of eliminating the short weave sections between loop ramps along both Capital Boulevard southbound and I-440 westbound is expected to be significant.

Alternatives 2A and 2B both provide significant improvements to safety, bikeability, and walkability over the existing condition. Both alternatives eliminate conflict points by removing the loop ramp and closing the existing median break along Capital Boulevard north of I-440. Additionally, the functional designs provided with this submittal include continuous sidewalk facilities along Capital Boulevard northbound from the I-440 interchange to Highwoods Boulevard, and the removal of free-flow ramp conflicts is a significant improvement for people who bike and walk through this interchange along Capital Boulevard.

Full functional designs and opinions of probable construction cost for Alternatives 2A and 2B are provided in Appendix E.

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1 BACKGROUND

As a part of its annual Transportation Feasibility and Impact Studies, the Capital Area Metropolitan Planning Organization (CAMPO) selected Kimley-Horn to evaluate the interchange of I-440 at Capital Boulevard for improvements to operations and safety. Kimley-Horn, in coordination with CAMPO and a steering committee consisting of members from the City of Raleigh and North Carolina Department of Transportation (NCDOT), has completed a study of feasible improvement alternatives at this interchange. This report summarizes the results of the study.

1.1 STUDY AREA

For the purposes of this study, the analysis, recommendations, and functional designs of the proposed alternatives were limited to the I-440/Capital Boulevard interchange and the following signalized intersections:

- · Capital Boulevard at Hodges Street
- · Capital Boulevard at Yonkers Road
- Capital Boulevard at Highwoods Boulevard
- Capital Boulevard at Westinghouse Boulevard

The study area is shown in Figure 1-1.



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The I-440/Capital Boulevard interchange currently has loop ramps in the northwest, southwest, and northeast quadrants (for the purposes of this study, Capital Boulevard was assumed to run North/South with I-440 running East/West) as well as a fly-over ramp for the I-440 eastbound to Capital Boulevard northbound movement. All of the existing ramps are free-flow movements except for the I-440 westbound to Capital Boulevard northbound ramp, which is stop-controlled.

Capital Boulevard is classified in Raleigh's 2030 Comprehensive Plan as an Avenue Six-Lane, Divided. It currently transitions from an eight-lane divided roadway at the north end of the study area to a six-lane divided roadway at the south end. The 2013 AADT volume was approximately 70,000 vehicles per day (vpd) north of I-440. Within the study area, I-440 is an eight-lane divided freeway with a 2013 AADT volume of approximately 119,000 vpd to the west of Capital Boulevard and approximately 101,000 vpd to the east.

1.2 PROJECT TEAM KICKOFF MEETING

Kimley-Horn team members held an initial kickoff meeting with CAMPO, City of Raleigh, and NCDOT staff to discuss existing operational and safety issues at the interchange and to consider any preconceptions about what needs to be fixed at the I-440/Capital Boulevard interchange. Based on conversations with the project team at the kickoff meeting, it was determined that the goal of this project would be to consider alternatives that would be lower-impact and shorter-term, as opposed to a complete reconstruction of the interchange that would operate for 20 years or more.

1.3 DATA COLLECTION AND INITIAL FIELD OBSERVATIONS

AM and PM peak hour turning movement counts were performed at the following study intersections on Wednesday, April 6, 2016:

- Capital Boulevard at Hodges Street
- Capital Boulevard at Yonkers Road
- Capital Boulevard at Westinghouse Boulevard

It was determined that older traffic counts from June 25, 2013 could be used at the intersection of Capital Boulevard at Highwoods Boulevard for the purposes of this study. Volumes at this intersection were adjusted accordingly to balance with the new turning movement counts taken at Westinghouse Boulevard. In addition to the turning movement counts, 24-hour tube counts were taken at all eight (8) directional ramps at the I-440/Capital Boulevard interchange. All of the raw turning movement counts used in the analysis are provided as attachments to this report in Appendix A.

Kimley-Horn team members conducted a one-day field review of the interchange to observe existing congestion, queue lengths, travel patterns, speed limits, and other information to assist with the alternatives analysis. The following is provided as a summary of the existing condition based on the field review:

- The stop-controlled I-440 westbound off-ramp approach operates with significant queuing and delay. Kimley-Horn team members
 noted in the field that approximately half of the vehicles making the westbound right-turn movement from the off-ramp ended up
 making a northbound left-turn from Capital Boulevard onto Highwoods Boulevard during the AM peak hour.
 - » The difficulty of merging from a stopped condition across four lanes of traffic makes the delay and queuing issues at this intersection worse than one would expect from solely considering the traffic volumes.
 - » Additionally, it was observed that this merge, given the need for vehicles to accelerate quickly to match speeds along Capital Boulevard, should be a focus area for safety improvements.

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- During the AM peak hour, Capital Boulevard southbound operates with infrequent instances of slowdown between I-440 and Westinghouse Boulevard due to spillback from I-440 westbound outside of the study area. (See Figure 1-2).
- During the PM peak hour, Capital Boulevard northbound operates with heavy queuing and delay through the entire I-440 interchange due to spillback from Brentwood Drive. As a result, it is recommended that any improvements at the I-440/Capital Boulevard interchange be considered in the context of the future plan for Capital Boulevard, particularly near Brentwood Drive.
- At the intersection of Capital Boulevard at Highwoods Boulevard:
 - » Queue lengths are currently exceeding storage lengths for the northbound left-turn movement during the AM peak hour.
 - » The eastbound (Highwoods Boulevard) approach operates with significant queuing and multiple-cycle delays during the PM peak hour.
- The short weave sections between loop ramps along both Capital Boulevard southbound and I-440 westbound both cause infrequent slowdown and spillback throughout the day. Additionally, each of these short weave sections should be focus areas for safety improvements. (See Figure 1-3).
- Capital Boulevard in this area is a very difficult place
 to maneuver for people who bike or walk. There are
 currently no sidewalk facilities along Capital Boulevard in
 the study area, but the Kimley-Horn team noticed several
 people walking along and crossing Capital Boulevard,
 particularly to the north of the I-440 interchange.
- Capital Boulevard is a heavily utilized transit route, and the GoRaleigh system has a bus stop along Capital Boulevard northbound approximately 300 feet south of Highwoods Boulevard. The Kimley-Horn team noticed multiple instances of people crossing the street midblock between the bus stop and the retail development on the west wide of Capital Boulevard. (See Figure 1-4).

Additional photographs from this field review are provided as attachments to this report in **Appendix B.**



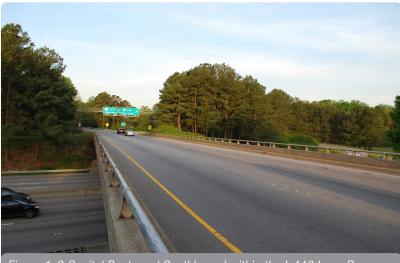


Figure 1-3 Capital Boulevard Southbound within the I-440 Loop Ramp Weave Section



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2 ANALYSIS SCENARIOS

The traffic operations analysis included four conditions:

- 2016 No Build
- 2016 Build
- 2026 No Build
- 2026 Build

At the onset of the project, the project team gave some consideration to evaluating improvement alternatives at the I-440/Capital Boulevard interchange for a horizon year of 2040, but after the aforementioned project kickoff meeting, it was determined that a 10-year horizon would be more appropriate for this analysis. The traffic operations analysis was completed using the microscopic simulation tool TransModeler (Version 4.0, Build 6010) for several different build alternatives. A detailed discussion of the considered alternatives as well as the results of the analysis is provided in Section 5.

In regard to the analysis scenarios listed above, the 2016 No Build scenario reflects traffic volumes and roadway configurations as they exist today. The results of the 2016 No Build analysis provides a baseline with which to compare the analysis results of the three other scenarios.

The 2016 Build scenario includes 2016 traffic volumes but is based on the Build geometry and traffic signal settings for the proposed alternatives.

The 2026 No Build scenario presents future traffic volumes without any proposed Build geometry and with existing roadway configurations. Traffic signal settings for the study intersections were optimized given the assumed 10-year horizon year.

The 2026 Build scenario reflects projected traffic volumes, the proposed project, and optimized traffic signal settings.

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3 MEASURES OF EFFECTIVENESS

Based on discussions with CAMPO staff, several measures of effectiveness (MOE) were established for comparing build alternatives as follows:

QUANTITATIVE MEASURES

- Intersection Level of Service (LOS) and Delay
- Critical Ramp Queue Lengths
- · Average Vehicle-Hours Traveled (VHT) across study network
- Average Vehicle Speed across study network

QUALITATIVE MEASURES

- Impact to Property Access
- Safety
- Bikeability
- Walkability

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4 NETWORK DEVELOPMENT

This section details the methodology of the traffic operations analysis, which consisted of a microscopic simulation using TransModeler software (Version 4.0, Build 6010).

4.1 GEOMETRY

The microsimulation model's geometry was developed using Google's satellite imagery (via TransModeler's web map layer options), intersection signal design plans, and site validation. The microsimulation model includes Capital Boulevard from south of Hodges Street to north of Westinghouse Boulevard and I-440 to the east and west of the Capital Boulevard interchange; however, adjacent interchanges on I-440 were not included in the analysis.

4.2 **VOLUME INPUT**

The collected AM and PM peak hour turning movement counts and directional ramp tube counts were used as inputs to the microsimulation model. The volumes inputted into TransModeler for the analysis scenarios were based on the peak hour of the study area. For the AM peak hour, the highest traffic volumes observed in the study area occurred between 7:15 AM and 8:15 AM. For the PM peak hour, the highest traffic volumes observed in the study area occurred between 4:45 PM and 5:45 PM.

The turning movement volumes were first developed into an origin-destination matrix for the 2016 No Build scenario. To develop the 2026 No Build origin-destination matrix, the trip values in the 2016 No Build origin-destination matrix were increased by link growth factors derived from historic traffic data and the Triangle Regional Model. No changes were made to the origin-destination matrices for the purposes of modeling any of the Build alternatives.

The origin-destination matrices were inputted into TransModeler in five 15-minute intervals. The first 15-minute interval is defined as the "warm-up period" and is intended to populate the model with vehicles before the peak hour analysis. The warm-up origin-



Figure 4-1 Modeling Existing Geometry at the I-440/Capital Boulevard Interchange in TransModeler



Figure 4-2 Modeling Existing AM Peak Hour Volumes at the I-440/Capital Boulevard Interchange in TransModeler

destination matrix for the AM peak hour is scaled to 87.8% of the peak hour origin-destination matrix based on the turning movement counts. For the PM peak hour, the warm-up matrix is scaled to 94% of the peak hour matrix. A demand curve with four 15-minute intervals was defined for the AM and PM peak hour origin-destination matrices to reflect the peak hour factors as observed in the turning movement counts. Each of the origin-destination matrices are included in **Appendix C.**

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4.3 SIMULATION SETTINGS

Appendix B of the Federal Highway Administration's (FHWA) Traffic Analysis Toolbox provides a methodology to compute the number of microsimulation runs to achieve a certain level of confidence. The traffic operations analysis included 10 simulation runs to achieve a desired confidence level of 90% for the desired range.

Each simulation run was defined by a random seed which controls the random arrivals of vehicles in each run. Simulation runs using the same random seed will produce the same results. Each simulation run was assigned a random seed between 5 and 50 in increments of 5. Outputs from the 10 simulation runs were averaged to provide representative results of the analysis.

5 ALTERNATIVES ANALYSIS AND RESULTS

5.1 NO BUILD SCENARIO RESULTS

The levels of service for each intersection averaged across 10 simulations for the 2016 No Build and 2026 No Build scenarios are shown in Table 5-1 below, with the unacceptable levels of service (LOS E or F) shown in red.

Intersection Leve	Table 5-1 Intersection Levels of Service for No Build Scenarios														
		Lo	evel of Serv	vice (Delay)											
Intersection	Control	2016 AM No Build	2016 PM No Build	2026 AM No Build	2026 PM No Build										
Capital Boulevard at Westinghouse Boulevard	Signal	E (63.2)	B (14.1)	F (137.0)	C (20.9)										
Capital Boulevard at Highwoods Boulevard	Signal	C (24.7)	D (49.7)	C (31.7)	E (71.2)										
Capital Boulevard at I-440 Westbound Off-Ramp	Stop	F (384.4)	F (247.0)	F (763.3)	F (698.2)										
Capital Boulevard at Yonkers Road	Signal	C (32.1)	A (8.1)	D (50.3)	B (13.6)										
Capital Boulevard at Hodges Street	Signal	A (8.7)	D (38.9)	B (10.7)	E (64.0)										

Visual observations of the existing AM and PM peak hour operations in the field were generally consistent with the 2016 No Build model results. However, the delay and queuing observed in the field at the intersection of Capital Boulevard at I-440 Westbound Off-Ramp was found to be better than that shown in the model. Kimley-Horn team members observed some infrequent instances of the off-ramp approach queuing back to the I-440 gore area, while the model shows the queuing to be more extensive.

Visual observations of the 2026 No Build simulations indicate that delay is expected to increase significantly across the study area, and the locations where queuing issues are noted in Section 1.3 are expected to worsen. As a result of the expected operations of the interchange in 2026 without any roadway improvements, the Kimley-Horn team considered a number of alternatives for improving safety and operational issues discussed above.

5.2 BUILD ALTERNATIVES PROCESS

The Kimley-Horn team, in coordination with CAMPO staff, developed five (5) initial alternatives for low-impact improvements within the study area. Some of these alternatives included elements such as:

- Highwoods Boulevard
 - » Widening Capital Boulevard and Highwoods Boulevard to accommodate triple northbound left-turns from Capital Boulevard
 - » Widening Highwoods Boulevard to accommodate triple right-turns onto Capital Boulevard
 - » Converting Highwoods Boulevard to a traditional synchronized street intersection (with left-over access but no left-out)
- I-440/Capital Boulevard interchange ramps
 - » Removing the I-440 westbound to Capital Boulevard southbound loop ramp and installing a traffic signal for the I-440 Westbound to Capital Boulevard ramp
 - » Installing a traffic signal for the I-440 Westbound to Capital Boulevard northbound ramp
 - » Converting the I-440 Westbound to Capital Boulevard northbound ramp to a free-flow movement
 - » Keeping the I-440 westbound to Capital Boulevard southbound loop ramp and widening Capital Boulevard southbound to the south of the interchange, thus eliminating a weaving movement for the I-440 westbound to Capital Boulevard southbound movement

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» Realigning and installing a traffic signal for the I-440 Eastbound to Capital Boulevard northbound ramp

Following a progress meeting with CAMPO staff and the steering committee, the Kimley-Horn team moved forward with developing detailed analyses and measures of effectiveness for three (3) alternatives, which are referred to here as Alternatives 2A, 2B, and 2D. Conceptual designs and preliminary cost estimates were also determined for each of these alternatives.

Alternatives 2A, 2B, and 2D are detailed in the following sections.

5.2.1 Alternative 2A

The following improvements are proposed as a part of Alternative 2A:

- Convert Highwoods Boulevard to a synchronized street intersection (no left-out from Highwoods Boulevard onto Capital Boulevard)
- Construct dual southbound U-turn lanes at the I-440 westbound off-ramp intersection to accommodate the Highwoods Boulevard synchronized street conversion
- Restripe the inside right-turn lane on Westinghouse Boulevard to provide triple westbound left-turn lanes on that approach
- Realign and signalize the I-440 eastbound to Capital Boulevard northbound ramp
- Remove the I-440 westbound to Capital Boulevard southbound loop ramp and install a traffic signal for the I-440 Westbound to Capital Boulevard ramp, which would be realigned
- Construct an additional southbound through lane along Capital Boulevard to the south of the interchange (to create a receiving
 - lane for the I-440 westbound offramp left-turn movement)
- Widen the bridge for Capital Boulevard southbound over the existing I-440 eastbound offramp
- Provide continuous sidewalk along northbound Capital Boulevard through the interchange (Note: not shown on conceptual exhibits)

Figures 5-1 and 5-2 provide conceptual exhibits showing the improvements associated with Alternative 2A within the study area. Full conceptual designs for this alternative are provided in **Appendix D.**

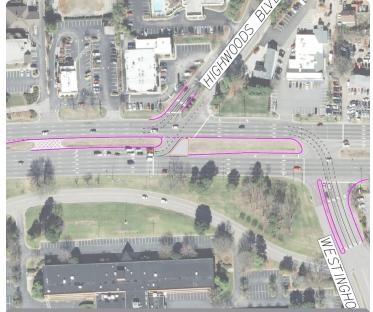
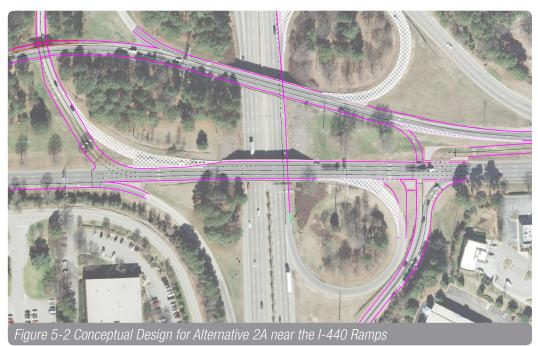


Figure 5-1 Conceptual Design for Alternative 2A near Westinghouse Boulevard and Highwoods Boulevard



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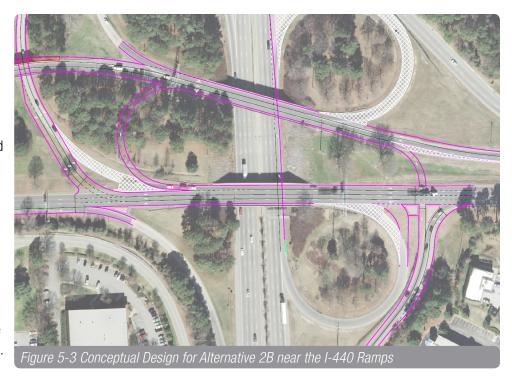
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5.2.2 Alternative 2B

Other than the improvements listed below, the proposed Alternative 2B improvements are the same as those in Alternative 2A:

 Construct a free-flow U-turn connection for southbound Capital Boulevard to accommodate the Highwoods Boulevard synchronized street conversion (instead of dual U-turn lanes at the I-440 westbound off-ramp)

Figure 5-3 provides a conceptual exhibit showing the improvements associated with Alternative 2B near the I-440 ramps. The proposed Alternative 2B improvements near Westinghouse Boulevard and Highwoods Boulevard are the same as those in Alternative 2A and can be referenced in Figure 5-1 above. Full conceptual designs for this alternative are provided in **Appendix D.**

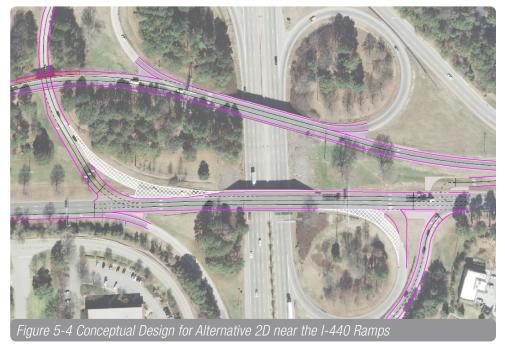


5.2.3 Alternative 2D

Other than the improvements listed below, the proposed Alternative 2D improvements are the same as those in Alternative 2A:

 Keep the I-440 westbound to Capital Boulevard southbound loop ramp and construct an additional southbound through lane along Capital Boulevard to the south of the interchange (to eliminate a weave for the I-440 westbound to Capital Boulevard southbound movement)

Figure 5-4 provides a conceptual exhibit showing the improvements associated with Alternative 2D near the I-440 ramps. The proposed Alternative 2D improvements near Westinghouse Boulevard and Highwoods Boulevard are the same as those in Alternatives 2A and 2B and can be referenced in Figure 5-1 above. Full conceptual designs for this alternative are provided in **Appendix D.**



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It should be noted that there are some small variations between the conceptual exhibits provided above and the functional designs that were ultimately completed for Alternatives 2A and 2B. These were determined based on conversations with CAMPO staff and the steering committee during the final progress meeting. In particular, the functional designs provide additional detail regarding the location of sidewalks along the east side of Capital Boulevard and the widening of the Capital Boulevard northbound bridge over I-440 to accommodate the sidewalk across the bridge.

5.3 BUILD ALTERNATIVES RESULTS AND SCENARIO COMPARISON

Ultimately, in coordination with the steering committee, Alternatives 2A, 2B, and 2D were compared to the interchange alternative that was developed by NCDOT Congestion Management through the SPOT 4.0 Prioritization process in 2014. The SPOT 4.0 alternative includes the reconstruction of the I-440/Capital Boulevard interchange and the conversion of the existing Westinghouse Boulevard and Highwoods Boulevard intersections to a square-loop interchange with Capital Boulevard. An exhibit of this alternative is provided below in Figure 5-5.

This alternative, which was also developed in 2014 using TransModeler, was compared to the new proposed alternatives 2A, 2B, and 2D using the same measures of effectiveness as discussed in Section 3. It should be noted that the model developed as a part of the SPOT 4.0 process was for years 2014 and 2024 instead of 2016 and 2026, and the intersections of Capital Boulevard at Yonkers Road and Capital Boulevard at Hodges Street were not modeled.

The tables that follow summarize the measures of effectiveness that were developed for Alternatives 2A, 2B, 2D, and the SPOT alternative. Tables 5-2 and 5-3 provide intersection level-of-service summaries for each of the no build and build scenarios. Table 5-4 provides a summary of maximum queues on the critical ramps for each of the no build and build scenarios. Table 5-5 provides a summary of average vehicle-hours traveled (VHT) across the entire network for each scenario, excluding the SPOT alternative because the size of the study network was not comparable to the analysis of the new alternatives. Table 5-6 provides average vehicle speeds across the entire study network for each scenario. Finally, Table 5-7 provides a comparison of the qualitative measures of effectiveness that were collected for each of the no build and build alternatives.



Table 5-2 TransModeler Intersection Level-of-Service Summary Existing 2016 Future 2026 **Condition AM Peak Hour PM Peak Hour AM Peak Hour PM Peak Hour** LOS (Delay) LOS (Delay) LOS (Delay) LOS (Delay) US 1 (Capital Blvd.) at Westinghouse Blvd. (Signalized) No Build E (63.2) B (14.1) F (137.0) C (20.9) Alternative 2A B (16.8) F (103.7) C (21.3) C (22.1) F (101.1) Alternative 2B C (24.5) B (16.8) C (20.4) Alternative 2D B (17.6) F (113.0) C (23.9) C (25.6) SPOT 4.0 Alt* See Table 5-3 US 1 (Capital Blvd.) at Highwoods Blvd. (Signalized) No Build C (24.7) D (49.7) C (31.7) E (71.2) Alternative 2A B (17.7) B (19.4) B (18.7) C (29.3) C (26.0) Alternative 2B B (16.8) B (19.2) B (18.0) Alternative 2D B (17.5) B (15.8) C (20.2) C (32.2) SPOT 4.0 Alt* See Table 5-3 US 1 (Capital Blvd.) at I-440 Westbound Off-Ramp WB - F (384.4) WB - F (247.0) No Build WB - F (763.3) WB - F (698.2) Alternative 2A D (43.0) D (40.2) D (47.0) D (53.8) Alternative 2B C (21.3) C(31.0)C (27.0) D (37.5) Alternative 2D D (37.9) D (38.9) D (44.2) D (50.9) SPOT 4.0 Alt* Free-Flow US 1 (Capital Blvd.) at I-440 Eastbound Off-Ramp Free-Flow No Build Alternative 2A B (19.0) C (27.2) B (18.7) E (72.1) Alternative 2B B (18.6) C (26.3) B (18.9) E (64.4) Alternative 2D B (18.7) C (26.9) B (18.7) E (63.9) SPOT 4.0 Alt* Free-Flow US 1 (Capital Blvd.) at Yonkers Rd. (Signalized) No Build C (32.1) A (8.1) D (50.3) B (13.6) Alternative 2A C (27.0) A (7.1) D (38.3) B (13.0) Alternative 2B C (26.5) A (7.0) D (38.0) B (10.6) Alternative 2D C (30.5) A (8.0) D (40.5) B (13.2) SPOT 4.0 Alt* Not modeled US 1 (Capital Blvd.) at Hodges St. (Signalized) No Build A (8.7) D (38.9) B (10.7) E (64.0) Alternative 2A C (26.8) B (10.3) E (65.5) A (9.1) Alternative 2B A (9.5) C (25.2) A (9.6) E (55.6) Alternative 2D A (8.8) C (26.8) B (10.6) D (52.2)

Not modeled

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SPOT 4.0 Alt*

^{*}The proposed SPOT 4.0 alternative included the conversion of the existing Westinghouse Blvd. and Highwoods Blvd. intersections to a square-loop interchange. The LOS results for the proposed square loop intersections are provided in Table 5-3.

1	Table 5-3 TransModeler Intersection Level-of-Service Summary (SPOT 4.0 Model)													
	Future	2024												
Condition	AM Peak Hour LOS (Delay)	PM Peak Hour LOS (Delay)	AM Peak Hour LOS (Delay)	PM Peak Hour LOS (Delay)										
US 1 (Capital Blvd.) at Square Loop Dr. (Signalized)														
SPOT 4.0 Alt*	B (13.4)	C (25.5)	B (19.4)	C (33.9)										
	Highwoods Blv	d. at Square Loop I	Dr. (Signalized)											
SPOT 4.0 Alt*	C (22.9)	C (30.4)	C (23.1)	D (39.2)										
	Westinghouse Blvd. at Square Loop Dr. (Signalized)													
SPOT 4.0 Alt*	B (19.5)	C (20.9)	B (19.3)	C (21.0)										

^{*}The SPOT 4.0 alternative results provided here are for model years 2014 and 2024. The proposed SPOT 4.0 alternative included the conversion of the existing Westinghouse Blvd. and Highwoods Blvd. intersections to a square-loop interchange.

	Toward of	Table 5-4							
	1	odeler Ramp Queuing S	· · · · · · · · · · · · · · · · · · ·						
		g 2016	Future 2026						
Condition	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour					
	Average Maximum	Average Maximum	Average Maximum	Average Maximum					
	Queue (ft)	Queue (ft)	Queue (ft)	Queue (ft)					
	I-440 Westbound	Off-Ramp Approach	n (at Capital Blvd.)						
No Build	2,757	1,436	4,396	4,343					
Alternative 2A	320	386	443	682					
Alternative 2B	408	455	453	488					
Alternative 2D	276	275	463	458					
SPOT 4.0 Alt		Free-	Flow						
Storage Length Provided		80	00						
	I-440 Eastbound	Off-Ramp Approach	(at Capital Blvd.)						
No Build		Free-	-Flow						
Alternative 2A	426	561	422	685					
Alternative 2B	454	577	508	560					
Alternative 2D	431	582	473	598					
SPOT 4.0 Alt		Free-	Flow						
Storage Length Provided		1,4	100						

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Capital Area Metropolitan Planning Organization I-440/CAPITAL BOULEVARD INTERCHANGE ALTERNATIVES

Table 5-5 TransModeler Network Summary Average Vehicle-Hours Traveled (VHT)													
Condition	Existin	g 2016	Future	2026									
Condition	AM Peak Hour VHT	PM Peak Hour VHT	AM Peak Hour VHT	PM Peak Hour VHT									
No Build	945	953	2105	1448									
Alternative 2A	835	924	1190	1425									
Alternative 2B	820	913	1159	1349									
Alternative 2D	836	926	1426	1376									

	Table 5-6 TransModeler Network Summary Average Vehicle Speed (MPH)													
Condition Existing 2016 Future 2026														
Condition	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour										
No Build	35	38	20	31										
Alternative 2A	40	39	33	32										
Alternative 2B	40	39	34	33										
Alternative 2D	40	39	27	32										
SPOT 4.0 Alt*	45	42	43	40										

^{*}The SPOT 4.0 alternative was modeled for years 2014 and 2024.

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Capital Area Metropolitan Planning Organization I-440/CAPITAL BOULEVARD INTERCHANGE ALTERNATIVES

Each of the cells in Table 5-7 below provides a qualitative comparison of impacts for each project over several categories. For example, the multiple 'X' marks associated with Alternative 2B under 'Property Access' indicate that the diversion of left-turns from Highwoods Boulevard in Alternative 2B is less favorable than the diversion of left-turns in Alternative 2A. In Alternative 2B, vehicles are required to change lanes and travel approximately 800 feet farther along Capital Boulevard southbound to make a U-turn than they are in Alternatives 2A and 2D. Blank cells indicate that the qualitative element discussed is not expected to differ significantly between the No Build condition and a particular alternative. Using the same example noted above, the diversion of left turns from Highwoods Boulevard to Capital Boulevard northbound in Alternatives 2A, 2B, and 2D is considered to be less favorable than the direct access in place today as a part of the No Build condition. For this particular qualitative element, the SPOT alternative is not expected to be significantly more or less favorable than the No Build condition, so as a result, it is shown with a blank cell.

I-440/Capi	Table 5-7 tal Blvd Alter Elements Su				
	No Build	Alt. 2A	Alt. 2B	Alt. 2D	SPOT
Property Access					
Diverts left turns from Highwoods Blvd SB to Capital Blvd NB		×	xx	×	
Diverts drivers to U-turn at Highwoods Blvd by closing existing median break		×	×	×	×
Significantly impact properties and requires additional ROW					xx
Safety	\ 				
Eliminates conflict points on Capital Blvd SB by removing I-440 WB loop off-ramp		\checkmark	✓		√
Reduces weaving by signalizing the intersection of Capital Blvd NB and I-440 EB off-ramp		\checkmark	√	✓	
Removes conflict points by closing existing median break		\checkmark	\checkmark	\checkmark	\checkmark
Intersection Operations					
Signalizes the intersection of Capital Blvd NB and I-440 WB off-ramp		\checkmark	\checkmark	✓	
Converts intersection of Capital Blvd and Highwoods Blvd to a synchronized street		\checkmark	\checkmark	\checkmark	
Bikeability					
Removes free-flow off-ramp conflicts on Capital Blvd SB		\checkmark	√		
Removes free-flow off-ramp conflicts on Capital Blvd NB		\checkmark		\checkmark	
Diverts left turns from Highwoods Blvd SB to Capital Blvd NB		×	xx	×	
Walkability					
Removes free-flow off-ramp conflicts on Capital Blvd SB		√	✓		
Removes free-flow off-ramp conflicts on Capital Blvd NB		√	✓	√	
Adds signalized crosswalks on Capital Blvd NB		√	√	√ √	

Capital Area Metropolitan Planning Organization I-440/CAPITAL BOULEVARD INTERCHANGE ALTERNATIVES

Opinions of probable cost of construction (provided in **Appendix D**) were completed for Alternatives 2A, 2B, and 2D as a part of the conceptual designs and provided to the steering committee for comparison. The opinions of probable cost were found to be approximately \$4.1 million for Alternative 2A, approximately \$3.9 million for Alternative 2B, and approximately \$4 million for Alternative 2D. For Alternatives 2A and 2B, these opinions of probable cost did not include some of the elements that were changed in the development of the final functional designs.

Based on a discussion of the measures of effectiveness for each of the alternatives, the project team concluded that it would be most beneficial to move forward to functional design for two final alternatives: 2A and 2B. These alternatives, when compared to Alternative 2D and the SPOT alternative, are projected to provide a significant network-wide benefit at relatively low cost. Based on the measures and discussions of Alternative 2D, it was determined that the most beneficial set of improvements at the interchange should include the removal of the I-440 westbound to Capital Boulevard southbound loop ramp. Based on the analysis, the removal of the loop ramp significantly improves operations along mainline I-440 westbound in 2026, and the benefit of eliminating the short weave sections between loop ramps along both Capital Boulevard southbound and I-440 westbound is expected to be significant.

Alternatives 2A and 2B both provide significant improvements to safety, bikeability, and walkability over the existing condition. Both alternatives eliminate conflict points by removing the loop ramp and closing the existing median break along Capital Boulevard north of I-440. Additionally, the functional designs provided with this submittal include continuous sidewalk facilities along Capital Boulevard northbound from the I-440 interchange to Highwoods Boulevard, and the removal of free-flow ramp conflicts is a significant improvement for people who bike and walk through this interchange along Capital Boulevard.

Full functional designs and opinions of probable cost of construction for Alternatives 2A and 2B (with and without sidewalks) are provided in **Appendix E.** Based on the elements in the functional designs, the opinions of probable cost of construction (with sidewalks) were found to be approximately \$4.5 million for Alternative 2A and \$4.6 million for Alternative 2B. Also included with this submittal are the traffic analysis files from TransModeler and digital Microstation design files, which are provided in **Appendix F** and **Appendix G**, respectively.

Capital Area Metropolitan Planning Organization I-440/CAPITAL BOULEVARD INTERCHANGE ALTERNATIVES

6 CONCLUSION

The results of the traffic operations analysis and alternatives development at the I-440/Capital Boulevard interchange indicate that proposed Alternatives 2A and 2B both provide significant improvements to the interchange for vehicular traffic operations, safety, bikeability, and walkability. Based on the analysis and conversations with the project team, it was determined that the most beneficial set of improvements at the interchange should include the removal of the I-440 westbound to Capital Boulevard southbound loop ramp. Based on the analysis, the removal of the loop ramp significantly improves operations along mainline I-440 westbound in 2026, and the benefit of eliminating the short weave sections between loop ramps along both Capital Boulevard southbound and I-440 westbound is expected to be significant.

The proposed conversion of the Capital Boulevard at Highwoods Boulevard intersection to prevent left turns out from Highwoods Boulevard is expected to significantly improve operations at this intersection and improve queuing. Additionally, the functional designs for Alternatives 2A and 2B provided with this submittal include continuous sidewalk facilities along Capital Boulevard northbound from the I-440 interchange to Highwoods Boulevard, and the removal of free-flow ramp conflicts is a significant improvement for people who bike and walk through this interchange along Capital Boulevard.

Finally, it is recommended that any of these potential improvements at the I-440/Capital Boulevard interchange and adjacent intersections be considered in the context of the future plan for Capital Boulevard, particularly near Brentwood Drive. During the PM peak hour, vehicles traveling on Capital Boulevard northbound frequently spill back through the I-440/Capital Boulevard interchange as a result of the Brentwood Drive intersection. As a result, improvements at the I-440/Capital Boulevard interchange are only expected to be as successful as the operation of the Brentwood Drive intersection as well as the Capital Boulevard system as a whole.

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7 APPENDICES

APPENDIX A: TURNING MOVEMENT COUNTS (INCLUDED IN PRINT)

APPENDIX B: FIELD REVIEW PHOTOGRAPHS (INCLUDED ON CD)

APPENDIX C: ORIGIN-DESTINATION MATRICES (INCLUDED IN PRINT)

APPENDIX D: CONCEPTUAL DESIGNS AND OPCCS FOR ALTERNATIVES 2A, 2B, AND 2D (INCLUDED IN PRINT)

APPENDIX E: FUNCTIONAL DESIGNS AND OPCCS FOR ALTERNATIVES 2A AND 2B (INCLUDED IN PRINT)

APPENDIX F: TRANSMODELER ANALYSIS FILES (INCLUDED ON CD)

APPENDIX G: DIGITAL MICROSTATION DESIGN FILES (INCLUDED ON CD)

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Appendix A:
Turning Movement Counts



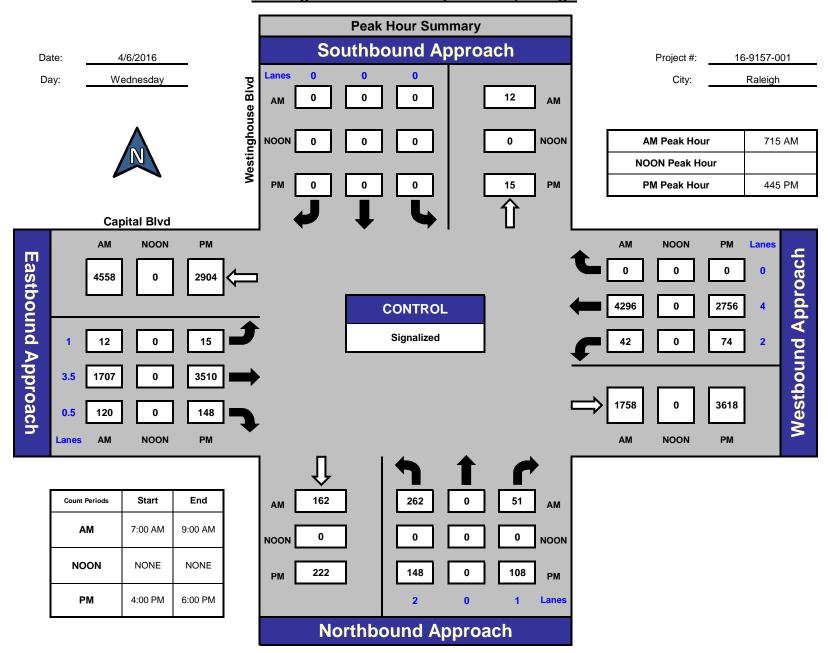


ITM Peak Hour Summary

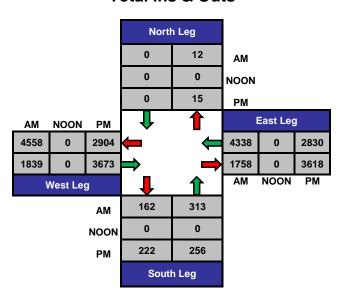


National Data & Surveying Services

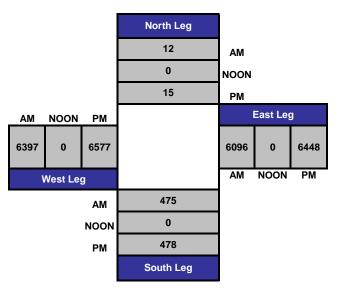
Westinghouse Blvd and Capital Blvd , Raleigh



Total Ins & Outs



Total Volume Per Leg



Project ID: 16-9157-001

Location: Westinghouse Blvd & Capital Blvd

City: Raleigh

Day: Wednesday Date: 4/6/2016

Peak S	Peak Start Times										
AM	7:00 AM										
MD	12:00 AM										
PM	4:00 PM										

Groups Printed - Cars, PU, Vans - Heavy Trucks

-	Groups Printed - Cars, PU, Vans - Heavy Trucks Westinghouse Blvd Westinghouse Blvd Capital Blvd Capital Blvd														-						
								_			Capital Blvd						Capital Blvd				
			rthbou			Southbound				Eastbound					Westbound						
Start Time	Left	Thru	Rgt	Peds A		Left	Thru	Rgt	Peds Ap	p. Total	Left	Thru	Rgt		App. Total	Left	Thru	Rgt	Peds	App. Total	Int. Total
7:00 AM	42	0	9	0	51	0	0	0	0	0	1	353	30	2	384	13	1048	0	1	1061	1496
7:15 AM	53	0	12	2	65	0	0	0	0	0	2	437	36	0	475	16	1135	0	1	1151	1691
7:30 AM	70	0	10	0	80	0	0	0	0	0	1	437	27	0	465	8	1077	0	0	1085	1630
7:45 AM	68	0	13	1	81	0	0	0	0	0	1	407	30	0	438	9	1087	0	1	1096	1615
Total	233	0	44	3	277	0	0	0	0	0	5	1634	123	2	1762	46	4347	0	3	4393	6432
8:00 AM	71	0	16	0	87	0	0	0	0	0	8	426	27	0	461	9	997	0	0	1006	1554
8:15 AM	77	0	10	0	87	0	0	0	0	0	1	440	26	0	467	7	1022	0	0	1029	1583
8:30 AM	71	0	8	0	79	0	0	0	0	0	7	423	27	0	457	12	922	0	0	934	1470
8:45 AM	83	0	9	0	92	0	0	0	0	0	5	413	21	0	439	14	933	0	1	947	1478
Total	302	0	43	0	345	0	0	0	0	0	21	1702	101	0	1824	42	3874	0	1	3916	6085
BREAK																					
4:00 PM	40	0	42	0	82	0	0	0	0	0	4	802	44	0	850	23	673	0	0	696	1628
4:15 PM	44	0	30	0	74	0	0	0	0	0	0	874	32	0	906	22	679	0	0	701	1681
4:30 PM	56	0	31	0	87	0	0	0	0	0	3	808	38	0	849	11	640	0	1	651	1587
4:45 PM	31	0	20	0	51	0	0	0	0	0	3	912	32	0	947	20	683	0	0	703	1701
Total	171	0	123	0	294	0	0	0	0	0	10	3396	146	0	3552	76	2675	0	1	2751	6597
5:00 PM	42	0	32	1	74	0	0	0	0	0	4	793	52	0	849	14	677	0	0	691	1614
5:15 PM	28	0	24	2	52	0	0	0	0	0	4	962	32	1	998	12	778	0	0	790	1840
5:30 PM	47	0	32	0	79	0	0	0	0	0	4	843	32	0	879	28	618	0	2	646	1604
5:45 PM	23	0	16	0	39	0	0	0	0	0	2	799	29	0	830	17	741	0	1	758	1627
Total	140	0	104	3	244	0	0	0	0	0	14	3397	145	1	3556	71	2814	0	3	2885	6685
Grand Total	846	0	314	6	1160	0	0	0	0	ol	50	10129	515	3	10694	235	13710	0	8	13945	25799
Apprch %	72.9	0.0	27.1	0.5		0.0	0.0	0.0	0.0		0.5	94.7	4.8	0.0		1.7	98.3	0.0	0.1		
Total %	3.3	0.0	1.2	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.2	39.3	2.0	0.0	41.5	0.9	53.1	0.0	0.0	54.1	
Cars, PU, Vans	842	0	311	6	1153	0	0	0	0	0	50	10013	513	3	10576	231	13556	0	8	13787	25516
% Cars, PU, Vans	99.5	0.0	99.0	100.0	99.4	0.0	0.0	0.0	0.0	0.0	100.0	98.9	99.6	100.0	98.9	98.3	98.9	0.0	100.0	98.9	98.9
Heavy Trucks	4	0	3		7	0	0	0		0	0	116	2		118	4	154	0		158	283
%Heavy Trucks	0.5	0.0	1.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.4	0.0	1.1	1.7	1.1	0.0	0.0	1.1	1.1

Project ID: 16-9157-001

Location: Westinghouse Blvd & Capita

City: Raleigh

PEAK HOURS

Day: Wednesday Date: 4/6/2016

v
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	We	stingho	use Bl	∕d	We	stingho	use Bl	vd	Capital Blvd				Capital Blvd				
		Northb	ound			Southb		Eastbound									
Start Time	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Int. Total
Peak Hour Analys	sis from	07:00 A	M to 09:	:00 AM													
Peak Hour for En	tire Inter	section	Begins	at 07:1	5 AM												
_					-			_				_					_
7:15 AM	53	0	12	65	0	0	0	0	2	437	36	475	16	1135	0	1151	1691
7:30 AM	70	0	10	80	0	0	0	0	1	437	27	465	8	1077	0	1085	1630
7:45 AM	68	0	13	81	0	0	0	0	1	407	30	438	9	1087	0	1096	1615
8:00 AM	71	0	16	87	0	0	0	0	8	426	27	461	9	997	0	1006	1554
Total Volume	262	0	51	313	0	0	0	0	12	1707	120	1839	42	4296	0	4338	6490
% App. Total	83.7	0.0	16.3	100	0.0	0.0	0.0	0	0.7	92.8	6.5	100	1.0	99.0	0.0	100	
PHF				0.899				0.000				0.968				0.942	
Cars, PU, Vans	261	0	49	310	0	0	0	0	12	1674	120	1806	42	4254	0	4296	6412
% Cars, PU, Vans		0.0	96.1	99.0	0.0	0.0	0.0	0.0	100.0	98.1	100.0	98.2	100.0	99.0	0.0	99.0	98.8
Heavy Trucks	1	0	2	3	0	0	0	0	0	33	0	33	0	42	0	42	78
%Heavy Trucks	0.4	0.0	3.9	1.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	1.8	0.0	1.0	0.0	1.0	1.2

PM

	We	estingh	ouse B	lvd	We	estingho	ouse B	lvd	Capital Blvd									
	Northbound				Southbound				Eastbound				Westbound					
Start Time	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Int.	Total

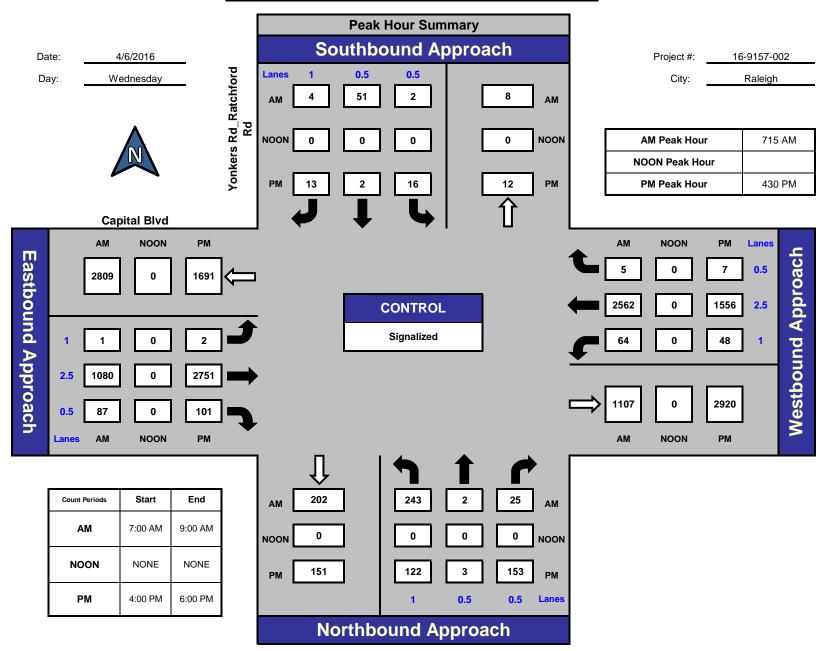
Peak Hour Analysis from 04:00 PM to 06:00 PM
Peak Hour for Entire Intersection Begins at 04:45 PM

	4:45 PM	31	0	20	51	0	0	0	0	3	912	32	947	20	683	0	703	1701
	5:00 PM	42	0	32	74	0	0	0	0	4	793	52	849	14	677	0	691	1614
	5:15 PM	28	0	24	52	0	0	0	0	4	962	32	998	12	778	0	790	1840
	5:30 PM	47	0	32	79	0	0	0	0	4	843	32	879	28	618	0	646	1604
	Total Volume	148	0	108	256	0	0	0	0	15	3510	148	3673	74	2756	0	2830	6759
	% App. Total	57.8	0.0	42.2	100	0.0	0.0	0.0	0	0.4	95.6	4.0	100	2.6	97.4	0.0	100	
	PHF				0.810				0.000				0.920				0.896	
С	ars, PU, Vans	146	0	108	254	0	0	0	0	15	3488	148	3651	74	2728	0	2802	6707
(% Cars, PU, Vans	98.6	0.0	100.0	99.2	0.0	0.0	0.0	0.0	100.0	99.4	100.0	99.4	100.0	99.0	0.0	99.0	99.2
	Heavy Trucks	2	0	0	2	0	0	0	0	0	22	0	22	0	28	0	28	52
	%Heavy Trucks	1.4	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6	0.0	1.0	0.0	1.0	8.0

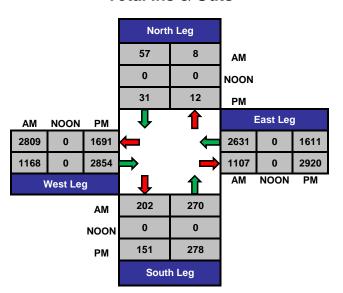
ITM Peak Hour Summary



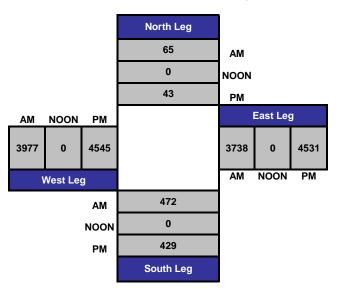
Yonkers Rd_Ratchford Rd and Capital Blvd , Raleigh







Total Volume Per Leg



Project ID: 16-9157-002

Location: Yonkers Rd_Ratchford Rd & Capital Blvd

City: Raleigh

Day: Wednesday Date: 4/6/2016

Peak S	tart Times
AM	7:00 AM
MD	12:00 AM
PM	4:00 PM

Groups Printed - Cars, PU, Vans - Heavy Trucks

Т					_					d - Cars,	PU, vai										
	Yo		_	chford R	d	Yc			chford	Rd			pital B					oital Blv			
			rthbou					uthbou					astbou					stboun			
Start Time		Thru	Rgt	Peds A		Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	Int. Total
7:00 AM	22	0	4	1	26	0	10	1	0	11	0	228	15	0	243	15	593	0	0	608	888
7:15 AM	25	0	7	0	32	2	8	0	0	10	1	275	23	0	299	19	680	1	0	700	1041
7:30 AM	74	0	4	1	78	0	14	0	0	14	0	288	21	0	309	10	630	1	0	641	1042
7:45 AM	78	2	4	0	84	0	20	4	0			250	29	0	279	15	663	1	0	679	1066
Total	199	2	19	2	220	2	52	5	0	59	1	1041	88	0	1130	59	2566	3	0	2628	4037
8:00 AM	66	0	10	0	76	0	9	0	0	9	0	267	14	0	281	20	589	2	0	611	977
8:15 AM	39	1	5	0	45	0	10	3	0	13	3	254	25	0	282	16	563	1	0	580	920
8:30 AM	56	2	6	0	64	2	11	4	0	17	1	279	19	0	299	20	594	2	0	616	996
8:45 AM	51	6	11	0	68	1	4	4	0	9	1	284	16	0	301	13	592	4	0	609	987
Total	212	9	32	0	253	3	34	11	0	48	5	1084	74	0	1163	69	2338	9	0	2416	3880
BREAK																					
4:00 PM	20	0	37	0	57	10	3	3	0	16		592	29	0	622	14	339	4	0	357	1052
4:15 PM	17	1	23	0	41	4	0	1	0	5		579	23	0	604	12	363	10	0	385	1035
4:30 PM	37	1	60	0	98	7	0	4	0	11	0	636	19	0	655	11	358	3	0	372	1136
4:45 PM	17	2	28	0	47	3	0	6	0	9		594	24	0	619	15	408	3	0	426	1101
Total	91	4	148	0	243	24	3	14	0	41	4	2401	95	0	2500	52	1468	20	0	1540	4324
5:00 PM	39	0	35	0	74	3	2	1	0	6	1	800	25	0	826	13	400	0	0	413	1319
5:15 PM	29	0	30	0	59	3	0	2	0	5	0	721	33	0	754	9	390	1	0	400	1218
5:30 PM	30	0	38	0	68	3	0	0	0	3	1	625	39	0	665	2	385	4	0	391	1127
5:45 PM	14	0	19	0	33	2	1	1	0	4	0	569	23	0	592	9	416	1	0	426	1055
Total	112	0	122	0	234	11	3	4	0	18	2	2715	120	0	2837	33	1591	6	0	1630	4719
Grand Total	614	15	321	2	950	40	92	34	0	166	12	7241	377	0	7630	213	7963	38	0	8214	16960
Apprch %	64.6	1.6	33.8	0.2		24.1	55.4	20.5	0.0		0.2	94.9	4.9	0.0		2.6	96.9	0.5	0.0		
Total %	3.6	0.1	1.9	0.0	5.6	0.2	0.5	0.2	0.0	1.0		42.7	2.2	0.0	45.0	1.3	47.0	0.2	0.0	48.4	
Cars, PU, Vans	612	15	316	2	943	39	89	34	0.0	162	12	7176	376	0.0	7564	208	7875	38	0.0	8121	16790
% Cars, PU, Vans	99.7	100.0	98.4	100.0	99.3	97.5	96.7	100.0	0.0	97.6		99.1	99.7	0.0	99.1	97.7	98.9	100.0	0.0	98.9	99.0
Heavy Trucks	2	0	5		7	1	3	0		4	0	65	1		66	5	88	0	_	93	170
%Heavy Trucks	0.3	0.0	1.6	0.0	0.7	2.5	3.3	0.0	0.0	2.4	0.0	0.9	0.3	0.0	0.9	2.3	1.1	0.0	0.0	1.1	1.0

Project ID: 16-9157-002

Location: Yonkers Rd_Ratchford Rd &

City: Raleigh

PEAK HOURS

Day: Wednesday Date: 4/6/2016

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	Yonke	rs Rd_F	Ratchfo	rd Rd	Yonker	s Rd_R	Ratchfo	rd Rd		Capital	Blvd			Capita	al Blvd		
		North	ound			Southb	ound			Eastbo	ound			Westl	oound		
Start Time	Left	Thru	Rgt .	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Int. Total
Peak Hour Analys	sis from	07:00 A	M to 09:	:00 AM													
Peak Hour for En	tire Inter	section	Begins	at 07:15	5 AM												
												-					_
7:15 AM	25	0	7	32	2	8	0	10	1	275	23	299	19	680	1	700	1041
7:30 AM	74	0	4	78	0	14	0	14	0	288	21	309	10	630	1	641	1042
7:45 AM	78	2	4	84	0	20	4	24	0	250	29	279	15	663	1	679	1066
8:00 AM	66	0	10	76	0	9	0	9	0	267	14	281	20	589	2	611	977
Total Volume	243	2	25	270	2	51	4	57	1	1080	87	1168	64	2562	5	2631	4126
% App. Total	90.0	0.7	9.3	100	3.5	89.5	7.0	100	0.1	92.5	7.4	100	2.4	97.4	0.2	100	
PHF				0.804				0.594				0.945				0.940	
Cars, PU, Vans	243	2	23	268	2	48	4	54	1	1063	87	1151	62	2535	5	2602	4075
% Cars, PU, Vans	100.0	100.0	92.0	99.3	100.0	94.1	100.0	94.7	100.0	98.4	100.0	98.5	96.9	98.9	100.0	98.9	98.8
Heavy Trucks	0	0	2	2	0	3	0	3	0	17	0	17	2	27	0	29	51
%Heavy Trucks	0.0	0.0	8.0	0.7	0.0	5.9	0.0	5.3	0.0	1.6	0.0	1.5	3.1	1.1	0.0	1.1	1.2

PM

	Yonke	_		ord Rd	Yonke	rs Rd_f		ord Rd		Capita Eastb				•	al Blvd bound		
Start Time	Left	Northbound Left Thru Rgt App. Total			Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Int. Total

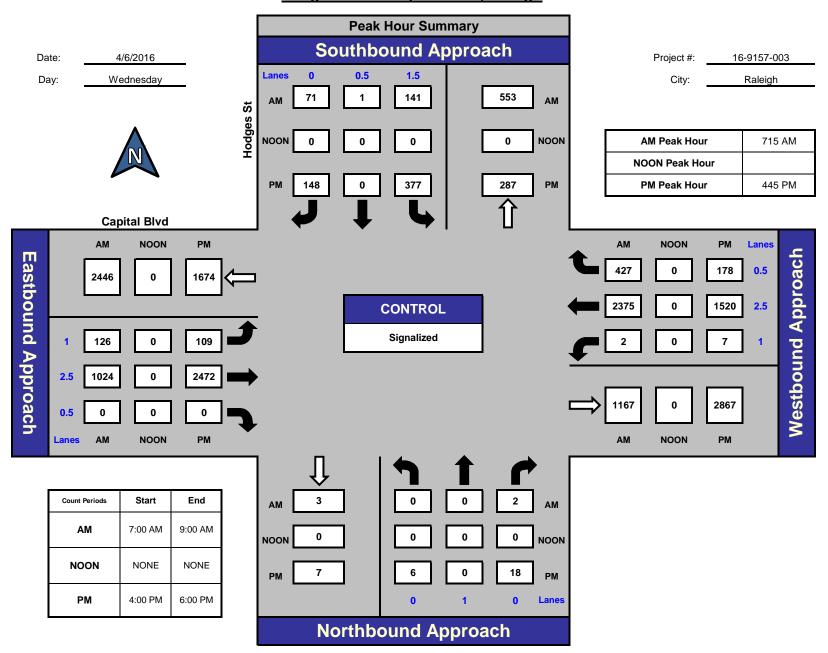
Peak Hour Analysis from 04:00 PM to 06:00 PM
Peak Hour for Entire Intersection Begins at 04:30 PM

4:30 PM	37	1	60	98	7	0	4	11	0	636	19	655	11	358	3	372	1136
4:45 PM	17	2	28	47	3	0	6	9	1	594	24	619	15	408	3	426	1101
5:00 PM	39	0	35	74	3	2	1	6	1	800	25	826	13	400	0	413	1319
5:15 PM	29	0	30	59	3	0	2	5	0	721	33	754	9	390	1	400	1218
Total Volume	122	3	153	278	16	2	13	31	2	2751	101	2854	48	1556	7	1611	4774
% App. Total	43.9	1.1	55.0	100	51.6	6.5	41.9	100	0.1	96.4	3.5	100	3.0	96.6	0.4	100	
PHF				0.709				0.705				0.864				0.945	
Cars, PU, Vans	122	3	153	278	16	2	13	31	2	2742	101	2845	47	1541	7	1595	4749
% Cars, PU, Vans	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.7	100.0	99.7	97.9	99.0	100.0	99.0	99.5
Heavy Trucks	0	0	0	0	0	0	0	0	0	9	0	9	1	15	0	16	25
%Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	2.1	1.0	0.0	1.0	0.5

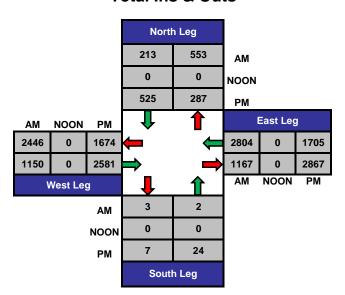
ITM Peak Hour Summary



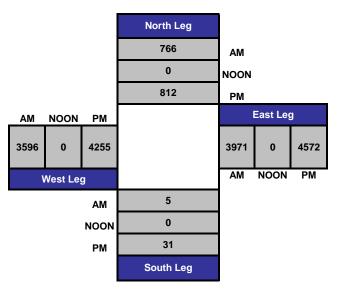
Hodges St and Capital Blvd, Raleigh



Total Ins & Outs



Total Volume Per Leg



Project ID: 16-9157-003

Location: Hodges St & Capital Blvd

City: Raleigh

Day: Wednesday Date: 4/6/2016

Peak Start Times AM 7:00 AM										
АМ	7:00 AM									
MD	12:00 AM									
PM	4:00 PM									

Groups Printed - Cars, PU, Vans - Heavy Trucks

										- Cars,	PU, Var										
		He	odges (St			H	odges	St			Ca	pital BI	vd			Cap	ital Blv	'd		
		No	rthbou				So	uthbou				Ea	astbour				We	stboun			
Start Time	Left	Thru	Rgt	Peds A	pp. Total	Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	Int. Total
7:00 AM	1	0	1	1	2	26	0	14	0	40	22	211	0	0	233	0	521	90	0	611	886
7:15 AM	0	0	0	0	0	23	1	16	0	40	37	284	0	0	321	0	619	91	0	710	1071
7:30 AM	0	0	1	0	1	34	0	21	0	55	25	269	0	1	294	0	602	96	1	698	1048
7:45 AM	0	0	0	0	0	35	0	17	0	52		248	0	0	280	0	613	136	0	749	1081
Total	1	0	2	1	3	118	1	68	0	187	116	1012	0	1	1128	0	2355	413	1	2768	4086
8:00 AM	0	0	1	0	1	49	0	17	0	66	32	223	0	0	255	2	541	104	0	647	969
8:15 AM	0	0	1	0	1	46	0	13	0	59	30	242	0	1	272	1	528	82	0	611	943
8:30 AM	0	0	1	0	1	23	0	26	0	49	34	269	0	0	303	2	540	106	0	648	1001
8:45 AM	0	0	2	0	2	34	0	14	1	48	39	274	1	0	314	2	555	98	1	655	1019
Total	0	0	5	0	5	152	0	70	1	222	135	1008	1	1	1144	7	2164	390	1	2561	3932
BREAK																					
4:00 PM	2	0	4	0	6	80	0	25	0	105		530	1	1	564	3	314	53	0	370	1045
4:15 PM	0	0	5	0	5	73	3	35	3	111	33	531	1	0	565	2	326	41	0	369	1050
4:30 PM	0	0	2	0	2	72	1	31	0	104	26	575	1	1	602	3	357	51	0	411	1119
4:45 PM	2	0	5	0	7	78	0	29	3	107	29	538	0	0	567	4	378	46	0	428	1109
Total	4	0	16	0	20	303	4	120	6	427	121	2174	3	2	2298	12	1375	191	0	1578	4323
5:00 PM	3	0	8	0	11	140	0	39	0	179		685	0	0	710	1	392	43	0	436	1336
5:15 PM	0	0	3	0	3	83	0	43	0	126	27	655	0	0	682	1	379	49	0	429	1240
5:30 PM	1	0	2	0	3	76	0	37	0	113	28	594	0	0	622	1	371	40	0	412	1150
5:45 PM	1	0	1	0	2	74	2	43	0	119		513	0	0	532	1	395	38	0	434	1087
Total	5	0	14	0	19	373	2	162	0	537	99	2447	0	0	2546	4	1537	170	0	1711	4813
Grand Total	10	0	37	1	47	946	7	420	7	1373	471	6641	4	4	7116	23	7431	1164	2	8618	17154
Apprch %	21.3	0.0	78.7	2.1		68.9	0.5	30.6	0.5		6.6	93.3	0.1	0.1		0.3	86.2	13.5	0.0		
Total %	0.1	0.0	0.2	0.0	0.3	5.5	0.0	2.4	0.0	8.0	2.7	38.7	0.0	0.0	41.5	0.1	43.3	6.8	0.0	50.2	
Cars, PU, Vans	9	0	37	1	46	914	7	417	7	1338	471	6609	4	4	7084	23	7368	1137	2	8528	16996
% Cars, PU, Vans	90.0	0.0	100.0	100.0	97.9	96.6	100.0	99.3	100.0	97.5	100.0	99.5	100.0	100.0	99.6	100.0	99.2	97.7	100.0	99.0	99.1
Heavy Trucks	1	0	0	_	1	32	0	3	_	35	0	32	0	_	32	0	63	27	_	90	158
%Heavy Trucks	10.0	0.0	0.0	0.0	2.1	3.4	0.0	0.7	0.0	2.5	0.0	0.5	0.0	0.0	0.4	0.0	8.0	2.3	0.0	1.0	0.9

Project ID: 16-9157-003

Location: Hodges St & Capital Blvd

City: Raleigh

PEAK HOURS

Day: Wednesday Date: 4/6/2016

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		Hodg	es St			Hodge	es St			Capital	Blvd			Capita	al Blvd		
		North	oound			Southb	ound			Eastbo	ound			Westl	bound		
Start Time	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Int. Total
Peak Hour Analys	sis from	07:00 A	M to 09	9:00 AM													
Peak Hour for En	tire Inte	rsection	Begins	at 07:15	5 AM												
7:15 AM	0	0	0	0	23	1	16	40	37	284	0	321	0	619	91	710	1071
7:30 AM	0	0	1	1	34	0	21	55	25	269	0	294	0	602	96	698	1048
7:45 AM	0	0	0	0	35	0	17	52	32	248	0	280	0	613	136	749	1081
8:00 AM	0	0	1	1	49	0	17	66	32	223	0	255	2	541	104	647	969
Total Volume	0	0	2	2	141	1	71	213	126	1024	0	1150	2	2375	427	2804	4169
% App. Total	0.0	0.0	100.0	100	66.2	0.5	33.3	100	11.0	89.0	0.0	100	0.1	84.7	15.2	100	
PHF				0.500				0.807				0.896				0.936	
Cars, PU, Vans	0	0	2	2	133	1	71	205	126	1017	0	1143	2	2354	422	2778	4128
% Cars, PU, Vans	0.0	0.0	100.0	100.0	94.3	100.0	100.0	96.2	100.0	99.3	0.0	99.4	100.0	99.1	98.8	99.1	99.0
Heavy Trucks	0	0	0	0	8	0	0	8	0	7	0	7	0	21	5	26	41
%Heavy Trucks	0.0	0.0	0.0	0.0	5.7	0.0	0.0	3.8	0.0	0.7	0.0	0.6	0.0	0.9	1.2	0.9	1.0

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		Hodg	jes St			Hodg	es St			Capita	l Blvd			Capita	al Blvd			
		North	bound			South	bound			Eastb	ound			West	bound			
Start Time	Left	Thru	Rat	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rat	App. Total	Int.	Total

Peak Hour Analysis from 04:00 PM to 06:00 PM
Peak Hour for Entire Intersection Begins at 04:45 PM

	4:45 PM	2	0	5	7	78	0	29	107	29	538	0	567	4	378	46	428	1109
	5:00 PM	3	0	8	11	140	0	39	179	25	685	0	710	1	392	43	436	1336
	5:15 PM	0	0	3	3	83	0	43	126	27	655	0	682	1	379	49	429	1240
	5:30 PM	1	0	2	3	76	0	37	113	28	594	0	622	1	371	40	412	1150
_	Total Volume	6	0	18	24	377	0	148	525	109	2472	0	2581	7	1520	178	1705	4835
	% App. Total	25.0	0.0	75.0	100	71.8	0.0	28.2	100	4.2	95.8	0.0	100	0.4	89.1	10.4	100	
	PHF				0.545				0.733				0.909				0.978	
ĺ	Cars, PU, Vans	6	0	18	24	372	0	148	520	109	2467	0	2576	7	1511	175	1693	4813
ļ	% Cars, PU, Vans	100.0	0.0	100.0	100.0	98.7	0.0	100.0	99.0	100.0	99.8	0.0	99.8	100.0	99.4	98.3	99.3	99.5
	Heavy Trucks	0	0	0	0	5	0	0	5	0	5	0	5	0	9	3	12	22
	%Heavy Trucks	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.0	0.0	0.2	0.0	0.2	0.0	0.6	1.7	0.7	0.5

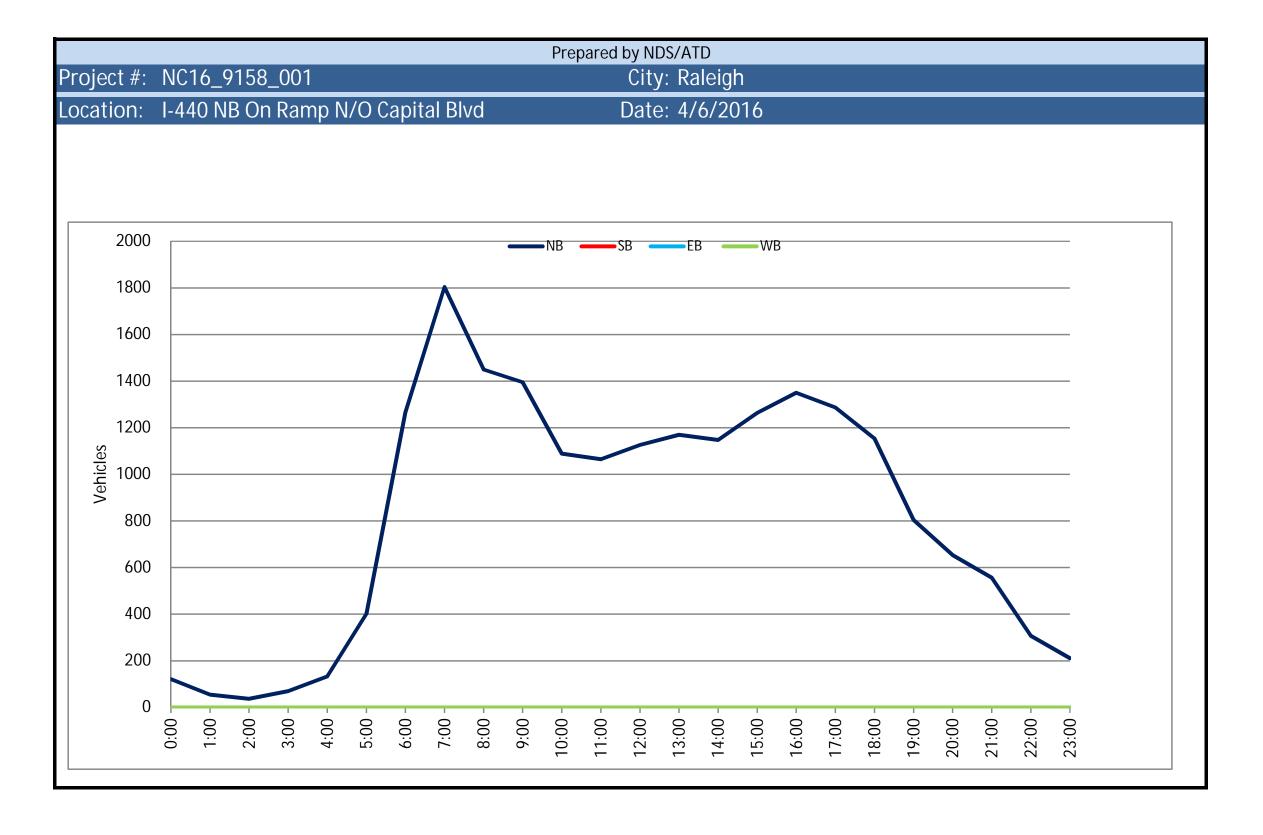
Prepared by NDS/ATD

VOLUME

I-440 NB On Ramp N/O Capital Blvd

Day: Wednesday Date: 4/6/2016 City: Raleigh
Project #: NC16_9158_001

	DAILY T	OTALS	NB	SB		EB		WB				То	otal
	DAILT	OTALS	19,918	0		0		0				19,	918
AM Period	NB	SB	EB WB	TO ⁻	TAL	PM Period	NB		SB	EB	WE	TO	TAL
0:00	32	0		32		12:00	261		0			261	
0:15	36	0		36		12:15	296		0			296	
0:30 0:45	23 30 121	0 0		23 30	121	12:30 12:45	282 287	1126	0 0			282 287	1126
1:00	20	0		20	121	13:00	268	1120	0			268	1120
1:15	12	0		12		13:15	324		0			324	
1:30	14	0		14		13:30	283	4470	0			283	1170
1:45 2:00	9 55 5	0		9 5	55	13:45 14:00	295 294	1170	0			295 294	1170
2:15	11	0		11		14:15	289		0			289	
2:30	11	0		11		14:30	298		0			298	
2:45 3:00	10 37 12	0		10	37	14:45 15:00	267 307	1148	0			 267 307	1148
3:15	17	0 0		17		15:00 15:15	307		0			307	
3:30	22	Ö		22		15:30	341		0			341	
3:45	19 70	0		19	70	15:45	312	1264	0			312	1264
4:00	15 22	0		15 22		16:00 16:15	329 360		0 0			329 360	
4:15 4:30	44	0		44		16:30	349		0			349	
4:45	52 133	0		52	133	16:45	312	1350	0			312	1350
5:00	51	0		51		17:00	322		0			322	
5:15 5:30	77 116	0 0		77 116		17:15 17:30	337 331		0 0			337 331	
5:45	157 401	0		157	401	17:45	297	1287	0			297	1287
6:00	203	0		203		18:00	348		0			348	1201
6:15	263	0		263		18:15	305		0			305	
6:30 6:45	397 403 1266	0 0		397 403	1266	18:30 18:45	277 224	1154	0 0			277 224	1154
7:00	462	0		462	1200	19:00	244	1134	0			244	1134
7:15	467	0		467		19:15	195		0			195	
7:30	437	0		437	1004	19:30	186	004	0			186	004
7:45 8:00	438 1804 358	0		438 358	1804	19:45 20:00	179 183	804	0			 179 183	804
8:15	419	0		419		20:15	171		0			171	
8:30	275	0		275		20:30	158		0			158	
8:45 9:00	398 1450 367	0		398 367	1450	20:45 21:00	142 165	654	0			 142 165	654
9:00 9:15	371	0		371		21:15	135		0			135	
9:30	337	0		337		21:30	126		0			126	
9:45	320 1395	0		320	1395	21:45	131	557	0			 131	557
10:00 10:15	252 248	0 0		252 248		22:00 22:15	92 76		0 0			92 76	
10:13	289	0		289		22:30	83		0			83	
10:45	300 1089	0		300	1089	22:45	56	307	0			56	307
11:00	280	0		280		23:00	66		0			66	
11:15 11:30	249 287	0 0		249 287		23:15 23:30	63 49		0 0			63 49	
11:45	249 1065	0		249	1065	23:45	33	211	0			33	211
TOTALS	8886				8886	TOTALS		11032					11032
SPLIT %	100.0%				44.6%	SPLIT %		100.0%					55.4%
JI LII 70	100.070				14.070	JI LII 70		100.070					33.770
	DAILY T	OTALS	NB	SB		EB		WB					otal
			19,918	0		0		0				19,	918
AM Peak Hour	7:00				7:00	PM Peak Hour		15:45					15:45
AM Pk Volume	1804				1804	PM Pk Volume		1350					1350
Pk Hr Factor	0.966		0	0	0.966	Pk Hr Factor		0.938			0		0.938
7 - 9 Volume 7 - 9 Peak Hour	3254 7:00				3254 7:00	4 - 6 Volume 4 - 6 Peak Hour		2637 16:00					2637 16:00
7 - 9 Pk Volume					1804	4 - 6 Pk Volume		1350					1350
Pk Hr Factor	0.966				0.966	Pk Hr Factor		0.938					0.938



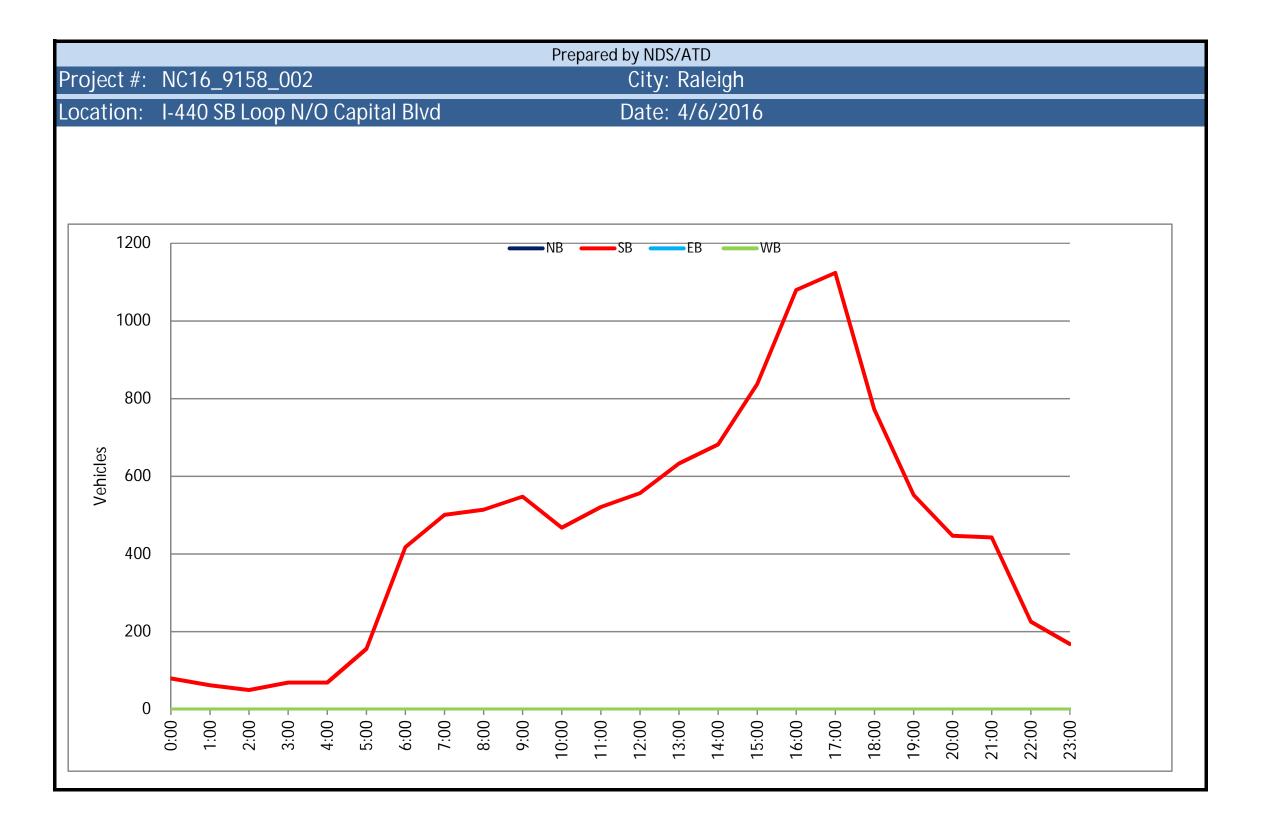
Prepared by NDS/ATD

VOLUME

I-440 SB Loop N/O Capital Blvd

Day: Wednesday Date: 4/6/2016 City: Raleigh
Project #: NC16_9158_002

	DAILY TO	ΣΙΔΤΩ	NB_							Total			
	DAILIT	JIALS	0		10,977	0		0				10,977	
AM Period	NB	SB E	EB WB		TOTAL	PM Period	NB	SB	EB	s W	В	TOT	AL
0:00		34	-0 110		34	12:00	0	137		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		137	
0:15		19			19	12:15	0	134				134	
0:30		11			11	12:30	0	142				142	
0:45 1:00		16 80 10			16 80 10	12:45 13:00	0	144 146	557			144 146	557
1:15		14			14	13:15	0	165				165	
1:30	0	20			20	13:30	0	177				177	
1:45		18 62			18 62	13:45	0	145	633				633
2:00 2:15	0 0	9 12			9 12	14:00 14:15	0 0	154 177				154 177	
2:30		16			16	14:30	0	166				166	
2:45	0	13 50			13 50	14:45	0	185	682			185	682
3:00		13			13	15:00	0	201				201	
3:15 3:30		24 16			24 16	15:15 15:30	0 0	176 238				176 238	
3:45		16 69			16 69	15:45	0	223	838				838
4:00		13			13	16:00	0	271				271	
4:15		14			14	16:15	0	246				246	
4:30		15 27 69			15 27 69	16:30 16:45	0	257 306	1000			257 306	1000
4:45 5:00		20 69			27 69 20	17:00	0	315	1080			315	1080
5:15		29			29	17:15	0	310				310	
5:30		48			48	17:30	0	263				263	
5:45		59 156			59 156	17:45 18:00	0	236	1124				1124
6:00 6:15		67 97			67 97	18:15	0 0	202 236				202 236	
6:30		121			121	18:30	0	175				175	
6:45		133 418			133 418	18:45	0	158	771			158	771
7:00		134			134	19:00	0	186				186	
7:15 7:30		117 138			117 138	19:15 19:30	0 0	123 120				123 120	
7:45		112 501			112 501	19:45	0	123	552				552
8:00	0	112			112	20:00	0	104				104	
8:15		125			125	20:15 20:30	0	147				147	
8:30 8:45		140 137 514			140 137 514	20:45	0 0	111 85	447			111 85	447
9:00		147			147	21:00	0	118	117			118	117
9:15		126			126	21:15	0	122				122	
9:30		131			131	21:30 21:45	0	115	440			115	4.42
9:45 10:00		<u>144 548</u> 122			144 548 122	21.45	0	88 71	443			88 71	443
10:15		98			98	22:15	0	48				48	
10:30	0	108			108	22:30	0	53				53	
10:45		140 468			140 468	22:45	0	54	226				226
11:00 11:15		130 124			130 124	23:00 23:15	0 0	57 48				57 48	
11:30		150			150	23:30	0	38				38	
11:45		117 521			117 521	23:45	0	25	168				168
TOTALS		3456			3456	TOTALS			7521			-	7521
SPLIT %		100.0%			31.5%	SPLIT %			100.0%			6	68.5%
	DAILY TO		NB		SB	EB		WB				Tota	al
	– DAILT IC	FIALS	0		10,977	0		0				10,9	77
AM Peak Hour		8:30			8:30	PM Peak Hour			16:45				16:45
AM Pk Volume		550			550	PM Pk Volume			1194				1194
Pk Hr Factor		0.935			0.935	Pk Hr Factor		0	0.948				0.948
7 - 9 Volume 7 - 9 Peak Hour		1015 8:00			1015 8:00	4 - 6 Volume 4 - 6 Peak Hour			2204 16:45				2204 16:45
7 - 9 Peak Hour 7 - 9 Pk Volume		8:00 514			8:00 514	4 - 6 Pk Volume			10:45				1194
Pk Hr Factor		0.918			0.918	Pk Hr Factor			0.948				0.948

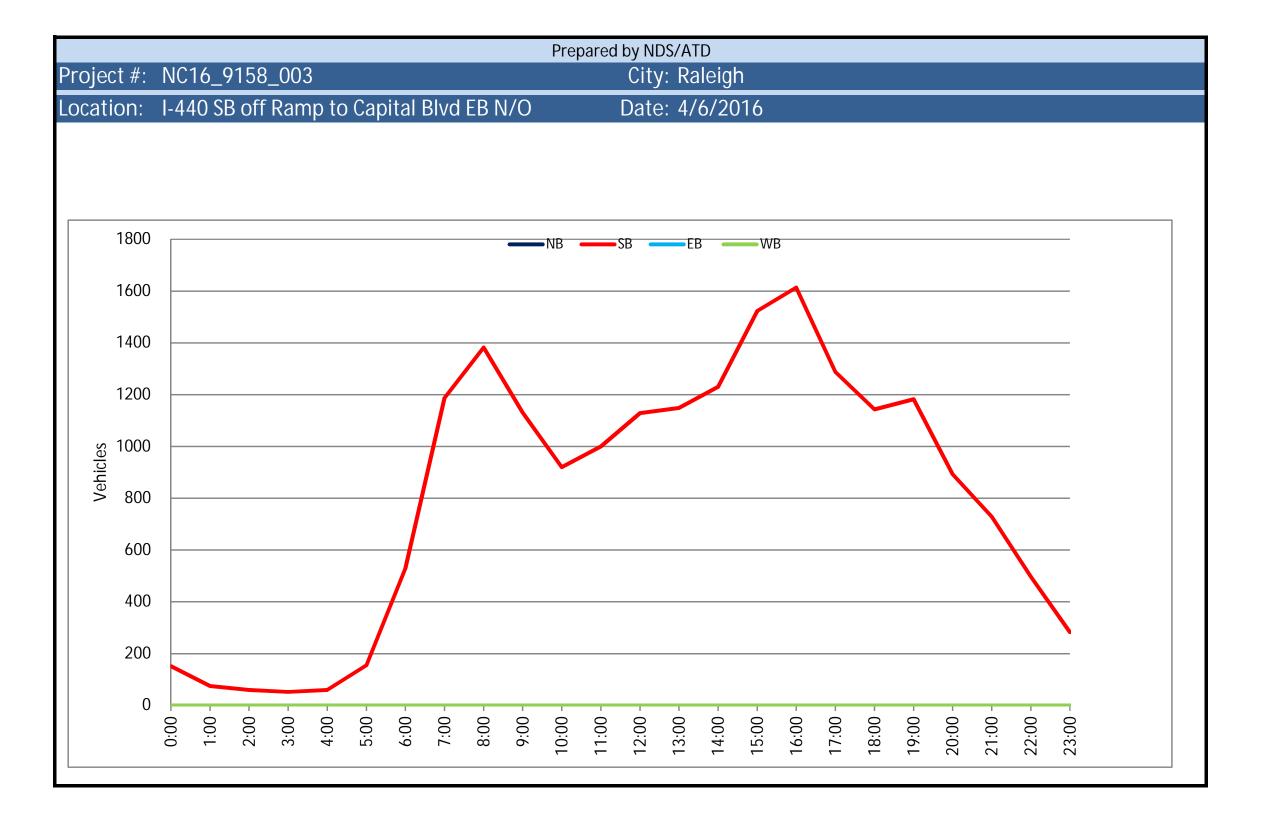


VOLUME

I-440 SB off Ramp to Capital Blvd EB N/O Capital Blvd

Day: Wednesday Date: 4/6/2016

	DAILY TO	ΤΔΙς	NB NB	SB	EB	WE	3_			Total
	DAILT TO	IALJ	0	19,363	0	0				19,363
AM Period	NB S	В І	EB WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
0:00	0 40			46	12:00	0	285			285
0:15	0 48			48	12:15	0	289			289
0:30 0:45	0 37 0 27			31 27 152	12:30 12:45	0 0	269 286 11	29		269 286 1129
1:00	0 19	9		19	13:00	0	255	129		255
1:15	0 2!			25	13:15	0	294			294
1:30	0 20			20	13:30	0	285			285
1:45	0 1			11 75	13:45	0		49		315 1149
2:00 2:15	0 14			14 15	14:00 14:15	0 0	287 308			287 308
2:30	0 13			13	14:30	0	328			328
2:45	0 18	8 60		18 60	14:45	0	307 12	230		307 1230
3:00	0 1!			15	15:00	0	340			340
3:15	0 12			12	15:15 15:30	0	392 351			392
3:30 3:45	0 8			8 17 52	15:45	0 0		523		351 440 1523
4:00	0 13			13	16:00	0	439	020		439
4:15	0 10	0		10	16:15	0	429			429
4:30	0 14			14	16:30	0	383			383
4:45	0 23			23 60 17	16:45 17:00	0		514		363 1614
5:00 5:15	0 17			33	17:00 17:15	0 0	363 329			363 329
5:30	0 48			48	17:30	0	319			319
5:45	0 5	7 155		57 155	17:45	0	277 12	288		277 1288
6:00	0 58			58	18:00	0	299			299
6:15 6:30	0 12 0 13			124 136	18:15 18:30	0 0	266 251			266 251
6:45	0 21			211 529	18:45	0		43		327 1143
7:00	0 20			208	19:00	0	371	10		371
7:15	0 31			316	19:15	0	292			292
7:30	0 30			303	19:30	0	261			261
7:45 8:00	0 36			360 1187 345	19:45 20:00	0	258 11 231	82		258 1182 231
8:15	0 36			363	20:15	0	235			235
8:30	0 31			318	20:30	0	219			219
8:45	0 35	6 1382		356 1382	20:45	0	208 8	93		208 893
9:00	0 27			279	21:00	0	212			212
9:15 9:30	0 28 0 27			287 275	21:15 21:30	0 0	200 172			200 172
9:45	0 29			290 1131	21:45	0		29		145 729
10:00	0 21			213	22:00	0	150			150
10:15	0 22			224	22:15	0	136			136
10:30	0 23			231	22:30	0	110	0.7		110
10:45 11:00	0 25 0 24			252 920 247	22:45 23:00	0	101 4 ⁹	97		101 497 84
11:15	0 25			253	23:15	0	78			78
11:30	0 24	17		247	23:30	0	57			57
11:45	0 25	3 1000		253 1000	23:45	0	64 2	83		64 283
TOTALS		6703		6703	TOTALS		12	660		12660
SPLIT %		100.0%		34.6%	SPLIT %		100	0.0%		65.4%
	DAILY TO	TALC	NB	SB	EB	WE	3			Total
	DAILY TO	TALS	0	19,363	0	0				19,363
AM Peak Hour		7:45		7:45	PM Peak Hour		15	5:45		15:45
AM Pk Volume		1386		1386	PM Pk Volume		16	691		1691
Pk Hr Factor		0.955		0.955	Pk Hr Factor			961		0.961
7 - 9 Volume	0	2569	0 0	2569	4 - 6 Volume	0		902	0 0	2902
7 - 9 Peak Hour		7:45		7:45	4 - 6 Peak Hour			5:00		16:00
7 - 9 Pk Volume		1386		1386	4 - 6 Pk Volume			614		1614
Pk Hr Factor	0.000	0.955	0.000 0.000	0.955	Pk Hr Factor	0.000	0.	919 0	.000 0.000	0.919

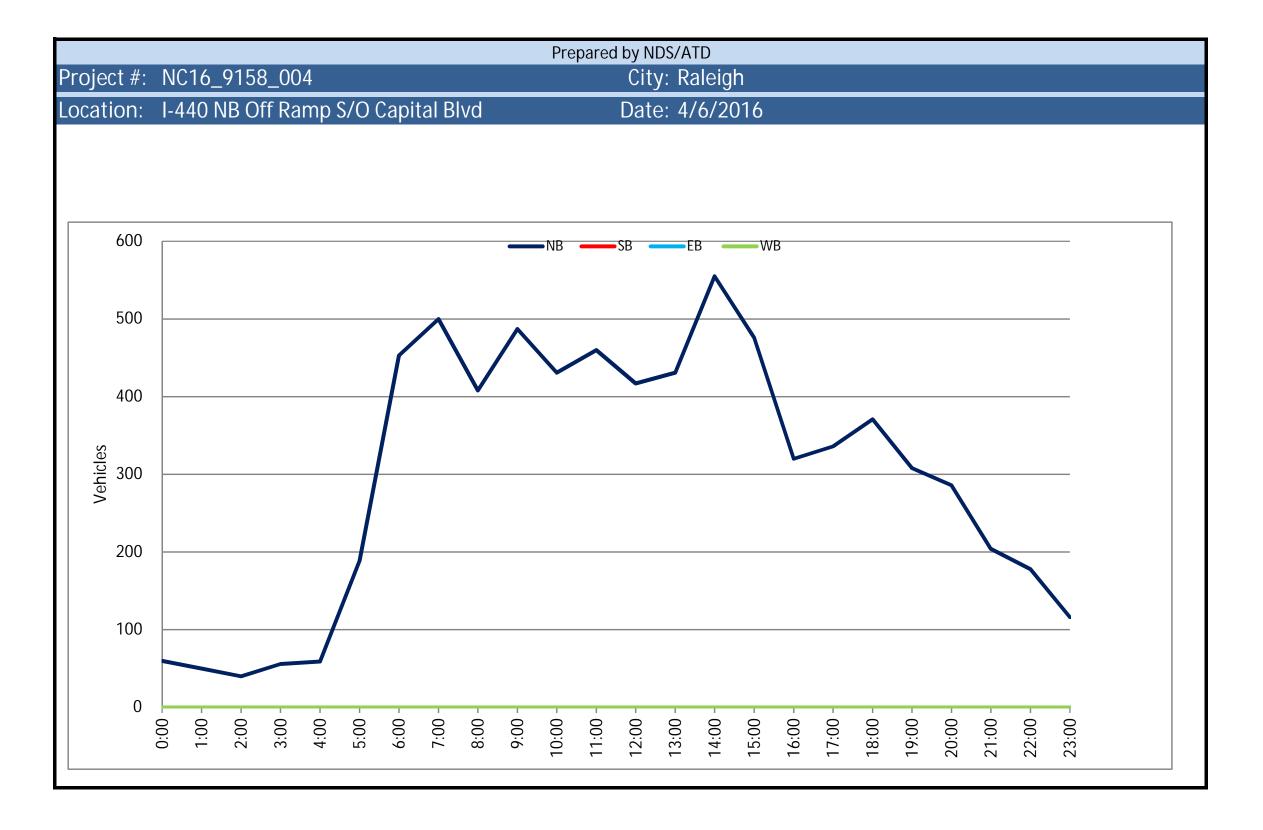


VOLUME

I-440 NB Off Ramp S/O Capital Blvd

Day: Wednesday Date: 4/6/2016

	DA	ILY T	OTALS		NB	SB		EB		WB						otal
					7,191	0		0		0						191
AM Period	NB 19			EB	WB		TAL	PM Period	NB		SB	EB		WB		TAL
0:00 0:15	19		0 0			19 13		12:00 12:15	114 110		0 0				114 110	
0:30	16		0			16		12:30	95	447	0				95	447
0:45 1:00	12 18	60	0			12 18	60	12:45 13:00	98 105	417	0				98 105	417
1:15	7		0			7		13:15	125		0				125	
1:30 1:45	13 12	50	0 0			13 12	50	13:30 13:45	106 95	431	0 0				106 95	431
2:00	9	30	0			9	30	14:00	107	431	0				107	431
2:15	8		0			8		14:15	127		0				127	
2:30 2:45	10 13	40	0 0			10 13	40	14:30 14:45	146 175	555	0 0				146 175	555
3:00	8		0			8		15:00	104		0				104	
3:15 3:30	12 19		0			12 19		15:15 15:30	127 95		0 0				127 95	
3:45	17	56	0			17	56	15:45	150	476	0				150	476
4:00	15		0			15		16:00	76		0				76	
4:15 4:30	6 17		0 0			6 17		16:15 16:30	93 63		0				93 63	
4:45	21	59	0			21	59	16:45	88	320	0				88	320
5:00 5:15	24 38		0 0			24 38		17:00 17:15	92 72		0 0				92 72	
5:30	52		0			52		17:30	86		0				86	
5:45 6:00	75 88	189	0			75 88	189	17:45 18:00	86 93	336	0				86 93	336
6:15	00 127		0			127		18:15	93 82		0				82	
6:30	116	450	0			116	450	18:30	88	074	0				88	074
6:45 7:00	122 134	453	0			122 134	453	18:45 19:00	108 80	371	0				108 80	371
7:15	137		0			137		19:15	84		0				84	
7:30 7:45	106 123	500	0 0			106 123	500	19:30 19:45	70 74	308	0 0				70 74	308
8:00	108	300	0			108	300	20:00	86	300	0				86	300
8:15	110		0			110		20:15	64		0				64	
8:30 8:45	94 96	408	0 0			94 96	408	20:30 20:45	69 67	286	0 0				69 67	286
9:00	112		0			112	, , ,	21:00	62		0				62	
9:15 9:30	104 151		0 0			104 151		21:15 21:30	49 41		0				49 41	
9:45	120	487	0			120	487	21:45	52	204	0				52	204
10:00	113		0			113		22:00 22:15	50		0				50	
10:15 10:30	101 115		0 0			101 115		22:30	53 41		0				53 41	
10:45	102	431	0			102	431	22:45	34	178	0				34	178
11:00 11:15	95 111		0 0			95 111		23:00 23:15	30 29		0				30 29	
11:30	130		0			130		23:30	28		0				28	
11:45		460	0			124	460	23:45	29	116	0				29	116
TOTALS		3193					3193	TOTALS		3998						3998
SPLIT %		100.0%					44.4%	SPLIT %		100.0%						55.6%
	DΔ	IJΥŢ	OTALS		NB	SB		EB		WB						otal
	— DI (OTALS		7,191	0		0		0					7,	191
AM Peak Hour		6:30					6:30	PM Peak Hour		14:00						14:00
AM Pk Volume		509					509	PM Pk Volume		555						555
Pk Hr Factor 7 - 9 Volume		0.929 908	0	0	0		0.929 908	Pk Hr Factor 4 - 6 Volume		0.793 656		0	0	0		0.793 656
7 - 9 Peak Hour		7:00					7:00	4 - 6 Peak Hour		16:45						16:45
7 - 9 Pk Volume		500					500	4 - 6 Pk Volume		338						338
Pk Hr Factor		0.912	0.000	0.000	0.000)	0.912	Pk Hr Factor		0.918	(0.000	0.000	0.000		0.918

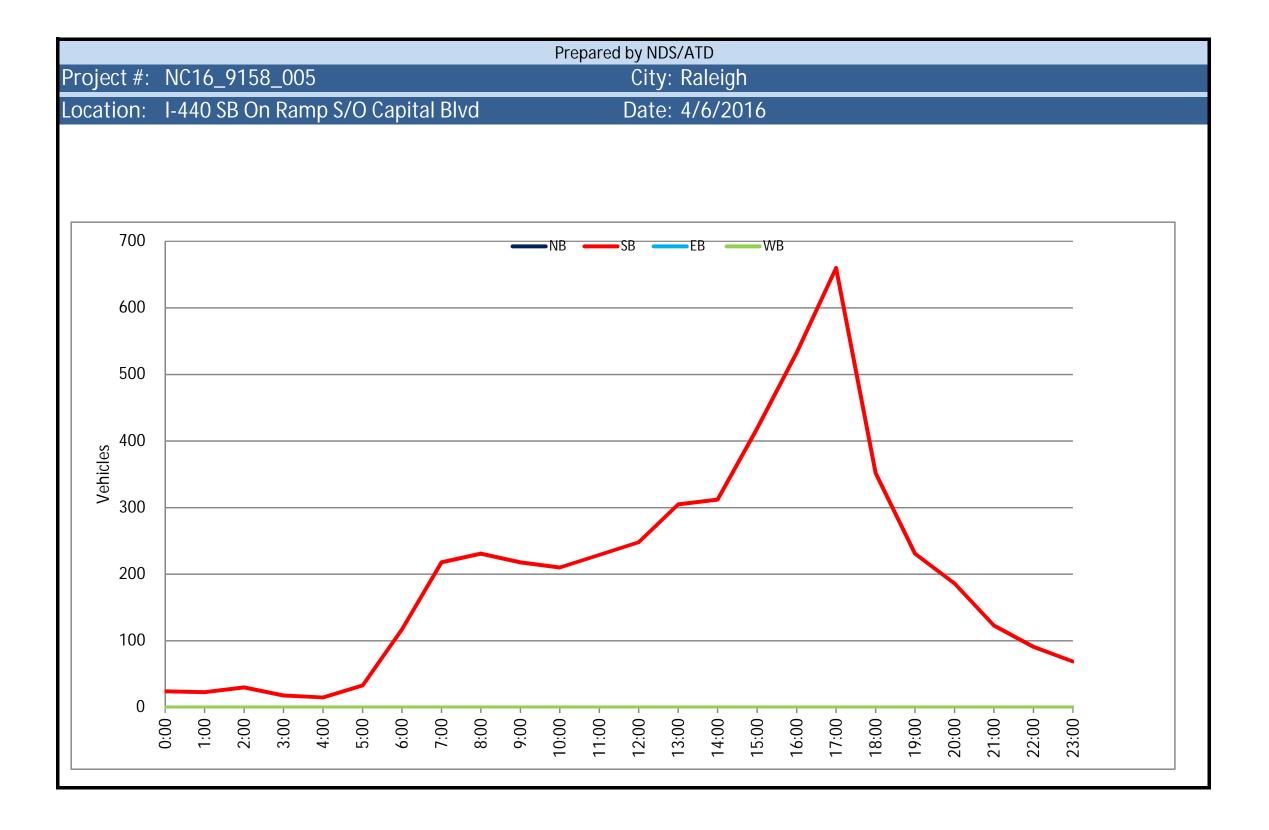


VOLUME

I-440 SB On Ramp S/O Capital Blvd

Day: Wednesday Date: 4/6/2016

	DAILY TOTA	ALS	NB 0	SB 4,895	EB 0	WB 0	-		Total 4,895
AM Period	NB SB	E	B WB	TOTAL	PM Period	NB	SB	EB WE	,
0:00 0:15	0 9 0 2			9 2	12:00 12:15	0 0	57 57		57 57
0:30	0 9	24		9	12:30	0	63		63
0:45 1:00	0 4 6	24		6 24	12:45 13:00	0	71 248 71		71 248 71
1:15 1:30	0 9 0 4			9	13:15 13:30	0 0	72 73		72 73
1:45	0 4	23		4 23	13:45	0	89 305		89 305
2:00 2:15	0 4 0 15			4 15	14:00 14:15	0 0	71 66		71 66
2:30 2:45	0 9 0 2	30		9 2 30	14:30 14:45	0 0	96 79 312		96 79 312
3:00	0 3	30		3	15:00	0	100		100
3:15 3:30	0 4 9			9	15:15 15:30	0 0	116 90		116 90
3:45 4:00	0 2	18		2 18	15:45 16:00	0	113 419 152		113 419 152
4:15	0 8			8	16:15	0	116		116
4:30 4:45	0 1 2	15		1 2 15	16:30 16:45	0 0	151 114 533		151 114 533
5:00	0 7	10		7	17:00	0	198		198
5:15 5:30	0 14 0 6			14 6	17:15 17:30	0 0	188 149		188 149
5:45 6:00	0 6 0 22	33		6 33	17:45 18:00	0	125 660 105		125 660 105
6:15	0 27			27	18:15	0	96		96
6:30 6:45	0 33 0 35	117		33 35 117	18:30 18:45	0 0	83 68 352		83 68 352
7:00	0 46			46	19:00 19:15	0	62		62
7:15 7:30	0 55 0 59			55 59	19:30	0 0	59 50		59 50
7:45 8:00	0 58 0 56	218		58 218 56	19:45 20:00	0	60 231 48		60 231 48
8:15	0 50			50	20:15	0	61		61
8:30 8:45	0 58 0 67	231		58 67 231	20:30 20:45	0 0	42 35 186		42 35 186
9:00 9:15	0 58 0 48			58 48	21:00 21:15	0 0	41 28		41 28
9:30	0 62			62	21:30	0	36		36
9:45 10:00	0 50 0 57	218		50 218 57	21:45 22:00	0	18 123 21		18 123 21
10:15 10:30	0 54			54 52	22:15 22:30	0	29 23		29 23
10:45	0 47	210		47 210	22:45	0	18 91		18 91
11:00 11:15	0 55 0 49			55 49	23:00 23:15	0 0	20 11		20 11
11:30	0 51	220		51	23:30 23:45	0	25 13 69		25 13 69
11:45 TOTALS	0 74	229 1366		74 229 1366	TOTALS	U	3529		3529
SPLIT %		100.0%		27.9%			100.0%		72.1%
			NB	SB	EB	WB			Total
	DAILY TOTA	ALS	0 0	4,895	0	0	<u>-</u>		4,895
AM Peak Hour		11:45		11:45	PM Peak Hour		17:00		17:00
AM Pk Volume Pk Hr Factor		251 0.848		251 0.848	PM Pk Volume Pk Hr Factor		660 0.833		660 0.833
7 - 9 Volume	0	449	0 0	449	4 - 6 Volume	0	1193	0	0.833
7 - 9 Peak Hour 7 - 9 Pk Volume		8:00 231		8:00 231	4 - 6 Peak Hour 4 - 6 Pk Volume		17:00 660		17:00 0 660
Pk Hr Factor	0 0.000	0.862	0 0 0.000 0.000		Pk Hr Factor	0.000		0 0.000	0 660 0.000 0.833

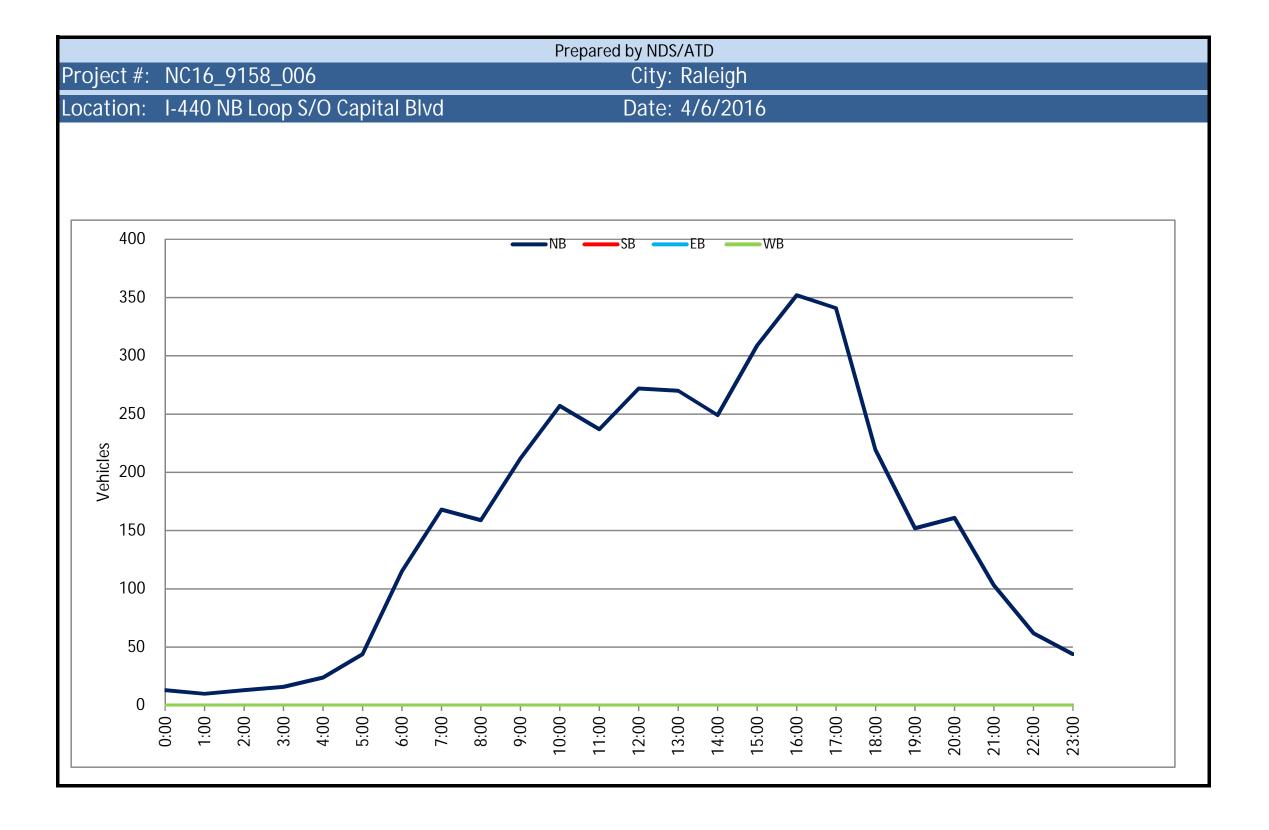


Prepared by NDS/ATD VOLUME

I-440 NB Loop S/O Capital Blvd

Day: Wednesday Date: 4/6/2016

	DA	JI Y T	OTALS		NB		SB		EB		WB							otal
	σ.		017120		3,802		0		0		0							802
AM Period	NB		SB	EB	WB			TAL	PM Period	NB		SB	E	В	WB			TAL
0:00 0:15	4 6		0 0				4 6		12:00 12:15	62 63		0 0					62 63	
0:30	0		0				0		12:30	78		0					78	
0:45 1:00	3	13	0				3	13	12:45 13:00	69 71	272	0					69 71	272
1:15	3 2		0				2		13:15	64		0					64	
1:30	3		0				3		13:30	63		0					63	
1:45 2:00	3	10	0				3	10	13:45 14:00	72 51	270	0					72 51	270
2:15	7		0				7		14:15	62		0					62	
2:30	2	10	0				2	10	14:30	71	0.40	0					71	0.40
2:45 3:00	2	13	0				2	13	14:45 15:00	65 70	249	0					65 70	249
3:15	1		0				1		15:15	74		0					74	
3:30	10	47	0				10	4.7	15:30	81	200	0					81	200
3:45 4:00	3	16	0				3	16	15:45 16:00	91	309	0					84 91	309
4:15	12		0				12		16:15	88		0					88	
4:30	7	2.4	0				7	2.4	16:30	101	252	0					101	252
4:45 5:00	3 7	24	0				<u>3</u>	24	16:45 17:00	72 94	352	0					72 94	352
5:15	6		0				6		17:15	87		0					87	
5:30 5:45	14 17	1.1	0				14	1.1	17:30 17:45	80	241	0					80	241
6:00	21	44	0				17 21	44	18:00	80 60	341	0					80 60	341
6:15	34		0				34		18:15	55		0					55	
6:30 6:45	25 35	115	0				25 35	115	18:30 18:45	52 52	219	0 0					52 52	219
7:00	39	115	0				39	110	19:00	39	219	0					39	219
7:15	59		0				59		19:15	36		0					36	
7:30 7:45	31 39	168	0 0				31 39	168	19:30 19:45	41 36	152	0 0					41 36	152
8:00	30	100	0				30	100	20:00	41	132	0					41	102
8:15	32		0				32		20:15	39		0					39	
8:30 8:45	50 47	159	0 0				50 47	159	20:30 20:45	41 40	161	0 0					41 40	161
9:00	64	107	0				64	137	21:00	39	101	0					39	101
9:15	59		0				59		21:15	26		0					26	
9:30 9:45	46 43	212	0 0				46 43	212	21:30 21:45	21 17	103	0 0					21 17	103
10:00	69	212	0				69	212	22:00	20	103	0					20	103
10:15	66		0				66		22:15	12		0					12	
10:30 10:45	60 62	257	0 0				60 62	257	22:30 22:45	10 20	62	0 0					10 20	62
11:00	51	20,	0				51	207	23:00	21		0					21	32
11:15	60 4 E		0				60 4 E		23:15 23:30	10		0					10	
11:30 11:45	65 61	237	0 0				65 61	237	23:30	6 7	44	0 0					6 7	44
TOTALS		1268						1268	TOTALS	•	2534							2534
SPLIT %		100.0%						33.4%	SPLIT %		100.0%							66.6%
					ND		CD		ED		MD							tol
	DA	ILY T	OTALS		NB 3,802		SB 0		EB 0		<u>WB</u> 0							otal 802
		11.45					0	14.45									- 5,0	
AM Peak Hour AM Pk Volume		11:45 264						11:45 264	PM Peak Hour PM Pk Volume		15:45 364							15:45 364
Pk Hr Factor		0.846						0.846	Pk Hr Factor		0.901							0.901
7 - 9 Volume		327	0	0		0		327	4 - 6 Volume		693		0	0		0		693
7 - 9 Peak Hour		7:00						7:00	4 - 6 Peak Hour		16:15							16:15
7 - 9 Pk Volume		168						168	4 - 6 Pk Volume		355							355
Pk Hr Factor		0.712	0.000	0.0	UU	0.000		0.712	Pk Hr Factor		0.879		0.000	0.00	U	0.000		0.879

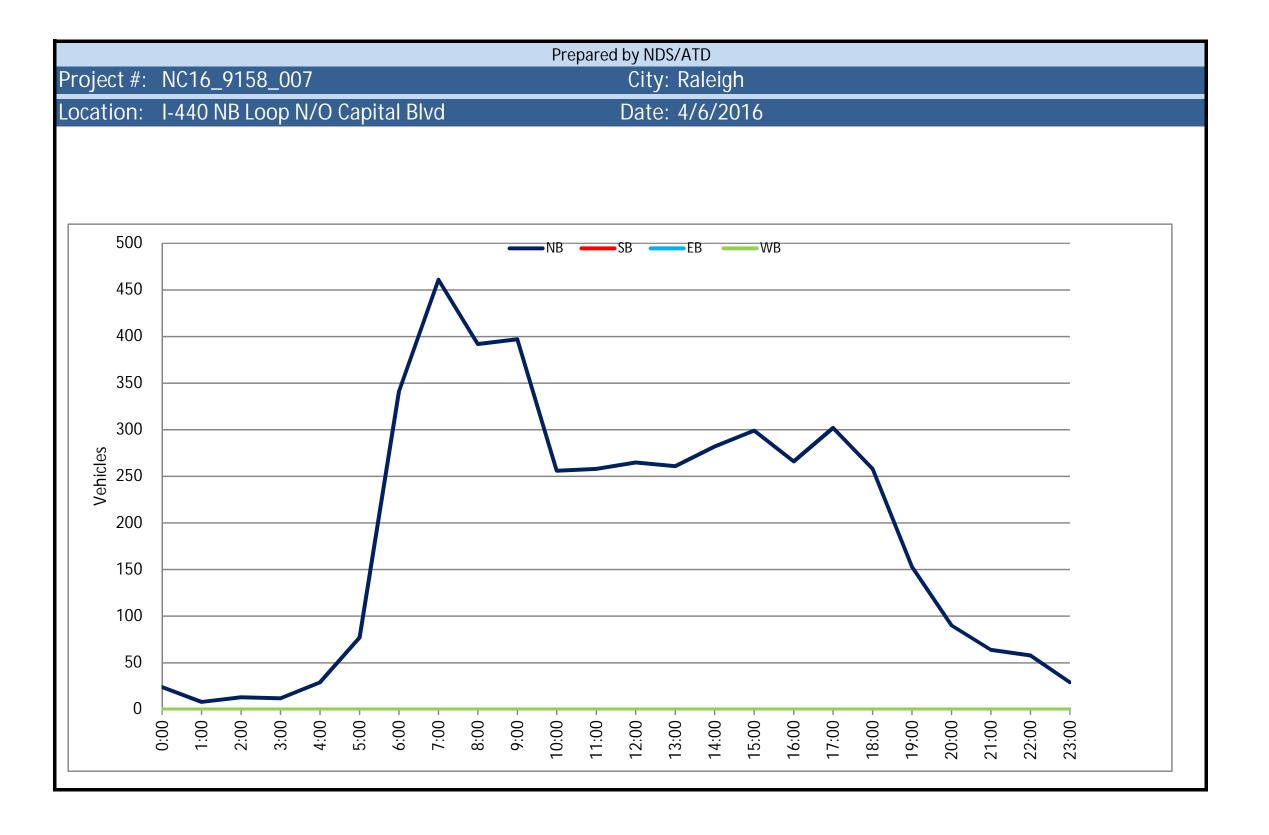


VOLUME

I-440 NB Loop N/O Capital Blvd

Day: Wednesday Date: 4/6/2016

	DAI	ΙΥΤ	OTALS		NB		SB		EB		WB							otal
	D/ (i		OTTIEO		4,595		0		0		0						4,	595
AM Period	NB		SB	EB	WB		TO	TAL	PM Period	NB		SB	Е	В	WB			TAL
0:00 0:15	6 5		0				6 5		12:00 12:15	69 68		0					69 68	
0:30	7		0				7		12:30	64		0					64	
0:45		24	0				6	24	12:45	64	265	0					64	265
1:00 1:15	2		0				2		13:00 13:15	61 68		0					61 68	
1:30	2		0				2		13:30	64		0					64	
1:45	1	8	0				1	8	13:45	68	261	0					68	261
2:00 2:15	3		0				3		14:00 14:15	58 77		0					58 77	
2:30	4		0				4		14:30	73		0					73	
2:45		13	0				3	13	14:45	74	282	0					74	282
3:00 3:15	0 4		0				0 4		15:00 15:15	62 73		0					62 73	
3:30	2		0				2		15:30	72		0					72	
3:45		12	0				6	12	15:45	92	299	0					92	299
4:00 4:15	2 11		0				2 11		16:00 16:15	64 57		0 0					64 57	
4:30	6		0				6		16:30	68		0					68	
4:45		29	0				10	29	16:45	77	266	0					77	266
5:00 5:15	6 9		0				6 9		17:00 17:15	88 74		0					88 74	
5:30	22		0				22		17:30	66		0					66	
5:45		77	0				40	77	17:45	74	302	0					74	302
6:00 6:15	54 73		0				54 73		18:00 18:15	74 63		0					74 63	
6:30	80		0				80		18:30	58		0					58	
6:45		341	0				134	341	18:45	63	258	0					63	258
7:00 7:15	140 130		0				140 130		19:00 19:15	43 40		0					43 40	
7:30	85		0				85		19:30	36		0					36	
7:45		461	0				106	461	19:45 20:00	34	153	0					34	153
8:00 8:15	88 88		0				88 88		20:15	18 23		0					18 23	
8:30	96		0				96		20:30	22		0					22	
8:45 9:00	120 3 134	392	0				120 134	392	20:45 21:00	27 18	90	0					27 18	90
9:00	81		0				81		21:15	17		0					17	
9:30	85		0				85		21:30	15		0					15	
9:45 10:00	97 3 55	397	0				97 55	397	21:45 22:00	14 13	64	0					14 13	64
10:00	81		0				81		22:15	14		0					14	
10:30	57	.	0				57	0=1	22:30	18		0					18	
10:45 11:00	63 2	256	0				63 63	256	22:45 23:00	13 9	58	0					13 9	58
11:15	76		0				76		23:15	5		0					5	
11:30	56	250	0				56	250	23:30	9	00	0					9	00
11:45		258	0				63	258	23:45	6	29	0					6	29
TOTALS SPLIT %		268						2268 49.4%	TOTALS SPLIT %		2327							2327 50.6%
1. 2 70																		
	DAI	LY T	OTALS		NB 4 FOF		SB		EB		WB							otal
					4,595		0		0		0						4,	595
AM Peak Hour		6:45						6:45	PM Peak Hour		16:30							16:30
AM Pk Volume Pk Hr Factor		489).873						489 0.873	PM Pk Volume Pk Hr Factor		307 0.872							307 0.872
7 - 9 Volume		853	0	0		0		853	4 - 6 Volume		568		0	0		0		568
7 - 9 Peak Hour		7:00						7:00	4 - 6 Peak Hour		16:30							16:30
7 - 9 Pk Volume		461						461	4 - 6 Pk Volume		307							307
Pk Hr Factor	0).823	0.000	0.000)	0.000		0.823	Pk Hr Factor		0.872		0.000	0.000)	0.000		0.872

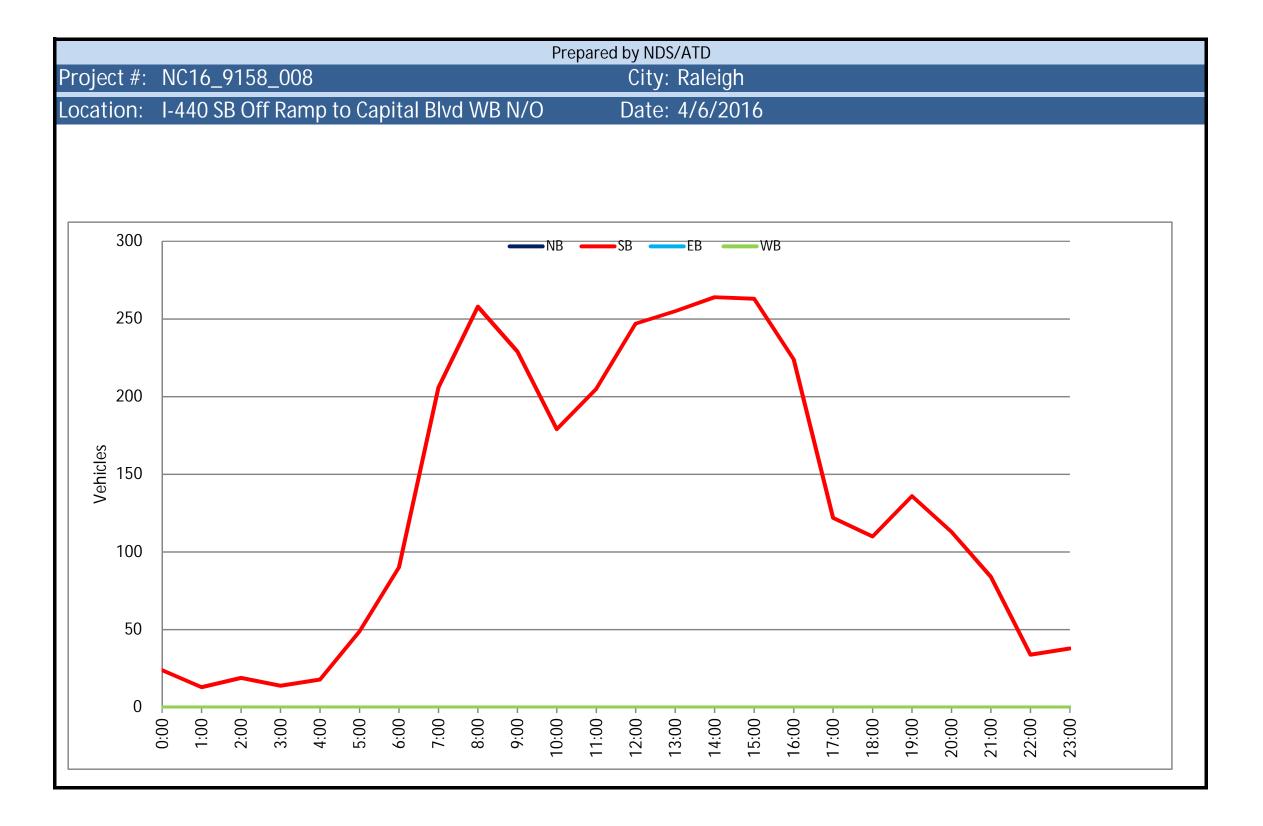


VOLUME

I-440 SB Off Ramp to Capital Blvd WB N/O Capital Blvd

Day: Wednesday Date: 4/6/2016

	DAILY TOTA	ALS	NB 0	SB 3,194	EB 0	WB 0			Total 3,194
AM Period	NB SB	E	B WB	TOTAL	PM Period	NB :	SB EB	B WB	TOTAL
0:00 0:15	0 11 0 5			11 5	12:00 12:15		62 78		62 78
0:30	0 4	2.4		4	12:30 12:45	0 !	54		54
0:45 1:00	0 4	24		4	13:00	0 (53 247 62		53 247 62
1:15 1:30	0 7 0 2			7 2	13:15 13:30		60 67		60 67
1:45	0 0	13		0 13	13:45	0 (66 255		66 255
2:00 2:15	0 8 0 2			8 2	14:00 14:15	0 5	71 53		71 53
2:30 2:45	0 6 0 3	19		6 3 19	14:30 14:45	0 ;	57 33 264		57 83 264
3:00	0 2	19		2	15:00	0 (58		68
3:15 3:30	0 3 4			3 4	15:15 15:30		66 69		66 69
3:45	0 5	14		5 14	15:45	0 (60 263		60 263
4:00 4:15	0 3 1			3 1	16:00 16:15		67 66		67 66
4:30 4:45	0 6	18		6 8 18	16:30 16:45	0	47 44 224		47 44 224
5:00	0 4	10		4	17:00	0 :	32		32
5:15 5:30	0 15 0 10			15 10	17:15 17:30		25 30		25 30
5:45	0 20	49		20 49	17:45	0 3	35 122		35 122
6:00 6:15	0 19 0 15			19 15	18:00 18:15		26 23		26 23
6:30 6:45	0 25 0 31	90		25 31 90	18:30 18:45	0 2	28 33 110		28 33 110
7:00	0 48	90		48	19:00	0	43		43
7:15 7:30	0 57 0 43			57 43	19:15 19:30		40 30		40 30
7:45	0 58	206		58 206	19:45	0 2	23 136		23 136
8:00 8:15	0 63 0 56			63 56	20:00 20:15		24 32		24 32
8:30 8:45	0 76 0 63	258		76 63 258	20:30 20:45	0 2	24 33 113		24 33 113
9:00	0 60	250		60	21:00	0 2	27		27
9:15 9:30	0 58 0 56			58 56	21:15 21:30		22 15		22 15
9:45	0 55	229		55 229	21:45	0 2	20 84		20 84
10:00 10:15	0 40 0 53			40 53	22:00 22:15		10 7		10 7
10:30 10:45	0 35 0 51	179		35 51 179	22:30 22:45		5 12 34		5 12 34
11:00	0 53	1 / 7		53	23:00	0	10		10
11:15 11:30	0 54 0 45			54 45	23:15 23:30		14 7		14 7
11:45	0 53	205		53 205	23:45		7 38		7 38
TOTALS		1304		1304	TOTALS		1890		1890
SPLIT %		100.0%		40.8%	SPLIT %		100.0%		59.2%
	DAILY TOTA	ALS	NB 0	SB 3,194	EB 0	WB 0			Total 3,194
AM 5 1 11		0.00	0				44.15		
AM Peak Hour AM Pk Volume		8:00 258		8:00 258	PM Peak Hour PM Pk Volume		14:45 286		14:45 286
Pk Hr Factor		0.849		0.849	Pk Hr Factor		0.861		0.861
7 - 9 Volume 7 - 9 Peak Hour		464 8:00		464 8:00	4 - 6 Volume 4 - 6 Peak Hour		346 16:00		346 16:00
7 - 9 Pk Volume		258		258	4 - 6 Pk Volume		224		224
Pk Hr Factor	0.000	0.849	0.000 0.000	0.849	Pk Hr Factor	0.000	0.836	0.000 0.000	0.836



Appendix B: Field Review Photographs (Included on CD)



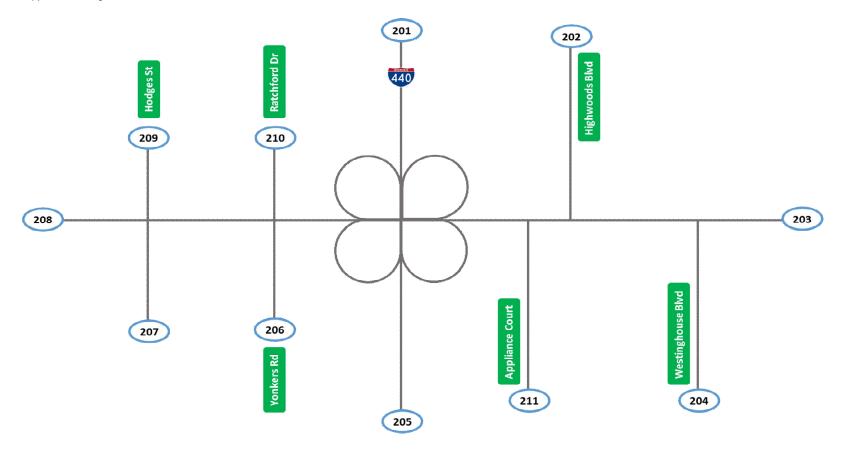


Appendix C:
Origin-Destination Matrices





Appendix C - Origin-Destination Matrices



Appendix C - Origin-Destination Matrices

2016 - AM	201	202	203	204	205	206	207	208	209	210	211	SUM
201		341	860	61	2,955	5	0	182	33	0	63	4500
202	75		85	6	21	2	0	73	13	0	0	275
203	1533	527		42	432	44	1	1488	268	3	0	4338
204	93	32	51		26	3	0	91	16	0	0	312
205	4,917	122	308	23		10	0	337	61	1	21	5800
206	4	4	11	1	5		0	206	37	2	0	270
207	0	0	2	0	0	0		0	0	0	0	2
208	136	158	400	28	195	76	0		126	1	30	1150
209	19	22	55	4	27	11	1	71		0	3	213
210	0	0	2	0	0	51	0	3	1		0	57
211	0	0	0	0	0	0	0	0	0	0		0
SUM	6777	1206	1774	165	3661	202	2	2451	555	7	117	

2016 - PM	201	202	203	204	205	206	207	208	209	210	211	SUM
201		64	1228	52	5175	4	1	131	15	1	29	6700
202	290		292	12	266	6	1	214	25	1	0	1107
203	961	95		74	881	20	3	710	83	4	0	2831
204	52	5	108		47	1	0	38	4	0	0	255
205	3097	16	302	13		9	1	316	37	2	7	3800
206	15	4	77	3	30		0	103	12	2	2	248
207	2	1	10	0	4	1		6	0	0	0	24
208	273	74	1394	59	533	104	6		109	3	26	2581
209	42	11	212	9	81	16	0	148		0	6	525
210	1	0	5	0	2	2	0	8	1		1	20
211	0	0	0	0	0	0	0	0	0	0		0
SUM	4733	270	3628	222	7019	163	12	1674	286	13	71	

Appendix C - Origin-Destination Matrices

2026 - AM	201	202	203	204	205	206	207	208	209	210	211	SUM
201		351	1013	65	3,744	4	0	194	31	0	51	5453
202	77		111	6	15	2	0	82	13	0	0	306
203	1687	580		44	471	48	1	1681	298	3	0	4813
204	102	34	62		25	3	0	100	16	0	0	342
205	6,004	141	417	26		11	0	409	70	1	15	7094
206	2	2	12	1	5		0	233	40	2	0	297
207	0	0	2	0	0	0		0	0	0	0	2
208	146	169	480	30	219	82	0		130	1	24	1281
209	19	22	64	3	29	11	1	81		0	0	230
210	0	0	2	0	0	56	0	2	1		0	61
211	0	0	0	0	0	0	0	0	0	0		0
SUM	8037	1299	2163	175	4508	217	2	2782	599	7	90	

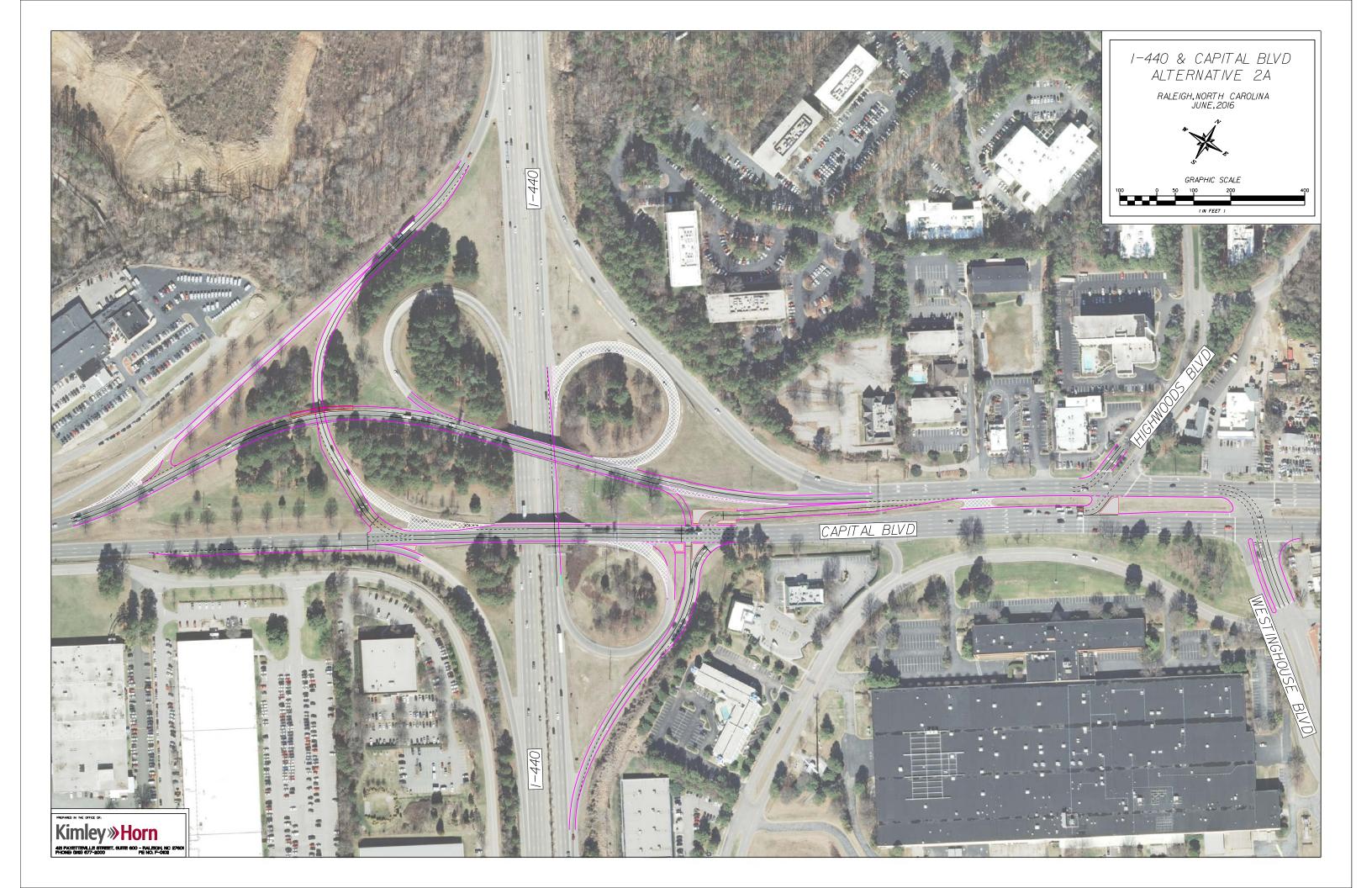
2026 - PM	201	202	203	204	205	206	207	208	209	210	211	SUM
201		64	1394	56	6355	3	0	145	14	1	23	8055
202	312		351	13	300	6	0	250	28	1	0	1261
203	1045	100		79	991	21	2	824	93	4	0	3159
204	56	3	125		51	1	0	43	4	0	0	283
205	3787	18	389	15		10	0	394	43	2	0	4658
206	14	3	87	2	34		0	119	12	2	0	273
207	2	1	11	0	4	1		6	0	0	0	25
208	292	79	1606	65	602	113	4		112	3	19	2895
209	42	10	242	9	91	16	0	167		0	0	577
210	1	0	5	0	2	2	0	9	1		0	20
211	0	0	0	0	0	0	0	0	0	0		0
SUM	5551	278	4210	239	8430	173	6	1957	307	13	42	

Appendix D:

Conceptual Designs and OPCCs for Alternatives 2A, 2B, and 2D







CAMPO Project Estimate

Project: <u>I-440 and Capital Blvd Improvements</u>

Concept.

County:

Wake

Alternate 2A
From: I-440 and Cap

I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Typical Section: Interchange Curb and Gutter and Shoulder

CONSTR. COST \$4,128,300

4,128,300.00

Description	Quantity	Unit	Price	Amount
9 11		T 0		100,000,00
Grading	1	LS	\$ 400,000.00	\$ 400,000.00
Drainage Existing Location				
Curb and Gutter Section	0.5	MI	\$ 275,000.00	\$ 137,500.00
Shoulder Section	1.0	MI	\$ 175,000.00	\$ 175,000.00
Removal of Existing Asphalt Pavement	5,100	SY	\$ 4.00	\$ 20,400.00
New Pavement	7,000	SY	\$ 55.00	\$ 385,000.00
Pavement Resurfacing	3,000	SY	\$ 15.00	\$ 45,000.00
6"Average Asphalt Wedging	1,000	SY	\$ 30.00	\$ 30,000.00
2'-6" Concrete Curb and Gutter	200	LF	\$ 18.00	\$ 3,600.00
1'-6" Concrete Curb and Gutter	2,000	LF	\$ 14.00	\$ 28,000.00
5" Monolithic Concrete Islands	600		\$ 100.00	\$ 60,000.00
Guardrail	800	LF	\$ 15.00	\$ 12,000.00
Guardrail Anchors	10		\$ 2,000.00	\$ 20,000.00
Erosion Control	3	AC	\$ 20,000.00	\$ 52,800.00
Traffic Signals				
New Traffic Signal (Metal Pole)	2	EA	\$ 125,000.00	\$ 250,000.00
Revised Traffic Signal	2		\$ 60,000.00	\$ 120,000.00
Traffic Control	1	LS	\$ 400,000.00	\$ 400,000.00
Thermo and Markers	1		\$ 20,000.00	\$ 20,000.00
Signage	1	MI	\$ 10,000.00	\$ 5,000.00
<u>Structures</u>				
Widening of Existing Bridge on Curve (175'x12')	2,100	SF	\$ 125.00	\$ 262,500.00
Misc. & Mob (15% Strs&Util)	1	LS	\$ 39,400.00	\$ 39,400.00
Misc. & Mob (45% Conceptual)	1		\$ 974,000.00	\$ 974,000.00
	tract Cost		 	\$ 3,440,200.00
Right of '	Way Cost		 	\$ -
Engineering & Public Involvement	ent (20%)		 	\$ 688,100.00

The Consultant has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Consultant at this time and represent only the Consultant's judgment as a design professional familiar with the construction industry. The Consultant cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Full Project Implementation Cost



CAMPO Project Estimate

Project: <u>I-440 and Capital Blvd Improvements</u>

Alternate 2B

From: I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Typical Section: Interchange Curb and Gutter and Shoulder

Concept. County: Wake

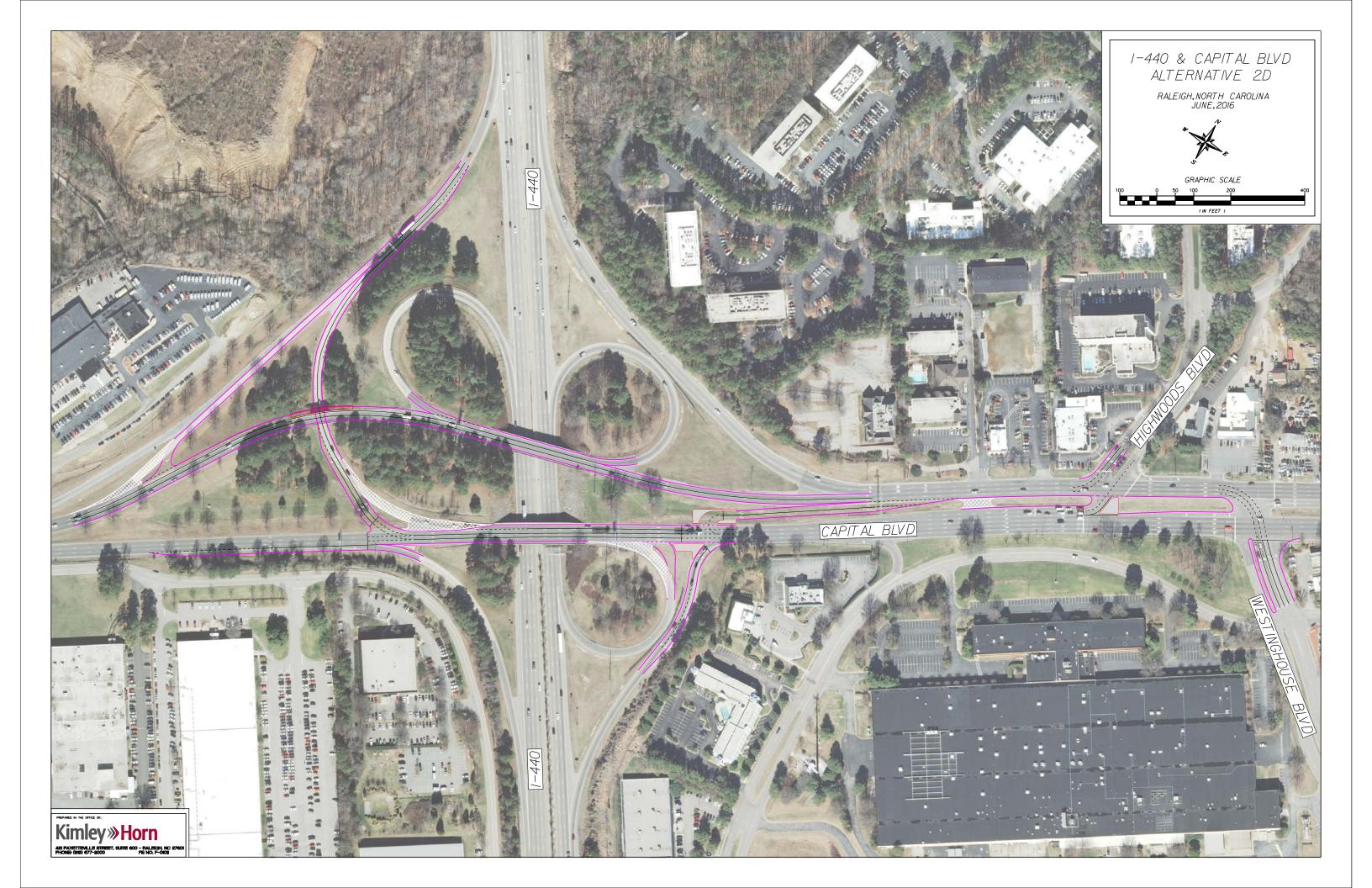
\$3,885,900

Description	Quantity	Unit		Price	Amount
			<u> </u>		
Grading	1	LS	\$	400,000.00	\$ 400,000.00
Drainage Existing Location					
Curb and Gutter Section	0.5	MI	\$	275,000.00	\$ 137,500.00
Shoulder Section	1.0	MI	\$	175,000.00	\$ 175,000.00
Removal of Existing Asphalt Pavement	4,800	SY	\$	4.00	\$ 19,200.00
New Pavement	5,600	SY	\$	55.00	\$ 308,000.00
Pavement Resurfacing	2,000	SY	\$	15.00	\$ 30,000.00
6"Average Asphalt Wedging	500	SY	\$	30.00	\$ 15,000.00
2'-6" Concrete Curb and Gutter	600	LF	\$	18.00	\$ 10,800.00
5" Monolithic Concrete Islands	450	SY	\$	100.00	\$ 45,000.00
Guardrail	1,100	LF	\$	15.00	\$ 16,500.00
Guardrail Anchors	12	EA	\$	2,000.00	\$ 24,000.00
				·	
Erosion Control	2	AC	\$	20,000.00	\$ 44,000.00
Traffic Signals					
New Traffic Signal (Metal Pole)	2	EA	\$	125,000.00	\$ 250,000.00
Revised Traffic Signal	2	EA	\$	60,000.00	\$ 120,000.00
Traffic Control	1	LS	\$	400,000.00	\$ 400,000.00
Thermo and Markers	1	MI	\$	20,000.00	\$ 20,000.00
Signage	1	MI	\$	10,000.00	\$ 10,000.00
Structures					
Widening of Existing Bridge on Curve (175'x12')	2,100	SF	\$	125.00	\$ 262,500.00
Misc. & Mob (15% Strs&Util)	1	LS	\$	39,400.00	\$ 39,400.00
Misc. & Mob (45% Conceptual)	1	LS	\$	911,300.00	\$ 911,300.00
	st				\$ 3,238,200.00
Right of Way Co	st				\$ -
Engineering & Public Involvement (20%)	<u>o)</u>				\$ 647,700.00

The Consultant has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Consultant at this time and represent only the Consultant's judgment as a design professional familiar with the construction industry. The Consultant cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

.....

Full Project Implementation Cost



CAMPO Project Estimate

Project: **I-440 and Capital Blvd Improvements**

Alternate 2D

From: I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Typical Section: Interchange Curb and Gutter and Shoulder

Concept. County: CONSTR. COST

\$4,031,300

Description	Quantity	Unit		Price		Amount
Grading	1	LS	\$	400,000.00	\$	400,000.00
Oraung	1	Lo	φ	400,000.00	Ф	400,000.00
Drainage Existing Location						
Curb and Gutter Section	0.5	MI	\$	275,000.00	\$	137,500.00
Shoulder Section	1.0	MI	\$	175,000.00	\$	175,000.0
Removal of Existing Asphalt Pavement	2,500	SY	\$	4.00	\$	10,000.00
New Pavement	6,500	SY	\$	55.00	\$	357,500.00
Pavement Resurfacing	2,000	SY	\$	15.00	\$	30,000.0
6"Average Asphalt Wedging	500	SY	\$	30.00	\$	15,000.00
2'-6" Concrete Curb and Gutter	200	LF	\$	18.00	\$	3,600.00
1'-6" Concrete Curb and Gutter	2,000	LF	\$	14.00	\$	28,000.0
5" Monolithic Concrete Islands	600	SY	\$	100.00	\$	60,000.0
Guardrail	800	LF	\$	15.00	\$	12,000.0
Guardrail Anchors	10	EA	\$	2,000.00	\$	20,000.0
Erosion Control	3	AC	\$	20,000.00	\$	60,000.0
Traffic Signals						
New Traffic Signal (Metal Pole)	2	EA	\$	125,000.00	\$	250,000.0
Revised Traffic Signal	2	EA	\$	60,000.00	\$	120,000.0
Traffic Control	1	LS	\$	400,000.00	\$	400,000.0
Thermo and Markers	1	MI	\$	20,000.00	\$	20,000.0
Signage	1	MI	\$	10,000.00	\$	10,000.0
Structures						
Widening of Existing Bridge on Curve (175'x12')	2,100	SF	\$	125.00	\$	262,500.0
Misc. & Mob (15% Strs&Util)	1	LS	\$	39,400.00	\$	39,400.0
Misc. & Mob (45% Conceptual)	1	LS	\$	948,900.00	\$	948,900.0
Contra					\$	3,359,400.00
	•				\$	-
Engineering & Public Involvemen	<u>t (20%)</u>				\$	671,900.0

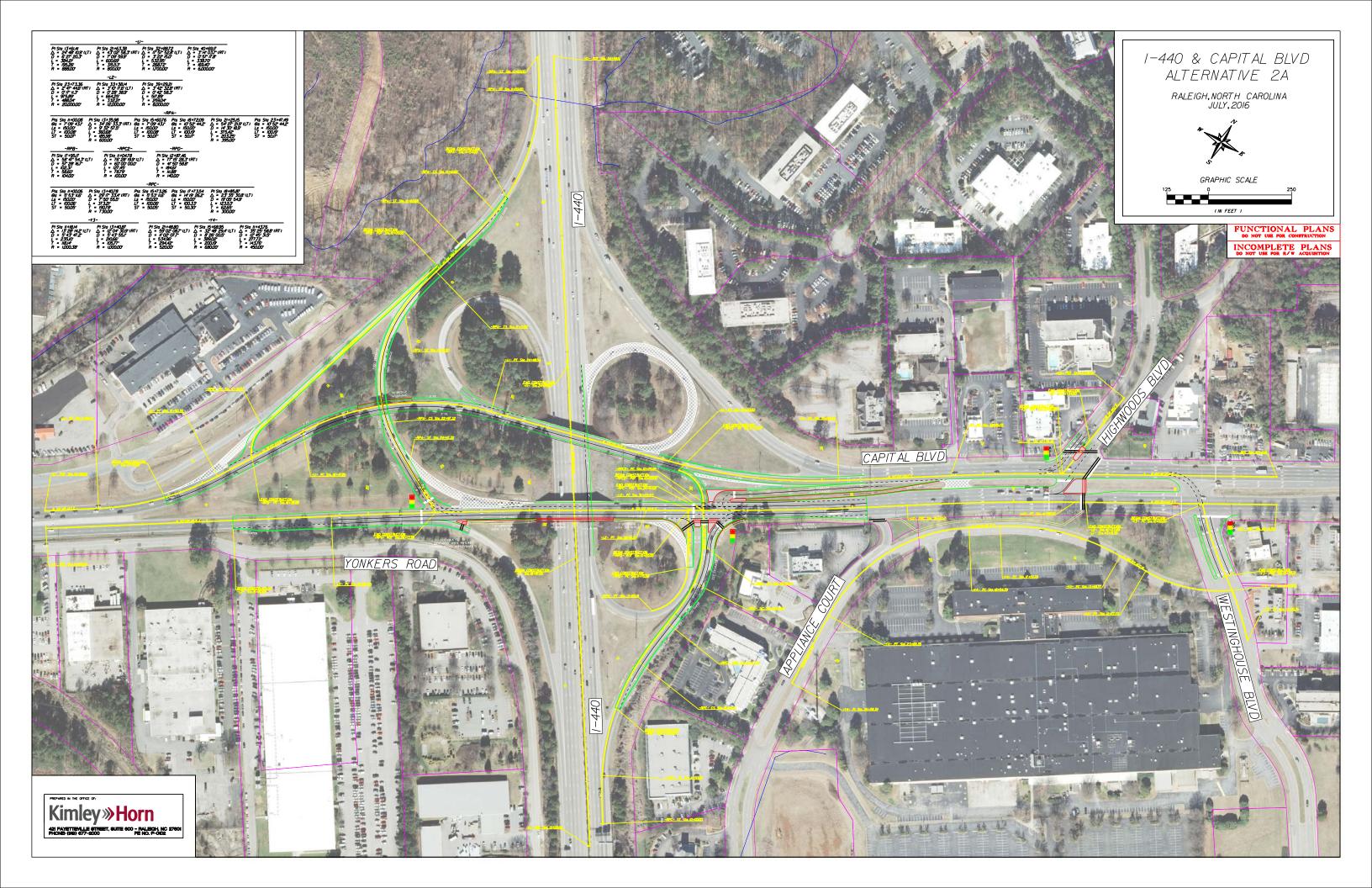
Engineering & Public Involvement (20%) 671,900.00 Full Project Implementation Cost 4,031,300.00

Appendix E:

Functional Designs and OPCCs for Alternatives 2A and 2B







County: Wake

Project: I-440 and Capital Boulevard Improvements

Description: I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Alternative: Alternative 2A

mlay Horn

CONSTR. COST \$4,532,466

Prepared By: Kimley-Horn Requested By: CAMPO

Line		Sec						
Item	Des	No.	Description	Quantity	Unit	Price		Amount
		G	Grading	1	LS	\$ 300,000.00	\$	300,000.00
		D	Curb and Gutter Section	0.5	Miles	\$ 275,000.00	\$	137,500.00
		D	Shoulder Section	1.0	Miles	\$ 275,000.00	\$	275,000.00
		D	N Danner and	7,000	CV	¢ 55.00	¢.	124 500 00
		P	New Pavement	7,900	SY	\$ 55.00	\$	434,500.00
		P	Pavement Resurfacing (3")	2,600	SY	\$ 15.00	\$	39,000.00
		P	6"Average Asphalt Wedging	300	SY	\$ 30.00	\$	9,000.00
		G	1'-6" Concrete Curb and Gutter	1,300	LF	\$ 14.00	\$	18,200.00
		G	2'-6" Concrete Curb and Gutter	700	LF	\$ 15.00	\$	10,500.00
		G	4" Concrete Sidewalk	1,100	SY	\$ 28.00	\$	30,800.00
		G	Curb Ramps	16	Each	\$ 2,500.00	\$	40,000.00
		G	5" Monolithic Islands	700	SY	\$ 100.00	\$	70,000.00
		G	Concrete Barrier	90	LF	\$ 90.00	\$	8,100.00
		G	Guardrail	600	LF	\$ 15.00	\$	9,000.00
		G	Guardrail Anchors, Type GRAU 350	2	Each	\$ 2,000.00	\$	4,000.00
		G	Guardrail Anchors, Type CAT-1	2	Each	\$ 800.00	\$	1,600.00
		G	Guardrail Anchors, Type III	4	Each	\$ 500.00	\$	2,000.00
		G	Erosion Control	4	Acres	\$ 20,000.00	\$	76,000.00
		Y	Traffic Signals (New Metal Pole)	2	Each	\$125,000.00	\$	250,000.00
		Y	Modify Traffic Signals	2	Each	\$ 60,000.00	\$	120,000.00
		Y	Traffic Control (-L- Line)	1.0	Miles	\$ 350,000.00	\$	350,000.00
		Y	Traffic Control (-Y- Lines)	0.1	Miles	\$ 150,000.00	\$	15,000.00
		Y	Traffic Control (Ramps)	0.4	Miles	\$ 100,000.00	\$	40,000.00
		G	Thermo and Markers (-L- Line)	0.8	Miles	\$ 30,000.00	\$	24,000.00
		G	Thermo and Markers (-Y- Lines)	0.1	Miles	\$ 30,000.00	\$	3,000.00
		G	Thermo and Markers (Ramps)	0.4	Miles	\$ 12,000.00	\$	4,800.00
			_					
		~	Structures CR 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6.10-	~~	h 127.5		0.00 700 7
		S	Widening of Existing SB Bridge (175'x12')	2,100	SF	\$ 125.00	\$	262,500.00
		S	Widening of Existing NB Bridge (240'x10')	2,400	SF	\$ 125.00	\$	300,000.00
			Misc. & Mob (15% Strs&Util)				\$	84,375.00
			Misc. & Mob (45% Functional)				\$	1,022,400.00

 Contract Cost
 \$ 3,941,275.00

 E. & C. 15%
 \$ 591,191.25

 Construction Cost
 \$ 4,532,466.25

County: Wake

Project: I-440 and Capital Boulevard Improvements

Description: I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Alternative: Alternative 2A without Sidewalks

\$4,041,002

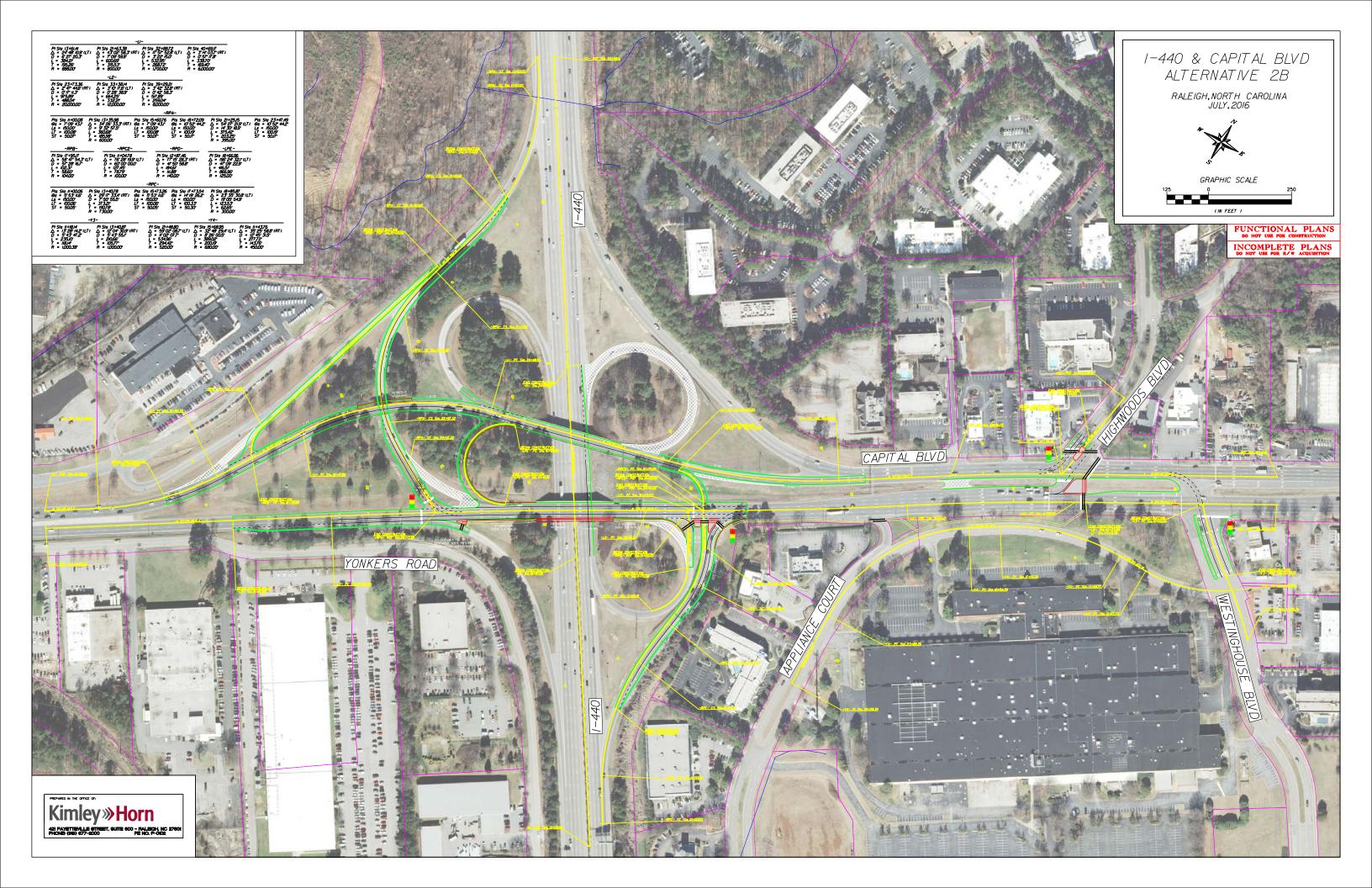
Prepared By: Kimley-Horn Requested By: CAMPO

T4		Sec					
item	Des	No.	Description	Quantity	Unit	Price	Amount
		G	Grading	1	LS	\$ 300,000.00	\$ 300,000.00
		D	Curb and Gutter Section	0.5	Miles	\$ 275,000.00	\$ 137,500.00
		D	Shoulder Section	1.0	Miles	\$ 275,000.00	\$ 275,000.00
		P	New Pavement	7,900	SY	\$ 55.00	\$ 434,500.00
		P	Pavement Resurfacing (3")	2,600	SY	\$ 15.00	\$ 39,000.00
		P	6"Average Asphalt Wedging	300	SY	\$ 30.00	\$ 9,000.00
		G	1'-6" Concrete Curb and Gutter	1,300	LF	\$ 14.00	\$ 18,200.00
		G	2'-6" Concrete Curb and Gutter	700	LF	\$ 15.00	\$ 10,500.00
		G	Curb Ramps	4	Each	\$ 2,500.00	\$ 10,000.00
		G	5" Monolithic Islands	700	SY	\$ 100.00	\$ 70,000.00
		G	Concrete Barrier	90	LF	\$ 90.00	\$ 8,100.00
		G	Guardrail	600	LF	\$ 15.00	\$ 9,000.00
		G	Guardrail Anchors, Type GRAU 350	2	Each	\$ 2,000.00	\$ 4,000.00
		G	Guardrail Anchors, Type CAT-1	2	Each	\$ 800.00	\$ 1,600.00
		G	Guardrail Anchors, Type III	4	Each	\$ 500.00	\$ 2,000.00
		G	Erosion Control	4	Acres	\$ 20,000.00	\$ 80,000.00
		Y	Traffic Signals (New Metal Pole)	2	Each	\$125,000.00	\$ 250,000.00
		Y	Modify Traffic Signals	2	Each	\$ 60,000.00	\$ 120,000.00
		Y	Traffic Control (-L- Line)	1.0	Miles	\$ 350,000.00	\$ 350,000.00
		Y	Traffic Control (-Y- Lines)	0.1	Miles	\$ 150,000.00	\$ 15,000.00
		Y	Traffic Control (Ramps)	0.4	Miles	\$ 100,000.00	\$ 40,000.00
		G	Thermo and Markers (-L- Line)	0.8	Miles	\$ 30,000.00	\$ 24,000.00
		G	Thermo and Markers (-Y- Lines)	0.1	Miles	\$ 30,000.00	\$ 3,000.00
		G	Thermo and Markers (Ramps)	0.4	Miles	\$ 12,000.00	\$ 4,800.00
			<u>Structures</u>				
		S	Widening of Existing SB Bridge (175'x12')	2,100	SF	\$ 125.00	\$ 262,500.00
			Misc. & Mob (15% Strs&Util)				\$ 39,375.00
			Misc. & Mob (15% Sus&Cttl) Misc. & Mob (45% Functional)				\$ 996,840.00

 Contract Cost
 \$ 3,513,915.00

 E. & C. 15%
 \$ 527,087.25

 Construction Cost
 \$ 4,041,002.25



County: Wake

Project: I-440 and Capital Boulevard Improvements

Description: I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Alternative: Alternative 2B

\$4,557,479

Prepared By: Kimley-Horn Requested By: CAMPO

Line		Sec				Ī		
Item	Des	No.	Description	Quantity	Unit	Price		Amount
		G	Grading	1.0	LS	\$ 400,000.00	\$	400,000.00
		D	Curb and Gutter Section	0.5	Miles	\$ 275,000.00	\$	137,500.00
		D	Shoulder Section	1.0	Miles	\$ 275,000.00	\$	275,000.00
		P	New Pavement	6,700	SY	\$ 55.00	\$	368,500.00
		P	Pavement Resurfacing (3")	2,900	SY	\$ 15.00		43,500.00
		P	6"Average Asphalt Wedging	300	SY	\$ 30.00	\$	9,000.00
			5 1 5 5					,
		G	2'-6" Concrete Curb and Gutter	1,200	LF	\$ 15.00	\$	18,000.00
		G	4" Concrete Sidewalk	1,100	SY	\$ 28.00	\$	30,800.00
		G	Curb Ramps	16	Each	\$ 2,500.00	\$	40,000.00
		G	5" Monolithic Islands	500	SY	\$ 100.00	\$	50,000.00
		G	Concrete Barrier	90	LF	\$ 90.00	\$	8,100.00
		G	Guardrail	600	LF	\$ 15.00	\$	9,000.00
		G	Guardrail Anchors, Type GRAU 350	3	Each	\$ 2,000.00	\$	6,000.00
		G	Guardrail Anchors, Type CAT-1	2	Each	\$ 800.00	\$	1,600.00
		G	Guardrail Anchors, Type III	4	Each	\$ 1,500.00	\$	6,000.00
		G	Erosion Control	4	Acres	\$ 20,000.00	\$	70,000.00
						.		
		Y	Traffic Signals (New Metal Pole)	2	Each	\$ 125,000.00	\$	250,000.00
		Y	Modify Traffic Signals	2	Each	\$ 60,000.00	\$	120,000.00
				1.0	3.611	A. 25 0.000.00	Φ.	250 000 00
		Y	Traffic Control (-L- Line)	1.0	Miles	\$ 350,000.00	\$	350,000.00
		Y	Traffic Control (-Y- Lines)	0.1	Miles	\$ 150,000.00	\$	15,000.00
		Y	Traffic Control (Ramps)	0.4	Miles	\$ 100,000.00	\$	40,000.00
		G	Thermo and Markers (-L- Line)	0.8	Miles	\$ 30,000.00	\$	24,000.00
		G	Thermo and Markers (-Y- Lines)	0.2	Miles	\$ 30,000.00	\$	6,600.00
		G	Thermo and Markers (Ramps)	0.7	Miles	\$ 12,000.00	\$	8,400.00
			1 /	1				·
			Structures					
		S	Widening of Existing SB Bridge (175'x12')	2,100	SF	\$ 125.00	\$	262,500.00
		S	Widening of Existing NB Bridge (240'x10')	2,400	SF	\$ 125.00	\$	300,000.00
			Misc. & Mob (15% Strs&Util)				\$	84,375.00
			Misc. & Mob (45% Functional)				\$	1,029,150.00
<u> </u>			Contract Con				Ф	2,062,025,00

 Contract Cost
 \$ 3,963,025.00

 E. & C. 15%
 \$ 594,453.75

 Construction Cost
 \$ 4,557,478.75

County: Wake

Project: I-440 and Capital Boulevard Improvements

Description: I-440 and Capital Blvd including Highwoods-Capital Blvd Intersection

Alternative: Alternative 2B without Sidewalks

\$4,017,807

Prepared By: Kimley-Horn Requested By: CAMPO

Line		Sec					
Item	Des	No.	Description	Quantity	Unit	Price	Amount
		G	Grading	1.0	LS	\$ 400,000.00	\$ 400,000.00
		D	Curb and Gutter Section	0.5	Miles	\$ 275,000.00	\$ 137,500.00
		D	Shoulder Section	1.0	Miles	\$ 275,000.00	\$ 275,000.00
		ע	Shoulder Section	1.0	Milles	\$ 273,000.00	\$ 273,000.00
		P	New Pavement	6,638	SY	\$ 55.00	\$ 365,090.00
		P	Pavement Resurfacing (3")	2,900	SY	\$ 15.00	\$ 43,500.00
		P	6"Average Asphalt Wedging	300	SY	\$ 30.00	\$ 9,000.00
		G	2'-6" Concrete Curb and Gutter	700	LF	\$ 15.00	\$ 10,500.00
		G	Curb Ramps	4	Each	\$ 2,500.00	\$ 10,000.00
		G	5" Monolithic Islands	500	SY	\$ 100.00	\$ 50,000.00
		G	Concrete Barrier	90	LF	\$ 90.00	\$ 8,100.00
		G	Guardrail	600	LF	\$ 15.00	\$ 9,000.00
		G	Guardrail Anchors, Type GRAU 350	3	Each	\$ 2,000.00	\$ 6,000.00
		G	Guardrail Anchors, Type CAT-1	2	Each	\$ 800.00	\$ 1,600.00
		G	Guardrail Anchors, Type III	4	Each	\$ 500.00	\$ 2,000.00
		G	Erosion Control	3	Acres	\$ 20,000.00	\$ 60,000.00
		Y	Traffic Signals (New Metal Pole)	2	Each	\$ 125,000.00	\$ 250,000.00
		Y	Modify Traffic Signals	2	Each	\$ 60,000.00	\$ 120,000.00
		1	Would Harte Signals	2	Lacii	φ 00,000.00	Ψ 120,000.00
		Y	Traffic Control (-L- Line)	1.0	Miles	\$ 350,000.00	\$ 350,000.00
		Y	Traffic Control (-Y- Lines)	0.1	Miles	\$ 150,000.00	\$ 15,000.00
		Y	Traffic Control (Ramps)	0.4	Miles	\$ 100,000.00	\$ 40,000.00
		G	Thermo and Markers (-L- Line)	0.8	Miles	\$ 30,000.00	\$ 24,000.00
		G	Thermo and Markers (-Y- Lines)	0.2	Miles	\$ 30,000.00	\$ 6,600.00
		G	Thermo and Markers (Ramps)	0.7	Miles	\$ 12,000.00	\$ 8,400.00
		_	<u>Structures</u>				
		S	Widening of Existing SB Bridge (175'x12')	2,100	SF	\$ 125.00	\$ 262,500.00
			Misc. & Mob (15% Strs&Util)				\$ 39,375.00
			Misc. & Mob (45% Functional)				\$ 990,580.50

 Contract Cost
 \$ 3,493,745.50

 E. & C. 15%
 \$ 524,061.83

 Construction Cost
 \$ 4,017,807.33

Appendix F: TransModeler Analysis Files (Included on CD)





Appendix G:
Digital Microstation Design Files
(Included on CD)



