Feasibility Study

I-95/I-85 Interchange Feasibility Study

Petersburg, Virginia

April 2015

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

Feasibility Study

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Petersburg, Virginia

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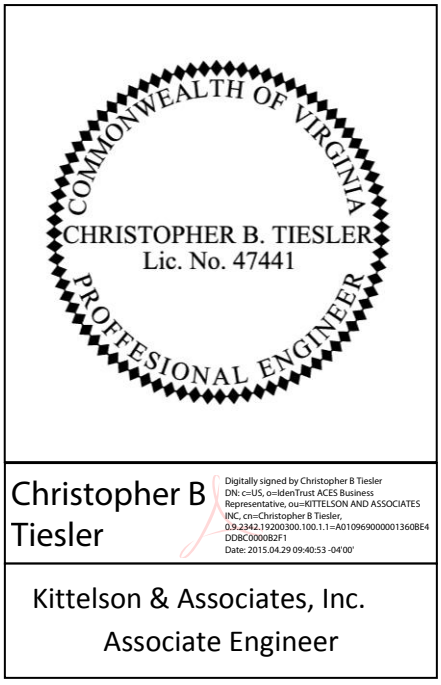


TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

Section 1
Executive Summary

EXECUTIVE SUMMARY

The Virginia Department of Transportation Central Region Operations (VDOT-CRO) had Kittelson & Associates, Inc. (KAI) conduct a feasibility analysis of three potential safety and operational projects at the I-95/I-85 interchange in Petersburg, Virginia. The analysis considered and built upon information from a 2013 study of the I-95 corridor.

The work efforts generally included evaluating historical crash data, reviewing and assessing previous conceptual projects (developed by others), and developing new concepts and/or refining prior concepts. Concept revisions and refinements incorporated contemporary planning, operations, design, and safety performance considerations while considering three dimensional roadway design principles. Order of magnitude cost opinions were also developed.

BACKGROUND

- Interstates 95 and 85, as well as Route 460 and US 301 (S. Crater Road), converge in Petersburg, Virginia in a complex series of interchanges developed in the mid-1950's as part of the Richmond-Petersburg Turnpike. These interchanges reflect their vintage and do not necessarily reflect contemporary freeway and interchange planning, operations, design, and safety performance considerations.
- The designs exhibit short acceleration/deceleration lanes, relatively small radius turns, and relatively short weave/merge areas.
- The I-95/I-85 Interchange Roadway Safety Assessment Report published by Kimley-Horn & Associates, Inc. (KHA) in March 2013 was intended to be the first phase of an eventual larger I-95/I-85/Route 460 Interchange Area operations and conceptual design study that would update comprehensive planning study was conducted in the study same area between 1998 and 2000 and identified a number of "capacity and safety issues" *[sic]*.
- <u>Issue #1: I-85 Northbound Off-Ramp to I-95 Southbound Weaving Section</u>: The configuration of the I-85 northbound off-ramp to I-95 southbound movement results in periodic congestion/queuing leading into and through this section. The configuration includes a 250-foot weaving segment (between the I-85 northbound off-ramp merge with the I-95 southbound collector-distributor road and the Graham Road off-ramp) with an approximately 7% average uphill grade of the I-85 northbound off-ramp itself.
    - KHA identified a long-term concept (Concept #1) that included the following changes/modifications:
        - Close the existing I-95 southbound off-ramp to Graham Road;
        - Close the existing I-95 southbound on-ramp from S. Crater Road;
        - Reconstruct the Graham Road and S. Crater Road intersection and the on-ramp to southbound I-95 to allow southbound left-turn movement from S. Crater Road; and,
        - Construct new I-95 off-ramp to S. Crater Road.

- Issue #2: S. Crater Road to I-95 Northbound Weaving Section: An approximately 360-foot weaving section exists between the S. Crater Road on-ramp to I-95 northbound movement and the off-ramp to the E. Wythe Street/E. Washington Street couplet in downtown Petersburg.
    - KHA identified a long-term concept (Concept #2) to address this issue that included the following changes/modifications:
        - Close the existing I-95 northbound on-ramp from S. Crater Road and reuse the existing Winfield Road to relocate the northbound I-95 on-ramp connection to County Drive (Route 460 Bus.).
        - Reconstruct two intersections to facilitate new traffic movements:
            - Winfield Road/County Drive (Route 460 Bus.)
            - Winfield Road/Crater Road
- Issue #3: I-95 Northbound Off-Ramp to I-85 Southbound Ramp Radius and Bridge Clearance: The existing I-95 northbound to I-85 southbound ramp has a 200 foot radius curve and the current bridge clearance for the ramp beneath I-95 is 13 feet 10 inches; it does not meet current Federal Highway Administration (FHWA) minimum clearance requirements for interstates (16 feet).
    - KHA identified a long-term concept (Concept #3) to address this issue that included the following changes/modifications:
        - Close the existing I-95 northbound off-ramp to I-85 southbound and construct a new flyover ramp (left-hand exit) from I-95 northbound to I-85 southbound.

INITIAL CONCEPT EVALUATION

- KAI reviewed each long-term Concept to consider its feasibility. Criteria considered included:
    - Potential upstream and downstream impacts
    - Intersection/turn lane improvements
    - Design year peak hour operational performance (intersections)
        - LOS D or better
    - Application of contemporary planning, operations, design, and safety performance features
    - Environmental, right-of-way, and utility impacts
    - Constructability
    - Estimated Cost
- KAI identified issues/questions that could not be immediately determined without further investigation, analysis, and/or refinement.

CONCEPT REVISIONS

- KAI revised each original concept to reflect contemporary planning, operations, design, and safety performance considerations. The revisions consider three dimensional roadway design principles.

- An iterative process of refining the concepts included:
  - Developing forecast design year 2040 weekday a.m. and p.m. peak hour traffic volumes
  - Reassigning forecast traffic to the transportation network based for each Concept considered
  - Identifying necessary intersection-level details such as appropriate intersection control and sizing of turn lanes
  - Confirming geometric design details (turn lanes/storages, horizontal and vertical alignment, etc.)
  - Retaining current network connectivity to ensure no Concept would eliminate connections that exist today
- KAI developed two additional evaluated the compatibility of individual concepts and potential for phasing improvements.
- Each revised Concept carried forward was ultimately refined and illustrated by KAI as a single-line taping. The tapings depict concepts reflecting contemporary planning, operations, design, and safety performance considerations, as well as three dimensional roadway design principles.
- Each configuration developed through this process helps clarify each Concept's impact, cost, and feasibility with respect to the criteria discussed previously.

OPERATIONAL ANALYSIS

- VDOT staff selected a design year of 2040 to assess the potential design life of the concepts.
- Compounded annual growth (provided by VDOT) was adjusted to address identified imbalances (caused by different growth rates) that occurred between closely-spaced intersections.
- KAI performed an operational analysis for each refined Concept as well as a no-build condition.
- Each refined concept is forecast to meet VDOT performance criteria in the design year.

COST ESTIMATES

- Base mapping was developed to serve as a basis for developing the estimates. Data sources investigated to inform the mapping include:
  - VDOT record drawings
  - City of Petersburg GIS shape file data
  - US Fish and Wildlife's National Wetland Inventory (NWI) mapping
  - US Department of Agriculture Natural Resources Conversation Service Web Soil Survey
  - Virginia Game and Inland Fisheries (VaFWIS) database
  - Virginia Department of Conservation and Recreation (DCR) Natural Heritage Program database
  - Virginia Department of Historic Resource's (VDHR) Virginia Cultural Resources Information System (V-CRIS)
  - Environmental Data Resources, Inc. with GeoCheck
- When possible, Concepts were broken out into smaller "Projects" when stand-alone improvements/modifications could be isolated. The ability to isolate Projects was governed by a desire to retain all existing movements/connections, thereby avoiding a long-term loss of connectivity on the roadway network.

- Refined Concept #1**:** This Concept has been broken out into three separate projects (A, B, and C).
    - Project A would eliminate the loop ramp to I-95 southbound from S. Crater Road, realign Graham Road and the I-95 on-ramp to intersect, and create separate north- and southbound left-turn lanes on S. Crater Road.
        - Project A Cost: $3.3M
    - Project B would eliminate the I-95 southbound C-D road off-ramp to Graham Road and construct a new off-ramp to S. Crater Road from the Route 460 Bus./I-95 southbound split.
        - Project B Cost: 8.1M
    - Project C would use the area in the vacated loop ramp as a potential future location for a park and ride lot. Assuming Graham Road is realigned, there would be enough area to provide roughly 150 parking spaces.
        - Project C Cost: $750,000
    - **Total Refined Concept #1 Cost: $12.15M**
- Refined Concept #2: This Concept has been broken out into two separate projects (A and B).
    - Project A includes intersection improvements on S. Crater Road north of I-95, Winfield Road corridor improvements, and modifications to the Winfield Road/Route 460 Bus. intersection as well as the I-95 northbound on-ramp and C-D road.
        - Project A Cost: $11.6M
    - Project B includes improvements to the I-95 southbound off-ramp to Graham Road, Graham Road widening, and modifications to the Graham Road/S. Crater Road intersection.
        - Project B Cost: $3.8M
        - Note: Project B does not directly address the identified weaving issue on the I-95 NB C-D road. Rather, Project B includes improvements that address operational/ capacity issues identified in the no-build analysis on the south side of I-95 at the Graham Road/ I-95 Off-Ramp and Graham Road/S. Crater Road intersections. It should be noted that this particular project would largely conflict with Project A from Refined Concept #1, or if implemented prior to Project A from Refined Concept #1 require significant reconstruction and additional cost.
    - **Total Refined Concept #2 Cost: $15.4M**
- Refined Concept #3: This Concept would provide a flyover ramp to serve I-95 northbound to I-85 southbound movements and is designed with a right-hand exit configuration.
    - **Total** Refined **Concept #3 Cost: $92.4M**
- Refined Concept #1 & #2 Combined: This Concept would combine Refined Concepts #1 and #2, but also provides a new two-way extension of Route 460 Bus. from I-95 to S. Crater Road. This Concept has been broken out into four separate projects (A, B, C, and D).
    - Project A is similar to Project A of Refined Concept #1 discussed earlier.
        - Project A Cost: $3.3M

- Project B is similar to Project A of Refined Concept #2 except that it does not include improvements (widening) to Winfield Road to the same extent or to the County Road corridor.
  - Project B Cost: $11.6M
- Project C includes the elimination of the I-95 southbound off-ramp to Graham Road (similar to Project B of Refined Concept #1), but creates a new intersection with the extension of Route 460 Bus. as opposed to a free-flow off-ramp connection to S. Crater Road.
  - Project C Cost: $18.5M
- Project D would use the area in the vacated loop ramp as a potential future location for a park and ride lot. Assuming Graham Road is realigned, there would be enough area to provide roughly 150 parking spaces.
  - Project D Cost: $750,000
- **Total Refined Concept #1 & #2 Combined Cost: $34.15M**

- Combined Concept: This Concept would merge Refined Concept #1 & #2 Combined with Refined Concept #3.
  - **Total Combined Concept Cost: $125-130M**
  - Strategically phasing improvements (assuming the "Combined Concept" would be constructed in several phases and not as one project) and anticipating future construction could help minimize reconstruction efforts/costs.

Section 2
Introduction

INTRODUCTION

The Virginia Department of Transportation Central Region Operations (VDOT-CRO) had Kittelson & Associates, Inc. (KAI) conduct a feasibility analysis of three potential safety and operational projects at the I-95/I-85 interchange in Petersburg, Virginia. The analysis considered and built upon information from a 2013 study of the I-95 corridor.

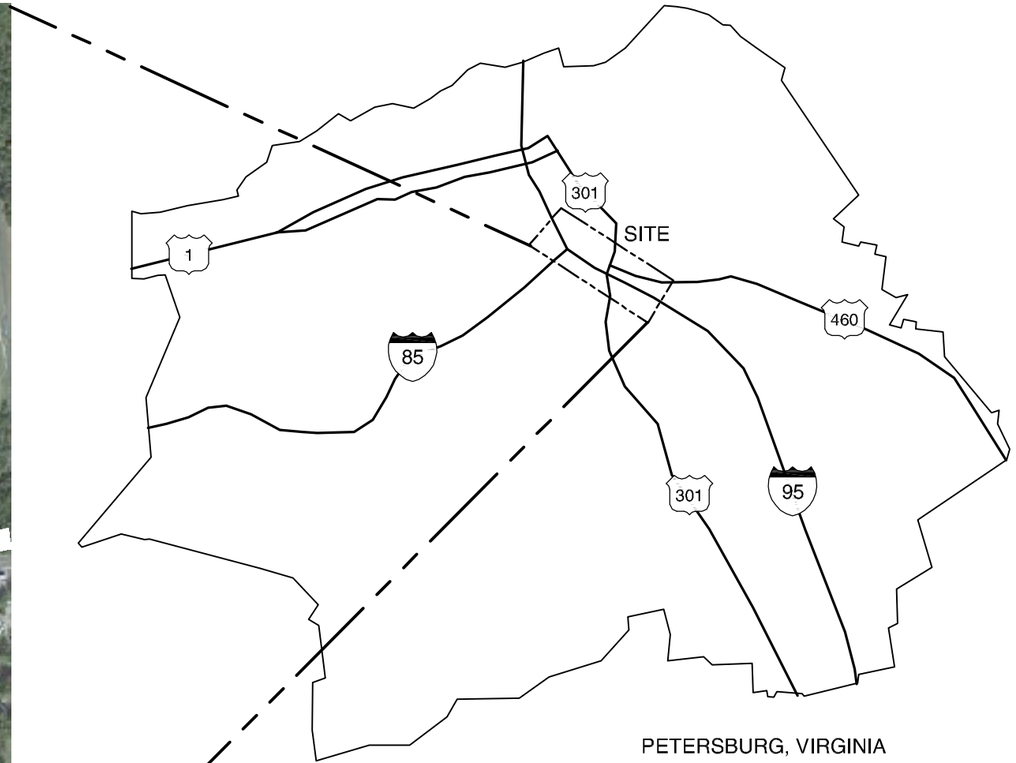
The work efforts generally included evaluating historical crash data, reviewing and assessing previous conceptual projects (developed by others), and developing new concepts and/or refining prior concepts. Concept revisions and refinements incorporated contemporary planning, operations, design, and safety performance considerations while considering three dimensional roadway design principles. Order of magnitude cost opinions were also developed.

The following key objectives guided the project team and VDOT in identifying and refining potential projects at the I-95/I-85 interchange and adjacent intersections/interchanges:

- Considering long-term feasibility of identified projects through year of 2040
- Address documented existing interchange/intersection operations and safety performance
- Minimize potential right-of-way, environmental, and utility impacts

Study Area

The study area is primarily focused on the I-95/I-85 interchange itself, though the close proximity of adjacent interchanges necessitates considering the interchanges and the adjoining local street network. **Figure 1** illustrates the study limits.



SITE VICINITY MAP
PETERSBURG, VIRGINIA

FIGURE 1

KITTELSON & ASSOCIATES, INC.
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Section 3
Background & Contextual Evaluation

BACKGROUND & CONTEXTUAL EVALUATION

Evaluating existing conditions helps to better understand current operational and geometric characteristics of the I-95/I-85 interchange and surrounding roadways within the study area. Reviewing previous studies provides a base from which to begin in assessing possible solutions either by refining prior ideas or considering additional concepts.

To better understand prevailing conditions in the study area, Kittelson and Associates, Inc. (KAI) staff reviewed of previous studies and collected additional traffic data (beyond that originally available and provided by VDOT) to document current issues, conditions, and previously identified concepts. KAI considered the following information from VDOT to evaluate the study area:

- Intersection turning movement counts
- Average Daily Traffic (ADT) counts
- Intersection and roadway geometry
- Traffic observations during the a.m. and p.m. peak hours
- Reported crash history from 2008 through 2013
- Aerial imagery

KAI staff visited the study area in July 2014 to collect information regarding field conditions, adjacent land uses, and existing traffic operations.

BACKGROUND

Interstates 95 and 85, as well as Route 460 and US 301 (S. Crater Road), converge in Petersburg, Virginia in a complex series of interchanges developed in the mid-1950's as part of the Richmond-Petersburg Turnpike. These interchanges reflect their vintage and do not necessarily reflect contemporary freeway and interchange planning, operations, design, and safety performance considerations. The designs exhibit short acceleration/deceleration lanes, relatively small radius turns, and relatively short weave/merge areas.

The *I-95/I-85 Interchange Roadway Safety Assessment Report* published by Kimley-Horn & Associates, Inc. (KHA) in March 2013 was intended to be the first phase of an eventual larger I-95/I-85/Route 460 Interchange Area operations and conceptual design study. That future study would update a previous planning study conducted in the study same area between 1998 and 2000 that identified a number of capacity and safety issues. The 2013 KHA report highlights three "safety issues" within the I-95/I-85 interchange area (originally identified in the 2000 study) and presents three long-term "Concepts" to address them.

The following sections summarize key elements of the three concepts and the "issue" than led to their development.

Issue #1: I-85 Northbound Off-Ramp to I-95 Southbound Weaving Section

The configuration of the I-85 northbound off-ramp to I-95 southbound movement results in periodic congestion/queuing leading into and through this section. The configuration includes a 250-foot weaving segment (between the I-85 northbound off-ramp merge with the I-95 southbound collector-distributor road and the Graham Road off-ramp) with an approximately 7% average uphill grade of the I-85 northbound off-ramp itself.

Concept #1

KHA identified a long-term concept (Concept #1) that included the following changes/modifications:

- Close the existing I-95 southbound off-ramp to Graham Road;
- Close the existing I-95 southbound on-ramp from S. Crater Road;
- Reconstruct the Graham Road and S. Crater Road intersection and the on-ramp to southbound I-95 to allow southbound left-turn movement from S. Crater Road; and,
- Construct new I-95 off-ramp to S. Crater Road. [Preliminary engineering (30% plans) recommended to determine environmental feasibility.]

Figure 2 illustrates Concept #1 at a diagrammatic planning-level as provided by VDOT. As noted in the figure, the cost of this project was estimated at $6.9 million.

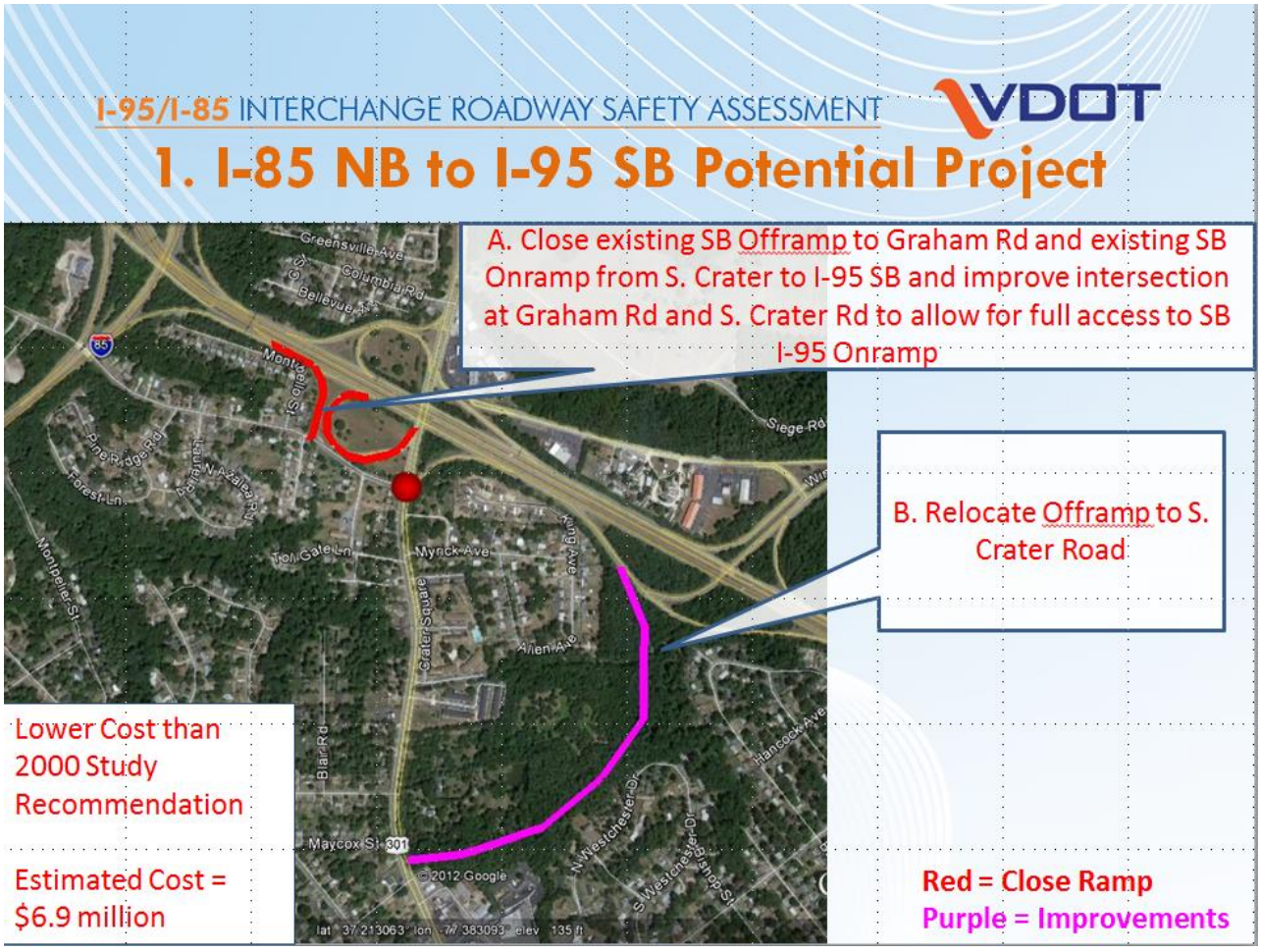


Figure 2 Concept #1 (Graphic provided by VDOT)

Issue #2: S. Crater Road to I-95 Northbound Weaving Section

An approximately 360-foot weaving section exists between the S. Crater Road on-ramp to I-95 northbound movement and the off-ramp to the E. Wythe Street/E. Washington Street couplet in downtown Petersburg.

Concept #2

KHA identified a long-term concept (Concept #2) to address this issue that included the following changes/modifications:

- Close the existing I-95 northbound on-ramp from S. Crater Road and reuse the existing Winfield Road to relocate the northbound I-95 on-ramp connection to County Drive (Route 460 Bus.).
- Reconstruct two intersections to facilitate new traffic movements:
  - Winfield Road/County Drive (Route 460 Bus.)
  - Winfield Road/Crater Road

Figure 3 illustrates Concept #2 at a diagrammatic planning-level as provided by VDOT. As noted in the figure, the cost of this project was estimated at $3.5 million.

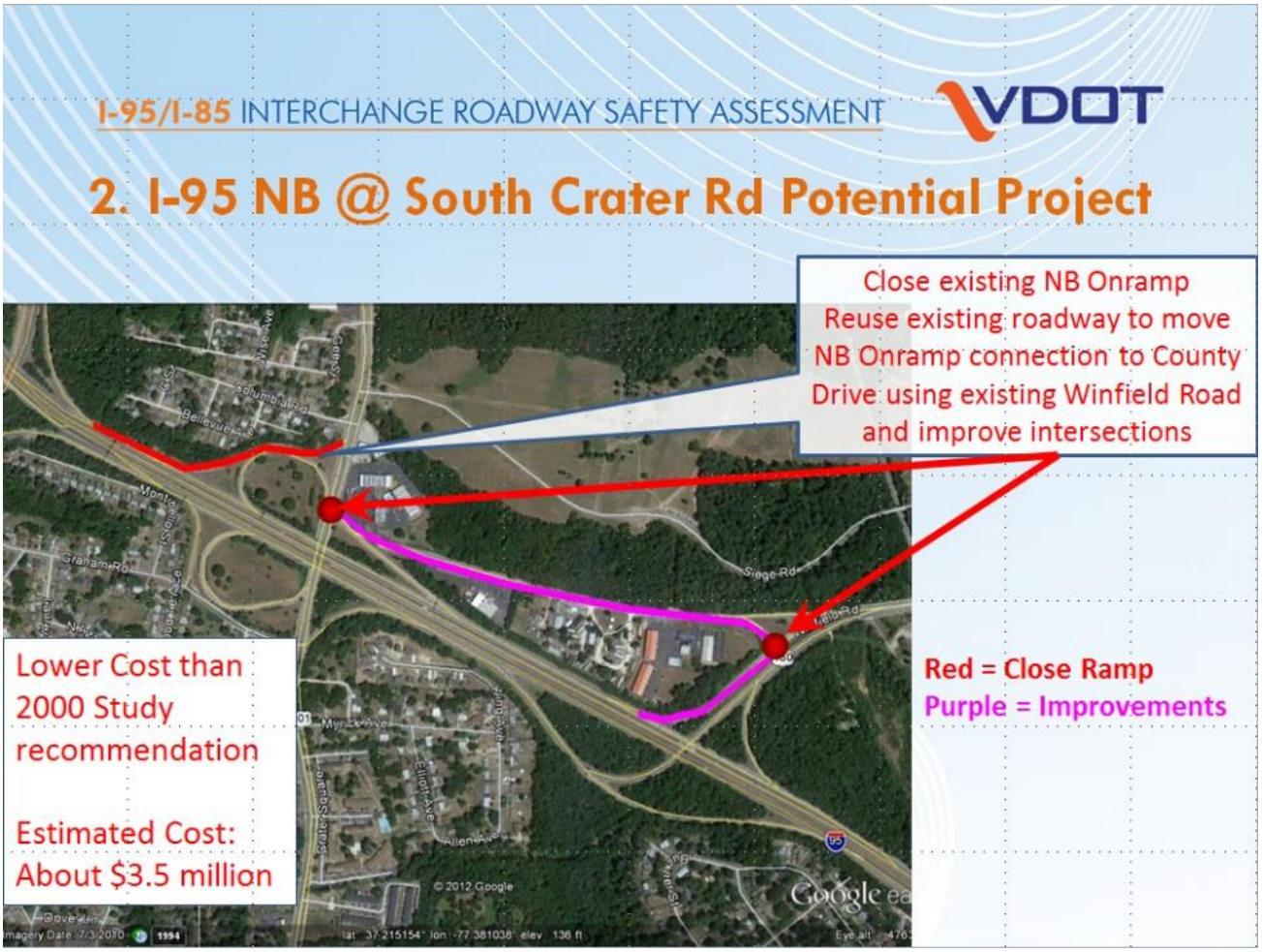


Figure 3 Concept #2 (Graphic provided by VDOT)

Issue #3: I-95 Northbound Off-Ramp to I-85 Southbound Ramp Radius and Bridge Clearance

The existing I-95 northbound to I-85 southbound ramp has a 200 foot radius curve and the current bridge clearance for the ramp beneath I-95 is 13 feet 10 inches; it does not meet current Federal Highway Administration (FHWA) minimum clearance requirements for interstates (16 feet).

Concept #3

KHA identified a long-term concept (Concept #3) to address this issue that included the following changes/modifications:

- Close the existing I-95 northbound off-ramp to I-85 southbound and construct a new flyover ramp (left-hand exit) from I-95 northbound to I-85 southbound.

Figure 4 illustrates Concept #3 at a diagrammatic planning-level as provided by VDOT. As noted in the figure, the cost of this project was estimated at $55.8 million.

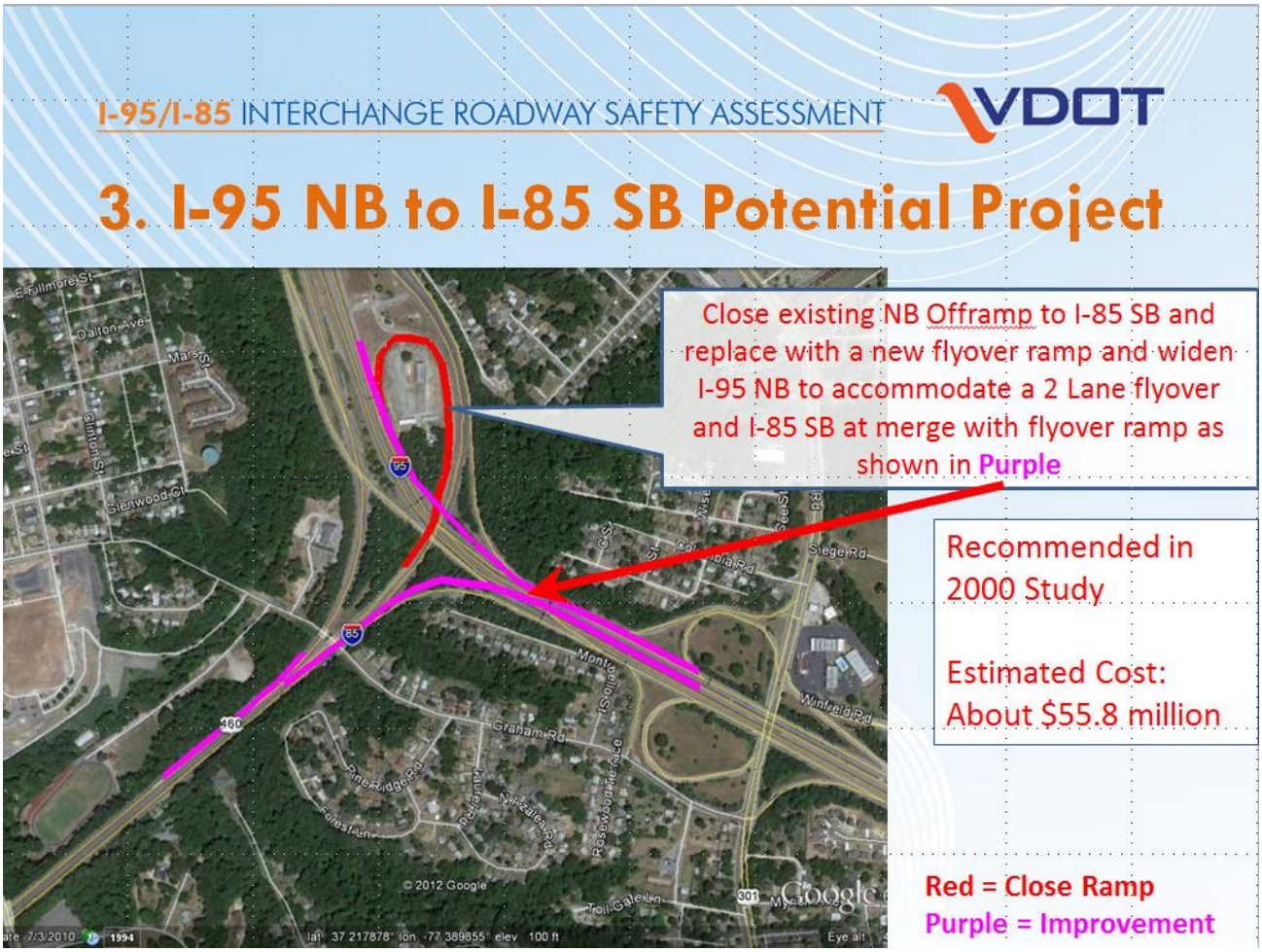


Figure 4 Concept #3 (Graphic provided by VDOT)

DATA AVAILABILITY AND RESOLUTION

VDOT initially supplied the project team with data to support a feasibility assessment of each KHA concept. This included:

- Average Daily Traffic volumes (by link)
- Crash data from 2008 to 2013
- VGIN Digital Orthophotography
- Documented right-of-way, utilities, and/or environmental resources in the study area
- Annual traffic growth rates for roadways in the site vicinity

KAI supplemented these data with plat record research (Timmons Group) and supplemental intersection turning movement counts (KAI) at key intersections during the weekday a.m. and p.m. peak hours. **Appendix A** contains the intersection turning movement count data.

The crash data does not contain enough detail/resolution to accurately isolate crash locations and correlate crashes to specific locations in the study area. KAI could locate an individual crash by mile point on I-95 southbound, for example, but there was no way to determine if the crash occurred on I-95 main line or on the adjacent collector-distributor road. As such, a detailed safety analysis of reported crashes and descriptive statistics was not possible.

INITIAL CONCEPT EVALUATION

KAI reviewed each long-term concept to consider its feasibility. Criteria considered included:

- Potential upstream and downstream impacts
- Intersection/turn lane improvements
- Design year peak hour operational performance (intersections)
    - LOS D or better
- Application of contemporary planning, operations, design, and safety performance features
- Environmental, right-of-way, and utility impacts
- Constructability
- Estimated Cost

The following section summarizes identified issues/questions for each original Concept that could not be immediately determined without further investigation, analysis, and/or refinement.

Concept #1

Implementing this concept would eliminate the approximately 250-foot weaving section between the I-85 northbound off-ramp merge with the I-95 southbound collector-distributor road and the Graham Road off-ramp. It would shift traffic demand from the existing Graham Road off-ramp to a new off-ramp that would ultimately connect to S. Crater Road approximately one-half mile south of the current Graham Road/S. Crater Road intersection. While this Concept addresses the short weaving section identified between ramps, the concept requires further investigation, analysis, and/or refinement to determine feasibility, including:

- The extent of intersection construction to the Graham Road/S. Crater Road intersection to appropriately accommodate a southbound left-turn movement from S. Crater Road to I-95 Southbound
- The magnitude of intersection construction for the new intersection created at the I-95 off-ramp/S. Crater Road intersection
- The operational performance of new intersection configurations and effect of rerouted traffic demand
- The feasibility of designing and placing overhead guide signs to account for a third option at the downstream I-95 Southbound/Route 460 Bus./S. Crater Road off-ramp diverge point
- Quantifying out-of-direction travel introduced by new off-ramp alignment to S. Crater Road
- The risk of wrong-way movements at an isolated on-way off-ramp that violates driver expectancy
- Potential environmental, right-of-way, and utility impacts of improvements
- Updating cost estimates

Concept #2

Implementing this concept would eliminate the approximately 360 foot weaving section between the S. Crater Road on-ramp to I-95 northbound movement and the off-ramp to the E. Wythe Street/E. Washington Street couplet in downtown Petersburg. While this Concept addresses the short weaving section, the concept requires additional investigation/analysis, including:

- The extent of intersection construction to the Winfield Road/S. Crater Road intersection to appropriately accommodate new turning movements to/from S. Crater Road and two-way operation of Winfield Road
- The extent of intersection construction to the Winfield Road/Route 460 Bus. Intersection to appropriately accommodate additional I-95 northbound demand displaced by on-ramp closure.
- The extent of intersection construction to the I-95 northbound C-D road off-ramp to S. Crater Road and a two-way Winfield Road
- Quantifying out-of-direction travel on Winfield Road for new access to I-95 northbound/I-85 southbound from S. Crater Road
- Determining operational performance of new intersection configurations and effects of rerouted traffic demand
- Quantifying the impact of increased demand on the I-95 northbound C-D road between the existing on-ramp from Route 460 Bus. and the off-ramp to S. Crater Road
- Potential environmental, right-of-way, and utility impacts of improvements
- Updating cost estimates

Concept #3

Implementing this concept would eliminate the existing I-95 northbound to I-85 southbound ramp with a 200 foot tight radius and address the vertical clearance issue noted previously. While this Concept addresses these issues, additional concerns require further investigation/analysis, including:

- Assessing impacts of removing ramp access from the I-95/S. Crater Road interchange to I-85 southbound.
- Exploring the ramification of a left and exit. Left-hand exits are inconsistent with American Association of State Highway Transportation Officials (AASHTO) policy, violate driver expectancy, and would likely necessitate a shift to the I-95 main line northbound roadway alignment.
- Assessing the extent of flyover ramp vertical alignment and construction limits south of Graham Road where the ramp would connect to I-85 southbound.
- Updating cost estimates

All three Concepts could be advanced by VDOT (assuming provision of certain modifications discussed later in this report) for further assessments. In addition to several refinements, KAI also developed two additional concepts that illustrate their combination in an integrated manner.

SINGLE-LINE TAPINGS

Each Concept carried forward was ultimately refined and illustrated by KAI as a single-line taping. The taping depicts concepts reflecting contemporary planning, operations, design, and safety performance considerations. The concepts consider three dimensional roadway design principles. An iterative process of refining the concepts included:

- Developing forecast design year 2040 weekday a.m. and p.m. peak hour traffic volumes
- Reassigning forecast traffic to the transportation network based for each Concept considered
- Identifying necessary intersection-level details such as appropriate intersection control and sizing of turn lanes
- Confirming geometric design details (turn lanes/storages, horizontal and vertical alignment, etc.)
- Retaining current network connectivity to ensure no Concept would eliminate connections that exist today

Each configuration developed through this process helps clarify each Concept's impact, cost, and feasibility with respect to the criteria discussed previously. These tapings are illustrated in subsequent figures summarizing identified intersection controls, lane configurations, and detailed design year traffic operational results at affected intersections on the network.

Section 4
Operational Analysis of Concepts

OPERATIONAL ANALYSIS OF CONCEPTS

KAI performed an operational analysis for each Concept carried forward. VDOT staff selected a design year of 2040 to assess the potential design life of the concepts. A 2040 No-Build analysis serves as a base condition to assess how the study area's roadway network would operate at the future planning horizon assuming no future improvements were implemented.

FUTURE TRAFFIC VOLUMES AND BACKGROUND GROWTH

KAI developed design year 2040 traffic volumes using annual growth rates provided by VDOT that are summarized below.

- I-95 SB & I-85 NB to I-95 SB Collector Distributor Road – 1.1%
- I-95 SB Off-Ramp to Graham Road – 0.5%
- I-95 NB Off-Ramp & Route 460 WB – 0.5%
- I-95 Ramps and Route 460 BUS. – 1.2%
- Route 460 WB Main line – 0.8%
- SB Crater Road to I-95 SB – 1.3%
- S. Crater Road – 0.5%
- Graham Road – 1.25%
- I-95 Main line – 1.4%
- I-85 Main line – 1.4%

Compounded annual growth was adjusted to address identified imbalances (caused by different growth rates) that occurred between closely-spaced intersections.

YEAR 2040 NO-BUILD OPERATIONS ANALYSIS

Figure 5 illustrates year 2040 no-build lane configurations and traffic control devices (assuming no modifications are made) at key study intersections. **Figure 6** and **Figure 7** summarize the No-Build operational results during the weekday a.m. and p.m. peak hours, respectively.

Under year 2040 No-Build conditions, the analysis shows the following intersections would operate at LOS F and/or over capacity for the identified time periods:

- I-95 Off-Ramp/Graham Road – Critical SB Approach
  - Weekday p.m. peak hour v/c = 1.36,
  - LOS F
  - 95th percentile queue on off-ramp: 771 feet
- I-95 On-Ramp/S. Crater Road/Commercial Entrance – Critical WB Approach
  - LOS F (Weekday a.m. and p.m. peak hours)

I-95 Off-Ramp/Graham Road – Critical SB Approach

The critical southbound approach at the I-95 Off-Ramp/Graham Road intersection is forecast to operate over capacity during the weekday p.m. peak hour. Estimated queues extend onto the C-D road. This condition would further exacerbate the congestion and friction within the weaving section between the I-85/I-95 off-ramp merge and Graham Road/C-D Road diverge.

I-95 On-Ramp/S. Crater Road/Commercial Entrance – Critical WB Approach

The critical westbound approach of the I-95 On-Ramp/S. Crater Road/Commercial Entrance intersection is forecast to operate at LOS F during the weekday a.m. and p.m. peak hours. While the critical approach is forecast to continue to operate below capacity, excessive delay for this approach could adversely impact the operation of the intersection.

Appendix B contains the year 2040 no-build traffic operations worksheets.

2040 NO-BUILD CONDITIONS
LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES
PETERSBURG, VIRGINIA

FIGURE 5

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

2040 NO-BUILD TRAFFIC CONDITIONS
WEEKDAY AM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 6

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

2040 NO-BUILD TRAFFIC CONDITIONS
WEEKDAY PM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 7

REFINED CONCEPT #1

Key modifications, improvements, and assumptions identified for Refined Concept #1 are summarized below. *(Intersection numbers refer to the numbered intersections in the figures for clarity)*

General Elements

- Close the existing I-95 Southbound C-D road off-ramp to Graham Road
- Close the existing on-ramp to I-95 Southbound/Route 460 Bus. from S. Crater Road
- Construct a new off-ramp to S. Crater Road
    - Widen I-95 Southbound C-D Road to accommodate new exit
    - Re-design placement/design of overhead guide signs to account for a third option at the downstream I-95 Southbound/Route 460 Bus./S. Crater Road off-ramp at diverge point
- Remove the yield condition on I-85 northbound to I-95 southbound C-D Road. A two-lane C-D road can accept single-lane ramps from I-95 southbound and I-85 northbound in a free-flow condition.

Intersection-Specific Elements

- Intersection #1 (Graham Road/S. Crater Road/I-95 Southbound On-Ramp)
    - Realign Graham Road and on-ramp to intersect
    - Shift southbound lanes on S. Crater Road through intersection to develop a separate southbound left-turn lane to the I-95 Southbound on-ramp
    - Develop a separate northbound left-turn lane on S. Crater Road to Graham Road
    - Proposed traffic signal operation
        - 85 second cycle
        - Protected/permissive NB/SB left turns
- Intersection #2 (New I-95 Southbound Off-Ramp/S. Crater Road)
    - Install new traffic signal
    - Develop dual westbound left-turn lanes and a single right-turn lane on off-ramp
    - Proposed traffic signal operation
        - 100 second cycle
        - Two phase signal operation

Figure 8 illustrates year 2040 Concept #1 lane configurations and traffic control devices at key study intersections. **Figure 9** and **Figure 10** summarize the operational results during the weekday a.m. and p.m. peak hours, respectively.

As shown in the figures, the study intersections are forecast to meet VDOT performance criteria in the design year. **Appendix C** contains the year 2040 Refined Concept #1 traffic operations worksheets.

BELLEVUE AVE
COLUMBIA RD
S CRATER RD (US 301)
WINFIELD RD
COUNTY DR (RTE 460 BUS.)
GRAHAM RD
MYRICK AVE
RTE 460 BUS.
CLAREMONT ST
NEW I-95 SB OFF-RAMP
85
95

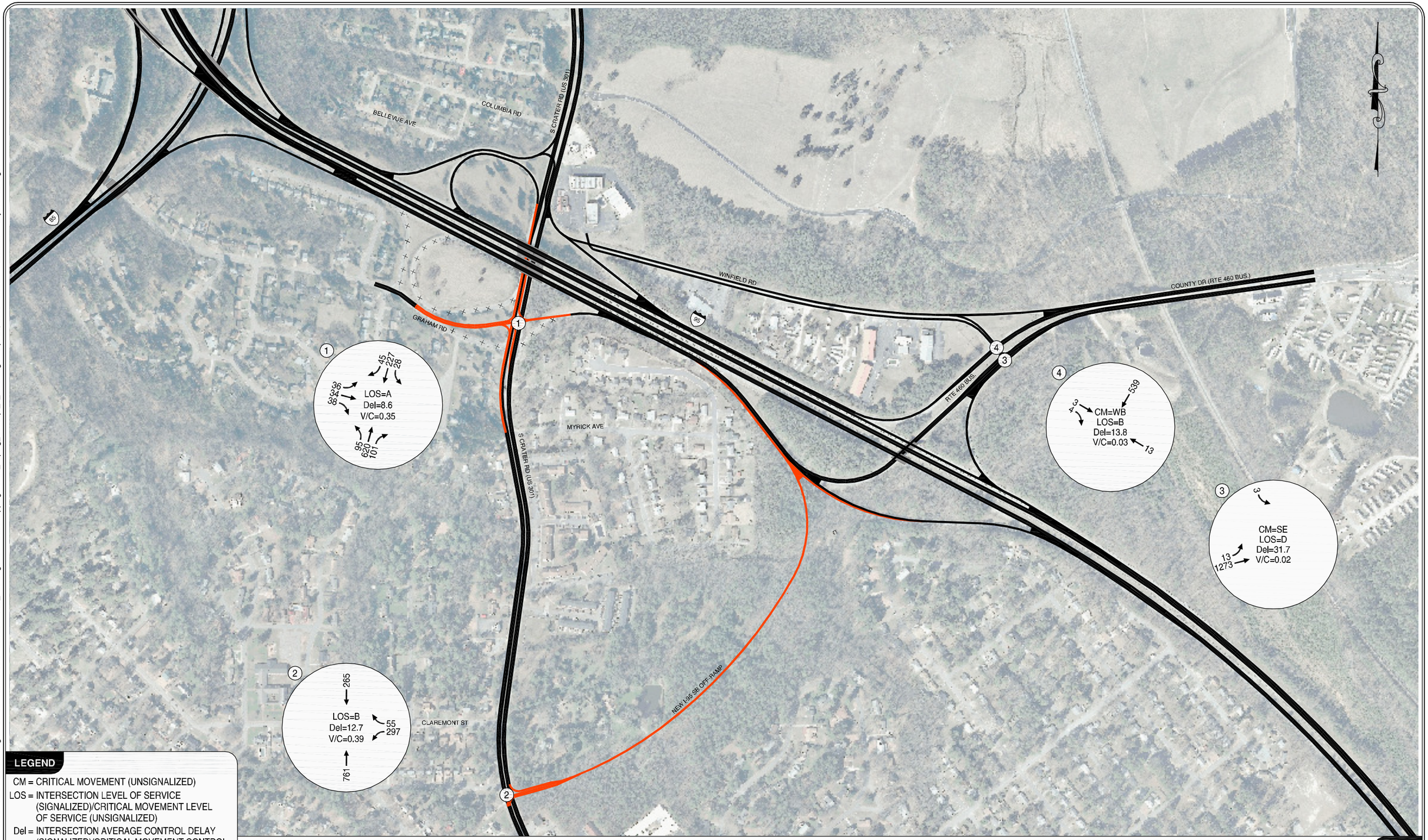
1
2
3
4

LEGEND
- EXISTING ROADWAY
- NEW ROADWAY
X - CLOSE/REMOVE
- STOP SIGN
- TRAFFIC SIGNAL
- PROPOSED IMPROVEMENT

REFINED CONCEPT 1 LANE CONFIGURATIONS
AND TRAFFIC CONTROL DEVICES
PETERSBURG, VIRGINIA

FIGURE 8

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING



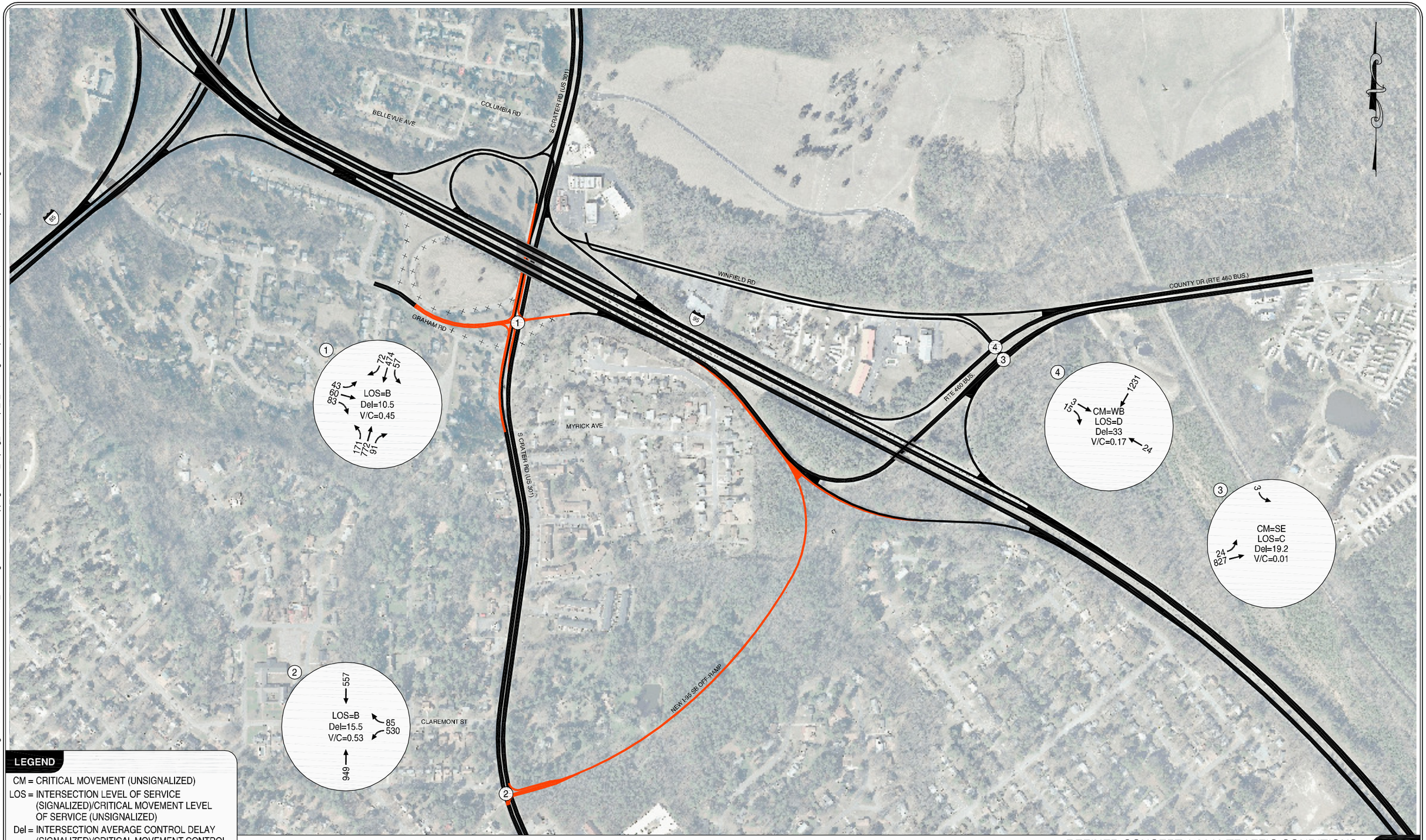
LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

REFINED CONCEPT 1 2040 TRAFFIC CONDITIONS
WEEKDAY AM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 9

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING



LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

REFINED CONCEPT 1 2040 TRAFFIC CONDITIONS
WEEKDAY PM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 10

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING

Refined Concept #1 Findings

The following describes how the refined concept addresses the identified outstanding issues/concerns requiring additional investigation, analysis, and/or refinement. "Answers" to "questions" are summarized below in *italics.*

- The extent of construction at the Graham Road/S. Crater Road intersection to appropriately accommodate a southbound left-turn movement from S. Crater Road to I-95 Southbound
  - *See previous description of Intersection #1*
- The extent of construction at the I-95 off-ramp/S. Crater Road intersection
  - *See previous description of Intersection #2*
- Determining operational performance of new intersection configurations and effect of rerouted traffic demand
  - *Operational analysis demonstrates acceptable intersection performance at affected intersections.*
- The feasibility of designing and placing overhead guide signs to account for a third option at the downstream I-95 Southbound/Route 460 Bus./S. Crater Road off-ramp diverge point
  - *Eliminating the weaving section and developing an additional lane on C-D road in advance of the three-way split would include overhead lane signs to direct travelers to the desired lane.*
- Determining the effects of out-of-direction travel introduced by new off-ramp alignment to S. Crater Road
  - *Limited impact since demand is oriented south of the new off-ramp intersection with S. Crater Road.*
- The risk for wrong-way movements from introducing an isolated on-way off-ramp that violates driver expectancy
  - *Potential remains, but risks can be mitigated by providing signage in accordance with 2009 Manual on Uniform Traffic Control Devices (MUTCD) and VDOT Supplement.*
- Potential project environmental, right-of-way, and utility impacts
  - *New off-ramp avoids Poor Creek pumping station and sanitary force mains*
- Updating cost estimates
  - *See subsequent section for details regarding costs*

Park and Ride Lot

VDOT identified the area in the vacated loop ramp as a potential future location for a park and ride lot. Assuming Graham Road is realigned, there would be enough area to provide roughly 150 parking spaces, with an estimated cost of approximately $750,000.

REFINED CONCEPT #2

Key modifications, improvements, and assumptions identified for Concept #2 are summarized below. *(Intersection numbers refer to the numbered intersections in the figures for clarity)*

General Elements

- Develop a second eastbound lane on Graham Road between the Off-Ramp and S. Crater Road
- Reconstruct the I-95 Northbound on-ramp merge from Winfield Road/Route 460 Bus. to provide adequate merge and decision distance requirements

Intersection-Specific Elements

- Intersection #1 (I-95 NB On-Ramp/S. Crater Road)
  - Remove the existing on-ramp to I-95 Northbound from S. Crater Road
  - Eliminate the free-flow I-95 NB off-ramp movement to southbound S. Crater Road and reconstruct the approach to intersect S. Crater Road at a controlled intersection
    - Develop separate left- and right-turn lanes on the off-ramp
- Intersection #2 (Winfield Road/S. Crater Road)
  - Remove the Off-Ramp from I-95 Northbound to S. Crater Road
  - Realign Winfield Road to S. Crater Road to provide full movements
    - Construct a separate southbound left-turn lane on S. Crater Road
    - Construct a separate northbound right-turn lane on S. Crater Road (beyond the I-95 bridge structure)
- Intersection #3 (Graham Road/S. Crater Road)
  - Construct a second eastbound right-turn lane from Graham Road to S. Crater Road
- Intersection #4 (I-95 Southbound Off-Ramp/Graham Road)
  - Develop dual southbound left-turn lanes on the I-95 Southbound off-ramp and a separate shared through-right lane
  - Realign off-ramp and Rosewood Terrace to intersect one another
- Intersection #6 (Winfield Road/Route 460 Bus.)
  - Construct channelized right-turn lane from eastbound Winfield Road to the I-95 Northbound on-ramp

Figure 11 illustrates year 2040 Concept #2 lane configurations and traffic control devices at key study intersections. **Figure 12** and **Figure 13** summarize the operational results during the weekday a.m. and p.m. peak hours, respectively.

As shown in the figures, the study intersections are forecast to meet VDOT performance criteria in the design year. **Appendix D** contains the year 2040 Refined Concept #2 traffic operations worksheets.

BELLEVUE AVE
COLUMBIA RD
S CRATER RD (US 301)
WINFIELD RD
GRAHAM RD
ROSEWOOD TER
MYRICK AVE
ROUTE 460 BUS.
95

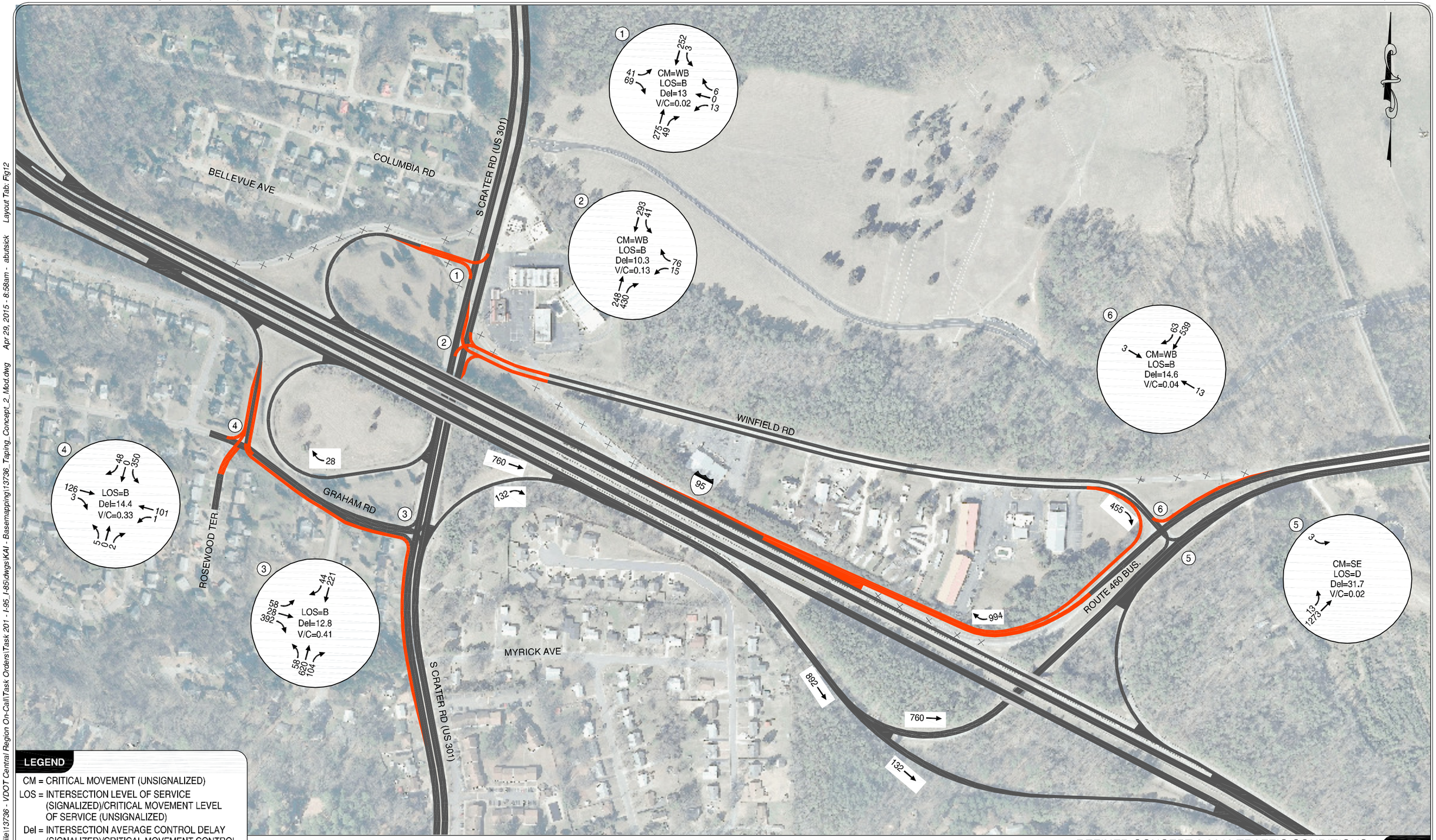
1
2
3
4
5
6

LEGEND

- EXISTING ROADWAY
- NEW ROADWAY
X - CLOSE/REMOVE
- STOP SIGN
- TRAFFIC SIGNAL
- PROPOSED IMPROVEMENT

REFINED CONCEPT 2 LANE CONFIGURATIONS
AND TRAFFIC CONTROL DEVICES
PETERSBURG, VIRGINIA

FIGURE 11

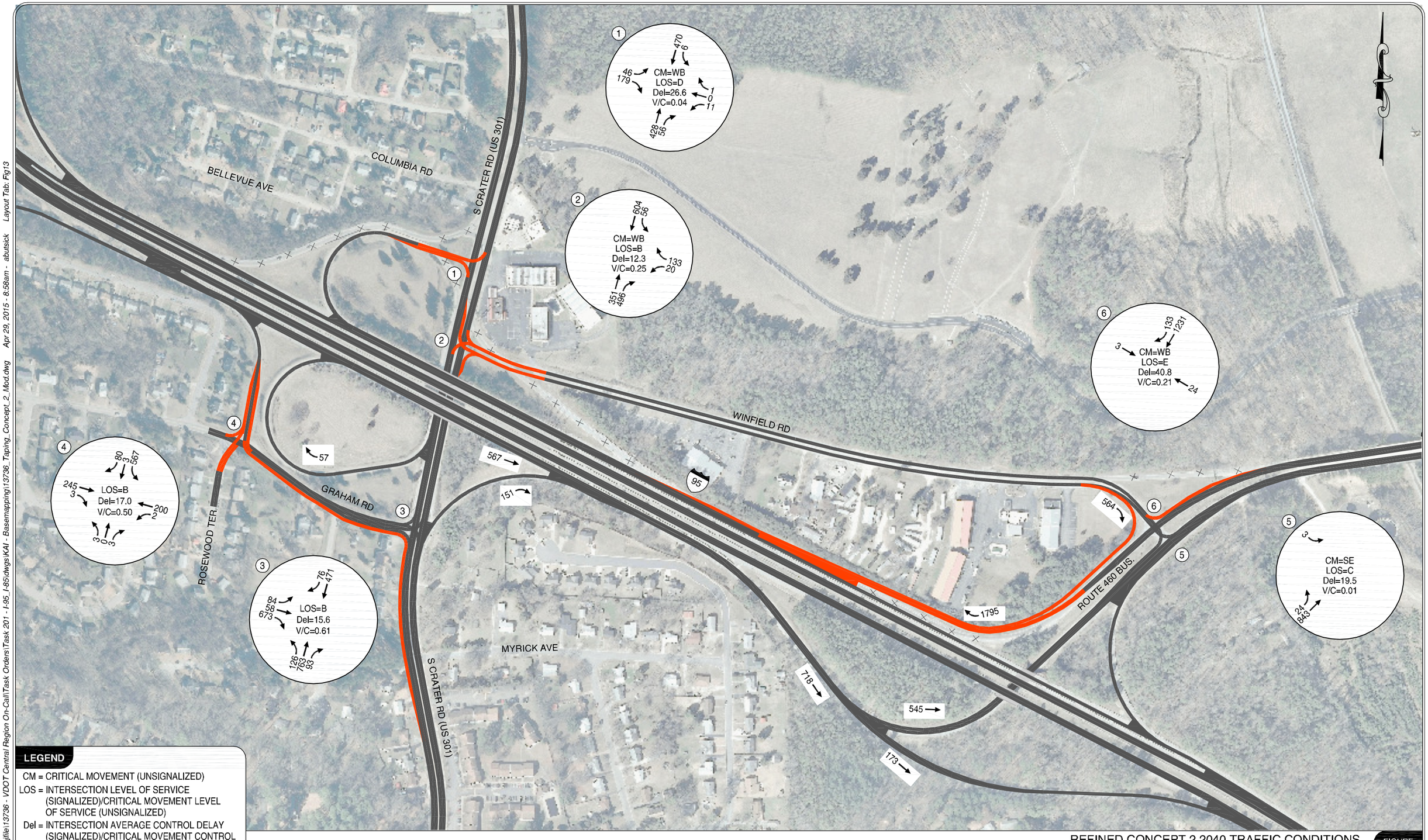


LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

REFINED CONCEPT 2 2040 TRAFFIC CONDITIONS
WEEKDAY AM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 12



LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

REFINED CONCEPT 2 2040 TRAFFIC CONDITIONS
WEEKDAY PM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 13

Refined Concept #2 Findings

The following describes how the refined concept addresses the identified outstanding issues/concerns requiring additional investigation, analysis, and/or refinement. "Answers" to "questions" are summarized below in *italics.*

- The extent of construction at the Winfield Road/S. Crater Road intersection to appropriately accommodate new turning movements to/from S. Crater Road and two-way operation of Winfield Road.
    - *See previous description of improvements at Intersection #2*
- The extent of construction at to the Winfield Road/Route 460 Bus. Intersection to appropriately accommodate additional I-95 northbound demand displaced by on-ramp closure.
    - *See previous description of improvements at Intersections #5 and #6*
- The extent of construction at the I-95 northbound C-D road off-ramp to S. Crater Road and a two-way Winfield Road
    - *See previous description of improvements at Intersection #1*
- Determining the effects of out-of-direction travel introduced by the elimination of the I-95 northbound on-ramp from S. Crater Road via a new connection from Winfield
    - *Introduces approximately one total mile of out-of-direction travel for drivers traveling from S. Crater Road to I-95 northbound/I-85 southbound/E. Wythe Street.*
- Determining operational performance of new intersection configurations and effect of rerouted traffic demand
    - *Operational analysis demonstrates acceptable intersection performance at affected intersections.*
- Determining the impact of increased demand on the I-95 northbound C-D road between the existing on-ramp from Route 460 Bus. and the off-ramp to S. Crater Road
    - *Elimination of the I-95 northbound off-ramp to S. Crater Road northbound increases the overall weaving distance between on- and off-ramps on C-D road.*
- Potential project environmental, right-of-way, and utility impacts
    - *Winfield Road should not be widened to the north to avoid impacting existing cultural resources.*
    - *Increased traffic volumes on Winfield Road require further investigation of access management policies and should include outreach to affected business and property owners along this corridor.*
    - *Realigning the Graham Road off ramp with Rosewood Terrace (the existing offset subdivision road across from the Graham Road off ramp) or vice versa will require some right of way.*
    - *Widening along Graham Road is assumed to be towards the Limited Access Right of Way in lieu of towards the outside to reduce right of way impacts. Impacts to properties along S. Crater Road south of Graham Road are anticipated.*
- Updating cost estimate
    - *See subsequent section for details regarding costs*

REFINED CONCEPT #3

Key modifications, improvements, and assumptions identified for Refined Concept #3 are summarized below. *(Intersection numbers refer to the numbered intersections in the figures for clarity)*

General Elements

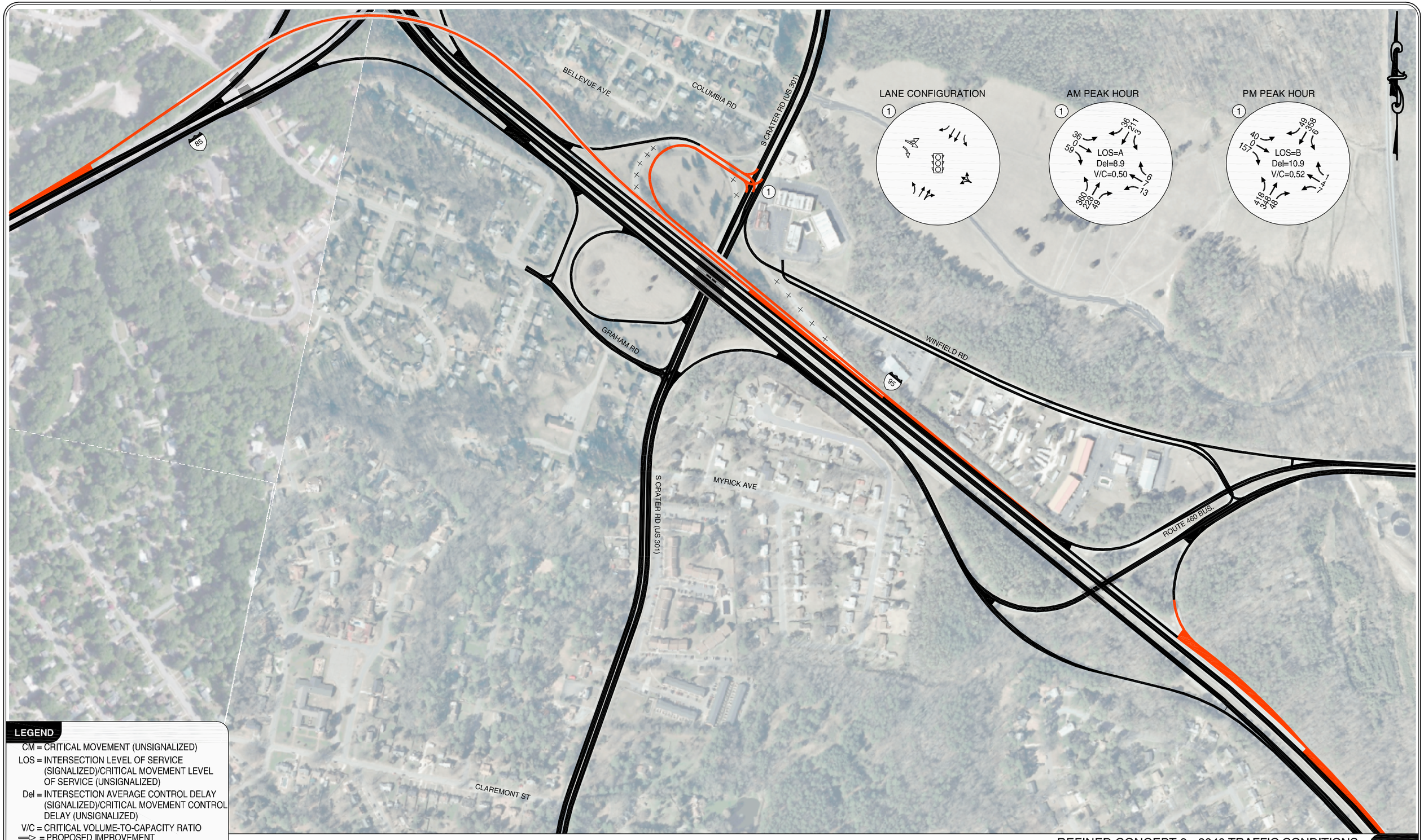
- Construct a right-hand exit flyover ramp from I-95 Northbound to I-85 Southbound
- Re-design the I-95 Northbound on/off ramps at S. Crater Road
- Remove the existing I-95 Northbound off-ramp to S. Crater Road
- Re-design the weaving section on the I-95 Northbound C-D road between Route 460 Bus. and S. Crater Road.
- Re-design the I-95 Northbound off-ramp to Route 460 Bus. and S. Crater Road to provide adequate decision distance between diverge points
- Retain existing tight-radius loop ramp to I-85 southbound to serve demand between S. Crater Road southbound and I-85 southbound.

Intersection-Specific Elements

- Intersection #1 (I-95 NB On & Off Ramp/S. Crater Road)
    - Construct a new traffic signal
        - Proposed traffic signal operation
            - 85 second cycle
            - Protected/permissive NB/SB left turns
            - Permissive EB/SB right turns

Figure 14 illustrates year 2040 Refined Concept #3 lane configurations and traffic control devices and operational results during the weekday a.m. and p.m. peak hours.

As shown in the figure, the affected study intersection is forecast to meet VDOT performance criteria in the design year. **Appendix E** contains the year 2040 Refined Concept #3 traffic operations worksheets.



LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO
⇨ = PROPOSED IMPROVEMENT
= EXISTING ROADWAY
= NEW ROADWAY
X = CLOSE/REMOVE

REFINED CONCEPT 3 - 2040 TRAFFIC CONDITIONS
LANE CONFIGURATIONS AND TRAFFIC OPERATIONS ANALYSIS
PETERSBURG, VIRGINIA

FIGURE 14

Refined Concept #3 Findings

The following describes how the refined concept addresses the identified outstanding issues/concerns requiring additional investigation, analysis, and/or refinement. "Answers" to "questions" are summarized below in *italics.*

- Removing the ramp access from the I-95/S. Crater Road interchange to I-85 southbound
  - *The existing 200 foot radius loop ramp from I-95 northbound to I-85 southbound is retained to facilitate this movement.*
  - *This concept does not address existing bridge clearance issue.*
- Inconsistency of left-hand exit design
  - *Flyover ramp has been redesigned to a right-hand exit to better meet driver expectation and contemporary geometric design principles.*
- Determining the extent of the flyover ramp vertical alignment and construction limits south of Graham Road where the ramp would connect to I-85 southbound
  - *Flyover ramp vertical alignment and limits updated to meet contemporary geometric design principles*
  - *Gore point for initial exit from I-95 northbound to the flyover extended southward to provide adequate decision distance between exits on C-D road.*
- Potential project environmental, right-of-way, and utility impacts
  - *A right-hand exit design increases impacts to property owners in the Bellevue Avenue corridor relative to the original left-hand exit design. However, the right-hand exit design incorporates contemporary geometric design principles, better meets driver expectations, and avoids costly reconstruction of the I-95 main line.*
- Updating cost estimate
  - *See subsequent section for details regarding costs*

REFINED CONCEPTS #1 & #2 COMBINED

KAI evaluated this combination to ensure the compatibility of concepts and determine any necessary modifications. Key modifications, improvements, and assumptions identified for Refined Concepts #1 & #2 Combined are summarized below. *(Intersection numbers refer to the numbered intersections in the figures for clarity)*

General Elements

- Close the existing I-95 Southbound C-D road off-ramp to Graham Road
- Close the existing on-ramp to I-95 Southbound/Route 460 Bus. from S. Crater Road
- Construct two-way extension of Route 460 Bus. west to S. Crater Road
- Re-construct I-95 Southbound C-D Road to intersect with new Route 460 Bus. extension
- Reconstruct the I-95 Northbound on-ramp merge from Winfield Road/Route 460 Bus. to provide adequate merge and decision distance requirements
- Yield condition on I-85 northbound to I-95 southbound C-D Road can be removed. Two-lane C-D road can accept both single-lane ramps from I-95 southbound and I-85 northbound in a free-flow condition.
- 150-space park and ride lot in vacated loop area

Intersection-Specific Elements

- Intersection #1 (I-95 NB On-Ramp/S. Crater Road)
    - Close the existing on-ramp to I-95 Northbound from S. Crater Road
    - Eliminate the free-flow I-95 NB off-ramp movement and "T" into S. Crater Road
        - Develop separate left- and right-turn lanes on the off-ramp
- Intersection #2 (Winfield Road/S. Crater Road)
    - Close the existing Off-Ramp from I-95 Northbound to S. Crater Road
    - Realign Winfield Road to "T" into S. Crater Road and provide full movements
        - Construct a separate southbound left-turn lane on S. Crater Road
        - Construct a separate northbound right-turn lane on S. Crater Road (beyond the I-95 bridge structure)
- Intersection #3 (I-95 Southbound On-Ramp/Graham Road/S. Crater Road)
    - Close existing I-95 Southbound on-ramp loop from Graham Road
    - Relocate and realign I-95 Southbound on-ramp and Graham Road to intersect at single intersection
    - Construct a separate southbound left-turn lane on S. Crater Road
    - Construct a separate northbound left-turn lane on S. Crater Road
- Intersection #4 (Route 460 Bus. Extension/S. Crater Road)
    - Construct a separate southbound left turn lane on S. Crater Road
    - Construct a separate northbound right-turn lane on S. Crater Road
    - Construct dual westbound left-turns and a separate right-turn lane on Route 460 Bus. Extension
    - Construct a new traffic signal
        - Proposed traffic signal operation
            - 100 second cycle

- Protected/permissive SB left turn

- Intersection #5 (I-95 Southbound C-D Road/Route 460 Bus. Extension)
  - Construct a new traffic signal
    - Proposed traffic signal operation
      - 85 second cycle
      - Permissive SB left turn and NB right turn
- Intersection #6 (I-95 Northbound Off-Ramp/Route 460 Bus.)
  - Reconstruct off-ramp to intersect Route 460 Bus. at a controlled intersection
  - Construct a new traffic signal
    - Proposed traffic signal operation
      - 85 second cycle
      - Permissive WB right turn
- Intersection #7 (Winfield Road/Route 460 Bus.)
  - Construct channelized right-turn lane from eastbound Winfield Road to the I-95 Northbound on-ramp
  - Construct a new traffic signal
    - Proposed traffic signal operation
      - 85 second cycle
      - Protected/permissive NB left turn

Figure 15 illustrates year 2040 Combined Concepts #1 & #2 lane configurations and traffic control devices at key study intersections. **Figure 16** and **Figure 17** summarize the operational results during the weekday a.m. and p.m. peak hours, respectively.

As shown in the figures, the study intersections are forecast to meet VDOT performance criteria in the design year. **Appendix F** contains the year 2040 Refined Concepts #1 & #2 Combined traffic operations worksheets.

LEGEND

- EXISTING ROADWAY
- NEW ROADWAY
- X - CLOSE/REMOVE
- STOP SIGN
- TRAFFIC SIGNAL
- PROPOSED IMPROVEMENT

REFINED CONCEPT 1 & 2 COMBINED
LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES
PETERSBURG, VIRGINIA

FIGURE 15

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING

H:\proj\file\13736 - VDOT Central Region On-Call\Task Orders\Task 201 - I-95_I-85\dwgs\KAI - Basemapping\13736_Taping_CombinedConcept1&2.dwg Apr 29, 2015 - 9:03am - abutsick Layout Tab: Fig15

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

REFINED CONCEPT 1 & 2 COMBINED - 2040 TRAFFIC CONDITIONS
WEEKDAY AM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 16

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

REFINED CONCEPT 1 & 2 COMBINED - 2040 TRAFFIC CONDITIONS
WEEKDAY PM PEAK HOUR
PETERSBURG, VIRGINIA

FIGURE 17

COMBINED CONCEPT

KAI developed a single-line taping that combines "Refined Concepts #1 & #2 Combined" and "Refined Concept #3" to evaluate the compatibility of individual concepts and potential for phasing improvements. **Figure 18** illustrates the combined concepts.

The I-95 NB off-ramp to S. Crater Road illustrated in Refined Concepts #1 & #2 Combined would need to be removed to construct the right-hand exit flyover ramp and provide appropriate merge/weave distances on the C-D road. Movements affected by the removal of the off-ramp would instead be served by the reconfigured I-95 northbound off-ramp to Route 460 Bus. Unlike Refined Concept #3, the existing loop ramp to I-85 southbound could be removed and travel demand between S. Crater Road southbound and I-85 southbound would be served on other network elements.

YEAR 2040 COMBINED CONCEPT
PETERSBURG, VA

FIGURE 18

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING

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Section 5
Cost Estimates

COST ESTIMATES

Timmons Group prepared planning level three phased cost estimates (Preliminary Engineering, Right of Way, and Construction) for the various alternatives presented in this report. Base mapping was developed to serve as a basis for developing the estimates, and was prepared through the following process.

- Obtained and reviewed available VDOT record drawings for the study area
- Obtained GIS information for the City of Petersburg and converted to AutoCAD. Shape file information included: topographical information, existing waterlines, existing sanitary sewer lines, existing right of way lines, existing property owner lines, existing structures, driveways, roads, etc.
- Positioned the City GIS information onto City aerial photogrammetry to complete the base mapping
- Conducted a site visit to the project area to field verify the mapping

ENVIRONMENTAL CONSIDERATIONS

A Preliminary Environmental Assessment report was developed for the project area. The full findings of this report are available for viewing as necessary upon request. An environmental inventory map is shown below as **Figure 19**.

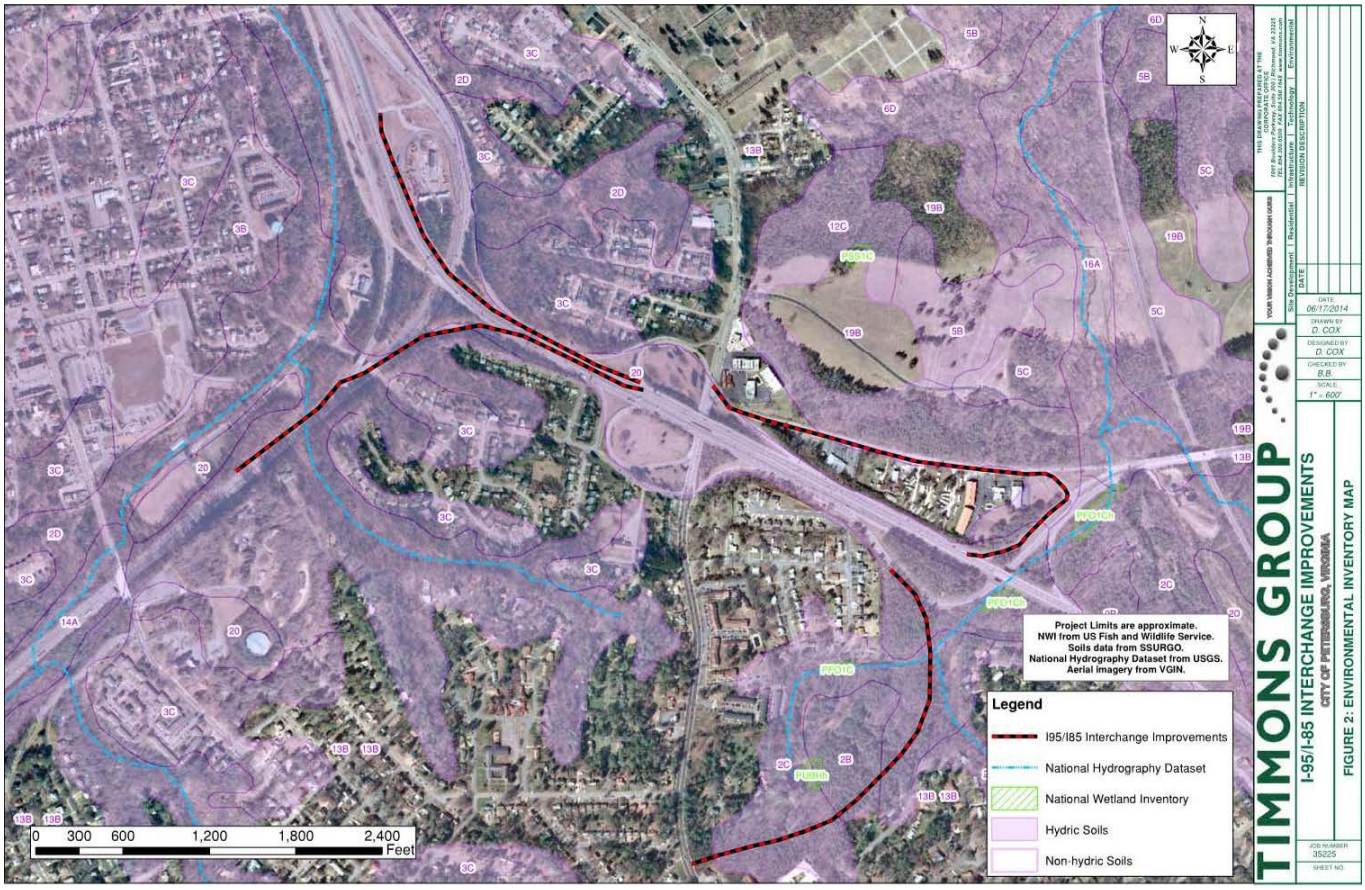


Figure 19 Environmental Inventory Map

A certified wetlands scientist visited the project area and performed a preliminary wetland assessment of the area on June 18, 2014. This included a review of the US Fish and Wildlife's National Wetland Inventory (NWI) mapping and the US Department of Agriculture Natural Resources Conversation Service Web Soil Survey. A preliminary wetlands assessment map is shown below as **Figure 20**.

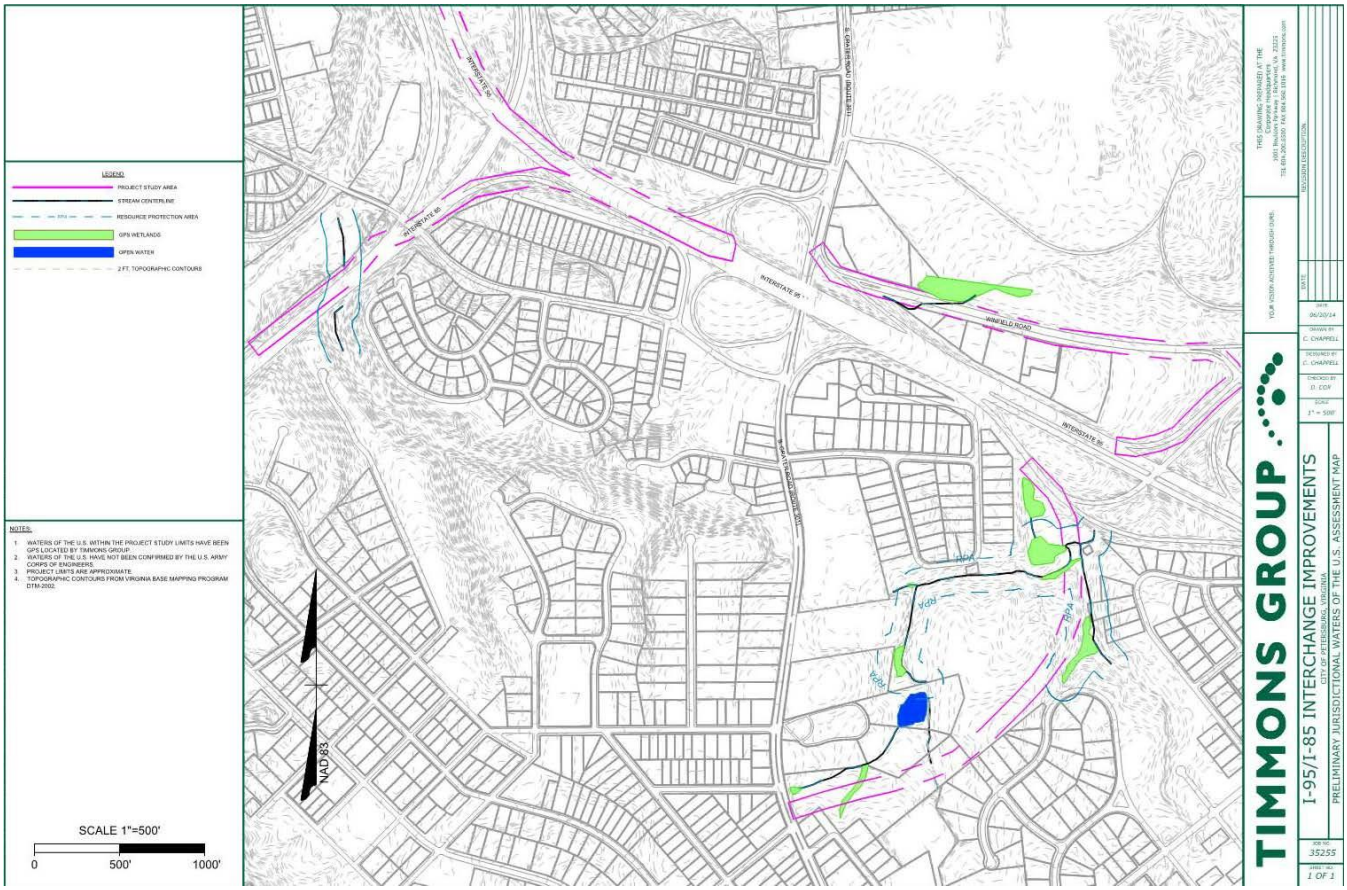


Figure 20 Wetlands Assessment Map

An online database research of the project area was performed to identify any cultural resources, threatened & endangered (T&E) species, and hazardous materials within the project limits. Additional study would have to be done on all of these areas once a project began to move forward.

Federal and State T&E information was obtained using resources from the Virginia Game and Inland Fisheries (VaFWIS) database and the Virginia Department of Conservation and Recreation (DCR) Natural Heritage Program database. No adverse impacts to current endangered or threatened species were identified within the study area. However, it should be noted that the Northern Long Eared Bat may be added to the list of endangered species in 2015, whose habitat is predominantly wooded areas such as those found in the study area. Refer to the VaFWIS Department of Game and Inland Fisheries map below in **Figure 21**.

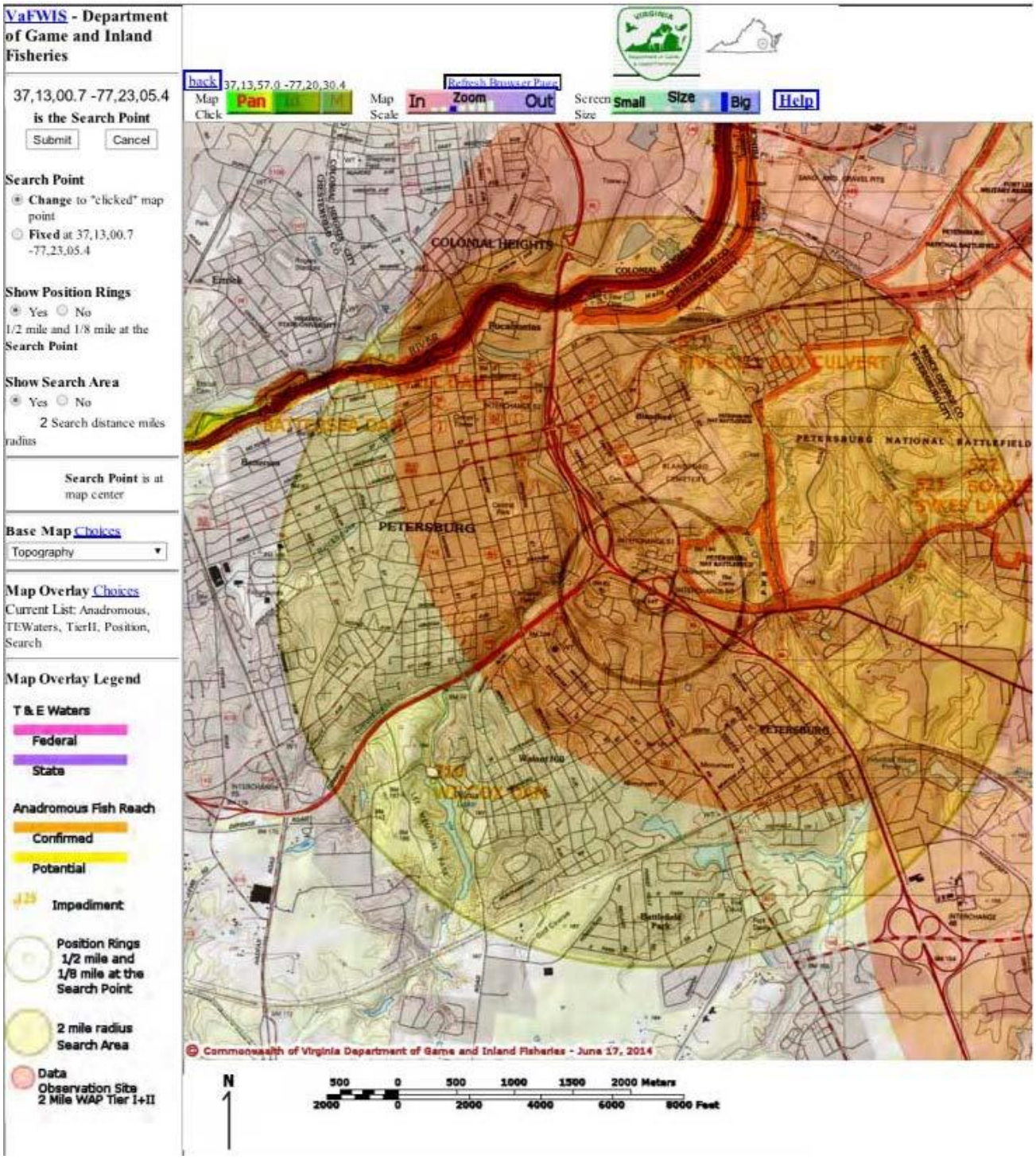


Figure 21 VaFWIS Department of Game and Inland Fisheries map

A query of the Virginia Department of Historic Resource's (VDHR) Virginia Cultural Resources Information System (V-CRIS) was performed for the project area. While multiple architectural resources associated with the Petersburg National Battlefield were identified within the study area, a preliminary review indicates none of the Concepts would adversely impact these resources. Additional studies will be required when/if a Concept moves forward to conclusively determine the potential significance of the resources.

An online search with Environmental Data Resources, Inc. with GeoCheck revealed no projects related to the I-95/I-85 Interchange area listed on any of the reviewed state databases.

BASE MAPPING

After assembling all of the topographic features, utility information, property lines, environmental constraints, etc., available information was combined into one overall digital map. City topographic features from GIS data were used to create a Digital Terrain Model (DTM) for preliminary profiles and sections for each Concept. Concept alignments were then overlaid and assigned stationing for generating profiles for various design features used to estimate costs.

COST ESTIMATE METHODOLOGY

Variables considered in the cost estimates include:

- Roadway improvements
- Ramp improvements
- Drainage improvements
- Traffic signal additions
- Storm water management facilities
- Bridge improvements
- Utility adjustments
- Environmental impacts (mitigation)
- Survey and design
- Interchange Modification Report
- Wetlands permitting
- Environmental documentation
- Right of Way acquisition costs
- Right of Way real property costs
- Relocation costs
- Demolition costs
- Construction Engineering & Inspection costs
- VDOT Administration costs
- Contingencies

For right of way costs, assessed value information taken from the City of Petersburg GIS data was increased by 25% to reasonably represent the difference between assessed value and fair market value. All right of way acquisition costs were based on the assumption that a full appraisal would be required for each affected parcel, and all costs were projected to be in year 2021 Fiscal Year dollars.

Combining Concepts would likely introduce economies of scale if complimentary Concepts were advanced together as one large project as opposed to many different, smaller projects. For the purposes of these preliminary cost estimates, it is assumed that any project(s) derived from the

identified Concepts would be moved forward as a traditional Design-Bid-Build (under a normal VDOT schedule process) approach as opposed to a Design-Build approach.

COST ESTIMATES

Cost estimates and a brief description for each Concept are provided below. When possible, Concepts were broken out into smaller "Projects" when stand-alone improvements/modifications could be isolated. The ability to isolate Projects was governed by a desire to retain all existing movements/connections, thereby avoiding a long-term loss of connectivity on the roadway network.

Refined Concept #1

This Concept has been broken out into three separate projects (A, B, and C). Project A would eliminate the loop ramp to I-95 southbound from S. Crater Road, realign Graham Road and the I-95 on-ramp to intersect, and create separate north- and southbound left-turn lanes on S. Crater Road. Project B would eliminate the I-95 southbound C-D road off-ramp to Graham Road and construct a new off-ramp to S. Crater Road from the Route 460 Bus./I-95 southbound split. Project C assumes construction of a 150-space park and ride lot in the vacated loop area. Key considerations of this Concept include the following:

- The new off-ramp alignment is designed to avoid the Poor Creek pump station and sanitary force mains.

Estimated costs for Refined Concept #1 are summarized below.

- Project A Cost: $3.3M
- Project B Cost: $8.1M
- Project C Cost: $750,000
- **Total Refined Concept #1 Cost: $12.15M**

Refined Concept #2

This Concept has been broken out into two separate projects (A and B). Project A includes intersection improvements on S. Crater Road north of I-95, Winfield Road corridor improvements, and modifications to the Winfield Road/Route 460 Bus. intersection as well as the I-95 northbound on-ramp and C-D road. Project B includes improvements to the I-95 southbound off-ramp to Graham Road, Graham Road widening, and modifications to the Graham Road/S. Crater Road intersection.

Project B does not directly address the identified weaving issue on the I-95 NB C-D road. Rather, Project B includes improvements that address operational/capacity issues identified in the no-build analysis on the south side of I-95 at the Graham Road/ I-95 Off-Ramp and Graham Road/S. Crater Road intersections. It should be noted that this particular project would largely conflict with Project A from Refined Concept #1, or if implemented prior to Project A from Refined Concept #1 require significant reconstruction and additional cost.

Key considerations of this Concept include the following:

- Winfield Road should not be widened to the north to avoid impacting existing cultural resources.
- Increased traffic volumes on Winfield Road require further investigation of access management policies and should include outreach to affected business and property owners along this corridor.
- Realigning the Graham Road off ramp with Rosewood Terrace (the existing offset subdivision road across from the Graham Road off ramp) or vice versa will require some right of way.
- Widening along Graham Road is assumed to be towards the Limited Access Right of Way in lieu of towards the outside to reduce right of way impacts. Impacts to properties along S. Crater Road south of Graham Road are anticipated.

Estimated costs for Refined Concept #2 are summarized below.

- Project A Cost: $11.6M
- Project B Cost: $3.8M
- **Total Refined Concept #2 Cost: $15.4M**

Refined Concept #3

This Concept would provide a flyover ramp to serve I-95 northbound to I-85 southbound movements and is designed with a right-hand exit configuration. Key considerations of this Concept include the following:

- A right-hand exit design increases impacts to property owners in the Bellevue Avenue corridor relative to the original left-hand exit design. However, the right-hand exit design incorporates contemporary geometric design principles, better meets driver expectations, and avoids costly reconstruction of the I-95 main line.

Estimated costs for Refined Concept #3 are summarized below.

- **Total Refined Concept #3 Cost: $92.4M**

Refined Concept #1 & #2 Combined

As reflected in the name, this Concept would combine Refined Concepts #1 and #2, but also provides a new two-way extension of Route 460 Bus. from I-95 to S. Crater Road. This Concept has been broken out into four separate projects (A, B, C, and D). Project A is similar to Project A of Refined Concept #1 discussed earlier. Project B is similar to Project A of Refined Concept #2 except that it does not include improvements (widening) to Winfield Road to the same extent or to the County Road corridor. Project C includes the elimination of the I-95 southbound off-ramp to Graham Road (similar to Project B of Refined Concept #1), but creates a new intersection with the extension of Route 460 Bus. as opposed to a free-flow off-ramp connection to S. Crater Road. Project D assumes construction of a 150-space park and ride lot in the vacated loop area. Key considerations of this Concept include the following:

- The alignment of the Route 460 Bus. extension to S. Crater Road is designed to avoid the Poor Creek Sanitary Pump Station and sanitary force mains.
- The design assumes that the existing Route 460 Bus. underpass of I-95 is not modified to accommodate two-way traffic (two travel lanes total) underneath the bridge.

Estimated costs for Refined Concept #1 & #2 Combined are summarized below.

- Project A Cost: $3.3M
- Project B Cost: $11.6M
- Project C Cost: $18.5M
- Project D Cost: $750,000
- **Total Refined Concept #1 & #2 Combined Cost: $34.15M**

Combined Concept

This Concept would merge Refined Concept #1 & #2 Combined with Refined Concept #3. At this preliminary level it is reasonable to assume the individual cost estimates could be added to produce overall estimate of roughly $131M. Key considerations of this Concept include the following:

- Additional costs associated with re-constructing portions of the I-95 Northbound C-D road between Route 460 Bus. and S. Crater Road may be incurred depending on how individual projects are phased.
    - The I-95 NB off-ramp to S. Crater Road illustrated in Refined Concepts #1 & #2 Combined would need to be removed to construct the right-hand exit flyover ramp and provide appropriate merge/weave distances on the C-D road.
    - Movements affected by the removal of the off-ramp would instead be served by the reconfigured I-95 northbound off-ramp to Route 460 Bus.
    - Unlike Refined Concept #3, the existing loop ramp to I-85 southbound could be removed and travel demand between S. Crater Road southbound and I-85 southbound would be served on other network elements.
- Strategically phasing improvements (assuming the “Combined Concept” would be constructed in several phases and not as one project) and anticipating future construction could help minimize reconstruction efforts/costs.

A complete listing of individual cost components for each Concept/Project is provided in **Appendix G**.

Section 6
Study Findings

STUDY FINDINGS

The Virginia Department of Transportation Central Region Operations (VDOT-CRO) had Kittelson & Associates, Inc. (KAI) conduct a feasibility analysis of three potential safety and operational projects at the I-95/I-85 interchange in Petersburg, Virginia. The analysis considered and built upon information from a 2013 study of the I-95 corridor.

The work efforts generally included evaluating historical crash data, reviewing and assessing previous conceptual projects (developed by others), and developing new concepts and/or refining prior concepts. Concept revisions and refinements incorporated contemporary planning, operations, design, and safety performance considerations while considering three dimensional roadway design principles. Order of magnitude cost opinions were also developed.

BACKGROUND

- Interstates 95 and 85, as well as Route 460 and US 301 (S. Crater Road), converge in Petersburg, Virginia in a complex series of interchanges developed in the mid-1950's as part of the Richmond-Petersburg Turnpike. These interchanges reflect their vintage and do not necessarily reflect contemporary freeway and interchange planning, operations, design, and safety performance considerations.
- The designs exhibit short acceleration/deceleration lanes, relatively small radius turns, and relatively short weave/merge areas.
- The I-95/I-85 Interchange Roadway Safety Assessment Report published by Kimley-Horn & Associates, Inc. (KHA) in March 2013 was intended to be the first phase of an eventual larger I-95/I-85/Route 460 Interchange Area operations and conceptual design study that would update comprehensive planning study was conducted in the study same area between 1998 and 2000 and identified a number of "capacity and safety issues" *[sic]*.
- <u>Issue #1: I-85 Northbound Off-Ramp to I-95 Southbound Weaving Section</u>: The configuration of the I-85 northbound off-ramp to I-95 southbound movement results in periodic congestion/queuing leading into and through this section. The configuration includes a 250-foot weaving segment (between the I-85 northbound off-ramp merge with the I-95 southbound collector-distributor road and the Graham Road off-ramp) with an approximately 7% average uphill grade of the I-85 northbound off-ramp itself.
    - KHA identified a long-term concept (Concept #1) that included the following changes/modifications:
        - Close the existing I-95 southbound off-ramp to Graham Road;
        - Close the existing I-95 southbound on-ramp from S. Crater Road;
        - Reconstruct the Graham Road and S. Crater Road intersection and the on-ramp to southbound I-95 to allow southbound left-turn movement from S. Crater Road; and,
        - Construct new I-95 off-ramp to S. Crater Road.

- Issue #2: S. Crater Road to I-95 Northbound Weaving Section: An approximately 360-foot weaving section exists between the S. Crater Road on-ramp to I-95 northbound movement and the off-ramp to the E. Wythe Street/E. Washington Street couplet in downtown Petersburg.
    - KHA identified a long-term concept (Concept #2) to address this issue that included the following changes/modifications:
        - Close the existing I-95 northbound on-ramp from S. Crater Road and reuse the existing Winfield Road to relocate the northbound I-95 on-ramp connection to County Drive (Route 460 Bus.).
        - Reconstruct two intersections to facilitate new traffic movements:
            - Winfield Road/County Drive (Route 460 Bus.)
            - Winfield Road/Crater Road
- Issue #3: I-95 Northbound Off-Ramp to I-85 Southbound Ramp Radius and Bridge Clearance: The existing I-95 northbound to I-85 southbound ramp has a 200 foot radius curve and the current bridge clearance for the ramp beneath I-95 is 13 feet 10 inches; it does not meet current Federal Highway Administration (FHWA) minimum clearance requirements for interstates (16 feet).
    - KHA identified a long-term concept (Concept #3) to address this issue that included the following changes/modifications:
        - Close the existing I-95 northbound off-ramp to I-85 southbound and construct a new flyover ramp (left-hand exit) from I-95 northbound to I-85 southbound.

INITIAL CONCEPT EVALUATION

- KAI reviewed each long-term Concept to consider its feasibility. Criteria considered included:
    - Potential upstream and downstream impacts
    - Intersection/turn lane improvements
    - Design year peak hour operational performance (intersections)
        - LOS D or better
    - Application of contemporary planning, operations, design, and safety performance features
    - Environmental, right-of-way, and utility impacts
    - Constructability
    - Estimated Cost
- KAI identified issues/questions that could not be immediately determined without further investigation, analysis, and/or refinement.

CONCEPT REVISIONS

- KAI revised each original concept to reflect contemporary planning, operations, design, and safety performance considerations. The revisions consider three dimensional roadway design principles.

- An iterative process of refining the concepts included:
  - Developing forecast design year 2040 weekday a.m. and p.m. peak hour traffic volumes
  - Reassigning forecast traffic to the transportation network based for each Concept considered
  - Identifying necessary intersection-level details such as appropriate intersection control and sizing of turn lanes
  - Confirming geometric design details (turn lanes/storages, horizontal and vertical alignment, etc.)
  - Retaining current network connectivity to ensure no Concept would eliminate connections that exist today
- KAI developed two additional evaluated the compatibility of individual concepts and potential for phasing improvements.
- Each revised Concept carried forward was ultimately refined and illustrated by KAI as a single-line taping. The tapings depict concepts reflecting contemporary planning, operations, design, and safety performance considerations, as well as three dimensional roadway design principles.
- Each configuration developed through this process helps clarify each Concept's impact, cost, and feasibility with respect to the criteria discussed previously.

OPERATIONAL ANALYSIS

- VDOT staff selected a design year of 2040 to assess the potential design life of the concepts.
- Compounded annual growth (provided by VDOT) was adjusted to address identified imbalances (caused by different growth rates) that occurred between closely-spaced intersections.
- KAI performed an operational analysis for each refined Concept as well as a no-build condition.
- Each refined concept is forecast to meet VDOT performance criteria in the design year.

COST ESTIMATES

- Base mapping was developed to serve as a basis for developing the estimates. Data sources investigated to inform the mapping include:
  - VDOT record drawings
  - City of Petersburg GIS shape file data
  - US Fish and Wildlife's National Wetland Inventory (NWI) mapping
  - US Department of Agriculture Natural Resources Conversation Service Web Soil Survey
  - Virginia Game and Inland Fisheries (VaFWIS) database
  - Virginia Department of Conservation and Recreation (DCR) Natural Heritage Program database
  - Virginia Department of Historic Resource's (VDHR) Virginia Cultural Resources Information System (V-CRIS)
  - Environmental Data Resources, Inc. with GeoCheck
- When possible, Concepts were broken out into smaller "Projects" when stand-alone improvements/modifications could be isolated. The ability to isolate Projects was governed by a

desire to retain all existing movements/connections, thereby avoiding a long-term loss of connectivity on the roadway network.

- Refined Concept #1**:** This Concept has been broken out into three separate projects (A, B, and C).
    - Project A would eliminate the loop ramp to I-95 southbound from S. Crater Road, realign Graham Road and the I-95 on-ramp to intersect, and create separate north- and southbound left-turn lanes on S. Crater Road.
        - Project A Cost: $3.3M
    - Project B would eliminate the I-95 southbound C-D road off-ramp to Graham Road and construct a new off-ramp to S. Crater Road from the Route 460 Bus./I-95 southbound split.
        - Project B Cost: 8.1M
    - Project C would use the area in the vacated loop ramp as a potential future location for a park and ride lot. Assuming Graham Road is realigned, there would be enough area to provide roughly 150 parking spaces.
        - Project C Cost: $750,000
    - **Total Refined Concept #1 Cost: $12.15M**
- Refined Concept #2: This Concept has been broken out into two separate projects (A and B).
    - Project A includes intersection improvements on S. Crater Road north of I-95, Winfield Road corridor improvements, and modifications to the Winfield Road/Route 460 Bus. intersection as well as the I-95 northbound on-ramp and C-D road.
        - Project A Cost: $11.6M
    - Project B includes improvements to the I-95 southbound off-ramp to Graham Road, Graham Road widening, and modifications to the Graham Road/S. Crater Road intersection.
        - Project B Cost: $3.8M
        - Note: Project B does not directly address the identified weaving issue on the I-95 NB C-D road. Rather, Project B includes improvements that address operational/ capacity issues identified in the no-build analysis on the south side of I-95 at the Graham Road/ I-95 Off-Ramp and Graham Road/S. Crater Road intersections. It should be noted that this particular project would largely conflict with Project A from Refined Concept #1, or if implemented prior to Project A from Refined Concept #1 require significant reconstruction and additional cost.
    - **Total Refined Concept #2 Cost: $15.4M**
- Refined Concept #3: This Concept would provide a flyover ramp to serve I-95 northbound to I-85 southbound movements and is designed with a right-hand exit configuration.
    - **Total** Refined **Concept #3 Cost: $92.4M**
- Refined Concept #1 & #2 Combined: This Concept would combine Refined Concepts #1 and #2, but also provides a new two-way extension of Route 460 Bus. from I-95 to S. Crater Road. This Concept has been broken out into four separate projects (A, B, C, and D).
    - Project A is similar to Project A of Refined Concept #1 discussed earlier.
        - Project A Cost: $3.3M

- Project B is similar to Project A of Refined Concept #2 except that it does not include improvements (widening) to Winfield Road to the same extent or to the County Road corridor.
  - Project B Cost: $11.6M
- Project C includes the elimination of the I-95 southbound off-ramp to Graham Road (similar to Project B of Refined Concept #1), but creates a new intersection with the extension of Route 460 Bus. as opposed to a free-flow off-ramp connection to S. Crater Road.
  - Project C Cost: $18.5M
- Project D would use the area in the vacated loop ramp as a potential future location for a park and ride lot. Assuming Graham Road is realigned, there would be enough area to provide roughly 150 parking spaces.
  - Project D Cost: $750,000
- **Total Refined Concept #1 & #2 Combined Cost: $34.15M**

- Combined Concept: This Concept would merge Refined Concept #1 & #2 Combined with Refined Concept #3.
  - **Total Combined Concept Cost: $125-130M**
  - Strategically phasing improvements (assuming the "Combined Concept" would be constructed in several phases and not as one project) and anticipating future construction could help minimize reconstruction efforts/costs.

Appendix A
Traffic Data

Type of peak hour being reported: User-Defined

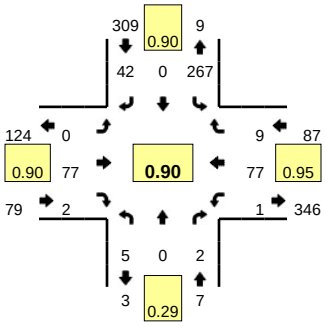
Method for determining peak hour: Total Entering Volume

LOCATION: I-95 SB C-D Rd -- Graham Rd

CITY/STATE: Petersburg, VA

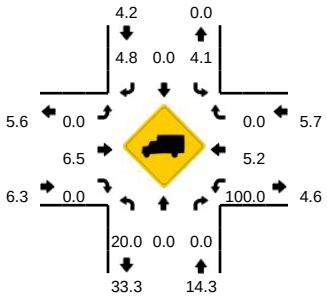
QC JOB #: 12786601

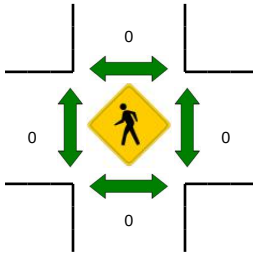
DATE: Tue, Sep 09 2014

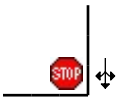


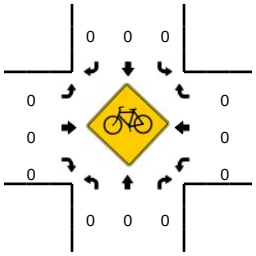
Peak-Hour: 7:30 AM -- 8:30 AM

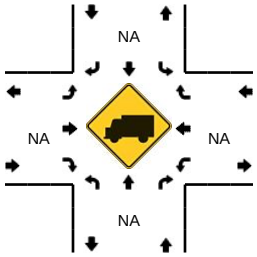
Peak 15-Min: 8:15 AM -- 8:30 AM

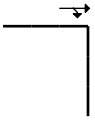


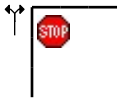


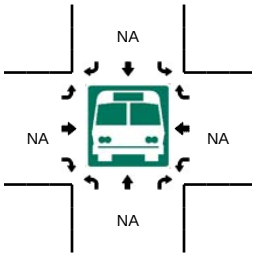












15-Min Count Period Beginning At	I-95 SB C-D Rd (Northbound)				I-95 SB C-D Rd (Southbound)				Graham Rd (Eastbound)				Graham Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	0	0	0	9	0	2	0	0	14	0	0	0	7	0	0	32	
6:15 AM	0	0	0	0	15	0	6	0	0	22	0	0	0	6	0	0	49	
6:30 AM	0	0	0	0	25	0	4	0	0	19	0	0	0	4	0	0	52	
6:45 AM	0	0	0	0	62	0	5	0	0	19	0	0	0	9	0	0	95	228
7:00 AM	0	0	2	0	46	0	2	0	0	19	0	0	1	9	0	1	80	276
7:15 AM	0	0	0	0	55	0	2	0	0	30	0	0	0	10	0	0	97	324
7:30 AM	1	0	0	0	56	0	8	0	0	21	0	0	1	20	0	0	107	379
7:45 AM	0	0	0	0	60	0	13	0	0	22	0	0	0	20	0	0	115	399
8:00 AM	0	0	0	0	76	0	10	0	0	16	1	0	0	19	4	0	126	445
8:15 AM	4	0	2	0	75	0	11	0	0	18	1	0	0	18	5	0	134	482
8:30 AM	0	0	0	0	58	1	7	0	0	21	0	0	0	16	3	0	106	481
8:45 AM	0	0	0	0	73	0	10	0	0	23	0	0	0	26	5	0	137	503

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	0	8	0	300	0	44	0	0	72	4	0	0	72	20	0	536
Heavy Trucks	0	0	0		20	0	0		0	4	0		0	0	0		24
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:21 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

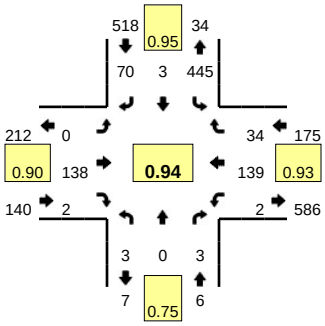
Method for determining peak hour: Total Entering Volume

LOCATION: I-95 SB C-D Rd -- Graham Rd

CITY/STATE: Petersburg, VA

QC JOB #: 12786602

DATE: Tue, Sep 09 2014



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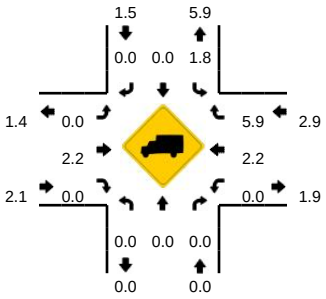
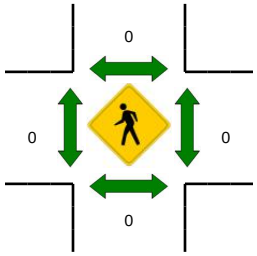
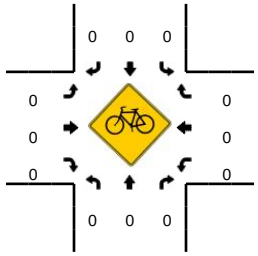
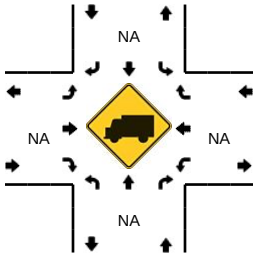
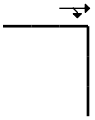
Peak 15-Min: 5:30 PM -- 5:45 PM

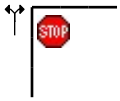


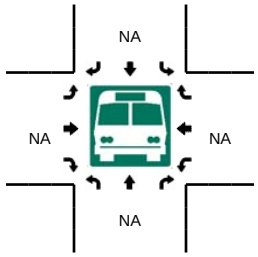












15-Min Count Period Beginning At	I-95 SB C-D Rd (Northbound)				I-95 SB C-D Rd (Southbound)				Graham Rd (Eastbound)				Graham Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	94	0	5	0	0	40	0	0	0	25	9	0	173	
4:15 PM	0	0	2	0	98	1	13	0	0	31	0	0	1	20	5	0	171	
4:30 PM	0	0	0	0	116	0	6	0	0	26	0	0	0	23	10	0	181	
4:45 PM	1	0	0	0	108	1	16	0	0	30	1	0	0	37	10	0	204	729
5:00 PM	1	0	1	0	111	1	18	0	0	31	1	0	0	36	6	0	206	762
5:15 PM	0	0	1	0	108	0	18	0	0	39	0	0	2	30	9	0	207	798
5:30 PM	1	0	1	0	118	1	18	0	0	38	0	0	0	36	9	0	222	839
5:45 PM	0	0	0	0	119	0	18	0	0	33	1	0	0	28	9	0	208	843
6:00 PM	1	0	0	0	109	0	13	0	0	32	1	0	0	31	6	0	193	830
6:15 PM	0	0	1	0	89	1	11	0	0	31	1	0	1	30	6	0	171	794
6:30 PM	0	0	2	0	98	0	9	0	0	26	0	0	1	22	7	0	165	737
6:45 PM	0	0	1	0	84	2	8	0	0	23	0	0	0	35	12	0	165	694

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	0	4	0	472	4	72	0	0	152	0	0	0	144	36	0	888
Heavy Trucks	0	0	0		8	0	0		0	0	0		0	4	0		12
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:22 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

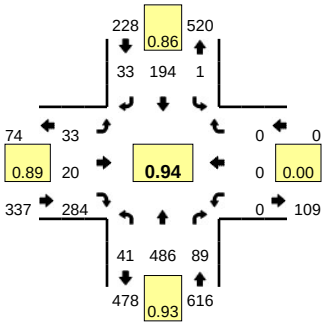
Method for determining peak hour: Total Entering Volume

LOCATION: S Crater Rd -- Graham Rd

QC JOB #: 12786603

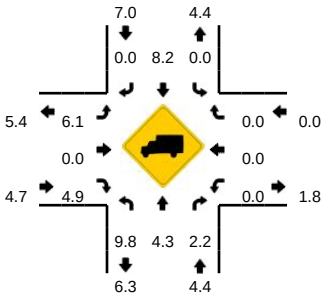
CITY/STATE: Petersburg, VA

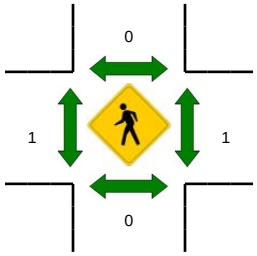
DATE: Tue, Sep 09 2014

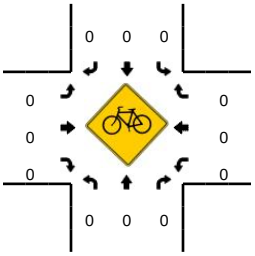


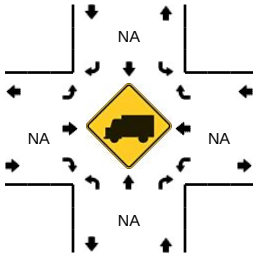
Peak-Hour: 7:30 AM -- 8:30 AM

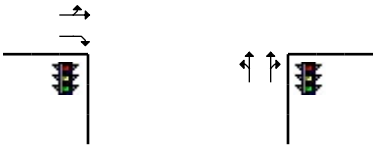
Peak 15-Min: 8:15 AM -- 8:30 AM

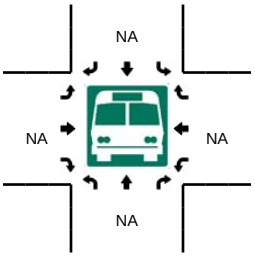












15-Min Count Period Beginning At	S Crater Rd (Northbound)				S Crater Rd (Southbound)				Graham Rd (Eastbound)				Graham Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	1	52	9	0	0	15	9	0	9	3	11	0	0	0	0	0	109	
6:15 AM	2	77	16	0	0	16	5	0	12	5	17	0	0	0	0	0	150	
6:30 AM	1	96	21	0	1	24	4	0	12	7	18	0	0	0	0	0	184	
6:45 AM	3	86	9	0	0	40	6	0	13	5	68	0	0	0	0	0	230	673
7:00 AM	6	103	23	0	0	40	6	0	12	7	49	0	0	0	0	0	246	810
7:15 AM	3	99	23	0	0	35	7	0	15	14	57	0	0	0	0	0	253	913
7:30 AM	8	142	15	0	0	32	11	0	9	10	56	0	0	0	0	0	283	1012
7:45 AM	11	126	29	0	0	45	9	0	12	3	65	0	0	0	0	0	300	1082
8:00 AM	13	94	24	0	0	59	6	1	4	2	81	0	0	0	0	0	284	1120
8:15 AM	9	124	21	0	0	58	7	0	8	5	82	0	0	0	0	0	314	1181
8:30 AM	3	87	17	0	0	42	14	1	12	6	71	0	0	0	0	0	253	1151
8:45 AM	13	109	14	0	0	62	14	0	3	5	80	0	0	0	0	0	300	1151

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	36	496	84	0	0	232	28	0	32	20	328	0	0	0	0	0	1256
Heavy Trucks	0	12	4		0	20	0		4	0	16		0	0	0		56
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:21 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

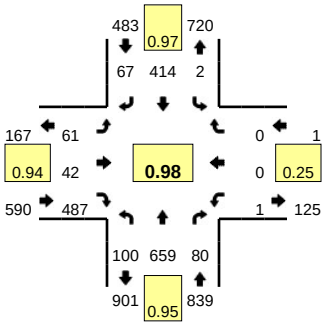
Method for determining peak hour: Total Entering Volume

LOCATION: S Crater Rd -- Graham Rd

CITY/STATE: Petersburg, VA

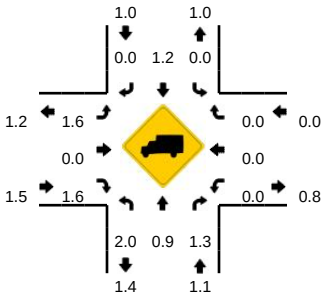
QC JOB #: 12786604

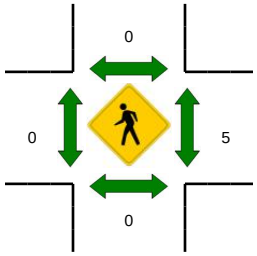
DATE: Tue, Sep 09 2014

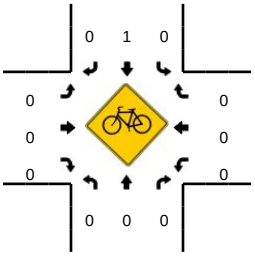


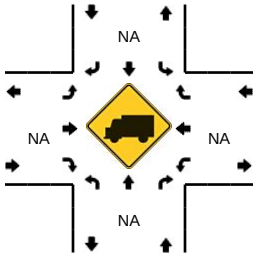
Peak-Hour: 4:45 PM -- 5:45 PM

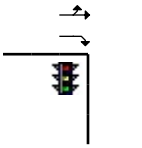
Peak 15-Min: 4:45 PM -- 5:00 PM

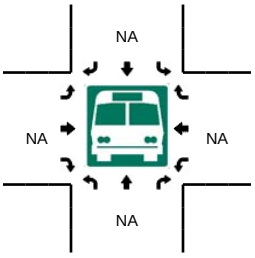












15-Min Count Period Beginning At	S Crater Rd (Northbound)				S Crater Rd (Southbound)				Graham Rd (Eastbound)				Graham Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	16	153	17	0	0	109	15	0	10	9	103	0	0	0	0	0	432	
4:15 PM	14	156	13	0	0	111	11	0	19	11	102	0	0	0	0	0	437	
4:30 PM	18	143	13	1	0	119	14	0	11	4	122	0	0	0	0	0	445	
4:45 PM	29	173	18	0	0	111	14	0	12	9	121	0	0	0	0	1	488	1802
5:00 PM	21	170	24	0	1	98	19	0	16	14	113	0	0	0	0	0	476	1846
5:15 PM	26	167	18	0	1	109	15	0	18	5	125	0	0	0	0	0	484	1893
5:30 PM	24	149	20	0	0	96	19	0	15	14	128	0	0	0	0	0	465	1913
5:45 PM	21	137	19	0	0	97	14	0	17	9	121	0	0	0	0	0	435	1860
6:00 PM	15	151	10	0	0	98	17	0	11	11	116	0	0	0	0	0	429	1813
6:15 PM	21	116	21	0	0	76	15	0	18	10	101	0	0	0	0	0	378	1707
6:30 PM	14	127	15	0	0	85	14	0	16	9	106	0	0	0	0	0	386	1628
6:45 PM	20	108	19	0	0	63	22	0	4	11	89	0	0	0	0	0	336	1529

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	116	692	72	0	0	444	56	0	48	36	484	0	0	0	0	4	1952
Heavy Trucks	8	4	4		0	8	0		0	0	4		0	0	0		28
Pedestrians		0				0				0				8			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:22 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

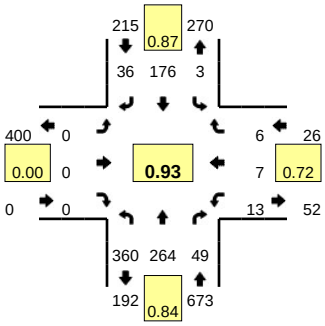
Method for determining peak hour: Total Entering Volume

LOCATION: S Crater Rd -- I-95 NB On Ramp

CITY/STATE: Petersburg, VA

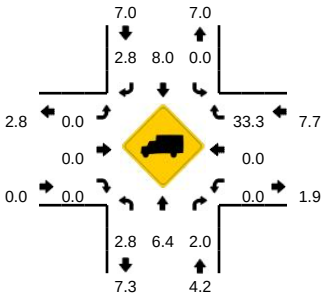
QC JOB #: 12786605

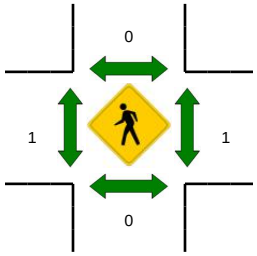
DATE: Tue, Sep 09 2014

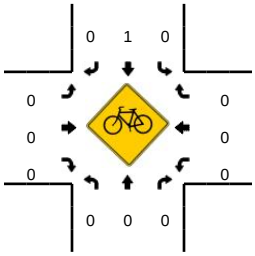


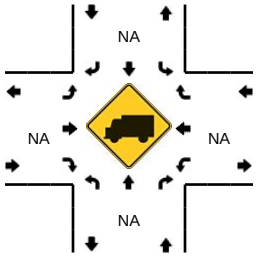
Peak-Hour: 7:30 AM -- 8:30 AM

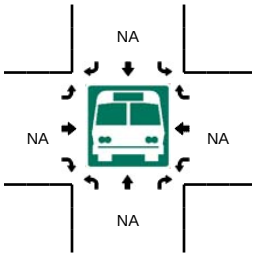
Peak 15-Min: 7:30 AM -- 7:45 AM











15-Min Count Period Beginning At	S Crater Rd (Northbound)				S Crater Rd (Southbound)				I-95 NB On Ramp (Eastbound)				I-95 NB On Ramp (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	52	31	10	0	1	12	6	0	0	0	0	0	1	2	1	0	116	
6:15 AM	62	50	15	0	0	21	10	0	0	0	0	0	0	2	4	0	164	
6:30 AM	90	40	12	0	0	26	6	0	0	0	0	0	2	5	1	0	182	
6:45 AM	79	44	7	0	1	41	11	0	0	0	0	0	0	0	0	0	183	645
7:00 AM	84	47	14	1	0	37	10	0	0	0	0	0	1	3	1	0	198	727
7:15 AM	86	57	10	0	0	34	8	0	0	0	0	0	2	4	1	0	202	765
7:30 AM	107	78	13	2	0	33	7	0	0	0	0	0	2	2	2	0	246	829
7:45 AM	95	74	8	0	1	40	11	0	0	0	0	0	2	3	4	0	238	884
8:00 AM	65	53	14	0	1	51	9	0	0	0	0	0	4	1	0	0	198	884
8:15 AM	90	59	14	1	1	52	9	0	0	0	0	0	5	1	0	0	232	914
8:30 AM	58	66	10	1	1	42	6	0	0	0	0	0	4	2	2	0	192	860
8:45 AM	71	73	9	1	1	58	16	0	0	0	0	0	0	6	1	0	236	858

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	428	312	52	8	0	132	28	0	0	0	0	0	8	8	8	0	984
Heavy Trucks	20	16	0		0	24	0		0	0	0		0	0	4		64
Pedestrians		0				0				4				0			4
Bicycles	0	0	0		0	1	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:21 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

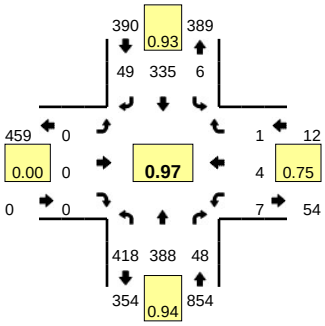
Method for determining peak hour: Total Entering Volume

LOCATION: S Crater Rd -- I-95 NB On-Ramp

CITY/STATE: Petersburg, VA

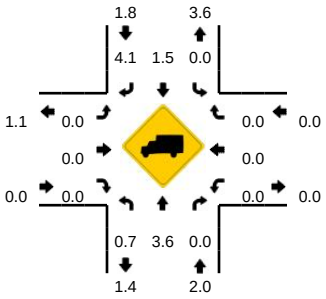
QC JOB #: 12786606

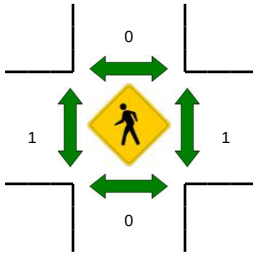
DATE: Tue, Sep 09 2014

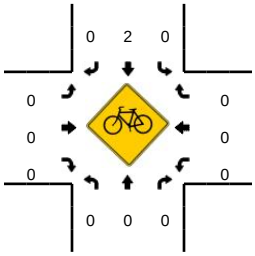


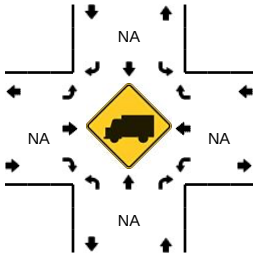
Peak-Hour: 4:45 PM -- 5:45 PM

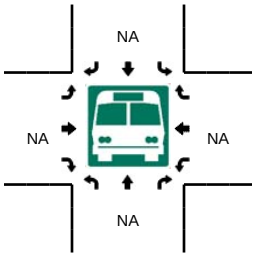
Peak 15-Min: 5:15 PM -- 5:30 PM











15-Min Count Period Beginning At	S Crater Rd (Northbound)				S Crater Rd (Southbound)				I-95 NB On-Ramp (Eastbound)				I-95 NB On-Ramp (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	76	117	9	1	2	89	12	0	0	0	0	0	3	1	0	0	310	
4:15 PM	103	105	12	3	1	90	7	0	0	0	0	0	2	0	0	0	323	
4:30 PM	76	115	7	3	1	82	6	0	0	0	0	0	0	1	2	0	293	
4:45 PM	96	90	16	2	1	82	14	0	0	0	0	0	2	2	0	0	305	1231
5:00 PM	118	99	8	2	2	76	15	0	0	0	0	0	2	0	0	0	322	1243
5:15 PM	93	112	15	6	1	83	11	0	0	0	0	0	1	1	1	0	324	1244
5:30 PM	99	87	9	2	2	94	9	0	0	0	0	0	2	1	0	0	305	1256
5:45 PM	81	93	12	2	1	80	11	0	0	0	0	0	3	3	1	0	287	1238
6:00 PM	92	80	12	1	0	82	14	0	0	0	0	0	2	1	1	0	285	1201
6:15 PM	73	88	9	0	0	72	5	0	0	0	0	0	1	1	0	0	249	1126
6:30 PM	20	32	3	0	0	22	0	0	0	0	0	0	1	1	0	0	79	900
6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	613

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	372	448	60	24	4	332	44	0	0	0	0	0	4	4	4	0	1296
Heavy Trucks	8	20	0		0	4	0		0	0	0		0	0	0		32
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:22 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

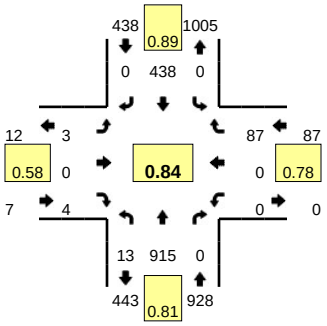
Method for determining peak hour: Total Entering Volume

LOCATION: I-95 Ramps -- Route 460

CITY/STATE: Petersburg, VA

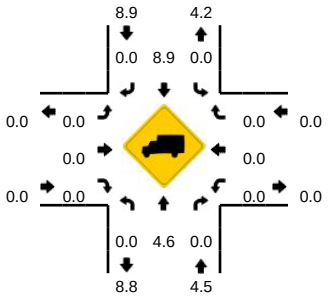
QC JOB #: 12786607

DATE: Tue, Sep 09 2014

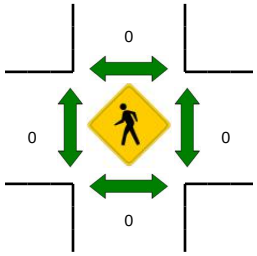


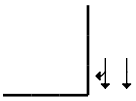
Peak-Hour: 7:30 AM -- 8:30 AM

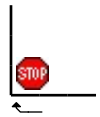
Peak 15-Min: 7:45 AM -- 8:00 AM

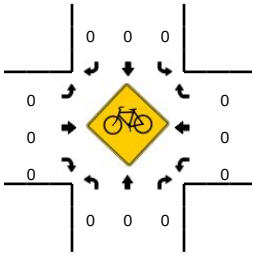


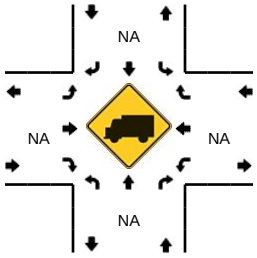
Quality Counts
TRANSPORTATION DATA COLLECTION SERVICES

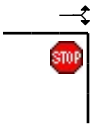


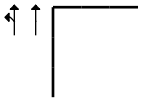


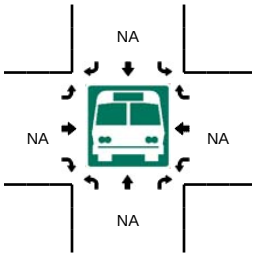












15-Min Count Period Beginning At	I-95 Ramps (Northbound)				I-95 Ramps (Southbound)				Route 460 (Eastbound)				Route 460 (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	4	105	0	0	0	83	0	0	1	0	0	0	0	0	2	0	195	
6:15 AM	2	130	0	0	0	72	0	0	0	0	1	0	0	0	8	0	213	
6:30 AM	0	170	0	0	0	105	0	0	0	0	0	0	0	0	12	0	287	
6:45 AM	0	217	0	0	0	94	0	0	2	0	1	0	0	0	17	0	331	1026
7:00 AM	1	204	0	0	0	103	0	0	0	0	0	0	0	0	16	0	324	1155
7:15 AM	0	265	0	0	0	88	0	0	1	0	1	0	0	0	13	0	368	1310
7:30 AM	1	254	0	0	0	123	0	0	1	0	0	0	0	0	20	0	399	1422
7:45 AM	4	280	0	1	0	118	0	0	1	0	1	0	0	0	28	0	433	1524
8:00 AM	7	197	0	0	0	105	0	0	0	0	1	0	0	0	13	0	323	1523
8:15 AM	0	184	0	0	0	92	0	0	1	0	2	0	0	0	26	0	305	1460
8:30 AM	1	187	0	0	0	93	0	0	1	0	1	0	0	0	25	0	308	1369
8:45 AM	0	130	0	0	0	101	0	0	0	0	0	0	0	0	7	0	238	1174

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	1120	0	4	0	472	0	0	4	0	4	0	0	0	112	0	1732
Heavy Trucks	0	40	0		0	56	0		0	0	0		0	0	0		96
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:21 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: User-Defined

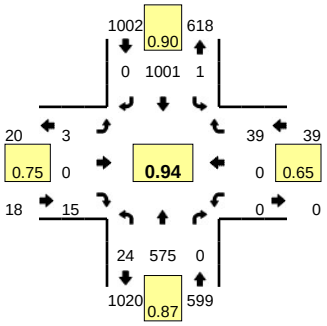
Method for determining peak hour: Total Entering Volume

LOCATION: I-95 Ramps -- Route 460

CITY/STATE: Petersburg, VA

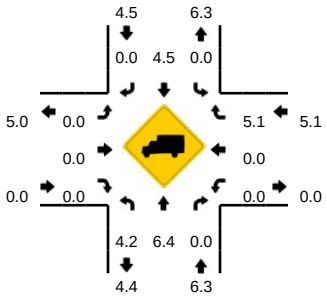
QC JOB #: 12786608

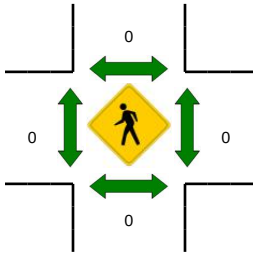
DATE: Tue, Sep 09 2014

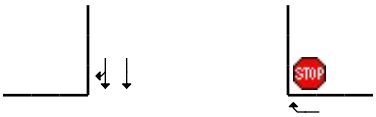


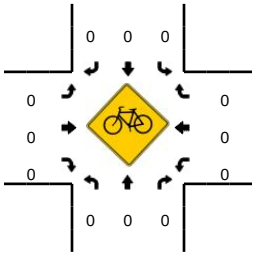
Peak-Hour: 4:45 PM -- 5:45 PM

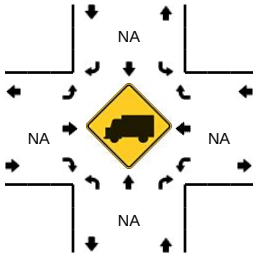
Peak 15-Min: 5:00 PM -- 5:15 PM

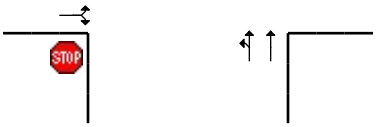


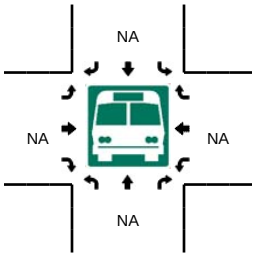












15-Min Count Period Beginning At	I-95 Ramps (Northbound)				I-95 Ramps (Southbound)				Route 460 (Eastbound)				Route 460 (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	5	136	0	0	0	250	0	1	2	0	2	0	0	0	4	0	400	
4:15 PM	7	142	0	1	0	268	0	0	0	0	1	0	0	1	4	0	424	
4:30 PM	9	143	0	0	0	295	0	0	3	0	2	0	0	0	3	0	455	
4:45 PM	7	131	0	0	0	272	0	0	0	0	2	0	0	0	9	0	421	1700
5:00 PM	5	137	0	0	0	277	0	1	1	0	5	0	0	0	15	0	441	1741
5:15 PM	4	168	0	1	0	256	0	0	2	0	3	0	0	0	5	0	439	1756
5:30 PM	4	139	0	3	0	196	0	0	0	0	5	0	0	0	10	0	357	1658
5:45 PM	7	126	0	0	0	172	0	0	0	0	2	0	0	0	10	0	317	1554
6:00 PM	4	116	0	0	0	150	0	0	1	0	0	0	0	0	5	0	276	1389
6:15 PM	2	163	0	0	0	137	0	0	8	0	3	0	0	0	12	0	325	1275
6:30 PM	6	116	0	0	0	113	0	0	3	0	0	0	0	0	2	0	240	1158
6:45 PM	4	121	0	0	0	106	0	0	4	0	3	0	0	0	2	0	240	1081

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	20	548	0	0	0	1108	0	4	4	0	20	0	0	0	60	0	1764
Heavy Trucks	4	28	0		0	68	0		0	0	0		0	0	4		104
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 11/18/2014 2:22 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

LOCATION: On Ramp 460 East/95 South
QC JOB #: 12786609
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		11				11			11	
12:15 AM		12				12			12	
12:30 AM		13				13			13	
12:45 AM		10				10			10	
1:00 AM		7				7			7	
1:15 AM		13				13			13	
1:30 AM		3				3			3	
1:45 AM		7				7			7	
2:00 AM		3				3			3	
2:15 AM		6				6			6	
2:30 AM		12				12			12	
2:45 AM		10				10			10	
3:00 AM		5				5			5	
3:15 AM		7				7			7	
3:30 AM		12				12			12	
3:45 AM		9				9			9	
4:00 AM		23				23			23	
4:15 AM		16				16			16	
4:30 AM		24				24			24	
4:45 AM		25				25			25	
5:00 AM		24				24			24	
5:15 AM		47				47			47	
5:30 AM		69				69			69	
5:45 AM		73				73			73	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: On Ramp 460 East/95 South
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786609
DIRECTION: SB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		62				62			62	
6:15 AM		105				105			105	
6:30 AM		138				138			138	
6:45 AM		135				135			135	
7:00 AM		118				118			118	
7:15 AM		118				118			118	
7:30 AM		127				127			127	
7:45 AM		**177**				**177**			**177**	
8:00 AM		114				114			114	
8:15 AM		124				124			124	
8:30 AM		111				111			111	
8:45 AM		114				114			114	
9:00 AM		77				77			77	
9:15 AM		83				83			83	
9:30 AM		70				70			70	
9:45 AM		78				78			78	
10:00 AM		86				86			86	
10:15 AM		65				65			65	
10:30 AM		71				71			71	
10:45 AM		79				79			79	
11:00 AM		83				83			83	
11:15 AM		58				58			58	
11:30 AM		81				81			81	
11:45 AM		68				68			68	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: On Ramp 460 East/95 South
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786609
DIRECTION: SB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 PM		72				72			72	
12:15 PM		70				70			70	
12:30 PM		84				84			84	
12:45 PM		66				66			66	
1:00 PM		81				81			81	
1:15 PM		56				56			56	
1:30 PM		67				67			67	
1:45 PM		72				72			72	
2:00 PM		64				64			64	
2:15 PM		81				81			81	
2:30 PM		87				87			87	
2:45 PM		84				84			84	
3:00 PM		84				84			84	
3:15 PM		82				82			82	
3:30 PM		98				98			98	
3:45 PM		**114**				**114**			**114**	
4:00 PM		99				99			99	
4:15 PM		82				82			82	
4:30 PM		94				94			94	
4:45 PM		92				92			92	
5:00 PM		82				82			82	
5:15 PM		109				109			109	
5:30 PM		80				80			80	
5:45 PM		83				83			83	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: On Ramp 460 East/95 South
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786609
DIRECTION: SB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 PM		90				90			90	
6:15 PM		66				66			66	
6:30 PM		89				89			89	
6:45 PM		80				80			80	
7:00 PM		63				63			63	
7:15 PM		44				44			44	
7:30 PM		52				52			52	
7:45 PM		54				54			54	
8:00 PM		35				35			35	
8:15 PM		30				30			30	
8:30 PM		36				36			36	
8:45 PM		36				36			36	
9:00 PM		32				32			32	
9:15 PM		27				27			27	
9:30 PM		39				39			39	
9:45 PM		21				21			21	
10:00 PM		34				34			34	
10:15 PM		24				24			24	
10:30 PM		26				26			26	
10:45 PM		25				25			25	
11:00 PM		23				23			23	
11:15 PM		15				15			15	
11:30 PM		16				16			16	
11:45 PM		16				16			16	
Day Total		5739				5739			5739	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		7:45 AM				7:45 AM			7:45 AM	
Volume		177				177			177	
PM Peak		3:45 PM				3:45 PM			3:45 PM	
Volume		114				114			114	

Comments:

LOCATION: SB Crater Rd to I-95 SB
QC JOB #: 12786610
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		5				5			5	
12:15 AM		4				4			4	
12:30 AM		6				6			6	
12:45 AM		2				2			2	
1:00 AM		0				0			0	
1:15 AM		2				2			2	
1:30 AM		3				3			3	
1:45 AM		2				2			2	
2:00 AM		1				1			1	
2:15 AM		1				1			1	
2:30 AM		1				1			1	
2:45 AM		1				1			1	
3:00 AM		0				0			0	
3:15 AM		3				3			3	
3:30 AM		1				1			1	
3:45 AM		1				1			1	
4:00 AM		1				1			1	
4:15 AM		3				3			3	
4:30 AM		3				3			3	
4:45 AM		2				2			2	
5:00 AM		3				3			3	
5:15 AM		2				2			2	
5:30 AM		1				1			1	
5:45 AM		7				7			7	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: SB Crater Rd to I-95 SB
QC JOB #: 12786610
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		3				3			3	
6:15 AM		3				3			3	
6:30 AM		5				5			5	
6:45 AM		4				4			4	
7:00 AM		5				5			5	
7:15 AM		4				4			4	
7:30 AM		5				5			5	
7:45 AM		2				2			2	
8:00 AM		5				5			5	
8:15 AM		8				8			8	
8:30 AM		2				2			2	
8:45 AM		8				8			8	
9:00 AM		7				7			7	
9:15 AM		7				7			7	
9:30 AM		9				9			9	
9:45 AM		**11**				**11**			**11**	
10:00 AM		7				7			7	
10:15 AM		11				11			11	
10:30 AM		5				5			5	
10:45 AM		7				7			7	
11:00 AM		8				8			8	
11:15 AM		5				5			5	
11:30 AM		6				6			6	
11:45 AM		5				5			5	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: SB Crater Rd to I-95 SB
QC JOB #: 12786610
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 PM		7				7			7	
12:15 PM		8				8			8	
12:30 PM		11				11			11	
12:45 PM		7				7			7	
1:00 PM		10				10			10	
1:15 PM		8				8			8	
1:30 PM		10				10			10	
1:45 PM		7				7			7	
2:00 PM		6				6			6	
2:15 PM		8				8			8	
2:30 PM		14				14			14	
2:45 PM		9				9			9	
3:00 PM		9				9			9	
3:15 PM		5				5			5	
3:30 PM		10				10			10	
3:45 PM		11				11			11	
4:00 PM		**16**				**16**			**16**	
4:15 PM		9				9			9	
4:30 PM		13				13			13	
4:45 PM		9				9			9	
5:00 PM		8				8			8	
5:15 PM		11				11			11	
5:30 PM		13				13			13	
5:45 PM		10				10			10	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: SB Crater Rd to I-95 SB
QC JOB #: 12786610
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 PM		8				8			8	
6:15 PM		7				7			7	
6:30 PM		8				8			8	
6:45 PM		13				13			13	
7:00 PM		6				6			6	
7:15 PM		10				10			10	
7:30 PM		12				12			12	
7:45 PM		5				5			5	
8:00 PM		3				3			3	
8:15 PM		6				6			6	
8:30 PM		6				6			6	
8:45 PM		6				6			6	
9:00 PM		9				9			9	
9:15 PM		3				3			3	
9:30 PM		2				2			2	
9:45 PM		4				4			4	
10:00 PM		1				1			1	
10:15 PM		3				3			3	
10:30 PM		6				6			6	
10:45 PM		0				0			0	
11:00 PM		8				8			8	
11:15 PM		2				2			2	
11:30 PM		2				2			2	
11:45 PM		4				4			4	
Day Total		560				560			560	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		9:45 AM				9:45 AM			9:45 AM	
Volume		11				11			11	
PM Peak		4:00 PM				4:00 PM			4:00 PM	
Volume		16				16			16	

Comments:

LOCATION: Route 460 WB Mainline
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786611
DIRECTION: WB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		6				6			6	
12:15 AM		1				1			1	
12:30 AM		3				3			3	
12:45 AM		2				2			2	
1:00 AM		2				2			2	
1:15 AM		2				2			2	
1:30 AM		4				4			4	
1:45 AM		2				2			2	
2:00 AM		0				0			0	
2:15 AM		2				2			2	
2:30 AM		0				0			0	
2:45 AM		0				0			0	
3:00 AM		4				4			4	
3:15 AM		2				2			2	
3:30 AM		2				2			2	
3:45 AM		4				4			4	
4:00 AM		1				1			1	
4:15 AM		5				5			5	
4:30 AM		3				3			3	
4:45 AM		0				0			0	
5:00 AM		6				6			6	
5:15 AM		5				5			5	
5:30 AM		4				4			4	
5:45 AM		9				9			9	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Route 460 WB Mainline
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786611
DIRECTION: WB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		10				10			10	
6:15 AM		11				11			11	
6:30 AM		11				11			11	
6:45 AM		11				11			11	
7:00 AM		12				12			12	
7:15 AM		10				10			10	
7:30 AM		12				12			12	
7:45 AM		16				16			16	
8:00 AM		11				11			11	
8:15 AM		12				12			12	
8:30 AM		15				15			15	
8:45 AM		17				17			17	
9:00 AM		15				15			15	
9:15 AM		12				12			12	
9:30 AM		14				14			14	
9:45 AM		18				18			18	
10:00 AM		22				22			22	
10:15 AM		16				16			16	
10:30 AM		16				16			16	
10:45 AM		15				15			15	
11:00 AM		22				22			22	
11:15 AM		**26**				**26**			**26**	
11:30 AM		19				19			19	
11:45 AM		18				18			18	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Route 460 WB Mainline
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786611
DIRECTION: WB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 PM		20				20			20	
12:15 PM		14				14			14	
12:30 PM		15				15			15	
12:45 PM		15				15			15	
1:00 PM		21				21			21	
1:15 PM		19				19			19	
1:30 PM		16				16			16	
1:45 PM		22				22			22	
2:00 PM		21				21			21	
2:15 PM		26				26			26	
2:30 PM		22				22			22	
2:45 PM		14				14			14	
3:00 PM		17				17			17	
3:15 PM		26				26			26	
3:30 PM		30				30			30	
3:45 PM		27				27			27	
4:00 PM		24				24			24	
4:15 PM		29				29			29	
4:30 PM		**39**				**39**			**39**	
4:45 PM		34				34			34	
5:00 PM		26				26			26	
5:15 PM		24				24			24	
5:30 PM		24				24			24	
5:45 PM		18				18			18	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Route 460 WB Mainline
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786611
DIRECTION: WB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 PM		22				22			22	
6:15 PM		19				19			19	
6:30 PM		21				21			21	
6:45 PM		19				19			19	
7:00 PM		17				17			17	
7:15 PM		24				24			24	
7:30 PM		11				11			11	
7:45 PM		19				19			19	
8:00 PM		9				9			9	
8:15 PM		6				6			6	
8:30 PM		6				6			6	
8:45 PM		11				11			11	
9:00 PM		7				7			7	
9:15 PM		8				8			8	
9:30 PM		8				8			8	
9:45 PM		4				4			4	
10:00 PM		7				7			7	
10:15 PM		7				7			7	
10:30 PM		4				4			4	
10:45 PM		6				6			6	
11:00 PM		3				3			3	
11:15 PM		4				4			4	
11:30 PM		5				5			5	
11:45 PM		2				2			2	
Day Total		1222				1222			1222	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		11:15 AM				11:15 AM			11:15 AM	
Volume		26				26			26	
PM Peak		4:30 PM				4:30 PM			4:30 PM	
Volume		39				39			39	

Comments:

LOCATION: Route 460 WB Near I 95 Off Ramp
QC JOB #: 12786612
SPECIFIC LOCATION: 0 ft from
DIRECTION: NB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		6				6			6	
12:15 AM		4				4			4	
12:30 AM		4				4			4	
12:45 AM		3				3			3	
1:00 AM		2				2			2	
1:15 AM		0				0			0	
1:30 AM		7				7			7	
1:45 AM		2				2			2	
2:00 AM		0				0			0	
2:15 AM		2				2			2	
2:30 AM		0				0			0	
2:45 AM		0				0			0	
3:00 AM		2				2			2	
3:15 AM		1				1			1	
3:30 AM		3				3			3	
3:45 AM		4				4			4	
4:00 AM		1				1			1	
4:15 AM		4				4			4	
4:30 AM		4				4			4	
4:45 AM		1				1			1	
5:00 AM		5				5			5	
5:15 AM		8				8			8	
5:30 AM		4				4			4	
5:45 AM		9				9			9	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Route 460 WB Near I 95 Off Ramp
QC JOB #: 12786612
SPECIFIC LOCATION: 0 ft from
DIRECTION: NB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		8				8			8	
6:15 AM		14				14			14	
6:30 AM		8				8			8	
6:45 AM		13				13			13	
7:00 AM		10				10			10	
7:15 AM		12				12			12	
7:30 AM		11				11			11	
7:45 AM		17				17			17	
8:00 AM		10				10			10	
8:15 AM		13				13			13	
8:30 AM		14				14			14	
8:45 AM		17				17			17	
9:00 AM		17				17			17	
9:15 AM		14				14			14	
9:30 AM		16				16			16	
9:45 AM		20				20			20	
10:00 AM		21				21			21	
10:15 AM		16				16			16	
10:30 AM		12				12			12	
10:45 AM		20				20			20	
11:00 AM		21				21			21	
11:15 AM		22				22			22	
11:30 AM		**23**				**23**			**23**	
11:45 AM		16				16			16	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Route 460 WB Near I 95 Off Ramp
QC JOB #: 12786612
SPECIFIC LOCATION: 0 ft from
DIRECTION: NB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
		09-Sep-14								
12:00 PM		20				20			20	
12:15 PM		11				11			11	
12:30 PM		18				18			18	
12:45 PM		13				13			13	
1:00 PM		23				23			23	
1:15 PM		22				22			22	
1:30 PM		17				17			17	
1:45 PM		20				20			20	
2:00 PM		19				19			19	
2:15 PM		25				25			25	
2:30 PM		25				25			25	
2:45 PM		10				10			10	
3:00 PM		22				22			22	
3:15 PM		29				29			29	
3:30 PM		24				24			24	
3:45 PM		28				28			28	
4:00 PM		27				27			27	
4:15 PM		24				24			24	
4:30 PM		**37**				**37**			**37**	
4:45 PM		26				26			26	
5:00 PM		27				27			27	
5:15 PM		25				25			25	
5:30 PM		22				22			22	
5:45 PM		25				25			25	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Route 460 WB Near I 95 Off Ramp
QC JOB #: 12786612
SPECIFIC LOCATION: 0 ft from
DIRECTION: NB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 PM		21				21			21	
6:15 PM		17				17			17	
6:30 PM		19				19			19	
6:45 PM		19				19			19	
7:00 PM		20				20			20	
7:15 PM		21				21			21	
7:30 PM		14				14			14	
7:45 PM		17				17			17	
8:00 PM		14				14			14	
8:15 PM		5				5			5	
8:30 PM		6				6			6	
8:45 PM		8				8			8	
9:00 PM		11				11			11	
9:15 PM		6				6			6	
9:30 PM		15				15			15	
9:45 PM		7				7			7	
10:00 PM		8				8			8	
10:15 PM		5				5			5	
10:30 PM		6				6			6	
10:45 PM		8				8			8	
11:00 PM		3				3			3	
11:15 PM		3				3			3	
11:30 PM		8				8			8	
11:45 PM		4				4			4	
Day Total		1245				1245			1245	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		11:30 AM				11:30 AM			11:30 AM	
Volume		23				23			23	
PM Peak		4:30 PM				4:30 PM			4:30 PM	
Volume		37				37			37	

Comments:

LOCATION: I-95 NB Off-ramp to S Crater Rd SB

QC JOB #: 12786613

SPECIFIC LOCATION: 0 ft from

DIRECTION: SB

CITY/STATE: Petersburg, VA

DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		5				5			5	
12:15 AM		4				4			4	
12:30 AM		1				1			1	
12:45 AM		1				1			1	
1:00 AM		2				2			2	
1:15 AM		3				3			3	
1:30 AM		2				2			2	
1:45 AM		3				3			3	
2:00 AM		1				1			1	
2:15 AM		3				3			3	
2:30 AM		2				2			2	
2:45 AM		1				1			1	
3:00 AM		0				0			0	
3:15 AM		2				2			2	
3:30 AM		1				1			1	
3:45 AM		1				1			1	
4:00 AM		0				0			0	
4:15 AM		1				1			1	
4:30 AM		1				1			1	
4:45 AM		6				6			6	
5:00 AM		3				3			3	
5:15 AM		2				2			2	
5:30 AM		3				3			3	
5:45 AM		7				7			7	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: I-95 NB Off-ramp to S Crater Rd SB

QC JOB #: 12786613

SPECIFIC LOCATION: 0 ft from

DIRECTION: SB

CITY/STATE: Petersburg, VA

DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		7				7			7	
6:15 AM		8				8			8	
6:30 AM		9				9			9	
6:45 AM		10				10			10	
7:00 AM		14				14			14	
7:15 AM		11				11			11	
7:30 AM		12				12			12	
7:45 AM		17				17			17	
8:00 AM		17				17			17	
8:15 AM		13				13			13	
8:30 AM		15				15			15	
8:45 AM		**26**				**26**			**26**	
9:00 AM		23				23			23	
9:15 AM		10				10			10	
9:30 AM		14				14			14	
9:45 AM		13				13			13	
10:00 AM		14				14			14	
10:15 AM		15				15			15	
10:30 AM		13				13			13	
10:45 AM		15				15			15	
11:00 AM		4				4			4	
11:15 AM		21				21			21	
11:30 AM		24				24			24	
11:45 AM		26				26			26	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: I-95 NB Off-ramp to S Crater Rd SB

QC JOB #: 12786613

SPECIFIC LOCATION: 0 ft from

DIRECTION: SB

CITY/STATE: Petersburg, VA

DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 PM		25				25			25	
12:15 PM		24				24			24	
12:30 PM		25				25			25	
12:45 PM		24				24			24	
1:00 PM		25				25			25	
1:15 PM		25				25			25	
1:30 PM		29				29			29	
1:45 PM		20				20			20	
2:00 PM		20				20			20	
2:15 PM		20				20			20	
2:30 PM		21				21			21	
2:45 PM		24				24			24	
3:00 PM		34				34			34	
3:15 PM		22				22			22	
3:30 PM		28				28			28	
3:45 PM		23				23			23	
4:00 PM		36				36			36	
4:15 PM		36				36			36	
4:30 PM		**52**				**52**			**52**	
4:45 PM		44				44			44	
5:00 PM		41				41			41	
5:15 PM		42				42			42	
5:30 PM		30				30			30	
5:45 PM		26				26			26	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: I-95 NB Off-ramp to S Crater Rd SB

QC JOB #: 12786613

SPECIFIC LOCATION: 0 ft from

DIRECTION: SB

CITY/STATE: Petersburg, VA

DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
		09-Sep-14								
6:00 PM		36				36			36	
6:15 PM		27				27			27	
6:30 PM		22				22			22	
6:45 PM		29				29			29	
7:00 PM		16				16			16	
7:15 PM		35				35			35	
7:30 PM		23				23			23	
7:45 PM		15				15			15	
8:00 PM		14				14			14	
8:15 PM		16				16			16	
8:30 PM		15				15			15	
8:45 PM		10				10			10	
9:00 PM		14				14			14	
9:15 PM		10				10			10	
9:30 PM		11				11			11	
9:45 PM		14				14			14	
10:00 PM		7				7			7	
10:15 PM		5				5			5	
10:30 PM		9				9			9	
10:45 PM		8				8			8	
11:00 PM		7				7			7	
11:15 PM		6				6			6	
11:30 PM		7				7			7	
11:45 PM		5				5			5	
Day Total		1463				1463			1463	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		8:45 AM				8:45 AM			8:45 AM	
Volume		26				26			26	
PM Peak		4:30 PM				4:30 PM			4:30 PM	
Volume		52				52			52	

Comments:

LOCATION: Exit 50 to 460/Carter Rd
QC JOB #: 12786614
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		9				9			9	
12:15 AM		38				38			38	
12:30 AM		27				27			27	
12:45 AM		28				28			28	
1:00 AM		17				17			17	
1:15 AM		13				13			13	
1:30 AM		12				12			12	
1:45 AM		4				4			4	
2:00 AM		12				12			12	
2:15 AM		11				11			11	
2:30 AM		6				6			6	
2:45 AM		6				6			6	
3:00 AM		7				7			7	
3:15 AM		7				7			7	
3:30 AM		5				5			5	
3:45 AM		8				8			8	
4:00 AM		9				9			9	
4:15 AM		13				13			13	
4:30 AM		16				16			16	
4:45 AM		17				17			17	
5:00 AM		40				40			40	
5:15 AM		40				40			40	
5:30 AM		59				59			59	
5:45 AM		77				77			77	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Exit 50 to 460/Carter Rd
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786614
DIRECTION: SB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		67				67			67	
6:15 AM		98				98			98	
6:30 AM		123				123			123	
6:45 AM		184				184			184	
7:00 AM		174				174			174	
7:15 AM		**235**				**235**			**235**	
7:30 AM		221				221			221	
7:45 AM		228				228			228	
8:00 AM		191				191			191	
8:15 AM		176				176			176	
8:30 AM		167				167			167	
8:45 AM		134				134			134	
9:00 AM		120				120			120	
9:15 AM		123				123			123	
9:30 AM		114				114			114	
9:45 AM		123				123			123	
10:00 AM		97				97			97	
10:15 AM		107				107			107	
10:30 AM		101				101			101	
10:45 AM		133				133			133	
11:00 AM		113				113			113	
11:15 AM		100				100			100	
11:30 AM		131				131			131	
11:45 AM		126				126			126	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Exit 50 to 460/Carter Rd
SPECIFIC LOCATION: 0 ft from
CITY/STATE: Petersburg, VA

QC JOB #: 12786614
DIRECTION: SB
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 PM		142				142			142	
12:15 PM		152				152			152	
12:30 PM		149				149			149	
12:45 PM		155				155			155	
1:00 PM		143				143			143	
1:15 PM		138				138			138	
1:30 PM		131				131			131	
1:45 PM		135				135			135	
2:00 PM		130				130			130	
2:15 PM		143				143			143	
2:30 PM		152				152			152	
2:45 PM		160				160			160	
3:00 PM		144				144			144	
3:15 PM		186				186			186	
3:30 PM		192				192			192	
3:45 PM		168				168			168	
4:00 PM		169				169			169	
4:15 PM		195				195			195	
4:30 PM		196				196			196	
4:45 PM		199				199			199	
5:00 PM		196				196			196	
5:15 PM		**216**				**216**			**216**	
5:30 PM		216				216			216	
5:45 PM		179				179			179	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: Exit 50 to 460/Carter Rd
QC JOB #: 12786614
SPECIFIC LOCATION: 0 ft from
DIRECTION: SB
CITY/STATE: Petersburg, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 PM		182				182			182	
6:15 PM		177				177			177	
6:30 PM		166				166			166	
6:45 PM		144				144			144	
7:00 PM		135				135			135	
7:15 PM		128				128			128	
7:30 PM		83				83			83	
7:45 PM		101				101			101	
8:00 PM		73				73			73	
8:15 PM		74				74			74	
8:30 PM		96				96			96	
8:45 PM		81				81			81	
9:00 PM		128				128			128	
9:15 PM		102				102			102	
9:30 PM		103				103			103	
9:45 PM		80				80			80	
10:00 PM		69				69			69	
10:15 PM		61				61			61	
10:30 PM		46				46			46	
10:45 PM		36				36			36	
11:00 PM		51				51			51	
11:15 PM		48				48			48	
11:30 PM		44				44			44	
11:45 PM		36				36			36	
Day Total		10097				10097			10097	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		7:15 AM				7:15 AM			7:15 AM	
Volume		235				235			235	
PM Peak		5:15 PM				5:15 PM			5:15 PM	
Volume		216				216			216	

Comments:

LOCATION: I95 off Ramp to S Crater Rd
QC JOB #: 12786615
SPECIFIC LOCATION: 0 ft from
DIRECTION: WB
CITY/STATE: Petersburgh, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		1				1			1	
12:15 AM		0				0			0	
12:30 AM		0				0			0	
12:45 AM		0				0			0	
1:00 AM		1				1			1	
1:15 AM		1				1			1	
1:30 AM		0				0			0	
1:45 AM		0				0			0	
2:00 AM		2				2			2	
2:15 AM		0				0			0	
2:30 AM		0				0			0	
2:45 AM		0				0			0	
3:00 AM		1				1			1	
3:15 AM		1				1			1	
3:30 AM		0				0			0	
3:45 AM		0				0			0	
4:00 AM		2				2			2	
4:15 AM		2				2			2	
4:30 AM		2				2			2	
4:45 AM		0				0			0	
5:00 AM		2				2			2	
5:15 AM		2				2			2	
5:30 AM		3				3			3	
5:45 AM		4				4			4	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: I95 off Ramp to S Crater Rd
QC JOB #: 12786615
SPECIFIC LOCATION: 0 ft from
DIRECTION: WB
CITY/STATE: Petersburgh, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 AM		9				9			9	
6:15 AM		**11**				**11**			**11**	
6:30 AM		7				7			7	
6:45 AM		5				5			5	
7:00 AM		8				8			8	
7:15 AM		11				11			11	
7:30 AM		8				8			8	
7:45 AM		6				6			6	
8:00 AM		4				4			4	
8:15 AM		5				5			5	
8:30 AM		9				9			9	
8:45 AM		7				7			7	
9:00 AM		6				6			6	
9:15 AM		5				5			5	
9:30 AM		5				5			5	
9:45 AM		8				8			8	
10:00 AM		5				5			5	
10:15 AM		5				5			5	
10:30 AM		8				8			8	
10:45 AM		2				2			2	
11:00 AM		5				5			5	
11:15 AM		7				7			7	
11:30 AM		7				7			7	
11:45 AM		9				9			9	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

Comments:

LOCATION: I95 off Ramp to S Crater Rd
QC JOB #: 12786615
SPECIFIC LOCATION: 0 ft from
DIRECTION: WB
CITY/STATE: Petersburgh, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 PM		9				9			9	
12:15 PM		7				7			7	
12:30 PM		8				8			8	
12:45 PM		3				3			3	
1:00 PM		4				4			4	
1:15 PM		8				8			8	
1:30 PM		7				7			7	
1:45 PM		4				4			4	
2:00 PM		5				5			5	
2:15 PM		5				5			5	
2:30 PM		8				8			8	
2:45 PM		10				10			10	
3:00 PM		7				7			7	
3:15 PM		11				11			11	
3:30 PM		8				8			8	
3:45 PM		7				7			7	
4:00 PM		8				8			8	
4:15 PM		10				10			10	
4:30 PM		10				10			10	
4:45 PM		2				2			2	
5:00 PM		11				11			11	
5:15 PM		**14**				**14**			**14**	
5:30 PM		13				13			13	
5:45 PM		3				3			3	
Day Total										
% Weekday Average										
% Week Average										
AM Peak Volume										
PM Peak Volume										

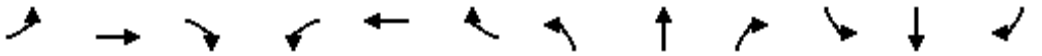
Comments:

LOCATION: I95 off Ramp to S Crater Rd
QC JOB #: 12786615
SPECIFIC LOCATION: 0 ft from
DIRECTION: WB
CITY/STATE: Petersburgh, VA
DATE: Sep 09 2014 - Sep 09 2014

Start Time	Mon	Tue 09-Sep-14	Wed	Thu	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
6:00 PM		7				7			7	
6:15 PM		9				9			9	
6:30 PM		5				5			5	
6:45 PM		3				3			3	
7:00 PM		2				2			2	
7:15 PM		6				6			6	
7:30 PM		5				5			5	
7:45 PM		4				4			4	
8:00 PM		5				5			5	
8:15 PM		1				1			1	
8:30 PM		4				4			4	
8:45 PM		2				2			2	
9:00 PM		1				1			1	
9:15 PM		4				4			4	
9:30 PM		0				0			0	
9:45 PM		2				2			2	
10:00 PM		4				4			4	
10:15 PM		4				4			4	
10:30 PM		2				2			2	
10:45 PM		2				2			2	
11:00 PM		1				1			1	
11:15 PM		4				4			4	
11:30 PM		2				2			2	
11:45 PM		3				3			3	
Day Total		450				450			450	
% Weekday Average		100.0%								
% Week Average		100.0%				100.0%				
AM Peak		6:15 AM				6:15 AM			6:15 AM	
Volume		11				11			11	
PM Peak		5:15 PM				5:15 PM			5:15 PM	
Volume		14				14			14	

Comments:

Appendix B
2040 No-Build Traffic Operations Worksheets



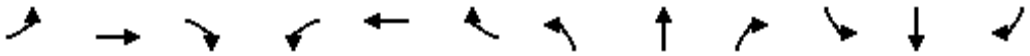
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	13	7	6	416	321	58	3	210	41
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	14	8	7	452	349	63	3	228	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1077				
pX, platoon unblocked												
vC, conflicting volume	1324	1551	114	1405	1520	206	228			412		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1324	1551	114	1405	1520	206	228			412		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	7.6	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.6	2.2			2.2		
p0 queue free %	100	100	100	81	90	99	66			100		
cM capacity (veh/h)	79	76	923	74	79	713	1330			1158		

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	28	452	233	179	3	114	114	45
Volume Left	14	452	0	0	3	0	0	0
Volume Right	7	0	0	63	0	0	0	45
cSH	95	1330	1700	1700	1158	1700	1700	1700
Volume to Capacity	0.30	0.34	0.14	0.11	0.00	0.07	0.07	0.03
Queue Length 95th (ft)	28	38	0	0	0	0	0	0
Control Delay (s)	57.9	9.1	0.0	0.0	8.1	0.0	0.0	0.0
Lane LOS	F	A			A			
Approach Delay (s)	57.9	4.8			0.1			
Approach LOS	F							

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	42.2%	ICU Level of Service	A	
Analysis Period (min)	15			

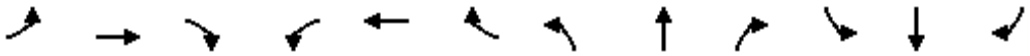
Lane Group	EBT	EBR	NBT	SBT
Lane Group Flow (vph)	92	417	841	288
v/c Ratio	0.25	0.39	0.40	0.35
Control Delay	30.0	3.3	7.3	25.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	30.0	3.3	7.3	25.3
Queue Length 50th (ft)	41	22	92	60
Queue Length 95th (ft)	83	60	124	95
Internal Link Dist (ft)	640		552	223
Turn Bay Length (ft)		100		
Base Capacity (vph)	373	1060	2119	834
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.25	0.39	0.40	0.35

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	58	28	392	0	0	0	58	620	104	0	221	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0					6.0			6.0	
Lane Util. Factor		1.00	1.00					0.95			0.95	
Frt		1.00	0.85					0.98			0.97	
Flt Protected		0.97	1.00					1.00			1.00	
Satd. Flow (prot)		1767	1538					3384			3300	
Flt Permitted		0.97	1.00					0.92			1.00	
Satd. Flow (perm)		1767	1538					3122			3300	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	62	30	417	0	0	0	62	667	112	0	240	48
RTOR Reduction (vph)	0	0	142	0	0	0	0	14	0	0	20	0
Lane Group Flow (vph)	0	92	275	0	0	0	0	827	0	0	268	0
Heavy Vehicles (%)	6%	0%	5%	0%	0%	0%	10%	4%	2%	0%	8%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA			NA	
Protected Phases	3	3	1				1	6			2	
Permitted Phases			3				6					
Actuated Green, G (s)		18.0	46.0					55.0			21.0	
Effective Green, g (s)		18.0	46.0					55.0			21.0	
Actuated g/C Ratio		0.21	0.54					0.65			0.25	
Clearance Time (s)		6.0	6.0					6.0			6.0	
Lane Grp Cap (vph)		374	940					2106			815	
v/s Ratio Prot		0.05	c0.10					c0.13			0.08	
v/s Ratio Perm			0.08					c0.12				
v/c Ratio		0.25	0.29					0.39			0.33	
Uniform Delay, d1		27.9	10.6					7.1			26.2	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		1.6	0.8					0.6			1.1	
Delay (s)		29.4	11.4					7.6			27.3	
Level of Service		C	B					A			C	
Approach Delay (s)		14.7			0.0			7.6			27.3	
Approach LOS		B			A			A			C	

Intersection Summary					
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B		
HCM 2000 Volume to Capacity ratio	0.41				
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A		
Analysis Period (min)	15				
c Critical Lane Group					



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	126	3	1	101	0	5	0	2	350	0	48
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93
Hourly flow rate (vph)	0	137	3	1	110	0	5	0	2	376	0	52
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					720							
pX, platoon unblocked												
vC, conflicting volume	110			140			302	251	139	253	252	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	110			140			302	251	139	253	252	110
tC, single (s)	4.1			5.1			7.3	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			3.1			3.7	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	46	100	94
cM capacity (veh/h)	1493			1011			582	655	915	694	654	936

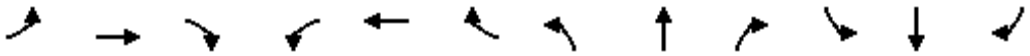
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	140	111	8	428
Volume Left	0	1	5	376
Volume Right	3	0	2	52
cSH	1700	1011	649	717
Volume to Capacity	0.08	0.00	0.01	0.60
Queue Length 95th (ft)	0	0	1	100
Control Delay (s)	0.0	0.1	10.6	17.2
Lane LOS		A	B	C
Approach Delay (s)	0.0	0.1	10.6	17.2
Approach LOS			B	C

Intersection Summary				
Average Delay	10.8			
Intersection Capacity Utilization	40.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Volume (veh/h)	3	0	13	1268	0	0
Sign Control	Stop			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	14	1378	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1407	0	0		30	28
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1407	0	0		30	28
tC, single (s)	6.5	6.2	4.1		7.1	6.5
tC, 2 stage (s)						
tF (s)	4.0	3.3	2.2		3.5	4.0
p0 queue free %	98	100	99		100	100
cM capacity (veh/h)	139	1091	1636		960	861

Direction, Lane #	SE 1	NE 1	NE 2	NE 3	NE 4
Volume Total	3	14	459	459	459
Volume Left	0	14	0	0	0
Volume Right	0	0	459	459	459
cSH	139	1636	1700	1700	1700
Volume to Capacity	0.02	0.01	0.27	0.27	0.27
Queue Length 95th (ft)	2	1	0	0	0
Control Delay (s)	31.5	7.2	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	31.5	0.1			
Approach LOS	D				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	3	4	0	13	0	0	0	0	0	539	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	4	0	14	0	0	0	0	0	586	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	593	586	293	299	586	0	586			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	593	586	293	299	586	0	586			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	99	100	97	100	100			100		
cM capacity (veh/h)	384	425	710	628	425	1091	999			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	8	14	293	293
Volume Left	0	0	0	0
Volume Right	4	0	0	0
cSH	551	425	1700	1700
Volume to Capacity	0.01	0.03	0.17	0.17
Queue Length 95th (ft)	1	3	0	0
Control Delay (s)	11.6	13.8	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.6	13.8	0.0	
Approach LOS	B	B		

Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	49.6%	ICU Level of Service	A	
Analysis Period (min)	15			

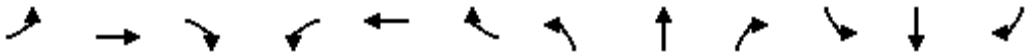
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	7	4	1	500	452	55	7	418	56
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.94	0.93	0.93	0.93
Hourly flow rate (vph)	0	0	0	8	4	1	532	481	59	8	449	60
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1077				
pX, platoon unblocked												
vC, conflicting volume	1772	2068	225	1814	2038	270	449			539		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1772	2068	225	1814	2038	270	449			539		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	76	85	100	52			99		
cM capacity (veh/h)	30	29	785	31	30	734	1114			1039		

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	13	532	321	219	8	225	225	60
Volume Left	8	532	0	0	8	0	0	0
Volume Right	1	0	0	59	0	0	0	60
cSH	33	1114	1700	1700	1039	1700	1700	1700
Volume to Capacity	0.39	0.48	0.19	0.13	0.01	0.13	0.13	0.04
Queue Length 95th (ft)	32	66	0	0	1	0	0	0
Control Delay (s)	170.9	11.1	0.0	0.0	8.5	0.0	0.0	0.0
Lane LOS	F	B			A			
Approach Delay (s)	170.9	5.5			0.1			
Approach LOS	F							

Intersection Summary				
Average Delay	5.1			
Intersection Capacity Utilization	52.6%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBT	EBR	NBT	SBT
Lane Group Flow (vph)	149	708	1035	576
v/c Ratio	0.50	0.69	0.50	0.72
Control Delay	38.7	13.6	6.4	35.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	38.7	13.6	6.4	35.4
Queue Length 50th (ft)	73	201	103	145
Queue Length 95th (ft)	132	330	136	203
Internal Link Dist (ft)	640		552	223
Turn Bay Length (ft)		100		
Base Capacity (vph)	300	1026	2062	798
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.50	0.69	0.50	0.72

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	58	673	0	0	0	127	763	93	0	471	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0					6.0			6.0	
Lane Util. Factor		1.00	1.00					0.95			0.95	
Frt		1.00	0.85					0.99			0.98	
Flt Protected		0.97	1.00					0.99			1.00	
Satd. Flow (prot)		1824	1583					3496			3505	
Flt Permitted		0.97	1.00					0.63			1.00	
Satd. Flow (perm)		1824	1583					2222			3505	
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	61	708	0	0	0	134	803	98	0	496	80
RTOR Reduction (vph)	0	0	24	0	0	0	0	9	0	0	16	0
Lane Group Flow (vph)	0	149	684	0	0	0	0	1026	0	0	560	0
Heavy Vehicles (%)	2%	0%	2%	0%	0%	0%	2%	1%	1%	0%	1%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA			NA	
Protected Phases	3	3	1				1	6			2	
Permitted Phases			3				6					
Actuated Green, G (s)		14.0	48.0					59.0			19.0	
Effective Green, g (s)		14.0	48.0					59.0			19.0	
Actuated g/C Ratio		0.16	0.56					0.69			0.22	
Clearance Time (s)		6.0	6.0					6.0			6.0	
Lane Grp Cap (vph)		300	1005					2051			783	
v/s Ratio Prot		0.08	c0.27					0.20			c0.16	
v/s Ratio Perm			0.16					0.15				
v/c Ratio		0.50	0.68					0.50			0.72	
Uniform Delay, d1		32.3	13.1					6.1			30.5	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		5.8	3.7					0.9			5.5	
Delay (s)		38.1	16.8					7.0			36.1	
Level of Service		D	B					A			D	
Approach Delay (s)		20.5			0.0			7.0			36.1	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	254	3	3	200	0	3	0	3	558	3	80
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.94
Hourly flow rate (vph)	0	276	3	3	217	0	3	0	3	594	3	85
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					720							
pX, platoon unblocked												
vC, conflicting volume	217			279			588	502	278	505	503	217
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	217			279			588	502	278	505	503	217
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	0	99	90
cM capacity (veh/h)	1364			1295			377	473	766	475	472	827

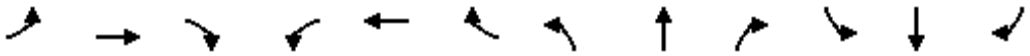
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	279	221	7	682
Volume Left	0	3	3	594
Volume Right	3	0	3	85
cSH	1700	1295	505	501
Volume to Capacity	0.16	0.00	0.01	1.36
Queue Length 95th (ft)	0	0	1	771
Control Delay (s)	0.0	0.1	12.2	197.9
Lane LOS		A	B	F
Approach Delay (s)	0.0	0.1	12.2	197.9
Approach LOS			B	F

Intersection Summary			
Average Delay	113.7		
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Volume (veh/h)	3	0	24	846	0	0
Sign Control	Stop			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	26	920	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	972	0	0		54	52
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	972	0	0		54	52
tC, single (s)	6.5	6.2	4.1		7.1	6.5
tC, 2 stage (s)						
tF (s)	4.0	3.3	2.2		3.5	4.0
p0 queue free %	99	100	98		100	100
cM capacity (veh/h)	251	1091	1636		929	830

Direction, Lane #	SE 1	NE 1	NE 2	NE 3	NE 4
Volume Total	3	26	307	307	307
Volume Left	0	26	0	0	0
Volume Right	0	0	307	307	307
cSH	251	1636	1700	1700	1700
Volume to Capacity	0.01	0.02	0.18	0.18	0.18
Queue Length 95th (ft)	1	1	0	0	0
Control Delay (s)	19.6	7.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	19.6	0.2			
Approach LOS	C				

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	3	15	0	24	0	0	0	0	0	1231	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	16	0	26	0	0	0	0	0	1338	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1351	1338	669	687	1338	0	1338			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1351	1338	669	687	1338	0	1338			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	96	100	83	100	100			100		
cM capacity (veh/h)	96	154	405	318	154	1091	522			1636		

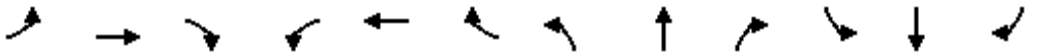
Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	20	26	669	669
Volume Left	0	0	0	0
Volume Right	16	0	0	0
cSH	319	154	1700	1700
Volume to Capacity	0.06	0.17	0.39	0.39
Queue Length 95th (ft)	5	15	0	0
Control Delay (s)	17.0	33.0	0.0	0.0
Lane LOS	C	D		
Approach Delay (s)	17.0	33.0	0.0	
Approach LOS	C	D		

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			

Appendix C
2040 Refined Concept #1
Traffic Operations Worksheets

Lane Group	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	29	451	389	3	236	45
v/c Ratio	0.21	0.45	0.13	0.00	0.08	0.03
Control Delay	33.2	5.6	1.3	2.3	1.5	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	5.6	1.3	2.3	1.5	0.9
Queue Length 50th (ft)	11	0	0	0	0	0
Queue Length 95th (ft)	36	98	28	2	22	6
Internal Link Dist (ft)	58		185		384	
Turn Bay Length (ft)		175		125		125
Base Capacity (vph)	318	1010	3033	898	3027	1424
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.45	0.13	0.00	0.08	0.03

Intersection Summary



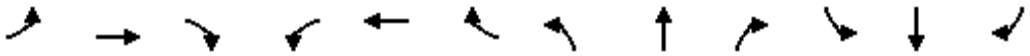
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	13	7	6	415	302	56	3	217	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0		6.0	6.0		6.0	6.0	6.0
Lane Util. Factor					1.00		1.00	0.95		1.00	0.95	1.00
Frt					0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected					0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)					1662		1752	3345		1805	3343	1568
Flt Permitted					0.98		0.60	1.00		0.52	1.00	1.00
Satd. Flow (perm)					1662		1116	3345		992	3343	1568
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	14	8	7	451	328	61	3	236	45
RTOR Reduction (vph)	0	0	0	0	7	0	0	10	0	0	0	8
Lane Group Flow (vph)	0	0	0	0	22	0	451	379	0	3	236	37
Heavy Vehicles (%)	0%	0%	0%	0%	0%	33%	3%	6%	2%	0%	8%	3%
Turn Type				Split	NA		Perm	NA		Perm	NA	Perm
Protected Phases				8	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)					3.2		69.8	69.8		69.8	69.8	69.8
Effective Green, g (s)					3.2		69.8	69.8		69.8	69.8	69.8
Actuated g/C Ratio					0.04		0.82	0.82		0.82	0.82	0.82
Clearance Time (s)					6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)					3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)					62		916	2746		814	2745	1287
v/s Ratio Prot					c0.01			0.11			0.07	
v/s Ratio Perm							c0.40			0.00		0.02
v/c Ratio					0.36		0.49	0.14		0.00	0.09	0.03
Uniform Delay, d1					39.9		2.3	1.5		1.4	1.5	1.4
Progression Factor					1.00		1.61	0.91		1.00	1.00	1.00
Incremental Delay, d2					3.5		1.9	0.1		0.0	0.1	0.0
Delay (s)					43.4		5.5	1.5		1.4	1.5	1.4
Level of Service					D		A	A		A	A	A
Approach Delay (s)		0.0			43.4			3.7			1.5	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	74	40	102	776	30	296
v/c Ratio	0.40	0.10	0.13	0.31	0.05	0.13
Control Delay	41.0	8.0	3.6	6.2	3.8	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.0	8.0	3.6	6.2	3.8	6.2
Queue Length 50th (ft)	38	0	11	51	4	30
Queue Length 95th (ft)	75	22	27	145	10	40
Internal Link Dist (ft)	610			679		92
Turn Bay Length (ft)		100	100		100	
Base Capacity (vph)	380	437	800	2522	567	2225
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.09	0.13	0.31	0.05	0.13

Intersection Summary



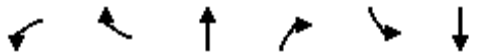
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	34	38	0	0	0	95	620	101	28	227	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0				6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00	1.00				1.00	0.95		1.00	0.95	
Frt		1.00	0.85				1.00	0.98		1.00	0.98	
Flt Protected		0.97	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1797	1538				1641	3407		1805	3300	
Flt Permitted		0.97	1.00				0.54	1.00		0.36	1.00	
Satd. Flow (perm)		1797	1538				929	3407		680	3300	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	38	36	40	0	0	0	102	667	109	30	247	49
RTOR Reduction (vph)	0	0	34	0	0	0	0	10	0	0	13	0
Lane Group Flow (vph)	0	74	6	0	0	0	102	766	0	30	283	0
Heavy Vehicles (%)	6%	0%	5%	0%	0%	0%	10%	4%	2%	0%	8%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	5				5	2		1	6	
Permitted Phases			4				2			6		
Actuated Green, G (s)		7.7	13.5				62.6	56.8		56.0	53.5	
Effective Green, g (s)		7.7	13.5				62.6	56.8		56.0	53.5	
Actuated g/C Ratio		0.09	0.16				0.74	0.67		0.66	0.63	
Clearance Time (s)		6.0	6.0				6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0				3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		162	352				732	2276		481	2077	
v/s Ratio Prot		c0.04	0.00				c0.01	c0.22		0.00	0.09	
v/s Ratio Perm			0.00				0.09			0.04		
v/c Ratio		0.46	0.02				0.14	0.34		0.06	0.14	
Uniform Delay, d1		36.7	30.2				3.2	6.0		5.0	6.4	
Progression Factor		1.00	1.00				1.00	1.00		1.04	0.91	
Incremental Delay, d2		2.0	0.0				0.1	0.4		0.1	0.1	
Delay (s)		38.7	30.2				3.3	6.4		5.3	5.9	
Level of Service		D	C				A	A		A	A	
Approach Delay (s)		35.7			0.0			6.1			5.9	
Approach LOS		D			A			A			A	

Intersection Summary					
HCM 2000 Control Delay	8.6	HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.35				
Actuated Cycle Length (s)	85.0	Sum of lost time (s)		18.0	
Intersection Capacity Utilization	42.5%	ICU Level of Service		A	
Analysis Period (min)	15				

c Critical Lane Group

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	323	60	827	285
v/c Ratio	0.61	0.21	0.34	0.12
Control Delay	38.8	10.5	5.7	4.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	38.8	10.5	5.7	4.6
Queue Length 50th (ft)	84	0	77	22
Queue Length 95th (ft)	125	32	122	40
Internal Link Dist (ft)	1109		85	737
Turn Bay Length (ft)	250	500		
Base Capacity (vph)	1104	544	2416	2349
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.29	0.11	0.34	0.12

Intersection Summary



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	297	55	761	0	0	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	0.97	1.00	0.95			0.95
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3367	1538	3438			3343
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3367	1538	3438			3343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.93	0.93
Adj. Flow (vph)	323	60	827	0	0	285
RTOR Reduction (vph)	0	51	0	0	0	0
Lane Group Flow (vph)	323	9	827	0	0	285
Heavy Vehicles (%)	4%	5%	5%	0%	0%	8%
Turn Type	Prot	Prot	NA			NA
Protected Phases	8	8	2			6
Permitted Phases						
Actuated Green, G (s)	13.4	13.4	60.1			60.1
Effective Green, g (s)	13.4	13.4	60.1			60.1
Actuated g/C Ratio	0.16	0.16	0.70			0.70
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	527	241	2416			2349
v/s Ratio Prot	c0.10	0.01	c0.24			0.09
v/s Ratio Perm						
v/c Ratio	0.61	0.04	0.34			0.12
Uniform Delay, d1	33.6	30.6	5.0			4.1
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	2.1	0.1	0.4			0.1
Delay (s)	35.7	30.7	5.4			4.2
Level of Service	D	C	A			A
Approach Delay (s)	34.9		5.4			4.2
Approach LOS	C		A			A

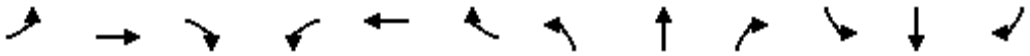
Intersection Summary			
HCM 2000 Control Delay	12.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Volume (veh/h)	3	0	13	1273	0	0
Sign Control	Stop			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	14	1384	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1412	0	0		30	28
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1412	0	0		30	28
tC, single (s)	6.5	6.2	4.1		7.1	6.5
tC, 2 stage (s)						
tF (s)	4.0	3.3	2.2		3.5	4.0
p0 queue free %	98	100	99		100	100
cM capacity (veh/h)	138	1091	1636		960	861

Direction, Lane #	SE 1	NE 1	NE 2	NE 3	NE 4
Volume Total	3	14	461	461	461
Volume Left	0	14	0	0	0
Volume Right	0	0	461	461	461
cSH	138	1636	1700	1700	1700
Volume to Capacity	0.02	0.01	0.27	0.27	0.27
Queue Length 95th (ft)	2	1	0	0	0
Control Delay (s)	31.7	7.2	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	31.7	0.1			
Approach LOS	D				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		



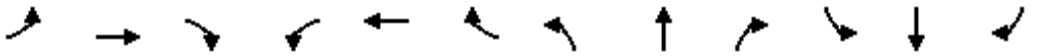
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	3	4	0	13	0	0	0	0	0	539	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	4	0	14	0	0	0	0	0	586	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	593	586	293	299	586	0	586			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	593	586	293	299	586	0	586			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	99	100	97	100	100			100		
cM capacity (veh/h)	384	425	710	628	425	1091	999			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	8	14	293	293
Volume Left	0	0	0	0
Volume Right	4	0	0	0
cSH	551	425	1700	1700
Volume to Capacity	0.01	0.03	0.17	0.17
Queue Length 95th (ft)	1	3	0	0
Control Delay (s)	11.6	13.8	0.0	0.0
Lane LOS	B	B		
Approach Delay (s)	11.6	13.8	0.0	
Approach LOS	B	B		

Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	49.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	13	522	536	8	448	60
v/c Ratio	0.10	0.59	0.16	0.01	0.13	0.04
Control Delay	36.2	5.5	0.8	1.3	0.8	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.2	5.5	0.8	1.3	0.8	0.5
Queue Length 50th (ft)	6	0	0	0	0	0
Queue Length 95th (ft)	24	250	40	3	35	7
Internal Link Dist (ft)	58		193		384	
Turn Bay Length (ft)		175		125		125
Base Capacity (vph)	344	885	3273	822	3412	1485
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.59	0.16	0.01	0.13	0.04

Intersection Summary



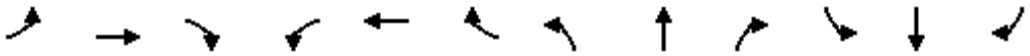
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	7	4	1	491	448	55	7	417	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0		6.0	6.0		6.0	6.0	6.0
Lane Util. Factor					1.00		1.00	0.95		1.00	0.95	1.00
Frt					0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected					0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)					1824		1787	3428		1805	3574	1553
Flt Permitted					0.97		0.49	1.00		0.45	1.00	1.00
Satd. Flow (perm)					1824		927	3428		860	3574	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.94	0.93	0.93	0.93
Adj. Flow (vph)	0	0	0	8	4	1	522	477	59	8	448	60
RTOR Reduction (vph)	0	0	0	0	1	0	0	5	0	0	0	10
Lane Group Flow (vph)	0	0	0	0	12	0	522	531	0	8	448	50
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	1%	4%	0%	0%	1%	4%
Turn Type				Split	NA		Perm	NA		Perm	NA	Perm
Protected Phases				8	8			2			6	
Permitted Phases							2			6		6
Actuated Green, G (s)					1.5		71.5	71.5		71.5	71.5	71.5
Effective Green, g (s)					1.5		71.5	71.5		71.5	71.5	71.5
Actuated g/C Ratio					0.02		0.84	0.84		0.84	0.84	0.84
Clearance Time (s)					6.0		6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)					3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)					32		779	2883		723	3006	1306
v/s Ratio Prot					c0.01			0.15			0.13	
v/s Ratio Perm							c0.56			0.01		0.03
v/c Ratio					0.38		0.67	0.18		0.01	0.15	0.04
Uniform Delay, d1					41.3		2.5	1.3		1.1	1.2	1.1
Progression Factor					1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2					7.3		4.6	0.1		0.0	0.1	0.1
Delay (s)					48.5		7.0	1.4		1.1	1.3	1.2
Level of Service					D		A	A		A	A	A
Approach Delay (s)		0.0			48.5			4.2			1.3	
Approach LOS		A			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	3.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	108	87	180	909	60	575
v/c Ratio	0.43	0.17	0.29	0.39	0.13	0.30
Control Delay	36.0	5.2	5.1	9.2	4.9	10.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.0	5.2	5.1	9.2	4.9	10.7
Queue Length 50th (ft)	48	0	22	121	7	71
Queue Length 95th (ft)	95	27	48	191	19	122
Internal Link Dist (ft)	610			679		173
Turn Bay Length (ft)		100	100		100	
Base Capacity (vph)	476	650	738	2343	500	1893
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.13	0.24	0.39	0.12	0.30

Intersection Summary



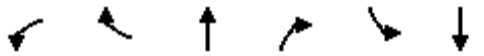
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	43	60	83	0	0	0	171	772	91	57	474	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0				6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00	1.00				1.00	0.95		1.00	0.95	
Frt		1.00	0.85				1.00	0.98		1.00	0.98	
Flt Protected		0.98	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1846	1583				1770	3518		1805	3508	
Flt Permitted		0.98	1.00				0.38	1.00		0.31	1.00	
Satd. Flow (perm)		1846	1583				714	3518		594	3508	
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	45	63	87	0	0	0	180	813	96	60	499	76
RTOR Reduction (vph)	0	0	68	0	0	0	0	8	0	0	11	0
Lane Group Flow (vph)	0	108	19	0	0	0	180	901	0	60	564	0
Heavy Vehicles (%)	2%	0%	2%	0%	0%	0%	2%	1%	1%	0%	1%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	5				5	2		1	6	
Permitted Phases			4				2			6		
Actuated Green, G (s)		8.0	16.2				54.0	45.8		44.8	41.2	
Effective Green, g (s)		8.0	16.2				54.0	45.8		44.8	41.2	
Actuated g/C Ratio		0.11	0.21				0.72	0.61		0.59	0.55	
Clearance Time (s)		6.0	6.0				6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0				3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		195	466				626	2136		410	1916	
v/s Ratio Prot		c0.06	0.00				c0.03	c0.26		0.01	0.16	
v/s Ratio Perm			0.01				0.17			0.08		
v/c Ratio		0.55	0.04				0.29	0.42		0.15	0.29	
Uniform Delay, d1		32.0	23.4				3.6	7.8		6.4	9.2	
Progression Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.4	0.0				0.3	0.6		0.2	0.4	
Delay (s)		35.4	23.5				3.9	8.4		6.6	9.6	
Level of Service		D	C				A	A		A	A	
Approach Delay (s)		30.1			0.0			7.7			9.3	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	75.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	576	92	1032	605
v/c Ratio	0.73	0.21	0.46	0.27
Control Delay	36.5	8.2	9.6	7.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	36.5	8.2	9.6	7.9
Queue Length 50th (ft)	148	3	134	67
Queue Length 95th (ft)	203	38	218	115
Internal Link Dist (ft)	702		96	777
Turn Bay Length (ft)	250	500		
Base Capacity (vph)	1362	680	2253	2253
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.42	0.14	0.46	0.27

Intersection Summary



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	530	85	949	0	0	557
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	0.97	1.00	0.95			0.95
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3433	1583	3574			3574
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3433	1583	3574			3574
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	576	92	1032	0	0	605
RTOR Reduction (vph)	0	66	0	0	0	0
Lane Group Flow (vph)	576	26	1032	0	0	605
Heavy Vehicles (%)	2%	2%	1%	0%	0%	1%
Turn Type	Prot	Prot	NA			NA
Protected Phases	8	8	2			6
Permitted Phases						
Actuated Green, G (s)	19.7	19.7	54.1			54.1
Effective Green, g (s)	19.7	19.7	54.1			54.1
Actuated g/C Ratio	0.23	0.23	0.63			0.63
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	788	363	2253			2253
v/s Ratio Prot	c0.17	0.02	c0.29			0.17
v/s Ratio Perm						
v/c Ratio	0.73	0.07	0.46			0.27
Uniform Delay, d1	30.6	25.9	8.2			7.0
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	3.5	0.1	0.7			0.3
Delay (s)	34.1	26.0	8.9			7.3
Level of Service	C	C	A			A
Approach Delay (s)	33.0		8.9			7.3
Approach LOS	C		A			A

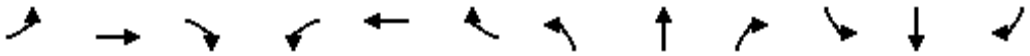
Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Volume (veh/h)	3	0	24	827	0	0
Sign Control	Stop			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	26	899	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	951	0	0		54	52
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	951	0	0		54	52
tC, single (s)	6.5	6.2	4.1		7.1	6.5
tC, 2 stage (s)						
tF (s)	4.0	3.3	2.2		3.5	4.0
p0 queue free %	99	100	98		100	100
cM capacity (veh/h)	258	1091	1636		929	830

Direction, Lane #	SE 1	NE 1	NE 2	NE 3	NE 4
Volume Total	3	26	300	300	300
Volume Left	0	26	0	0	0
Volume Right	0	0	300	300	300
cSH	258	1636	1700	1700	1700
Volume to Capacity	0.01	0.02	0.18	0.18	0.18
Queue Length 95th (ft)	1	1	0	0	0
Control Delay (s)	19.2	7.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	19.2	0.2			
Approach LOS	C				

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	3	15	0	24	0	0	0	0	0	1231	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	16	0	26	0	0	0	0	0	1338	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1351	1338	669	687	1338	0	1338			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1351	1338	669	687	1338	0	1338			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	96	100	83	100	100			100		
cM capacity (veh/h)	96	154	405	318	154	1091	522			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	20	26	669	669
Volume Left	0	0	0	0
Volume Right	16	0	0	0
cSH	319	154	1700	1700
Volume to Capacity	0.06	0.17	0.39	0.39
Queue Length 95th (ft)	5	15	0	0
Control Delay (s)	17.0	33.0	0.0	0.0
Lane LOS	C	D		
Approach Delay (s)	17.0	33.0	0.0	
Approach LOS	C	D		

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	60.2%	ICU Level of Service	B	
Analysis Period (min)	15			

Appendix D
2040 Refined Concept #2
Traffic Operations Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	41	0	69	13	0	6	0	275	49	3	252	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	45	0	75	14	0	7	0	299	53	3	274	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1076				
pX, platoon unblocked												
vC, conflicting volume	436	633	137	544	606	176	274			352		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	436	633	137	544	606	176	274			352		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	7.6	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.6	2.2			2.2		
p0 queue free %	91	100	92	96	100	99	100			100		
cM capacity (veh/h)	498	395	886	390	409	748	1286			1218		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	45	75	10	10	199	153	3	137	137
Volume Left	45	0	7	7	0	0	3	0	0
Volume Right	0	75	3	3	0	53	0	0	0
cSH	498	886	459	459	1700	1700	1218	1700	1700
Volume to Capacity	0.09	0.08	0.02	0.02	0.12	0.09	0.00	0.08	0.08
Queue Length 95th (ft)	7	7	2	2	0	0	0	0	0
Control Delay (s)	12.9	9.4	13.0	13.0	0.0	0.0	8.0	0.0	0.0
Lane LOS	B	A	B	B			A		
Approach Delay (s)	10.7		13.0		0.0		0.1		
Approach LOS	B		B						

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	25.8%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	76	248	430	41	293
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	83	270	467	45	318
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			774			
pX, platoon unblocked						
vC, conflicting volume	518	135			737	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	518	135			737	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	91			95	
cM capacity (veh/h)	462	889			865	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	99	135	135	467	45	159	159
Volume Left	16	0	0	0	45	0	0
Volume Right	83	0	0	467	0	0	0
cSH	772	1700	1700	1700	865	1700	1700
Volume to Capacity	0.13	0.08	0.08	0.27	0.05	0.09	0.09
Queue Length 95th (ft)	11	0	0	0	4	0	0
Control Delay (s)	10.3	0.0	0.0	0.0	9.4	0.0	0.0
Lane LOS	B				A		
Approach Delay (s)	10.3	0.0			1.2		
Approach LOS	B						

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	NBT	SBT
Lane Group Flow (vph)	92	417	841	288
v/c Ratio	0.46	0.45	0.35	0.14
Control Delay	41.6	4.2	4.0	6.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	41.6	4.2	4.0	6.8
Queue Length 50th (ft)	47	0	61	27
Queue Length 95th (ft)	89	34	101	51
Internal Link Dist (ft)	640		552	223
Turn Bay Length (ft)		200		
Base Capacity (vph)	436	1235	2399	2108
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.34	0.35	0.14

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	58	28	392	0	0	0	58	620	104	0	221	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0					6.0			6.0	
Lane Util. Factor		1.00	0.88					0.95			0.95	
Frt		1.00	0.85					0.98			0.97	
Flt Protected		0.97	1.00					1.00			1.00	
Satd. Flow (prot)		1767	2707					3384			3300	
Flt Permitted		0.97	1.00					0.90			1.00	
Satd. Flow (perm)		1767	2707					3069			3300	
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	62	30	417	0	0	0	62	667	112	0	240	48
RTOR Reduction (vph)	0	0	347	0	0	0	0	9	0	0	11	0
Lane Group Flow (vph)	0	92	70	0	0	0	0	832	0	0	277	0
Heavy Vehicles (%)	6%	0%	5%	0%	0%	0%	10%	4%	2%	0%	8%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA			NA	
Protected Phases	4	4	5				5	2			6	
Permitted Phases			4				2					
Actuated Green, G (s)		8.6	14.2					64.4			52.8	
Effective Green, g (s)		8.6	14.2					64.4			52.8	
Actuated g/C Ratio		0.10	0.17					0.76			0.62	
Clearance Time (s)		6.0	6.0					6.0			6.0	
Vehicle Extension (s)		3.0	3.0					3.0			3.0	
Lane Grp Cap (vph)		178	643					2345			2049	
v/s Ratio Prot		c0.05	0.01					c0.02			0.08	
v/s Ratio Perm			0.02					c0.25				
v/c Ratio		0.52	0.11					0.35			0.14	
Uniform Delay, d1		36.2	30.0					3.4			6.7	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		2.5	0.1					0.1			0.1	
Delay (s)		38.8	30.1					3.5			6.8	
Level of Service		D	C					A			A	
Approach Delay (s)		31.7			0.0			3.5			6.8	
Approach LOS		C			A			A			A	

Intersection Summary					
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service		B	
HCM 2000 Volume to Capacity ratio	0.41				
Actuated Cycle Length (s)	85.0	Sum of lost time (s)		18.0	
Intersection Capacity Utilization	49.3%	ICU Level of Service		A	
Analysis Period (min)	15				

c Critical Lane Group

Lane Group	EBT	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	140	111	7	376	52
v/c Ratio	0.39	0.31	0.03	0.45	0.05
Control Delay	18.7	17.7	0.2	15.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	18.7	17.7	0.2	15.9	0.1
Queue Length 50th (ft)	29	23	0	39	0
Queue Length 95th (ft)	73	60	0	74	0
Internal Link Dist (ft)	104	640	34		395
Turn Bay Length (ft)				150	
Base Capacity (vph)	631	629	461	1265	1099
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.22	0.18	0.02	0.30	0.05

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	126	3	1	101	0	5	0	2	350	0	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00			1.00		0.97	1.00	
Frt		1.00			1.00			0.96		1.00	0.85	
Flt Protected		1.00			1.00			0.97		0.95	1.00	
Satd. Flow (prot)		1789			1794			1543		3367	1538	
Flt Permitted		1.00			1.00			0.61		0.95	1.00	
Satd. Flow (perm)		1789			1788			979		3367	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93
Adj. Flow (vph)	0	137	3	1	110	0	5	0	2	376	0	52
RTOR Reduction (vph)	0	2	0	0	0	0	0	6	0	0	39	0
Lane Group Flow (vph)	0	138	0	0	111	0	0	1	0	376	13	0
Heavy Vehicles (%)	0%	6%	0%	100%	5%	0%	20%	0%	0%	4%	0%	5%
Turn Type		NA		Perm	NA		Perm	NA		Split	NA	
Protected Phases					2			3		4	4	
Permitted Phases		6		2			3					
Actuated Green, G (s)		8.7			8.7			5.6		10.6	10.6	
Effective Green, g (s)		8.7			8.7			5.6		10.6	10.6	
Actuated g/C Ratio		0.20			0.20			0.13		0.25	0.25	
Clearance Time (s)		6.0			6.0			6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		362			362			127		831	380	
v/s Ratio Prot										c0.11	0.01	
v/s Ratio Perm		c0.08			0.06			c0.00				
v/c Ratio		0.38			0.31			0.01		0.45	0.03	
Uniform Delay, d1		14.8			14.5			16.2		13.7	12.3	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		0.7			0.5			0.0		0.4	0.0	
Delay (s)		15.5			15.0			16.3		14.1	12.3	
Level of Service		B			B			B		B	B	
Approach Delay (s)		15.5			15.0			16.3			13.9	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	42.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Volume (veh/h)	3	0	13	1273	0	0
Sign Control	Stop			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	14	1384	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1412	0	0		30	28
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1412	0	0		30	28
tC, single (s)	6.5	6.2	4.1		7.1	6.5
tC, 2 stage (s)						
tF (s)	4.0	3.3	2.2		3.5	4.0
p0 queue free %	98	100	99		100	100
cM capacity (veh/h)	138	1091	1636		960	861

Direction, Lane #	SE 1	NE 1	NE 2	NE 3	NE 4
Volume Total	3	14	461	461	461
Volume Left	0	14	0	0	0
Volume Right	0	0	461	461	461
cSH	138	1636	1700	1700	1700
Volume to Capacity	0.02	0.01	0.27	0.27	0.27
Queue Length 95th (ft)	2	1	0	0	0
Control Delay (s)	31.7	7.2	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	31.7	0.1			
Approach LOS	D				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑						↑↑	↱
Volume (veh/h)	0	3	0	0	13	0	0	0	0	0	539	63
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	0	0	14	0	0	0	0	0	586	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	593	586	293	295	654	0	654			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	593	586	293	295	654	0	654			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	100	100	96	100	100			100		
cM capacity (veh/h)	383	425	710	637	389	1091	942			1636		

Direction, Lane #	EB 1	WB 1	SB 1	SB 2	SB 3
Volume Total	3	14	293	293	68
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	68
cSH	425	389	1700	1700	1700
Volume to Capacity	0.01	0.04	0.17	0.17	0.04
Queue Length 95th (ft)	1	3	0	0	0
Control Delay (s)	13.5	14.6	0.0	0.0	0.0
Lane LOS	B	B			
Approach Delay (s)	13.5	14.6	0.0		
Approach LOS	B	B			

Intersection Summary				
Average Delay	0.4			
Intersection Capacity Utilization	49.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	46	0	179	11	0	1	0	428	56	6	470	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.93	0.93	0.92
Hourly flow rate (vph)	50	0	195	12	0	1	0	455	60	6	505	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1076				
pX, platoon unblocked												
vC, conflicting volume	747	1033	253	945	1003	257	505			515		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	747	1033	253	945	1003	257	505			515		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	100	74	93	100	100	100			99		
cM capacity (veh/h)	300	230	747	162	239	748	1056			1061		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	50	195	7	7	304	211	6	253	253
Volume Left	50	0	6	6	0	0	6	0	0
Volume Right	0	195	1	1	0	60	0	0	0
cSH	300	747	173	173	1700	1700	1061	1700	1700
Volume to Capacity	0.17	0.26	0.04	0.04	0.18	0.12	0.01	0.15	0.15
Queue Length 95th (ft)	15	26	3	3	0	0	0	0	0
Control Delay (s)	19.4	11.5	26.6	26.6	0.0	0.0	8.4	0.0	0.0
Lane LOS	C	B	D	D			A		
Approach Delay (s)	13.1		26.6		0.0		0.1		
Approach LOS	B		D						

Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	37.4%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	133	351	496	56	604
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	145	382	539	61	657
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			782			
pX, platoon unblocked						
vC, conflicting volume	832	191			921	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	832	191			921	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	82			92	
cM capacity (veh/h)	282	819			737	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	166	191	191	539	61	328	328
Volume Left	22	0	0	0	61	0	0
Volume Right	145	0	0	539	0	0	0
cSH	656	1700	1700	1700	737	1700	1700
Volume to Capacity	0.25	0.11	0.11	0.32	0.08	0.19	0.19
Queue Length 95th (ft)	25	0	0	0	7	0	0
Control Delay (s)	12.3	0.0	0.0	0.0	10.3	0.0	0.0
Lane LOS	B				B		
Approach Delay (s)	12.3	0.0			0.9		
Approach LOS	B						

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	NBT	SBT
Lane Group Flow (vph)	149	708	1034	576
v/c Ratio	0.57	0.67	0.53	0.30
Control Delay	42.0	16.8	6.4	11.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	42.0	16.8	6.4	11.1
Queue Length 50th (ft)	75	106	94	74
Queue Length 95th (ft)	126	145	156	133
Internal Link Dist (ft)	640		552	223
Turn Bay Length (ft)		200		
Base Capacity (vph)	386	1390	1945	1949
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.39	0.51	0.53	0.30

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	58	673	0	0	0	126	763	93	0	471	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0					6.0			6.0	
Lane Util. Factor		1.00	0.88					0.95			0.95	
Frt		1.00	0.85					0.99			0.98	
Flt Protected		0.97	1.00					0.99			1.00	
Satd. Flow (prot)		1824	2787					3496			3505	
Flt Permitted		0.97	1.00					0.74			1.00	
Satd. Flow (perm)		1824	2787					2593			3505	
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	61	708	0	0	0	133	803	98	0	496	80
RTOR Reduction (vph)	0	0	232	0	0	0	0	7	0	0	10	0
Lane Group Flow (vph)	0	149	476	0	0	0	0	1027	0	0	566	0
Heavy Vehicles (%)	2%	0%	2%	0%	0%	0%	2%	1%	1%	0%	1%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA			NA	
Protected Phases	4	4	5				5	2			6	
Permitted Phases			4				2					
Actuated Green, G (s)		12.2	20.0					60.8			47.0	
Effective Green, g (s)		12.2	20.0					60.8			47.0	
Actuated g/C Ratio		0.14	0.24					0.72			0.55	
Clearance Time (s)		6.0	6.0					6.0			6.0	
Vehicle Extension (s)		3.0	3.0					3.0			3.0	
Lane Grp Cap (vph)		261	852					1937			1938	
v/s Ratio Prot		0.08	c0.05					0.05			0.16	
v/s Ratio Perm			0.12					c0.33				
v/c Ratio		0.57	0.56					0.53			0.29	
Uniform Delay, d1		34.0	28.6					5.5			10.1	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		3.0	0.8					0.3			0.4	
Delay (s)		37.0	29.4					5.8			10.5	
Level of Service		D	C					A			B	
Approach Delay (s)		30.7			0.0			5.8			10.5	
Approach LOS		C			A			A			B	

Intersection Summary				
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	65.9%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBT	WBT	NBT	SBL	SBT
Lane Group Flow (vph)	269	219	6	603	88
v/c Ratio	0.60	0.49	0.02	0.62	0.17
Control Delay	23.3	20.8	0.2	19.1	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.3	20.8	0.2	19.1	5.4
Queue Length 50th (ft)	73	58	0	78	1
Queue Length 95th (ft)	133	110	0	129	26
Internal Link Dist (ft)	104	640	34		395
Turn Bay Length (ft)				150	
Base Capacity (vph)	567	566	664	1117	585
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.47	0.39	0.01	0.54	0.15

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	245	3	2	200	0	3	0	3	567	3	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00			1.00		0.97	1.00	
Frt		1.00			1.00			0.93		1.00	0.86	
Flt Protected		1.00			1.00			0.98		0.95	1.00	
Satd. Flow (prot)		1860			1862			1729		3433	1625	
Flt Permitted		1.00			1.00			0.98		0.95	1.00	
Satd. Flow (perm)		1860			1855			1729		3433	1625	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	0	266	3	2	217	0	3	0	3	603	3	85
RTOR Reduction (vph)	0	1	0	0	0	0	0	5	0	0	61	0
Lane Group Flow (vph)	0	268	0	0	219	0	0	1	0	603	27	0
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%
Turn Type		NA		Perm	NA		Split	NA		Split	NA	
Protected Phases					2		3	3		4	4	
Permitted Phases		6		2								
Actuated Green, G (s)		12.0			12.0			5.6		14.0	14.0	
Effective Green, g (s)		12.0			12.0			5.6		14.0	14.0	
Actuated g/C Ratio		0.24			0.24			0.11		0.28	0.28	
Clearance Time (s)		6.0			6.0			6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)		450			448			195		968	458	
v/s Ratio Prot								c0.00		c0.18	0.02	
v/s Ratio Perm		c0.14			0.12							
v/c Ratio		0.60			0.49			0.00		0.62	0.06	
Uniform Delay, d1		16.7			16.2			19.5		15.5	13.0	
Progression Factor		1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2		2.1			0.8			0.0		1.3	0.1	
Delay (s)		18.8			17.0			19.5		16.8	13.0	
Level of Service		B			B			B		B	B	
Approach Delay (s)		18.8			17.0			19.5			16.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	17.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	49.6	Sum of lost time (s)	18.0
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Volume (veh/h)	3	0	24	843	0	0
Sign Control	Stop			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	26	916	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	968	0	0		54	52
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	968	0	0		54	52
tC, single (s)	6.5	6.2	4.1		7.1	6.5
tC, 2 stage (s)						
tF (s)	4.0	3.3	2.2		3.5	4.0
p0 queue free %	99	100	98		100	100
cM capacity (veh/h)	252	1091	1636		929	830

Direction, Lane #	SE 1	NE 1	NE 2	NE 3	NE 4
Volume Total	3	26	305	305	305
Volume Left	0	26	0	0	0
Volume Right	0	0	305	305	305
cSH	252	1636	1700	1700	1700
Volume to Capacity	0.01	0.02	0.18	0.18	0.18
Queue Length 95th (ft)	1	1	0	0	0
Control Delay (s)	19.5	7.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	19.5	0.2			
Approach LOS	C				

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑						↑↑	↱
Volume (veh/h)	0	3	0	0	24	0	0	0	0	0	1231	133
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	3	0	0	26	0	0	0	0	0	1338	145
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1351	1338	669	671	1483	0	1483			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1351	1338	669	671	1483	0	1483			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	100	100	79	100	100			100		
cM capacity (veh/h)	93	154	405	341	126	1091	460			1636		

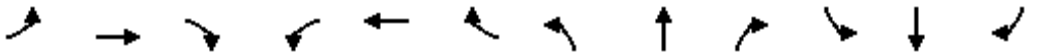
Direction, Lane #	EB 1	WB 1	SB 1	SB 2	SB 3
Volume Total	3	26	669	669	145
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	145
cSH	154	126	1700	1700	1700
Volume to Capacity	0.02	0.21	0.39	0.39	0.09
Queue Length 95th (ft)	2	18	0	0	0
Control Delay (s)	28.8	40.8	0.0	0.0	0.0
Lane LOS	D	E			
Approach Delay (s)	28.8	40.8	0.0		
Approach LOS	D	E			

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			

Appendix E
2040 Refined Concept #3
Traffic Operations Worksheets

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	39	64	30	424	326	4	248	42
v/c Ratio	0.13	0.17	0.13	0.43	0.13	0.01	0.34	0.09
Control Delay	22.6	0.9	20.4	4.6	3.9	7.7	19.7	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	0.9	20.4	4.6	3.9	7.7	19.7	0.4
Queue Length 50th (ft)	10	0	6	42	14	0	33	0
Queue Length 95th (ft)	37	2	27	78	40	3	70	0
Internal Link Dist (ft)	44		58		15		384	
Turn Bay Length (ft)						125		125
Base Capacity (vph)	845	797	628	1280	3057	460	1901	952
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.08	0.05	0.33	0.11	0.01	0.13	0.04

Intersection Summary



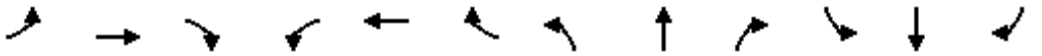
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	0	59	13	7	6	360	228	49	3	211	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frt		1.00	0.85		0.97		1.00	0.97		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1805	1615		1667		1752	3337		1805	3343	1568
Flt Permitted		1.00	1.00		0.82		0.46	1.00		0.55	1.00	1.00
Satd. Flow (perm)		1900	1615		1404		854	3337		1054	3343	1568
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	39	0	64	15	8	7	424	268	58	4	248	42
RTOR Reduction (vph)	0	0	59	0	6	0	0	19	0	0	0	31
Lane Group Flow (vph)	0	39	5	0	24	0	424	307	0	4	248	11
Heavy Vehicles (%)	0%	0%	0%	0%	0%	33%	3%	6%	2%	0%	8%	3%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		3.8	3.8		3.8		35.0	30.4		14.3	13.7	13.7
Effective Green, g (s)		3.8	3.8		3.8		35.0	30.4		14.3	13.7	13.7
Actuated g/C Ratio		0.07	0.07		0.07		0.69	0.60		0.28	0.27	0.27
Clearance Time (s)		6.0	6.0		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		142	120		105		894	1996		305	901	422
v/s Ratio Prot							c0.16	0.09		0.00	0.07	
v/s Ratio Perm		c0.02	0.00		0.02		c0.17			0.00		0.01
v/c Ratio		0.27	0.04		0.22		0.47	0.15		0.01	0.28	0.03
Uniform Delay, d1		22.2	21.8		22.1		3.5	4.5		13.2	14.6	13.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.1	0.1		1.1		0.4	0.0		0.0	0.2	0.0
Delay (s)		23.3	21.9		23.2		3.9	4.5		13.2	14.8	13.7
Level of Service		C	C		C		A	A		B	B	B
Approach Delay (s)		22.4			23.2			4.2			14.6	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	8.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	50.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	43	171	14	445	421	6	385	53
v/c Ratio	0.20	0.52	0.06	0.48	0.18	0.01	0.48	0.12
Control Delay	25.4	11.3	22.8	5.8	5.0	7.5	21.5	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.4	11.3	22.8	5.8	5.0	7.5	21.5	0.5
Queue Length 50th (ft)	12	0	4	45	21	1	55	0
Queue Length 95th (ft)	42	48	18	109	65	4	111	0
Internal Link Dist (ft)	44		58		15		384	
Turn Bay Length (ft)						125		125
Base Capacity (vph)	575	587	609	1072	2960	411	1980	923
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.29	0.02	0.42	0.14	0.01	0.19	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	0	157	7	4	1	418	348	48	6	358	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.83		1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1805	1336		1829		1787	3424		1805	3574	1553
Flt Permitted		0.75	1.00		0.80		0.42	1.00		0.51	1.00	1.00
Satd. Flow (perm)		1422	1336		1504		782	3424		961	3574	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.94	0.94	0.94	0.93	0.93	0.93
Adj. Flow (vph)	43	0	171	8	5	1	445	370	51	6	385	53
RTOR Reduction (vph)	0	0	153	0	1	0	0	11	0	0	0	38
Lane Group Flow (vph)	0	43	18	0	13	0	445	410	0	6	385	15
Confl. Peds. (#/hr)			157									
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	1%	4%	0%	0%	1%	4%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		5.9	5.9		5.9		37.8	33.2		16.0	15.4	15.4
Effective Green, g (s)		5.9	5.9		5.9		37.8	33.2		16.0	15.4	15.4
Actuated g/C Ratio		0.11	0.11		0.11		0.68	0.60		0.29	0.28	0.28
Clearance Time (s)		6.0	6.0		6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		150	141		159		862	2040		285	988	429
v/s Ratio Prot							c0.17	0.12		0.00	0.11	
v/s Ratio Perm		c0.03	0.01		0.01		c0.18			0.01		0.01
v/c Ratio		0.29	0.13		0.08		0.52	0.20		0.02	0.39	0.03
Uniform Delay, d1		23.0	22.6		22.5		4.1	5.2		14.2	16.3	14.7
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.1	0.4		0.2		0.5	0.0		0.0	0.3	0.0
Delay (s)		24.0	23.0		22.7		4.6	5.2		14.3	16.6	14.8
Level of Service		C	C		C		A	A		B	B	B
Approach Delay (s)		23.2			22.7			4.9			16.3	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	55.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Appendix F
2040 Refined
Concept #1 & #2 Combined
Traffic Operations Worksheets

HCM Unsignalized Intersection Capacity Analysis
1: US 301 (Crater Road) & I-95 NB Off-ramp

10/28/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	44	0	22	20	0	6	0	325	3	3	237	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	48	0	24	22	0	7	0	353	3	3	258	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1017				
pX, platoon unblocked												
vC, conflicting volume	447	621	129	514	619	178	258			357		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	447	621	129	514	619	178	258			357		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	97	95	100	99	100			100		
cM capacity (veh/h)	490	401	897	431	402	834	1304			1199		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	48	24	22	7	236	121	89	172
Volume Left	48	0	22	0	0	0	3	0
Volume Right	0	24	0	7	0	3	0	0
cSH	490	897	431	834	1700	1700	1199	1700
Volume to Capacity	0.10	0.03	0.05	0.01	0.14	0.07	0.00	0.10
Queue Length 95th (ft)	8	2	4	1	0	0	0	0
Control Delay (s)	13.1	9.1	13.8	9.4	0.0	0.0	0.3	0.0
Lane LOS	B	A	B	A			A	
Approach Delay (s)	11.8		12.8		0.0		0.1	
Approach LOS	B		B					

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	25.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	50	73	255	360	36	243
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	79	277	391	39	264
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			679			
pX, platoon unblocked						
vC, conflicting volume	488	139			668	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	488	139			668	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	91			96	
cM capacity (veh/h)	487	884			917	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	134	139	139	391	39	132	132
Volume Left	54	0	0	0	39	0	0
Volume Right	79	0	0	391	0	0	0
cSH	664	1700	1700	1700	917	1700	1700
Volume to Capacity	0.20	0.08	0.08	0.23	0.04	0.08	0.08
Queue Length 95th (ft)	19	0	0	0	3	0	0
Control Delay (s)	11.8	0.0	0.0	0.0	9.1	0.0	0.0
Lane LOS	B				A		
Approach Delay (s)	11.8	0.0			1.2		
Approach LOS	B						

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	59	44	96	640	33	285
v/c Ratio	0.35	0.12	0.12	0.26	0.05	0.13
Control Delay	40.7	8.1	3.4	6.7	3.4	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.7	8.1	3.4	6.7	3.4	5.8
Queue Length 50th (ft)	30	0	10	74	3	23
Queue Length 95th (ft)	64	23	24	116	11	46
Internal Link Dist (ft)	640			552		599
Turn Bay Length (ft)		150	100		100	
Base Capacity (vph)	387	466	851	2475	658	2245
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.09	0.11	0.26	0.05	0.13

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	10	41	0	0	0	89	570	25	30	200	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0				6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00	1.00				1.00	0.95		1.00	0.95	
Frt		1.00	0.85				1.00	0.99		1.00	0.96	
Flt Protected		0.96	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1735	1538				1641	3452		1770	3281	
Flt Permitted		0.96	1.00				0.56	1.00		0.41	1.00	
Satd. Flow (perm)		1735	1538				961	3452		762	3281	
Peak-hour factor, PHF	0.94	0.92	0.94	0.92	0.92	0.92	0.93	0.93	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	11	44	0	0	0	96	613	27	33	217	68
RTOR Reduction (vph)	0	0	37	0	0	0	0	2	0	0	22	0
Lane Group Flow (vph)	0	59	7	0	0	0	96	638	0	33	263	0
Heavy Vehicles (%)	6%	2%	5%	2%	2%	2%	10%	4%	2%	2%	8%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	5				5	2		1	6	
Permitted Phases			4				2			6		
Actuated Green, G (s)		7.2	12.9				61.8	56.1		57.8	54.1	
Effective Green, g (s)		7.2	12.9				61.8	56.1		57.8	54.1	
Actuated g/C Ratio		0.08	0.15				0.73	0.66		0.68	0.64	
Clearance Time (s)		6.0	6.0				6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0				3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		146	341				744	2278		562	2088	
v/s Ratio Prot		c0.03	0.00				c0.01	c0.18		0.00	0.08	
v/s Ratio Perm			0.00				0.09			0.04		
v/c Ratio		0.40	0.02				0.13	0.28		0.06	0.13	
Uniform Delay, d1		36.9	30.7				3.4	6.0		4.4	6.1	
Progression Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.8	0.0				0.1	0.3		0.0	0.1	
Delay (s)		38.7	30.7				3.5	6.3		4.5	6.2	
Level of Service		D	C				A	A		A	A	
Approach Delay (s)		35.3			0.0			6.0			6.0	
Approach LOS		D			A			A			A	

Intersection Summary					
HCM 2000 Control Delay	8.6	HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.29				
Actuated Cycle Length (s)	85.0	Sum of lost time (s)		18.0	
Intersection Capacity Utilization	38.2%	ICU Level of Service		A	
Analysis Period (min)	15				

c Critical Lane Group

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	450	74	670	97	29	203
v/c Ratio	0.69	0.21	0.32	0.10	0.06	0.09
Control Delay	37.9	8.7	10.3	3.7	6.0	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	8.7	10.3	3.7	6.0	5.8
Queue Length 50th (ft)	117	0	68	2	5	17
Queue Length 95th (ft)	165	34	168	28	16	36
Internal Link Dist (ft)	1132		403			737
Turn Bay Length (ft)	300			100	100	
Base Capacity (vph)	1218	603	2095	1018	532	2224
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.12	0.32	0.10	0.05	0.09

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	414	68	616	89	27	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3367	1538	3438	1615	1805	3343
Flt Permitted	0.95	1.00	1.00	1.00	0.34	1.00
Satd. Flow (perm)	3367	1538	3438	1615	637	3343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.93	0.93
Adj. Flow (vph)	450	74	670	97	29	203
RTOR Reduction (vph)	0	60	0	36	0	0
Lane Group Flow (vph)	450	14	670	61	29	203
Heavy Vehicles (%)	4%	5%	5%	0%	0%	8%
Turn Type	NA	Prot	NA	Perm	pm+pt	NA
Protected Phases	3	3	2		1	6
Permitted Phases				2	6	
Actuated Green, G (s)	16.7	16.7	52.3	52.3	60.8	60.8
Effective Green, g (s)	16.7	16.7	52.3	52.3	60.8	60.8
Actuated g/C Ratio	0.19	0.19	0.58	0.58	0.68	0.68
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	628	286	2009	943	465	2270
v/s Ratio Prot	c0.13	0.01	c0.19		0.00	c0.06
v/s Ratio Perm				0.04	0.04	
v/c Ratio	0.72	0.05	0.33	0.06	0.06	0.09
Uniform Delay, d1	34.2	29.9	9.6	8.0	5.2	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.9	0.1	0.4	0.1	0.1	0.1
Delay (s)	38.1	29.9	10.0	8.2	5.2	5.0
Level of Service	D	C	B	A	A	A
Approach Delay (s)	36.9		9.8			5.0
Approach LOS	D		A			A

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

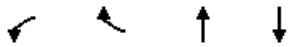
Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	722	121	447	104	22	43	77
v/c Ratio	0.73	0.06	0.41	0.19	0.04	0.11	0.14
Control Delay	18.0	7.1	1.8	26.8	5.0	15.6	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	7.1	1.8	26.8	5.0	15.6	15.3
Queue Length 50th (ft)	250	13	0	43	0	15	27
Queue Length 95th (ft)	300	19	28	92	11	58	88
Internal Link Dist (ft)		417		653			595
Turn Bay Length (ft)	300		200		100	100	
Base Capacity (vph)	1166	2331	1195	558	501	385	558
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.05	0.37	0.19	0.04	0.11	0.14

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	664	111	411	0	0	0	0	96	20	40	71	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0					6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00					1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583					1863	1583	1770	1863	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.69	1.00	
Satd. Flow (perm)	1770	3539	1583					1863	1583	1285	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	722	121	447	0	0	0	0	104	22	43	77	0
RTOR Reduction (vph)	0	0	197	0	0	0	0	0	15	0	0	0
Lane Group Flow (vph)	722	121	250	0	0	0	0	104	7	43	77	0
Turn Type	Split	NA	Prot					NA	Perm	Perm	NA	
Protected Phases	4	4	4					2			6	
Permitted Phases									2	6		
Actuated Green, G (s)	47.5	47.5	47.5					25.5	25.5	25.5	25.5	
Effective Green, g (s)	47.5	47.5	47.5					25.5	25.5	25.5	25.5	
Actuated g/C Ratio	0.56	0.56	0.56					0.30	0.30	0.30	0.30	
Clearance Time (s)	6.0	6.0	6.0					6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	989	1977	884					558	474	385	558	
v/s Ratio Prot	c0.41	0.03	0.16					c0.06			0.04	
v/s Ratio Perm									0.00	0.03		
v/c Ratio	0.73	0.06	0.28					0.19	0.01	0.11	0.14	
Uniform Delay, d1	14.0	8.6	9.8					22.1	20.9	21.5	21.7	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.56	0.56	
Incremental Delay, d2	2.8	0.0	0.2					0.7	0.1	0.6	0.5	
Delay (s)	16.8	8.6	10.0					22.8	21.0	12.7	12.8	
Level of Service	B	A	A					C	C	B	B	
Approach Delay (s)		13.7			0.0			22.5			12.7	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	50	500	826	71
v/c Ratio	0.11	0.74	0.97	0.38
Control Delay	28.3	17.6	61.2	36.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	28.3	17.6	61.2	36.9
Queue Length 50th (ft)	21	63	478	37
Queue Length 95th (ft)	53	#242	#693	67
Internal Link Dist (ft)	942		595	147
Turn Bay Length (ft)		250		
Base Capacity (vph)	451	673	854	306
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.11	0.74	0.97	0.23

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	46	460	760	0	0	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1770	1583	1863			1863
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1770	1583	1863			1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	500	826	0	0	71
RTOR Reduction (vph)	0	270	0	0	0	0
Lane Group Flow (vph)	50	230	826	0	0	71
Turn Type	NA	Perm	NA			NA
Protected Phases	3		2			6
Permitted Phases		3				
Actuated Green, G (s)	21.7	21.7	37.8			7.5
Effective Green, g (s)	21.7	21.7	37.8			7.5
Actuated g/C Ratio	0.26	0.26	0.44			0.09
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	451	404	828			164
v/s Ratio Prot	0.03		c0.44			c0.04
v/s Ratio Perm		c0.15				
v/c Ratio	0.11	0.57	1.00			0.43
Uniform Delay, d1	24.3	27.6	23.6			36.7
Progression Factor	1.00	1.00	1.78			0.89
Incremental Delay, d2	0.5	5.7	28.0			1.8
Delay (s)	24.8	33.3	69.9			34.7
Level of Service	C	C	E			C
Approach Delay (s)	32.6		69.9			34.7
Approach LOS	C		E			C

Intersection Summary			
HCM 2000 Control Delay	54.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	6	16	1310	660
v/c Ratio	0.05	0.03	0.48	0.25
Control Delay	24.3	1.5	2.4	3.6
Queue Delay	0.0	0.0	0.9	0.0
Total Delay	24.3	1.5	3.2	3.6
Queue Length 50th (ft)	2	1	23	31
Queue Length 95th (ft)	m11	m1	m80	95
Internal Link Dist (ft)	7		173	513
Turn Bay Length (ft)		150		
Base Capacity (vph)	368	631	2717	2681
Starvation Cap Reductn	0	0	1022	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.02	0.03	0.77	0.25

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	3	3	15	1205	500	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.93		1.00	1.00	0.97	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1729		1805	3438	3514	
Flt Permitted	0.98		0.37	1.00	1.00	
Satd. Flow (perm)	1729		697	3438	3514	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	3	16	1310	543	117
RTOR Reduction (vph)	3	0	0	0	11	0
Lane Group Flow (vph)	3	0	16	1310	649	0
Heavy Vehicles (%)	0%	0%	0%	5%	0%	0%
Turn Type	NA		pm+pt	NA	NA	
Protected Phases	6		7	4	8	
Permitted Phases			4			
Actuated Green, G (s)	1.1		71.9	71.9	64.6	
Effective Green, g (s)	1.1		71.9	71.9	64.6	
Actuated g/C Ratio	0.01		0.85	0.85	0.76	
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	22		606	2908	2670	
v/s Ratio Prot	c0.00		0.00	c0.38	0.18	
v/s Ratio Perm			0.02			
v/c Ratio	0.14		0.03	0.45	0.24	
Uniform Delay, d1	41.5		1.2	1.6	3.0	
Progression Factor	0.80		0.77	0.67	1.00	
Incremental Delay, d2	12.5		0.0	0.0	0.2	
Delay (s)	45.6		1.0	1.1	3.2	
Level of Service	D		A	A	A	
Approach Delay (s)	45.6			1.1	3.2	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	2.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	46	0	62	11	0	1	0	417	3	3	497	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.92	0.92	0.93	0.93
Hourly flow rate (vph)	50	0	67	12	0	1	0	444	3	3	534	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1017				
pX, platoon unblocked												
vC, conflicting volume	764	988	267	786	986	223	534			447		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	764	988	267	786	986	223	534			447		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	100	91	95	100	100	100			100		
cM capacity (veh/h)	296	245	737	256	246	780	1037			1110		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	50	67	12	1	296	151	181	356
Volume Left	50	0	12	0	0	0	3	0
Volume Right	0	67	0	1	0	3	0	0
cSH	296	737	256	780	1700	1700	1110	1700
Volume to Capacity	0.17	0.09	0.05	0.00	0.17	0.09	0.00	0.21
Queue Length 95th (ft)	15	8	4	0	0	0	0	0
Control Delay (s)	19.6	10.4	19.8	9.6	0.0	0.0	0.2	0.0
Lane LOS	C	B	C	A			A	
Approach Delay (s)	14.3		18.9		0.0		0.1	
Approach LOS	B		C					

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	31.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	50	114	303	476	71	499
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.94	0.94	0.92	0.92
Hourly flow rate (vph)	54	124	322	506	77	542
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			679			
pX, platoon unblocked						
vC, conflicting volume	748	161			829	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	748	161			829	
tC, single (s)	6.8	7.0			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	83	85			90	
cM capacity (veh/h)	318	843			799	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	178	161	161	506	77	271	271
Volume Left	54	0	0	0	77	0	0
Volume Right	124	0	0	506	0	0	0
cSH	561	1700	1700	1700	799	1700	1700
Volume to Capacity	0.32	0.09	0.09	0.30	0.10	0.16	0.16
Queue Length 95th (ft)	34	0	0	0	8	0	0
Control Delay (s)	14.4	0.0	0.0	0.0	10.0	0.0	0.0
Lane LOS	B				A		
Approach Delay (s)	14.4	0.0			1.2		
Approach LOS	B						

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	115	97	144	791	62	535
v/c Ratio	0.50	0.20	0.22	0.34	0.11	0.25
Control Delay	41.7	5.5	4.5	8.5	4.0	8.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	5.5	4.5	8.5	4.0	8.6
Queue Length 50th (ft)	58	0	18	99	7	60
Queue Length 95th (ft)	104	30	41	160	18	105
Internal Link Dist (ft)	640			552		599
Turn Bay Length (ft)		150	100		100	
Base Capacity (vph)	428	564	742	2317	578	2125
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.17	0.19	0.34	0.11	0.25

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	86	22	92	0	0	0	134	693	42	57	371	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0				6.0	6.0		4.0	6.0	
Lane Util. Factor		1.00	1.00				1.00	0.95		1.00	0.95	
Frt		1.00	0.85				1.00	0.99		1.00	0.96	
Flt Protected		0.96	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1820	1615				1805	3414		1770	3476	
Flt Permitted		0.96	1.00				0.41	1.00		0.35	1.00	
Satd. Flow (perm)		1820	1615				785	3414		657	3476	
Peak-hour factor, PHF	0.95	0.92	0.95	0.92	0.92	0.92	0.93	0.93	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	24	97	0	0	0	144	745	46	62	403	132
RTOR Reduction (vph)	0	0	78	0	0	0	0	4	0	0	26	0
Lane Group Flow (vph)	0	115	19	0	0	0	144	787	0	62	509	0
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	0%	5%	2%	2%	0%	0%
Turn Type	Split	NA	pm+ov				pm+pt	NA		pm+pt	NA	
Protected Phases	4	4	5				5	2		1	6	
Permitted Phases			4				2			6		
Actuated Green, G (s)		9.4	16.9				61.9	54.4		55.3	50.1	
Effective Green, g (s)		9.4	16.9				61.9	54.4		55.3	50.1	
Actuated g/C Ratio		0.11	0.20				0.73	0.64		0.65	0.59	
Clearance Time (s)		6.0	6.0				6.0	6.0		4.0	6.0	
Vehicle Extension (s)		3.0	3.0				3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		201	435				661	2184		495	2048	
v/s Ratio Prot		c0.06	0.00				c0.02	c0.23		0.01	0.15	
v/s Ratio Perm			0.01				0.14			0.07		
v/c Ratio		0.57	0.04				0.22	0.36		0.13	0.25	
Uniform Delay, d1		35.9	27.5				3.6	7.2		5.4	8.4	
Progression Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.9	0.0				0.2	0.5		0.1	0.3	
Delay (s)		39.8	27.6				3.7	7.6		5.5	8.7	
Level of Service		D	C				A	A		A	A	
Approach Delay (s)		34.2			0.0			7.0			8.4	
Approach LOS		C			A			A			A	

Intersection Summary				
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.39			
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	43.1%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	799	113	832	115	8	463
v/c Ratio	0.78	0.21	0.44	0.12	0.02	0.23
Control Delay	34.8	5.4	14.3	5.7	10.3	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.8	5.4	14.3	5.7	10.3	10.5
Queue Length 50th (ft)	211	0	127	8	2	62
Queue Length 95th (ft)	275	35	262	45	9	108
Internal Link Dist (ft)	1132		408			737
Turn Bay Length (ft)	300			100	100	
Base Capacity (vph)	1456	737	1900	928	333	1971
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.15	0.44	0.12	0.02	0.23

Intersection Summary

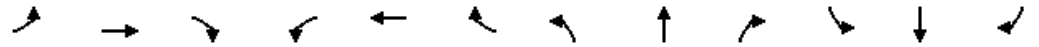
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	735	104	765	106	7	431
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3502	1615	3438	1615	1805	3438
Flt Permitted	0.95	1.00	1.00	1.00	0.25	1.00
Satd. Flow (perm)	3502	1615	3438	1615	476	3438
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.93	0.93
Adj. Flow (vph)	799	113	832	115	8	463
RTOR Reduction (vph)	0	82	0	38	0	0
Lane Group Flow (vph)	799	31	832	77	8	463
Heavy Vehicles (%)	0%	0%	5%	0%	0%	5%
Turn Type	NA	Prot	NA	Perm	pm+pt	NA
Protected Phases	3	3	2		1	6
Permitted Phases				2	6	
Actuated Green, G (s)	26.0	26.0	49.4	49.4	56.1	56.1
Effective Green, g (s)	26.0	26.0	49.4	49.4	56.1	56.1
Actuated g/C Ratio	0.28	0.28	0.52	0.52	0.60	0.60
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	967	446	1804	847	293	2049
v/s Ratio Prot	c0.23	0.02	c0.24		0.00	c0.13
v/s Ratio Perm				0.05	0.02	
v/c Ratio	0.83	0.07	0.46	0.09	0.03	0.23
Uniform Delay, d1	31.9	25.1	14.0	11.1	8.8	8.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.9	0.1	0.9	0.2	0.0	0.3
Delay (s)	37.8	25.2	14.9	11.4	8.9	9.1
Level of Service	D	C	B	B	A	A
Approach Delay (s)	36.2		14.4			9.1
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	94.1	Sum of lost time (s)	18.0
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	447	132	748	91	32	76	161
v/c Ratio	0.57	0.08	0.81	0.12	0.05	0.15	0.22
Control Delay	18.2	10.5	14.3	22.5	7.8	9.9	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.2	10.5	14.3	22.5	7.8	9.9	9.5
Queue Length 50th (ft)	164	19	147	30	0	17	36
Queue Length 95th (ft)	156	21	183	81	20	87	153
Internal Link Dist (ft)		417		653			595
Turn Bay Length (ft)	300		200		100	100	
Base Capacity (vph)	1112	2224	1139	741	653	517	741
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.06	0.66	0.12	0.05	0.15	0.22

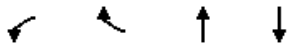
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	411	121	688	0	0	0	0	84	29	71	151	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0					6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00					1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1719	3438	1538					1863	1583	1770	1863	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.70	1.00	
Satd. Flow (perm)	1719	3438	1538					1863	1583	1300	1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.94	0.94	0.94
Adj. Flow (vph)	447	132	748	0	0	0	0	91	32	76	161	0
RTOR Reduction (vph)	0	0	220	0	0	0	0	0	19	0	0	0
Lane Group Flow (vph)	447	132	528	0	0	0	0	91	13	76	161	0
Heavy Vehicles (%)	5%	5%	5%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Split	NA	Prot					NA	Perm	Perm	NA	
Protected Phases	4	4	4					2			6	
Permitted Phases									2	6		
Actuated Green, G (s)	39.2	39.2	39.2					33.8	33.8	33.8	33.8	
Effective Green, g (s)	39.2	39.2	39.2					33.8	33.8	33.8	33.8	
Actuated g/C Ratio	0.46	0.46	0.46					0.40	0.40	0.40	0.40	
Clearance Time (s)	6.0	6.0	6.0					6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	792	1585	709					740	629	516	740	
v/s Ratio Prot	0.26	0.04	c0.34					0.05			c0.09	
v/s Ratio Perm									0.01	0.06		
v/c Ratio	0.56	0.08	0.74					0.12	0.02	0.15	0.22	
Uniform Delay, d1	16.7	12.8	18.8					16.2	15.5	16.4	16.9	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.40	0.41	
Incremental Delay, d2	0.9	0.0	4.2					0.3	0.1	0.6	0.7	
Delay (s)	17.6	12.9	23.0					16.6	15.6	7.2	7.5	
Level of Service	B	B	C					B	B	A	A	
Approach Delay (s)		20.2			0.0			16.3			7.4	
Approach LOS		C			A			B			A	

Intersection Summary				
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.50			
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group



Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	146	312	527	90
v/c Ratio	0.30	0.47	0.68	0.44
Control Delay	29.2	6.3	41.6	32.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	29.2	6.3	41.6	32.5
Queue Length 50th (ft)	64	0	303	41
Queue Length 95th (ft)	124	65	406	m50
Internal Link Dist (ft)	942		595	147
Turn Bay Length (ft)		250		
Base Capacity (vph)	488	664	780	306
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.47	0.68	0.29

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	137	293	495	0	0	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1805	1615	1792			1863
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1805	1615	1792			1863
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	146	312	527	0	0	90
RTOR Reduction (vph)	0	228	0	0	0	0
Lane Group Flow (vph)	146	84	527	0	0	90
Heavy Vehicles (%)	0%	0%	6%	0%	0%	2%
Turn Type	NA	Perm	NA			NA
Protected Phases	3		2			6
Permitted Phases		3				
Actuated Green, G (s)	23.0	23.0	35.8			8.2
Effective Green, g (s)	23.0	23.0	35.8			8.2
Actuated g/C Ratio	0.27	0.27	0.42			0.10
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	488	437	754			179
v/s Ratio Prot	c0.08		c0.29			c0.05
v/s Ratio Perm		0.05				
v/c Ratio	0.30	0.19	0.70			0.50
Uniform Delay, d1	24.6	23.9	20.2			36.5
Progression Factor	1.00	1.00	1.87			0.80
Incremental Delay, d2	1.6	1.0	5.1			1.6
Delay (s)	26.2	24.8	42.7			30.8
Level of Service	C	C	D			C
Approach Delay (s)	25.3		42.7			30.8
Approach LOS	C		D			C

Intersection Summary			
HCM 2000 Control Delay	34.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	6	29	827	1365
v/c Ratio	0.01	0.12	0.38	0.76
Control Delay	18.7	3.5	4.0	17.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	18.7	3.5	4.0	17.4
Queue Length 50th (ft)	1	3	40	260
Queue Length 95th (ft)	m8	m5	51	306
Internal Link Dist (ft)	4		154	538
Turn Bay Length (ft)		150		
Base Capacity (vph)	560	237	2562	1983
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.01	0.12	0.32	0.69

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	3	3	27	761	1083	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.93		1.00	1.00	0.98	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1729		1805	3610	3281	
Flt Permitted	0.98		0.10	1.00	1.00	
Satd. Flow (perm)	1729		184	3610	3281	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	3	29	827	1177	188
RTOR Reduction (vph)	2	0	0	0	17	0
Lane Group Flow (vph)	4	0	29	827	1348	0
Heavy Vehicles (%)	0%	0%	0%	0%	9%	0%
Turn Type	NA		pm+pt	NA	NA	
Protected Phases	6		7	4	8	
Permitted Phases			4			
Actuated Green, G (s)	23.7		53.3	53.3	46.2	
Effective Green, g (s)	23.7		53.3	53.3	46.2	
Actuated g/C Ratio	0.28		0.63	0.63	0.54	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	482		174	2263	1783	
v/s Ratio Prot	c0.00		0.01	c0.23	c0.41	
v/s Ratio Perm			0.10			
v/c Ratio	0.01		0.17	0.37	0.76	
Uniform Delay, d1	22.2		10.2	7.7	15.0	
Progression Factor	0.81		0.58	0.42	1.00	
Incremental Delay, d2	0.0		0.4	0.1	1.9	
Delay (s)	17.9		6.4	3.3	16.9	
Level of Service	B		A	A	B	
Approach Delay (s)	17.9			3.4	16.9	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Appendix G
Preliminary Cost Estimates

VDOT CRO-201:85-95 Study
PETERSBURG, VA
ENGINEER'S OPINION OF PROBABLE COSTS
SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT # 1 - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA (ORIGINAL IDEA)
PROJECT 1 - GRAHAM / CRATER INTERSECTION IMPROVEMENTS

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	SWM Facilities	1	EA	$200,000.00	$200,000.00
	Overhead Sign Structure	1	EA	$150,000.00	$150,000.00
	Reconstructed Graham / Crater int. (road - east section)	400	LF	$420.00	$168,000.00
	Reconstructed Graham / Crater int. (road - west section)	700	LF	$525.00	$367,500.00
	Reconstructed Graham / Crater int. (road - Crater LTL's)	1	LS	$115,000.00	$115,000.00
	Reconstructed Graham / Crater int. (road - Graham RTL)	1	LS	$115,000.00	$115,000.00
	Graham / Crater Intersection (demo road)	600	LF	$100.00	$60,000.00
	Graham / Crater Intersection (demo ramps)	1,000	LF	$100.00	$100,000.00
	Graham / Crater Intersection (demo loops)	1,200	LF	$100.00	$120,000.00
	Graham / Crater Intersection (Signal)	1	EA	$275,000.00	$275,000.00
	SUBTOTAL:				**$1,670,500.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$130,287.50
	Construction Staking/Engineering	2%	PCT		$33,410.00
	Materials Testing	2%	PCT		$33,410.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation for Crater widening	0.1	AC.	$60,000.00	$6,000.00
	WUS Mitigation	50	LF	$600.00	$30,000.00
	Battlefield (4(f) Impacts	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$1,905,607.50**
	Contingencies On All Above Items	15%	PCT		$285,841.13
	Construction Engineering & Inspection (CEI)	16.5%	PCT		$314,425.24
	VDOT Administration	1	LS	$50,000.00	$50,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$2,555,873.86**
	RIGHT OF WAY & UTILITY COSTS				
	U/G Telecommunications	500	LF	$50.00	$25,000.00
	DVP Pole in Crater/Graham int.	1	EA	$25,000.00	$25,000.00
	Reconstruct Waterline	200	LF	$120.00	$24,000.00
	ROW acquistion	0	Parcel	$15,000.00	$0.00
	ROW Contingency	1	LS	$50,000.00	$25,000.00
	VDOT Administration	1	LS	$15,000.00	$25,000.00
	EXPECTED ROW TOTAL:				**$124,000.00**
	PRELIMINARY ENGINEERING				
	IMR	5%	PCT		$127,793.69
	Design	11%	PCT		$281,146.12
	Wetland Permitting/Environmental Document	2.0%	PCT		$51,117.48
	VDOT Administration	1	LS		$50,000.00
	Contingency	1	LS		$100,000.00
	EXPECTED PE TOTAL:				**$610,057.30**
	PROJECT BUDGET:				**$3,289,931.16**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
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SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT # 1 - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA (ORIGINAL IDEA)
PROJECT 2 - NEW CONNECTOR ROAD TO CRATER

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	Traffic Signal at Crater and connector road	1	LS	$300,000.00	$300,000.00
	Extend Pipe in Crater to new outfall	150	LF	$225.00	$33,750.00
	New (1 lane) Roadway (CD to Crater)	3,300	LF	$420.00	$1,386,000.00
	Fill for New Roadway (CD to Crater)	80,000	CY	$12.00	$960,000.00
	New Box culvert near Walnut Hill Pump Station	1	LS	$400,000.00	$400,000.00
	SWM Facilities	2	EA	$200,000.00	$400,000.00
	Box Culvert at sta 108	1	EA	$225,000.00	$225,000.00
	Overhead Sign Structure	1	EA	$150,000.00	$150,000.00
	Street Lighting (Pole & Conduit) for new connector road	50	EA	$1,500.00	$75,000.00
	SUBTOTAL:				**$3,929,750.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$299,731.25
	Construction Staking/Engineering	2%	PCT		$78,595.00
	Materials Testing	2%	PCT		$78,595.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation for Crater widening	0.2	AC.	$60,000.00	$12,000.00
	Wetland Mitigation for New Connector Roadway	0.4	AC.	$60,000.00	$24,000.00
	WUS Mitigation for New 460 Connector Roadway	500	LF	$600.00	$300,000.00
	Battlefield (4(f) Impacts for New 460 Connector Roadway	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$4,724,671.25**
	Contingencies On All Above Items	15%	PCT		$708,700.69
	Construction Engineering & Inspection (CEI)	15.0%	PCT		$708,700.69
	VDOT Administration	1	LS	$50,000.00	$50,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$6,192,072.63**
	RIGHT OF WAY & UTILITY COSTS				
	Harrison, Richard & Gina for new connector road	1.5	AC	$37,000.00	$55,500.00
	Powell Properties for new connector road	1.5	AC	$15,000.00	$22,500.00
	Powell, Johns for new connector road	1.0	AC	$15,000.00	$15,000.00
	Hale, Elizabeth for new connector road	3.0	AC	$8,000.00	$24,000.00
	Clements, Newton for connector road	1.0	AC	$8,000.00	$8,000.00
	Small, Mary Francis for conenctor road	1.0	AC	$100,000.00	$100,000.00
	Add on for potential damages (if required)	1	LS	$125,000.00	$125,000.00
	U/G Telecommunications	500	LF	$50.00	$25,000.00
	DVP Pole in Crater	1	EA	$25,000.00	$25,000.00
	Reconstruct Waterline	200	LF	$120.00	$24,000.00
	ROW acquistion	6	Parcel	$15,000.00	$90,000.00
	ROW Contingency	1	LS	$100,000.00	$100,000.00
	VDOT Administration	1	LS	$25,000.00	$25,000.00
	EXPECTED ROW TOTAL:				**$639,000.00**
	PRELIMINARY ENGINEERING				
	IMR	3%	PCT		$185,762.18
	Design	11%	PCT		$681,127.99
	Wetland Permitting/Environmental Document	2.0%	PCT		$123,841.45
	VDOT Administration	1	LS		$100,000.00
	Contingency	1	LS		$100,000.00
	EXPECTED PE TOTAL:				**$1,190,731.62**
	PROJECT BUDGET:				**$8,021,804.25**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
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SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT # 2 - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA (ORIGINAL)
PROJECT 1 - NORTH SIDE IMPROVEMENTS

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	SWM Facilities	1	EA	$200,000.00	$200,000.00
	Overhead Sign Structure	1	EA	$150,000.00	$150,000.00
	Street Lighting (Pole & Conduit)	25	EA	$1,500.00	$37,500.00
	Int. Improvements at Crater / Winfield (RTL)	1	LS	$100,000.00	$100,000.00
	Int. Improvements at Crater / Winfield (LTL)	1	LS	$100,000.00	$100,000.00
	Int. Improvements at County Dr / Winfield (RTL)	1	LS	$100,000.00	$100,000.00
	Int. Improvements at County Dr / Winfield (LTL)	1	LS	$100,000.00	$100,000.00
	Reconstruct Winfield (road) - 3 lane road	2,600	LF	$420.00	$1,092,000.00
	Crater to NB 95 (demo ramp)	1,200	LF	$100.00	$120,000.00
	NB 95 to Crater (demo ramp)	700	LF	$100.00	$70,000.00
	NB 95 TO Crater (demo loop)	300	LF	$100.00	$30,000.00
	Imrpove NB on ramp between Winfield and 95	1,000	LF	$600.00	$600,000.00
	Imrpove NB 95 CD Road	1,000	LF	$800.00	$800,000.00
	Imrpove Winfield at Crater	300	LF	$520.00	$156,000.00
	Sound Wall along NB CD road	15,000	SF	$30.00	$450,000.00
	SUBTOTAL:				**$4,105,500.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$312,912.50
	Construction Staking/Engineering	2%	PCT		$82,110.00
	Materials Testing	2%	PCT		$82,110.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation	0.2	AC.	$60,000.00	$12,000.00
	WUS Mitigation	0	LF	$600.00	$0.00
	*Battlefield (4(f) Impacts)	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$4,596,632.50**
	Contingencies On All Above Items	15%	PCT		$689,494.88
	Construction Engineering & Inspection (CEI)	15.0%	PCT		$689,494.88
	VDOT Administration	1	LS	$50,000.00	$50,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$6,025,622.25**
	RIGHT OF WAY & UTILITY COSTS				
	** Property Owner Direct impacts (Motel site on Winfield)	0.3	AC	$150,000.00	$45,000.00
	Add on for potential damages (if required)	1	LS	$15,000.00	$15,000.00
	U/G Telecommunications	2,600	LF	$50.00	$130,000.00
	DVP Pole	2	EA	$25,000.00	$50,000.00
	Reconstruct Waterline (Winfield)	1,800	LF	$120.00	$216,000.00
	ROW Acquistion	1	Parcel	$15,000.00	$15,000.00
	ROW Contingency	1	LS	$25,000.00	$25,000.00
	VDOT Administration	1	LS	$25,000.00	$25,000.00
	EXPECTED ROW TOTAL:				**$521,000.00**
	PRELIMINARY ENGINEERING				
	IMR	3%	PCT		$180,768.67
	Design	11%	PCT		$662,818.45
	Wetland Permitting/Environmental Document	2%	PCT		$120,512.45
	VDOT Administration	1	LS		$50,000.00
	Contingency	1	LS		$50,000.00
	EXPECTED PE TOTAL:				**$1,064,099.56**

PROJECT BUDGET: $7,610,721.81

* Must stay within Winfield ROW and stay away from widening to the north side of Winfield.

VDOT CRO-201:85-95 Study
PETERSBURG, VA
ENGINEER'S OPINION OF PROBABLE COSTS
SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT # 2 - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA (ORIGINAL)
PROJECT 2 - SOUTH SIDE IMPROVEMENTS

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	SWM Facilities	1	EA	$200,000.00	$200,000.00
	Overhead Sign Structure	1	EA	$150,000.00	$150,000.00
	Street Lighting (Pole & Conduit)	25	EA	$1,500.00	$37,500.00
	Int. Improvements at Crater / Graham (Signal)	1	LS	$300,000.00	$300,000.00
	Int. Improvements at Off Ramp / Graham (Signal)	1	LS	$300,000.00	$300,000.00
	Imrpove SB 95 off ramp at Graham (LTL)	1	EA	$100,000.00	$100,000.00
	Imrpove SB 95 off ramp at Graham (RTL)	1	EA	$100,000.00	$100,000.00
	Imrpove Graham between 95 off ramp and Crater	700	LF	$350.00	$245,000.00
	Imrpove Crater south of Graham	700	LF	$350.00	$245,000.00
	Realign Subdivision Street at Graham	250	LF	$520.00	$130,000.00
	SUBTOTAL:				**$1,807,500.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$140,562.50
	Construction Staking/Engineering	2%	PCT		$36,150.00
	Materials Testing	2%	PCT		$36,150.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation	0.2	AC.	$60,000.00	$12,000.00
	WUS Mitigation	0	LF	$600.00	$0.00
	Battlefield (4(f) Impacts)	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$2,034,362.50**
	Contingencies On All Above Items	15%	PCT		$305,154.38
	Construction Engineering & Inspection (CEI)	16.5%	PCT		$335,669.81
	VDOT Administration	1	LS	$25,000.00	$25,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$2,700,186.69**
	RIGHT OF WAY & UTILITY COSTS				
	Property Owner Direct impacts (Rosewood Terrace and Graham/Crater)	0.6	AC	$150,000.00	$90,000.00
	Add on for potential damages (if required)	1	LS	$50,000.00	$50,000.00
	U/G Telecommunications	1,000	LF	$50.00	$50,000.00
	DVP Pole	5	EA	$25,000.00	$125,000.00
	Reconstruct Waterline (Graham & Crater)	500	LF	$120.00	$60,000.00
	ROW Acquistion	4	Parcel	$15,000.00	$60,000.00
	ROW Contingency	1	LS	$25,000.00	$25,000.00
	VDOT Administration	1	LS	$25,000.00	$25,000.00
	EXPECTED ROW TOTAL:				**$485,000.00**
	PRELIMINARY ENGINEERING				
	IMR	5%	PCT		$135,009.33
	Design	11%	PCT		$297,020.54
	Wetland Permitting/Environmental Document	1%	PCT		$13,500.93
	VDOT Administration	1	LS		$50,000.00
	Contingency	1	LS		$100,000.00
	EXPECTED PE TOTAL:				**$595,530.80**
	PROJECT BUDGET:				**$3,780,717.49**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
ENGINEER'S OPINION OF PROBABLE COSTS
SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT #1 & #2 COMBINED - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA
PROJECT 1 - GRAHAM / CRATER IMPROVEMENTS

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	SWM Facilities	1	EA	$200,000.00	$200,000.00
	Overhead Sign Structure	1	EA	$150,000.00	$150,000.00
	Reconstructed Graham / Crater int. (road - east section)	400	LF	$420.00	$168,000.00
	Reconstructed Graham / Crater int. (road - west section)	700	LF	$525.00	$367,500.00
	Reconstructed Graham / Crater int. (road - Crater LTL's)	1	LS	$115,000.00	$115,000.00
	Reconstructed Graham / Crater int. (road - Graham RTL)	1	LS	$115,000.00	$115,000.00
	Graham / Crater Intersection (demo road)	600	LF	$100.00	$60,000.00
	Graham / Crater Intersection (demo ramps)	1,000	LF	$100.00	$100,000.00
	Graham / Crater Intersection (demo loops)	1,200	LF	$100.00	$120,000.00
	Graham / Crater Intersection (Signal)	1	EA	$275,000.00	$275,000.00
	SUBTOTAL:				**$1,670,500.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$130,287.50
	Construction Staking/Engineering	2%	PCT		$33,410.00
	Materials Testing	2%	PCT		$33,410.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation for Crater widening	1.0	AC.	$60,000.00	$60,000.00
	Battlefield (4(f) Impacts	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$1,929,607.50**
	Contingencies On All Above Items	15%	PCT		$289,441.13
	Construction Engineering & Inspection (CEI)	17.0%	PCT		$328,033.28
	VDOT Administration	1	LS	$50,000.00	$50,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$2,597,081.90**
	RIGHT OF WAY & UTILITY COSTS				
	U/G Telecommunications	500	LF	$50.00	$25,000.00
	DVP Pole in Crater	1	EA	$50,000.00	$50,000.00
	DVP Pole in Crater/Graham int.	2	EA	$25,000.00	$50,000.00
	Reconstruct Waterline	200	LF	$120.00	$24,000.00
	ROW acquistion	0	Parcel	$15,000.00	$0.00
	ROW Contingency	1	LS	$50,000.00	$50,000.00
	VDOT Administration	1	LS	$15,000.00	$15,000.00
	EXPECTED ROW TOTAL:				**$214,000.00**
	PRELIMINARY ENGINEERING				
	IMR	5.0%	PCT		$129,854.10
	Design	11%	PCT		$285,679.01
	Wetland Permitting/Environmental Document	2%	PCT		$51,941.64
	VDOT Administration	1	LS		$50,000.00
	Contingency	1	LS		$100,000.00
	EXPECTED PE TOTAL:				**$617,474.74**
	PROJECT BUDGET:				**$3,428,556.64**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
ENGINEER'S OPINION OF PROBABLE COSTS
SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT #1 & #2 COMBINED - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA
PROJECT 2 - WINFIELD / CRATER IMPROVEMENTS

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	SWM Facilities	1	EA	$200,000.00	$200,000.00
	Overhead Sign Structure	1	EA	$150,000.00	$150,000.00
	Int. Improvements at Crater / Winfield (RTL)	1	LS	$100,000.00	$100,000.00
	Int. Improvements at Crater / Winfield (LTL)	1	LS	$100,000.00	$100,000.00
	Crater to NB 95 (demo ramp)	1,200	LF	$100.00	$120,000.00
	NB 95 to Crater (demo ramp)	700	LF	$100.00	$70,000.00
	NB 95 TO Crater (demo loop)	300	LF	$100.00	$30,000.00
	Imrpove Winfield at Crater	300	LF	$520.00	$156,000.00
	SUBTOTAL:				**$926,000.00**

OTHER CONSTRUCTION COSTS

	Mobilization	1	LS		$74,450.00
	Construction Staking/Engineering	2%	PCT		$18,520.00
	Materials Testing	2%	PCT		$18,520.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation for Crater widening	0.2	AC.	$60,000.00	$12,000.00
	WUS Mitigation	0	LF	$600.00	$0.00
	Battlefield (4(f) Impacts for New 460 Connector Roadway	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$1,051,490.00**
	Contingencies On All Above Items	15%	PCT		$157,723.50
	Construction Engineering & Inspection (CEI)	17.0%	PCT		$178,753.30
	VDOT Administration	1	LS	$50,000.00	$50,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$1,437,966.80**

RIGHT OF WAY & UTILITY COSTS

	U/G Telecommunications	500	LF	$50.00	$25,000.00
	DVP Pole	2	EA	$25,000.00	$50,000.00
	Reconstruct Waterline	250	LF	$120.00	$30,000.00
	ROW acquistion	0	Parcel	$15,000.00	$0.00
	ROW Contingency	1	LS	$25,000.00	$25,000.00
	VDOT Administration	1	LS	$15,000.00	$15,000.00
	EXPECTED ROW TOTAL:				**$145,000.00**

PRELIMINARY ENGINEERING

	IMR	8.0%	PCT		$115,037.34
	Design	12%	PCT		$172,556.02
	Wetland Permitting/Environmental Document	2%	PCT		$28,759.34
	VDOT Administration	1	LS		$25,000.00
	Contingency	1	LS		$75,000.00
	EXPECTED PE TOTAL:				**$416,352.70**

PROJECT BUDGET: **$1,999,319.50**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
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SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT #1 & #2 COMBINED - IMPROVE CRATER-GRAHAM-460 CONNECTOR INTERCHANGE AREA
PROJECT 3 - NEW CONNCECTOR ROAD

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	Right turn lane added in Crater Road	1	LS	$100,000.00	$100,000.00
	Left turn lane added in Crater Road	1	LS	$250,000.00	$250,000.00
	Traffic Signal at Crater and 460 connector extended	1	LS	$300,000.00	$300,000.00
	Extend Pipe in Crater to new outfall	150	LF	$225.00	$33,750.00
	New (2 Lane) Roadway (Crater to I-95 SB)	3,000	LF	$700.00	$2,100,000.00
	Fill for New Roadway (Crater to I-95 SB)	70,000	CY	$12.00	$840,000.00
	New Box culverts near Walnut Hill Pump Station	2	LS	$400,000.00	$800,000.00
	SWM Facilities	2	EA	$200,000.00	$400,000.00
	Box Culvert at sta 108	1	EA	$225,000.00	$225,000.00
	Overhead Sign Structure	4	EA	$150,000.00	$600,000.00
	Street Lighting (Pole & Conduit) for new connector road	50	EA	$1,500.00	$75,000.00
	Corridor Improvements at new connector road/ramp EB	700	LF	$700.00	$490,000.00
	Int. Improvements at new connector road/ramp (RTL)	1	LS	$100,000.00	$100,000.00
	Int. Improvements at new connector road/ramp (LTL)	1	LS	$100,000.00	$100,000.00
	Int. Improvements at new connector road/Crater (Signal)	1	LS	$300,000.00	$300,000.00
	Int. Improvements at new connector road/ramp (Demo of ramp)	500	LF	$100.00	$50,000.00
	Corridor Improvements at new connector road/ramp EB (east of new int.)	500	LF	$300.00	$150,000.00
	Int. Improvements at new connector road/ramp (Ret. Wall)	3,200	SF	$55.00	$176,000.00
	Int. Improvements at new connector road/ramp (Sound Wall)	4,000	SF	$30.00	$120,000.00
	CD Road Improvements south of new connector (road)	3,000	LF	$800.00	$2,400,000.00
	CD Road Improvements south of new connector (demo)	500	LF	$100.00	$50,000.00
	CD Road Improvements south of new connector (box culvert)	1	EA	$225,000.00	$225,000.00
	CD Road Improvements south of new connector (signal)	1	EA	$275,000.00	$275,000.00
	CD Road Improvements north of new connector (road)	1,300	LF	$800.00	$1,040,000.00
	CD Road Improvements north of new connector (demo)	750	LF	$100.00	$75,000.00
	CD Road Improvements north of new connector (ret. wall)	112,000	SF	$55.00	$6,160,000.00
	Reconstructed Connector Rd East of 95 NB (road)	1,400	LF	$800.00	$1,120,000.00
	Reconstructed Connector Rd East of 95 NB (box culv)	1	EA	$150,000.00	$150,000.00
	Reconstructed Connector Rd East of 95 NB (signal)	1	LS	$250,000.00	$250,000.00
	Reconstructed Connector Rd East of 95 NB (grading)	1	LS	$100,000.00	$100,000.00
	County Drive / Winfield Intersection (Signal)	1	EA	$250,000.00	$250,000.00
	SUBTOTAL:				**$19,304,750.00**

OTHER CONSTRUCTION COSTS

	Mobilization	1	LS		$1,452,856.25
	Construction Staking/Engineering	2%	PCT		$386,095.00
	Materials Testing	2%	PCT		$386,095.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation for New 460 Connector Roadway	0.4	AC.	$60,000.00	$24,000.00
	WUS Mitigation for New 460 Connector Roadway	700	LF	$600.00	$420,000.00
	Battlefield (4(f) Impacts for New 460 Connector Roadway	1	LS	$0.00	$0.00

EXPECTED CONSTRUCTION CONTRACT TOTAL:	**$21,975,796.25**

	Contingencies On All Above Items	15%	PCT		$3,296,369.44
	Construction Engineering & Inspection (CEI)	12.5%	PCT		$2,746,974.53
	VDOT Administration	1	LS	$200,000.00	$200,000.00

EXPECTED CONSTRUCTION TOTAL:	**$28,219,140.22**

RIGHT OF WAY & UTILITY COSTS

	Powell Properties for RTL in Crater	0.2	AC	$15,000.00	$3,000.00
	Ritcheson, Barbara for RTL in Crater	0.2	AC	$400,000.00	$80,000.00
	Harrison, Richard & Gina for new connector road	1.5	AC	$37,000.00	$55,500.00
	Powell Properties for new connector road	1.5	AC	$15,000.00	$22,500.00
	Powell, Johns for new connector road	1.0	AC	$15,000.00	$15,000.00
	Hale, Elizabeth for new connector road	3.0	AC	$8,000.00	$24,000.00
	Clements, Newton for connector road	1.0	AC	$8,000.00	$8,000.00
	Small, Mary Francis for conenctor road	1.0	AC	$100,000.00	$100,000.00
	Collins, Jerry for new CD Road south of new connector road	0.5	AC	$12,000.00	$6,000.00
	3L Properties for new CD Road south of new connector road	0.5	AC	$19,000.00	$9,500.00
	Aashirwad, LLC for new CD Road north of new connector road	0.4	AC	$77,000.00	$30,800.00
	Clements, NL & Joyce on new CD Road north of new connector rd	0.3	AC	$95,000.00	$28,500.00
	Clements, NL & Joyce on new CD Road north of new connector rd	0.2	AC	$95,000.00	$19,000.00
	Hudgins, David on new CD Road north of new connector rd	0.2	AC	$90,000.00	$18,000.00
	Add on for potential damages (if required)	1	LS	$125,000.00	$125,000.00
	U/G Telecommunications	2,000	LF	$50.00	$100,000.00
	DVP Pole in Crater	1	EA	$50,000.00	$50,000.00
	DVP Pole (others)	2	EA	$25,000.00	$50,000.00
	Reconstruct Waterline	650	LF	$120.00	$78,000.00

VDOT CRO-201:85-95 Study
PETERSBURG, VA

	ROW acquistion	14	Parcel	$15,000.00	$210,000.00
	ROW Contingency	1	LS	$150,000.00	$125,000.00
	VDOT Adminstration	1	LS	$50,000.00	$75,000.00

EXPECTED ROW TOTAL:	**$1,232,800.00**

PRELIMINARY ENGINEERING

	IMR	1.0%	PCT		$282,191.40
	Design	8%	PCT		$2,257,531.22
	Wetland Permitting/Environmental Document	1.5%	PCT		$423,287.10
	VDOT Administration	1	LS		$250,000.00
	Contingency	1	LS		$500,000.00

EXPECTED PE TOTAL:	**$3,713,009.72**

PROJECT BUDGET:	**$33,164,949.94**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
ENGINEER'S OPINION OF PROBABLE COSTS
SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
ORIGINAL CONCEPT #3 - IMPROVE 95 NB to 85 SB (original left exit)

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	New Bridge Flyover from I-95 NB to I-85 SB (3,000' High Bridge)	144,000	SF	$300.00	$43,200,000.00
	New Bridge Flyover from I-95 NB to I-85 SB (MSE Walls)	42,000	SF	$60.00	$2,520,000.00
	Sound Walls	22,000	SF	$30.00	$660,000.00
	Close existing I-95 NB to I-85 SB ramp	3,000	LF	$100.00	$300,000.00
	Reconstruction at Crater (loop)	2,000	LF	$600.00	$1,200,000.00
	Reconstruction at Crater (ramp)	500	LF	$600.00	$300,000.00
	Reconstruction at Crater (signal)	1	LS	$300,000.00	$300,000.00
	Reconstruction at Crater (CD roadway)	2,000	LF	$1,000.00	$2,000,000.00
	Reconstruction at County Drive (CD roadway)	2,000	LF	$1,000.00	$2,000,000.00
	Reconstruction at Crater (Ret. Wall)	12,000	SF	$55.00	$660,000.00
	Reconstruction at Crater (OVHD Signs)	8	EA	$150,000.00	$1,200,000.00
	Reconstruction at Crater (High Lights)	100	EA	$10,000.00	$1,000,000.00
	Reconstruction of I-95 NB	3,600	LF	$1,500.00	$5,400,000.00
	Reconstruction of I-85 SB	1,200	LF	$1,500.00	$1,800,000.00
	SUBTOTAL:				**$62,540,000.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$4,695,500.00
	Construction Staking/Engineering	2%	PCT		$1,250,800.00
	Materials Testing	2%	PCT		$1,250,800.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation	0.5	AC.	$60,000.00	$30,000.00
	WUS Mitigation	300	LF	$600.00	$180,000.00
	Battlefield (4(f) Impacts for New 460 Connector Roadway	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$69,949,100.00**
	Contingencies On All Above Items	12%	PCT		$8,393,892.00
	Construction Engineering & Inspection (CEI)	12.5%	PCT		$8,743,637.50
	VDOT Adminstration	1	LS	$250,000.00	$250,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$87,336,629.50**
	RIGHT OF WAY & UTILITY COSTS				
	City of Petersburg Parcel just south of Graham	1.0	AC	$31,000.00	$31,000.00
	Add on for potential damages (if required)	1	LS	$30,000.00	$30,000.00
	U/G Telecommunications	1,000	LF	$50.00	$50,000.00
	DVP Pole	1	EA	$25,000.00	$25,000.00
	Reconstruct Waterline	500	LF	$120.00	$60,000.00
	ROW acquistion	1	Parcel	$15,000.00	$15,000.00
	ROW Contingency	1	LS	$100,000.00	$100,000.00
	VDOT Administration	1	LS	$25,000.00	$25,000.00
	EXPECTED ROW TOTAL:				**$336,000.00**
	PRELIMINARY ENGINEERING				
	IMR	0.5%	PCT		$436,683.15
	Design	8%	PCT		$6,986,930.36
	Wetland Permitting/Environmental Document	1%	PCT		$873,366.30
	VDOT Administration	1	LS		$50,000.00
	Contingency	1	LS		$750,000.00
	EXPECTED PE TOTAL:				**$9,096,979.80**
	PROJECT BUDGET:				**$96,769,609.30**

VDOT CRO-201:85-95 Study
PETERSBURG, VA
ENGINEER'S OPINION OF PROBABLE COSTS
SUBMITTAL DATED 11-10-14 (STUDY STAGE) - DRAFT
REFINED CONCEPT # 3(B) REVISED - IMPROVE 95 NB to 85 SB Manuver with Interchange Flyover (right side)

VDOT ITEM #	ITEM	Quantity	UNIT	UNIT PRICE	COST
	New Bridge Flyover from I-95 NB to I-85 SB (3,300' High Bridge)	158,400	SF	$300.00	$47,520,000.00
	New Bridge Flyover from I-95 NB to I-85 SB (MSE Walls)	21,000	SF	$60.00	$1,260,000.00
	Sound Walls	45,000	SF	$30.00	$1,350,000.00
	Close existing ramp	3,000	LF	$100.00	$300,000.00
	Reconstruction at Crater (loop)	2,000	LF	$600.00	$1,200,000.00
	Reconstruction at Crater (ramp)	500	LF	$600.00	$300,000.00
	Reconstruction at Crater (signal)	1	LS	$300,000.00	$300,000.00
	Reconstruction at Crater (CD roadway)	2,000	LF	$1,000.00	$2,000,000.00
	Reconstruction at County Drive (CD roadway)	2,000	LF	$1,000.00	$2,000,000.00
	Reconstruction at Crater (Ret. Wall)	12,000	SF	$55.00	$660,000.00
	Reconstruction at Crater (OVHD Signs)	8	EA	$150,000.00	$1,200,000.00
	Reconstruction at Crater (High Lights)	100	EA	$10,000.00	$1,000,000.00
	SUBTOTAL:				**$59,090,000.00**
	OTHER CONSTRUCTION COSTS				
	Mobilization	1	LS		$4,436,750.00
	Construction Staking/Engineering	2%	PCT		$1,181,800.00
	Materials Testing	2%	PCT		$1,181,800.00
	Permanent Signs	1	LS		$2,000.00
	Wetland Mitigation	0.5	AC.	$60,000.00	$30,000.00
	WUS Mitigation	300	LF	$600.00	$180,000.00
	Battlefield (4(f) Impacts for New 460 Connector Roadway	1	LS	$0.00	$0.00
	EXPECTED CONSTRUCTION CONTRACT TOTAL:				**$66,102,350.00**
	Contingencies On All Above Items	12%	PCT		$7,932,282.00
	Construction Engineering & Inspection (CEI)	12.5%	PCT		$8,262,793.75
	VDOT Adminstration	1	LS	$250,000.00	$250,000.00
	EXPECTED CONSTRUCTION TOTAL:				**$82,547,425.75**
	RIGHT OF WAY & UTILITY COSTS				
	City of Petersburg Parcel just south of Graham	1.0	AC	$31,000.00	$31,000.00
	Gayterry Parcel off Bellevue Ave (total take)	1	LS	$4,500.00	$4,500.00
	Lafrenier, Paul Parcel off Bellevue Ave (total take)	1	LS	$150,000.00	$150,000.00
	Turner, Steven Parcel off Bellevue Ave (total take)	1	LS	$120,000.00	$120,000.00
	Benitez, Joe & Mary Parcel off Bellevue Ave (total take)	1	LS	$80,000.00	$80,000.00
	Barboza, Lauren Parcel off Bellevue Ave (total take)	1	LS	$165,000.00	$165,000.00
	Walker, Patquin Parcel off Bellevue Ave	0.2	AC	$120,000.00	$24,000.00
	Jones, James & Marjorie Parcel off Bellevue Ave	0.1	AC	$105,000.00	$10,500.00
	Add on for potential damages (if required)	1	LS	$100,000.00	$100,000.00
	Relocation fees for four parcels	1	LS	$100,000.00	$100,000.00
	U/G Telecommunications	1,000	LF	$50.00	$50,000.00
	DVP Pole	1	EA	$25,000.00	$25,000.00
	Reconstruct Waterline	500	LF	$120.00	$60,000.00
	ROW acquistion	8	Parcel	$15,000.00	$120,000.00
	ROW Contingency	1	LS	$100,000.00	$100,000.00
	VDOT Administration	1	LS	$100,000.00	$100,000.00
	EXPECTED ROW TOTAL:				**$1,240,000.00**
	PRELIMINARY ENGINEERING				
	IMR	0.5%	PCT		$412,737.13
	Design	8%	PCT		$6,603,794.06
	Wetland Permitting/Environmental Document	1%	PCT		$825,474.26
	VDOT Administration	1	LS		$50,000.00
	Contingency	1	LS		$750,000.00
	EXPECTED PE TOTAL:				**$8,642,005.45**
	PROJECT BUDGET:				**$92,429,431.20**