MINUTES
JAMES CITY COUNTY BOARD OF SUPERVISORS
WORK SESSION
County Government Center Board Room
101 Mounts Bay Road, Williamsburg, VA 23185
May 26, 2015
4:00 PM

A. CALL TO ORDER

Mr. Hipple called the Board of Supervisors to order.

Mr. Holt called the Planning Commission to order.

B. ROLL CALL

Board of Supervisors
Mary K. Jones, Berkeley District
John J. McGlennon, Roberts District
Kevin D. Onizuk, Vice-Chairman, Jamestown District
James G. Kennedy, Stonehouse District
Michael J. Hipple, Chairman, Powhatan District

Bryan J. Hill, County Administrator

Planning Commission
Rich Krapf, Powhatan District
Tim O'Connor, At Large Representative
Christopher Basic, Vice-Chairman, Berkeley District
George Drummond, Roberts District
John Wright, III, At Large Representative
Heath Richardson, Stonehouse District
Robin Bledsoe, Chairman, Jamestown District

Paul Holt, Planning Director, Secretary to the Commission

C. BOARD DISCUSSIONS

1. Mooretown Road Extended Corridor Study Alignment Update

Mr. Jason Purse, Zoning Administrator, addressed the Board stating that the Mooretown Road Extended Corridor Study was started in March 2014. Three public meetings were subsequently held to engage the community on issues and opportunities that should be considered during the development of alternative alignments for the potential roadway. VHB, the consultant leading the project, has prepared a brief presentation to provide an update to and receive feedback from the Board of Supervisors on a potential alignment of Mooretown Road Extended. This is an abbreviated version of the presentation from the most recent public meeting held on March 12, 2015.

After the presentation, the Board generally discussed the Corridor Study, the three different alternatives, possible uses for the developable land in the area and a planning level estimate of the cost to build.

2. Joint Board of Supervisors and Planning Commission Work Session - Update on the 2009 Comprehensive Plan Review, "Toward 2035: Leading the Way"

Ms. Tammy Rosario, Principle Planner, addressed the Board stating in accordance with the adopted methodology for the streamlined 2009 Comprehensive Plan review, Toward

2035: Leading the Way, joint work sessions were planned at various milestone points in the plan's development to allow for discussion between the Planning Commission and the Board of Supervisors on the progress reached and direction moving forward. Based upon the feedback at the January joint work session with the Board, the Planning Commission completed its review and recommended approval of the draft plan in April, paving the way for this work session to focus on the Planning Commission's final discussions, revisions and recommendation of approval.

Ms. Robin Bledsoe, Planning Commission Chairman, stated that on April 1, 2015, the Planning Commission reviewed the above information during its public hearing on the draft Comprehensive Plan. Following discussion, the Planning Commission took individual votes on three land use applications:

1 - LU-0003-2014, 499 Jolly Pond Road (Colonial Heritage) - The Planning Commission recommended approval of LU-0003-2014, which would redesignate the property to Low Density Residential and include it in the Primary Service Area, by a vote of 5-2.

2 - LU-0007-2014, 8515 Pocahontas Trail (Kingsmill and Woods Course) - The Planning Commission recommended approval of LU-0007-2014 as recommended by the Planning Commission Working Group (PCWG), which would change 8515 Pocahontas Trail to Low Density Residential and 101 Busch Service Road to Open Space/Recreation and leave 8581 Pocahontas Trail as Limited Industry, by a vote of 5-1-1.

3 - LU-0009-2014, 5961 Pocahontas Trail (BASF Property) - A motion to recommend approval of LU-0009-2014, which would redesignate the property to Mixed Use (with a Mixed Use description that references Fort Eustis), failed by a vote of 3-4.

In addition, the Planning Commission discussed the pending revisions to address the Virginia Department of Transportation comments and to add the Executive Summary. Afterwards, the Planning Commission voted 7-0 to recommend approval of the draft Comprehensive Plan inclusive of those changes and the remaining land use applications as recommended by the PCWG on the voting sheet. These revisions are shown on the attached errata sheet for the Board of Supervisors' consideration of the 2035 Comprehensive Plan.

Ms. Jones followed-up on the question of possible industrial development available for the area, even without the BASF property, that was asked during the Commission meeting.

Ms. Ellen Cook, Planner III, stated that in the lower part of the County there is 321 acres of vacant M-1 or M-2 zoned land available that is developable, more generally there is 1,458 acres of developable or partially developed land that is zoned M-1 or M-2 in the County and there is roughly 3,312 acres of M-1, M-2 or Mixed Use land designated on the Comprehensive Plan.

Significant discussion ensued regarding several of the Land Use Applications, the impact on water withdrawal and the Primary Service Area (PSA). There was concern raised over the considerable exception being made to the PSA with the Colonial Heritage Land Use Application. The broader implications for the PSA was brought into question and several Board members reiterated their desire to have a broader discussion on the PSA as a growth management tool. More discussion ensued regarding density and more intense development through that corridor near Colonial Heritage and Centerville Road.

Ms. Rosario stated that if there are Land Use Applications that the Board would like broken out from the rest of the overall vote, then staff is happy to do so and to let those

property owners know. She stated that she believes that she is hearing that desire, especially regarding Colonial Heritage.

Mr. McGlennon stated that his preference would be to vote on the Land Use Applications individually during the Board meeting on June 9 and Mr. Onizuk concurred. The rest of the Board voiced their agreement as well.

Mr. Onizuk stated that he would like to have the broader discussion on the PSA and Land Use with the Planning Commission in the near future. Mr. Hipple concurred.

Mr. Hill stated that he would like the opportunity to sit down with the team and determine a list of topics that have been discussed regarding these topics and hopefully work systematically. He would prefer not to assign topics on the fly.

As there were no other questions for the Planning Commission, Ms. Bledsoe adjourned the Planning Commission at 5:19 p.m.

D. CLOSED SESSION

E. ADJOURNMENT

1. Adjourn until Regular Meeting

A motion to Adjourn was made by Mr. Kennedy and the motion result was Passed.

AYES: 5 NAYS: 0 ABSTAIN: 0 ABSENT: 0
Ayes: Jones, McGlennon, Onizuk, Kennedy, Hipple

At 5:20 p.m., Mr. Hipple adjourned the Board.

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Bryan J. Hill
County Administrator

A REGULAR MEETING OF THE PLANNING COMMISSION OF THE COUNTY OF JAMES CITY, VIRGINIA, WAS HELD ON THE SEVENTH DAY OF OCTOBER TWO-THOUSAND AND FIFTEEN, AT 7:00 P.M. IN THE COUNTY GOVERNMENT CENTER BOARD ROOM, 101-F MOUNTS BAY ROAD, JAMES CITY COUNTY, VIRGINIA.

1. ROLL CALL

Planning Commissioners Present:
Robin Bledsoe
Rich Krapf
Chris Basic
Tim O'Connor
George Drummond
John Wright, III
Heath Richardson

Staff Present:
Paul Holt, Planning Director
Roberta Sulouff, Planner
Maxwell Hlavin, Assistant County Attorney

Ms. Robin Bledsoe called the meeting to order at 7:00 p.m.

2. PUBLIC COMMENT

Ms. Bledsoe opened the public comment.

As no one wished to speak, Ms. Bledsoe closed the public comment.

3. CONSENT AGENDA

A. **Minutes from the September 2, 2015 Regular Meeting**

B. **C-0018-2015, New Town Shared Parking Update**

C. **C-0067-2015, Lightfoot Marketplace-MP Consistency**

D. **SP-0049-2015, The Promenade at John Tyler-MP Consistency**

E. **MP-0001-2015, Greensprings Plantation Master Sign Plan Amendment**

Mr. Heath Richardson moved to approve the Consent Agenda.

The consent agenda was approved by voice vote, 7-0.

4. REPORTS OF THE COMMISSION

A. Policy Committee

Ms. Bledsoe stated that there was not a Policy Committee meeting last month.

5. PUBLIC HEARING

A. **SUP-0003-2015, Colonial Heritage Deer Lake Estates Utility Extension**

Ms. Roberta Sulouff, Planner, provided an overview of the request to extend public water and sewer facilities to the previously approved 50-lot rural cluster to be known as Deer Lake Estates. Ms. Sulouff stated that the 725 acre property formally known as the Boy Scout property is located at 499 Jolly Pond Rd. The A-1 district of the Zoning Ordinance requires a Special Use Permit (SUP) for any extension of public utilities. Ms. Sulouff stated that as part of the 2035 Comprehensive Plan process, a land use application was submitted to change the land use designation and extend the PSA to incorporate Deer Lake Estates. The land use application was approved with the 2035 Comprehensive Plan adoption by the Boards of Supervisors. Ms. Sulouff stated that Section 19-59 of the Subdivision Ordinance states that major subdivisions within the PSA must connect to public water and sewer thus this extension of public utilities is necessary to bring the subdivision into conformance with the ordinance. Ms. Sulouff stated that staff finds the proposal to be compatible with the 2035 Comprehensive Plan, the Zoning Ordinance and surrounding development and recommends that the Planning Commission recommend approval to the Board of Supervisors subject to the conditions listed in the staff report.

Ms. Bledsoe opened the floor for questions from the Commission.

Mr. John Wright inquired whether this application was for only 50 lots.

Ms. Sulouff stated that is correct and any change to the number of lots would require amending the SUP through the legislative process.

Ms. Bledsoe asked about Section 5b-3 of the staff report for clarification on why the construction activity was limited to between 7:00am and 5:00pm.

Ms. Sulouff stated that the construction language is standard for work being done in residential areas where there are existing homes.

Ms. Bledsoe opened the public hearing.

Mr. Will Holt of Kaufman and Canoles stated that he represents the applicant. Mr. Holt provided a history of the property regarding the previously approved SUP application and the 2035 Comprehensive Plan process where the change in land use designation and PSA extension were approved. Mr. Will Holt stated that the configuration of the connection has been amended to provide better water flow for present and future James City Service Authority (JCSA) customers in Colonial heritage and Deer Lake Estates.

Ms. Bledsoe opened the floor for questions from the Commission.

Mr. Heath Richardson inquired when the perennial stream study would occur as stated in the conditions.

Mr. Will Holt stated that there had been a study when the first SUP was submitted which would fulfil the requirement.

Mr. Richardson inquired if the previous study would actually fulfill the requirement in the conditions.

Ms. Sulouff stated that it is possible that the previous study would fulfill the requirement, however, it would be evaluated during the administrative plan review stage.

Mr. Will Holt stated that the study would be updated and resubmitted at the Site Plan stage.

Mr. Wright inquired about the Deer Lake dam being under safety review and asked for additional information.

Mr. Will Holt stated that during the annual inspection of the dam some issues were discovered that are part of the normal maintenance of the dam.

Mr. Wright inquired about the oversight agency.

Mr. Will Holt stated that the Virginia Department of Conservation and Recreation was the reviewing agency.

Mr. Tim O'Connor stated that he felt condition No. 1 left wiggle room for a developer to come in and develop an additional 250 lots. Mr. O'Connor asked Mr. Max Hlavin if condition No. 1 caps the development at 50 lots.

Mr. Max Hlavin stated that it does cap the development at 50 lots.

Ms. Bledsoe stated that she did not have any additional questions.

Mr. Will Holt stated that the applicant would be open to visiting the hours of operation condition with staff to remove that restriction as the noise ordinance already restricts the hours of construction.

Ms. Bledsoe asked Mr. Paul Holt to explain why this restriction was being put in place.

Mr. Paul Holt stated that this restriction is typically put in place because the utility lines run past residential homes that are occupied and the restriction on hours would be in place to mitigate the construction impacts on those existing residents. Mr. Paul Holt stated that this situation is a little different because the lots that the construction would be going through have not been platted. Mr. Paul Holt stated that the Commission could recommend a condition be taken out or amended if the Commission would like it changed.

Ms. Bledsoe inquired where the closest residents would be effected.

Mr. Will Holt stated that they are not shown on the map.

Ms. Bledsoe asked the Commission if there was a motion to change the conditions.

Mr. Basic stated that he is okay with keeping the condition.

Mr. O'Connor asked if there was one or two roads into the development.

Mr. Paul Holt stated that there is one road into the development as currently designed, the conditions state that there is a possibility for a second entrance but it must come through the Development Review Committee and Planning Commission for approval.

Ms. Bledsoe asked the Commissioners for any disclosures.

Mr. O'Connor stated that he works for First Service which manages the Colonial Heritage Home Owners Association but he does not oversee or derive benefit from that project so there is no conflict.

Ms. Bledsoe closed the public hearing and asked for any other discussion or a motion.

Mr. O'Connor moved to recommend approval of the application as submitted.

On a roll call vote, the Commission voted to recommend approval of SUP-0003-2015, Colonial Heritage Deer Lake Estates Utility Extension (7-0).

6. PLANNING DIRECTOR'S REPORT

Mr. Holt stated that there was nothing more to add other than what was submitted in the Planning Commission packet.

Ms. Bledsoe inquired about when the Planning Division would hear back about the transportation funding applications.

Mr. Holt stated that it would most likely be after the 1st of the year.

Ms. Bledsoe stated that she would like to recognize the Norge Depot Association and staff for Jamestown Rediscovery project because they were selected by the James City County Historical Commission as the winners of the 2015 Historical Preservation Award.

7. COMMISSION DISCUSSION AND REQUESTS

Ms. Bledsoe stated that she handed out a new Board of Supervisor coverage schedule for the rest of the year.

Mr. O'Connor stated that he wanted to bring up one item that was discussed at the last Development Review Committee meeting concerning the buffer between the Promenade and the neighboring residential neighborhood. Mr. O'Connor commended the applicant for their flexibility in creating a denser buffer area than was proposed previously to enhance the landscaping.

8. ADJOURNMENT

Ms. Bledsoe called for a motion to adjourn.

Mr. Wright moved to adjourn.

The meeting was adjourned at approximately 7:26 p.m.

_____ _____

Robin Bledsoe, Chairwoman Paul D. Holt, III, Secretary

Special Use Permit-0005-2015, Clara Byrd Baker E.S. Parking Addition and Improvements
Staff Report for the November 4, 2015, Planning Commission Public Hearing

This staff report is prepared by the James City County Planning Division to provide information to the Planning Commission and Board of Supervisors to assist them in making a recommendation on this application. It may be useful to members of the general public interested in this application.

PUBLIC HEARINGS	**Building F Board Room; County Government Complex**
Planning Commission:	November 4, 2015, 7:00 p.m.
Board of Supervisors:	December 8, 2015, 7:00 p.m. (tentative)

SUMMARY FACTS

Applicant:	Mr. Paul Tschiderer of AES Consulting Engineers
Land Owner:	Williamsburg-James City County Public schools (WJCC)
Proposal:	A request to allow the construction of additional parking spaces, a reconfiguration of the existing parking area and other minor improvements to the site. If approved, this SUP will also bring the existing school into conformance with the zoning ordinance.
Location:	3131 Ironbound Road
Tax Map/Parcel:	4710100058
Parcel Size:	± 24 acres
Existing Zoning:	PL, Public Lands
Comprehensive Plan:	Federal, State, and County Land
Primary Service Area:	Inside

STAFF RECOMMENDATION

Staff finds the proposed use to be compatible with the surrounding zoning and development and consistent with the 2035 Comprehensive Plan Land Use Map. Staff recommends the Planning Commission recommend approval of this application to the Board of Supervisors with the conditions listed in the staff report. Approval of this SUP application will also bring the existing school use into conformance with the zoning ordinance.

Staff Contact: Jose Ribeiro, Senior Planner II Phone: 253-6890

PROJECT DESCRIPTION

Mr. Paul Tschiderer of AES Consulting Engineers, has applied on behalf of Williamsburg-James City County Schools (WJCC) for a Special Use Permit (SUP) to allow the reconfiguration and expansion of the parking area capacity from 101 to 152 parking spaces (an increase of 51 parking spaces three of which will be ADA accessible spaces), drainage improvements and the construction of an internal sidewalk. According to the applicant, the proposed expansion of the parking lot is not triggered by an increase in traffic; rather, the expansion would better accommodate current parking needs, allowing vehicles parking in areas not improved for parking to park in areas specifically designed for this purpose.

The proposed increase in the number of parking spaces is consistent with WJCC schools plans to increase the availability of parking spaces at school sites to a range of 135 to 150 parking spaces. In 2010, a request to increase the parking spaces at D.J. Montague Elementary School from 87 to 140 parking spaces (SUP-0032-2010) was approved by the Board of Supervisors and in 2012, a request to increase the number of parking spaces at the Toano Middle School from 117 to 147 parking spaces (SUP-0012-2012) was also approved by the Board.

Clara Byrd Baker did not require an SUP when it was opened in 1989; however, the school site was rezoned to Public Land's district in 2007, where schools are a specially permitted use. Though the school is a legally nonconforming use, an SUP is required for any expansion. Approval of this SUP will also bring the existing school use into conformance with the zoning ordinance and permit the referenced improvements to the site.

The property is located at 3131 Ironbound Road and zoned PL, Public Lands, and designated by the 2035 Comprehensive Plan as Federal, State and County Land. Properties to west, east and south of the site are zoned R-8, Rural Residential and to the north, properties are zoned MU, Mixed Use and B-1, General Business. Ironbound Road is designated by the 2035 Comprehensive Plan as a Community Character Corridor and the school is located within the Five Forks Community Character Area.

PUBLIC IMPACTS

Environmental

Watershed: Powhatan Creek

The Engineering and Resource Protection Division (ERP) has reviewed this application and recommends approval. Based on the site's location in the Powhatan Creek watershed, this plan of development is subject to Special Stormwater Criteria (SSC), adopted by the Board of Supervisors on December 14, 2014. During the development plan review process, the applicant will need to provide additional information to demonstrate compliance with SSC regulations.

Public Utilities

The site is located within the Primary Service Area (PSA) and it is served by public water and sewer. The James City Service Authority (JCSA) has reviewed this application and recommends approval. The JCSA has requested that the applicant develop water conservation standards prior to development plan approval (SUP condition No. 2).

Transportation

The Virginia Department of Transportation (VDOT) has reviewed this application and recommends approval. No additional vehicle trips are expected to be generated by the creation of additional parking spaces.

Traffic Counts: The James City County/Williamsburg/York County Comprehensive Transportation Study (Regional Study) that was completed in March 2012 indicated that the most recent weekday volume for Ironbound Road from Jamestown Road to John Tyler Highway was 7,150 trips. This represents a current weekday PM peak hour LOS of A-C for the corridor.

Projected Traffic Volume: On Ironbound Road from Jamestown Road to John Tyler Highway, the 2035 Comprehensive Plan projects 10,982 trips in 2035. This is in the category of acceptable and not anticipated to need improvement. The Regional Study notes that the PM peak hour LOS for the corridor is projected to still be at a LOS of A-C in 2034.

Staff notes that the existing parking lot does not meet all current zoning ordinance requirements. The distances between landscape islands average more than 100 feet apart from each other (the zoning ordinance requires a maximum distance of 90 feet.) Also, some of the landscape islands do not meet the current zoning ordinance regulations for dimensions. The applicant intents to bring the entire parking lot, including landscape islands, into conformance with the zoning ordinance.

Ironbound Road is addressed in both the Regional Bikeways Map and the Pedestrian Accommodations Master Plan. These plans identify the Ironbound Corridor for shoulder bike lanes and a sidewalk on both sides of the street. There is currently a sidewalk along the school's frontage but no bike lanes have been installed in this area. Given the narrowness of this segment of the Ironbound Road Right-of-Way, it may not be feasible to install the recommended bike lane and the applicant has proposed to install a multi-use path across the property. Staff has proposed a condition that will allow the Planning Director flexibility to continue to evaluate the preferred pedestrian accommodations through the site plan phase of the project (SUP condition No. 3). Staff notes that a similar SUP condition regarding pedestrian accommodation was approved for the Williamsburg Unitarian Universalist Expansion (SUP-0017-2014).

COMPREHENSIVE PLAN

The site is designated by the 2035 Comprehensive Plan as Federal, State, and County Land. Land uses in this designation are publicly owned and include County offices and facilities and larger utility sites. Staff finds the proposed improvements to the school's parking area consistent with the Comprehensive Plan as these are accessory to a recommended land use. From a land use perspective, staff finds this project will have no impact on the local road system (no additional traffic generation) or adjacent properties. The new layout of the school's parking lot will increase public safety and add much needed additional parking areas. The proposed multi-use path will also be a benefit for the schools and the community as a whole as it provides for a safer means of alternative transportation.

STAFF RECOMMENDATION

Staff finds the proposed use to be compatible with the surrounding zoning and development and consistent with the 2035 Comprehensive Plan Land Use Map. Staff recommends the Planning Commission recommend approval of this application to the Board of Supervisors with the conditions listed in the staff report. Approval of this SUP application will also bring the existing school use into conformance with the zoning ordinance.

1. **Master Plan**. This special use permit shall be valid for the existing school, construction of additional parking spaces, a reconfiguration of the existing parking and other minor improvements to the site located at 3131 Ironbound Road and further identified as JCC Real Estate Tax Map No. 4710100058 (the "Property"). Development of the site shall occur generally as shown on the exhibit drawn by AES Consulting Engineers, entitled "Clara Byrd Baker Elementary School Parking Improvements W/JCC Public Schools" dated 9/21/2015, with only changes thereto that the Director of Planning determines do not change the basic concept or character of the development.

2. **Water Conservation.** The Williamsburg-James City County School Board shall be responsible for developing and enforcing water conservation standards to be submitted to and approved by the James City Service Authority (the "JCSA") prior to final site plan approval. The standards shall include, but shall not be limited to such water conservation measures as limitations on the installation and use of irrigation systems and irrigation wells, the use of approved landscaping materials including the use of drought resistant native and other adopted low water use landscaping materials and warm season turf where appropriate, and the use of water conserving fixtures and appliances to promote water conservation and minimize the use of public water resources.

3. **Ironbound Road Pedestrian and Bike Improvements.** In accordance with the Regional Bikeways Map and Pedestrian Accommodation Master Plan, a shoulder bike lane and sidewalk shall be provided along the Property's Ironbound Road frontage. However, this requirement may be waived or adjusted by the Director of Planning should the Owner demonstrate that existing pavement width or section, drainage, or other engineering constrains would restrict the ability of the Owner to install the bike lane and sidewalk in a manner that would meet Virginia Department of Transportation ("VDOT") requirements. Such analysis shall be submitted prior to or concurrent with the initial site plan submission and shall address the provision of an alternative bike and pedestrian accommodation, such as an asphalt multi-use path constructed on the property that would serve the community as well, if not better than, a shoulder bike and sidewalk. In the event that the Director of Planning disapproved the waiver, the applicant may appeal the decision to the Development Review Committee, which shall forward a recommendation to the Planning Commission. Pedestrian and bike accommodations shall be installed within 12 months from the date of approval of the site plan for the parking expansion/improvements. Upon written request this construction period may be extended to an additional 12 months by the Director of Planning.

4. **Commencement of Construction.** If construction has not commenced on this project within thirty-six (36) months from the issuance of a special use permit, the special use permit shall become void.

5. **Severance Clause.** This Special Use Permit is not severable. Invalidation of any word, phrase, clause, sentence, or paragraph shall invalidate the remainder.

Jose Ribeiro, Senior Planner, II

ATTACHMENTS:

1. Location map
2. Master Plan

JCC-SUP-0005-2015
Clara Byrd Baker E.S. Parking Addition and Improvements

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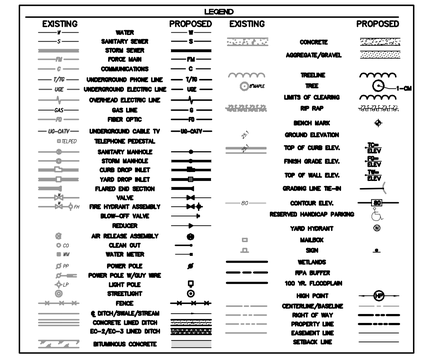
SUP-0005-2015

GENERAL NOTES

1. SITE IS CURRENTLY ZONED PUBLIC LANDS, PL.
2. SITE ADDRESS: 3131 IRONBOUND ROAD WILLIAMSBURG, VA 23185
3. TAX MAP PARCEL #4710100058
4. USE GROUP: E- EDUCATIONAL
   CONSTRUCTION TYPE: II C
5. APPLICANT: WILLIAMSBURG JAMES CITY COUNTY PUBLIC SCHOOLS
   597 JOLLY POND ROAD
   WILLIAMSBURG VA. 23188-7328
   CONTACT: ALAN ROBERTSON
   PHONE: (757) 259-7157
   FAX: (757) 565-1462
5. THE PURPOSE OF THIS SUP IS PROVIDE ADDITIONAL HANDICAP AND PARKING SPACES TO THIS SITE.
6. PROPERTY SHOWN HEREON LIES IN ZONE "X", PER F.I.R.M. MAP NUMBER #51095C0185C, DATED 9/28/07. ZONE X IS DEFINED AS AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.
7. PROJECT LIES WITHIN TIDAL MAINSTREAM OF POWHATAN CREEK WATERSHED, HYDROLOGIC UNIT CODE (HUC) JL31.
8. SITE IS SERVED BY PUBLIC WATER AND SEWER.
9. NO ADDITIONAL WATER OR SEWER CONNECTIONS ARE REQUIRED FOR THIS PROJECT
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING MISS UTILITY (1-800-552-7001) FOR EXISTING UTILITY LOCATIONS AT LEAST 3 WORKING DAYS PRIOR TO COMMENCING CONSTRUCTION AND ALSO HAVE A PRIVATE UTILITY LOCATOR FOR PRIVATE UTILITIES AT SAME TIME FRAME.
11. EXISTING UTILITY LOCATIONS SHOWN ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES.
12. ALL UTILITIES WILL BE PLACED UNDERGROUND.
13. THE OWNER SHALL BE RESPONSIBLE FOR OBTAINING A VSMP AND A LAND DISTURBING PERMIT AND CONTRACTOR THE SILTATION AGREEMENT, WITH SURETY, ALONG WITH ANY OTHER REQUIRED PERMITS FOR THIS PROJECT.
14. ANY UTILITIES NOT LOCATED BY MISS UTILITY OR PRIVATE LOCATOR AND ARE UNCOVERED DURING CONSTRUCTION, CONTRACTOR SHALL NOTIFY OWNER/DEVELOPER'S IMMEDIATELY, SECURE AREA AND AT THE OWNER/DEVELOPER'S EXPENSE REPAIRS ARE TO BE MADE.
15. ON-SITE EXTERIOR CONCRETE IS TO BE A MINIMUM OF 3500 PSI WITH 5% TO 7% AIR ENTRAINMENT.
16. CONTRACTOR IS RESPONSIBLE FOR MAINTENANCE OF ALL SITE IMPROVEMENTS, INCLUDING LANDSCAPING, AS SHOWN ON THE APPROVED PLAN.
17. ALL TRAFFIC CONTROL SIGNS AND MARKINGS TO CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (2003 EDITION).
18. HORIZONTAL DATUM: JAMES CITY COUNTY
    GEODETIC CONTROL NETWORK
    VIRGINIA STATE PLANE COORDINATE
    SYSTEM - SOUTH ZONE
    NAD 83 (1994 VA HARN)
    VERTICAL DATUM: JAMES CITY COUNTY
    GEODETIC CONTROL NETWORK
    NGVD 29
19. ALL NEW SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.

INDEX OF SHEETS

CO-1 MASTER PLAN

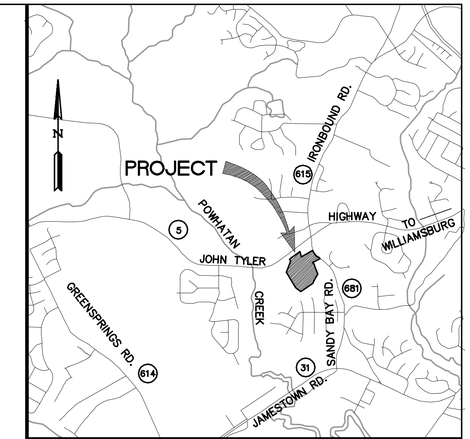


LAND USE SUMMARY TABLE

TOTAL SITE AREA	=	1,028,016 S.F.-	100%	23.6± ACRES
EXISTING BUILDING AREA	=	52,800 S.F.-	5.14%	
EXISTING OTHER IMPERVIOUS AREA	=	117,283 S.F.-	11.40%	
TOTAL EXISTING IMPERVIOUS AREA	=	170,083 S.F.-	16.54%	
EXISTING OPEN SPACE AREA	=	857,933 S.F.-	83.46%	
PROPOSED BUILDING AREA	=	52,800 S.F.-	5.14%	
PROPOSED OTHER IMPERVIOUS AREA	=	130,391 S.F.-	12.68%	
TOTAL PROPOSED IMPERVIOUS AREA	=	183,191 S.F.-	17.82%	
PROPOSED OPEN SPACE AREA	=	844,825 S.F.-	82.18%	
PROPOSED DISTURBED AREA	=	38,405 S.F.±	0.88± ACRES	

PARKING CALCULATIONS

EXISTING PARKING	101/ INCLUDING 3 HANDICAPPED
EXISTING BUS PARKING	15 BUSES
PROPOSED PARKING	152/ INCLUDING 6 HANDICAPPED
PROPOSED BUS PARKING	15 BUSES



VICINITY MAP
SCALE: 1"=2000'

SOIL CHARACTERISTICS

SOIL#	SOIL NAME	HYDROLOGIC GROUP
11C	CRAVEN	C
14B	EMPORIA	C
29B	SLAGLE	C

INFORMATION TAKEN FROM "SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG, VIRGINIA" ISSUED IN APRIL, 1985 BY THE UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE IN COOPERATION WITH VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY.

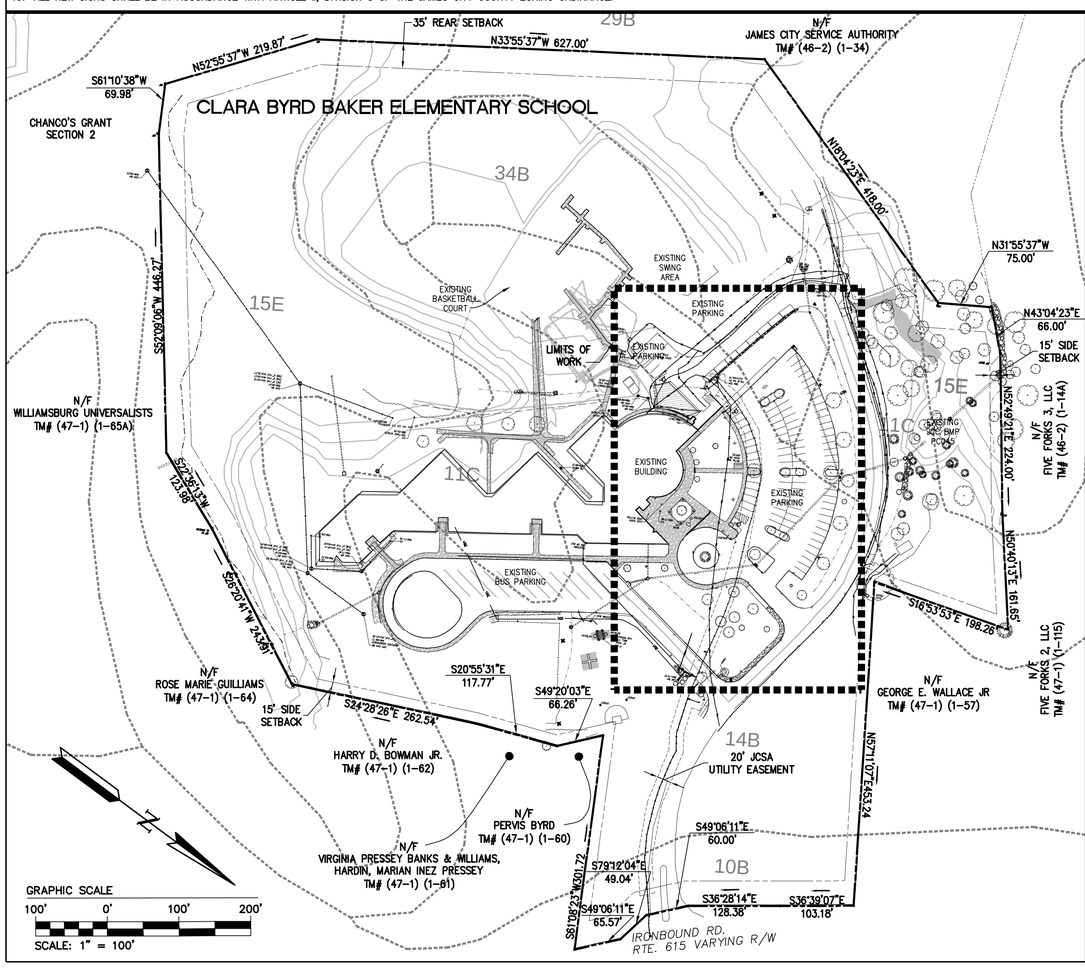
THE MAP SHOWN IS A "BEST FIT MODEL" OF THE SCS MAPS WITH EXISTING BASE INFORMATION.

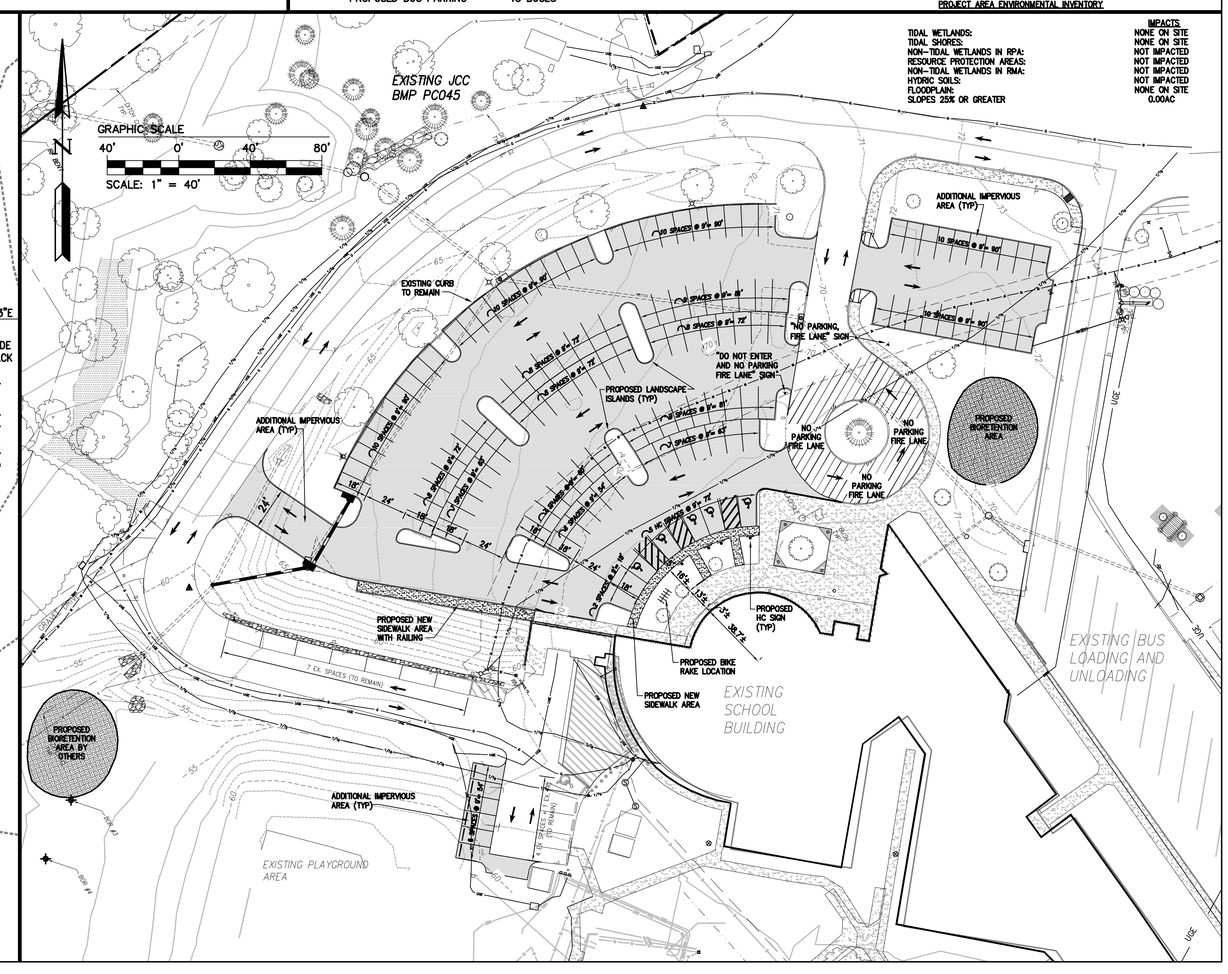
25% SLOPES

PROJECT AREA ENVIRONMENTAL INVENTORY

	IMPACTS
TIDAL WETLANDS:	NONE ON SITE
TIDAL SHORES:	NONE ON SITE
NON-TIDAL WETLANDS IN RPA:	NOT IMPACTED
RESOURCE PROTECTION AREAS:	NOT IMPACTED
NON-TIDAL WETLANDS IN RMA:	NOT IMPACTED
HYDRIC SOILS:	NOT IMPACTED
FLOODPLAIN:	NONE ON SITE
SLOPES 25% OR GREATER	0.00AC

COMMONWEALTH OF VIRGINIA PAUL E. TSCHIDERER Lic. No. 054318 9/21/15 PROFESSIONAL ENGINEER





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Project Contacts:	PET/LBA
Project Number:	W10119-E-52
Scale: AS NOTED	Date: 9/21/15
Sheet Title: MASTER PLAN	
Sheet Number	C-01

MEMORANDUM

DATE: November 4, 2015

TO: The Planning Commission

FROM: Jason Purse, Zoning Administrator

SUBJECT: Adoption of the Mooretown Road Extended Corridor Study Report

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In 2009, the Mooretown Road extension was incorporated into the adopted James City County Comprehensive Plan after analysis revealed that such a road could improve evacuation options during severe weather events and had the potential to alleviate traffic congestion. It was also noted that this road extension could open several large parcels of land to economic development. However, the Comprehensive Plan did not define a specific route for the Mooretown Road extension.

The Mooretown Road extension remained a recommendation of the adopted Comprehensive Plan update, *Toward 2035 Leading the Way*, and was included in a corridor vision section with the following:

> It has been recommended to extend Mooretown Road from its current terminus in York County to Croaker Road or Rochambeau Drive. Development within the vicinity of the proposed Mooretown Road extension should be discouraged until master plans are approved and infrastructure is planned to handle intensive development that does not solely rely on Richmond Road. Private funding is expected, although public and private efforts may be beneficial to fund infrastructure improvements.

In October 2012, the Board of Supervisors appropriated $400,000 in Federal Regional Surface Transportation Program (RSTP) funds to conduct a feasibility study of the potential Mooretown Road Extended Corridor. The RSTP funds are eligible for 100 percent reimbursement to the County by VDOT and require no local match. The study sought to identify a preferred alignment, evaluate potential environmental impacts, estimate construction costs, as well as identify design constraints for multiple development patterns based on land use alternatives. In November 2013, Vanasse Hangen Brustlin (VHB) was chosen as the consultant for the study.

The study began in early 2014 with a data collection phase that has included the following public meetings:

- April 29, 2014. VHB gave a presentation of the current and projected traffic conditions in the study area, a review of the known environmental conditions, current and planned land uses, and an overview of the real estate market. The public was encouraged to provide input on issues and opportunities that should be considered during the development of alternative alignments for the potential roadway.

- October 20, 2014. The consultant team presented information about potential alternative alignments and road features for the Mooretown Road extension, as well as an analysis of future traffic conditions, land use, and real estate market potential for the study area. Attendees had the opportunity to comment on the alternative alignments and road design concepts and the overall project in an interactive work session following the presentation.

- March 21, 2015. Based on public input from the previous two community meetings, as well as technical information gathered in the study area, VHB presented a potential alignment for the Mooretown Road Extension. The community had an opportunity to comment on the alignment and overall project prior to the final study recommendation document.

- Check-ins with the Policy Committee and Board of Supervisors. Staff and the consultant provided updates and opportunities for feedback to the Policy Committee at its meeting in November 2014. Staff and the consultant also provided updates to the Board of Supervisors and Planning Commission at their joint work session in May 2015.

The results of the work from the data collection and public meetings have now been compiled into the Mooretown Road Extended Corridor Study Report, which is attached. The study document includes detailed discussions of existing conditions, traffic forecasts, development of alternatives, as well as recommendations. It should be noted that there are no existing plans to construct any of these potential alignments, and no funding has been identified.

Adoption of this study document does not dictate future decisions about a potential extension of Mooretown Road; however, all of the potential impacts of the various alignments will have already been evaluated should a proposal for the road be submitted in the future. Staff concurs with VHB that Alternative 2 limits the environmental impacts, leaves the most developable area acreage available, and also confines the roadway to those properties that originally "opted-in" to the Economic Opportunity designation area in 2009. Given uncertainty regarding ultimate land use needs surrounding the potential roadway in the future, staff also understands the need to preserve a certain amount of flexibility with respect to final alignment options and believes it's important to keep the pro/con discussion of all three alignments should future conditions dictate the need for a modified design.

Recommendation:
Staff recommends that the Planning Commission recommend that the Board of Supervisors adopt the Mooretown Road Extended Corridor Study Report.

Jason Purse

Attachments
1. Mooretown Road Extended Corridor Study Report (posted on Planning Commission agenda page)
2. Mooretown Road Extended Corridor Study Appendix (posted on Planning Commission agenda page)

Mooretown Road Extension Corridor Study

James City and York Counties, Virginia

PREPARED FOR James City County Virginia Jamestown 1607 York County Virginia America's Finest Since 1691

PREPARED BY vhb

OCTOBER 2015

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1.0 INTRODUCTION

The Mooretown Road Extension Corridor Study was conducted to examine and compare alternative alignments for a potential extension of Mooretown Road (SR 603) from Lightfoot Road (SR 646) to Croaker Road (SR 607). The following report is a summary of the analysis and recommendations prepared as part of the Mooretown Road Corridor Extension Study.

Corridor studies are conducted in Virginia as part of the preliminary planning and engineering process. They allow for early public involvement in the selection of roadway improvements.

1.1 PROJECT PURPOSE AND GOALS

The purpose of the Corridor Study is to identify and evaluate a range of options to address the long-term mobility needs and economic development potential of the parcels in northern James City and York Counties. Both the 2009 and 2035 James City County Comprehensive Plans recommend extending Mooretown Road from its current terminus in York County (at the intersection with Lightfoot Road) to Croaker Road. The extended road will serve two purposes: To alleviate traffic on Richmond Road (US 60) while providing an alternative corridor during emergency situations, and to provide primary access for the Economic Opportunity area situated between the Croaker and Lightfoot I-64 interchanges.

The primary goals of the study are:

- Through professional analysis and public and stakeholder input, determine what context-sensitive design characteristics should be implemented to provide access to the Economic Opportunity properties, provide an alternative route for Richmond Road (US 60), and provide minimal impact to sensitive environmental and rural areas affected by the road extension; and
- Determine the preferred road alignment and costs associated with right-of-way acquisition and construction.

1.2 PROJECT BACKGROUND

Mooretown Road is primarily a two lane road, widening to four lanes approximately 1.3 miles south of its present northern terminus at Lightfoot Road. It extends approximately 4.5 miles through York County from Lightfoot Road to Waller Mill Road, running along the James City and York County boundary line north east of the CSX railway.

In the late 1990's the Virginia Department of Transportation (VDOT) constructed a four lane relocation of Mooretown Road connecting the roadway to an interchange on Humelsine Parkway (SR 199) and terminating at Lightfoot Road. The possible extension of Mooretown Road is discussed in the York County 2005 Comprehensive Plan (and the 2013 Plan update). James City County discussed a potential extension of Mooretown Road during the 2009 update to their

Comprehensive Plan and the concept was ultimately adopted into the plan. The Economic Opportunity overlay district was also established in James City County as part of those actions.

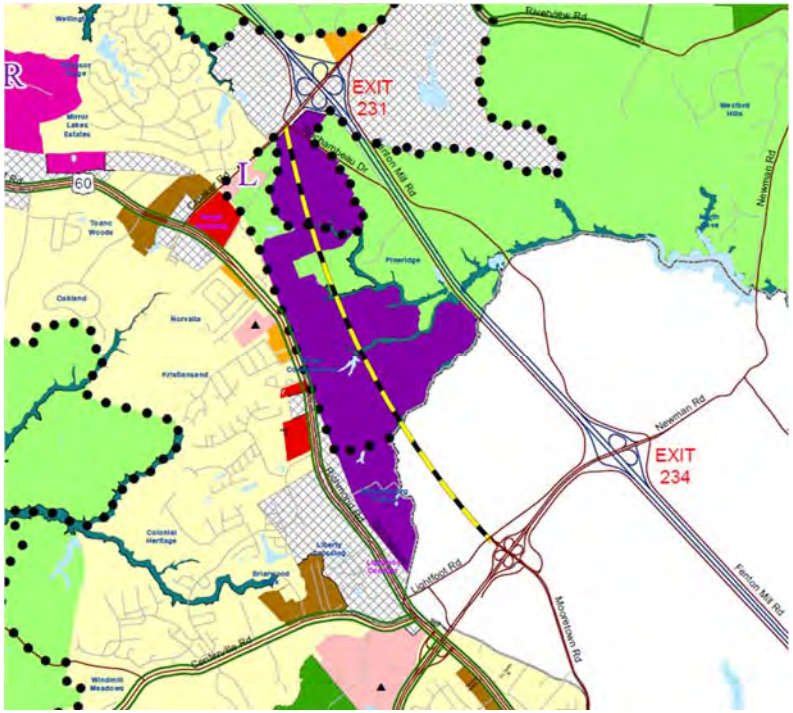
In January 2010, the Hampton Roads Transportation Planning Organization (HRTPO) approved an allocation of Regional Surface Transportation Program (RSTP) funds for this Corridor Study. The Mooretown Road Extension was included as a candidate project for the Hampton Roads Long Range Transportation Plan in May 2010.

While an alignment had not been chosen, a conceptual sketch of the road was included with James City County's 2009 and 2035 Comprehensive Plans with a portion located in York County and a portion in James City County. A similar alignment is shown in the York County 2013 Comprehensive Plan. The potential route as shown in the Comprehensive Plans would impact multiple Chesapeake Bay Resource Protection Areas (RPAs) and steep slopes. Environmental constraints, as well as the concerns of citizens are key factors in determining the recommended alignment of the corridor.

James City County notes in their Comprehensive Plan that private funding of the extension is expected, although public and private efforts may be beneficial to fund infrastructure improvements. Other than funding for this corridor study, no additional funding sources have been identified at this time. The York County Comprehensive Plan's 2035 Roadway Plan map shows the extension of Mooretown Road in York County as a recommended improvement. The Plan states that although not critical to York County in terms of relieving traffic congestion, such a road would provide an alternate route between the Lightfoot and Croaker areas and potentially divert traffic off of Richmond Road. The 2013 York County Comprehensive Plan further notes that the extension could yield economic benefits by improving accessibility to the Williamsburg Pottery property located on both sides of the proposed corridor. Accordingly, the Plan states that any extension of Mooretown Road in York County "should be funded by the property owner or developer and not with scarce public highway funds." Similar to James City County, the ultimate development of the Economic Opportunity areas in York County is envisioned as a mix of office, light industrial, commercial, and tourist related uses. The York County Comprehensive Plan also identifies this area as a potential location for mixed-use development incorporating residential as well as retail and office uses.

While there are some differences in terminology and technical approaches used, the Economic Opportunity portion of this focus area, particularly the Williamsburg Pottery property, is very similar between the two counties. One key item to note is that the comprehensive plans of both counties allow substantial flexibility. In each case, the plans would allow a purely commercial use, such as a light industrial park, but also provide for the possibility of a master-planned mixed use community that includes integrated retail and residential uses. Both counties' comprehensive plans recognize the importance and potential of this area without establishing a specific vision. In accordance with longstanding practice, any large-scale

development on either side of the jurisdictional boundary would include opportunities for the other county to participate by reviewing plans and offering input. Alternatively, any master planning exercise or development project involving property on both sides of the county line would require joint participation and close cooperation on the part of both counties.



Mooretown Road as shown on the James City County Comprehensive Plan

1.3 STUDY AREA

The Study Area for the Mooretown Road Extension Corridor Study is approximately 2,100 acres and is generally bounded by Humelsine Parkway on the southeast, Richmond Road on the southwest, Croaker Road on the northwest and Interstate 64 on the northeast. The study area is outlined on Figure 1.0.

The area is a mix of agricultural, residential, commercial and undeveloped areas. While the area generally appears flat, there are steep slopes associated with multiple streams that pass through the study area and divide the overall area into several sub areas. Within the study area there are approximately 250 parcels that are owned by approximately 210 different property owners. Properties range in size from half-acre residential lots to 420 acre farm tracts.

Beyond the road corridors that bound the study area, there is one road connection through the area, Rochambeau Drive which parallels Interstate 64. In addition there are a number of smaller roads within the study area that provide access to neighborhoods along the edges of the study area or private streets that provide access to individual houses. The infrastructure within the study area is limited with the major utility corridors along or adjacent to Richmond Road and Croaker Road.

Study Area Boundary
Parcels
County Boundary

NORTH
0 2,000 Feet

Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 1.0
Study Area

Surrounding the study area are a number of residential neighborhoods particularly to the west and north. In addition, Richmond Road and Lightfoot Road contain a range of commercial and retail uses. Areas to the northeast across Interstate 64 are generally lower density residential.

1.4 STUDY PREPARATION PROCESS

The Mooretown Road Extension Corridor Study was developed over a 16 month study process that included five major task elements:

- Task 1: Project Initiation and Kick-off, which involved James City County, York County and the Virginia Department of Transportation.
- Task 2: Data Collection and Analysis, which included review of existing data from public sources, on site observations and stakeholder interviews of property owners, businesses and County stakeholders such as emergency services and economic development.
- Task 3: Development of Alternatives, which included identification of multiple potential alignments for the Mooretown Road Extension.
- Task 4: Preparation of Supporting Plan Elements, which involved evaluation of the alignment alternatives, additional analysis of cultural resources and geotechnical conditions, as well as further analysis of land use, traffic and environmental conditions and the development of recommendations.
- Task 5: Development of the Final Report and Technical Materials, which included compiling the technical research materials and public comments into a consolidated study report.

Participants at October 20, 2014 Public Meeting

During the process, the team hosted three (3) public meetings for residents, business owners and other interested stakeholders to review the project information and provide feedback to the County and consultant team. Each of these meetings was attended by 28 to 50 people and provided

valuable feedback to the team regarding citizen concerns and ideas about the corridor. Many of the comments received during these meetings focused around several key themes:

- Opposition to the roadway extension,
- Opportunity for the roadway extension to open up property for future development,
- Concerns about impacts to individual properties
- Concerns about impacts to environmental features, and
- Comments about traffic flow on the future roadway extension or on existing roads such as Rochambeau Drive.

2.0 EXISTING CONDITIONS

This section provides an evaluation of the existing conditions within the study area including:

- Roadways,
- General traffic conditions,
- Accident history,
- Environmental features, and
- Utility Systems.

2.1 EXISTING ROADWAY AND TRAFFIC CONDITIONS

The roadways in the project vicinity are classified by the Virginia Department of Transportation (VDOT) as a mixture of roadway types, ranging from interstate to local roads. Classifications listed in this report reflect the recently released VDOT 2014 Approved Functional Classification.

2.1.1 Existing Roadways

I-64

I-64 is a four lane, divided interstate with completely controlled access and serves as a regional connection between Williamsburg, Norfolk, and Richmond. The posted speed limit along I-64 is 70 mph within the study area.

Humelsine Parkway

Humelsine Parkway (SR 199) is a four lane divided facility with completely controlled access in the study area and has a full cloverleaf interchange with Mooretown Road. The posted speed limit along this roadway is 60 mph within the study area. This roadway provides access to local resources such as the medical center, resort locations, and commercial shopping areas. VDOT has classified Humelsine Parkway under "Other Freeway or Expressway," as it is not an interstate route. On the section through the study area, Humelsine Parkway is designated a limited access facility, and pedestrian and bicycle activity is not permitted.

Richmond Road south of Norge

Richmond Road

Richmond Road (US 60) is designated by the James City County Comprehensive Plan as a "Community Character

Corridor." It is a four-lane roadway, classified by VDOT as an "Other Principal Arterial," running through the communities of Lightfoot and Norge, a "Community Character Area." Through most of the study area it is a divided four-lane roadway with a depressed median, except for the five-lane section through the community of Norge. The posted speed limit along this roadway is 45 mph within the study area. Richmond Road has no dedicated bicycle facilities. There are sidewalks along most of the road through the community of Norge.

Croaker Road

Croaker Road (SR 607) is a three-lane facility that transitions to a four-lane divided facility in the study area. The posted speed limit along this roadway is 55 mph within the study area. This roadway provides a connection between I-64 and Richmond Road, and is classified as a Major Collector. VDOT is currently developing plans to widen Croaker Road to four lanes from Richmond Road to Rochambeau Drive and to add a shared use path along the northern right of way line between Richmond Road and Rose Lane.

Croaker Road at Maxton Lane looking southwest

Lightfoot Road

Lightfoot Road (SR 646) is a two-lane road running from Richmond Road to Rochambeau Drive. From Richmond Road to Mooretown Road, it is classified as a Major Collector; from Mooretown Road to Rochambeau Drive, it is classified as a Local Road. The posted speed limit along this roadway is 45 mph within the study area. Prior to the construction of Humelsine Parkway, Lightfoot Road provided access to I-64. Mooretown Road presently ends at Lightfoot Road, which has no dedicated pedestrian or bicycle facilities.

Lightfoot Road east of Richmond Road

Rochambeau Drive

Rochambeau Drive (SR 30, SR 755, and FR-137) is a two lane road running along I-64 through most of the study area. The section northwest of Croaker Road, listed as SR 30, is posted with a 55 mph speed limit. The section between Croaker Road and north of Skimino Creek (SR 755) has a posted speed limit of 45 mph. The section in York County between Skimino Creek and Lightfoot Road (FR-137) has a posted speed limit of 55 mph. The section of Rochambeau Drive through the study area is classified as a Local Road; the section north of the study area is classified as a Major Collector. Rochambeau Drive has no dedicated pedestrian or bicycle facilities.

Rochambeau Drive south of Croaker Road

2.1.2 Existing (2014) Traffic Conditions

A traffic capacity analysis was performed on the study area roadways and intersections to determine the current level of congestion on the network roadways and to establish a baseline for evaluating the impacts of the proposed extension on those same roadways. The roadways and intersections included in the operation analysis are:

Roadways

- Croaker Road (SR 607), northeast of Richmond Road (US 60)
- Richmond Road (US 60), southeast of Croaker Road (SR 607)
- Lightfoot Road (SR 646), northeast of Richmond Road (US 60)
- Mooretown Road (SR 603), southeast of Lightfoot Road (SR 646)

Intersections

- Croaker Road (SR 607) at I-64 Westbound Ramps – Unsignalized Intersection
- Croaker Road (SR 607) at I-64 Eastbound Ramps – Unsignalized Intersection
- Croaker Road (SR 607) at Rochambeau Drive (SR 30/SR 755) – Signalized Intersection
- Croaker Road (SR 607) at Point O Woods/Maxton Lane (SR 758) – Unsignalized Intersection

- Richmond Road (US 60) at Croaker Road (SR 607) – Signalized Intersection
- Richmond Road (US 60) at Lightfoot Road (SR 646) – Signalized Intersection
- Lightfoot Road (SR 646) at Mooretown Road (SR 603) – Signalized Intersection
- Mooretown Road (SR 603) at Humelsine Parkway (SR 199) Southbound Ramps – Unsignalized Intersection
- Mooretown Road (SR 603) at Humelsine Parkway (SR 199) Northbound Ramps – Unsignalized Intersection.

Croaker Road at Richmond Road

James City County, York County, and VDOT provided available counts and traffic impact studies which included traffic counts for intersections around the study area. Volumes were balanced between closely spaced ramps and intersections by summing the total difference in each direction along each corridor, and adjusting the through or turn volumes to reduce discrepancies between the intersections. Counts were projected to 2014 conditions using model growth rates or existing forecasts. The specific source and forecasting method applied to each intersection are summarized in Table A-1 included in Appendix A. The exiting (2014) lane configurations and traffic control (Figure A-1) and the AM and PM peak hour turning movement counts (Figure A-2) are included in Appendix A as well. The estimated daily volumes for the corridors are mapped on Figure 2.1.

The AM and PM peak period operating conditions of the study area roadways and intersections were analyzed to determine average traffic delays, traffic densities, and other characteristics used in determining the operating level of service (LOS). LOS is a qualitative measurement of traffic operations. For intersections and ramps it is a measure of delay time; on connecting roadway sections, it is determined by the density of vehicles or the time spent following another vehicle. The Transportation Research Board's *Highway Capacity Manual (HCM)* defines six levels of service for intersections with LOS "A" representing operating conditions with minimal constraints on traffic movements and LOS "F" representing extremely congested operating conditions.

Study Area Boundary
Parcels
County Boundary

LOS*	Signalized	Unsignalized	Segment
A/B			ADT
C/D			ADT
E/F			ADT

*Worst peak level of service

NORTH

0 2,000 Feet

Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 2.1
Existing (2014) Traffic Conditions

AM and PM peak period operating conditions at signalized and unsignalized intersections were analyzed using an intersection capacity analysis software called *Synchro* to determine average delays and LOS for each approach and the overall intersection. The *Highway Capacity Software (HCS)* was used to analyze the interchange ramps and the roadway links between intersections. Detailed traffic analysis results are available in the Appendix A.

According to the existing 2014 conditions analysis:

- All network intersections are currently operating at overall acceptable levels of service during typical peak travel periods (AM and PM).
- The analyzed corridor segments are operating acceptably with the exception of Croaker Road north of Richmond Road, which is operating at LOS E in the PM peak hour.
- Operations at the interchange ramps between I-64 and Croaker Road as well as Humelsine Parkway and Mooretown Road are all operating acceptably during the peak hours under current travel conditions.

The existing (2014) analysis results are summarized in the following tables. Table 2.1.2-1 lists the average delay and LOS for intersections in the study area under AM and PM peak period traffic volumes. Table 2.1.2-2 lists the LOS and traffic density on the multilane road segments around the study area. Table 2.1.2-3 and Table 2.1.2-4 present the level of service and percent of time spent following on Croaker Road, a Class I Two-Lane Segment and Lightfoot Road, a Class II Two-Lane Segment. The Class I and Class II designations are based on the descriptions in the *Highway Capacity Manual*, the document which outlines the analysis procedures used in *HCS*. Class I Two Lane Segments operate at high speeds. Class II Two Lane Segments include local roads and operate at lower speeds.

Table 2.1.2-5 lists the average delay and level of service of the ramps within the Croaker Road/I-64 interchange (Exit 231) and the Mooretown Road/Humelsine Parkway interchange. The worst case peak hour LOS values for the intersections and segments studied are mapped on Figure 2.1 as well.

Table 2.1.2-1
Existing (2014) Conditions – Intersections

	Intersection		Eastbound		Westbound		Northbound		Southbound		Worst Approach		
	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Approach	LOS[1]	Overall
AM													
Croaker Road & Rochambeau Drive	34.9	C	44.1	D	35.3	C	34.1	C	26.7	C	Eastbound	D	C (EB-D)
Croaker Road & Point O Woods	2.1	A	13.6	B	10.8	B	-	-	-	-	Eastbound	B	(EB-B)
Croaker Road & Richmond Road	50.9	D	82.1	F	24.3	C	20.3	C	27.0	C	Eastbound	F	D (EB-F)
Richmond Road & Lightfoot Road	21.8	C	19.6	B	19.0	B	18.8	B	35.0	D	Southbound	D	C (SB-D)
Lightfoot Road & Mooretown Road	21.2	C	18.7	B	25.2	C	8.6	A	30.2	C	Southbound	C	C (SB-C)
PM													
Croaker Road & Rochambeau Drive	31.6	C	45.9	D	44.5	D	24.5	C	23.1	C	Eastbound	D	C (EB-D)
Croaker Road & Point O Woods	1.5	A	12.8	B	11.4	B	-	-	-	-	Eastbound	B	(EB-B)
Croaker Road & Richmond Road	42.5	D	45.0	D	42.7	D	28.6	C	42.6	D	Eastbound	D	D (EB-D)
Richmond Road & Lightfoot Road	26.5	C	24.7	C	25.1	C	23.3	C	34.4	C	Southbound	C	C (SB-C)
Lightfoot Road & Mooretown Road	21.7	C	23.7	C	19.4	B	15.7	B	37.4	D	Southbound	D	C (SB-D)

[1]*LOS – Level of Service*

Table 2.1.2-2
Existing (2014) Conditions - Multilane Segments

		AM Peak				PM Peak			
		Eastbound/ Northbound		Westbound/ Southbound		Eastbound/ Northbound		Westbound/ Southbound	
Roadway	Location	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)
Mooretown Road	Between Lightfoot Road and Humelsine Parkway	A	5.7	A	3.8	A	6.2	A	8.0
Richmond Road	Between Croaker Road and Popular Creek	A	10.2	A	8.6	A	10.9	B	12.2
Croaker Road	Between Rochambeau Drive and I-64	A	6.6	A	5.8	A	5.0	A	6.4

[1]*LOS – Level of Service*

Table 2.1.2-3
Existing (2014) Conditions - Two-Lane Segment Analysis (Class I)

		AM Peak			PM Peak		
Two-Lane Highway	Location	Segment LOS[1]	PTSF[2] (%)	ATS[3] (mph)	Segment LOS[1]	PTSF[2] (%)	ATS[3] (mph)
Croaker Road	Between Richmond Road and Rochambeau Drive	D	71.3	40.8	E	71.2	39.8

[1]*LOS – Level of Service*

[2]*PTSF – Percent Time Spent Following*

[3]*ATS – Average Travel Speed*

Table 2.1.2-4
Existing (2014) Conditions - Two-Lane Segment Analysis (Class II)

		AM Peak		PM Peak	
Two-Lane Highway	Location	Segment LOS[1]	PTSF[2] (%)	Segment LOS[1]	PTSF[2] (%)
Lightfoot Road	Between Richmond Road and Mooretown Road	C	64.9	D	70.3

[1]*LOS – Level of Service*

[2]*PTSF – Percent Time Spent Following*

Table 2.1.2-5
Existing (2014) Conditions - Ramps

	Intersection		Eastbound		Westbound		Northbound		Southbound		Worst		
	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Approach	LOS[1]	Overall
AM													
Croaker Road & I-64 Westbound Ramps	4.4	A	11.3	B	8.9	A	-	-	-	-	Eastbound	B	(EB-B)
Croaker Road & I-64 Eastbound Ramps	0.7	A	10.2	B	9.0	A	-	-	-	-	Eastbound	B	(EB-B)
Mooretown Road & SR 199 Southbound Ramps	7.6	A	-	-	-	-	21.4	C	10.0	A	Northbound	C	(NB-C)
Mooretown Road & SR 199 Northbound Ramps	7.1	A	-	-	-	-	34.7	D	9.7	A	Northbound	D	(NB-C)
PM													
Croaker Road & I-64 Westbound Ramps	6.1	A	12.7	B	9.6	A	-	-	-	-	Eastbound	B	(EB-B)
Croaker Road & I-64 Eastbound Ramps	0.8	A	10.9	B	9.2	A	-	-	-	-	Eastbound	B	(EB-B)
Mooretown Road & SR 199 Southbound Ramps	2.9	A	-	-	-		14.8	B	11.4	B	Northbound	B	(NB-B)
Mooretown Road & SR 199 Northbound Ramps	5.4	A	-	-	-		28.0	D	14.0	B	Northbound	D	(NB-D)

[1]*LOS – Level of Service*

[2]*PTSF – Percent Time Spent Following*

[3]*ATS – Average Travel Speed*

2.1.3 Other Transportation Features

In addition to the roadway network described above, the study area contains a major railroad, supports two local bus routes, and is adjacent to a VDOT Park and Ride commuter parking lot.

2.1.3.1 CSX Railroad

Railroad crossing on Lightfoot Road

The CSX railroad line runs through the study area near Richmond Road. It carries both freight and Amtrak traffic between Newport News and Richmond. The crossings at Croaker Road and Humelsine Parkway are grade separated. There are four minor at-grade crossings in the study area providing access to part of the Williamsburg Pottery, Hill Pleasant Farm, the parcel northeast of Hill Pleasant Farm, and Peach Street properties. There are also gated crossings on the main roadway through the Williamsburg Pottery property and at Lightfoot Road. There are two tracks through most of the study area. The railroad right-of-way width varies from 80 to 200 feet.

2.1.3.2 Bus Routes

The Williamsburg Area Transit Authority operates the area's public transportation system. Currently there are two bus routes which overlap in the southern portion of the study area, the Blue Line and Purple Line 2. Transfers can be made between these lines at the Walmart, just south of the study area. Riders can also transfer at this point to the Tan line which serves existing Mooretown Road.[1] Route modifications could be requested if development progresses within the study area.

2.1.3.3 Commuter Parking

VDOT provides a Park and Ride lot for commuters located north of the intersection of Croaker Road and Rochambeau Drive, near the Croaker Road interchange of I-64.

2.2 ACCIDENT ANALYSIS

The accident analysis was derived from three years of available collision data obtained from VDOT. The data covered the period from January 1, 2009 to December 31, 2012. The summary includes collisions that were reported along Richmond Road, Mooretown Road, Croaker Road and Lightfoot Road within the project study area.

The highest-frequency collision type in the study area was rear-end collisions, which constituted 39% of the overall

collisions during the study period; angle, ran off road, and sideswipe collisions were also common, composing 31%, 11%, and 7% of the total collisions in the area, respectively. Rear-end collisions generally indicate overall congestion issues, as these types of collisions occur mainly in areas where there is frequent "stop and go" traffic or at traffic signals where vehicles may stop suddenly to avoid running a red light. Angle collisions often indicate the need for more controlled access to side streets, thereby localizing the turning movements and making them more predictable to on-coming traffic. Table 2.2-1 summarizes the total number of crashes by type and segment; Table 2.2-2 summarizes the severity of accidents within the study area.

During the three years studied, there were no fatalities along these roadways; there was one pedestrian injury accident along Richmond Road.

2.3 ENVIRONMENTAL FEATURES

There are a number of notable environmental features within the study area, both natural and cultural. The following are descriptions of the existing environmental features that are found within the study area.

2.3.1 Streams, Wetlands and Floodplains

There are numerous hydraulic features in the study area including wetland areas, streams, and open water features. There are three main stream channels flowing through the study area with a number of tributaries and minor streams feeding into these, ultimately flowing toward the York River approximately four miles north of the project. The impacted stream channels were classified as Stage 1 – Stable stream reaches per the Channel Evolution Model (CEM). The streams are contained in confined valleys mostly made up of sandy loam. The streams have down cut in the sandy valley but have reached equilibrium through natural geomorphic processes.

Stream between Maxton Lane and Peach Street

Since some of these streams are deep ravines, bridging may be required to reduce environmental impacts. Skimino Creek is the dominant hydrologic feature in the study area, receiving flow from multiple headwater drainage ways in James City and York County portions of the study corridor.

Table 2.2-1
Crash Types and Totals by Segment (2009-2012)

Segment Name	From	To	Length (mile)	Rear End	Angle	Ran Off Road	Side-swipe	Other	Total
Richmond Rd (US 60)	Croaker Rd (SR 607)	Humelsine Pkwy (SR 199)	3.1	24	16	7	3	8	58
Mooretown Rd (SR 603)	Lightfoot Rd (SR 646)	E Rochambeau Drive	0.3	4	2	1	1	1	9
Croaker Rd (SR 607)	Richmond Rd (US 60)	I-64	1.2	3	3	1	1	1	9
Lightfoot Rd (SR 646)	Richmond Rd (US 60)	Mooretown Rd (SR 603)	0.67	2	5	0	1	0	8
			Total	33	26	9	6	10	84
			Percentage	39%	31%	11%	7%	12%	100%

Table 2.2-2
Crash Severity and Totals by Segment (2009-2012)

Segment Name	From	To	Length (mile)	Fatal	Injury	PDO	Total
Richmond Rd (US 60)	Croaker Rd (SR 607)	Humelsine Pkwy (SR 199)	3.1	0	30	28	58
Mooretown Rd (SR 603)	Lightfoot Rd (SR 646)	E Rochambeau Drive	0.3	0	6	3	9
Croaker Rd (SR 607)	Richmond Rd (US 60)	I-64	1.2	0	4	5	9
Lightfoot Rd (SR 646)	Richmond Rd (US 60)	Mooretown Rd (SR 603)	0.67	0	1	7	8
			Total	0	41	43	84
			Percentage	0%	49%	51%	100%

The dominant Waters of the United States (WOUS) resource type is freshwater forested wetlands [classified by Cowardin et al. 1979 as Palustrine Forested (PFO) systems]. These PFO wetlands exist in most drainage ways within the study area, and usually include jurisdictional stream channels internal to the wetland boundary. Other stream channels in the upper headwaters, near the transition to non-wetland communities, often flow perennially and can have narrow riparian wetlands along the top of bank. These resources are regulated by the U.S. Army Corps of Engineers (USACE) and Virginia Department of Environmental Quality (VADEQ) and would require permits (i.e., Clean Water Act compliance) if impacts resulting from land disturbance activities are proposed.

Under the Chesapeake Bay Act, each of these perennial streams and its associated wetland areas is protected by a 100 foot Resource Protection Area (RPA) buffer. Each of the Counties has additional regulations limiting development in the RPA and on the steep slopes of the ravines. FEMA identifies the bottom of these ravines as part of the 100-year and 500-year floodplains. However, local RPA and wetlands permitting requirements govern construction in these areas, discouraging construction of residences or commercial buildings in these floodplains.

2.3.2 Rare, Threatened, and Endangered Species

The project study area contains habitat for three rare, threatened, or endangered (RTE) species: Mabee's salamander (*Ambystoma mabeei*), small whorled pogonia (*Isotria medeoloides*), and northern long-eared bat *(Myotis septentrionalis).* Mabee's salamander is a state-threatened animal that breeds in fish-free vernal pools and is regulated by the Virginia Department of Game and Inland Fisheries (VDGIF). Small whorled pogonia is a federally-threatened plant that inhabits certain forested upland habitats of a particular composition and maturity and is regulated by the U.S. Fish and Wildlife Service (USFWS). Northern long-eared bats are a federally threatened species which inhabit forested areas during summer months while rearing pups.

Pond along Rochambeau Drive

Alternatives that cross potential habitat for any of these protected species will likely require site-specific habitat assessments, as well as detailed ground surveys at the time of permitting. Further, it is important to note that natural resources agencies regularly update their databases of known RTE species occurrences. Therefore, appropriate coordination with these agencies as the project progresses to obtain the most recent data available is recommended. As mentioned above, these resources are regulated by either VDGIF or USFWS and coordination would be expected to occur during any future federal environmental permit review process for land disturbance activities within the study corridor.

The streams, wetlands, RPAs, and potential small whorled pagonia and Mabee's salamander habitats are noted on the Environmental Features Map, Figure 2.2.

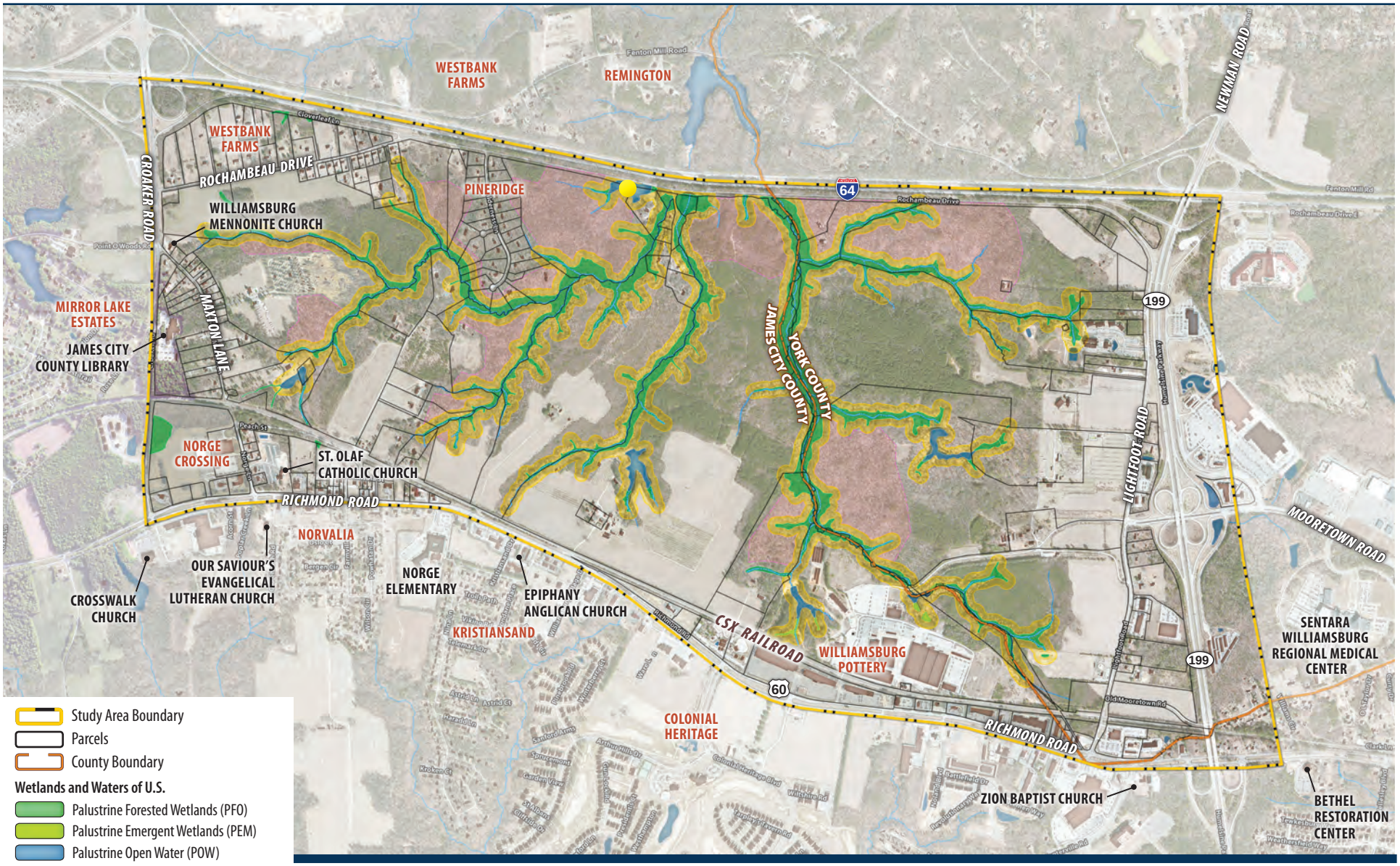
2.3.3 Soils Conditions

The Corridor Study included review of the USGS and USDA Soil Surveys, and the area topography. The alternatives were reviewed in the field to provide an overview of soil conditions in the study area. As part of this review, soils and substructure engineering considerations to be evaluated during the design of the Mooretown Road Extension are presented below. Soils in the area are anticipated to be similar to other areas in northern James City and York Counties.

Ravine bottoms are expected to have deep organic layers over clays and silt deposits. Construction specifications for fills over these ravines typically include provisions for settlement monitoring. Culverts would likely require 2 to 3 feet of bedding material. The maximum recommended unreinforced fill slope is 3:1 (horizontal: vertical). Steeper slopes could be designed using geogrids or other reinforcing material, allowing for smaller fill foot prints and reduced wetlands impacts

The largest ravine crossing is over Skimino Creek. Due to the magnitude of this ravine, this crossing will likely require the installation of a bridge structure. Typically, the bridge structure will consist of structural steel with a concrete deck supported on concrete bents and abutments. The substructures (bents and abutments) will need to be supported by a deep foundation system. In this region, the most economical deep foundation system would consist of concrete piles. These usually will consist of square pre-cast pre-stressed concrete piles with a width of 12 to 14 inches. Similar projects in the region have required a minimum pile embedment below grades of about 70 to 90 feet. Pile lengths and size will be dependent on actual soil conditions and structural loading. Other alternatives of piles that could be considered are augercast piles or steel H-piles.

Soils in the upland areas are expected to be silty sands or sandy silt with ground water depths in excess of 10 feet below existing grade. According to the USDA Soil Survey, much of the upland property is expected to have infiltration rates greater than 0.5 inches per hour, suitable for infiltration based stormwater management systems.



Study Area Boundary
Parcels
County Boundary

Wetlands and Waters of U.S.

Palustrine Forested Wetlands (PFO)
Palustrine Emergent Wetlands (PEM)
Palustrine Open Water (POW)
Streams Channels (within Study Area)
Resource Protection Areas (RPA)

Threatened & Endangered Species

Potential Mabee's Salamander Habitat
Potential Small Whorled Pogonia Habitat

NORTH

0 2,000 Feet

Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 2.2
Environmental Features Map

2.3.4 Hazardous Materials

Research on specific hazardous materials sites within the study area was not part of the scope of this study. With the history of agricultural and manufacturing activities in the study area, the presence of such cannot be ruled out. Current registry research and site testing will be required during further detailed studies and the permitting process.

Norge Depot

2.3.5 Historic Resources

The Williamsburg region is rich with historic resources. Within the study area, there are no properties or structures listed on or determined eligible for the National Register of Historic Places (NRHP) that would be potentially impacted by the proposed project. However, there are several historic features in the area that could warrant further research.

Research into known historic and other cultural resources was completed for the study area. Historic resources research included archival searches using the Virginia Department of Historic Resources (VDHR) online system, which included findings from county wide architectural resource surveys conducted in James City County. The most significant architectural sites noted in this research are described here. Their locations do not appear to present any concern for the evaluated project alternatives.

In the western portion of the study area, near Croaker Road, there are three notable resources, two nineteenth and one early twentieth century residences associated with the Williamsburg Mennonite Church property. Research indicates that no formal determinations of eligibility have been made for any of these three resources; however, all considered alternatives clearly avoid direct impact to these resources.

In the eastern portion of the study area, the Levorsen House and Plantation is located along Williamsburg Pottery Road and includes a former house, barns, corn crib, sheds, a post office and blacksmith shop. A 2000 survey, however, determined that this property and associated structures was not eligible for the NRHP.

Williamsburg Mennonite Church and Lutheran Grave Yard

Hill Pleasant Farm is located in the southern part of the study area, along Richmond Road. This property was surveyed in 2000 and 2007, with no formal determination of eligibility for the NRHP being returned either time.

Archival research of potential archaeological sites and a review other archaeological sites near the study area indicate potential for previously undocumented sites. Maps of the area drawn during the Civil War era show the project area primarily wooded with minor development along Old Stage Road (now Richmond Road).

The project corridor has the environmental conditions and physiographic settings that may contain both Native American and historic archaeological resources. An analysis of Native American sites within two miles of the project corridor reveals that the majority of the sites are located along the inland streams. Given the project corridor's close proximity to streams and the fact that all of the previously identified sites for which there is soil information fall within at least one or more of the project corridor soils, the possibility of finding Native American and historic resources would be considered moderate to high. It is possible that a Native American site, most likely a lithic scatter, could be found within the undeveloped areas of the project corridor. Phase I research will most likely be required for these areas if the Mooretown Road Extension continues to the permitting stage.

Hill Pleasant Farm

While none of the architectural resources identified in the study area are currently listed on or eligible for the NRHP, this status could change. Since the undeveloped areas of the study area have not been subject to detailed archaeological surveys, and the site topography is similar to other areas in which Native American sites have been found, it is possible that additional historic resources may exist in the study area. Therefore it would be prudent to perform additional historic and archaeological surveys for the study area during the preliminary plan development stage of the project and coordinate with the Virginia Department of Historic Resources to ensure no adverse impacts are imposed on historic resources due to the project.

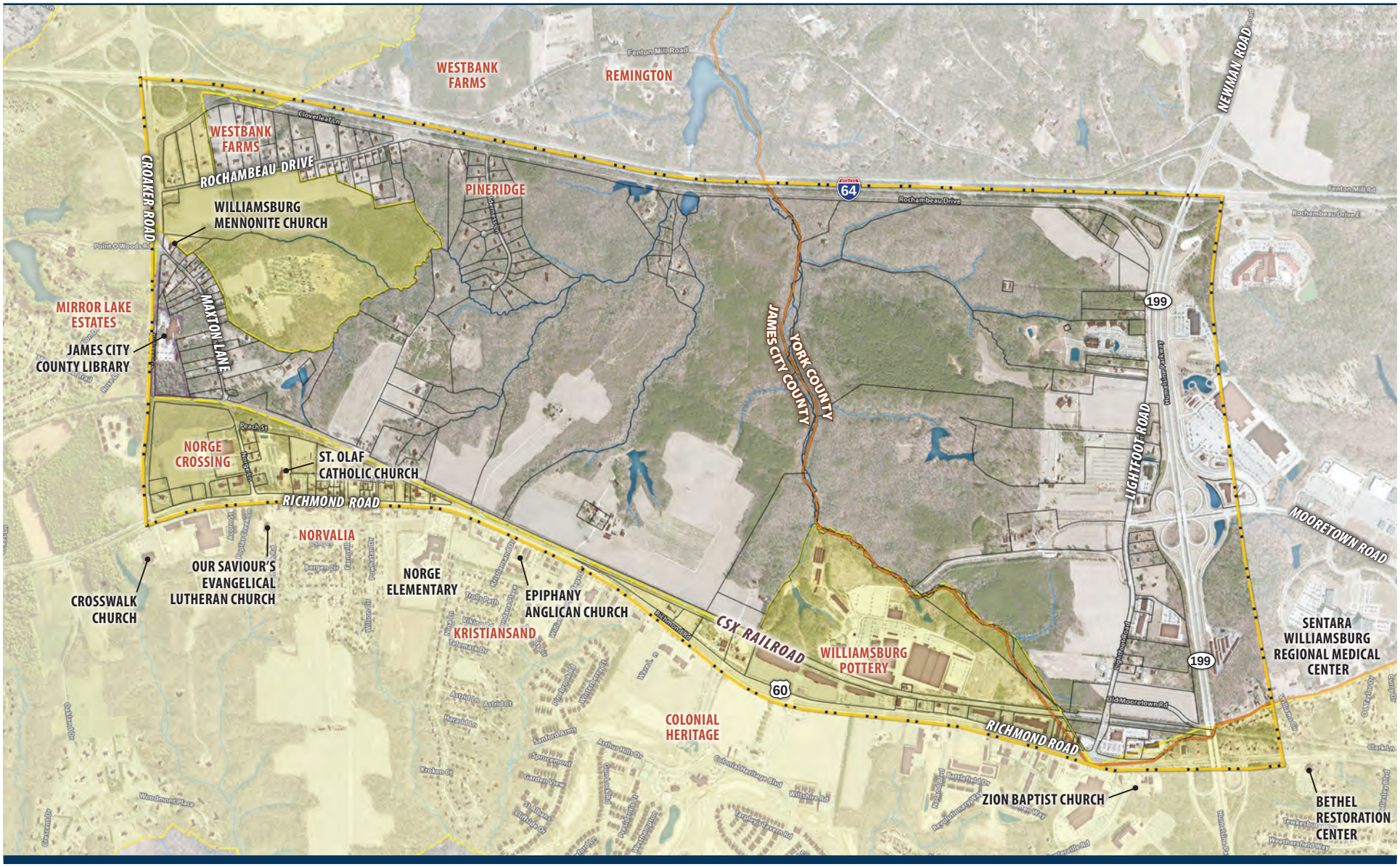
The full cultural resources report can be found in Appendix C.

2.4 UTILITIES

James City County and York County maintain separate publically owned, water distribution and sanitary sewage collection systems. Sanitary sewage treatment is provided regionally by the Hampton Roads Sanitation District. Private utility companies provide natural gas, telephone, electricity, cable television, and internet communication service.

York County has constructed wells and water mains in anticipation of future development in the York County portion of the study area. These water mains and sewer collection systems would need to be extended into the undeveloped property, most likely by the developers.

James City County maintains water mains along Richmond Road, Croaker Road and part of Rochambeau Drive through the James City Service Authority. Properties along Richmond Road and north of Croaker Road are served by public sanitary sewers, while properties within the study area are primarily served by private wells and septic systems. The James City County Zoning Ordinance prohibits the by-right expansion of public utilities into most of the study area as it is currently outside of the Primary Service Area or PSA. The intent is to include parcels within the EO designation in the PSA (where not already included) pending the outcome of master planning efforts for the EO area. The PSA is shown on Figure 2.3.



Study Area Boundary
Parcels
County Boundary
James City County Primary Service Area

NORTH

0 2,000 Feet

Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 2.3
Primary Service Area

3.0 LAND USE

The existing land uses within the study area include private, public, institutional, and transportation uses. This evaluation includes the area generally bounded by I-64 on the east, Humelsine Parkway on the south, Richmond Road on the west, and Croaker Road on the north to provide an understanding and setting for the proposed corridor extension.

Richmond Road, Humelsine Parkway, and Mooretown Road are key features that have influenced the larger area land use with many major developments including residential communities, retail / commercial centers, and institutional users such as hospitals located along these corridors. In addition, the environmental features within the study area constitute larger areas of open space extending organically throughout the study area. Both of these patterns are represented within the study area and described in the following section.

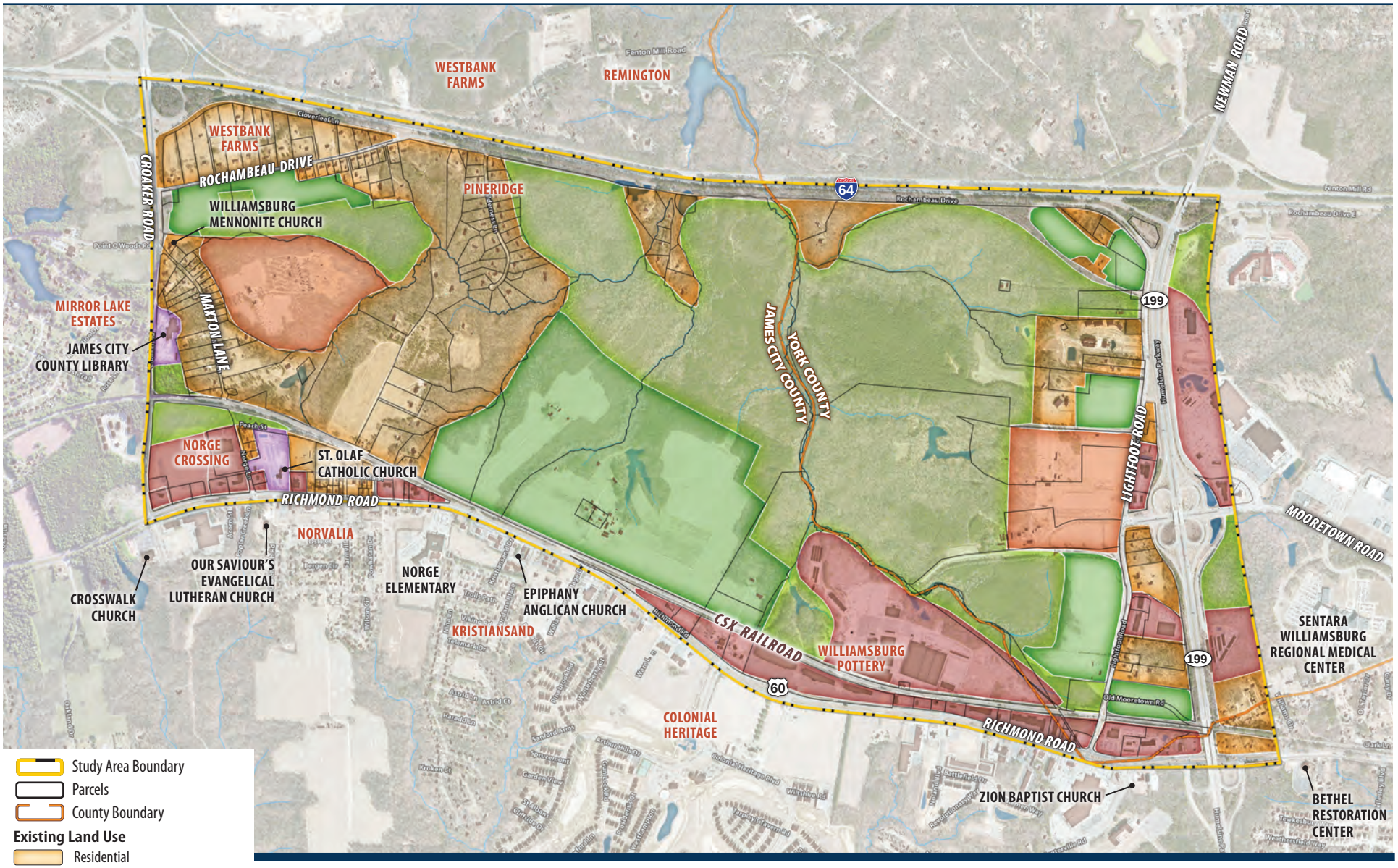
3.1 EXISTING LAND USE

The 2,100 acre study area includes approximately 800 acres within York County and 1,300 acres within James City County. The existing land uses within the study area include a wide range from residential, to commercial / retail, to institutional, to campground to open space and farming. Figure 3.1 provides a summary map illustrating the location of each of the existing land uses with this study area.

The general pattern is described as follows:

- Along the southern portion of the study area the Richmond Road corridor includes many commercial, retail and residential areas. These include larger commercial/retail uses such as the Williamsburg Pottery and strip shopping centers as well as smaller, individual uses such as gas stations, small professional offices and a car wash.
- The community of Norge, on the western edge of the study area, is designated in the James City County Comprehensive Plan as a Community Character Area. It contains several late nineteenth and early twentieth century buildings.

Norge Storefront



Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 3.1
Existing Land Use

- Croaker Road is generally characterized by lower density uses such as single family residential, open space, and institutional uses. The institutional uses include a church and a county library. There are some retail / commercial uses at the intersection of Croaker and Richmond Road.
- East Rochambeau Drive, southeast of Humelsine Parkway, includes both some larger scale uses such as a shopping center, hotel and self-storage as well as smaller scale retail and single family residential.
- Rochambeau Drive between Croaker Road and Lightfoot Road is characterized by single family housing both fronting on Rochambeau as well as along Wilderness Lane.
- Between Humelsine Parkway and the border of York and James City County, the existing land use is mainly open space which is characterized by wooded areas. There is also an existing campground in this area, some support functions for the Williamsburg Pottery, and a timeshare resort.
- The area north of the York / James City County border includes a larger area in the center of the study area that is farm and open space area. The areas further north include residential uses, a campground and some open space.

American Heritage RV Park, Maxton Lane

- In addition to the major roads forming boundaries of the study area, the CSX Railroad is also a major dividing line due to limited opportunities for crossing the line. The railroad line also creates a northern edge to the commercial, retail uses along Richmond Road.

The following table provides a summary of the existing land use acreages within the study area.

Table 3.1-1
Existing Land Use

	JCC	York County
Campground	71 ac	66 ac
Church/Library/School/ Hospital	16 ac	0 ac
Farm	297 ac	83 ac
Open Space	342 ac	458 ac
Residential	404 ac	106 ac
Retail	171 ac	88 ac
Subtotal by County	1300 ac	800 ac
	Total	2100 ac

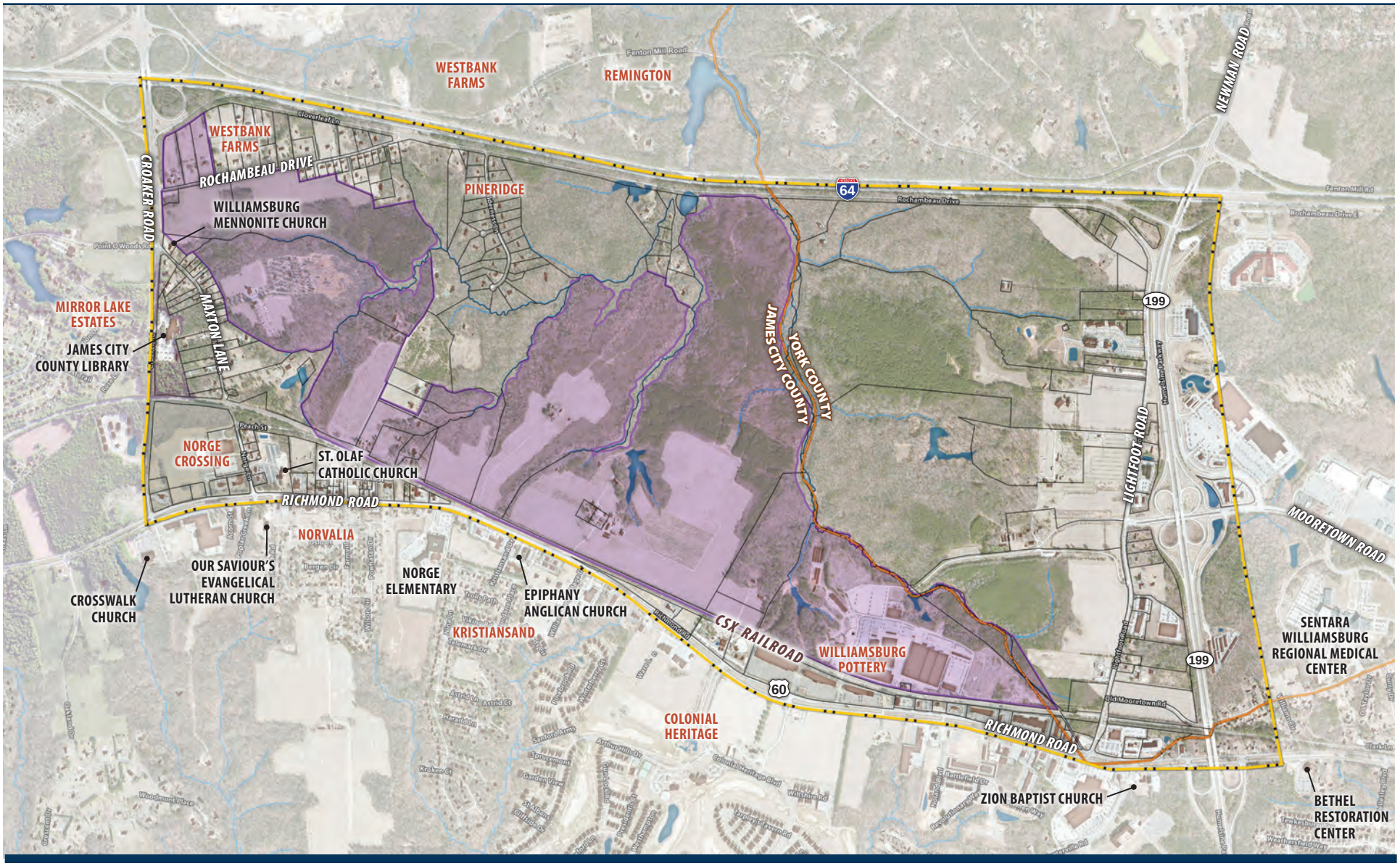
3.2 FUTURE LAND USE

The future development of the study area will be influenced by a number of factors including York and James City County's Comprehensive Land Use Plans and Zoning Ordinances for this area, the presence of environmental features such as the streams, wetlands, topography, the location of existing and planned infrastructure such as the existing rail line, the potential alignment of the Mooretown Road Extension, and county and state policies that affect the location of development like required setbacks from existing wetland areas.

The York and James City County Comprehensive Plans show portions of the study area as economic opportunity areas, which are seen as potential locations for job growth and tax revenue generation. Much of the area is currently zoned A-1, General Agricultural, including many of the residential properties. However, there is an anticipation that the extension of the Mooretown Road corridor will also see some of these properties rezone to the Economic Opportunity designation as shown on the Comprehensive Plan Land Use Map. Master planning is at the core of this designation, and no development should occur unless incorporated into area/corridor master planning efforts. For the Mooretown Road/Hill Pleasant Farm area, the primary suggested uses include industrial, light industrial, and office uses. James City County will require rezoning with a master plan approval before allowing construction of any Economic Opportunity development. This process includes public hearings and approvals from the Board of Supervisors. The land in York County is already zoned Economic Opportunity and may be developed for many commercial uses without further legislative action. Figure 3.2 highlights the parcels in James City County that are within the Economic Opportunity Overlay Zone.

3.3 MARKET ANALYSIS SUMMARY

The market assessment included review of relevant plans and documents, and interviews with key stakeholders including municipal staff, local real estate professionals and developers, business leaders, economic development practitioners, and others. Stakeholder input provided local context for analyzing



Study Area Boundary
Parcels
County Boundary
Economic Development Area (Comp Plan 2035)

NORTH

0 2,000 Feet

Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 3.2
Comprehensive Plan 2035 - Economic Opportunity Area

factors that will impact land uses in James City and York Counties in general, and the study area in particular.

Based on the assessment of the demographic, market and economic data the following trends were identified. The full Market Analysis Report can be found in Appendix D.

3.3.1 Demographic Analysis

The greater Mooretown Road Corridor area's economy has supported robust population and household growth over the past decade. James City County, York County, and Williamsburg combined to add almost 12,000 new jobs from 2002 to 2013. The population in James City County alone grew by 46% from 2000 to 2013, and Williamsburg City saw a surge in population as well. As long as the area's economy continues to expand beyond the entertainment and hospitality industries, the demand for land to accommodate both residential and non-residential uses will continue.

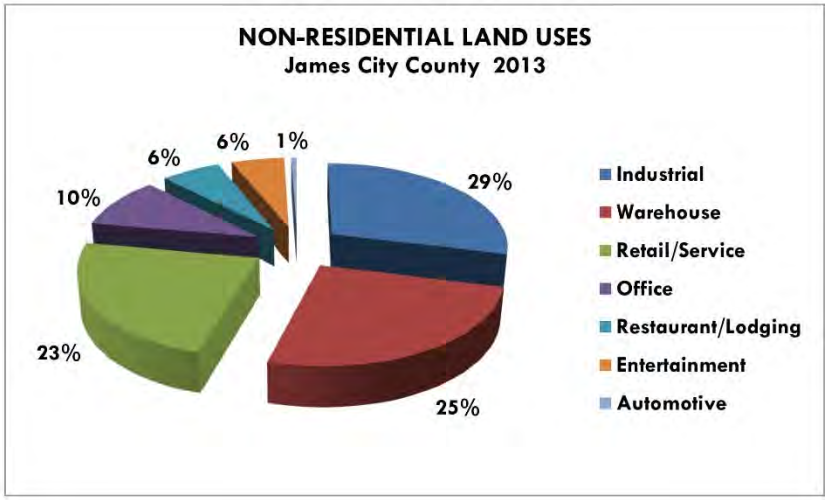
3.3.2 Residential Market Trends

In James City County, an annual average of 932 single family units were added to the inventory from 2003 through 2007, followed by apartments at 39, timeshares at 33, and condos at 20. In the six year period from 2008 through 2013, the average annual construction of single family units declined to 466, while the average annual construction of apartments increased from 39 to 105 following a national trend of apartment construction in response to tightened credit and lower demand from potential home buyers.

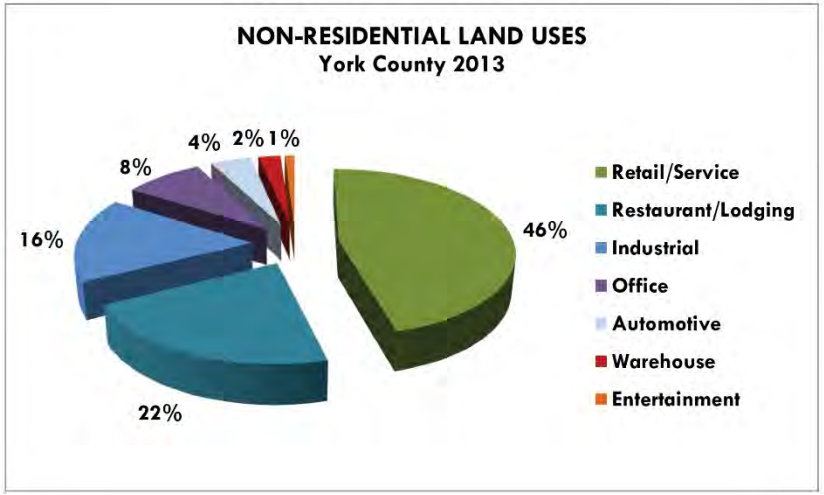
In York County, an annual average of 342 units were added to the inventory in the five-year period from 2003 through 2007. During the same period, and an average of 43 apartments were added annually, followed by timeshare units at 29, condos at 27, and duplexes at 12. From 2008 to 2013, average annual construction rate for single family units was 175. Average apartment construction increased slightly to 45 units per year. Timeshare unit construction decreased to 14 per year, followed by an average of six condos per year, and zero duplexes.

<u>Housing Characteristics</u> — In 2013, median owner occupied dwelling unit values were as follows: James City County, $324,200; York County, $336,600. Median cash rents in James City and York Counties are relatively close, at $1,066 and $1,110 respectively.

<u>Future Development</u> —According to the County of York 2012-2013 Comprehensive Plan, residential development in York County is projected to add approximately 5,700 new housing units by 2035. In James City County, master planned communities, by-right subdivisions with approved construction plans and other vacant lots have an estimated development potential of 11,170 residential units with an estimated absorption of 14 to 28 years.



Source: James City County; RKG Associate 2014



Source: James City County; RKG Associate 2014

3.3.3 Non-Residential Market Trends

In James City County, industrial uses account for the largest amount of improved space at 5.3 million square feet, approximately 3.2 million square feet of which is owned and operated by a single user, the Anheuser-Busch brewery. Warehouse space comprises the second largest land use at approximately 25% or 4.7 million square feet followed by retail/service at 23% or 4.3 million square feet, and office at 10% or 1.8 million square feet.

In York County, retail/services comprises the largest amount of improved space at 3.9 million square feet or 42%, followed by restaurant/lodging at 1.8 million square feet or 20%, industrial at 1.4 million square feet or 15%, and office space at 705,000 square feet or 8%.

Retail — James City County added an average of approximately 136,000 square feet annually from 2003 through 2013, for a total of just under 1.5 million square feet. During the same period, York County added an average of approximately 120,324 square feet annually for a total of just over 1.3 million square feet. Except for grocery stores, the greater Williamsburg area is over retailed due to the preponderance of stores and shopping centers that cater to visitors, such as Williamsburg Pottery and Premium Outlets. For community and neighborhood shopping centers which are generally locally serving, there was a 15% vacancy rate, which is reflected by the empty storefronts in the area. Nonetheless,

the high visibility and access of the Mooretown Road Extension Corridor offers a very attractive site for developers and retail tenants who might overlook market trends to be in a more advantageous location.

Office — Since 2003, James City County has seen an average of 60,000 square feet of office delivered annually, compared to about 83,000 square feet in York County. This rate of absorption would support low density, suburban campus style development such as that which already characterizes much of the local marketplace, and office space as an element of mixed use development, such as that in New Town.

Industrial — Although warehousing/distribution operations prefer proximity to highway interchanges, the demand from other land uses in the Mooretown Road Extension Corridor could likely price them out of the market. In James City County, industrial development has slowed down in the past five years to one-tenth of what it was the previous five years, so the demand can be absorbed into existing industrial parks into the foreseeable future. If the market for flex space picks up in the next decade, it could be a land use that wants to reside in the Corridor.

Visitation Attractions — The owners of the Williamsburg Pottery are currently (Fall 2014) in the process of assessing the potential for "an international, family-focused entertainment and education complex" on 720 acres of land in the Mooretown Road Extension Corridor. About 80% of the land is in York County with the remainder in James City County. If the project moves forward to fruition, it could represent the dominant use in the Corridor.

Lodging — One of the proposed uses in the aforementioned Williamsburg Pottery concept is lodging. Even in an over supplied market, a well positioned, unique product could garner enough of the market share to thrive, at other's expense of course. A strategically sited product in the corridor could have the distinct competitive advantage of easy access and maximum visibility.

3.3.4 Summary Conclusions

Residential — The Virginia Employment Commission projects that James City and York Counties combined will add an additional 20,000 to 25,000 households by 2030. At the current rates of absorption, James City County could potentially consume its current residential development pipeline in 12 to 13 years, and York County will consume its pipeline units in just three years. Of course, rezonings and development approvals will continually add to the pipeline in both jurisdictions, (in James City County's case, it is anticipated it could be enough for 19-38 years of growth). The consensus among real estate professionals interviewed for this analysis is that viable development tracts are becoming scarce as the inventory is consumed.

If household growth continues as projected, demand for new housing should remain steady ten to fifteen years in the future. The locational characteristics of the Mooretown Road Extension Corridor will make it attractive for developers and

residents with its easy access to I-64 and the employment centers of Richmond and Hampton Roads.

Non-Residential Summary Conclusions - Although the Mooretown Road trade area is over supplied with retail, the high visibility and access of the Mooretown Road Corridor offers a very attractive site for developers and retail tenants who might overlook market trends to be in a more advantageous location. Office absorption rates over the past eleven years indicate a market that will continue to support low density, suburban campus style development such as that which already characterizes much of the local marketplace. Office space can also function well in mixed use developments, such as that in New Town. Industrial development has slowed down in the past five years to one-tenth of what it was the previous five years, so the demand should be absorbed into existing industrial parks into the foreseeable future. A strategically sited hotel product in the corridor could have a distinct competitive advantage of easy access and maximum visibility, and may succeed in an oversupplied market. A new visitor's attraction in the marketplace may represent the riskiest investment in terms of land use, since visitation at all local attractions has been steadily declining.

Although significant development opportunities in the Mooretown Road Extension Corridor may be fifteen years or more off in the future, they should present themselves at an opportune time from a supply perspective. There is a general consensus in the planning and real estate communities in both James City and York County that most of the prime development sites have been consumed, and developers are already facing the prospect of considering less desirable sites. Of course, the access that an extended Mooretown Road will provide to new opportunity sites will make them extremely desirable for a variety of land uses.

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4.0 TRAFFIC FORECAST

This study included traffic forecasting (which helps to identify the effects and need for a proposed facility), as well as travel demand modeling (which accounts for changes to travel patterns that might occur in the future due to changes in the transportation network, population and employment). The design year for a proposed corridor is usually at least 20 years in the future. The year 2040 was selected as the design year for this study to align with regional forecasts underway at the Hampton Roads Transportation Planning Organization (HRTPO).

4.1 TRAFFIC FORECAST

The first step in developing a travel demand forecast is to develop a future year baseline forecast. The future year baseline forecast is often referred to as the No-Build scenario, which includes all proposed improvements to the regional transportation network that have been adopted into the long range plan for the region. The 2040 traffic conditions including the proposed development, or Build conditions, are often compared to the No-Build scenario to determine the impacts with or without the proposed facility.

For this effort the travel demand forecasts were developed for year 2040 using the Hampton Roads Travel Demand Forecast Model. The model set (HRMODEL_102913) was provided by the Virginia Department of Transportation (VDOT). This version was used for developing the travel demand forecast.

Major improvements to the model set include the use of the 2009 National Household Travel Survey (NHTS) to improve the trip generation and trip distribution models, a better mode choice model and more sophisticated assignment algorithm including time-of-day assignments. In preparing the model for the analyses required for this study, none of the model constants or coefficients were altered. The only changes made were to the roadway network to validate the study corridor and test the build alternatives. This included coding the Mooretown Road extension as part of the build alternatives.

A travel demand forecast model (TDFM) is a set of computer-based mathematical relationships that attempts to capture the interaction of travel activities and choices made by a population in a specific region given a proposed network (e.g., highway, transit, etc.) and demographic or land use inputs (e.g., population, employment, etc.). The main inputs to the travel demand model are:

- Demographic and economic changes in the region, specifically the location of employment and housing, and
- Characteristics of the region's transportation system, including proposed changes in transportation facilities and operating policies.

Although VDOT maintains the TDFM for the Hampton Roads region, they are not responsible for the land use data. The Hampton Roads Transportation Planning Organization (HRTPO) provided land use forecast for the year 2034 for use in this study. Currently, the latest year that HRTPO has a land

use forecast developed for is year 2034. To develop year 2040 traffic forecasts, the year 2034 land uses were factored at the Transportation Analysis Zone (TAZ) level. Factors were applied to all zones that showed growth, if a zone did not show growth or decreased, the year 2034 land use was held. For zones that did show growth, a growth of one percent per year was applied for the six year period between 2034 and 2040. This applied to zones in the study area. In order for the growth rate to be applied the TAZ had to show a positive growth from the year 2009 forecast. The one percent growth rate reflected an approximate aggregate regional growth rate for zones in the region that showed growth over the forecasted period. It was a conservative approach to demonstrate a level of sensitivity to the potential land use growth for the study area. The number of households per zone and the number of employees by type of employment per zone were factored. Population was adjusted based on the year 2034 household size and factored to reflect the increase in zones that showed household growth. Auto ownerships was factored to reflect the increase in households for applicable zones by applying the year 2034 vehicles ownership per household rates.

4.2 DEFINED STUDY AREA

Traffic forecasts were developed for the project study area. The following list includes intersections where forecasts were developed for average morning weekday peak hour and evening peak hour.

- I-64 Westbound Ramps and Croaker Road (SR 607)
- I-64 Eastbound Ramps and Croaker Road (SR 607)
- Rochambeau Drive /Mooretown Road and Croaker Road (SR 607)
- Point O Woods/Maxton Lane and Croaker Road (SR 607)
- Richmond Road (US 60) and Croaker Road (SR 607)
- Mooretown Road and Humelsine Parkway Ramps (SR 199) and Mooretown Road
- Williamsburg Pottery Road/Mooretown Road and Lightfoot Road
- Richmond Road (US 60) and Lightfoot Road

4.3 VALIDATION

The travel demand forecast model set used in this study was calibrated and validated for the region. The base year for this calibration and validation was year 2009, and was based on data from the NHTS and data collected as part of the Hampton Roads Transit (HRT) Comprehensive Operations Analysis. The study area model was reviewed to confirm that the TDFM was adequately replicating the traffic conditions for the set validation year.

Lightfoot Road looking southeast to Mooretown Road

4.4 POST PROCESSING

Post-processing refers to analyses performed after execution of the TDFM run. Post-processing activities are applied to TDFM model results to compensate for the limitations of the model. These limitations are usually a result of the coarseness of the network and aggregate design of the model. The model used for this project produced peak period volumes by applying a set of static factors to each trip purpose. The static factors do not capture the effects of peak spreading and discretionary travel choices. Since the model chain does not specifically include a time-of-day choice model, our experience has shown that it is best practice to use the daily traffic results for post processing and then derive the peak hour from the refined average daily traffic (ADT) volume. The addition of time-of-day assignments provides a more accurate aggregated result.

The time-of-day assignments do not necessarily produce direct output that is within acceptable validation criteria for using in project planning studies.

Roadway post-processing involves three stages:

- Refinement of the raw link volumes, which is done with the direct output from the model for the ADT volumes;
- Derivation of the peak hour link volumes; and
- Calculation of the turning movements.

For this study, the post-processing activities for refining the roadway link ADT volumes and developing turning volumes involved procedures outlined in NCHRP-255 Highway Traffic Data for Urbanized Area Project Planning and Design, published by the Transportation Research Board. This technical report provides a set of procedures for refining "raw" link volumes output directly from the TDFM.

For design and analysis purposes, peak hour traffic projections are required. These were derived from the refined ADT volumes. The peak hour projections were based on the existing ratio of peak hour traffic to daily traffic. The peak hour inbound and outbound link approach volumes on the interchanges and intersections were derived from the daily volumes and then used in the iterative proportioning function (IPF) routine to calculate turning volumes that balanced the interchange and intersection approaches.

The turning movements at the intersections of interest were developed using a more elaborate methodology combining procedures from the A-Turns and B-Turns methodology outlined in NCHRP-255. This procedure utilized an IPF to calculate turning movements. In this process, the refined future forecast approach link volumes, both inbound and outbound, serve as the inputs. The existing turning volumes were used as seed volumes and the IPF routine iteratively adjusted the turns to balance forecasted approach inbound and outbound link volumes. The end results are reviewed for reasonableness against the existing conditions, future growth patterns, and raw model results. This model was used to generate the 2040 No-Build daily volumes presented in Figure 4.1 and the peak hour volumes illustrated in Figure A-4 in the Appendix.

4.5 NETWORK AND LAND USE CHANGES

As part of this project, the extension of Mooretown Road was added to the model network in one alternative as a two lane roadway facility and in another alternative as a four lane roadway facility. In both alternatives the road was extended between Croaker Road (SR 607) and Humelsine Parkway (SR 199). This was the only addition to the network. The remaining changes between the existing roadway and transit network conditions and the year 2040 conditions are documented in the HRTPO's long range transportation plan documents.

As part of the travel demand forecasting effort, the land use for the area immediate adjacent to the proposed Mooretown Road Extension was modified based on the range of future land use projections described in Section 3. The purpose was to examine potential impacts of different land use scenarios based on the extension of the road. Three different year 2040 land use scenarios were formulated. These were run through the model in addition to the base planned regional forecast. The different scenarios looked at reducing households and adding more employment. The highest traffic volumes from these scenarios were used to formulate the 2040 Build volumes. These daily volume estimates are presented in Figure 5.5 and the intersection peak hour volumes are illustrated in Figure A-6 in the Appendix. The capacity analysis results illustrated on Figure 5-5 will be discussed in greater detail in Section 4.6.

4.6 NO-BUILD (2040) CAPACITY ANALYSIS

Using the projected volumes from the forecasting effort and illustrated on Figure 4.1, a No-Build (2040) capacity analysis was undertaken to understand the future conditions along the study area roadways and at intersections if the Mooretown Road Extension project was not in place. This analysis assumed that the Croaker Road widening plan, currently under design by VDOT, and several proposed developments with their associated proffered road improvements would be in place by 2040. These are:

- Stonehouse – Which has proffered to improve Rochambeau Drive (SR 30) northwest of Croaker Road, add turn lanes to Rochambeau Drive at the intersection

of Croaker Road and Rochambeau Drive, and add a second left turn lane to eastbound Croaker Road at this intersection, and add a left turn lane on Croaker Road to Richmond Road.

- The Candle Factory – Which has proffered to improve the right turn lane from Richmond Road into the Candle Factory.
- Lightfoot Marketplace – Which has proffered to improve the signalized intersection at Richmond Road and Lightfoot Road, improve the left turn lane onto Lightfoot Road and add a left turn lane for traffic leaving the shopping center.

According to the No-Build (2040) conditions analysis, some network intersections are projected to drop below acceptable operations during at least one peak hour. Some of the notable changes between the Existing (2014) conditions and the No-Build (2040) are:

- Assuming the widening of Croaker Road north of Richmond Road, all the analyzed corridor segments are expected to operate acceptably.
- Each of the I-64 at Croaker Road ramp approaches operate at acceptable levels, with the exception of the I-64 westbound loop approach, which drops to a LOS E during the PM peak hour.
- At the Humelsine Parkway (SR 199) and Mooretown Road interchange, both the northbound and southbound yield-controlled approaches are expected to operate at LOS E or worse during at least in one peak.

The analysis results are summarized in the following tables. Table 4.6-1 lists the average delay and level of service (LOS) for intersections in the study area under AM and PM peak period traffic volumes. Table 4.6-2 lists the level of service and traffic density on the multilane road segments around the study area. Table 4.6-3 presents the level of service and percent of time spent following on Lightfoot Road, a Class II Two-Lane Segment. Table 4.6-4 lists the average delay and level of service of the ramps within the Croaker Road-I-64 interchange (Exit 231) and the Mooretown Road- Humelsine Parkway interchange. The worst case LOS are mapped on Figure 4.1. The No-Build (2040) land configurations and traffic control (Figure A-3) and the AM and PM peak hour turning movement volumes (Figure A-4) along with the detailed traffic analysis results are included in Appendix A.

Study Area Boundary
Parcels
County Boundary

LOS*	Signalized	Unsignalized	Segment
A/B			ADT
C/D			ADT
E/F			ADT

*Worst peak level of service

NORTH

0 2,000 Feet

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FIGURE 4.1

No-Build (2040) Traffic Conditions

Table 4.6-1
No-Build (2040) Conditions - Intersections

	Intersection		Eastbound		Westbound		Northbound		Southbound		Worst Approach		
	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Approach	LOS[1]	Overall
AM													
Croaker Road & Rochambeau Drive	26.3	C	23.0	C	46.8	D	29.0	C	22.7	C	Westbound	D	C (WB-D)
Croaker Road & Point O Woods	2.2	A	20.7	C	13.0	B	-	-	-	-	Eastbound	C	(EB-C)
Croaker Road & Richmond Road	40.2	D	37.9	D	41.6	D	42.8	D	41.5	D	Northbound	D	D (NB-D)
Richmond Road & Lightfoot Road	32.3	C	31.3	C	34.5	C	41.1	D	27.4	C	Northbound	D	C (NB-D)
Lightfoot Road & Mooretown Road	25.6	C	26.7	C	28.9	C	13.2	B	34.8	C	Southbound	C	C (SB-C)
PM													
Croaker Road & Rochambeau Drive	34.3	C	27.4	C	52.6	D	39.9	D	27.7	C	Westbound	D	C (WB-D)
Croaker Road & Point O Woods	1.5	A	20.7	C	16.1	C	-	-	-	-	Eastbound	C	(EB-C)
Croaker Road & Richmond Road	63.4	E	67.8	E	50.9	D	86.0	F	70.2	E	Northbound	F	E (NB-F)
Richmond Road & Lightfoot Road	98.9	F	121.8	F	92.1	F	102.3	F	35.5	D	Eastbound	F	F (EB-F)
Lightfoot Road & Mooretown Road	54.1	D	42.6	D	45.2	D	51.7	D	80.0	F	Southbound	F	D (SB-F)

[1]*LOS – Level of Service*

Table 4.6-2
No-Build (2040) Conditions - Multilane Segments

		AM Peak				PM Peak			
		Eastbound/ Northbound		Westbound/ Southbound		Eastbound/ Northbound		Westbound/ Southbound	
Roadway	Location	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)
Mooretown Road	Between Lightfoot Road and Humelsine Parkway	A	8.2	A	5.0	A	8.9	A	9.6
Richmond Road	Between Croaker Road and Popular Creek	B	15.5	B	14	C	21.2	C	23.6
Croaker Road	Between Richmond Road and Rochambeau Drive	A	6.9	A	6.2	A	8.6	A	8.2
Croaker Road	Between Rochambeau Drive and I-64	B	12.6	A	9.7	A	10.3	B	11.6

Table 4.6-3
No-Build (2040) Conditions - Two-Lane Segment Analysis (Class II)

		AM Peak		PM Peak	
Two-Lane Highway	Location	Segment LOS[1]	PTSF[2] (%)	Segment LOS[1]	PTSF[2] (%)
Lightfoot Road	Between Richmond Road and Mooretown Road	D	72.0	D	77.9

(No Class I segments in 2040)

[1]*LOS – Level of Service*

[2]*PTSF – Percent Time Spent Following*

Table 4.6-4
No-Build (2040) Conditions - Ramps

	Intersection		Eastbound		Westbound		Northbound		Southbound		Worst		
	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Approach	LOS[1]	Overall
AM													
Croaker Road & I-64 Westbound Ramps	6.6	A	22.3	C	10.3	B	-	-	-	-	Eastbound	C	(EB-C)
Croaker Road & I-64 Eastbound Ramps	2.4	A	17.6	C	12.3	B	-	-	-	-	Eastbound	C	(EB-C)
Mooretown Road & SR 199 Southbound Ramps	10.5	B	-	-	-	-	35.6	E	10.4	B	Northbound	E	(NB-E)
Mooretown Road & SR 199 Northbound Ramps	23.2	C	-	-	-	-	108.7	F	10.0	B	Northbound	F	(NB-F)
PM													
Croaker Road & I-64 Westbound Ramps	17.0	B	46.8	E	11.5	B	-	-	-	-	Eastbound	E	(EB-E)
Croaker Road & I-64 Eastbound Ramps	3.2	A	23.9	C	12.1	B	-	-	-	-	Eastbound	C	(EB-C)
Mooretown Road & SR 199 Southbound Ramps	4.5	A	-	-	-	-	24.9	C	13.0	B	Northbound	C	(NB-C)
Mooretown Road & SR 199 Northbound Ramps	28.6	C	-	-	-	-	167.2	F	17.6	C	Northbound	F	(NB-F)

[1]*LOS – Level of Service*

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5.0 DEVELOPMENT OF ALTERNATIVES

The Corridor Study considered a range of alternative alignments for the extension of Mooretown Road and various roadway typical cross-sections that could be applied to these alignments. Early traffic studies found much of the traffic forecasted to use the Extension would be continuing through from existing Mooretown Road or coming from Rochambeau Drive northwest of the study area. Connecting to Croaker Road was logical to continue the through traffic movement and to not add another intersection to Croaker Road. Cultural resource and residential constraints also limited possible connection points if major impacts were to be avoided. Therefore, all of the alternatives considered extending Mooretown Road to the intersection of Croaker Road and Rochambeau Drive.

During the development of alternatives, stakeholder input and public comments on environmental protection, traffic conditions on Rochambeau Drive, and the need for alternate access routes within the study area were considered. Alternatives were developed with the goals of minimizing the lengths of stream crossings and improving traffic capacity while providing access to the Economic Opportunity areas.

5.1 DESIGN CRITERIA

5.1.1 Roadway Geometry

The Mooretown Road Extension would connect two existing roadways, both classified by VDOT as Major Collectors[2]. The proposed roadway needs to carry forecasted traffic at speeds and under conditions appropriate for the anticipated development and in a manner consistent with the adjoining roadways. Although the roadway will provide an alternate route for I-64 and Richmond Road traffic, it will primarily carry traffic from the study area and connect neighborhoods and commercial areas within northern James City and York Counties. Therefore the Rural Collector design standard (VDOT standard GS-3)[3] should be applied in designing the Mooretown Road Extension. James City County and northern York County are considered rolling terrain.

The Rural Collector design standard for rolling terrain has a design speed of 50 mph and a minimum radius of 760 feet. According to VDOT's Access Management Standards for collector roads, signalized intersections should be spaced at least 1,050 feet apart, while full access unsignalized intersections or entrances may be 445 feet apart.

5.1.2 Drainage

According to the VDOT Drainage Manual, the final design of culverts and stream crossings for Mooretown Road Extension should be sized to carry a minimum 25-year year storm. For the concept level designs used in developing the alternatives, culverts were selected by comparing the relative drainage areas to each crossing and on the existing stream flow cross sections. Fish or wildlife passage provisions will most likely be required for culverts in perennial streams and will be defined during the permitting process. Bridge crossings will require a detailed hydrology and hydraulics study to assess flood stage at the crossing and the potential of scour at the bridge foundations. The

hydrologic estimates should consider the potential for development and increased impervious cover and reduced time of concentration.

Open roadside ditches may be used with the Rural Collector design standard. These would provide stormwater management benefits and reduce the overall runoff volume. Curbs and gutters can be used to collect roadway runoff. Curb and gutter sections require less right-of-way width than open ditches. Either drainage option would provide a buffer between vehicle traffic and pedestrians.

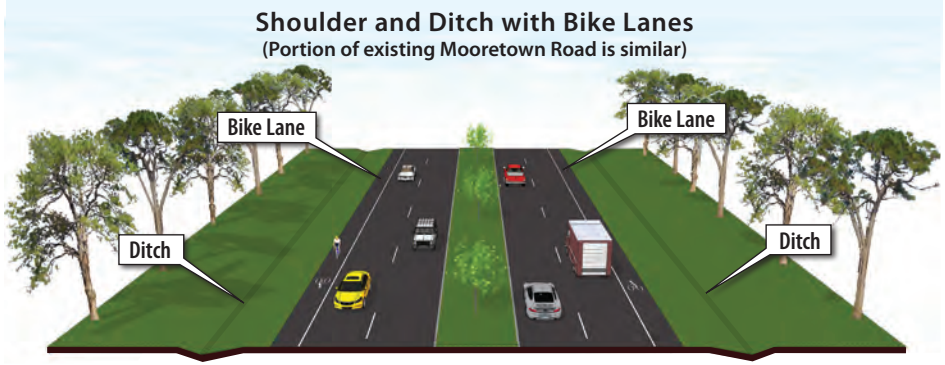
5.1.3 Typical Sections

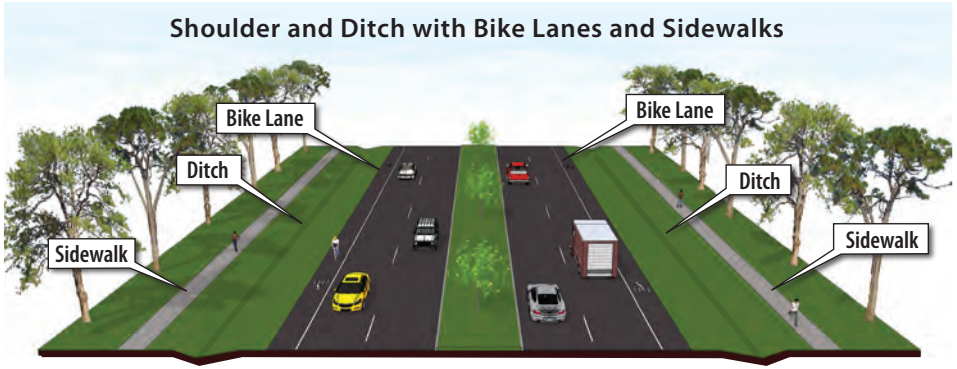
Existing Mooretown Road, southeast of Humelsine Parkway, has a four-lane divided roadway cross-section with a raised median. Rochambeau Drive northwest of the study area is a two-lane roadway at Croaker Road which transitions to a four- lane divided roadway with a depressed median approximately three-quarters of a mile north of Croaker Road. The Stonehouse development plan includes provisions, known as proffers, to widen Rochambeau Drive north of Croaker Road.

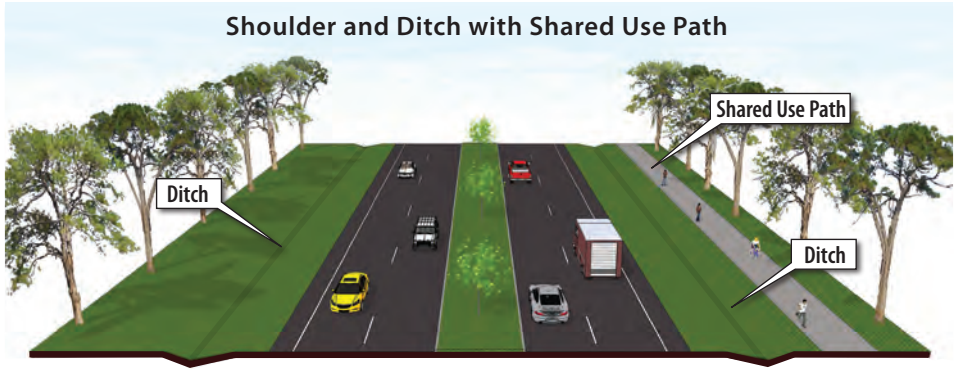
The forecasted 2040 volumes for the Mooretown Road Extension range from 18,600 vehicles per day (vpd) in the central section to 25,500 vpd at the north end. These traffic volumes warrant a four-lane cross-section. Since the Mooretown Road Extension would be connecting other four lane divided roadways, a four lane divided section with a raised median is recommended.

The typical section should address the needs of non-motorized users as well. Pedestrians and bicyclists can be served through sidewalks and bike lanes or through shared use paths. Several combinations of a four-lane divided typical section with either bike lanes and sidewalks or shared-use paths were developed. These presented both curb and gutter sections or paved shoulder and open ditches for drainage. These studied options are presented in Figure 5.1.

Mooretown Road southeast of Humelsine Parkway







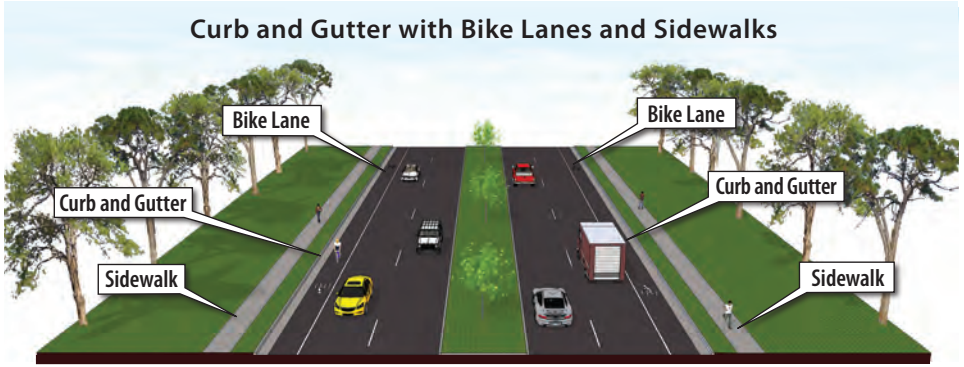


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FIGURE 5.1
Typical Section Options

5.2 ALTERNATIVE 1

Alternative 1 was developed to provide the most direct connection between Lightfoot Road and the Croaker Road-Rochambeau intersection, while minimizing the stream, wetland, and residential impacts through the center of the study area. Alternative 1 is shown in Figure 5.2.

5.2.1 Roadway Improvements

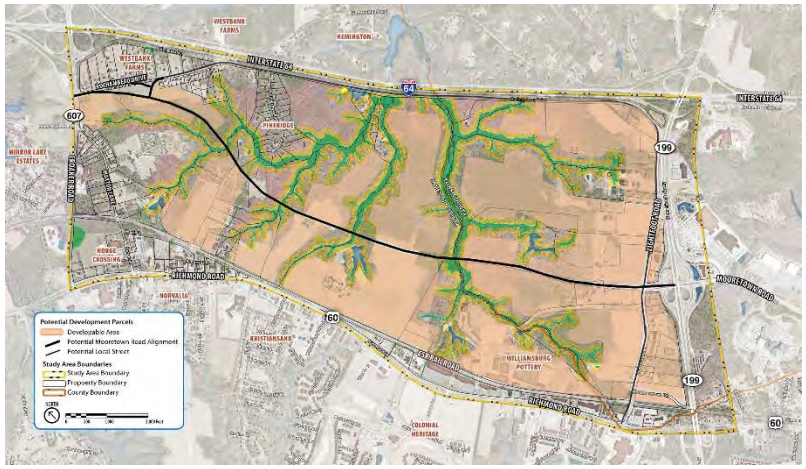
Alternative 1 begins at the existing intersection of Mooretown Road and Lightfoot Road and runs northwest through the Williamsburg Pottery property to Skimino Creek. A bridge is proposed to cross this large ravine and the wetlands surrounding the creek. The road would cross the Hill Pleasant Farm and neighboring Stevens properties, crossing two streams, before curving across the east end of Peach Street, over a fourth stream, and through the Broughton LLC property to Croaker Road at Rochambeau Drive.

This alternative includes a realignment of Rochambeau Drive to intersect the Mooretown Road Extension and discourage through traffic from using Rochambeau Drive. This intersection is expected to require a stop sign for Rochambeau Drive traffic. A right-turn lane from the Extension onto Rochambeau Drive is not needed for traffic operations based on the analysis, but should be considered for safety.

The traffic signals at Lightfoot Road and at Croaker Road would need reconfiguring to accommodate the additional lanes that would be required as part of the Mooretown Road Extension.

5.2.2 Future Land Use Analysis

Alternative 1 provides the most direct connection through the site, generally evenly dividing the study area in half between the northeast and southwest sections. A mixed-use or traditional retail/commercial development typically prefers access off of both sides of a roadway. The multiple parcels could support various uses with the ability to create buffers between uses as needed. However, part of the land traversed by this alternative classified as rural/agricultural in the James City County Comprehensive Plan. The largest, most accessible parcels occur on the eastern side of the study area. Alternative 1 provides potential developable space, with more than 400 feet of depth, along 7,200 linear feet of the railway.



Potential development areas accessed by Alternative 1

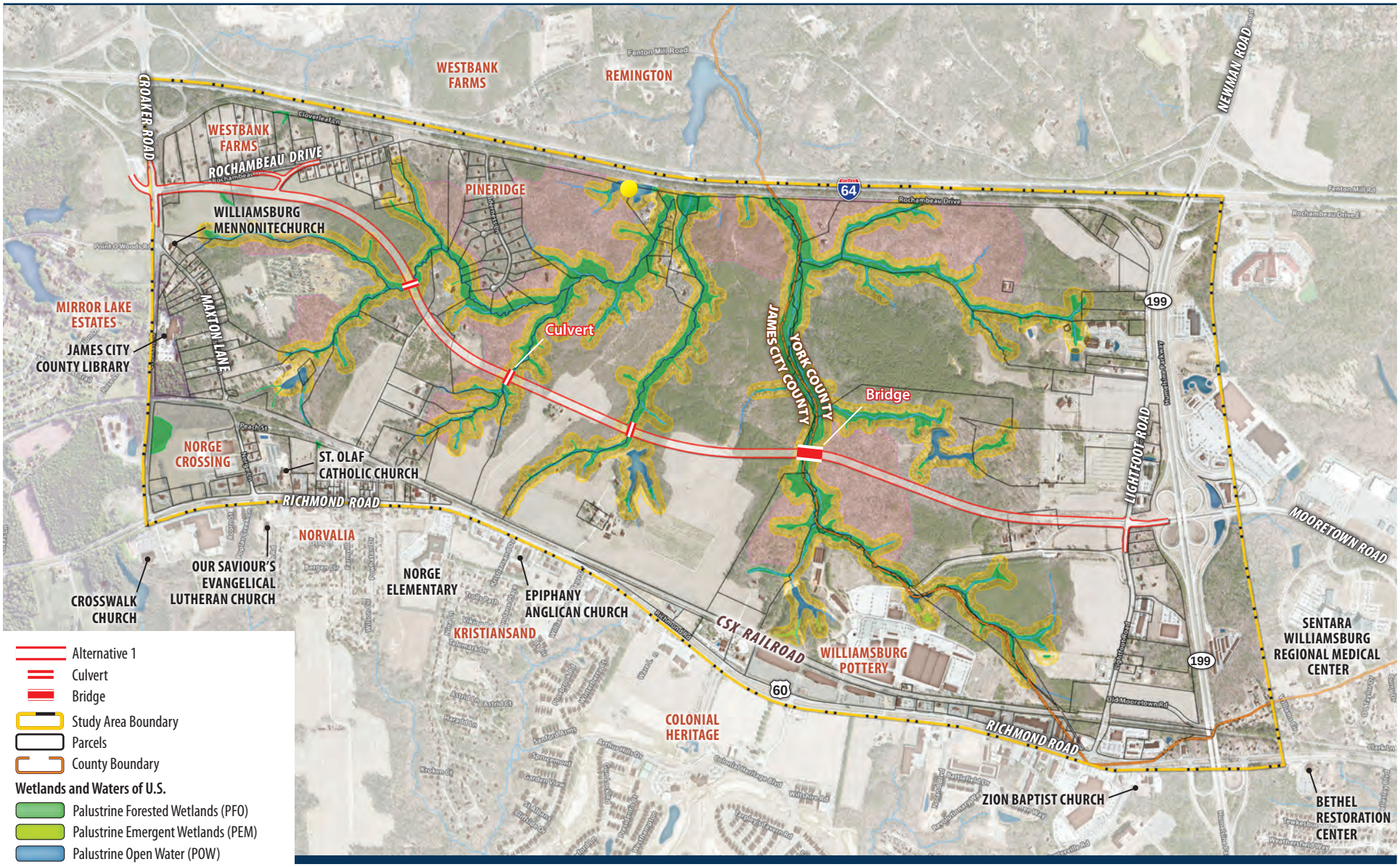


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FIGURE 5.2

Alternative 1

5.3 ALTERNATIVE 2

Alternative 2 seeks to reduce environmental impacts by sweeping the road alignment upstream of the headwaters of most of the streams. The alignment runs closest to the railroad line and stays mostly in the Economic Opportunity area as shown in Figure 5.3.

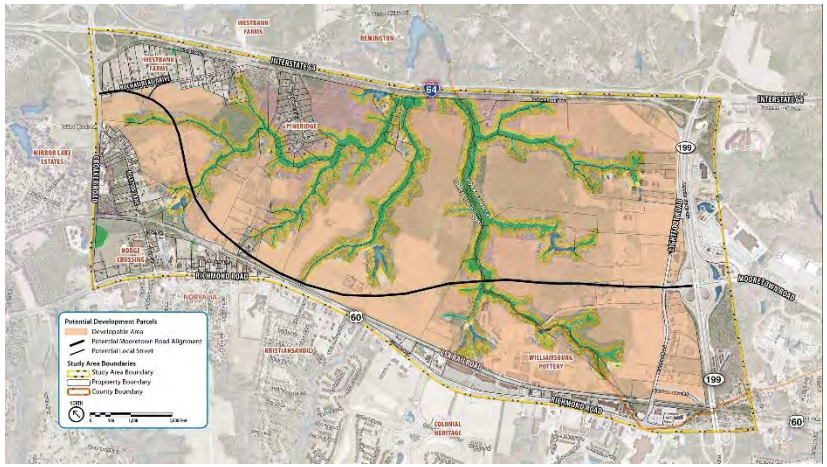
5.3.1 Roadway Improvements

Alternative 2 provides a "southwestern" alignment through the study area. It begins at the existing intersection of Mooretown Road and Lightfoot Road and runs northwest crossing Skimino Creek with a bridge, and then the alignment heads to the west toward the railroad. Alternative 2 crosses the streams on either side of the Stevens property upstream of the point of perennial flow thereby reducing the wetland impacts. Alternative 2 crosses Peach Street near the railroad tracks and turns north, crosses the American Heritage Campground property, and then turning northwest it intersects Croaker Road at Rochambeau Drive.

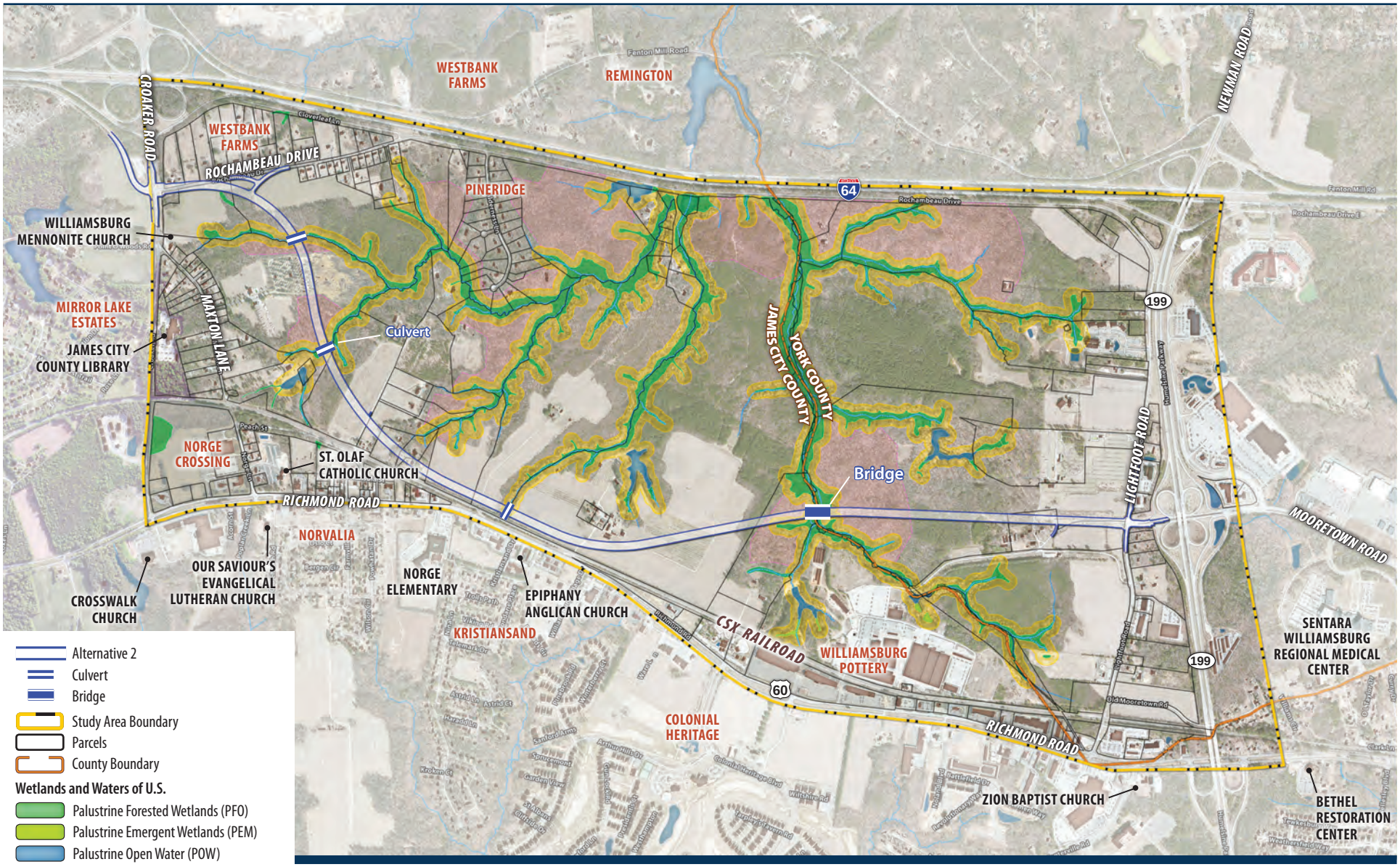
This alternative also includes a realignment of Rochambeau Drive to intersect Mooretown Road and discourage through traffic from using Rochambeau Drive. This intersection would require turn lanes and traffic control for Rochambeau Drive traffic similar to Alternative 1. The traffic signals at Lightfoot Road and at Croaker Road would need reconfiguring to accommodate the additional lanes that would be required as part of the Mooretown Road Extension.

5.3.2 Future Land Use Analysis

Alternative 2 is located primarily in land designated for economic development/opportunity through zoning and/or comprehensive plan designation. It provides access to more parcels within the James City County Economic Opportunity area, providing 130 more developable acres than Alternative 1. It impacts more residential properties than Alternative 1, but fewer than Alternative 3. This alignment, while offering the potential to develop a similar amount of property as Alternative 1, has a number of parcels that are primarily on one side of the road requiring longer internal road networks for development of the parcels. However, these very large parcels are more conducive to the industrial and light industrial development recommended in the adopted comprehensive plans, as the largest developable area sites are left contiguous. This alternative provides potential developable space along 3,500 linear feet of railway.



Potential development areas accessed by Alternative 2



Mooretown Road Extension Corridor Study

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FIGURE 5.3

Alternative 2

5.4 ALTERNATIVE 3

Alternative 3 was developed to provide access to the largest properties in the study area while also utilizing a portion of existing Rochambeau Drive. Similar to Alternative 2, this alternative initiated as a result of comments received during the stakeholders meetings and the first public meeting. Many of the comments focused on concerns with potential impacts to environmental features and residential areas, as well as suggestions to utilize Rochambeau Drive.

Alternative 3 is shown in Figure 5.5.

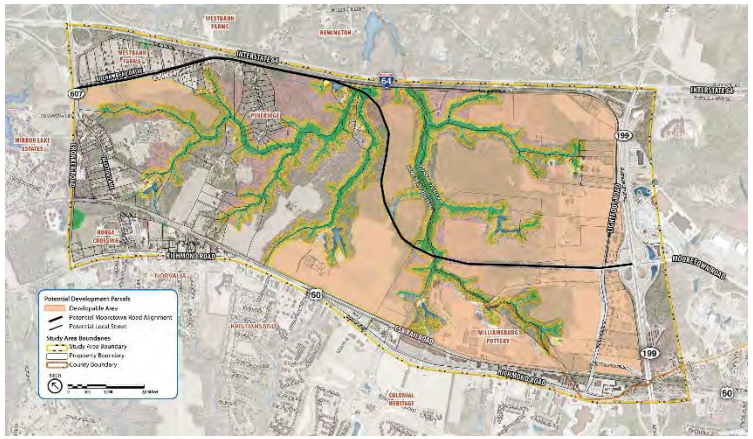
5.4.1 Roadway Improvements

Like the other Alternatives, Alternative 3 begins at the existing intersection of Mooretown Road and Lightfoot Road and runs northwest across Skimino Creek and includes a bridge crossing the creek. After crossing Skimino Creek, Alternative 3 turns east and connects to Rochambeau Drive approximately 7,300 feet southeast of Croaker Road. Rochambeau Drive south of Croaker Road would need to be widened to accommodate the additional traffic. Rochambeau Drive south of the proposed Mooretown Road Extension would be realigned to intersect with the Extension.

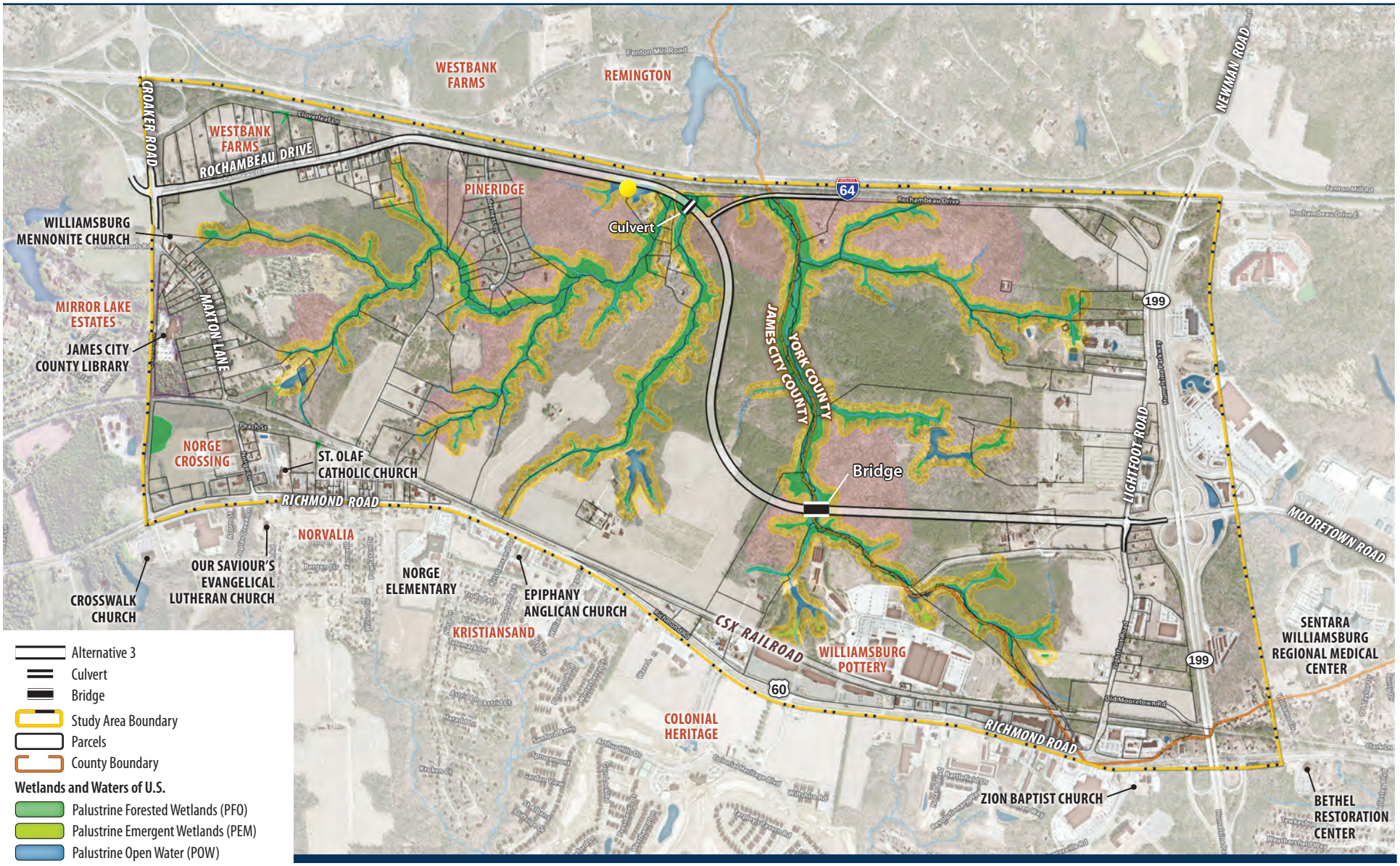
The traffic signals at Lightfoot Road and at Croaker Road would need reconfiguring to accommodate the additional lanes that would be required as part of the Mooretown Road extension.

5.4.2 Future Land Use Analysis

Alternative 3 provides a “northeastern” alignment and would only connect a portion of the study area with a new road alignment. This alternative would offer the least access to new potential development parcels of the three alternatives. The portion of Rochambeau Drive to be improved with this alternative is mostly residential with some smaller undeveloped parcels. Alternative 3 would require right-of-way acquisition along Rochambeau Drive, which would impact the residential area south of Croaker Road. The southeastern parcels of the property within York County would be well served by this alignment as would the parcels just west of Skimino Creek. The remaining portions of the site would need to rely on existing roads or new roads that would connect through the parcels to the Mooretown Road Extension to be developable as part of the project.



Potential development areas accessed by Alternative 3



Alternative 3
Culvert
Bridge
Study Area Boundary
Parcels
County Boundary

Wetlands and Waters of U.S.

Palustrine Forested Wetlands (PFO)
Palustrine Emergent Wetlands (PEM)
Palustrine Open Water (POW)
Streams Channels (within Study Area)
Resource Protection Areas (RPA)

Threatened & Endangered Species

Potential Mabee's Salamander Habitat
Potential Small Whorled Pogonia Habitat

NORTH

0 2,000 Feet

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FIGURE 5.4

Alternative 3

5.5 BUILD (2040) TRAFFIC CAPACITY ANALYSIS

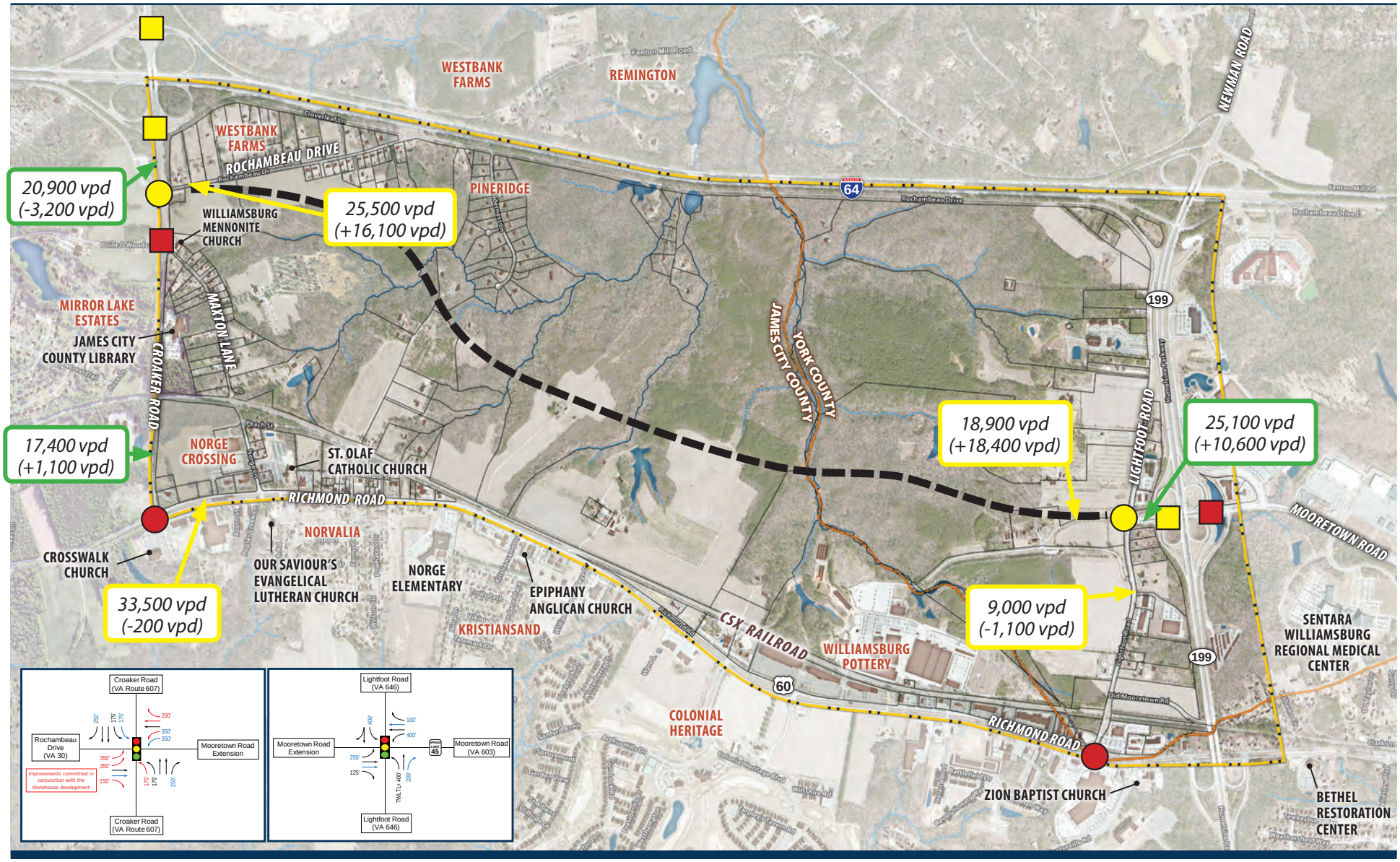
Regardless of the alternative selected, the impacts to the surrounding network traffic are expected to be similar under the 2040 Build traffic conditions. All alternatives begin at the same point on Lightfoot Road and eventually route traffic to the same intersection on Croaker Road. The travel time along the alternatives is similar. Figure 5.5 illustrates the highlights of the capacity analysis. The Build (2040) daily volumes are listed for each segment as well as the change relative to the No-Build (2040) volumes. The worst case peak hour level of service for each of the intersections and segments is also listed.

Based on the analysis, some of the intersections continue operating at undesirable levels of service; however, there is a decrease in delay at some of the intersections due to rerouting of traffic on to Mooretown Road extension.

All the analyzed corridor segments are expected to continue operating acceptably. At the I-64 and Croaker Road interchange, both the westbound and eastbound ramps are projected to operate acceptably. The yield-controlled southbound ramp at the Humelsine Parkway (SR 199) and Mooretown Road interchange is projected to operate acceptably and the northbound ramp is projected to operate at LOS E in the AM peak and LOS F during the PM peak hour.

It is important to note that the 2040 Build Traffic analysis includes traffic that would be generated by potential development of the land along the Mooretown Road Extension Corridor. The analysis demonstrates that the Extension will support development along the corridor with no increase in LOS except in the segment of Mooretown Road between Lightfoot Road and East Rochambeau Drive. Intersection improvements will reduce delays at the intersection of Lightfoot Road and Mooretown Road if Mooretown Road is extended. This will offset the increased delay in the segment to the southeast. The analysis also shows improved traffic operations along Richmond Road and Lightfoot Road for most scenarios.

Capacity analysis results of the 2040 Build Traffic Conditions are reported in the following tables. Table 5.5-1 lists the average delay and level of service (LOS) for intersections in the study area under AM and PM peak period traffic volumes. Table 5.5-2 lists the level of service and traffic density on the multilane road segments around the study area. Table 5.5-3 presents the level of service and percent of time spent following on Lightfoot Road, a Class II Two-Lane Segment. Table 5.5-4 lists the average delay and level of service of the ramps within the Croaker Road-I-64 interchange (Exit 231) and the Mooretown Road- Humelsine Parkway interchange. Detailed traffic analysis information, including intersection lane geometrics, traffic control, peak hour volumes, and *Synchro/HCS* output are contained in Appendix A.



Study Area Boundary
Parcels
County Boundary
Mooretown Road Extension

LOS*	Signalized	Unsignalized	Segment
A/B			ADT
C/D			ADT
E/F			ADT

*Worst peak level of service

NORTH

0 2,000 Feet

Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 5.5
Build (2040) Traffic Conditions

Table 5.5-1
Build (2040) Conditions - Intersections

	Intersection		Eastbound		Westbound		Northbound		Southbound		Worst Approach		
	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Approach	LOS[1]	Overall
AM													
Croaker Road & Rochambeau Drive	30.2	C	34.0	C	42.0	D	24.6	C	19.7	B	WB	D	C (WB-D)
Croaker Road & Point O Woods	3.7	A	27.9	D	14.6	B	-	-	-	-	EB	D	(EB-D)
Croaker Road & Richmond Road	53.4	D	52.1	D	69.8	E	33.4	C	31.4	C	WB	E	D (WB-E)
Richmond Road & Lightfoot Road	28.3	C	24.6	C	32.8	C	52.6	D	21.5	C	NB	D	C (NB-D)
Lightfoot Road & Mooretown Road	34.4	C	38.8	D	31.3	C	21.3	C	40.8	D	SB	D	C (SB-D)
PM													
Croaker Road & Rochambeau Drive	35.2	D	41.7	D	35.1	D	28.5	C	34.3	C	EB	D	D (EB-D)
Croaker Road & Point O Woods	3.8	A	47.6	E	19.5	C	-	-	-	-	EB	E	(EB-E)
Croaker Road & Richmond Road	62.3	E	62.0	E	58.8	E	79.6	E	61.9	E	NB	E	E (NB-E)
Richmond Road & Lightfoot Road	75.6	E	68.6	E	92.1	F	97.7	F	37.3	D	NB	F	E (NB-F)
Lightfoot Road & Mooretown Road	32.3	C	32.5	C	33.5	C	19.9	B	43.1	D	SB	D	C (SB-D)

[1]*LOS – Level of Service*

Table 5.5-2
Build (2040) Conditions - Multilane Segments

		AM Peak				PM Peak			
		Eastbound/ Northbound		Westbound/ Southbound		Eastbound/ Northbound		Westbound/ Southbound	
Roadway	Location	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)	Segment LOS[1]	Density (pc/mi/ln)
Mooretown Road	Between Lightfoot Road and Humelsine Parkway	B	14.3	A	8.8	B	12.6	B	17.0
Richmond Road	Between Croaker Road and Popular Creek	B	15.4	B	14.1	C	21.0	C	23.4
Croaker Road	Between Richmond Road and Rochambeau Drive	A	7.3	A	6.7	A	8.9	A	8.9
Croaker Road	Between Rochambeau Drive and I-64	A	10.8	A	8.7	A	8.5	A	10.3
Mooretown Road Extension	Between Lightfoot Road and Croaker Road	B	12.6	A	9.0	B	15.9	C	18.4

Table 5.5-3
Build (2040) Conditions - Two-Lane Segment Analysis (Class II)

		AM Peak		PM Peak	
Two-Lane Highway	Location	Segment LOS[1]	PTSF[2] (%)	Segment LOS[1]	PTSF[2] (%)
Lightfoot Road (SR 646)	Between Richmond Road and Mooretown Road	C	68.3	D	76.4

[1]*LOS – Level of Service*
[2]*PTSF – Percent Time Spent Following*

Table 5.5-4
Build (2040) Conditions - Ramps

	Intersection		Eastbound		Westbound		Northbound		Southbound		Worst		
	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Delay	LOS[1]	Approach	LOS[1]	Overall
AM													
Croaker Road & I-64 Westbound Ramps	4.7	A	15.8	C	9.4	A	-	-	-	-	EB	C	(EB-C)
Croaker Road & I-64 Eastbound Ramps	2.6	A	16.3	C	10.7	B	-	-	-	-	EB	C	(EB-C)
Mooretown Road & SR 199 Southbound Ramps	2.8	A	-	-	-	-	12.4	B	13.7	B	SB	B	(SB-B)
Mooretown Road & SR 199 Northbound Ramps	6.8	A	-	-	-	-	44.6	E	11.1	B	NB	E	(NB-E)
PM													
Croaker Road & I-64 Westbound Ramps	8.0	A	21.1	C	10.6	B	-	-	-	-	EB	C	(EB-C)
Croaker Road & I-64 Eastbound Ramps	3.6	A	21.3	C	10.6	B	-	-	-	-	EB	C	(EB-C)
Mooretown Road & SR 199 Southbound Ramps	2.1	A	-	-	-	-	16.0	C	25.6	D	SB	D	(SB-D)
Mooretown Road & SR 199 Northbound Ramps	20.1	C	-	-	-	-	183.5	F	31.3	D	NB	F	(NB-F)

[1]*LOS – Level of Service*

6.0 OPINION OF PROBABLE COST

Planning-level opinion of probable costs were determined using VDOT's Planning Estimate spreadsheet. Costs for each alternative are based on constructing a four-lane divided roadway with a sixteen-foot raised median and outside shoulders. Four-foot bike lanes would be marked on the shoulder. The costs for each alternative include a bridge over Skimino Creek. Sidewalks were not recommended due to anticipated low pedestrian demand for light industrial and industrial land use development as shown in the James City County Comprehensive Plan. As a result, sidewalks are not included in the construction costs, but costs are shown separately.

6.1 RIGHT-OF-WAY ESTIMATES

The study area is primarily rural and undeveloped, with few utilities. Most of the alternatives transect large parcels, so a minimal number of parcels are expected to be impacted. Therefore, in accordance with VDOT planning policies, right-of-way acquisition costs have been estimated as 25% of the construction costs.

6.2 CONSTRUCTION ESTIMATES

The estimated planning-level construction costs for each alternative is shown in Table 6.2–1 with the major design parameters affecting those costs. The estimated construction, mitigation, and right-of-way costs of each alternative are:

Table 6.2-1
Opinion of Probable Construction Costs

Design Parameters	Alt. 1	Alt. 2	Alt. 3
Bridge (linear feet)	400	320	350
Major Pipe/Box Culvert (linear feet)	1,375	510	450
Length (miles)	2.91	3.19	3.35
Total Right-of-Way Area Needed (ac)	45.8	51.6	50.9
Construction Cost	$ 50,400,000	$ 51,600,000	$ 53,100,000
Mitigation	$700,000	$75,000	$500,000
Right-of-way & Utilities	$12,600,000	12,900,000	$13,300,000
Total	*$ 63,700,000*	*$ 64,600,000*	*$ 66,900,000*

Adding five foot sidewalks along each side would increase construction costs $2,000,000 to $2,350,000.

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7.0 ALTERNATIVES EVALUATION

The alternatives were evaluated using a variety of measurable criteria. The evaluation considered social, economic, and environmental factors, as well as the roadway's ability to improve traffic flows within the study area. Impacts for each category are summarized in Table 7.0-1.

Impacted businesses were counted from active business entities which would lose operating area as a result of the right-of-way acquisition. Impacted residences were counted from residential parcels impacted to a point where their existing use would be altered.

The impacts to natural resources were measured based on the resources identified on the environmental features map. The critical resource impacts measured include areas of wetland impacts, and number and length of stream impacts. Economic impacts were measured both in terms of the developable acreage which would be opened by construction of the road, the length of the proposed road extension in the Economic Opportunity Area (EOA), and by the cost of right-of-way and construction. Construction of any of the alternatives will present social impacts in the disruption of businesses and residences, and were compared based on the number which would need to relocated or substantially impacted, and on the amount of right-of way acquisition required.

Table 7.0-1
Alternatives Comparison

Impact	Alternative 1 (Center)	Alternative 2 (West)	Alternative 3 (East)
Social Impacts			
Impacted - Businesses	0	2	0
Impacted – Residences Designated EO	0	4	0
Impacted – Residences Designated Rural Lands	2	0	4
Environmental Impacts			
Wetlands Impacted (ac)	3.5	1.4	4.25
Stream Crossings (USGS Blue Line)	4	4	3
Stream Impacts (lf)	1,177	480	852
Economic Impacts			
Developable acreage served (ac)	955	1085	825
Frontage in EOA (linear feet)	13,700	16,700	10,300
Total Right-of-Way (R/W) Area Needed (ac)	45.8	51.6	50.9
Construction Cost (inc. R/W and Mitigation)	*$ 63,700,000*	*$ 64,600,000*	*$ 66,900,000*

7.1 SOCIAL IMPACTS

As a new roadway alignment, the Mooretown Road Extension would require full right-of-way acquisition. All of the acquisition analyses are based on a 130-foot wide right-of way. Most of the land needed for the routes considered is either agricultural or wooded and undeveloped. These acquisitions would also have potential environmental impacts. Each of the alternatives would require some acquisitions from residential and business properties. All of the alternatives require right-of way from the Williamsburg Pottery properties, Hill Pleasant Farm, and the parcels at the southeast corner of Croaker Road and Rochambeau Drive. Intersection improvements at the intersection with Croaker Road, common to all alternatives, would impact a residential structure at 4392 Rochambeau Drive and would likely require a relocation. Alternative 2 and Alternative 3 would each require the relocation of three additional homes. Alternative 1 would require a total of two residential relocations, and the least amount of new right-of-way, impacting the fewest parcels. Alternate 2 would impact businesses more directly than the other alternatives, crossing through the American Heritage RV Park and the Drinkwater equine property, however both of these properties opted into and are currently designated Economic Opportunity. Alternative 3 requires right-of-way from the largest number of parcels. Most of the right-of-way required for Alternative 3 is located along the 7,600 linear feet of Rochambeau Drive that would be widened for this alternative.

The alternatives were developed to avoid churches, community property, and known, visible, historic architectural resources. However, this area is rich in history and only minimal archaeological investigations have been undertaken for this study. Additional archaeological investigations would be required as the road extension plans progress to the permitting stage, or if it receives state or federal funds to continue project development or construction.

Since Alternative 3 involves a long section of widening an existing roadway, it requires the least area of new right-of-way. Alternative 2 is the longest route, and is all on new alignment, therefore it will require the greatest amount of new right-of-way.

7.2 ENVIRONMENTAL IMPACTS

All alternatives must cross the main channel of Skimino Creek, which forms the boundary between York and James City Counties. This will be a substantial stream crossing and would likely require Individual Permits form the US Army Corps of Engineers (USACE) and the Virginia Department of Environmental Quality (VADEQ); crossings of smaller streams would also require permitting. All stream crossings would include two crossings of the 100 foot wide Resource Protection Areas (RPAs) which surround the streams. Alternatives 1 and 2 cross one more stream than Alternative 3, but at points further upstream, thereby reducing the total area of impacted streams and wetlands. Alternative 3 impacts the greatest area of wetlands, most of which are open water impacts associated

with merging to and widening of Rochambeau Drive where it abuts a pond. This pond has been identified as a potential habitat for Mabee's Salamander, a listed threatened species in Virginia. All three alternatives cross multiple streams and areas of potential small whorled pagonia (*Isotria medeoloides*) and northern long-eared bat (*Myotis septentrionalis*) habitat.

Wetlands near Rochambeau Drive

The land within the study area is primarily wooded and agricultural, with some residential development at the northern and eastern edges. Not surprisingly, most of the required right-of-way is wooded or agricultural. Alternative 1 encompasses the most wooded and agricultural land. Alternative 3 requires the least amount of wooded and agricultural land, but also requires the most right-of-way from residential parcels.

7.3 ECONOMIC IMPACTS

One of the primary purposes of the Mooretown Road Extension is to provide access to large developable parcels in the James City County Economic Opportunity overlay area and the York County Economic Opportunity zone. Section 3.0 of this report provides results of the land use and market analyses prepared for this study which researched development trends and possible uses in this area.

Each alternative brings improved access to different sections of the study area. With its central location, Alternative 1 provides the most direct connection between points outside the study area. It shortens travel times from all points within the study area to Humelsine Parkway or Croaker Road. The alignment divides the major parcels into large areas. The alignment of Alternative 2 is closest to the CSX railroad line, opening the potential for the largest development parcels on the Hill Pleasant Farm and neighboring Steven's properties, but leaves small wedges of property between the proposed road and the railroad. It also divides three properties near Peach Street into parcels which could be redeveloped if combined. Alternative 3 only provides improved access to the Hill Pleasant Farm and Williamsburg Pottery parcels.

As shown in Figure 7.1, each alignment alternative provides a different relationship to the Economic Opportunity Area as outlined in the both JCC and York County's comprehensive plans.

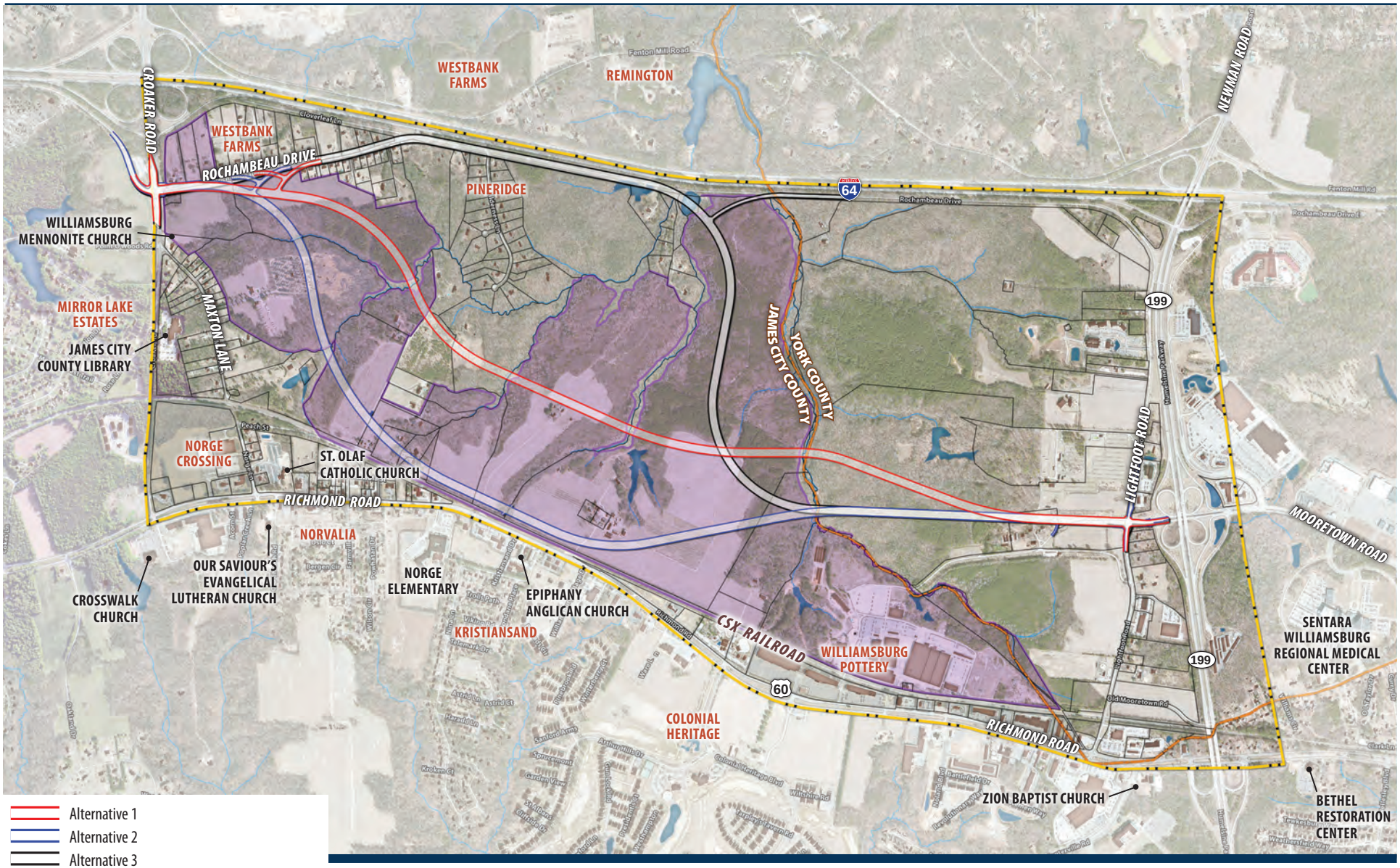

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FIGURE 7.1

Comprehensive Plan 2035 - Economic Opportunity Area and Alternatives 1-3

- Alternative 1 is the most centrally located of the alternatives, and with the irregular configuration of the Economic Opportunity Area (EOA), this alternative provides good access to the portion of the EOA just north of Skimino Creek, but not as strong access to the eastern portion of the EOA that is closer to Croaker Road.
- Alternative 2 is the most western located alternative, and while this alternative has a section running adjacent to the existing rail line, it also provides the most centrally located alignment through the overall EOA and therefore has the greatest linear footage within the EOA.
- Alternative 3 is the most eastern alignment and runs through only a portion of the EOA in the center of the study area.

7.4 TRANSPORTATION NETWORK IMPACTS

In addition to providing access to the property along the corridor, the Mooretown Road Extension is expected to attract through traffic from Rochambeau Drive, Richmond Road, and Humelsine Parkway. The development traffic will increase delay at the intersections on Croaker Road, but improve traffic conditions on Lightfoot Road. Overall, the Mooretown Road Extension will provide additional capacity to the area roadway network. This would be beneficial in carrying traffic diverted from I-64 or Richmond Road during emergency conditions or when incidents reduce the capacity of those roads. VDOT has identified a need for an improved alternate route in northern James City County should I-64 be used for one-way emergency evacuations. This would allow another route for emergency vehicles to travel in the opposite direction of the evacuation to assist those in need. Alternatives 1 and 2 provide the best routes for emergency traffic as they are more direct than Alternative 3.

7.5 PUBLIC COMMENT

Engaging the public during a planning process is a key element in contributing to a successful outcome. Understanding what the public envisions for their community, concerns they have, ideas, and providing them with an understanding of the market demands, environmental impacts, and transportation analysis for the area enables them to comment and understand the tradeoffs that may result in the delivery of a final project. During the Mooretown Road Extension planning process, the County and their consultant team facilitated both a series of smaller stakeholder meetings and three (3) public meetings for residents, business owners and other interested stakeholders to review the project information and provide feedback to the project team. These meetings provided an opportunity for presentation of information and dialogue between the stakeholders, the County and consultant team. The summary of the meetings is included below.

Small Group Stakeholder Meetings

This stakeholder meetings were held on March 31 and April 1, during the project initiation phase, before any Public Meetings were held. The intention of these meetings was to engage stakeholders with similar interests (residents, business owners, etc.) and gain an understanding of what they envisioned as the future of the area where the Mooretown Road Extension is proposed and what expectations they may have of such a project. Eight (8) small groups were identified: Nearby Business Interests, Emergency Services, Large Property Holders, Rochambeau Road Residents, Peach Street Residents, Pineridge Residents, Maxton Lane Residents, and Economic Development Directors. These groups were invited to send representatives to the small group meetings, and each group was represented during the focus group discussions.

Each group brought a unique perspective to the discussion of the potential roadway extension. Representatives of the Nearby Business Interests, Large Property Holders, and Economic Development Directors expressed support for the potential land development opportunities. Emergency Services representatives and Rochambeau Road residents described the traffic backups that occur on Rochambeau Drive, especially when there are traffic incidents on I-64. The Peach Street residents, and Pineridge residents voiced concern over potential impacts to their neighborhoods and property.

7.5.1 Public Meetings

The three (3) public meetings were held during the process for residents, business owners and other interested stakeholders to review the project information and provide feedback to the County and consultant team. Each of these meetings was attended by 28 to 50 people and provided valuable feedback to the team regarding citizen concerns and ideas about the corridor. Summaries of each meeting are below.

Public Meeting #1

This meeting was held on the evening of April 29, 2014 at the Croaker Road Library in James City County and provided an introduction to the project. The primary goals for this initial meeting were to inform the public about the process, solicit feedback and gain a general understanding of the public's view on this project. The general sentiment received during the meeting was a mix of those in favor and those against the idea of extending Mooretown Road. Some individuals opposed the road due to impacts to their properties and the natural environment and favored improving existing facilities before building a new one; others felt the project could benefit a specific set of landowners and potentially benefit economic development in the area. Overall the public provided good feedback for guiding the planning and development process for the project.

Public Meeting #2

This meeting was held on the evening of October 20, 2014 at Norge Elementary School and provided the public with three alternative alignments that had been developed by the County and consultant team. The goal of the meeting was to gather feedback from the community on these alternative alignments. Along with a presentation the community participating in review and comment through several activities and discussions. The activities included voting on which alignment was their preferred concept, voting on typical section concepts, and identifying the public's priorities and ideas for development along the proposed extension. Based on the feedback from the participants, their preferred alternative alignment was Alternative 1, followed by Alternative 2, including curb and gutter with a shared use path along the corridor. Most people prioritized protection of natural resources and encouraging development of the area. Additionally, most people felt that no development or maintenance of the existing rural residential nature of the area was ideal for future development; but if development was to occur, a mix of uses (commercial and residential) would be ideal.

Public Meeting #3

This meeting was held on the evening of March 12, 2015 at Toano Middle School and included a presentation describing the preferred alignment and provide more information about this alignment. The recommended alternative received a mixed review from the community. Many said they preferred Alternative #2 and said that Alternative #1 would not offer the most development opportunities for the area. Some attendees did note that this alignment did minimize the environmental impacts. There were suggestions made to change the alignment or project approach slightly for varying interests; however, there were still a number of citizens present that felt strongly the project should not be built at all.

In summary, including the public during the project planning process allows the project team to consider specific comments and interests that may otherwise be unknown throughout the project duration. It is important to balance these opinions and interests with the overall benefit that a project would have for the community and region as a whole. More detailed summaries of the public meeting activities and comments can be found in Appendix E.

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8.0 RECOMMENDATIONS

8.1 RECOMMENDED ALTERNATIVE

After consideration of public comments, the environmental impacts, and potential to improve access to the Economic Opportunity areas, Alternative 2 was selected as the Recommended Alternative. Alternative 2 provides a number of benefits including avoiding and minimizing the impacts to the existing streams and wetlands, and providing the greatest amount of access to the EOA. By locating the roadway along this alignment, Alternative 2 has the least impact to the sensitive environmental resources associated with Skimino Creek and other tributaries within the study area. A comparison summary of these impacts is included in Table 7.0 - 1. This alternative also provides the best and most extensive access into the Economic Opportunity Areas (EOA). The alignment provides 16,700 linear feet of access to the EOA compared to 13,700 linear feet and 10,300 linear feet for Alternatives 1 and 3. The Recommended Alternative (Alternative 2) is shown in Figure 8.1.

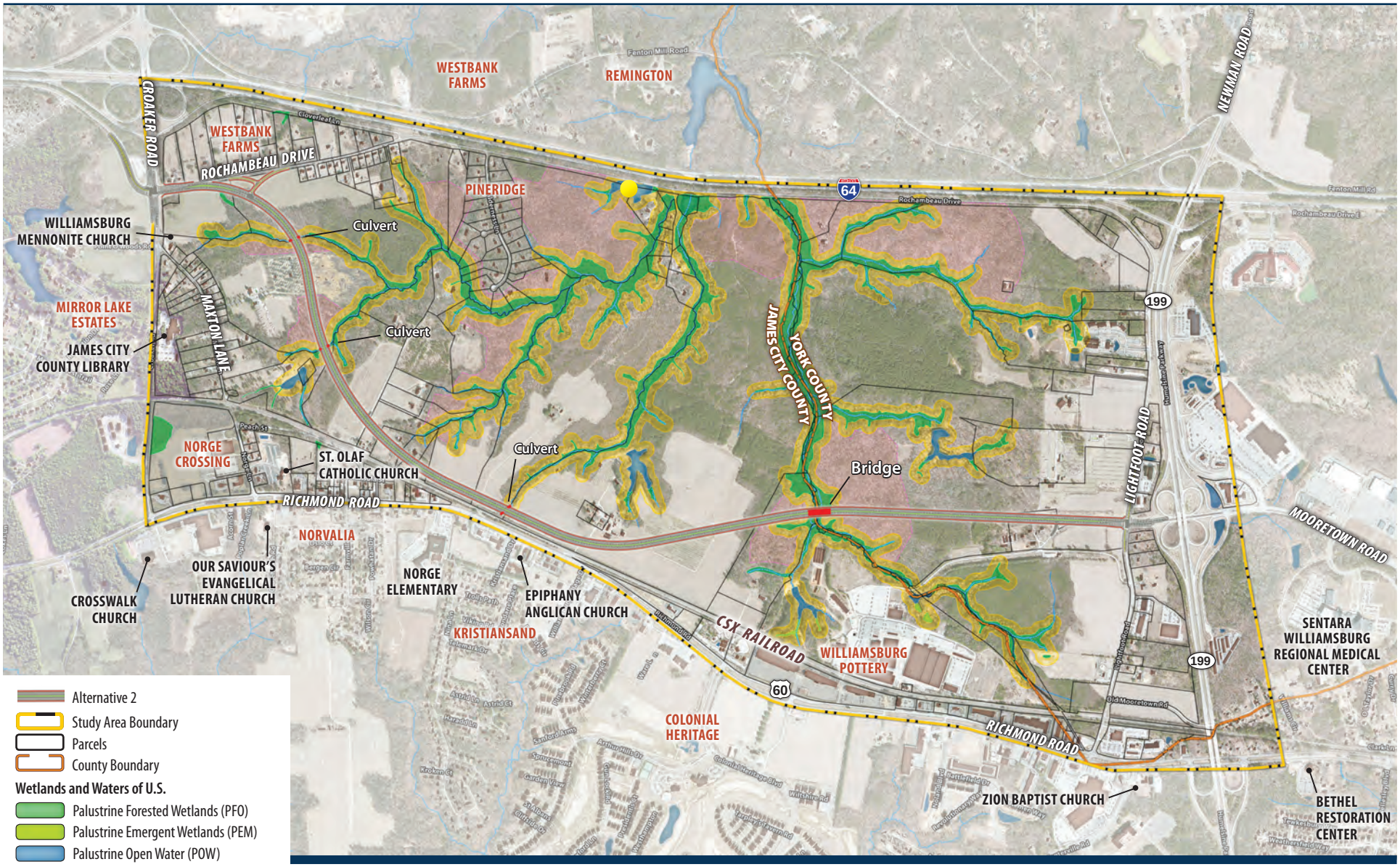
8.2 RECOMMENDED TYPICAL SECTION

The typical cross-section for the Mooretown Road Extension should provide adequate capacity for the traffic forecasted as a result of future development and growth, as well as providing a more direct route, and a less congested alternative route for some users, saving them travel time. It should also provide flexibility with other modes of travel. The ultimate typical section would need to provide capacity for up to 25,500 vehicles per day. This will require four through-lanes of traffic, two in each direction.

A raised median is recommended for safety and access management. The median should be wide enough to accommodate left-turn lanes, and could be narrowed at the approaches to provide a single bridge or the width would be maintained for dual two-lane bridges. This would be evaluated based on surrounding development and a cost analysis.

The existing section of Mooretown Road south of East Rochambeau Drive includes bike lanes on the shoulder. The bike lanes should be continued along the proposed extension to provide continuity for users. Paved shoulders are a recognized provision for pedestrians in areas with low pedestrian volumes. The need for sidewalks would be evaluated as the project develops and would be dependent on the type of land use developed in the study area. If sidewalks are included with the recommended typical section, they should be constructed offset from the roadway and separated from the bike lanes and roadway shoulder by the roadside ditches, or swales. This separation and swales would provide a distance clear of the roadway adding pedestrian comfort and safety, and the swales could be incorporated into the roadway's stormwater management plan.

The Recommended Typical Section is shown on Figure 8.2.

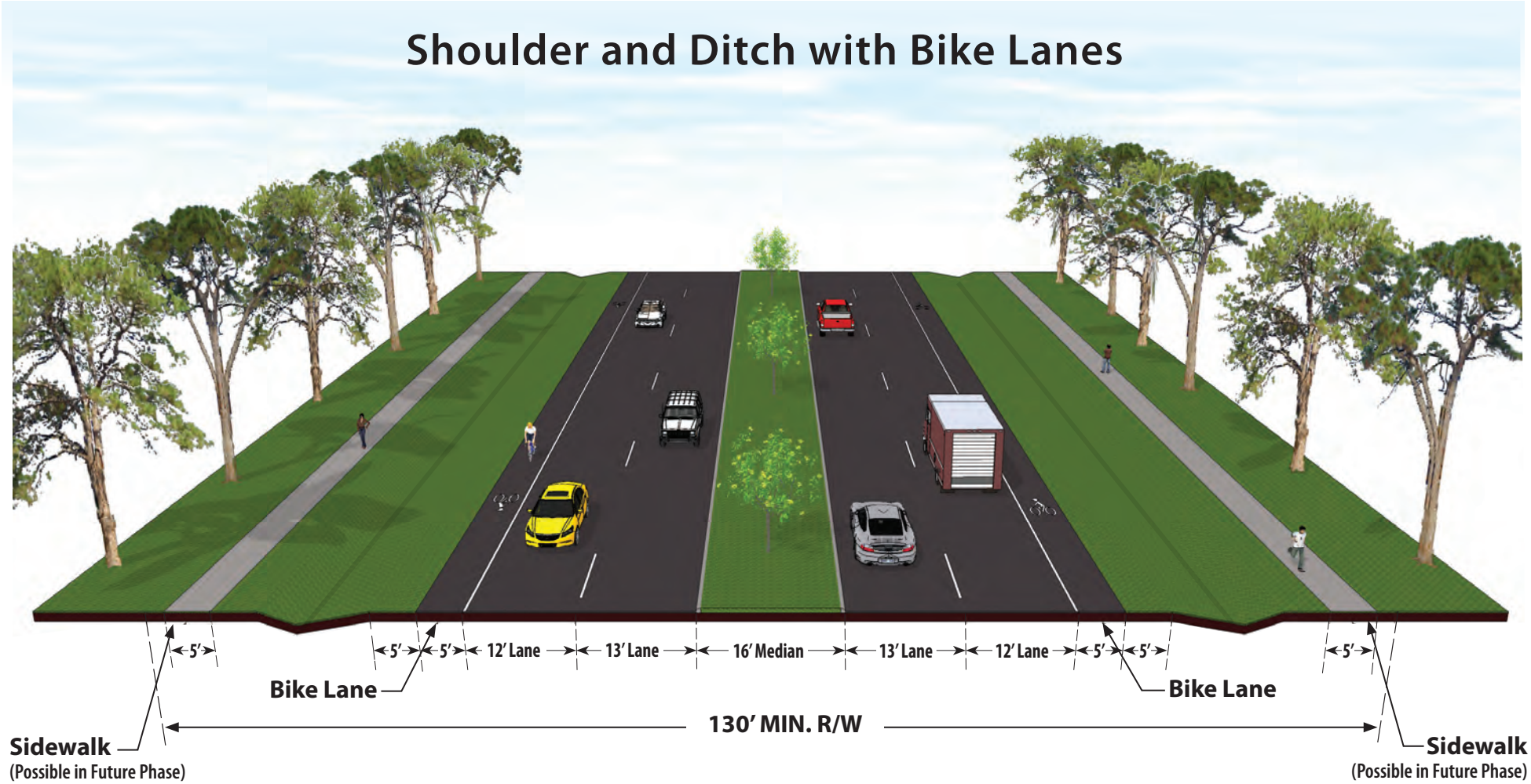


Mooretown Road Extension Corridor Study

James City County and York County, Virginia

FIGURE 8.1

Recommended Alternative



Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 8.2
Recommended Typical Section

8.3 RECOMMENDED DESIGN DETAILS

8.3.1 Stormwater Management

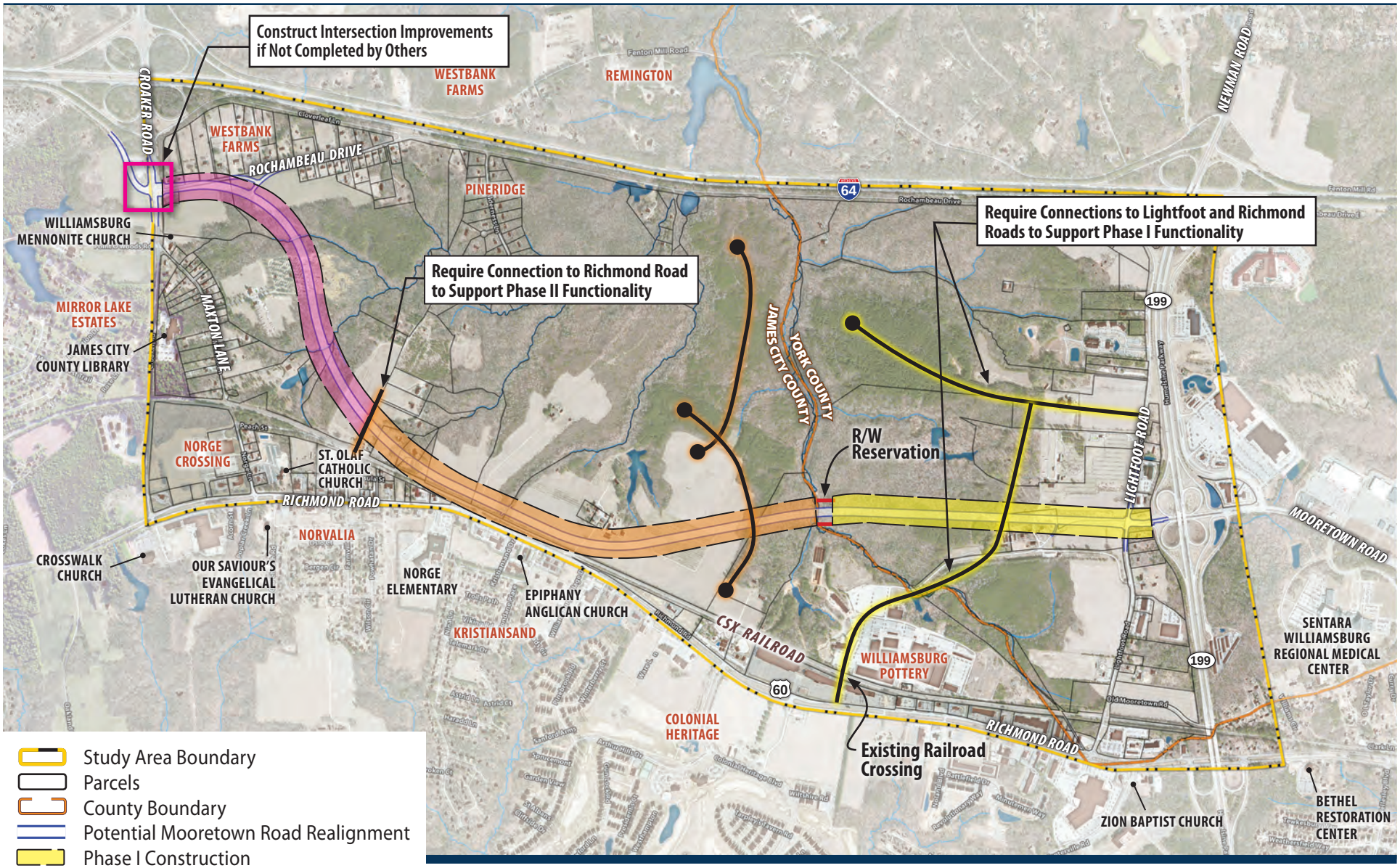
All development in southeast Virginia shall consider the impacts of increased stormwater runoff and the potential pollution of water ways and groundwater during construction and after the installation of pavement and roofs. James City County and York County require that stormwater runoff rates be maintained at or below pre-development rates.

The upland areas of the study area contain several large areas with soils noted to have moderately high to moderate infiltration rates. These are suitable for infiltration based stormwater treatment systems. These areas are highlighted in Figure 8.3. Infiltration based treatment systems reduce runoff rates and provide pollutant reduction. Infiltration based systems include enhanced roadside swales. Dry Swales are also ideal for linear projects. Other opportunities for water quality treatment would be in some of the smaller eroding swales adjacent to the proposed road alignment. These areas present a good opportunity for Regenerative Stormwater Conveyance Systems (RSC) per the DEQ BMP Clearinghouse Specification #10 which provide stabilization to the intermittent ditches will encouraging stormwater infiltration through a linear infiltration step pool system. These systems could potentially provide a 75% phosphorous removal efficiency. Based on the preliminary assessment of the soils, geomorphic, and environmental setting, the proposed alignment alternative has numerous best management practice opportunities to provide runoff reduction and nutrient reduction.

The majority of the streams in the study area are stable and show minimal signs of active erosion. However there are several reaches that are eroding and are candidates for stream restoration. Under current Virginia guide lines, stream restoration can be used to provide storm water pollution reduction. The candidate areas are also illustrated in Figure 8.3

8.3.2 Pavement

Typical pavement sections for anticipated traffic loadings on the Mooretown Road Extension are detailed in Table 8.3.2-1. These recommendations are based on subgrade conditions typical of James City County. Several options are presented to account for the anticipated range of truck percentages and total traffic volumes on the roadway. A thorough geotechnical evaluation should be conducted prior to final design of the proposed extension.



Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 8.4
Potential Developer Led Phasing

Table 8.3.2-1
Recommended Pavement Sections

Section	% Heavy Commercial Vehicles	Hot Mix Asphalt			Aggregate Base[1]	Subgrade[2]
		Surface	Intermediate	Base		
Mooretown Extension with ADT up to18,660 vpd	5	1.5	2	6	8	Stable and Compacted
Mooretown Extension with ADT up to25,500 vpd	5	2	2	6	8	Stable and Compacted
Mooretown Extension with ADT up to18,660 vpd	10	2	2	7	8	Stable and Compacted
Mooretown Extension with ADT up to25,500 vpd	10	2	2	7.5	8	Stable and Compacted

1 - VDOT Type 21-A, compacted to a dry density of at least 100% of the Standard Proctor maximum dry density (ASTM D 698).
2 - Compacted to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D 698).

8.3.3 Environmental Protection and Permitting

Any plan to extend Mooretown Road into James City County will require environmental permits from the US Army Corps of Engineers (USCOE) and the Virginia Department of Environmental Quality (DEQ) to cross Skimino Creek. Due to the extent of wetland impacts that will be associated with the total project, an individual permit (IP) would most likely be required. During the permitting phase, updated environmental and cultural impact assessments would be required. It is possible for the Recommended Alternative to be approved through a State Program General Permit as a result of the lower stream and wetland impacts. However, this would be evaluated further after detailed designs have determined the final impacts.

8.3.4 Transportation Interconnections

The degree of interconnectivity between transportation features will depend on the land uses ultimately developed within the study area. Larger parcels such as the Hill Pleasant Farm and Williamsburg Pottery properties may be subdivided into smaller parcels or planned as one large development. The developer of these parcels would provide roads within their development to access the proposed Mooretown Road Extension and other adjacent roads regardless of whether they are building neighborhood streets or commercial access roads. These developments may result in the opportunity for local connector roads between the proposed Extension and other sections of Lightfoot Road or Rochambeau Drive.

As these road networks are planned, consideration should be given to whether the existing railroad crossings would be allowed to be maintained or improved. Typically, railroad companies have been very restrictive on allowing improvements to existing at-grade crossings and hesitant to allow a new at-grade crossing. In recent years they have been focused on eliminating at-grade crossings. Extensive coordination and approvals would be necessary with CSX Railroad for any roadway improvements crossing the railroad.

Williamsburg Pottery railroad crossing

The main Williamsburg Pottery entrance crossing and the Peach Street crossing have potential to provide interconnections between Richmond Road and the Mooretown Road Extension at a safe grade and with minimal improvements. The main Williamsburg Pottery railroad crossing is already gated, although currently the Williamsburg Pottery has blocked access for the general public. This crossing provides direct access to an existing traffic signal on Richmond Road.

The Peach Street railroad crossing is minor and is not gated. The crossing allows property owners access to several properties. It is at a relatively flat grade, is a perpendicular crossing, and could be improved to connect to Richmond Road. The viability of improving this crossing depends on approval of CSX Railroad, and how it would benefit the

potential development. Any development with access to this railroad crossing would introduce more traffic and require a gated crossing.

Peach Street railroad crossing

The crossings serving the Stevens' property, the Hill Pleasant Farm property, and the northern portion of the Williamsburg Pottery should be closed to the public if Mooretown Road is extended and the properties developed. It is likely CSX may require closing of an at-grade crossing for the approval of improving others. This would be the appropriate one to close as a result of its close distance and grade differential between Richmond Road and the railroad. A public roadway could not be constructed to meet current standards without major realignment of Richmond Road or the railroad, neither of which is reasonable to maintain this crossing. The recommended alternative would provide alternate, and improved access to the properties now using this crossing.

Hill Pleasant Farm railroad crossing

The northern Williamsburg Pottery railroad crossing is a driveway crossing used mainly for access to a couple of residences and farming activities. This location would not be a good candidate for a potential connection to Richmond Road. It is not a crossing likely to be approved by CSX for upgrading to a public roadway. In addition, it would require right-of-way acquisition, would impact the Williamsburg Pottery buildings, and the resulting intersection with Richmond Road would need to remain unsignalized as the spacing to existing traffic signals is too close.

8.3.5 Phasing

Under the current roadway financing guidelines, the Mooretown Road Extension is most likely to be constructed by developers seeking access to parcels along the road. This could result in a phased development of Mooretown Road, but the

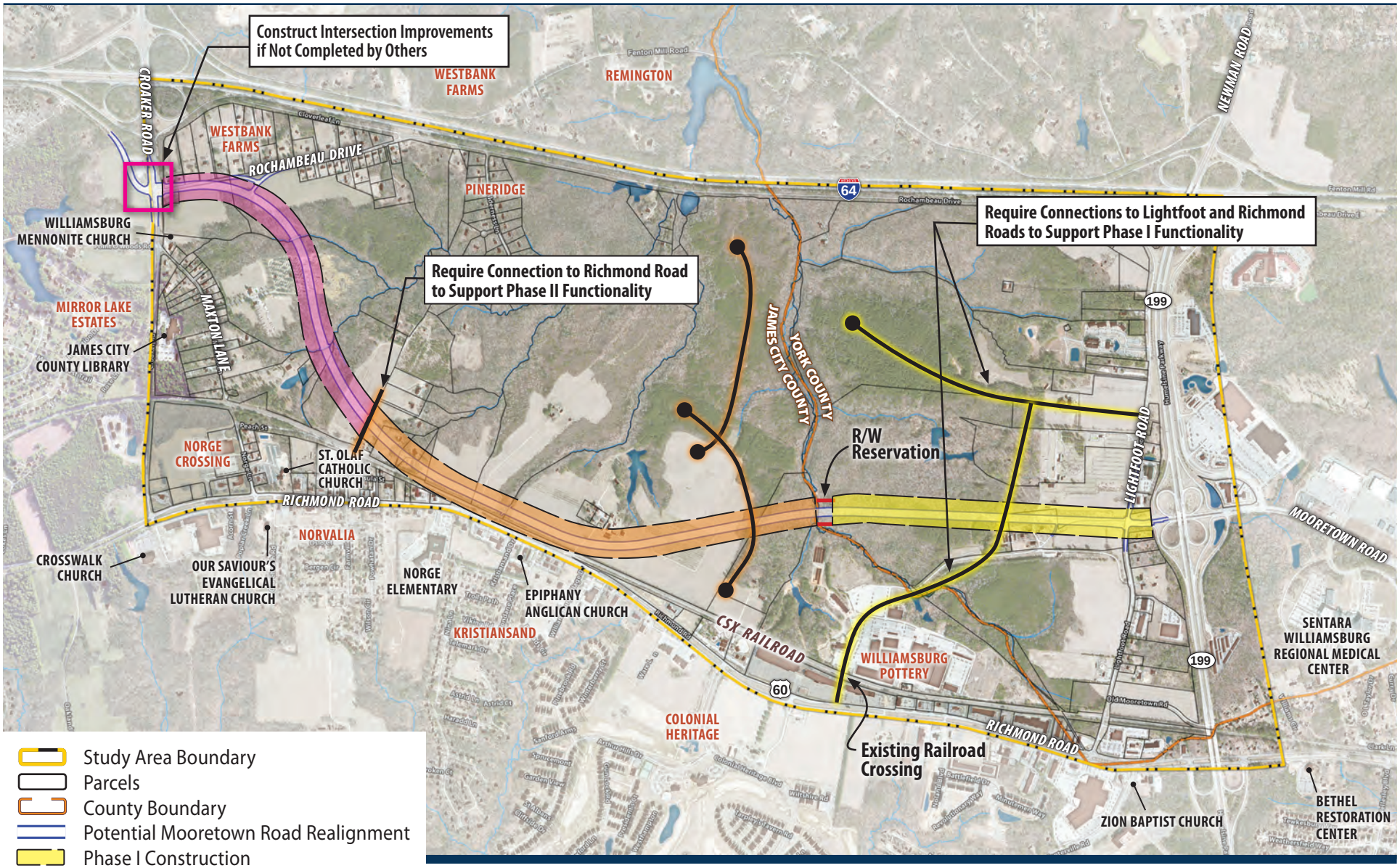
phasing would all depend on the developer's interest in certain properties, the type of development, required access, and many other factors. Based on the current configuration and ongoing planning for development, it is anticipated that the phasing would begin on the southern end where Mooretown Road currently terminates. A potential phasing pattern is illustrated in Figure 8.4.

The planning for development of these parcels should include construction of the appropriate portion of Mooretown Road, right-of-way reservations to the adjoining parcels, and construction of other roadway interconnections. These interconnections will be important as the road is only partially completed so the extension is not just a cul-de-sac but provides alternative connections to adjacent roads. The potential first phase includes construction of a local road which would interconnect to Richmond Road across the existing railroad crossing and another which would connect to Lightfoot Road near the Colonial Crossings timeshare entrance.

The potential second phase would require construction of the bridge over Skimino Creek. Interconnections to Rochambeau Drive are not recommended due to the expansive areas of wetlands which would need to be crossed. Peach Street could provide a good terminus for the second phase as it could end construction at a “T” intersection and provide interconnectivity of the partially completed road.

The final phase would complete the corridor. The required intersection improvements at Croaker Road and Rochambeau Drive may be constructed earlier, as they have been proffered as part of the Stonehouse development plan.

Another consideration in phasing of the Mooretown Road Extension relates to the project likely occurring in advance of full development of the Economic Opportunity properties which surround it. Although four travel lanes of traffic would ultimately be needed along the entire route at full development, initially two lanes would be adequate if funding is not available for the ultimate typical cross-section. However, most intersections would still need dedicated turn lanes. If only two lanes are to be constructed initially, sufficient right-of-way should be acquired or reserved for the full four-lane typical section and the two-lane section should be designed to accommodate the four-lane section. In addition, crossing drainage pipes and culverts should be constructed to accommodate the four-lane roadway, and bike lanes, and if the development warrants, sidewalks, should be included. The initial permitting effort should also address the ultimate build-out of the roadway.



Mooretown Road Extension Corridor Study
James City County and York County, Virginia

FIGURE 8.4
Potential Developer Led Phasing

9.0 CONCLUSIONS

The Mooretown Road Extension would provide vehicle access to several large parcels of land that have been designated for economic development in both James City County and York County. Extending the road into James City County would require crossing a significant stream at Skimino Creek, probably with a bridge. Extending the road the remaining distance to Croaker Road requires several other stream crossings and impacts to existing residential and commercial properties, the extent of which would vary with the road alignment chosen.

The recommended alternative provides access to the greatest number of economic opportunity parcels while minimizing impacts to streams, wetlands, Resource Protection Areas, and potential small whorled pagonia habitat. This alternative would satisfy the transportation needs of future economic development.

Phased construction of two lanes of an ultimate four-lane facility is recommended for economy of construction and to reduce the immediate environmental impacts. However, if forecasted traffic from planned development warrants a four-lane roadway it should be constructed initially. It is understood that development will determine when and how much of the proposed roadway would be constructed, likely in segments as development grows through the area.

Although the Mooretown Road Extension has been under consideration for many years, many steps would be required before construction could commence. In the current climate of slow real estate development and tight competition for public construction dollars, this process is unlikely to continue. However, should a developer come forth in the near future with a proposal for these economic opportunity zones, this report can be used as a guideline for extending Mooretown Road as the connector road through the region.

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REFERENCES

[1] http://gowata.org/Pages/busroutes.html, April 23, 2015

[2] http://www.virginiadot.org/projects/fxn_class/maps.asp, April 28, 2015

[3] http://www.extranet.vdot.state.va.us/locdes/Electronic_Pubs/2005%20RDM/appenda.pdf , March 13, 2015, p A-13

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APPENDICES

Appendix A	**Traffic Analysis Output**
Appendix B	**Geotechnical Considerations Memo**
Appendix C	**Cultural Resource Report**
Appendix D	**Market Analysis Report**
Appendix E	**Public Involvement Summaries**

APPENDIX A
Traffic Analysis Output

Existing Conditions
(2014)

Table A-1
Intersection Data Collection Summary

Intersection Name	Source	Count Date	Approach	Growth Rate	2014 Forecast Methodology*
I-64 Westbound Ramps & Croaker Road	I-64 EIS (Appendix B, Figure 1 & 2, Base Year, Sheet 4 of 7)	2011	NB	-	Based on the straight-line growth rate between 2011 and 2040 EIS volumes (Appendix G, Figure 1 & 2, 2040 Build Alt 1, Sheet 4 of 7)
			SB	-	
			EB	-	
			WB	-	
I-64 Eastbound Ramps & Croaker Road	I-64 EIS (Appendix B, Figure 1 & 2, Base Year, Sheet 4 of 7)	2011	NB	-	Based on the straight-line growth rate between 2011 and 2040 EIS volumes (Appendix G, Figure 1 & 2, 2040 Build Alt 1, Sheet 4 of 7)
			SB	-	
			EB	-	
			WB	-	
Rochambeau Drive & Croaker Road	I-64 EIS (Appendix B, Figure 1 & 2, Base Year, Sheet 4 of 7)	2011	NB	-	Based on the growth rate between 2011 and EIS volumes and 2017 CVS TIA Build Volumes
			SB	-	
			EB	-	
			WB	-	
Point O Woods & Croaker Road	2014 VDOT Count	2/6/2014	NB	-	No Growth (2014 counts)
			SB	-	
			EB	-	
			WB	-	
Richmond Road & Croaker Road	CVS TIA (Figure #6) and 2014 VDOT Count	2010	NB	0.00%	The 2010 volumes were grown at model rates, 2014 volumes applied to driveway volumes
			SB	1.64%	
			EB	1.45%	
			WB	2.19%	
Richmond Road & Lightfoot Road	Lightfoot Marketplace	4/16/2013	NB	1.64%	The volumes obtained from Lightfoot Marketplace were grown at model rates between 2013 and 2014
			SB	1.64%	
			EB	2.33%	
			WB	1.98%	
Williamsburg Pottery Road & Lightfoot Road	Mooretown Road Data from York County	5/1/2008	NB	1.64%	The 2008 volumes were grown at model rates between 2008 and 2014, eastbound volumes reduced to reflect closure of Pottery driveway
			SB	1.64%	
			EB	0.00%	
			WB	0.90%	
Mooretown Road & VA 199 Southbound Ramps	Mooretown Road Data from York County	5/1/2008	NB	1.19%	The 2008 volumes were grown at model rates between 2008 and 2014
			SB	0.94%	
			EB	0.90%	
			WB	0.90%	
Mooretown Road & VA 199 Northbound Ramps	Mooretown Road Data from York County	5/1/2008	NB	1.19%	The 2008 volumes were grown at model rates between 2008 and 2014
			SB	0.94%	
			EB	0.90%	
			WB	0.90%	

** After counts were projected to 2014 volumes, intersection balancing adjustments were made to reduce discrepancies between closely spaced intersections.*

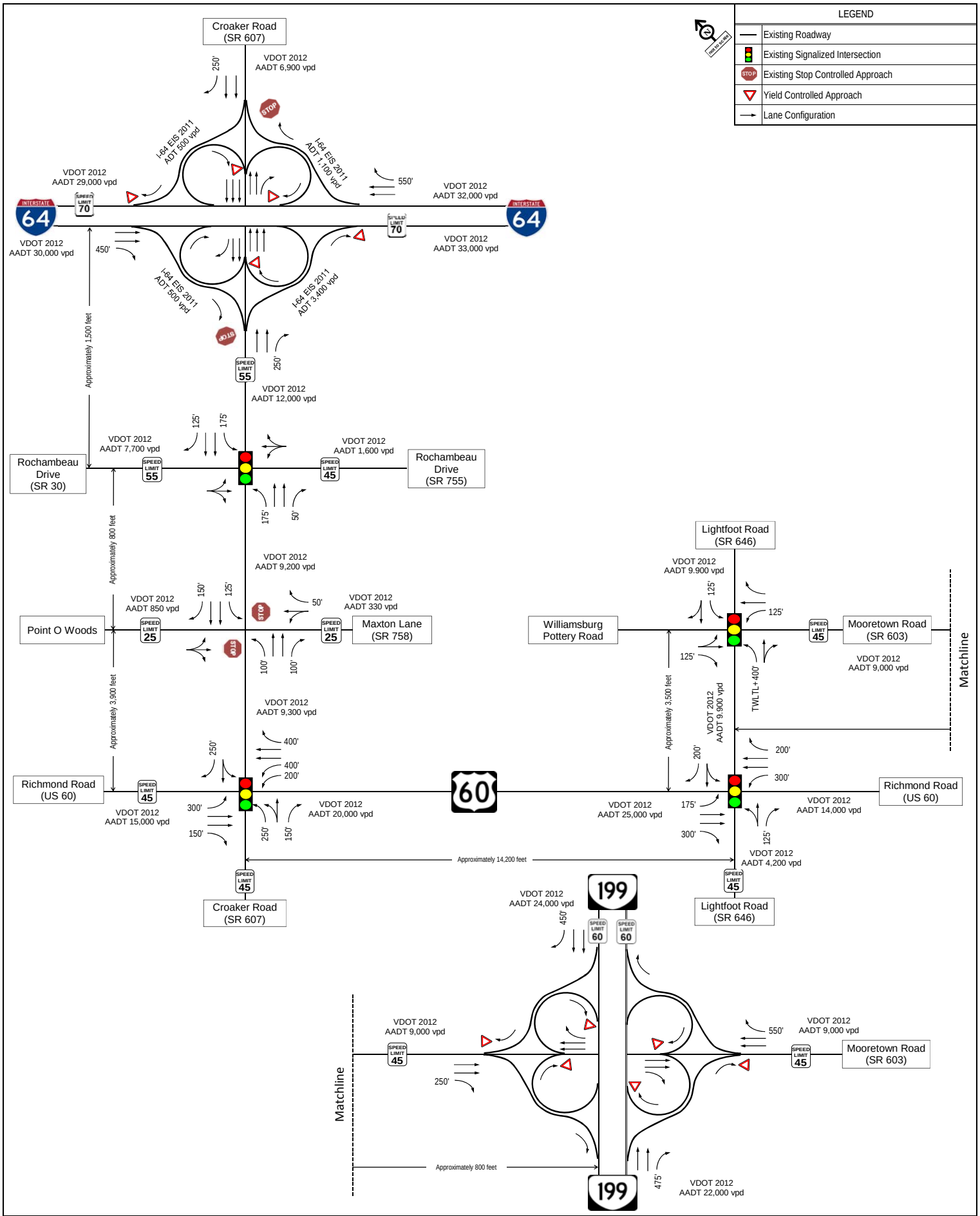


Figure A-1
Existing (2014) Lane Configurations and Traffic Control

Mooretown Road Corridor Study
Williamsburg, VA

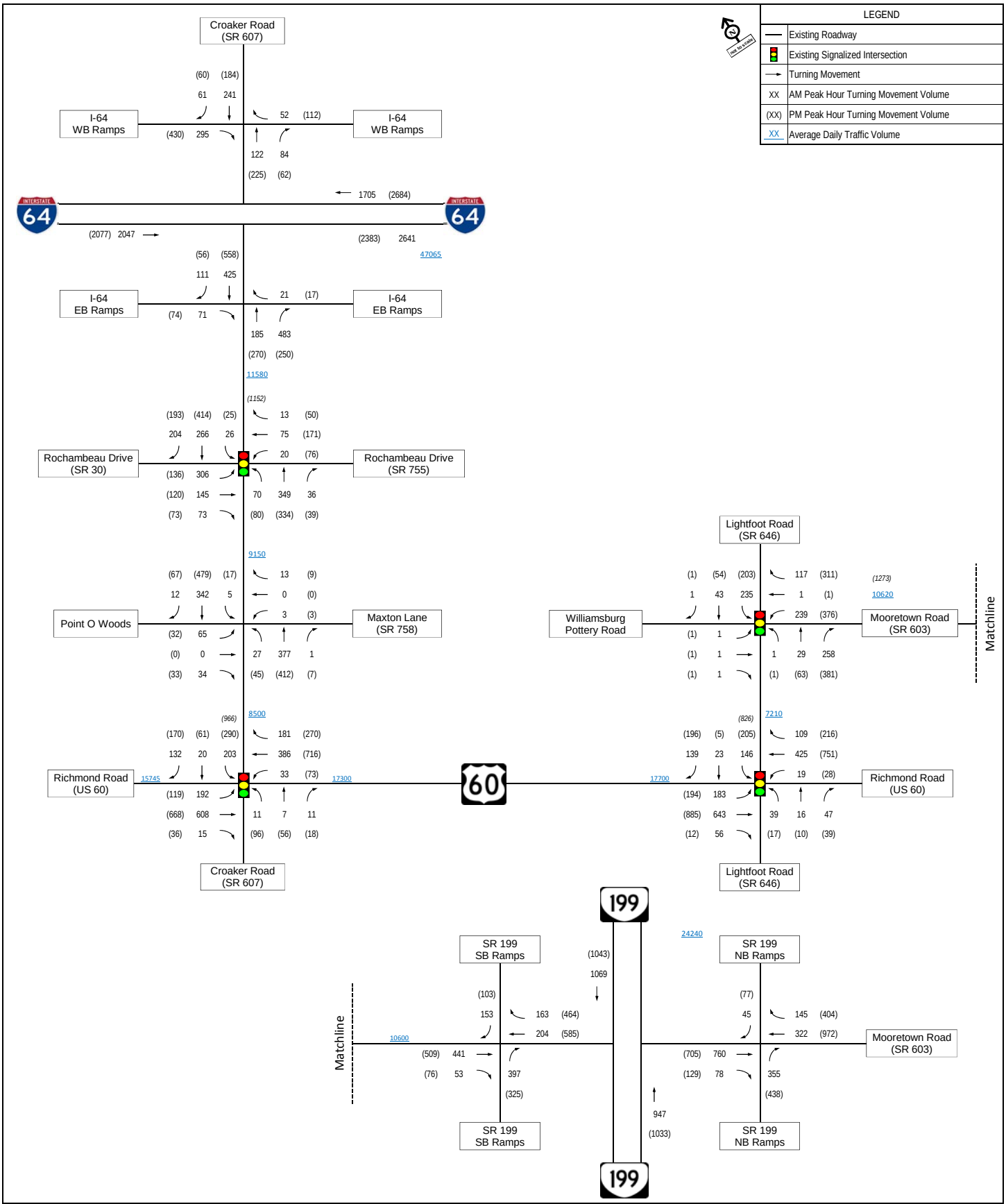


Figure A-2
Existing (2014) AM and PM Peak Hour Turning Movement Volumes

Mooretown Road Corridor Study
Williamsburg, VA

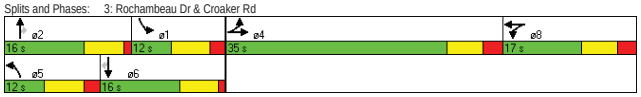
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	306	145	73	20	75	13	70	349	36	26	266	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	175		50	175		125
Storage Lanes	0		0	0		0	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.981			0.984				0.850			0.850
Flt Protected		0.972			0.991		0.950			0.950		
Satd. Flow (prot)	0	1759	0	0	1799	0	1736	3471	1553	1736	3471	1553
Flt Permitted		0.972			0.991		0.950			0.950		
Satd. Flow (perm)	0	1759	0	0	1799	0	1736	3471	1553	1736	3471	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			7				31			283
Link Speed (mph)		45			55			55			55	
Link Distance (ft)		763			1413			845			689	
Travel Time (s)		11.6			17.5			10.5			8.5	
Peak Hour Factor	0.81	0.81	0.81	0.69	0.69	0.69	0.91	0.91	0.91	0.72	0.72	0.72
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	378	179	90	29	109	19	77	384	40	36	369	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	647	0	0	157	0	77	384	40	36	369	283
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			36			36	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	17.0	17.0		17.0	17.0		12.0	16.0	16.0	12.0	16.0	16.0
Total Split (s)	35.0	35.0	0.0	17.0	17.0	0.0	12.0	16.0	16.0	12.0	16.0	16.0
Total Split (%)	43.8%	43.8%	0.0%	21.3%	21.3%	0.0%	15.0%	20.0%	20.0%	15.0%	20.0%	20.0%
Maximum Green (s)	28.0	28.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Yellow Time (s)	4.5	4.5		4.5	4.5		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.5	2.5		2.5	2.5		2.0	1.0	1.0	2.0	1.0	1.0
Lost Time Adjust (s)	-1.0	-3.0	-3.0	-1.0	-3.0	-1.0	-3.0	-2.0	-2.0	-3.0	-2.0	-2.0
Total Lost Time (s)	6.0	4.0	1.0	6.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag							Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		2.0	5.0	5.0	2.0	5.0	5.0
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)		30.3			13.1		8.1	14.4	14.4	8.1	12.1	12.1
Actuated g/C Ratio		0.39			0.17		0.11	0.19	0.19	0.11	0.16	0.16
v/c Ratio		0.92			0.50		0.42	0.59	0.13	0.20	0.67	0.59
Control Delay		44.1			35.3		41.7	34.6	15.2	36.0	38.6	9.8
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		44.1			35.3		41.7	34.6	15.2	36.0	38.6	9.8
LOS		D			D		D	C	B	D	D	A
Approach Delay		44.1			35.3			34.1			26.7	
Approach LOS		D			D			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 76.8
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 34.9 Intersection LOS: C
Intersection Capacity Utilization 59.5% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: Rochambeau Dr & Croaker Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	65	0	34	3	0	13	27	377	1	5	342	12
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.73	0.73	0.73	0.67	0.67	0.67	0.77	0.77	0.77	0.78	0.78	0.78
Hourly flow rate (vph)	89	0	47	4	0	19	35	490	1	6	438	15
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											845	
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	766	1012	219	838	1026	245	454			491		
vC1, stage 1 conf vol	451	451		560	560							
vC2, stage 2 conf vol	315	561		279	467							
vCu, unblocked vol	596	861	7	673	876	245	259			491		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	80	100	95	99	100	97	97			99		
cM capacity (veh/h)	449	366	994	383	360	753	1196			1055		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	136	24	35	245	245	1	6	219	219	15
Volume Left	89	4	35	0	0	0	6	0	0	0
Volume Right	47	19	0	0	0	1	0	0	0	15
cSH	553	926	1196	1700	1700	1700	1055	1700	1700	1700
Volume to Capacity	0.25	0.03	0.03	0.14	0.14	0.00	0.01	0.13	0.13	0.01
Queue Length 95th (ft)	24	2	2	0	0	0	0	0	0	0
Control Delay (s)	13.6	10.8	8.1	0.0	0.0	0.0	8.4	0.0	0.0	0.0
Lane LOS	B	B	A				A			
Approach Delay (s)	13.6	10.8	0.5				0.1			
Approach LOS	B	B								

Intersection Summary

Average Delay	2.1			
Intersection Capacity Utilization	36.1%	ICU Level of Service	A	
Analysis Period (min)	15			

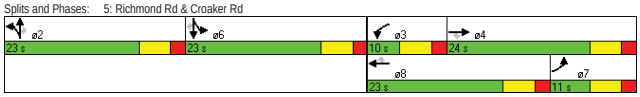
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	608	15	33	386	181	11	7	11	203	20	132
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		150	350		400	250		150	0		250
Storage Lanes	1		1	2		1	1		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.990			0.957	
Satd. Flow (prot)	1752	3505	1568	3400	3505	1568	1649	1718	1553	0	1748	1553
Flt Permitted	0.950			0.950			0.950	0.990			0.957	
Satd. Flow (perm)	1752	3505	1568	3400	3505	1568	1649	1718	1553	0	1748	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			16			197			12			143
Link Speed (mph)		45			45			30			55	
Link Distance (ft)		924			1194			582			3354	
Travel Time (s)		14.0			18.1			13.2			41.6	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	209	661	16	36	420	197	12	8	12	221	22	143
Shared Lane Traffic (%)							18%					
Lane Group Flow (vph)	209	661	16	36	420	197	10	10	12	0	243	143
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		45			50			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	23.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	11.0	24.0	24.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (%)	13.8%	30.0%	30.0%	12.5%	28.8%	28.8%	28.8%	28.8%	28.8%	28.8%	28.8%	28.8%
Maximum Green (s)	5.0	18.0	18.0	4.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Max	Max	Max	None	None	None
Act Effct Green (s)	6.3	20.9	20.9	5.0	15.2	15.2	18.1	18.1	18.1		15.3	15.3
Actuated g/C Ratio	0.08	0.28	0.28	0.07	0.20	0.20	0.24	0.24	0.24		0.20	0.20
v/c Ratio	1.41	0.68	0.04	0.16	0.59	0.42	0.03	0.02	0.03		0.68	0.33
Control Delay	251.7	30.1	11.9	36.8	31.2	7.2	24.4	24.4	13.3		38.6	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	251.7	30.1	11.9	36.8	31.2	7.2	24.4	24.4	13.3		38.6	7.4
LOS	F	C	B	D	C	A	C	C	B		D	A
Approach Delay		82.1			24.3			20.3			27.0	
Approach LOS		F			C			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 75.1
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.41
Intersection Signal Delay: 50.9 Intersection LOS: D
Intersection Capacity Utilization 52.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Richmond Rd & Croaker Rd



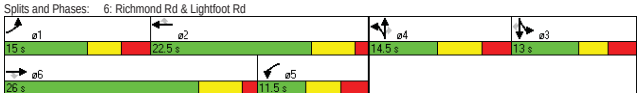
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	183	643	56	19	425	109	39	16	47	146	23	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	175		300	300		200	0		125	0		200
Storage Lanes	1		1	1		1	0		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950				0.966			0.959	
Satd. Flow (prot)	1752	3505	1568	1752	3505	1568	0	1782	1568	0	1769	1568
Flt Permitted	0.950			0.950				0.966			0.959	
Satd. Flow (perm)	1752	3505	1568	1752	3505	1568	0	1782	1568	0	1769	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			68			158			81			178
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		2866			884			391			2806	
Travel Time (s)		43.4			13.4			5.9			42.5	
Peak Hour Factor	0.82	0.82	0.82	0.69	0.69	0.69	0.58	0.58	0.58	0.78	0.78	0.78
Adj. Flow (vph)	223	784	68	28	616	158	67	28	81	187	29	178
Shared Lane Traffic (%)												
Lane Group Flow (vph)	223	784	68	28	616	158	0	95	81	0	216	178
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		50			50			12			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			3
Detector Phase	1	6	6	5	2	2	4	4	4	3	3	3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.5	21.0	21.0	11.5	21.0	21.0	14.5	14.5	14.5	13.0	13.0	13.0
Total Split (s)	15.0	26.0	26.0	11.5	22.5	22.5	14.5	14.5	14.5	13.0	13.0	13.0
Total Split (%)	23.1%	40.0%	40.0%	17.7%	34.6%	34.6%	22.3%	22.3%	22.3%	20.0%	20.0%	20.0%
Maximum Green (s)	8.5	20.0	20.0	5.0	16.5	16.5	7.0	7.0	7.0	7.0	7.0	7.0
Yellow Time (s)	3.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0	3.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-2.5	-2.0	-2.0	-2.5	-2.0	-2.0	-1.0	-3.5	-3.5	-1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.5	4.0	4.0	5.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Min	None	None	None	None	None	None
Act Effct Green (s)	11.1	29.1	29.1	7.6	18.4	18.4		10.6	10.6		9.1	9.1
Actuated g/C Ratio	0.18	0.47	0.47	0.12	0.30	0.30		0.17	0.17		0.15	0.15
v/c Ratio	0.71	0.47	0.09	0.13	0.59	0.27		0.31	0.24		0.83	0.46
Control Delay	40.6	14.9	4.9	27.5	22.2	5.1		27.4	8.8		56.1	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	40.6	14.9	4.9	27.5	22.2	5.1		27.4	8.8		56.1	9.4
LOS	D	B	A	C	C	A		C	A		E	A
Approach Delay		19.6			19.0			18.8			35.0	
Approach LOS		B			B			B			D	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 61.7
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 21.8 Intersection LOS: C
Intersection Capacity Utilization 48.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 6: Richmond Rd & Lightfoot Rd



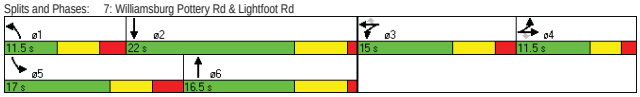
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	1	239	1	117	1	29	258	235	43	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		125	125		0	400		0	125		0
Storage Lanes	0		1	1		1	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.865			0.997	
Flt Protected		0.976		0.950			0.950			0.950		
Satd. Flow (prot)	0	1818	1583	1770	1863	1583	1752	1596	0	1752	1839	0
Flt Permitted		0.976		0.950			0.950			0.950		
Satd. Flow (perm)	0	1818	1583	1770	1863	1583	1752	1596	0	1752	1839	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			3			123		315			1	
Link Speed (mph)		30			45			45			45	
Link Distance (ft)		636			405			633			1283	
Travel Time (s)		14.5			6.1			9.6			19.4	
Peak Hour Factor	0.33	0.33	0.33	0.95	0.95	0.95	0.82	0.82	0.82	0.85	0.85	0.85
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%
Adj. Flow (vph)	3	3	3	252	1	123	1	35	315	276	51	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	6	3	252	1	123	1	350	0	276	52	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4	4	3	3	3	1	6		5	2	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	5.0	10.0		5.0	10.0	
Minimum Split (s)	11.5	11.5	11.5	13.0	13.0	13.0	11.5	16.0		12.0	16.0	
Total Split (s)	11.5	11.5	11.5	15.0	15.0	15.0	11.5	16.5	0.0	17.0	22.0	0.0
Total Split (%)	19.2%	19.2%	19.2%	25.0%	25.0%	25.0%	19.2%	27.5%	0.0%	28.3%	36.7%	0.0%
Maximum Green (s)	7.0	7.0	7.0	9.0	9.0	9.0	5.0	10.5		10.0	16.0	
Yellow Time (s)	3.0	3.0	3.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
All-Red Time (s)	1.5	1.5	1.5	2.0	2.0	2.0	2.5	1.0		3.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.5	3.5	3.5	5.0	5.0	5.0	5.5	5.0	3.0	6.0	5.0	3.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0		2.0	3.0	
Recall Mode	None	None	None	None	None	None	None	Min		None	Min	
Act Effct Green (s)		8.1	8.1	10.1	10.1	10.1	6.1	11.2		10.9	26.2	
Actuated g/C Ratio		0.16	0.16	0.20	0.20	0.20	0.12	0.22		0.22	0.52	
v/c Ratio		0.02	0.01	0.71	0.00	0.30	0.00	0.58		0.73	0.05	
Control Delay		20.5	15.0	34.2	19.0	6.9	22.0	8.5		34.0	9.7	
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		20.5	15.0	34.2	19.0	6.9	22.0	8.5		34.0	9.7	
LOS		C	B	C	B	A	C	A		C	A	
Approach Delay		18.7			25.2			8.6			30.2	
Approach LOS		B			C			A			C	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 50.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 62.9% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 7: Williamsburg Pottery Rd & Lightfoot Rd



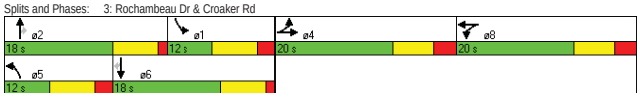
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	136	120	73	76	171	50	80	334	39	25	414	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	175		50	175		125
Storage Lanes	0		0	0		0	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.970			0.977				0.850			0.850
Flt Protected		0.980			0.987		0.950			0.950		
Satd. Flow (prot)	0	1754	0	0	1779	0	1736	3471	1553	1736	3471	1553
Flt Permitted		0.980			0.987		0.950			0.950		
Satd. Flow (perm)	0	1754	0	0	1779	0	1736	3471	1553	1736	3471	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			13				43			219
Link Speed (mph)		45			55			55			55	
Link Distance (ft)		763			1413			845			689	
Travel Time (s)		11.6			17.5			10.5			8.5	
Peak Hour Factor	0.89	0.89	0.89	0.82	0.82	0.82	0.81	0.81	0.81	0.88	0.88	0.88
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	153	135	82	93	209	61	99	412	48	28	470	219
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	370	0	0	363	0	99	412	48	28	470	219
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			36			36	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	17.0	17.0		17.0	17.0		12.0	16.0	16.0	12.0	16.0	16.0
Total Split (s)	20.0	20.0	0.0	20.0	20.0	0.0	12.0	18.0	18.0	12.0	18.0	18.0
Total Split (%)	28.6%	28.6%	0.0%	28.6%	28.6%	0.0%	17.1%	25.7%	25.7%	17.1%	25.7%	25.7%
Maximum Green (s)	13.0	13.0		13.0	13.0		5.0	12.0	12.0	5.0	12.0	12.0
Yellow Time (s)	4.5	4.5		4.5	4.5		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.5	2.5		2.5	2.5		2.0	1.0	1.0	2.0	1.0	1.0
Lost Time Adjust (s)	-1.0	-3.0	-3.0	-1.0	-3.0	-1.0	-3.0	-2.0	-2.0	-3.0	-2.0	-2.0
Total Lost Time (s)	6.0	4.0	1.0	6.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag							Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		2.0	5.0	5.0	2.0	5.0	5.0
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)		16.1			16.0		8.1	18.6	18.6	8.1	14.0	14.0
Actuated g/C Ratio		0.24			0.24		0.12	0.28	0.28	0.12	0.21	0.21
v/c Ratio		0.85			0.84		0.48	0.43	0.10	0.14	0.65	0.44
Control Delay		45.9			44.5		37.6	23.0	9.8	29.7	30.2	7.2
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		45.9			44.5		37.6	23.0	9.8	29.7	30.2	7.2
LOS		D			D		D	C	A	C	C	A
Approach Delay		45.9			44.5			24.5			23.1	
Approach LOS		D			D			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 67.5
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 31.6 Intersection LOS: C
Intersection Capacity Utilization 56.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: Rochambeau Dr & Croaker Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	32	0	33	3	0	9	45	412	7	17	479	67
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.60	0.60	0.60	0.82	0.82	0.82	0.94	0.94	0.94
Hourly flow rate (vph)	39	0	40	5	0	15	55	502	9	18	510	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											845	
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	907	1166	255	943	1229	251	581			511		
vC1, stage 1 conf vol	546	546		612	612							
vC2, stage 2 conf vol	361	621		331	617							
vCu, unblocked vol	748	1028	47	787	1095	251	398			511		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	96	99	100	98	95			98		
cM capacity (veh/h)	378	313	938	336	294	745	1063			1037		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	78	20	55	251	251	9	18	255	255	71
Volume Left	39	5	55	0	0	0	18	0	0	0
Volume Right	40	15	0	0	0	9	0	0	0	71
cSH	542	994	1063	1700	1700	1700	1037	1700	1700	1700
Volume to Capacity	0.14	0.02	0.05	0.15	0.15	0.01	0.02	0.15	0.15	0.04
Queue Length 95th (ft)	13	2	4	0	0	0	1	0	0	0
Control Delay (s)	12.8	11.4	8.6	0.0	0.0	0.0	8.5	0.0	0.0	0.0
Lane LOS	B	B	A				A			
Approach Delay (s)	12.8	11.4	0.8				0.3			
Approach LOS	B	B								

Intersection Summary

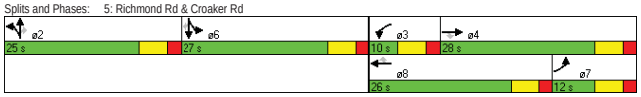
Average Delay 1.5
Intersection Capacity Utilization 37.0% ICU Level of Service A
Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	119	668	36	73	716	270	96	56	18	290	61	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		150	350		400	250		150	0		250
Storage Lanes	1		1	2		1	1		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.986			0.960	
Satd. Flow (prot)	1752	3505	1568	3400	3505	1568	1649	1711	1553	0	1754	1553
Flt Permitted	0.950			0.950			0.950	0.986			0.960	
Satd. Flow (perm)	1752	3505	1568	3400	3505	1568	1649	1711	1553	0	1754	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			38			293			20			185
Link Speed (mph)		45			45			30			55	
Link Distance (ft)		924			1194			582			3354	
Travel Time (s)		14.0			18.1			13.2			41.6	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	129	726	39	79	778	293	104	61	20	315	66	185
Shared Lane Traffic (%)							22%					
Lane Group Flow (vph)	129	726	39	79	778	293	81	84	20	0	381	185
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		45			50			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	23.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	12.0	28.0	28.0	10.0	26.0	26.0	25.0	25.0	25.0	27.0	27.0	27.0
Total Split (%)	13.3%	31.1%	31.1%	11.1%	28.9%	28.9%	27.8%	27.8%	27.8%	30.0%	30.0%	30.0%
Maximum Green (s)	6.0	22.0	22.0	4.0	20.0	20.0	19.0	19.0	19.0	21.0	21.0	21.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Max	Max	Max	None	None	None
Act Effct Green (s)	7.0	25.1	25.1	5.0	21.0	21.0	20.0	20.0	20.0		21.5	21.5
Actuated g/C Ratio	0.08	0.28	0.28	0.06	0.23	0.23	0.22	0.22	0.22		0.24	0.24
v/c Ratio	0.94	0.74	0.08	0.42	0.95	0.49	0.22	0.22	0.06		0.90	0.36
Control Delay	107.4	35.8	9.6	48.0	55.6	6.8	30.6	30.5	12.5		60.1	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	107.4	35.8	9.6	48.0	55.6	6.8	30.6	30.5	12.5		60.1	6.6
LOS	F	D	A	D	E	A	C	C	B		E	A
Approach Delay		45.0			42.7			28.6			42.6	
Approach LOS		D			D			C			D	

Intersection Summary
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 89.5
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 42.5 — Intersection LOS: D
Intersection Capacity Utilization 64.8% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Richmond Rd & Croaker Rd

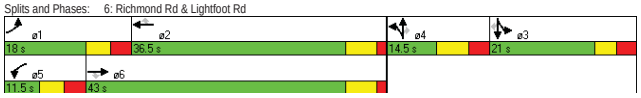


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	194	885	12	28	751	216	17	10	39	205	5	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	175		300	300		200	0		125	0		200
Storage Lanes	1		1	1		1	0		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950				0.969			0.953	
Satd. Flow (prot)	1752	3505	1568	1752	3505	1568	0	1787	1568	0	1758	1568
Flt Permitted	0.950			0.950				0.969			0.953	
Satd. Flow (perm)	1752	3505	1568	1752	3505	1568	0	1787	1568	0	1758	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			13			300			60			272
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		2866			884			391			2806	
Travel Time (s)		43.4			13.4			5.9			42.5	
Peak Hour Factor	0.91	0.91	0.91	0.72	0.72	0.72	0.65	0.65	0.65	0.72	0.72	0.72
Adj. Flow (vph)	213	973	13	39	1043	300	26	15	60	285	7	272
Shared Lane Traffic (%)												
Lane Group Flow (vph)	213	973	13	39	1043	300	0	41	60	0	292	272
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		50			50			12			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			3
Detector Phase	1	6	6	5	2	2	4	4	4	3	3	3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.5	21.0	21.0	11.5	21.0	21.0	14.5	14.5	14.5	13.0	13.0	13.0
Total Split (s)	18.0	43.0	43.0	11.5	36.5	36.5	14.5	14.5	14.5	21.0	21.0	21.0
Total Split (%)	20.0%	47.8%	47.8%	12.8%	40.6%	40.6%	16.1%	16.1%	16.1%	23.3%	23.3%	23.3%
Maximum Green (s)	11.5	37.0	37.0	5.0	30.5	30.5	7.0	7.0	7.0	15.0	15.0	15.0
Yellow Time (s)	3.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0	3.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-2.5	-2.0	-2.0	-2.5	-2.0	-2.0	-1.0	-3.5	-3.5	-1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.5	4.0	4.0	5.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Min	None	None	None	None	None	None
Act Effct Green (s)	13.8	43.5	43.5	7.6	32.3	32.3		10.6	10.6		16.8	16.8
Actuated g/C Ratio	0.16	0.51	0.51	0.09	0.38	0.38		0.12	0.12		0.20	0.20
v/c Ratio	0.76	0.55	0.02	0.25	0.79	0.39		0.19	0.24		0.85	0.52
Control Delay	54.7	18.3	7.4	43.2	30.4	4.2		38.3	13.0		58.8	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	54.7	18.3	7.4	43.2	30.4	4.2		38.3	13.0		58.8	8.2
LOS	D	B	A	D	C	A		D	B		E	A
Approach Delay		24.7			25.1			23.3			34.4	
Approach LOS		C			C			C			C	

Intersection Summary
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 86.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 26.5 — Intersection LOS: C
Intersection Capacity Utilization 59.8% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 6: Richmond Rd & Lightfoot Rd



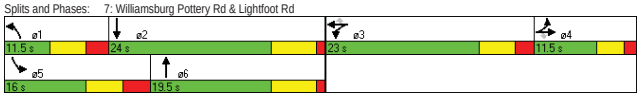
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	1	376	1	311	1	63	381	203	54	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		125	125		0	400		0	125		0
Storage Lanes	0		1	1		1	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.871			0.998	
Flt Protected		0.976		0.950			0.950			0.950		
Satd. Flow (prot)	0	1818	1583	1770	1863	1583	1752	1607	0	1752	1841	0
Flt Permitted		0.976		0.950			0.950			0.950		
Satd. Flow (perm)	0	1818	1583	1770	1863	1583	1752	1607	0	1752	1841	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			2			327		390			1	
Link Speed (mph)		30			45			45			45	
Link Distance (ft)		636			405			633			1283	
Travel Time (s)		14.5			6.1			9.6			19.4	
Peak Hour Factor	0.59	0.59	0.59	0.95	0.95	0.95	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%
Adj. Flow (vph)	2	2	2	396	1	327	1	72	433	231	61	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	2	396	1	327	1	505	0	231	62	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4	4	3	3	3	1	6		5	2	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	5.0	10.0		5.0	10.0	
Minimum Split (s)	11.5	11.5	11.5	13.0	13.0	13.0	11.5	16.0		12.0	16.0	
Total Split (s)	11.5	11.5	11.5	23.0	23.0	23.0	11.5	19.5	0.0	16.0	24.0	0.0
Total Split (%)	16.4%	16.4%	16.4%	32.9%	32.9%	32.9%	16.4%	27.9%	0.0%	22.9%	34.3%	0.0%
Maximum Green (s)	7.0	7.0	7.0	17.0	17.0	17.0	5.0	13.5		9.0	18.0	
Yellow Time (s)	3.0	3.0	3.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
All-Red Time (s)	1.5	1.5	1.5	2.0	2.0	2.0	2.5	1.0		3.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.5	3.5	3.5	5.0	5.0	5.0	5.5	5.0	3.0	6.0	5.0	3.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0		2.0	3.0	
Recall Mode	None	None	None	None	None	None	None	Min		None	Min	
Act Effct Green (s)		8.1	8.1	17.3	17.3	17.3	6.1	12.7		10.1	27.0	
Actuated g/C Ratio		0.14	0.14	0.30	0.30	0.30	0.10	0.22		0.17	0.46	
v/c Ratio		0.02	0.01	0.75	0.00	0.47	0.01	0.77		0.76	0.07	
Control Delay		25.5	20.0	31.3	17.0	5.1	27.0	15.7		44.1	12.6	
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		25.5	20.0	31.3	17.0	5.1	27.0	15.7		44.1	12.6	
LOS		C	B	C	B	A	C	B		D	B	
Approach Delay		23.7			19.4			15.7			37.4	
Approach LOS		C			B			B			D	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 58.2
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 21.7 Intersection LOS: C
Intersection Capacity Utilization 78.1% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 7: Williamsburg Pottery Rd & Lightfoot Rd



HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst: SS
Agency/Co: VHB
Date: 3/24/2014
Analysis Period: AM Peak
Highway: Mooretown Road
From/To: Lightfoot Road and VA 199
Jurisdiction: Williamsburg, VA
Analysis Year: 2014
Project ID: Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	494	vph	357	vph
Peak-hour factor, PHF	0.87		0.95	
Peak 15-minute volume, v15	142		94	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	286	pcphpl	189	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	286	pcphpl	189	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	5.7	pc/mi/ln	3.8	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	283.9	187.9
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.11	1.90
Bicycle LOS	B	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Mooretown Road
From/To:	Lightfoot Road and VA 199
Jurisdiction:	Williamsburg, VA
Analysis Year:	2014
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	585	vph	688	vph
Peak-hour factor, PHF	0.95		0.87	
Peak 15-minute volume, v15	154		198	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	310	pcphpl	399	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	310	pcphpl	399	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	6.2	pc/mi/ln	8.0	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	307.9	395.4
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.15	2.28
Bicycle LOS	B	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Richmond Road
From/To:	Lightfoot Rd and Croaker Rd
Jurisdiction:	Williamsburg, VA
Analysis Year:	2014
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	48.3	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	822	vph	600	vph
Peak-hour factor, PHF	0.82		0.71	
Peak 15-minute volume, v15	251		211	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	508	pcphpl	428	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	508	pcphpl	428	pcphpl
Free-flow speed, FFS	48.3	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	10.2	pc/mi/ln	8.6	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	501.2	422.5
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.63	2.55
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Richmond Road
From/To:	Lightfoot Rd and Croaker Rd
Jurisdiction:	Williamsburg, VA
Analysis Year:	2014
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	48.3	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	976	vph	1059	vph
Peak-hour factor, PHF	0.91		0.88	
Peak 15-minute volume, v15	268		301	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	544	pcphpl	610	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	544	pcphpl	610	pcphpl
Free-flow speed, FFS	48.3	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	A		B	
Density, D	10.9	pc/mi/ln	12.2	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	536.3	601.7
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.67	2.72
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Croaker Road
From/To:	Rochambeau Rd and I-64 EB Ramp
Jurisdiction:	Williamsburg, VA
Analysis Year:	2014
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	668	vph	496	vph
Peak-hour factor, PHF	0.86		0.72	
Peak 15-minute volume, v15	194		172	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	394	pcphpl	349	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	394	pcphpl	349	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	6.6	pc/mi/ln	5.8	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	388.4	344.4
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.50	2.44
Bicycle LOS	C	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Croaker Road
From/To:	Rochambeau Rd and I-64 EB Ramp
Jurisdiction:	Williamsburg, VA
Analysis Year:	2014
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	520	vph	632	vph
Peak-hour factor, PHF	0.88		0.83	
Peak 15-minute volume, v15	148		190	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	299	pcphpl	386	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	299	pcphpl	386	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	5.0	pc/mi/ln	6.4	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	295.5	380.7
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.36	2.49
Bicycle LOS	B	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Two-Lane Highways Release 6.65

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	AM Peak
Highway	Croaker Road (VA 607)
From/To	Richmond Rd to Point O Woods
Jurisdiction	Williamsburg, VA
Analysis Year	2014
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.77	
Shoulder width	3.0	ft	% Trucks and buses	4	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.6	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 380 veh/h
Opposing direction volume, Vo 355 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.2		1.2	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.992		0.992	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	497	pc/h	465	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	50.8	mi/h
Adjustment for no-passing zones, fnp	2.5	mi/h
Average travel speed, ATSd	40.8	mi/h
Percent Free Flow Speed, PFFS	80.5	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	494	pc/h	461	pc/h
Base percent time-spent-following,(note-4) BPTSFd	50.0	%		
Adjustment for no-passing zones, fnp	41.2			
Percent time-spent-following, PTSFd	71.3	%		

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.29	
Peak 15-min vehicle-miles of travel, VMT15	74	veh-mi
Peak-hour vehicle-miles of travel, VMT60	228	veh-mi
Peak 15-min total travel time, TT15	1.8	veh-h
Capacity from ATS, CdATS	1686	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1686	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.6	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	40.8	mi/h
Percent time-spent-following, PTSFd (from above)	71.3	
Level of service, LOSd (from above)	D	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	45
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	493.5
Effective width of outside lane, We	14.50
Effective speed factor, St	4.42
Bicycle LOS Score, BLOS	4.70
Bicycle LOS	E

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	PM Peak
Highway	Croaker Road (VA 607)
From/To	Richmond Rd to Point O Woods
Jurisdiction	Williamsburg, VA
Analysis Year	2014
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 1		Peak hour factor, PHF	0.82	
Shoulder width	3.0	ft	% Trucks and buses	4	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.6	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	5	/mi

Analysis direction volume, Vd 445 veh/h
Opposing direction volume, Vo 521 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.2		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.992		0.996	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	547	pc/h	638	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	1.3	mi/h
Free-flow speed, FFSd	50.8	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	39.8	mi/h
Percent Free Flow Speed, PFFS	78.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	543	pc/h	635	pc/h
Base percent time-spent-following,(note-4) BPTSFd	55.4	%		
Adjustment for no-passing zones, fnp	34.2			
Percent time-spent-following, PTSFd	71.2	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.32	
Peak 15-min vehicle-miles of travel, VMT15	81	veh-mi
Peak-hour vehicle-miles of travel, VMT60	267	veh-mi
Peak 15-min total travel time, TT15	2.0	veh-h
Capacity from ATS, CdATS	1693	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1693	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.6	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	39.8	mi/h
Percent time-spent-following, PTSFd (from above)	71.2	
Level of service, LOSd (from above)	E	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	E	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	45
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	542.7
Effective width of outside lane, We	14.50
Effective speed factor, St	4.42
Bicycle LOS Score, BLOS	4.75
Bicycle LOS	E

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS 2010: Two-Lane Highways Release 6.65

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	AM Peak
Highway	Lightfoot Road (VA 646)
From/To	Richmond Rd to Mooretown Rd
Jurisdiction	Williamsburg, VA
Analysis Year	2014
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 2		Peak hour factor, PHF	0.82	
Shoulder width	2.0	ft	% Trucks and buses	1	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 308 veh/h
Opposing direction volume, Vo 308 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.3	1.3
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.997	0.997
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	377 pc/h	377 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.3	mi/h
Adjustment for no-passing zones, fnp	2.8	mi/h
Average travel speed, ATSd	40.5	mi/h
Percent Free Flow Speed, PFFS	82.3	%

Percent Time-Spent-Following

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.1	1.1
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adjustment factor, fHV	0.999	0.999
Grade adjustment factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	376 pc/h	376 pc/h
Base percent time-spent-following,(note-4) BPTSFd	40.4 %	
Adjustment for no-passing zones, fnp	49.0	
Percent time-spent-following, PTSFd	64.9 %	

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.22	
Peak 15-min vehicle-miles of travel, VMT15	66	veh-mi
Peak-hour vehicle-miles of travel, VMT60	216	veh-mi
Peak 15-min total travel time, TT15	1.6	veh-h
Capacity from ATS, CdATS	1695	veh/h
Capacity from PTSF, CdPTSF	1698	veh/h
Directional Capacity	1698	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	40.5	mi/h
Percent time-spent-following, PTSFd (from above)	64.9	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	45
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	375.6
Effective width of outside lane, We	13.50
Effective speed factor, St	4.42
Bicycle LOS Score, BLOS	4.01
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS 2010: Two-Lane Highways Release 6.65

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	PM Peak
Highway	Lightfoot Road (VA 646)
From/To	Richmond Rd to Mooretown Rd
Jurisdiction	Williamsburg, VA
Analysis Year	2014
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 2		Peak hour factor, PHF	0.88	
Shoulder width	2.0	ft	% Trucks and buses	1	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 420 veh/h
Opposing direction volume, Vo 406 veh/h

Average Travel Speed

Direction	Analysis(d)	Opposing (o)
PCE for trucks, ET	1.2	1.2
PCE for RVs, ER	1.0	1.0
Heavy-vehicle adj. factor,(note-5) fHV	0.998	0.998
Grade adj. factor,(note-1) fg	1.00	1.00
Directional flow rate,(note-2) vi	478 pc/h	462 pc/h

Free-Flow Speed from Field Measurement:

Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.3	mi/h
Adjustment for no-passing zones, fnp	2.4	mi/h
Average travel speed, ATSd	39.5	mi/h
Percent Free Flow Speed, PFFS	80.2	%

_____Percent Time-Spent-Following_____

Direction	Analysis(d)	Opposing (o)	
PCE for trucks, ET	1.0	1.0	
PCE for RVs, ER	1.0	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	1.000	
Grade adjustment factor,(note-1) fg	1.00	1.00	
Directional flow rate,(note-2) vi	477 pc/h	461	pc/h
Base percent time-spent-following,(note-4) BPTSFd	48.9	%	
Adjustment for no-passing zones, fnp	42.1		
Percent time-spent-following, PTSFd	70.3	%	

_____Level of Service and Other Performance Measures_____

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.28	
Peak 15-min vehicle-miles of travel, VMT15	84	veh-mi
Peak-hour vehicle-miles of travel, VMT60	294	veh-mi
Peak 15-min total travel time, TT15	2.1	veh-h
Capacity from ATS, CdATS	0	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

_____Passing Lane Analysis_____

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	39.5	mi/h
Percent time-spent-following, PTSFd (from above)	70.3	
Level of service, LOSd (from above)	D	

_____Average Travel Speed with Passing Lane_____

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

_____Percent Time-Spent-Following with Passing Lane_____

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

_____Level of Service and Other Performance Measures with Passing Lane _____

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	-	veh-h

_____ Bicycle Level of Service _____

Posted speed limit, Sp	45
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	477.3
Effective width of outside lane, We	13.50
Effective speed factor, St	4.42
Bicycle LOS Score, BLOS	4.13
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Mooretown Road Extension Traffic Analysis — 1: I-64 WB Ramps & Croaker Rd
Existing (2014) AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	295	0	0	52	0	122	84	0	241	61
Sign Control		Yield			Stop			Free			Free	
Grade		-1%			-1%			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	321	0	0	57	0	133	91	0	262	66
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	385	395	131	264	395	66	262			133		
vC1, stage 1 conf vol	262	262		133	133							
vC2, stage 2 conf vol	123	133		131	262							
vCu, unblocked vol	385	395	131	264	395	66	262			133		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	64	100	100	94	100			100		
cM capacity (veh/h)	580	576	891	476	576	980	1292			1443		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	321	57	66	66	91	131	131	66
Volume Left	0	0	0	0	0	0	0	0
Volume Right	321	57	0	0	91	0	0	66
cSH	891	980	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.36	0.06	0.04	0.04	0.05	0.08	0.08	0.04
Queue Length 95th (ft)	41	5	0	0	0	0	0	0
Control Delay (s)	11.3	8.9	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	11.3	8.9	0.0			0.0		
Approach LOS	B	A						

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

Mooretown Road Extension Traffic Analysis — 2: I-64 EB Ramps & Croaker Rd
Existing (2014) AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	71	0	0	21	0	185	483	0	425	111
Sign Control		Stop			Yield			Free			Free	
Grade		-1%			-1%			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	77	0	0	23	0	201	525	0	462	121
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)								689				
pX, platoon unblocked												
vC, conflicting volume	562	663	231	432	663	101	462			201		
vC1, stage 1 conf vol	462	462		201	201							
vC2, stage 2 conf vol	101	201		231	462							
vCu, unblocked vol	562	663	231	432	663	101	462			201		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	90	100	100	98	100			100		
cM capacity (veh/h)	466	455	768	534	455	932	1088			1361		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	77	23	101	101	525	231	231	121
Volume Left	0	0	0	0	0	0	0	0
Volume Right	77	23	0	0	525	0	0	121
cSH	768	932	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.02	0.06	0.06	0.31	0.14	0.14	0.07
Queue Length 95th (ft)	8	2	0	0	0	0	0	0
Control Delay (s)	10.2	9.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.2	9.0	0.0			0.0		
Approach LOS	B	A						

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	33.2%	ICU Level of Service	A
Analysis Period (min)	15		

8: Mooretown Rd & Rt. 199 SB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	441	53	0	204	163	0	0	397	0	0	153
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
Peak Hour Factor	0.87	0.87	0.87	0.80	0.80	0.80	0.74	0.74	0.74	0.88	0.88	0.88
Hourly flow rate (vph)	0	507	61	0	255	204	0	0	536	0	0	174
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		405										
pX, platoon unblocked												
vC, conflicting volume	255			507			634	762	253	508	762	128
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	255			507			634	762	253	508	762	128
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	28	100	100	81
cM capacity (veh/h)	1307			1054			291	331	743	124	331	896

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	253	253	61	128	128	204	536	174
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	61	0	0	204	536	174
cSH	1700	1700	1700	1700	1700	1700	743	896
Volume to Capacity	0.15	0.15	0.04	0.07	0.07	0.12	0.72	0.19
Queue Length 95th (ft)	0	0	0	0	0	0	157	18
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	21.4	10.0
Lane LOS							C	A
Approach Delay (s)	0.0			0.0			21.4	10.0
Approach LOS							C	A

Intersection Summary			
Average Delay	7.6		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

9: Mooretown Rd & Rt. 199 NB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	760	78	0	322	145	0	0	355	0	0	45
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
Peak Hour Factor	0.77	0.77	0.77	0.86	0.86	0.86	0.85	0.85	0.85	0.83	0.83	0.83
Hourly flow rate (vph)	0	987	101	0	374	169	0	0	418	0	0	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1190										
pX, platoon unblocked												
vC, conflicting volume	374			987			1174	1361	494	868	1361	187
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	374			987			1174	1361	494	868	1361	187
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	19	100	100	93
cM capacity (veh/h)	1181			696			136	146	519	48	146	820

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	494	494	101	187	187	169	418	54
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	101	0	0	169	418	54
cSH	1700	1700	1700	1700	1700	1700	519	820
Volume to Capacity	0.29	0.29	0.06	0.11	0.11	0.10	0.81	0.07
Queue Length 95th (ft)	0	0	0	0	0	0	193	5
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	34.7	9.7
Lane LOS							D	A
Approach Delay (s)	0.0			0.0			34.7	9.7
Approach LOS							D	A

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

1: I-64 WB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	430	0	0	112	0	225	62	0	184	60
Sign Control		Yield			Stop			Free			Free	
Grade		-1%			-1%			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	467	0	0	122	0	245	67	0	200	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	444	445	100	345	445	122	200			245		
vC1, stage 1 conf vol	200	200		245	245							
vC2, stage 2 conf vol	244	245		100	200							
vCu, unblocked vol	444	445	100	345	445	122	200			245		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	50	100	100	87	100			100		
cM capacity (veh/h)	510	557	933	370	557	903	1362			1311		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	467	122	122	122	67	100	100	65
Volume Left	0	0	0	0	0	0	0	0
Volume Right	467	122	0	0	67	0	0	65
cSH	933	903	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.50	0.13	0.07	0.07	0.04	0.06	0.06	0.04
Queue Length 95th (ft)	72	12	0	0	0	0	0	0
Control Delay (s)	12.7	9.6	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	12.7	9.6	0.0			0.0		
Approach LOS	B	A						

Intersection Summary			
Average Delay	6.1		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

2: I-64 EB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	74	0	0	17	0	270	250	0	558	56
Sign Control		Stop			Yield			Free			Free	
Grade		-1%			-1%			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	80	0	0	18	0	293	272	0	607	61
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)								689				
pX, platoon unblocked												
vC, conflicting volume	753	900	303	597	900	147	607			293		
vC1, stage 1 conf vol	607	607		293	293							
vC2, stage 2 conf vol	147	293		303	607							
vCu, unblocked vol	753	900	303	597	900	147	607			293		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	88	100	100	98	100			100		
cM capacity (veh/h)	376	375	690	446	375	871	961			1258		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	80	18	147	147	272	303	303	61
Volume Left	0	0	0	0	0	0	0	0
Volume Right	80	18	0	0	272	0	0	61
cSH	690	871	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.02	0.09	0.09	0.16	0.18	0.18	0.04
Queue Length 95th (ft)	10	2	0	0	0	0	0	0
Control Delay (s)	10.9	9.2	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.9	9.2	0.0			0.0		
Approach LOS	B	A						

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

8: Mooretown Rd & Rt. 199 SB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	509	76	0	585	464	0	0	325	0	0	103
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	553	83	0	636	504	0	0	353	0	0	112
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		405										
pX, platoon unblocked												
vC, conflicting volume	636			553			871	1189	277	912	1189	318
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	636			553			871	1189	277	912	1189	318
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	51	100	100	83
cM capacity (veh/h)	943			1013			203	185	718	115	185	675

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	277	277	83	318	318	504	353	112
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	83	0	0	504	353	112
cSH	1700	1700	1700	1700	1700	1700	718	675
Volume to Capacity	0.16	0.16	0.05	0.19	0.19	0.30	0.49	0.17
Queue Length 95th (ft)	0	0	0	0	0	0	69	15
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	14.8	11.4
Lane LOS							B	B
Approach Delay (s)	0.0			0.0			14.8	11.4
Approach LOS							B	B

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

9: Mooretown Rd & Rt. 199 NB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	705	129	0	972	404	0	0	438	0	0	77
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
Peak Hour Factor	0.89	1.00	0.89	0.97	0.97	0.97	0.87	0.87	0.87	0.68	0.68	0.68
Hourly flow rate (vph)	0	705	145	0	1002	416	0	0	503	0	0	113
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1190										
pX, platoon unblocked												
vC, conflicting volume	1002			705			1206	1707	352	1355	1707	501
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1002			705			1206	1707	352	1355	1707	501
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	21	100	100	78
cM capacity (veh/h)	687			889			108	89	641	23	89	513

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	352	352	145	501	501	416	503	113
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	145	0	0	416	503	113
cSH	1700	1700	1700	1700	1700	1700	641	513
Volume to Capacity	0.21	0.21	0.09	0.29	0.29	0.24	0.79	0.22
Queue Length 95th (ft)	0	0	0	0	0	0	190	21
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	28.0	14.0
Lane LOS							D	B
Approach Delay (s)	0.0			0.0			28.0	14.0
Approach LOS							D	B

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

No-Build Conditions
(2040)

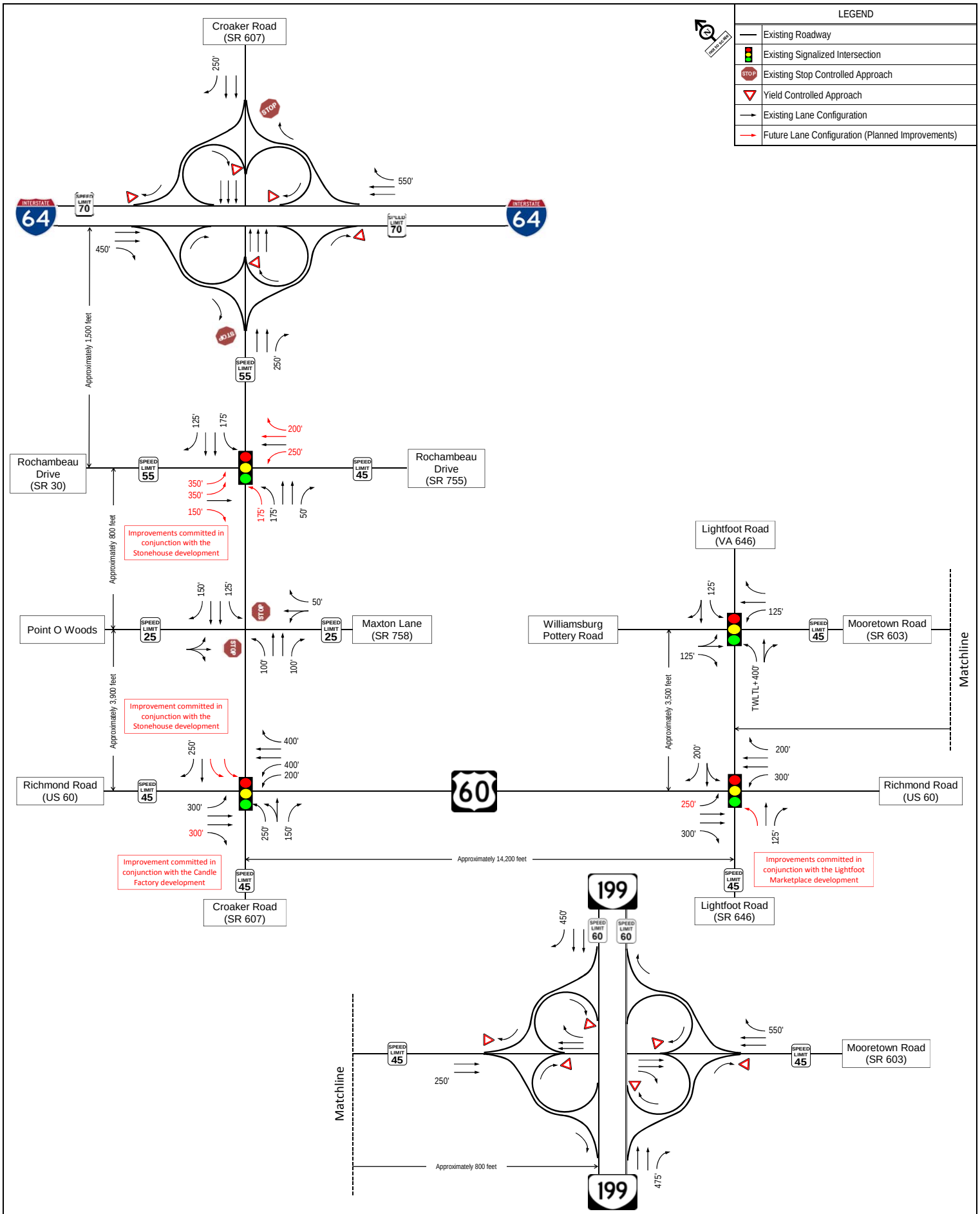


Figure A-3
No-Build (2040) Lane Configurations and Traffic Control

Mooretown Road Corridor Study
Williamsburg, VA

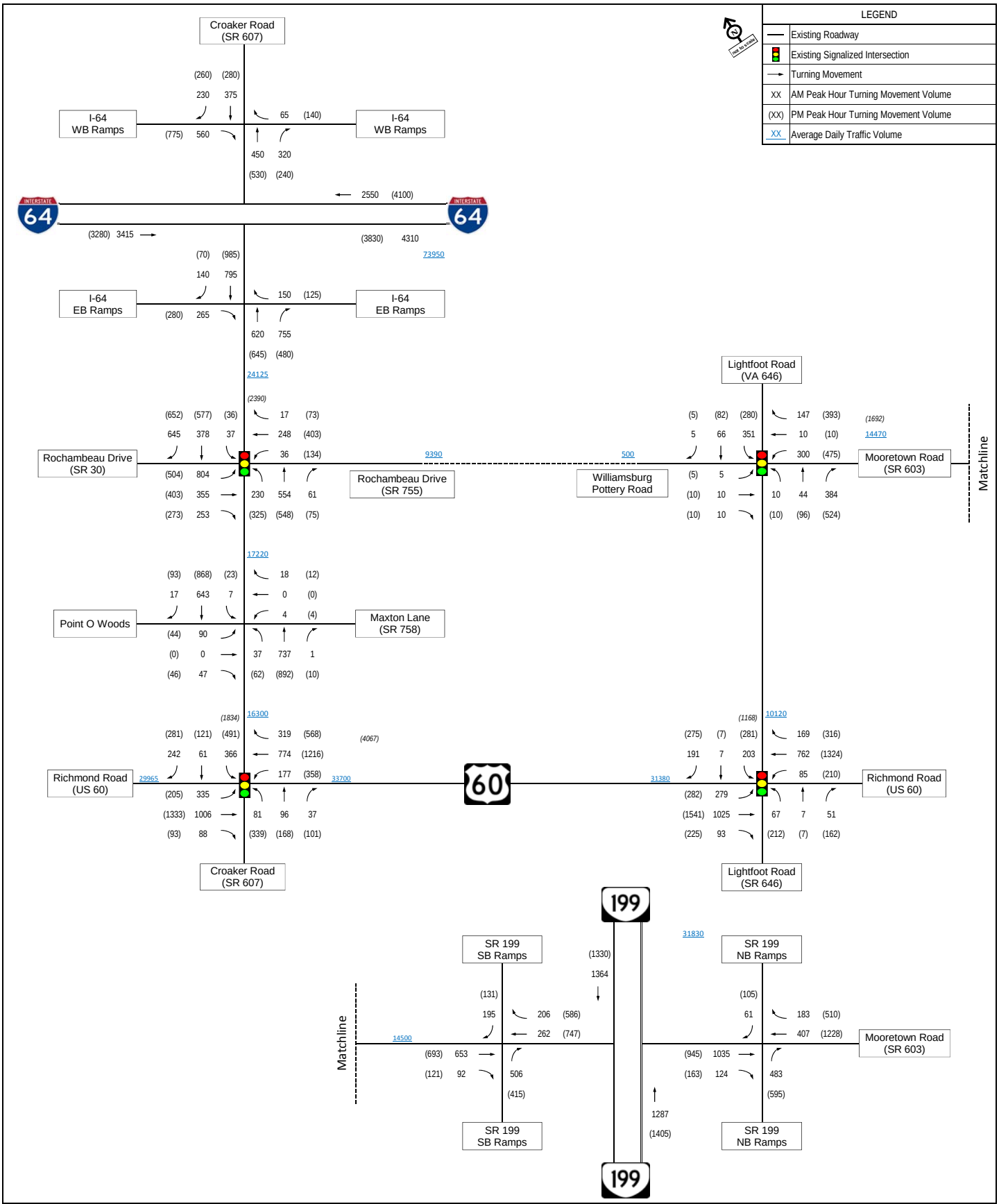


Figure A-4
No-Build (2040) AM and PM Peak Hour Turning Movement Volumes

Mooretown Road Corridor Study
Williamsburg, VA

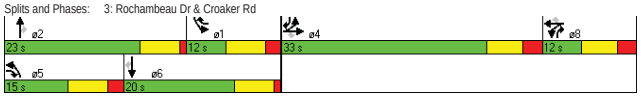
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	804	355	253	36	248	17	230	554	61	37	378	645
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	350		150	250		200	175		50	175		125
Storage Lanes	1		1	2		1	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3400	1845	1568	1752	3505	1568	3367	3471	1553	1736	3471	1553
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3400	1845	1568	1752	3505	1568	3367	3471	1553	1736	3471	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			274			18			45			71
Link Speed (mph)		45			55			55			55	
Link Distance (ft)		763			1413			845			689	
Travel Time (s)		11.6			17.5			10.5			8.5	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	874	386	275	39	270	18	250	602	66	40	411	701
Shared Lane Traffic (%)												
Lane Group Flow (vph)	874	386	275	39	270	18	250	602	66	40	411	701
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			36			36	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Split		pm+ov	Split		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	4
Permitted Phases			4			8			2			6
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	4
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	10.0	5.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	16.0	12.0	12.0	16.0	12.0
Total Split (s)	33.0	33.0	15.0	12.0	12.0	12.0	15.0	23.0	12.0	12.0	20.0	33.0
Total Split (%)	41.3%	41.3%	18.8%	15.0%	15.0%	15.0%	18.8%	28.8%	15.0%	15.0%	25.0%	41.3%
Maximum Green (s)	26.0	26.0	8.0	5.0	5.0	5.0	8.0	17.0	5.0	5.0	14.0	26.0
Yellow Time (s)	4.5	4.5	5.0	4.5	4.5	5.0	5.0	5.0	4.5	5.0	5.0	4.5
All-Red Time (s)	2.5	2.5	2.0	2.5	2.5	2.0	2.0	1.0	2.5	2.0	1.0	2.5
Lost Time Adjust (s)	-1.0	-3.0	-3.0	-1.0	-3.0	-1.0	-3.0	-2.0	-2.0	-3.0	-2.0	-2.0
Total Lost Time (s)	6.0	4.0	4.0	6.0	4.0	6.0	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lead			Lag	Lead	Lead		Lag	Lag	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0	2.0	2.0	5.0	3.0	2.0	5.0	3.0
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	None
Act Effct Green (s)	26.5	28.5	39.2	6.0	8.0	12.0	10.8	23.3	34.3	8.0	15.6	47.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.34	0.36	0.50	0.08	0.10	0.15	0.14	0.30	0.43	0.10	0.20	0.60
v/c Ratio	0.77	0.58	0.30	0.29	0.76	0.07	0.54	0.59	0.09	0.23	0.60	0.73
Control Delay	28.9	24.7	1.7	41.1	50.2	7.6	36.9	28.1	8.2	36.7	33.1	15.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.9	24.7	1.7	41.1	50.2	7.6	36.9	28.1	8.2	36.7	33.1	15.8
LOS	C	C	A	D	D	A	D	C	A	D	C	B
Approach Delay		23.0			46.8			29.0			22.7	
Approach LOS		C			D			C			C	
Queue Length 50th (ft)	197	152	0	19	70	0	60	146	7	19	98	203
Queue Length 95th (ft)	265	240	19	49	#128	10	97	204	31	48	145	348
Internal Link Dist (ft)		683			1333			765			609	
Turn Bay Length (ft)	350		150	250		200	175		50	175		125
Base Capacity (vph)	1164	678	922	133	356	254	470	1025	701	176	704	966
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.57	0.30	0.29	0.76	0.07	0.53	0.59	0.09	0.23	0.58	0.73

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 78.9
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 26.3 Intersection LOS: C
Intersection Capacity Utilization 64.2% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Rochambeau Dr & Croaker Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	90	0	47	4	0	18	37	737	1	7	643	17
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)	98	0	51	4	0	20	40	801	1	8	699	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											845	
pX, platoon unblocked	0.91	0.91	0.91	0.91	0.91		0.91					
vC, conflicting volume	1195	1597	349	1297	1614	401	717			802		
vC1, stage 1 conf vol	714	714		882	882							
vC2, stage 2 conf vol	481	883		416	733							
vCu, unblocked vol	1024	1463	98	1136	1482	401	501			802		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	66	100	94	98	100	97	96			99		
cM capacity (veh/h)	291	230	855	231	224	596	955			804		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	149	24	40	401	401	1	8	349	349	18
Volume Left	98	4	40	0	0	0	8	0	0	0
Volume Right	51	20	0	0	0	1	0	0	0	18
cSH	376	729	955	1700	1700	1700	804	1700	1700	1700
Volume to Capacity	0.40	0.03	0.04	0.24	0.24	0.00	0.01	0.21	0.21	0.01
Queue Length 95th (ft)	46	3	3	0	0	0	1	0	0	0
Control Delay (s)	20.7	13.0	8.9	0.0	0.0	0.0	9.5	0.0	0.0	0.0
Lane LOS	C	B	A				A			
Approach Delay (s)	20.7	13.0	0.4				0.1			
Approach LOS	C	B								

Intersection Summary

Average Delay	2.2		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

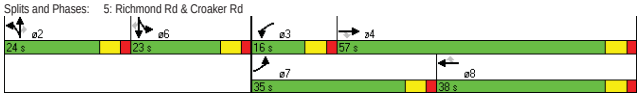
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	335	1006	88	177	774	319	81	96	37	366	61	242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		300	350		400	250		150	400		0
Storage Lanes	1		1	2		1	1		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.996		0.950		
Satd. Flow (prot)	1752	3505	1568	3400	3505	1568	1649	1729	1553	3367	1827	1553
Flt Permitted	0.950			0.950			0.950	0.996		0.950		
Satd. Flow (perm)	1752	3505	1568	3400	3505	1568	1649	1729	1553	3367	1827	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			96			347			40			263
Link Speed (mph)		45			45			30			55	
Link Distance (ft)		924			1194			582			3354	
Travel Time (s)		14.0			18.1			13.2			41.6	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	364	1093	96	192	841	347	88	104	40	398	66	263
Shared Lane Traffic (%)							10%					
Lane Group Flow (vph)	364	1093	96	192	841	347	79	113	40	398	66	263
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		45			50			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	23.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	35.0	57.0	57.0	16.0	38.0	38.0	24.0	24.0	24.0	23.0	23.0	23.0
Total Split (%)	29.2%	47.5%	47.5%	13.3%	31.7%	31.7%	20.0%	20.0%	20.0%	19.2%	19.2%	19.2%
Maximum Green (s)	29.0	51.0	51.0	10.0	32.0	32.0	18.0	18.0	18.0	17.0	17.0	17.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Max	Max	Max	None	None	None
Act Effct Green (s)	27.6	48.7	48.7	10.7	31.8	31.8	19.1	19.1	19.1	17.3	17.3	17.3

5: Richmond Rd & Croaker Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.24	0.42	0.42	0.09	0.27	0.27	0.16	0.16	0.16	0.15	0.15	0.15
v/c Ratio	0.87	0.74	0.13	0.61	0.87	0.51	0.29	0.40	0.14	0.79	0.24	0.58
Control Delay	64.8	31.9	4.5	60.6	51.8	6.4	47.6	49.6	14.2	60.6	47.5	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.8	31.9	4.5	60.6	51.8	6.4	47.6	49.6	14.2	60.6	47.5	11.0
LOS	E	C	A	E	D	A	D	D	B	E	D	B
Approach Delay		37.9			41.6			42.8			41.5	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	268	360	0	75	327	0	57	84	0	155	46	0
Queue Length 95th (ft)	#424	441	32	114	#432	73	108	146	32	#222	89	78
Internal Link Dist (ft)		844			1114			502			3274	
Turn Bay Length (ft)	300		300	350		400	250		150	400		
Base Capacity (vph)	456	1581	760	325	1003	697	272	285	290	526	285	465
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.69	0.13	0.59	0.84	0.50	0.29	0.40	0.14	0.76	0.23	0.57

Intersection Summary
Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 115.8
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 40.2 — Intersection LOS: D
Intersection Capacity Utilization 69.6% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Richmond Rd & Croaker Rd



6: Richmond Rd & Lightfoot Rd

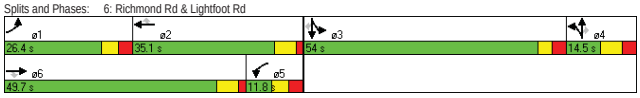
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	279	1025	93	85	762	169	67	7	51	203	7	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		300	300		200	0		125	0		200
Storage Lanes	1		1	1		1	1		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.954	
Satd. Flow (prot)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1760	1568
Flt Permitted	0.950			0.950			0.950				0.954	
Satd. Flow (perm)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1760	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			96			138			55			208
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		2866			884			391			2806	
Travel Time (s)		43.4			13.4			5.9			42.5	
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
Adj. Flow (vph)	303	1114	101	92	828	184	73	8	55	221	8	208
Shared Lane Traffic (%)												
Lane Group Flow (vph)	303	1114	101	92	828	184	73	8	55	0	229	208
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		50			50			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			3
Detector Phase	1	6	6	5	2	2	4	4	4	3	3	3
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.5	37.0	37.0	11.5	21.0	21.0	14.5	14.5	14.5	54.0	54.0	54.0
Total Split (s)	26.4	49.7	49.7	11.8	35.1	35.1	14.5	14.5	14.5	54.0	54.0	54.0
Total Split (%)	20.3%	38.2%	38.2%	9.1%	27.0%	27.0%	11.2%	11.2%	11.2%	41.5%	41.5%	41.5%
Maximum Green (s)	19.9	43.7	43.7	5.3	29.1	29.1	7.0	7.0	7.0	48.0	48.0	48.0
Yellow Time (s)	3.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0	3.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-2.5	-2.0	-2.0	-2.5	-2.0	-2.0	-1.0	-3.5	-3.5	-1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.5	4.0	4.0	5.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Min	None	None	None	None	None	None
Walk Time (s)		5.0	5.0							5.0	5.0	5.0
Flash Dont Walk (s)		26.0	26.0							43.0	43.0	43.0

6: Richmond Rd & Lightfoot Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Pedestrian Calls (#/hr)		0	0							0	0	0
Act Effct Green (s)	22.5	42.9	42.9	10.7	31.2	31.2	8.0	10.5	10.5		20.3	20.3
Actuated g/C Ratio	0.22	0.43	0.43	0.11	0.31	0.31	0.08	0.10	0.10		0.20	0.20
v/c Ratio	0.77	0.74	0.14	0.49	0.76	0.32	0.52	0.04	0.26		0.65	0.43
Control Delay	52.5	27.9	4.7	56.0	37.5	10.2	60.1	43.6	15.6		45.4	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	52.5	27.9	4.7	56.0	37.5	10.2	60.1	43.6	15.6		45.4	7.5
LOS	D	C	A	E	D	B	E	D	B		D	A
Approach Delay		31.3			34.5			41.1			27.4	
Approach LOS		C			C			D			C	
Queue Length 50th (ft)	183	289	2	58	250	21	46	5	0		135	0
Queue Length 95th (ft)	#346	419	33	#147	358	80	#107	21	38		213	57
Internal Link Dist (ft)		2786			804			311			2726	
Turn Bay Length (ft)	250		300	300		200			125			200
Base Capacity (vph)	391	1598	767	187	1087	582	140	193	214		878	886
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0		0	0
Reduced v/c Ratio	0.77	0.70	0.13	0.49	0.76	0.32	0.52	0.04	0.26		0.26	0.23

Intersection Summary
Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 100.5
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 32.3 — Intersection LOS: C
Intersection Capacity Utilization 64.8% — ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Richmond Rd & Lightfoot Rd



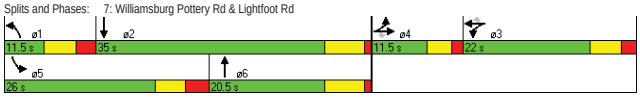
7: Williamsburg Pottery Rd & Lightfoot Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	10	10	300	10	147	10	44	384	351	66	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		125	125		0	400		0	125		0
Storage Lanes	0		1	1		1	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.865			0.990	
Flt Protected		0.985		0.950			0.950			0.950		
Satd. Flow (prot)	0	1835	1583	1770	1863	1583	1752	1596	0	1752	1826	0
Flt Permitted		0.985		0.950			0.950			0.950		
Satd. Flow (perm)	0	1835	1583	1770	1863	1583	1752	1596	0	1752	1826	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			11			160		417			5	
Link Speed (mph)		30			45			45			45	
Link Distance (ft)		636			405			633			1283	
Travel Time (s)		14.5			6.1			9.6			19.4	
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%
Adj. Flow (vph)	5	11	11	326	11	160	11	48	417	382	72	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	16	11	326	11	160	11	465	0	382	77	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						
Detector Phase	4	4	4	3	3	3	1	6		5	2	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	5.0	10.0		5.0	10.0	
Minimum Split (s)	11.5	11.5	11.5	13.0	13.0	13.0	11.5	16.0		12.0	16.0	
Total Split (s)	11.5	11.5	11.5	22.0	22.0	22.0	11.5	20.5	0.0	26.0	35.0	0.0
Total Split (%)	14.4%	14.4%	14.4%	27.5%	27.5%	27.5%	14.4%	25.6%	0.0%	32.5%	43.8%	0.0%
Maximum Green (s)	7.0	7.0	7.0	16.0	16.0	16.0	5.0	14.5		19.0	29.0	
Yellow Time (s)	3.0	3.0	3.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
All-Red Time (s)	1.5	1.5	1.5	2.0	2.0	2.0	2.5	1.0		3.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.5	3.5	3.5	5.0	5.0	5.0	5.5	5.0	3.0	6.0	5.0	3.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0		2.0	3.0	
Recall Mode	None	None	None	None	None	None	None	Min		None	Min	
Act Effct Green (s)		8.2	8.2	16.5	16.5	16.5	6.1	12.6		18.5	35.3	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio		0.12	0.12	0.24	0.24	0.24	0.09	0.19		0.27	0.52	
v/c Ratio		0.07	0.06	0.76	0.02	0.32	0.07	0.73		0.80	0.08	
Control Delay		32.2	18.7	39.9	24.0	6.9	34.3	12.7		39.6	11.2	
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		32.2	18.7	39.9	24.0	6.9	34.3	12.7		39.6	11.2	
LOS		C	B	D	C	A	C	B		D	B	
Approach Delay		26.7			28.9			13.2			34.8	
Approach LOS		C			C			B			C	
Queue Length 50th (ft)		6	0	114	3	0	4	16		129	11	
Queue Length 95th (ft)		25	15	#303	17	48	21	117		#337	51	
Internal Link Dist (ft)		556			325			553			1203	
Turn Bay Length (ft)			125	125			400			125		
Base Capacity (vph)		221	200	453	477	524	158	692		527	952	
Starvation Cap Reductn		0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn		0	0	0	0	0	0	0		0	0	
Storage Cap Reductn		0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio		0.07	0.06	0.72	0.02	0.31	0.07	0.67		0.72	0.08	

Intersection Summary
Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 67.9
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 25.6 Intersection LOS: C
Intersection Capacity Utilization 81.3% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Williamsburg Pottery Rd & Lightfoot Rd

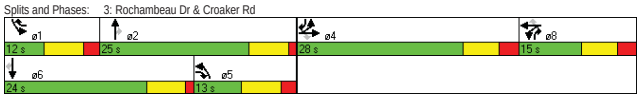


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	504	403	273	134	403	73	325	548	75	36	577	652
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	350		150	250		200	175		50	175		125
Storage Lanes	1		1	2		1	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3400	1845	1568	1752	3505	1568	3367	3471	1553	1736	3471	1553
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3400	1845	1568	1752	3505	1568	3367	3471	1553	1736	3471	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			106			68			56			14
Link Speed (mph)		45			55			55			55	
Link Distance (ft)		763			1413			845			689	
Travel Time (s)		11.6			17.5			10.5			8.5	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	548	438	297	146	438	79	353	596	82	39	627	709
Shared Lane Traffic (%)												
Lane Group Flow (vph)	548	438	297	146	438	79	353	596	82	39	627	709
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			36			36	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Split		pm+ov	Split		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	4
Permitted Phases			4			8			2			6
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	4
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	10.0	5.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	16.0	12.0	12.0	16.0	12.0
Total Split (s)	28.0	28.0	13.0	15.0	15.0	12.0	13.0	25.0	15.0	12.0	24.0	28.0
Total Split (%)	35.0%	35.0%	16.3%	18.8%	18.8%	15.0%	16.3%	31.3%	18.8%	15.0%	30.0%	35.0%
Maximum Green (s)	21.0	21.0	6.0	8.0	8.0	5.0	6.0	19.0	8.0	5.0	18.0	21.0
Yellow Time (s)	4.5	4.5	5.0	4.5	4.5	5.0	5.0	5.0	4.5	5.0	5.0	4.5
All-Red Time (s)	2.5	2.5	2.0	2.5	2.5	2.0	2.0	1.0	2.5	2.0	1.0	2.5
Lost Time Adjust (s)	-1.0	-3.0	-3.0	-1.0	-3.0	-1.0	-3.0	-2.0	-2.0	-3.0	-2.0	-2.0
Total Lost Time (s)	6.0	4.0	4.0	6.0	4.0	6.0	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag			Lag			Lead	Lag	Lag		Lead	Lead	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0	2.0	2.0	5.0	3.0	2.0	5.0	3.0
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	None
Act Effct Green (s)	21.8	23.8	36.8	9.0	11.0	21.0	9.0	23.2	33.3	8.0	19.8	41.6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.27	0.30	0.46	0.11	0.14	0.26	0.11	0.29	0.42	0.10	0.25	0.52
v/c Ratio	0.59	0.79	0.38	0.74	0.90	0.17	0.93	0.59	0.12	0.22	0.73	0.87
Control Delay	28.1	38.2	10.3	58.0	58.6	8.9	68.3	28.0	4.5	36.6	33.1	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.1	38.2	10.3	58.0	58.6	8.9	68.3	28.0	4.5	36.6	33.1	22.4
LOS	C	D	B	E	E	A	E	C	A	D	C	C
Approach Delay		27.4			52.6			39.9			27.7	
Approach LOS		C			D			D			C	
Queue Length 50th (ft)	121	200	56	72	115	4	91	139	5	18	151	124
Queue Length 95th (ft)	171	#344	112	#161	#200	36	#171	194	22	47	210	#317
Internal Link Dist (ft)		683			1333			765			609	
Turn Bay Length (ft)	350		150	250		200	175		50	175		125
Base Capacity (vph)	940	557	782	198	484	464	381	1013	681	175	872	822
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.79	0.38	0.74	0.90	0.17	0.93	0.59	0.12	0.22	0.72	0.86

Intersection Summary
Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 79.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 34.3 Intersection LOS: C
Intersection Capacity Utilization 71.6% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Rochambeau Dr & Croaker Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	44	0	46	4	0	12	62	892	10	23	868	93
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	50	4	0	13	67	970	11	25	943	101
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											845	
pX, platoon unblocked	0.86	0.86	0.86	0.86	0.86		0.86					
vC, conflicting volume	1613	2109	472	1676	2199	485	1045			980		
vC1, stage 1 conf vol	993	993		1104	1104							
vC2, stage 2 conf vol	620	1115		572	1095							
vCu, unblocked vol	1381	1959	48	1454	2065	485	717			980		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	76	100	94	97	100	98	91			96		
cM capacity (veh/h)	197	150	863	158	137	525	742			688		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	98	17	67	485	485	11	25	472	472	101
Volume Left	48	4	67	0	0	0	25	0	0	0
Volume Right	50	13	0	0	0	11	0	0	0	101
cSH	326	634	742	1700	1700	1700	688	1700	1700	1700
Volume to Capacity	0.30	0.03	0.09	0.29	0.29	0.01	0.04	0.28	0.28	0.06
Queue Length 95th (ft)	31	2	7	0	0	0	3	0	0	0
Control Delay (s)	20.7	16.1	10.3	0.0	0.0	0.0	10.4	0.0	0.0	0.0
Lane LOS	C	C	B				B			
Approach Delay (s)	20.7	16.1	0.7				0.2			
Approach LOS	C	C								

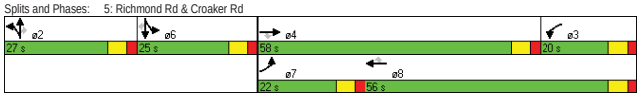
Intersection Summary
Average Delay 1.5
Intersection Capacity Utilization 49.9% ICU Level of Service A
Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	1333	93	358	1216	568	339	168	101	491	121	281
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		300	350		400	250		150	400		0
Storage Lanes	1		1	2		1	1		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.983		0.950		
Satd. Flow (prot)	1752	3505	1568	3400	3505	1568	1649	1706	1553	3367	1827	1553
Flt Permitted	0.950			0.950			0.950	0.983		0.950		
Satd. Flow (perm)	1752	3505	1568	3400	3505	1568	1649	1706	1553	3367	1827	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			80			503			92			237
Link Speed (mph)		45			45			30			55	
Link Distance (ft)		924			1194			582			3354	
Travel Time (s)		14.0			18.1			13.2			41.6	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	223	1449	101	389	1322	617	368	183	110	534	132	305
Shared Lane Traffic (%)							26%					
Lane Group Flow (vph)	223	1449	101	389	1322	617	272	279	110	534	132	305
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		45			50			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	23.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	22.0	58.0	58.0	20.0	56.0	56.0	27.0	27.0	27.0	25.0	25.0	25.0
Total Split (%)	16.9%	44.6%	44.6%	15.4%	43.1%	43.1%	20.8%	20.8%	20.8%	19.2%	19.2%	19.2%
Maximum Green (s)	16.0	52.0	52.0	14.0	50.0	50.0	21.0	21.0	21.0	19.0	19.0	19.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Max	Max	Max	None	None	None
Act Effct Green (s)	17.0	53.0	53.0	15.0	51.0	51.0	22.0	22.0	22.0	20.0	20.0	20.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.13	0.41	0.41	0.12	0.39	0.39	0.17	0.17	0.17	0.15	0.15	0.15
v/c Ratio	0.97	1.01	0.15	0.99	0.96	0.67	0.97	0.97	0.32	1.03	0.47	0.69
Control Delay	109.2	65.6	8.0	100.8	55.4	9.9	101.6	98.5	15.7	101.0	56.4	22.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	109.2	65.6	8.0	100.8	55.4	9.9	101.6	98.5	15.7	101.0	56.4	22.1
LOS	F	E	A	F	E	A	F	F	B	F	E	C
Approach Delay		67.8			50.9			86.0			70.2	
Approach LOS		E			D			F			E	
Queue Length 50th (ft)	190	~656	11	171	566	62	243	248	13	~247	103	51
Queue Length 95th (ft)	#354	#816	47	#277	#723	199	#431	#437	67	#362	170	156
Internal Link Dist (ft)		844			1114			502			3274	
Turn Bay Length (ft)	300		300	350		400	250		150	400		
Base Capacity (vph)	229	1429	687	392	1375	921	279	289	339	518	281	439
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.97	1.01	0.15	0.99	0.96	0.67	0.97	0.97	0.32	1.03	0.47	0.69

Intersection Summary
Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 130
Natural Cycle: 120
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 63.4 Intersection LOS: E
Intersection Capacity Utilization 91.5% ICU Level of Service F
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Richmond Rd & Croaker Rd

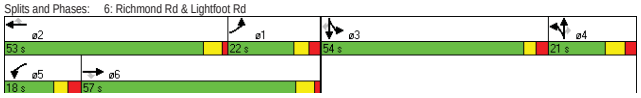


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	282	1541	225	210	1324	316	212	7	162	281	7	275
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		300	300		200	0		125	0		200
Storage Lanes	1		1	1		1	1		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.954	
Satd. Flow (prot)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1760	1568
Flt Permitted	0.950			0.950			0.950				0.954	
Satd. Flow (perm)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1760	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			134			145			176			253
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		2866			884			391			2806	
Travel Time (s)		43.4			13.4			5.9			42.5	
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
Adj. Flow (vph)	307	1675	245	228	1439	343	230	8	176	305	8	299
Shared Lane Traffic (%)												
Lane Group Flow (vph)	307	1675	245	228	1439	343	230	8	176	0	313	299
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		50			50			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			3
Detector Phase	1	6	6	5	2	2	4	4	4	3	3	3
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.5	37.0	37.0	11.5	21.0	21.0	14.5	14.5	14.5	54.0	54.0	54.0
Total Split (s)	22.0	57.0	57.0	18.0	53.0	53.0	21.0	21.0	21.0	54.0	54.0	54.0
Total Split (%)	14.7%	38.0%	38.0%	12.0%	35.3%	35.3%	14.0%	14.0%	14.0%	36.0%	36.0%	36.0%
Maximum Green (s)	15.5	51.0	51.0	11.5	47.0	47.0	13.5	13.5	13.5	48.0	48.0	48.0
Yellow Time (s)	3.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0	3.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-2.5	-2.0	-2.0	-2.5	-2.0	-2.0	-1.0	-3.5	-3.5	-1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.5	4.0	4.0	5.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Min	None	None	None	None	None	None
Walk Time (s)		5.0	5.0							5.0	5.0	5.0
Flash Dont Walk (s)		26.0	26.0							43.0	43.0	43.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Pedestrian Calls (#/hr)		0	0							0	0	0
Act Effct Green (s)	18.1	53.2	53.2	14.0	49.2	49.2	14.5	17.1	17.1		30.9	30.9
Actuated g/C Ratio	0.14	0.41	0.41	0.11	0.38	0.38	0.11	0.13	0.13		0.24	0.24
v/c Ratio	1.27	1.18	0.34	1.21	1.10	0.51	1.19	0.03	0.49		0.76	0.53
Control Delay	196.0	124.0	14.1	184.0	94.3	21.5	172.6	54.1	12.7		58.5	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	196.0	124.0	14.1	184.0	94.3	21.5	172.6	54.1	12.7		58.5	11.5
LOS	F	F	B	F	F	C	F	D	B		E	B
Approach Delay		121.8			92.1			102.3			35.5	
Approach LOS		F			F			F			D	
Queue Length 50th (ft)	~330	~898	60	~237	~728	126	~235	6	0		249	31
Queue Length 95th (ft)	#571	#1176	143	#447	#988	248	#445	24	72		352	113
Internal Link Dist (ft)		2786			804			311			2726	
Turn Bay Length (ft)	250		300	300		200			125			200
Base Capacity (vph)	241	1420	715	188	1313	678	194	240	357		673	756
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0		0	0
Reduced v/c Ratio	1.27	1.18	0.34	1.21	1.10	0.51	1.19	0.03	0.49		0.47	0.40

Intersection Summary
Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 131.2
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.27
Intersection Signal Delay: 98.9 Intersection LOS: F
Intersection Capacity Utilization 86.8% ICU Level of Service E
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Richmond Rd & Lightfoot Rd



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	10	10	475	10	393	10	96	524	280	82	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		125	125		0	400		0	125		0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.873			0.992	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1752	1610	0	1752	1830	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1752	1610	0	1752	1830	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			11			427		242			3	
Link Speed (mph)		30			45			45			45	
Link Distance (ft)		636			405			633			1283	
Travel Time (s)		14.5			6.1			9.6			19.4	
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%
Adj. Flow (vph)	5	11	11	516	11	427	11	104	570	304	89	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	11	11	516	11	427	11	674	0	304	94	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						
Detector Phase	4	4	4	3	3	3	1	6		5	2	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	5.0	10.0		5.0	10.0	
Minimum Split (s)	11.5	11.5	11.5	13.0	13.0	13.0	11.5	16.0		12.0	16.0	
Total Split (s)	11.5	11.5	11.5	39.0	39.0	39.0	11.5	43.5	0.0	26.0	58.0	0.0
Total Split (%)	9.6%	9.6%	9.6%	32.5%	32.5%	32.5%	9.6%	36.3%	0.0%	21.7%	48.3%	0.0%
Maximum Green (s)	7.0	7.0	7.0	33.0	33.0	33.0	5.0	37.5		19.0	52.0	
Yellow Time (s)	3.0	3.0	3.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
All-Red Time (s)	1.5	1.5	1.5	2.0	2.0	2.0	2.5	1.0		3.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.5	3.5	3.5	5.0	5.0	5.0	5.5	5.0	3.0	6.0	5.0	3.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lag	Lead	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0		2.0	3.0	
Recall Mode	None	None	None	None	None	None	None	Min		None	Min	
Act Effct Green (s)	8.0	8.0	8.0	34.1	34.1	34.1	6.0	38.6		20.0	62.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.07	0.07	0.07	0.30	0.30	0.30	0.05	0.33		0.17	0.54	
v/c Ratio	0.04	0.04	0.09	0.99	0.02	0.56	0.12	0.96		1.00	0.09	
Control Delay	53.4	52.9	27.5	77.9	31.2	6.2	57.5	51.6		100.2	14.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	53.4	52.9	27.5	77.9	31.2	6.2	57.5	51.6		100.2	14.9	
LOS	D	D	C	E	C	A	E	D		F	B	
Approach Delay		42.6			45.2			51.7			80.0	
Approach LOS		D			D			D			F	
Queue Length 50th (ft)	4	4	0	~429	6	0	8	373		~255	33	
Queue Length 95th (ft)	17	14	20	#645	21	81	28	#635		#434	74	
Internal Link Dist (ft)		556			325			553			1203	
Turn Bay Length (ft)			125	125			400			125		
Base Capacity (vph)	123	246	120	523	550	769	92	699		304	992	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.04	0.04	0.09	0.99	0.02	0.56	0.12	0.96		1.00	0.09	

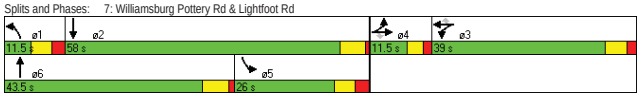
Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 115.4
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 54.1 Intersection LOS: D
Intersection Capacity Utilization 98.4% ICU Level of Service F
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 7: Williamsburg Pottery Rd & Lightfoot Rd



HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst: SS
Agency/Co: VHB
Date: 3/24/2014
Analysis Period: AM Peak
Highway: Mooretown Road
From/To: Lightfoot Road and VA 199
Jurisdiction: Williamsburg, VA
Analysis Year: 2040 NB
Project ID: Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	745	vph	457	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	202		124	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	408	pcphpl	250	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	408	pcphpl	250	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	8.2	pc/mi/ln	5.0	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	404.9	248.4
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.29	2.04
Bicycle LOS	B	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Mooretown Road
From/To:	Lightfoot Road and VA 199
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	814	vph	878	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	221		239	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	446	pcphpl	481	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	446	pcphpl	481	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	A		A	
Density, D	8.9	pc/mi/ln	9.6	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp	45	45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	442.4	477.2
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.34	2.38
Bicycle LOS	B	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Richmond Road
From/To:	Lightfoot Rd and Croaker Rd
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	48.3	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1409	vph	1270	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	383		345	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	777	pcphpl	700	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	777	pcphpl	700	pcphpl
Free-flow speed, FFS	48.3	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	B		B	
Density, D	15.5	pc/mi/ln	14.0	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp	45	45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	765.8	690.2
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.85	2.79
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Richmond Road
From/To:	Lightfoot Rd and Croaker Rd
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	48.3	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1925	vph	2142	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	523		582	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	1061	pcphpl	1181	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1061	pcphpl	1181	pcphpl
Free-flow speed, FFS	48.3	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	C		C	
Density, D	21.2	pc/mi/ln	23.6	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp	45	45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	1046.2	1164.1
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	3.00	3.06
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Croaker Road
From/To:	North of Richmond Road
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	750	vph	669	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	204		182	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	413	pcphpl	369	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	413	pcphpl	369	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	6.9	pc/mi/ln	6.2	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	407.6	363.6
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.53	2.47
Bicycle LOS	C	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Croaker Road
From/To:	North of Richmond Road
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	941	vph	893	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	256		243	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	519	pcphpl	492	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	519	pcphpl	492	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	8.6	pc/mi/ln	8.2	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp	45	45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	511.4	485.3
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.64	2.62
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Croaker Road
From/To:	Rochambeau Rd and I-64 EB Ramp
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	1375	vph	1060	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	374		288	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	758	pcphpl	584	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	758	pcphpl	584	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	B		A	
Density, D	12.6	pc/mi/ln	9.7	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp	45	45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	747.3	576.1
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.83	2.70
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Croaker Road
From/To:	Rochambeau Rd and I-64 EB Ramp
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 NB
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	1125	vph	1265	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	306		344	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	620	pcphpl	697	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	620	pcphpl	697	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		B	
Density, D	10.3	pc/mi/ln	11.6	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp	45	45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	611.4	687.5
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.73	2.79
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Two-Lane Highways Release 6.65

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	AM Peak
Highway	Lightfoot Road (VA 646)
From/To	Richmond Rd to Mooretown Rd
Jurisdiction	Williamsburg, VA
Analysis Year	2040 NB
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 2		Peak hour factor, PHF	0.92	
Shoulder width	2.0	ft	% Trucks and buses	1	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 455 veh/h
Opposing direction volume, Vo 401 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.2		1.3	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.998		0.997	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	496	pc/h	437	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.3	mi/h
Adjustment for no-passing zones, fnp	2.5	mi/h
Average travel speed, ATSd	39.5	mi/h
Percent Free Flow Speed, PFFS	80.1	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	495	pc/h	436	pc/h
Base percent time-spent-following,(note-4) BPTSFd	50.0	%		
Adjustment for no-passing zones, fnp	41.3			
Percent time-spent-following, PTSFd	72.0	%		

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.29	
Peak 15-min vehicle-miles of travel, VMT15	87	veh-mi
Peak-hour vehicle-miles of travel, VMT60	318	veh-mi
Peak 15-min total travel time, TT15	2.2	veh-h
Capacity from ATS, CdATS	0	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	39.5	mi/h
Percent time-spent-following, PTSFd (from above)	72.0	
Level of service, LOSd (from above)	D	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	PM Peak
Highway	Lightfoot Road (VA 646)
From/To	Richmond Rd to Mooretown Rd
Jurisdiction	Williamsburg, VA
Analysis Year	2040 NB
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 2		Peak hour factor, PHF	0.92	
Shoulder width	2.0	ft	% Trucks and buses	1	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 605 veh/h
Opposing direction volume, Vo 563 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.999		0.999	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	658	pc/h	613	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.3	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	37.5	mi/h
Percent Free Flow Speed, PFFS	76.2	%

Posted speed limit, Sp	45	
Percent of segment with occupied on-highway parking	0	
Pavement rating, P	3	
Flow rate in outside lane, vOL	494.6	
Effective width of outside lane, We	13.50	
Effective speed factor, St	4.42	
Bicycle LOS Score, BLOS	4.15	
Bicycle LOS	D	

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	658	pc/h	612	pc/h
Base percent time-spent-following,(note-4) BPTSFd	61.3	%		
Adjustment for no-passing zones, fnp	32.1			
Percent time-spent-following, PTSFd	77.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.39	
Peak 15-min vehicle-miles of travel, VMT15	115	veh-mi
Peak-hour vehicle-miles of travel, VMT60	423	veh-mi
Peak 15-min total travel time, TT15	3.1	veh-h
Capacity from ATS, CdATS	0	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	37.5	mi/h
Percent time-spent-following, PTSFd (from above)	77.9	
Level of service, LOSd (from above)	D	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	45	
Percent of segment with occupied on-highway parking	0	
Pavement rating, P	3	
Flow rate in outside lane, vOL	657.6	
Effective width of outside lane, We	13.50	
Effective speed factor, St	4.42	
Bicycle LOS Score, BLOS	4.30	
Bicycle LOS	D	

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

1: I-64 WB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	560	0	0	65	0	450	320	0	375	230
Sign Control		Yield			Stop			Free			Free	
Grade		-1%			-1%			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	609	0	0	71	0	489	348	0	408	250
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	723	897	204	693	897	245	408			489		
vC1, stage 1 conf vol	408	408		489	489							
vC2, stage 2 conf vol	315	489		204	408							
vCu, unblocked vol	723	897	204	693	897	245	408			489		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	24	100	100	91	100			100		
cM capacity (veh/h)	401	385	800	151	385	753	1141			1063		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	609	71	245	245	348	204	204	250
Volume Left	0	0	0	0	0	0	0	0
Volume Right	609	71	0	0	348	0	0	250
cSH	800	753	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.76	0.09	0.14	0.14	0.20	0.12	0.12	0.15
Queue Length 95th (ft)	183	8	0	0	0	0	0	0
Control Delay (s)	22.3	10.3	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B						
Approach Delay (s)	22.3	10.3	0.0			0.0		
Approach LOS	C	B						

Intersection Summary				
Average Delay	6.6			
Intersection Capacity Utilization	51.7%	ICU Level of Service	A	
Analysis Period (min)	15			

2: I-64 EB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	265	0	0	150	0	620	755	0	795	140
Sign Control		Stop			Yield			Free			Free	
Grade		-1%			-1%			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	288	0	0	163	0	674	821	0	864	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)								689				
pX, platoon unblocked												
vC, conflicting volume	1201	1538	432	1106	1538	337	864			674		
vC1, stage 1 conf vol	864	864		674	674							
vC2, stage 2 conf vol	337	674		432	864							
vCu, unblocked vol	1201	1538	432	1106	1538	337	864			674		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	49	100	100	75	100			100		
cM capacity (veh/h)	219	236	569	187	236	656	768			906		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	288	163	337	337	821	432	432	152
Volume Left	0	0	0	0	0	0	0	0
Volume Right	288	163	0	0	821	0	0	152
cSH	569	656	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.51	0.25	0.20	0.20	0.48	0.25	0.25	0.09
Queue Length 95th (ft)	71	24	0	0	0	0	0	0
Control Delay (s)	17.6	12.3	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B						
Approach Delay (s)	17.6	12.3	0.0			0.0		
Approach LOS	C	B						

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	50.1%	ICU Level of Service	A	
Analysis Period (min)	15			

8: Mooretown Rd & Rt. 199 SB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	653	92	0	262	206	0	0	506	0	0	195
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	710	100	0	285	224	0	0	550	0	0	212
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		405										
pX, platoon unblocked												
vC, conflicting volume	285			710			852	995	355	640	995	142
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	285			710			852	995	355	640	995	142
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	14	100	100	76
cM capacity (veh/h)	1274			885			191	242	639	50	242	876

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	355	355	100	142	142	224	550	212
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	100	0	0	224	550	212
cSH	1700	1700	1700	1700	1700	1700	639	876
Volume to Capacity	0.21	0.21	0.06	0.08	0.08	0.13	0.86	0.24
Queue Length 95th (ft)	0	0	0	0	0	0	246	24
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	35.6	10.4
Lane LOS							E	B
Approach Delay (s)	0.0			0.0			35.6	10.4
Approach LOS							E	B

Intersection Summary				
Average Delay	10.5			
Intersection Capacity Utilization	56.0%	ICU Level of Service	B	
Analysis Period (min)	15			

9: Mooretown Rd & Rt. 199 NB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1035	124	0	407	183	0	0	483	0	0	61
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	1125	135	0	442	199	0	0	525	0	0	66
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1190										
pX, platoon unblocked												
vC, conflicting volume	442			1125			1346	1567	562	1005	1567	221
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	442			1125			1346	1567	562	1005	1567	221
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	0	0	100	91
cM capacity (veh/h)	1114			617			100	109	467	0	109	780

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	562	562	135	221	221	199	525	66
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	135	0	0	199	525	66
cSH	1700	1700	1700	1700	1700	1700	467	780
Volume to Capacity	0.33	0.33	0.08	0.13	0.13	0.12	1.12	0.09
Queue Length 95th (ft)	0	0	0	0	0	0	452	7
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	108.7	10.0
Lane LOS							F	B
Approach Delay (s)	0.0			0.0			108.7	10.0
Approach LOS							F	B

Intersection Summary				
Average Delay	23.2			
Intersection Capacity Utilization	65.2%	ICU Level of Service	C	
Analysis Period (min)	15			

1: I-64 WB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	775	0	0	140	0	530	240	0	280	260
Sign Control		Yield			Stop			Free			Free	
Grade		-1%			-1%			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	842	0	0	152	0	576	261	0	304	283
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	745	880	152	728	880	288	304			576		
vC1, stage 1 conf vol	304	304		576	576							
vC2, stage 2 conf vol	440	576		152	304							
vCu, unblocked vol	745	880	152	728	880	288	304			576		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	2	100	100	78	100			100		
cM capacity (veh/h)	344	383	864	18	383	706	1246			986		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	842	152	288	288	261	152	152	283
Volume Left	0	0	0	0	0	0	0	0
Volume Right	842	152	0	0	261	0	0	283
cSH	864	706	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.98	0.22	0.17	0.17	0.15	0.09	0.09	0.17
Queue Length 95th (ft)	412	20	0	0	0	0	0	0
Control Delay (s)	46.8	11.5	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	B						
Approach Delay (s)	46.8	11.5	0.0			0.0		
Approach LOS	E	B						

Intersection Summary				
Average Delay	17.0			
Intersection Capacity Utilization	62.4%	ICU Level of Service		B
Analysis Period (min)	15			

2: I-64 EB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	280	0	0	125	0	645	480	0	985	70
Sign Control		Stop			Yield			Free			Free	
Grade		-1%			-1%			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	304	0	0	136	0	701	522	0	1071	76
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)								689				
pX, platoon unblocked												
vC, conflicting volume	1421	1772	535	1236	1772	351	1071			701		
vC1, stage 1 conf vol	1071	1071		701	701							
vC2, stage 2 conf vol	351	701		535	1071							
vCu, unblocked vol	1421	1772	535	1236	1772	351	1071			701		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	38	100	100	79	100			100		
cM capacity (veh/h)	174	196	487	134	196	643	641			885		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	304	136	351	351	522	535	535	76
Volume Left	0	0	0	0	0	0	0	0
Volume Right	304	136	0	0	522	0	0	76
cSH	487	643	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.62	0.21	0.21	0.21	0.31	0.31	0.31	0.04
Queue Length 95th (ft)	105	20	0	0	0	0	0	0
Control Delay (s)	23.9	12.1	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B						
Approach Delay (s)	23.9	12.1	0.0			0.0		
Approach LOS	C	B						

Intersection Summary				
Average Delay	3.2			
Intersection Capacity Utilization	51.2%	ICU Level of Service		A
Analysis Period (min)	15			

8: Mooretown Rd & Rt. 199 SB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	693	121	0	747	586	0	0	415	0	0	131
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	753	132	0	812	637	0	0	451	0	0	142
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		405										
pX, platoon unblocked												
vC, conflicting volume	812			753			1159	1565	377	1189	1565	406
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	812			753			1159	1565	377	1189	1565	406
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	27	100	100	76
cM capacity (veh/h)	810			853			114	109	618	38	109	592

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	377	377	132	406	406	637	451	142
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	132	0	0	637	451	142
cSH	1700	1700	1700	1700	1700	1700	618	592
Volume to Capacity	0.22	0.22	0.08	0.24	0.24	0.37	0.73	0.24
Queue Length 95th (ft)	0	0	0	0	0	0	156	23
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	24.9	13.0
Lane LOS							C	B
Approach Delay (s)	0.0			0.0			24.9	13.0
Approach LOS							C	B

Intersection Summary				
Average Delay	4.5			
Intersection Capacity Utilization	51.5%	ICU Level of Service		A
Analysis Period (min)	15			

9: Mooretown Rd & Rt. 199 NB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	945	163	0	1228	510	0	0	595	0	0	105
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	1027	177	0	1335	554	0	0	647	0	0	114
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1190										
pX, platoon unblocked												
vC, conflicting volume	1335			1027			1695	2362	514	1848	2362	667
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1335			1027			1695	2362	514	1848	2362	667
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	0	0	100	71
cM capacity (veh/h)	513			672			43	34	503	0	34	399

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	514	514	177	667	667	554	647	114
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	177	0	0	554	647	114
cSH	1700	1700	1700	1700	1700	1700	503	399
Volume to Capacity	0.30	0.30	0.10	0.39	0.39	0.33	1.29	0.29
Queue Length 95th (ft)	0	0	0	0	0	0	673	29
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	167.2	17.6
Lane LOS							F	C
Approach Delay (s)	0.0			0.0			167.2	17.6
Approach LOS							F	C

Intersection Summary				
Average Delay	28.6			
Intersection Capacity Utilization	69.6%	ICU Level of Service		C
Analysis Period (min)	15			

Build Conditions
(2040)

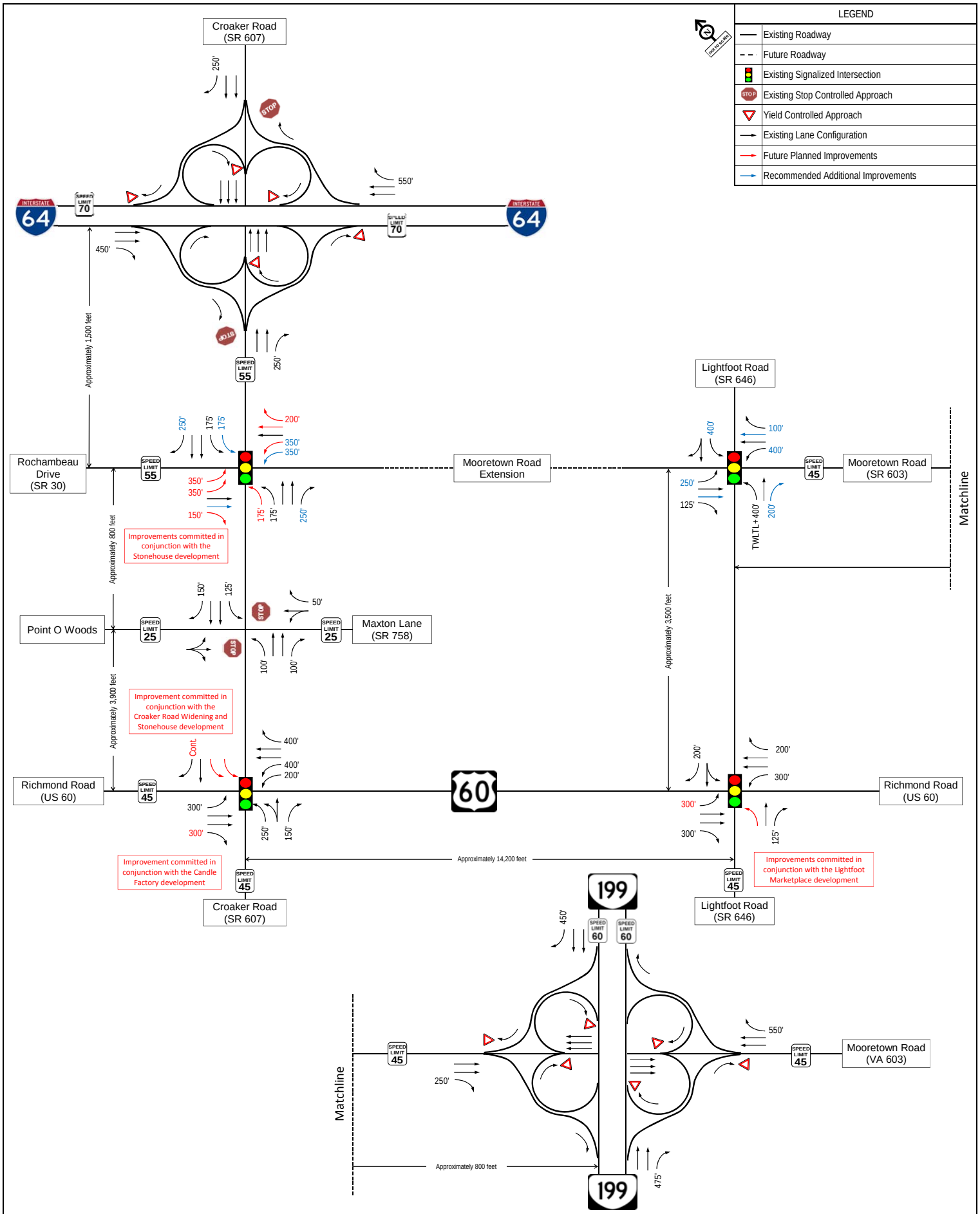


Figure A-5
Build (2040) Lane Configurations and Traffic Control

Mooretown Road Corridor Study
Williamsburg, VA

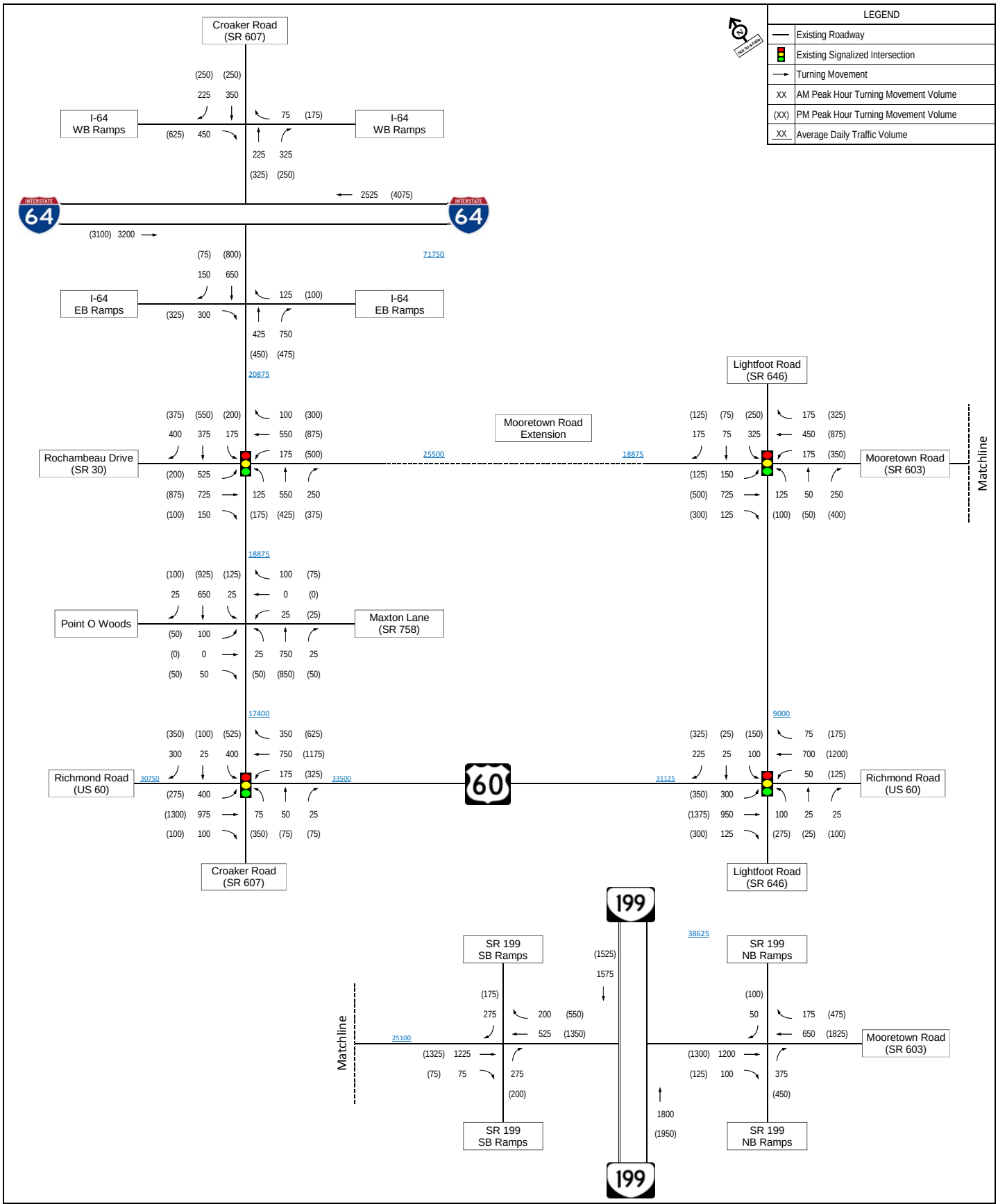


Figure A-6
Build (2040) AM and PM Peak Hour Turning Movement Volumes

Mooretown Road Corridor Study
Williamsburg, VA

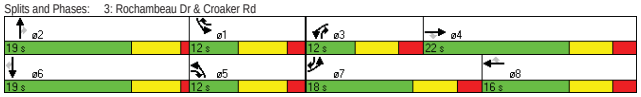
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	525	725	150	175	550	100	125	550	250	175	375	400
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	350		150	350		200	175		250	175		250
Storage Lanes	2		1	2		1	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3400	3505	1568	3400	3505	1568	3367	3471	1553	3367	3471	1553
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3400	3505	1568	3400	3505	1568	3367	3471	1553	3367	3471	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			95			28			66			101
Link Speed (mph)		45			55			55			55	
Link Distance (ft)		763			1413			845			689	
Travel Time (s)		11.6			17.5			10.5			8.5	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	571	788	163	190	598	109	136	598	272	190	408	435
Shared Lane Traffic (%)												
Lane Group Flow (vph)	571	788	163	190	598	109	136	598	272	190	408	435
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			36			36	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	10.0	5.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	16.0	12.0	12.0	16.0	12.0
Total Split (s)	18.0	22.0	12.0	12.0	16.0	12.0	12.0	19.0	12.0	12.0	19.0	18.0
Total Split (%)	27.7%	33.8%	18.5%	18.5%	24.6%	18.5%	18.5%	29.2%	18.5%	18.5%	29.2%	27.7%
Maximum Green (s)	11.0	15.0	5.0	5.0	9.0	5.0	5.0	13.0	5.0	5.0	13.0	11.0
Yellow Time (s)	4.5	4.5	5.0	4.5	4.5	5.0	5.0	5.0	4.5	5.0	5.0	4.5
All-Red Time (s)	2.5	2.5	2.0	2.5	2.5	2.0	2.0	1.0	2.5	2.0	1.0	2.5
Lost Time Adjust (s)	-1.0	-3.0	-3.0	-1.0	-3.0	-1.0	-3.0	-2.0	-2.0	-3.0	-2.0	-2.0
Total Lost Time (s)	6.0	4.0	4.0	6.0	4.0	6.0	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0	2.0	2.0	5.0	3.0	2.0	5.0	3.0
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	None
Act Effct Green (s)	12.0	18.0	26.4	6.0	12.0	16.0	8.4	15.0	21.0	8.0	14.6	26.6
Actuated g/C Ratio	0.18	0.28	0.41	0.09	0.18	0.25	0.13	0.23	0.32	0.12	0.22	0.41
v/c Ratio	0.91	0.81	0.24	0.61	0.92	0.27	0.31	0.75	0.50	0.46	0.52	0.62
Control Delay	47.7	30.3	4.0	37.4	49.5	9.5	28.2	30.2	10.4	30.5	24.8	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.7	30.3	4.0	37.4	49.5	9.5	28.2	30.2	10.4	30.5	24.8	10.2
LOS	D	C	A	D	D	A	C	C	B	C	C	B
Approach Delay		34.0			42.0			24.6			19.7	
Approach LOS		C			D			C			B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 65
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 30.2 Intersection LOS: C
Intersection Capacity Utilization 65.4% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 3: Rochambeau Dr & Croaker Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	0	50	25	0	100	25	750	25	25	650	25
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)	109	0	54	27	0	109	27	815	27	27	707	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											845	
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	1223	1658	353	1332	1658	408	734			842		
vC1, stage 1 conf vol	761	761		870	870							
vC2, stage 2 conf vol	462	897		462	788							
vCu, unblocked vol	1085	1553	148	1202	1553	408	558			842		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	55	100	93	88	100	82	97			97		
cM capacity (veh/h)	242	211	806	226	215	590	924			776		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	163	136	27	408	408	27	27	353	353	27
Volume Left	109	27	27	0	0	0	27	0	0	0
Volume Right	54	109	0	0	0	27	0	0	0	27
cSH	316	738	924	1700	1700	1700	776	1700	1700	1700
Volume to Capacity	0.52	0.18	0.03	0.24	0.24	0.02	0.03	0.21	0.21	0.02
Queue Length 95th (ft)	70	17	2	0	0	0	3	0	0	0
Control Delay (s)	27.9	14.6	9.0	0.0	0.0	0.0	9.8	0.0	0.0	0.0
Lane LOS	D	B	A				A			
Approach Delay (s)	27.9	14.6	0.3				0.4			
Approach LOS	D	B								

Intersection Summary

Average Delay	3.7		
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

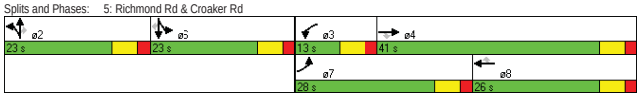
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	400	975	100	175	750	350	75	50	25	400	25	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		300	350		400	250		150	400		0
Storage Lanes	1		1	2		1	1		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.989		0.950		
Satd. Flow (prot)	1752	3505	1568	3400	3505	1568	1649	1716	1553	3367	1827	1553
Flt Permitted	0.950			0.950			0.950	0.989		0.950		
Satd. Flow (perm)	1752	3505	1568	3400	3505	1568	1649	1716	1553	3367	1827	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			109			380			27			326
Link Speed (mph)		45			45			30			55	
Link Distance (ft)		924			1194			582			3354	
Travel Time (s)		14.0			18.1			13.2			41.6	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	435	1060	109	190	815	380	82	54	27	435	27	326
Shared Lane Traffic (%)							19%					
Lane Group Flow (vph)	435	1060	109	190	815	380	66	70	27	435	27	326
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		45			50			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	23.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	28.0	41.0	41.0	13.0	26.0	26.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (%)	28.0%	41.0%	41.0%	13.0%	26.0%	26.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Maximum Green (s)	22.0	35.0	35.0	7.0	20.0	20.0	17.0	17.0	17.0	17.0	17.0	17.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Max	Max	Max	None	None	None
Act Effct Green (s)	23.0	36.0	36.0	8.0	21.0	21.0	18.0	18.0	18.0	17.2	17.2	17.2
Actuated g/C Ratio	0.23	0.36	0.36	0.08	0.21	0.21	0.18	0.18	0.18	0.17	0.17	0.17
v/c Ratio	1.07	0.83	0.17	0.69	1.10	0.60	0.22	0.23	0.09	0.74	0.09	0.60
Control Delay	103.0	36.1	5.0	58.8	101.1	8.1	37.3	37.3	13.6	47.6	35.0	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	103.0	36.1	5.0	58.8	101.1	8.1	37.3	37.3	13.6	47.6	35.0	9.4
LOS	F	D	A	E	F	A	D	D	B	D	D	A
Approach Delay		52.1			69.8			33.4			31.4	
Approach LOS		D			E			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 99.2
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.10
Intersection Signal Delay: 53.4 — Intersection LOS: D
Intersection Capacity Utilization 73.5% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Richmond Rd & Croaker Rd



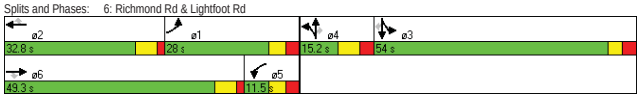
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	950	125	50	700	75	100	25	25	100	25	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		300	300		200	0		125	0		200
Storage Lanes	1		1	1		1	1		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.961	
Satd. Flow (prot)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1773	1568
Flt Permitted	0.950			0.950			0.950				0.961	
Satd. Flow (perm)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1773	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			136			65			27			245
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		2866			884			391			2806	
Travel Time (s)		43.4			13.4			5.9			42.5	
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
Adj. Flow (vph)	326	1033	136	54	761	82	109	27	27	109	27	245
Shared Lane Traffic (%)												
Lane Group Flow (vph)	326	1033	136	54	761	82	109	27	27	0	136	245
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		50			50			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			3
Detector Phase	1	6	6	5	2	2	4	4	4	3	3	3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.5	37.0	37.0	11.5	21.0	21.0	14.5	14.5	14.5	54.0	54.0	54.0
Total Split (s)	28.0	49.3	49.3	11.5	32.8	32.8	15.2	15.2	15.2	54.0	54.0	54.0
Total Split (%)	21.5%	37.9%	37.9%	8.8%	25.2%	25.2%	11.7%	11.7%	11.7%	41.5%	41.5%	41.5%
Maximum Green (s)	21.5	43.3	43.3	5.0	26.8	26.8	7.7	7.7	7.7	48.0	48.0	48.0
Yellow Time (s)	3.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0	3.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-2.5	-2.0	-2.0	-2.5	-2.0	-2.0	-1.0	-3.5	-3.5	-1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.5	4.0	4.0	5.0	4.0	4.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Min	None	None	None	None	None	None
Walk Time (s)		5.0	5.0							5.0	5.0	5.0
Flash Dont Walk (s)		26.0	26.0							43.0	43.0	43.0
Pedestrian Calls (#/hr)		0	0							0	0	0
Act Effct Green (s)	24.0	45.7	45.7	9.6	28.8	28.8	8.7	11.2	11.2		14.7	14.7
Actuated g/C Ratio	0.25	0.48	0.48	0.10	0.30	0.30	0.09	0.12	0.12		0.16	0.16
v/c Ratio	0.73	0.61	0.16	0.30	0.71	0.16	0.68	0.12	0.13		0.49	0.54
Control Delay	44.4	21.2	3.3	46.5	34.3	10.1	64.6	40.4	16.6		42.9	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	44.4	21.2	3.3	46.5	34.3	10.1	64.6	40.4	16.6		42.9	9.6
LOS	D	C	A	D	C	B	E	D	B		D	A
Approach Delay		24.6			32.8			52.6			21.5	
Approach LOS		C			C			D			C	

Intersection Summary

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 94.8
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 28.3 — Intersection LOS: C
Intersection Capacity Utilization 59.5% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 6: Richmond Rd & Lightfoot Rd



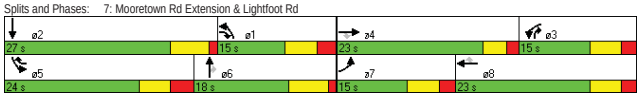
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	725	125	175	450	175	125	50	250	325	75	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		125	400		100	400		200	400		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850		0.895	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1752	1845	1568	1752	1651	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1752	1845	1568	1752	1651	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			136			190			85		144	
Link Speed (mph)		30			45			45			45	
Link Distance (ft)		636			405			633			1283	
Travel Time (s)		14.5			6.1			9.6			19.4	
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%
Adj. Flow (vph)	163	788	136	190	489	190	136	54	272	353	82	190
Shared Lane Traffic (%)												
Lane Group Flow (vph)	163	788	136	190	489	190	136	54	272	353	272	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		16			16			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		
Protected Phases	7	4	1	3	8	5	1	6	3	5	2	
Permitted Phases			4			8			6			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	1	3	8	5	1	6	3	5	2	
Switch Phase												
Minimum Initial (s)	4.0	7.0	5.0	4.0	4.0	5.0	5.0	10.0	4.0	5.0	10.0	
Minimum Split (s)	10.0	11.5	11.5	10.0	22.0	12.0	11.5	16.0	10.0	12.0	16.0	
Total Split (s)	15.0	23.0	15.0	15.0	23.0	24.0	15.0	18.0	15.0	24.0	27.0	0.0
Total Split (%)	18.8%	28.8%	18.8%	18.8%	28.8%	30.0%	18.8%	22.5%	18.8%	30.0%	33.8%	0.0%
Maximum Green (s)	9.0	18.5	8.5	9.0	17.0	17.0	8.5	12.0	9.0	17.0	21.0	
Yellow Time (s)	4.0	3.0	4.0	4.0	4.0	4.0	4.0	5.0	4.0	4.0	5.0	
All-Red Time (s)	2.0	1.5	2.5	2.0	2.0	3.0	2.5	1.0	2.0	3.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	3.5	5.5	5.0	5.0	6.0	5.5	5.0	5.0	6.0	5.0	3.0
Lead/Lag	Lead	Lead	Lag	Lag	Lag	Lead	Lag	Lag	Lag	Lead	Lead	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0	2.0	2.0	3.0	3.0	2.0	3.0	
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	
Walk Time (s)					5.0							
Flash Dont Walk (s)					11.0							
Pedestrian Calls (#/hr)					0							
Act Effct Green (s)	9.8	19.5	38.0	10.0	18.2	40.7	15.0	11.0	21.0	17.6	14.1	
Actuated g/C Ratio	0.13	0.25	0.49	0.13	0.23	0.52	0.19	0.14	0.27	0.23	0.18	
v/c Ratio	0.73	0.89	0.16	0.83	0.59	0.21	0.40	0.21	0.56	0.89	0.65	
Control Delay	53.1	41.9	3.2	64.2	29.9	2.1	33.6	31.9	13.1	55.8	21.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	53.1	41.9	3.2	64.2	29.9	2.1	33.6	31.9	13.1	55.8	21.2	
LOS	D	D	A	E	C	A	C	C	B	E	C	
Approach Delay		38.8			31.3			21.3			40.8	
Approach LOS		D			C			C			D	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 77.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 34.4 Intersection LOS: C
Intersection Capacity Utilization 71.9% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 7: Mooretown Rd Extension & Lightfoot Rd



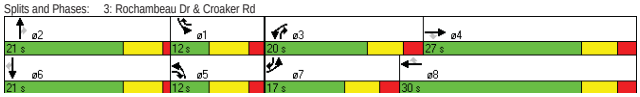
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	875	100	500	875	300	175	425	375	200	550	375
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	350		150	350		200	175		250	175		250
Storage Lanes	2		1	2		1	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3400	3505	1568	3400	3505	1568	3367	3471	1553	3367	3471	1553
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3400	3505	1568	3400	3505	1568	3367	3471	1553	3367	3471	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			21			90			21			34
Link Speed (mph)		45			55			55			55	
Link Distance (ft)		763			1413			845			689	
Travel Time (s)		11.6			17.5			10.5			8.5	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	217	951	109	543	951	326	190	462	408	217	598	408
Shared Lane Traffic (%)												
Lane Group Flow (vph)	217	951	109	543	951	326	190	462	408	217	598	408
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			28			36			36	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	10.0	5.0	5.0	10.0	5.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	16.0	12.0	12.0	16.0	12.0
Total Split (s)	17.0	27.0	12.0	20.0	30.0	12.0	12.0	21.0	20.0	12.0	21.0	17.0
Total Split (%)	21.3%	33.8%	15.0%	25.0%	37.5%	15.0%	15.0%	26.3%	25.0%	15.0%	26.3%	21.3%
Maximum Green (s)	10.0	20.0	5.0	13.0	23.0	5.0	5.0	15.0	13.0	5.0	15.0	10.0
Yellow Time (s)	4.5	4.5	5.0	4.5	4.5	5.0	5.0	5.0	4.5	5.0	5.0	4.5
All-Red Time (s)	2.5	2.5	2.0	2.5	2.5	2.0	2.0	1.0	2.5	2.0	1.0	2.5
Lost Time Adjust (s)	-1.0	-3.0	-3.0	-1.0	-3.0	-1.0	-3.0	-2.0	-2.0	-3.0	-2.0	-2.0
Total Lost Time (s)	6.0	4.0	4.0	6.0	4.0	6.0	4.0	4.0	5.0	4.0	4.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0	2.0	2.0	5.0	3.0	2.0	5.0	3.0
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	None
Act Effct Green (s)	10.6	23.0	31.0	14.0	26.4	30.7	8.0	16.7	30.7	8.3	17.0	27.6
Actuated g/C Ratio	0.13	0.29	0.39	0.18	0.33	0.38	0.10	0.21	0.38	0.10	0.21	0.34
v/c Ratio	0.48	0.94	0.18	0.91	0.82	0.50	0.56	0.64	0.67	0.62	0.81	0.73
Control Delay	35.9	46.9	7.3	54.7	32.3	10.9	41.4	33.4	17.1	43.1	40.2	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.9	46.9	7.3	54.7	32.3	10.9	41.4	33.4	17.1	43.1	40.2	21.0
LOS	D	D	A	D	C	B	D	C	B	D	D	C
Approach Delay		41.7			35.1			28.5			34.3	
Approach LOS		D			D			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 35.2 Intersection LOS: D
Intersection Capacity Utilization 73.6% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 3: Rochambeau Dr & Croaker Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	0	50	25	0	75	50	850	50	125	925	100
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)	54	0	54	27	0	82	54	924	54	136	1005	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						2						
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											845	
pX, platoon unblocked	0.87	0.87	0.87	0.87	0.87		0.87					
vC, conflicting volume	1848	2364	503	1861	2418	462	1114			978		
vC1, stage 1 conf vol	1277	1277		1033	1033							
vC2, stage 2 conf vol	571	1087		829	1386							
vCu, unblocked vol	1682	2272	142	1697	2335	462	842			978		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	49	100	93	79	100	85	92			80		
cM capacity (veh/h)	107	84	766	131	92	544	679			689		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	109	109	54	462	462	54	136	503	503	109
Volume Left	54	27	54	0	0	0	136	0	0	0
Volume Right	54	82	0	0	0	54	0	0	0	109
cSH	188	525	679	1700	1700	1700	689	1700	1700	1700
Volume to Capacity	0.58	0.21	0.08	0.27	0.27	0.03	0.20	0.30	0.30	0.06
Queue Length 95th (ft)	78	19	7	0	0	0	18	0	0	0
Control Delay (s)	47.6	19.5	10.8	0.0	0.0	0.0	11.5	0.0	0.0	0.0
Lane LOS	E	C	B				B			
Approach Delay (s)	47.6	19.5	0.6				1.3			
Approach LOS	E	C								

Intersection Summary

Average Delay	3.8			
Intersection Capacity Utilization	52.9%	ICU Level of Service	A	
Analysis Period (min)	15			

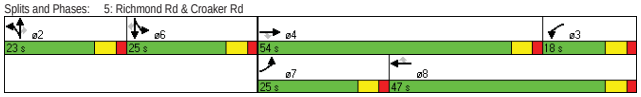
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	275	1300	100	325	1175	625	350	75	75	525	100	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		300	350		400	250		150	400		0
Storage Lanes	1		1	2		1	1		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.969		0.950		
Satd. Flow (prot)	1752	3505	1568	3400	3505	1568	1649	1682	1553	3367	1827	1553
Flt Permitted	0.950			0.950			0.950	0.969		0.950		
Satd. Flow (perm)	1752	3505	1568	3400	3505	1568	1649	1682	1553	3367	1827	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			97			579			82			304
Link Speed (mph)		45			45			30			55	
Link Distance (ft)		924			1194			582			3354	
Travel Time (s)		14.0			18.1			13.2			41.6	
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	299	1413	109	353	1277	679	380	82	82	571	109	380
Shared Lane Traffic (%)							40%					
Lane Group Flow (vph)	299	1413	109	353	1277	679	228	234	82	571	109	380
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		45			50			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	23.0	23.0	10.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	25.0	54.0	54.0	18.0	47.0	47.0	23.0	23.0	23.0	25.0	25.0	25.0
Total Split (%)	20.8%	45.0%	45.0%	15.0%	39.2%	39.2%	19.2%	19.2%	19.2%	20.8%	20.8%	20.8%
Maximum Green (s)	19.0	48.0	48.0	12.0	41.0	41.0	17.0	17.0	17.0	19.0	19.0	19.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Max	Max	Max	None	None	None
Act Effct Green (s)	20.0	49.0	49.0	13.0	42.0	42.0	18.0	18.0	18.0	20.0	20.0	20.0
Actuated g/C Ratio	0.17	0.41	0.41	0.11	0.35	0.35	0.15	0.15	0.15	0.17	0.17	0.17
v/c Ratio	1.02	0.99	0.16	0.96	1.04	0.73	0.92	0.93	0.27	1.02	0.36	0.74
Control Delay	108.4	56.5	6.1	91.2	75.4	10.7	91.3	91.8	12.1	92.0	48.2	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	108.4	56.5	6.1	91.2	75.4	10.7	91.3	91.8	12.1	92.0	48.2	20.4
LOS	F	E	A	F	E	B	F	F	B	F	D	C
Approach Delay		62.0			58.8			79.6			61.9	
Approach LOS		E			E			E			E	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Natural Cycle: 120
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 62.3 — Intersection LOS: E
Intersection Capacity Utilization 81.9% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Richmond Rd & Croaker Rd



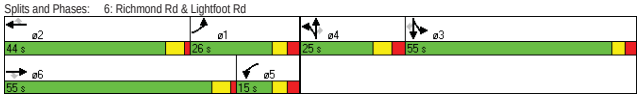
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	350	1375	300	125	1200	175	275	25	100	150	25	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		300	300		200	0		125	0		200
Storage Lanes	1		1	1		1	1		1	0		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950				0.959	
Satd. Flow (prot)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1769	1568
Flt Permitted	0.950			0.950			0.950				0.959	
Satd. Flow (perm)	1752	3505	1568	1752	3505	1568	1752	1845	1568	0	1769	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			196			82			109			225
Link Speed (mph)		45			45			45			45	
Link Distance (ft)		2866			884			391			2806	
Travel Time (s)		43.4			13.4			5.9			42.5	
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
Adj. Flow (vph)	380	1495	326	136	1304	190	299	27	109	163	27	353
Shared Lane Traffic (%)												
Lane Group Flow (vph)	380	1495	326	136	1304	190	299	27	109	0	190	353
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		50			50			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2			4			3
Detector Phase	1	6	6	5	2	2	4	4	4	3	3	3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	5.0	15.0	15.0	5.0	15.0	15.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.5	37.0	37.0	11.5	21.0	21.0	14.5	14.5	14.5	54.0	54.0	54.0
Total Split (s)	26.0	55.0	55.0	15.0	44.0	44.0	25.0	25.0	25.0	55.0	55.0	55.0
Total Split (%)	17.3%	36.7%	36.7%	10.0%	29.3%	29.3%	16.7%	16.7%	16.7%	36.7%	36.7%	36.7%
Maximum Green (s)	19.5	49.0	49.0	8.5	38.0	38.0	17.5	17.5	17.5	49.0	49.0	49.0
Yellow Time (s)	3.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0	3.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-2.5	-2.0	-2.0	-2.5	-2.0	-2.0	-1.0	-3.5	-3.5	-1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.5	4.0	4.0	5.0	4.0	4.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Min	None	None	None	None	None	None
Walk Time (s)		5.0	5.0							5.0	5.0	5.0
Flash Dont Walk (s)		26.0	26.0							43.0	43.0	43.0
Pedestrian Calls (#/hr)		0	0							0	0	0
Act Effct Green (s)	22.1	51.1	51.1	11.0	40.1	40.1	18.6	21.1	21.1		21.1	21.1
Actuated g/C Ratio	0.18	0.42	0.42	0.09	0.33	0.33	0.15	0.18	0.18		0.18	0.18
v/c Ratio	1.18	1.00	0.42	0.84	1.12	0.33	1.11	0.08	0.30		0.61	0.77
Control Delay	153.0	59.5	11.6	94.7	102.5	19.5	134.1	44.9	10.8		54.3	28.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	153.0	59.5	11.6	94.7	102.5	19.5	134.1	44.9	10.8		54.3	28.2
LOS	F	E	B	F	F	B	F	D	B		D	C
Approach Delay		68.6			92.1			97.7			37.3	
Approach LOS		E			F			F			D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 120.4
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.18
Intersection Signal Delay: 75.6 — Intersection LOS: E
Intersection Capacity Utilization 84.5% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 6: Richmond Rd & Lightfoot Rd



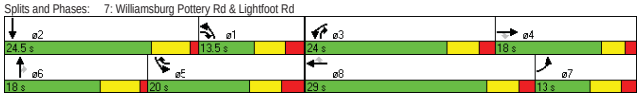
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	500	300	350	875	325	100	50	400	250	75	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		125	400		100	400		200	400		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850		0.906	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1752	1845	1568	1752	1671	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1752	1845	1568	1752	1671	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			326			343			80		99	
Link Speed (mph)		30			45			45			45	
Link Distance (ft)		636			405			633			1283	
Travel Time (s)		14.5			6.1			9.6			19.4	
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%
Adj. Flow (vph)	136	543	326	380	951	353	109	54	435	272	82	136
Shared Lane Traffic (%)												
Lane Group Flow (vph)	136	543	326	380	951	353	109	54	435	272	218	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		16			16			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane								Yes				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		
Protected Phases	7	4	1	3	8	5	1	6	3	5	2	
Permitted Phases			4			8			6			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	1	3	8	5	1	6	3	5	2	
Switch Phase												
Minimum Initial (s)	4.0	7.0	5.0	4.0	4.0	5.0	5.0	10.0	4.0	5.0	10.0	
Minimum Split (s)	10.0	11.5	11.5	10.0	22.0	12.0	11.5	16.0	10.0	12.0	16.0	
Total Split (s)	13.0	18.0	13.5	24.0	29.0	20.0	13.5	18.0	24.0	20.0	24.5	0.0
Total Split (%)	16.3%	22.5%	16.9%	30.0%	36.3%	25.0%	16.9%	22.5%	30.0%	25.0%	30.6%	0.0%
Maximum Green (s)	7.0	13.5	7.0	18.0	23.0	13.0	7.0	12.0	18.0	13.0	18.5	
Yellow Time (s)	4.0	3.0	4.0	4.0	4.0	4.0	4.0	5.0	4.0	4.0	5.0	
All-Red Time (s)	2.0	1.5	2.5	2.0	2.0	3.0	2.5	1.0	2.0	3.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	3.5	5.5	5.0	5.0	6.0	5.5	5.0	5.0	6.0	5.0	3.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lead	Lag	Lead	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0	2.0	2.0	3.0	3.0	2.0	3.0	
Recall Mode	None	None	None	None	None	None	None	Min	None	None	Min	
Walk Time (s)					5.0							
Flash Dont Walk (s)					11.0							
Pedestrian Calls (#/hr)					0							
Act Effct Green (s)	8.0	14.4	24.5	18.8	23.7	42.6	12.1	11.1	29.8	13.9	13.4	
Actuated g/C Ratio	0.10	0.19	0.32	0.24	0.31	0.55	0.16	0.14	0.38	0.18	0.17	
v/c Ratio	0.74	0.83	0.45	0.89	0.88	0.34	0.40	0.21	0.67	0.87	0.59	
Control Delay	60.4	42.9	3.6	53.7	37.0	2.2	36.9	32.0	14.1	59.6	22.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	60.4	42.9	3.6	53.7	37.0	2.2	36.9	32.0	14.1	59.6	22.6	
LOS	E	D	A	D	D	A	D	C	B	E	C	
Approach Delay		32.5			33.5			19.9			43.1	
Approach LOS		C			C			B			D	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 77.7
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 32.3 Intersection LOS: C
Intersection Capacity Utilization 71.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 7: Williamsburg Pottery Rd & Lightfoot Rd



HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst: SS
Agency/Co: VHB
Date: 3/24/2014
Analysis Period: AM Peak
Highway: Mooretown Road
From/To: Lightfoot Road and VA 199
Jurisdiction: Williamsburg, VA
Analysis Year: 2040 - Build
Project ID: Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1300	vph	800	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	353		217	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	713	pcphpl	439	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	713	pcphpl	439	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	B		A	
Density, D	14.3	pc/mi/ln	8.8	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	706.5	434.8
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.58	2.33
Bicycle LOS	C	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Mooretown Road
From/To:	Lightfoot Road and VA 199
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1150	vph	1550	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	312		421	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	631	pcphpl	850	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	631	pcphpl	850	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	B		B	
Density, D	12.6	pc/mi/ln	17.0	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	625.0	842.4
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.51	2.66
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Richmond Road
From/To:	Lightfoot Rd and Croaker Rd
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	48.3	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1400	vph	1275	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	380		346	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	772	pcphpl	703	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	772	pcphpl	703	pcphpl
Free-flow speed, FFS	48.3	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	B		B	
Density, D	15.4	pc/mi/ln	14.1	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	760.9	692.9
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.84	2.80
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Richmond Road
From/To:	Lightfoot Rd and Croaker Rd
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	48.3	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1900	vph	2125	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	516		577	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	1048	pcphpl	1172	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	1048	pcphpl	1172	pcphpl
Free-flow speed, FFS	48.3	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	C		C	
Density, D	21.0	pc/mi/ln	23.4	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	1032.6	1154.9
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	3.00	3.06
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Croaker Road
From/To:	North of Richmond Road
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	800	vph	725	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	217		197	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	441	pcphpl	399	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	441	pcphpl	399	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	7.3	pc/mi/ln	6.7	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	434.8	394.0
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.56	2.51
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Croaker Road
From/To:	North of Richmond Road
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	975	vph	975	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	265		265	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	537	pcphpl	537	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	537	pcphpl	537	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	8.9	pc/mi/ln	8.9	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	529.9	529.9
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.66	2.66
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Croaker Road
From/To:	Rochambeau Rd and I-64 EB Ramp
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	1175	vph	950	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	319		258	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	648	pcphpl	524	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	648	pcphpl	524	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	10.8	pc/mi/ln	8.7	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	638.6	516.3
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.76	2.65
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Croaker Road
From/To:	Rochambeau Rd and I-64 EB Ramp
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	15		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	62.0	mph	62.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	3.8	mph	2.5	mph
Free-flow speed	58.3	mph	59.5	mph

VOLUME

Direction	1		2	
Volume, V	925	vph	1125	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	251		306	
Trucks and buses	3	%	3	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.985		0.985	
Flow rate, vp	510	pcphpl	620	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	510	pcphpl	620	pcphpl
Free-flow speed, FFS	58.3	mph	59.5	mph
Avg. passenger-car travel speed, S	60.0	mph	60.0	mph
Level of service, LOS	A		A	
Density, D	8.5	pc/mi/ln	10.3	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	502.7	611.4
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.63	2.73
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	AM Peak
Highway:	Mooretown Rd Extension (west)
From/To:	East of Croaker Road
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1150	vph	825	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	312		224	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	631	pcphpl	452	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	631	pcphpl	452	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	B		A	
Density, D	12.6	pc/mi/ln	9.0	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	625.0	448.4
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.51	2.34
Bicycle LOS	C	B

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Multilane Highways Release 6.65

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	SS
Agency/Co:	VHB
Date:	3/24/2014
Analysis Period:	PM Peak
Highway:	Mooretown Rd Extension (west)
From/To:	East of Croaker Road
Jurisdiction:	Williamsburg, VA
Analysis Year:	2040 - Build
Project ID:	Mooretown Road Corridor Study

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	8		10	
Median type	Divided		Divided	
Free-flow speed:	Base		Base	
FFS or BFFS	52.0	mph	52.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	0.0	mph	0.0	mph
Access points adjustment, FA	2.0	mph	2.5	mph
Free-flow speed	50.0	mph	49.5	mph

VOLUME

Direction	1		2	
Volume, V	1450	vph	1675	vph
Peak-hour factor, PHF	0.92		0.92	
Peak 15-minute volume, v15	394		455	
Trucks and buses	2	%	2	%
Recreational vehicles	0	%	0	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990	
Flow rate, vp	795	pcphpl	919	pcphpl

RESULTS

Direction	1		2	
Flow rate, vp	795	pcphpl	919	pcphpl
Free-flow speed, FFS	50.0	mph	49.5	mph
Avg. passenger-car travel speed, S	50.0	mph	50.0	mph
Level of service, LOS	B		C	
Density, D	15.9	pc/mi/ln	18.4	pc/mi/ln

Bicycle Level of Service

Posted speed limit, Sp		45
Percent of segment with occupied on-highway parking	0	0
Pavement rating, P	3	3
Flow rate in outside lane, vOL	788.0	910.3
Effective width of outside lane, We	24.00	24.00
Effective speed factor, St	4.42	4.42
Bicycle LOS Score, BLOS	2.63	2.70
Bicycle LOS	C	C

Overall results are not computed when free-flow speed is less than 45 mph.

HCS 2010: Two-Lane Highways Release 6.65

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	AM Peak
Highway	Lightfoot Road (VA 646)
From/To	Richmond Rd to Mooretown Rd
Jurisdiction	Williamsburg, VA
Analysis Year	2040 - Build
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 2		Peak hour factor, PHF	0.92	
Shoulder width	2.0	ft	% Trucks and buses	1	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd 400 veh/h
Opposing direction volume, Vo 350 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.3		1.3	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.997		0.997	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	436	pc/h	382	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.3	mi/h
Adjustment for no-passing zones, fnp	2.8	mi/h
Average travel speed, ATSd	40.1	mi/h
Percent Free Flow Speed, PFFS	81.4	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		0.999	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	435	pc/h	381	pc/h
Base percent time-spent-following,(note-4) BPTSFd	44.6	%		
Adjustment for no-passing zones, fnp	44.4			
Percent time-spent-following, PTSFd	68.3	%		

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.26	
Peak 15-min vehicle-miles of travel, VMT15	76	veh-mi
Peak-hour vehicle-miles of travel, VMT60	280	veh-mi
Peak 15-min total travel time, TT15	1.9	veh-h
Capacity from ATS, CdATS	0	veh/h
Capacity from PTSF, CdPTSF	1698	veh/h
Directional Capacity	1698	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	40.1	mi/h
Percent time-spent-following, PTSFd (from above)	68.3	
Level of service, LOSd (from above)	C	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	45
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	434.8
Effective width of outside lane, We	13.50
Effective speed factor, St	4.42
Bicycle LOS Score, BLOS	4.09
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	SS
Agency/Co.	VHB
Date Performed	3/24/2014
Analysis Time Period	PM Peak
Highway	Lightfoot Road (VA 646)
From/To	Richmond Rd to Mooretown Rd
Jurisdiction	Williamsburg, VA
Analysis Year	2040 - Build
Description	Mooretown Road Corridor Study

Input Data

Highway class	Class 2		Peak hour factor, PHF	0.92	
Shoulder width	2.0	ft	% Trucks and buses	1	%
Lane width	11.5	ft	% Trucks crawling	0.0	%
Segment length	0.7	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length	-	mi	% No-passing zones	100	%
Up/down	-	%	Access point density	11	/mi

Analysis direction volume, Vd	550	veh/h
Opposing direction volume, Vo	500	veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.2	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.999		0.998	
Grade adj. factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	598	pc/h	545	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed total demand,(note-3) V	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	55.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	3.0	mi/h
Adj. for access point density,(note-3) fA	2.8	mi/h
Free-flow speed, FFSd	49.3	mi/h
Adjustment for no-passing zones, fnp	2.1	mi/h
Average travel speed, ATSd	38.3	mi/h
Percent Free Flow Speed, PFFS	77.7	%

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fg	1.00		1.00	
Directional flow rate,(note-2) vi	598	pc/h	543	pc/h
Base percent time-spent-following,(note-4) BPTSFd	57.7	%		
Adjustment for no-passing zones, fnp	35.6			
Percent time-spent-following, PTSFd	76.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.35	
Peak 15-min vehicle-miles of travel, VMT15	105	veh-mi
Peak-hour vehicle-miles of travel, VMT60	385	veh-mi
Peak 15-min total travel time, TT15	2.7	veh-h
Capacity from ATS, CdATS	0	veh/h
Capacity from PTSF, CdPTSF	1700	veh/h
Directional Capacity	1700	veh/h

Passing Lane Analysis

Total length of analysis segment, Lt	0.7	mi
Length of two-lane highway upstream of the passing lane, Lu	-	mi
Length of passing lane including tapers, Lpl	-	mi
Average travel speed, ATSd (from above)	38.3	mi/h
Percent time-spent-following, PTSFd (from above)	76.4	
Level of service, LOSd (from above)	D	

Average Travel Speed with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-	mi
Adj. factor for the effect of passing lane on average speed, fpl	-	
Average travel speed including passing lane, ATSpl	-	
Percent free flow speed including passing lane, PFFSpl	0.0	%

Percent Time-Spent-Following with Passing Lane

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	-	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	-	
Percent time-spent-following including passing lane, PTSFpl	-	%

Level of Service and Other Performance Measures with Passing Lane

Level of service including passing lane, LOSpl	A	
Peak 15-min total travel time, TT15	-	veh-h

Bicycle Level of Service

Posted speed limit, Sp	45
Percent of segment with occupied on-highway parking	0
Pavement rating, P	3
Flow rate in outside lane, vOL	597.8
Effective width of outside lane, We	13.50
Effective speed factor, St	4.42
Bicycle LOS Score, BLOS	4.25
Bicycle LOS	D

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

1: I-64 WB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	450	0	0	75	0	225	325	0	350	225
Sign Control		Yield			Stop			Free			Free	
Grade		-1%			-1%			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	489	0	0	82	0	245	353	0	380	245
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	584	625	190	435	625	122	380			245		
vC1, stage 1 conf vol	380	380		245	245							
vC2, stage 2 conf vol	204	245		190	380							
vCu, unblocked vol	584	625	190	435	625	122	380			245		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	40	100	100	91	100			100		
cM capacity (veh/h)	460	477	816	270	477	903	1167			1311		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	489	82	122	122	353	190	190	245
Volume Left	0	0	0	0	0	0	0	0
Volume Right	489	82	0	0	353	0	0	245
cSH	816	903	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.60	0.09	0.07	0.07	0.21	0.11	0.11	0.14
Queue Length 95th (ft)	102	7	0	0	0	0	0	0
Control Delay (s)	15.8	9.4	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A						
Approach Delay (s)	15.8	9.4	0.0			0.0		
Approach LOS	C	A						

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

2: I-64 EB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	300	0	0	125	0	425	750	0	650	150
Sign Control		Stop			Yield			Free			Free	
Grade		-1%			-1%			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	326	0	0	136	0	462	815	0	707	163
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)								689				
pX, platoon unblocked												
vC, conflicting volume	938	1168	353	815	1168	231	707			462		
vC1, stage 1 conf vol	707	707		462	462							
vC2, stage 2 conf vol	231	462		353	707							
vCu, unblocked vol	938	1168	353	815	1168	231	707			462		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	49	100	100	82	100			100		
cM capacity (veh/h)	294	308	640	234	308	768	881			1088		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	326	136	231	231	815	353	353	163
Volume Left	0	0	0	0	0	0	0	0
Volume Right	326	136	0	0	815	0	0	163
cSH	640	768	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.51	0.18	0.14	0.14	0.48	0.21	0.21	0.10
Queue Length 95th (ft)	73	16	0	0	0	0	0	0
Control Delay (s)	16.3	10.7	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B						
Approach Delay (s)	16.3	10.7	0.0			0.0		
Approach LOS	C	B						

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

8: Mooretown Rd & Rt. 199 SB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1225	75	0	525	200	0	0	275	0	0	275
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	1332	82	0	571	217	0	0	299	0	0	299
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		405										
pX, platoon unblocked				0.79			0.79	0.79	0.79	0.79	0.79	
vC, conflicting volume	571			1332			1617	1902	666	1236	1902	285
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	571			901			1260	1619	63	781	1619	285
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	62	100	100	58
cM capacity (veh/h)	998			596			58	81	783	139	81	709

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	666	666	82	285	285	217	299	299
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	82	0	0	217	299	299
cSH	1700	1700	1700	1700	1700	1700	783	709
Volume to Capacity	0.39	0.39	0.05	0.17	0.17	0.13	0.38	0.42
Queue Length 95th (ft)	0	0	0	0	0	0	45	53
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	12.4	13.7
Lane LOS							B	B
Approach Delay (s)	0.0			0.0			12.4	13.7
Approach LOS							B	B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

9: Mooretown Rd & Rt. 199 NB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1200	100	0	650	175	0	0	375	0	0	50
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	1304	109	0	707	190	0	0	408	0	0	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1190										
pX, platoon unblocked				0.95			0.95	0.95	0.95	0.95	0.95	
vC, conflicting volume	707			1304			1658	2011	652	1359	2011	353
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	707			1210			1583	1956	521	1267	1956	353
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	14	100	100	92
cM capacity (veh/h)	888			542			63	59	471	16	59	640

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	652	652	109	353	353	190	408	54
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	109	0	0	190	408	54
cSH	1700	1700	1700	1700	1700	1700	471	640
Volume to Capacity	0.38	0.38	0.06	0.21	0.21	0.11	0.86	0.08
Queue Length 95th (ft)	0	0	0	0	0	0	225	7
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	44.6	11.1
Lane LOS							E	B
Approach Delay (s)	0.0			0.0			44.6	11.1
Approach LOS							E	B

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

1: I-64 WB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	625	0	0	175	0	325	250	0	250	250
Sign Control		Yield			Stop			Free			Free	
Grade		-1%			-1%			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	679	0	0	190	0	353	272	0	272	272
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	639	625	136	489	625	177	272			353		
vC1, stage 1 conf vol	272	272		353	353							
vC2, stage 2 conf vol	367	353		136	272							
vCu, unblocked vol	639	625	136	489	625	177	272			353		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	23	100	100	77	100			100		
cM capacity (veh/h)	379	479	885	168	479	833	1281			1195		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	679	190	177	177	272	136	136	272
Volume Left	0	0	0	0	0	0	0	0
Volume Right	679	190	0	0	272	0	0	272
cSH	885	833	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.77	0.23	0.10	0.10	0.16	0.08	0.08	0.16
Queue Length 95th (ft)	191	22	0	0	0	0	0	0
Control Delay (s)	21.1	10.6	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B						
Approach Delay (s)	21.1	10.6	0.0			0.0		
Approach LOS	C	B						

Intersection Summary				
Average Delay	8.0			
Intersection Capacity Utilization	52.3%	ICU Level of Service		A
Analysis Period (min)	15			

2: I-64 EB Ramps & Croaker Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	325	0	0	100	0	450	475	0	800	75
Sign Control		Stop			Yield			Free			Free	
Grade		-1%			-1%			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	353	0	0	109	0	489	516	0	870	82
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)								689				
pX, platoon unblocked												
vC, conflicting volume	1114	1359	435	924	1359	245	870			489		
vC1, stage 1 conf vol	870	870		489	489							
vC2, stage 2 conf vol	245	489		435	870							
vCu, unblocked vol	1114	1359	435	924	1359	245	870			489		
tC, single (s)	7.6	6.6	7.0	7.6	6.6	7.0	4.2			4.2		
tC, 2 stage (s)	6.6	5.6		6.6	5.6							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	38	100	100	86	100			100		
cM capacity (veh/h)	243	262	567	168	262	753	764			1063		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	353	109	245	245	516	435	435	82
Volume Left	0	0	0	0	0	0	0	0
Volume Right	353	109	0	0	516	0	0	82
cSH	567	753	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.62	0.14	0.14	0.14	0.30	0.26	0.26	0.05
Queue Length 95th (ft)	107	13	0	0	0	0	0	0
Control Delay (s)	21.3	10.6	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B						
Approach Delay (s)	21.3	10.6	0.0			0.0		
Approach LOS	C	B						

Intersection Summary				
Average Delay	3.6			
Intersection Capacity Utilization	48.9%	ICU Level of Service		A
Analysis Period (min)	15			

8: Mooretown Rd & Rt. 199 SB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1325	75	0	1350	550	0	0	200	0	0	175
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	1440	82	0	1467	598	0	0	217	0	0	190
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		405										
pX, platoon unblocked				0.87			0.87	0.87	0.87	0.87	0.87	
vC, conflicting volume	1467			1440			2174	2908	720	2188	2908	734
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1467			1200			2047	2893	369	2062	2893	734
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	60	100	100	47
cM capacity (veh/h)	456			500			13	13	542	16	13	361

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	720	720	82	734	734	598	217	190
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	82	0	0	598	217	190
cSH	1700	1700	1700	1700	1700	1700	542	361
Volume to Capacity	0.42	0.42	0.05	0.43	0.43	0.35	0.40	0.53
Queue Length 95th (ft)	0	0	0	0	0	0	48	74
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	16.0	25.6
Lane LOS							C	D
Approach Delay (s)	0.0			0.0			16.0	25.6
Approach LOS							C	D

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	55.7%	ICU Level of Service		B
Analysis Period (min)	15			

9: Mooretown Rd & Rt. 199 NB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1300	125	0	1825	475	0	0	450	0	0	100
Sign Control		Free			Free			Yield			Yield	
Grade		0%			0%			-1%			-1%	
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	1413	136	0	1984	516	0	0	489	0	0	109
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1190										
pX, platoon unblocked												
vC, conflicting volume	1984			1413			2405	3397	707	2690	3397	992
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1984			1413			2405	3397	707	2690	3397	992
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
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			100	100	0	0	100	55
cM capacity (veh/h)	287			478			9	7	376	0	7	243

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	707	707	136	992	992	516	489	109
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	136	0	0	516	489	109
cSH	1700	1700	1700	1700	1700	1700	376	243
Volume to Capacity	0.42	0.42	0.08	0.58	0.58	0.30	1.30	0.45
Queue Length 95th (ft)	0	0	0	0	0	0	559	54
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	183.5	31.3
Lane LOS							F	D
Approach Delay (s)	0.0			0.0			183.5	31.3
Approach LOS							F	D

Intersection Summary				
Average Delay	20.1			
Intersection Capacity Utilization	70.5%	ICU Level of Service		C
Analysis Period (min)	15			

APPENDIX B
Geotechnical Considerations Memo

February 19, 2015

TO: **VHB, Inc.**
351 McLaws Circle, Suite 3
Williamsburg, Virginia 23185-6316

Attn: Ms. Deborah Lenceski, PE

RE: Report of Preliminary Geotechnical Considerations
Mooretown Road Corridor Study
James City and York County, Virginia
G E T Project No: WM14-107G

Dear Ms. Lenceski:

Pursuant to your request, **G E T Solutions, Inc.** is pleased to submit this letter for the purpose of providing preliminary geotechnical engineering considerations as related to earthwork, infrastructure, pavements, and storm water management design and construction within the study area. This report is for preliminary planning purposes only. An actual subsurface investigation was not permitted or performed at this time. Our geotechnical considerations are based solely on published information such as the USDA soil surveys, information available through the USGS, previous investigations completed on nearby projects, and our experience with similar soils in this region.

Project Information:

The purpose of this study was to conduct a corridor analysis for the extension of Mooretown Road in portions of James City County and York County, Virginia. The 2009 James City County (JCC) Comprehensive Plan recommends extending Mooretown Road from its current terminus in York County (at the intersection with Lightfoot Road) to Croaker Road. In the 2009 James City County Comprehensive Plan 2035 projections, the Mooretown Road extension was factored into traffic analysis models as a four-lane road with 19,122 average daily trips. The proposed Mooretown Road extension will serve multiple purposes: to alleviate traffic on Richmond Road (Route 60), while providing an alternative corridor during emergency situations, and to provide primary access for the newly created economic opportunity designated area situated between the Croaker and Lightfoot I-64 interchanges.

In 2009, Richmond Road (Route 60) between Croaker Road and Centerville Road experienced 19,000 daily trips. For the 2035 projections, this segment of Richmond Road is anticipated to have 39,110 daily trips. In the past, during storm events, these sections of Richmond Road have become flooded, and a Mooretown extension was originally proposed as an alternative route during emergency situations.

Based on information provided by our client, the proposed Mooretown Road extension will likely consist mainly of a 2 lane roadway, but with a 4 lane right-of-way for future widening. It is possible that it will be 4 lanes initially just where the extension approaches Croaker Road. The projected average daily traffic (ADT) we have been provided ranges from 18,660 to 25,500 vehicles per day along the proposed Mooretown Road extension.

Project Location and Topography:

The proposed Mooretown Road extension would start at its current terminus in York County (at the intersection with Lightfoot Road) and continue generally northwest into James City County and terminate at Croaker Road. Several alignment alternatives have been previously considered, but the Alternative #2 alignment has been selected at this time and is the focus of this study.

The Alternative #2 alignment would extend Mooretown Road from its current terminus at the intersection with Lightfoot Road in a generally northwest direction. The proposed alignment would initially coincide with the existing Williamsburg Pottery Road for roughly 750 linear feet and then continue in the same northwest direction, whereas Williamsburg Pottery Road turns more to a westerly direction. The proposed alignment would then continue south of Williamsburg Pottery Campground into undeveloped wooded land. The alignment then continues in this northwest direction through this undeveloped wooded land where it will pass over Skimino Creek north of Williamsburg Pottery Outlets. After passing over Skimino Creek the alignment will continue across agricultural fields and come in close proximity to a CSX railroad line, then parallel the railroad for some distance. As the proposed alignment approaches Peach Street the alignment gradually turns in a more northerly direction across more agricultural fields, undeveloped wooded areas, an RV park, and finally terminate at Rochambeau Road near its intersection with Croaker Road.

The terrain along this proposed alignment is highly variable. The developed portions of the alignment such as the Williamsburg Pottery parcel near its intersection with Lightfoot Road are relatively flat. Similarly, the portions of the alignment that are located along existing agricultural land are relatively flat to gently sloping. Conversely, the undeveloped wooded areas along the proposed alignment consist of moderately to severely sloping terrain that contains multiple ravines and creeks. The elevations along the proposed alignment range from about 40 feet MSL (where Skimino Creek is located) up to 120 feet MSL.

Regional Geology:

The project site is located within the Atlantic Coastal Plain physiographic province. Bedrock of the Late Mesozoic age is present at depths of greater than 2,000 ft, and is overlain by Lower and Upper Cretaceous, Tertiary, Pleistocene and recent Sediments.

Across the outer Coastal Plain, the Pliocene age Yorktown Formation of the Tertiary Period is widespread, occurring from Maryland to North Carolina. Its age is estimated as between 4.8 million and 2.8 million years and is estimated to have been deposited during three transgressive episodes. The depositional environment was shallow marine in nature, consisting of inner shelf, barrier-island, estuarine and lagoonal patterns. The Yorktown Formation is a glauconitic, fossiliferous, Silty to Clayey greenish-gray fine Sand. This material has been pre-consolidated by an increased effective overburden pressure generated due to a drop in the sea level at the end of the Tertiary Period, and by previously overlying sediments, which eroded away as the sea level subsequently lowered.

As sea levels rose during the Pleistocene Epoch of the Quaternary Period, areas within the project limits were filled and overlain by soils of the Bacons Castle Formation. This formation is generally composed of fluvial and estuarine sand, silt, clay, organic soil and peat. In localized areas, recent Holocene sediments, primarily marsh or swamp, colluvium, and alluvium overlie these formations.

Anticipated Subsurface Conditions:

Based on previous projects completed in the vicinity of this corridor and our review of published information obtained for USGS and USDA Soil Surveys the following information is provided in regards to anticipated subsurface conditions.

The topsoil layer likely ranges from 6 to 18 inches, with an average of 12 inches anticipated. Isolated areas of deeper deposits of organics should be expected within the undeveloped wooded areas, particularly within the base of the ravines. Within the agricultural areas approximately 8 to 12 inches of till material is anticipated.

Underlying the topsoil layer, the soils will consist of various soil types. Generally, it is anticipated that the initial soil layer consists of Silty SAND (SM) or Sandy SILT (ML) with varying amounts of organics within the upper 12 to 24 inches. Underlying this initial soil layer the soils will likely consist of Lean CLAY (CL) with varying amounts of Silt and Sand and Silty and Clayey SAND (SM, SC). At greater depths (>20 to 30 feet) predominately Silty and Clayey SAND (SM and SC) soils are anticipated. Deeper deposits of organic laden soils, such as Organic Soils (OH/OL) and Peat (PT) are expected to be located within the base of the larger ravines prior to encountering inorganic soils. Other soils types are likely present along the proposed alignment, but likely at a lesser degree than those described above. These soil types could consist of SAND (SP, SP-SM, SC-SM), SILT (ML, MH), and CLAY (CH).

The groundwater level is expected to be located at depths in excess of 10 feet below existing grades for the majority of the proposed alignment that is beyond the limits of the ravines. These are generally considered areas located at an elevation of 80 feet MSL or higher. However, temporary perched water conditions should be expected at shallower depths above confining layers (such as Clays and Silts) following more significant rain events and prolonged wet periods. These temporary perched water conditions would dissipate with time and can typically be managed with sump pumps. Dewatering below the actual groundwater table may likely require well pointing. Groundwater levels will likely be near or above existing grades within the base of the ravines.

CONSTRUCTION CONSIDERATIONS

Ravine Crossings – Culverts Scenario

The proposed Mooretown Road extension will traverse several ravines with moderate to severe side slopes. It is anticipated that most of these crossing will be accomplished with the installation of culverts and significant embankment fills. After reviewing the existing topography it is expected that embankment fills on the order of 20 to 40 feet will be required at these locations. It is expected that these ravines, particularly the more significant ones, will have several feet (roughly 2 to 10 feet) of organic laden soils present within their base.

Considering the magnitude of embankment fill and expected soil conditions, it is expected that settlement magnitudes will exceed tolerable amounts for culvert installation. As a result, provisions will need to be implemented during construction to account for these settlement magnitudes. Typically this can be addressed by installing the embankment fill in its entirety. Then monitor the rate and magnitude of settlement across the embankment by installing settlement plates and risers that will need to be monitored by a licensed surveyor throughout a period of time determined by the Geotechnical Engineer. This monitoring period typically ranges from 1 to 3 months, but can approach 6 months in some instances. Once this movement has stabilized, culvert installation and subsequent backfill can proceed. In some instances, a surcharge load (additional fill placed across the embankment above finish subgrade elevations) may be required to induce or speed up the anticipated settlement prior to culvert installation in order to prevent long term embankment and pavement settlement issues after the project's construction phase is completed. Areas with more significant fills will need to be evaluated on a case by case basis. Although not likely and only when extremely poor soil conditions are encountered (considered worse case scenario) the culvert(s) would need to be supported by a deep foundation system such as piles.

Unless the culverts are required to be pile supported, it is likely that the culverts will require at least 2 to 3-feet of bedding material (possibly more) of open graded stone such as VDOT No. 57 stone wrapped in geotextile fabric to provide a suitable bearing surface.

Typically, the maximum slope recommended on an unreinforced slope is a 3:1 (horizontal: vertical). Since these embankment fills will encroach into Resource Protection Areas minimizing their overall footprint can be a benefit to the developer. In order to decrease this footprint, installing a reinforced slope, such as using geogrid for instance, could potentially (pending analysis) allow for slopes as steep as a 1.5:1(horizontal: vertical).

Ravine Crossing – Bridge Scenario

The largest ravine crossing along the proposed alignment is where the James City County and York County jurisdictional line is located. This is also the location of Skimino Creek. Due to the magnitude of this ravine, this crossing will likely require the installation of a bridge structure. Typically, the bridge structure will consist of structural steel with a concrete deck supported on concrete bents and abutments. The substructures (bents and abutments) will need to be supported by a deep foundation system. In our region, the most economical deep foundation system would consist of concrete piles. These usually will consist of square pre-cast pre-stressed concrete piles with a width of 12 to 14-inches. Similar projects in the region have required a minimum pile embedment below grades of about 70 to 90 feet. Of course pile lengths and size will be dependant on actual soil conditions and structural loading. Other alternatives of piles that could be considered are augercast piles or steel H-piles.

Pavement Considerations

Based on our review of published information and our experience in this region, it is anticipated that the pavement subgrade will likely consist mainly of Lean CLAY (CL), SILT (ML), and Silty and Clayey SAND (SM and SC). The soaked CBR values within these soils types generally range from about 6 to 18. The soaked CBR value would then be multiplied by a factor of two-thirds to determine a pavement design CBR value. The two-thirds factor provides the necessary safety margins to compensate for some non-uniformity of the soil. Therefore, it is estimated that a design CBR value on the order of 7 to 10 would be used for the design of this roadway extension. The design ADT provided by the client ranged from 18,660 to 25,500 vehicles per day. Typical minimum pavement section designs are provided in the Table 1 on the following page.

Table 1 - Typical Pavement Sections

Section	% Heavy Commercial Vehicles	Hot Mix Asphalt			Aggregate Base[1]	Subgrade[2]
		Surface	Intermediate	Base		
Mooretown Extension with ADT up 18,660 vpd	5	1.5	2	6	8	Stable and Compacted
Mooretown Extension with ADT up 25,500 vpd	5	2	2	6	8	Stable and Compacted
Mooretown Extension with ADT up 18,660 vpd	10	2	2	7	8	Stable and Compacted
Mooretown Extension with ADT up 25,500 vpd	10	2	2	7.5	8	Stable and Compacted

1 - VDOT Type 21-A, compacted to a dry density of at least 100% of the Standard Proctor maximum dry density (ASTM D 698).
2 - Compacted to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D 698).

Some isolated areas of instabilities should be expected along the proposed roadway alignment during construction. Where excessively unstable subgrade soils are observed during proofrolling and/or fill placement, it is expected that these weak areas can be stabilized by means of thickening the aggregate base course layer by 4 to 6 inches, lining the subgrade with geotextile stabilization fabric, and/or adding 12 inches of Structural Fill subbase. Another alternative that would be effective in stabilizing unstable subgrade, particularly in fine grained cohesive soils with elevated moistures, would be the application of lime. This would greatly reduce the amount of time delays and effort required to dry out soils with elevated moisture contents over other conventional methods such as aerating, scarifying, and discing. These recommendations would need to be addressed by the Geotechnical Engineer during construction, if necessary, who will recommend the most economical approach at the time.

Storm Water Management Considerations

The proposed Mooretown Road extension will require the construction of storm water management (SWM) facilities. At this stage the design, type, and location of these SWM facilities have not been determined. However, we have been requested to provide potential site locations along the corridor that an infiltration type component may be feasible. In order accomplish this task the USDA Soil Survey was reviewed to determine potential locations. As indicated on the USDA Soil Survey there are numerous soil types along this corridor. With a lot of these soils types you could encounter pockets of soil with infiltration rates >0.50 inches/hour, but not consistently. As a result, we focused on the most favorable soil series where the probability of encountering soils with infiltration rates meeting or exceeding 0.50 inches/hour was greatest. Please note that this most certainly would need to be explored further as this project develops by completing actual field testing (borings and in-situ infiltration testing).

Based on our review of the USDA Soil Survey, the most likely soil series appropriate for an infiltration component would be the Kempsville (map symbol 18B), Kenansville (map symbol 20B), and Suffolk (map symbol 31B) soil series. The Kempsville soil series in some locations is grouped with Emporia soil series and identified as the Kempsville-Emporia (map symbol 19B) soil series. Some portions of this particular soil series may also be appropriate for infiltration, but not as likely as the Kempsville (map symbol 18B) soil series. Again, other locations along this corridor with other soil series identified may also provide the infiltration component needed for SWM purposes, however these listed above are most probable. The locations of these potential locations will be provided to VHB, Inc. on a map that will be submitted separately from this report.

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The purpose of this study and report was for general information purposes in the planning stage. All considerations and information provided in this report may differ from actual site conditions, and variations from these descriptions are considered likely. As the design of this project develops the completion of actual subsurface investigations and geotechnical engineering will be required.

We appreciate the opportunity to submit this information, and we look forward to working with you towards a successful completion of this project. Please feel free to contact us any time at (757) 564-6452 with any questions that you may have.

Respectfully Submitted,
G E T Solutions, Inc.

James R. Wheeler
Project Geologist

Bruce R Spiro, P.E.
Principal Engineer
VA Lic. # 015791

COMMONWEALTH OF VIRGINIA
BRUCE R SPIRO
Lic. No. 015791
PROFESSIONAL ENGINEER

APPENDIX C
Cultural Resources Report

Circa~ Cultural Resource Management, L.L.C.
453 McLaws Circle, Suite 3
Williamsburg, Virginia 23185
(757) 220-5023

Current Conditions Assessment
Mooretown Road Extension Project
James City and York Counties, Virginia
February 2015

In January 2014, Circa~ Cultural Resource Management, LLC (Circa~) conducted an archival search of the overall study area, bordered by Croaker Road to the north, Rochambeau Drive to the east, Lightfoot Road to the south, and Richmond Road the west, where the extension of Mooretown Road is proposed. The archival search identified nine archaeological resources and 11 architectural resources within the original study area boundaries. Mapped on the overall project mapping, this information was helpful in the guidance of the final selection for the preferred alternatives. The study proposed three alternatives for the proposed extension. James City County chose Alternative 2 out of three proposed alignments from the results of engineering and environmental studies, and the input from public meetings.

Circa~ conducted a pedestrian survey of the preferred alternative for the extension of Mooretown Road in January 2015. The right-of-way begins at the intersection of Mooretown Road and Lightfoot Road and heads northwest until it terminates at Croaker Road (see Appendix A). Three previously identified

architectural resources and no previously identified archaeological resources are located within the proposed alternative. None of the project right-of-way had been previously surveyed for archaeological resources.

The pedestrian survey started at the intersection of Mooretown Road and Lightfoot Road and continued roughly 1,000 feet northwest along the rear entrance road to the Pottery (Plate 1). Circa~ also looked at the tie-ins with the existing Mooretown and Lightfoot roads. The tie-in for the Mooretown Road extension runs roughly 500 feet to the south along the existing road right-of-way (Plate 2). The tie-in for Lightfoot Road runs roughly 500 feet to the east along the existing right-of-way (Plate 3). These areas are disturbed from the development of the existing roads.

The proposed right-of-way veers east from the Pottery back entrance road and runs roughly 600 feet through an open field and to the east of Site 099-5101 (Plate 4). Site 099-5105 is the circa 1875 Levorsen House and includes one house, two barns, one corncrib, two sheds, one well, one blacksmith shop, and one post office (Plate 5). MAAR identified the site in May 1999 during a Phase II survey, and recommended that the site was not eligible for listing on the National Register of Historic Places. VDHR concurred with their recommendation in February 2000.

The right-of-way enters the woods (Plate 6) and runs roughly 3,500 through the words (Plates 7 and 8) and crosses a stream, then enters into an open agricultural field within Hill Pleasant Farm (Plate 9). Site 047-5157 is the circa 1904 Hill Pleasant Farm that includes two houses, four outbuildings, two barns, one shed, and one silo (Plates 10 and 11). MAAR identified the site in 2000 during a cost-share survey of resources in James City County. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In March 2007, the Ottery Group, Inc. surveyed the site during a Phase I survey. They also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

The right-of-way continues across the farm field, hugging the edge of the railroad track (Plate 12). The right-of-way crosses the headwaters of a small stream (Plate 13), then crosses over another field (Plate 14) until it runs through a rural neighborhood and small farms (Plates 15, 16, 17, and 18). The project-right-of-way then enters into another wooded area, crosses a stream (Plate 19), and then runs through a RV park (Plate 20). The project right-of way exits the RV park, crosses a stream, and then terminates at the intersection of Crocker Road (Route 607) and Rochambeau Drive (Plates 21, 22, and 23). Circa~ also looked at

the tie-ins with the existing Croaker Road and Rochambeau Drive. The tie-in for the Mooretown Road extension runs roughly 500 feet to the east and west along the existing Croaker Road right-of-way. These areas are disturbed from the development of the existing roads. The tie-in for Rochambeau Drive runs roughly 1,000 feet to the east along the existing right-of-way (Plate 24). Site 047-5152 is a circa 1927 house that includes two houses, one animal shelter, and one garage. This site is just to the north of the tie-in at the intersection of Rochambeau and Croaker roads (Plate 25). MAAR identified the site in 2000 during a cost-share survey of architectural resources in James City County. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In December 2006, the Ottery Group, Inc. surveyed the site during a Phase I survey. They also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. Sarah Clarke surveyed the site in July 2010 for a Virginia Department of Transportation (VDOT) I-64 corridor study. She recommended that the site was not eligible for listing on the National Register of Historic Places. VDHR concurred with her recommendation in July 2011. A branch road ties into Rochambeau Drive across a grassy field from the proposed right-of-way extension to Rochambeau Drive (Plate 26).

A review of previous studies indicates that information such as site location and types of artifacts can be linked with data from previous studies to produce an overall picture of the evolution of the region and how it was used over time, as well as a view how the stream dynamics affected settlement choice and type. An analysis of Native American sites within two miles of the project right-of-way reveals that the majority of the sites are located along the inland streams. The majority of the interior sites consisted of small encampments or resource procurement sites used for nut, shellfish, fish, quarries, or hunting sites. In assessing the previously identified archaeological resources with a Native American component, several similarities were discovered. Most of the resources are a variant of a lithic scatter with a few diagnostic points or other tools recovered from a plowed context.

The most influential historical studies of settlement patterns in the region have emphasized the importance of economic and ecological factors in the process by which Euro-Americans distributed themselves across the landscape. From the standpoint of cultural resource management, this "descriptive", or "functional", approach is most useful in creating a testable model of historic settlement patterns, taking into account variables such as soil type, the availability of fresh water, proximity to neighbors, and access to transportation routes.

European settlement of the county began in the 17th century, when large tracts of prime riverfront land were granted to the Virginia's elite tobacco planters. Since rivers served as the primary arteries of transportation and communication during the colonial period, planters and tenants alike settled initially along rivers and major tributaries. Tobacco dominated the Virginia economy from the beginnings of English settlement in the region through the American Revolution, and correspondingly dictated the nature of social and race relations. Since tobacco was overwhelmingly important as a staple crop, it should follow that planters would choose to settle on lands most conducive to growing this crop. The relative importance of a variety of environmental factors in site selection, including soils, access to drinking water, proximity of navigable waterways, and distance from the nearest neighbor, a productive soil type clearly was the most significant locational factor affecting colonial settlement.

By the latter years of the 18th century, however, regional planters, great or small, were beginning to feel the pinch of a sputtering, century-old tobacco economy. Meanwhile, decades of intensive tobacco farming had simply exhausted all the best tobacco land, making it difficult, if not impossible, to boost production in order to counteract dwindling prices. By the beginning of the 19th century, a fundamental shift had occurred in the area's rural economy. Farmers responded to the decline of tobacco by shifting their emphasis to raising grain

crops and livestock. At the same time, a small group of Virginians dedicated to "scientific agriculture" helped to usher in a new era of productive farming. In his series of essays entitled *Aerator*, Caroline County's John Taylor demonstrated the benefits of four-field crop rotation, in which soils could be improved significantly by rotating corn, wheat, fertilizer, and clover. Similarly, in the early 1820s Edmund Ruffin publicized the effectiveness of marl in reducing soil acidity, a technique that could triple the productivity of the region's exhausted soils. Other agricultural improvements included contour plowing to reduce erosion, cast iron plows, threshing machines, and corn sellers.

The conventional historical wisdom asserts that the decline of the tobacco economy, the introduction of new crops, and advances in farm management and fertilization had a significant effect on settlement patterns in 19th century Tidewater Virginia. Lands formerly considered marginal could now be incorporated into agricultural production, a process accelerated by the increasing subdivision of family farms through inheritance. Extrapolating from the region's settlement model, the environmental characteristics of 19th century sites theoretically should exhibit a diminishing correlation between soil type and settlement, given that a wider variety of soils could now be made agriculturally productive. As with sites associated with the colonial period, the agricultural productivity of the upland soil types within the project right of-way suggests

that there is a moderate to good chance for the presence of 19th century domestic farmstead sites within the tract. These sites would be located on the edges of the fields or the landforms, leaving the majority of the good soil available for raising crops.

The project right-of-way has the environmental conditions and physiographic settings that may contain both Native American and historic archaeological resources. Given the project right-of-way's close proximity to streams and the fact that all of the previously identified sites for which there is soil information fall within at least one or more of the project right-of-way soils, the possibility of finding Native American and historic resources would be considered moderate to high. It is possible that a Native American site, most likely a lithic scatter, could be found within the project right-of-way. Given the previously identified sites, this site would most likely date to the general Native American period and would range in size from under one acre to less than four acres. Judging from the previously identified sites, if a site was found within the project right-of-way, it would probably not contain many Native American ceramic artifacts.

A historic archaeological site, most likely a domestic site, could be found within the project right-of-way. Given the previously identified sites, this site would most likely date to the 19th century and would range in size from under

one acre. Judging from the previously identified sites, if a site was found within the project right-of-way, it would probably not contain many historic ceramic artifacts. In sum, Circa~ recommends a Phase I survey of the project right-of-way. No further archaeological survey work is recommended for the developed areas of the project right-of-way.

Plate 1. View of the proposed Mooretown Road Alternative 2, looking along the rear entrance of The Pottery, looking north.

Plate 2. View of exisitng Mooretown Road, looking south.

Plate 3. View of Lightfoot Road, looking west.

Plate 4. View of the proposed right-of-way, looking south. Site 099-5105 in the right side of the photo.

Plate 5. View of Site 099-5105, looking east.

Plate 6. View of project right-of-way, looking north.

Plate 7. View of project right-of-way, looking south.

Plate 8. View of project right-of-way, looking north.

Plate 9. View of the project right-of-way, looking southeast.

Plate 10. View of Site 047-5157, looking northeast.

Plate 11. View of outbuildings at Site 047-5157, looking southeast.

Plate 12. View of the right-of-way, looking northwest.

Plate 13. View of project right-of-way near stream crossing, looking south.

Plate 14. View of project right-of-way, in agricultural field, looking north.

Plate 15. View of project right-of-way, looking south.

Plate 16. View of project right-of-way, looking north.

Plate 17. View of project right-of-way, looking south.

Plate 18. View of project right-of-way, looking north.

Plate 19. View of project right-of-way, looking south.

Plate 20. View of project right-of-way, looking north.

Plate 21. View of project right-of-way at tie-in to Croaker Road, looking west.

Plate 22. View of project right-of-way at intsection of Croaker Road and Rochambeau Drive, looking north.

Plate 23. View of project right-of-way along Croaker Road, looking east.

Plate 24. View of project right-of-way tie-in along Rochambeau Drive, looking south.

Plate 25. View of Site 047-5152, looking east.

Plate 26. View of the tie-in from Rochambeau Drive to the proopsed right-of-way, looking west.

Mooretown Road Extension Corridor Study
Archival Search Results

January 2014

Prepared by:

Circa~ Cultural Resource Management, LLC

1.0 ARCHIVAL SEARCH RESULTS

Circa~ Cultural Resource Management, LLC (Circa~) performed an archival search for the Extension study of Mooretown Road project using the Virginia Department of Historic Resources (VDHR) online V-CRIS system on January 29, 2014. This research was completed to determine if historic resources exist within the project area boundaries. The project area is bordered by Croaker Road to the north, Rochambeau Drive to the east, Lightfoot Road to the south, and Richmond Road the west. The search identified nine archaeological resources and 11 architectural resources within the project area boundaries. Table 1-1 lists all of the resources within the project area boundaries. A brief summary of these resources follows Table 1. Once an alignment is selected for the extension of Mooretown Road, Circa~ will conduct further cultural resources surveys of the area impacted by the proposed alignment.

Table 1-1

Previously Identified Cultural Resources Within The Project Area Boundaries.

VDHR Survey Number	Date of resource	Description of resource	Survey Information	Recommendation
Archaeological Resources				
44JC0295	19th century	Church related residence	Site was map projected from J. F. Gilmer's 1860s Vicinity of Richmond and Part of the Peninsula map 12/1/83	None made

VDHR Survey Number	Date of resource	Description of resource	Survey Information	Recommendation
44YO0260	18th century	Indeterminate site	Site was map projected from Alexander Berthier map of the James York Peninsula 7/1/83	None made
44YO0261	18th century	Indeterminate site	Site was map projected from Alexander Berthier map of the James York Peninsula 7/1/83	None made
44YO0262	18th century	Indeterminate site	Site was map projected from Alexander Berthier map of the James York Peninsula 7/1/83	None made
44YO0263	19th century	Indeterminate site	Site was map projected from J. F. Gilmer's 1860s Vicinity of Richmond and Part of the Peninsula map 12/1/83	VDHR recommended further work if the site cannot be avoided 12/6/07
44YO0301	Historic	Plantation site	Site was map projected from J. F. Gilmer's 1860s Vicinity of Richmond and Part of the Peninsula map 12/1/83	None made

VDHR Survey Number	Date of resource	Description of resource	Survey Information	Recommendation
44YO0506	No date	Indeterminate site	Phase I survey 8/9/89	None made
44YO0507	18th century 19th century	Indeterminate site	Phase I survey 8/9/89	None made
44YO1038	Middle Archaic Early Woodland 18th century 19th century 20th century	Temporary camp and farmstead	Archaeological data recovery 10/10/02	None made
Architectural Resources				
047-0070	Historic	Site includes two houses, one barn, and two sheds	Phase I survey 10/15/71 Reported demolished 4/11	None made
047-0077	ca. 1870	Lutheran Parish House	Phase I survey 1971	None made
047-5151	ca. 1908	Bethany Parish Lutheran Residence, 101 Maxton Lane	Phase I survey 2000 and 3/6/07	None made
047-5152	ca. 1927	House, 4392 Rochambeau Drive (SR 30/ SR 755), site includes two houses, one animal shelter, and one garage	Phase I survey 2000, 12/21/06, and 7/1/10	VDHR determined not eligible 7/1/11
047-5157	ca. 1904	Hill Pleasant Farm, 7152 Richmond Road (US 60), site includes two houses, four outbuildings, two barns, one shed, and one silo	Phase I survey 2000 and 3/6/07	None made

VDHR Survey Number	Date of resource	Description of resource	Survey Information	Recommendation
047-5301	ca. 1908	Norge Depot aka Norge Train Depot, 7770 Croaker Road (SR 607)	Phase I survey 12/29/90 Phase II survey 9/6/05 National Register of Historic Places nomination 9/20/07	Listed on the Virginia Landmark Register (VLR) 12/5/07 Federal determination of not eligible 4/23/08
099-0003	ca. 1820	Cherry Hall, 1015 Lightfoot Road (SR 658), site includes one house and one smokehouse	Historic American Building Survey (HABS) 9/1/58 Volunteer survey 6/1/70 and 7/1/07	None made
099-5105	ca. 1875	Levorsen House, 603 Lightfoot Road (SR 658), site includes one house, two barns, one corn crib, two sheds, one well, one blacksmith shop, and one post office	Phase II survey 5/6/99	VDHR determined not eligible 2/28/00
099-5107	ca. 1920	House, 1021 Lightfoot Road (SR 658)	Phase I survey 4/1/99	Recommended not eligible 4/1/99
099-5108	ca. 1935	House, 1321 Lightfoot Road (SR 658), site includes one house and one shed	Phase I survey 7/1/10	VDHR determined not eligible 7/1/11
099-5291	ca. 1950	House, 5703 Rochambeau Drive (SR 30/ SR 755), site includes one house and one shed	Phase I survey 7/1/10	VDHR determined not eligible 7/1/11

1.1 Site 44JC0295, Church related residence

Site 44JC0295 is identified as a 19th century church related site. Martha McCartney first identified the site in December 1983 when she map projected the site using J. F. Gilmer's 1860s *Vicinity of Richmond and Part of the Peninsula* map. At the time, she conducted no fieldwork to verify the location of the site and did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.2 Site 44YO0260, Indeterminate site

Site 44YO0260 is identified as an 18th indeterminate site. Martha McCartney first identified the site in July 1983 when she map projected the site using Alexander Berthier's map of the James-York peninsula. At the time, she conducted no fieldwork to verify the location of the site and did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.3 Site 44YO0261, Indeterminate site

Site 44YO0261 is identified as an 18th indeterminate site. Martha McCartney first identified the site in July 1983 when she map projected the site using Alexander Berthier's map of the James-York peninsula. At the time, she conducted no fieldwork to verify the location of the site and did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.4 Site 44YO0262, Indeterminate site

Site 44YO0262 is identified as an 18th indeterminate site. Martha McCartney first identified the site in July 1983 when she map projected the site using Alexander Berthier's map of the James-York peninsula. At the time, she conducted no fieldwork to verify the location of the site and did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.5 Site 44YO0263, Cherry Hill Brick Clamp

Site 44YO0263 is identified as a 19th century Cherry Hill Brick Clamp site. The site represents a second or third quarter 19th century brick clamp, possibly associated with the adjacent Cherry Hill site. The site consists of brick wasters, unfired brick and rubble, air channels, and large areas of burned earth. Martha McCartney first identified the site in July 1983 when she map projected the site using J. F. Gilmer's 1860s *Vicinity of Richmond and Part of the Peninsula* map. At the time, she conducted no fieldwork to verify the location of the site and did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In 2007, Lyle Browning conducted a Phase II assessment survey of the site. He recommended that the research potential of the site had been exhausted and that the site was not eligible for listing on the National Register of Historic Places. In December 2007, VDHR noted that the site may contribute to the understanding of the history of Cherry Hill and settlement of that portion of York County. The recommended that the site be avoided by future work or further survey work of the site if it could not be avoided.

1.6 Site 44YO0301, Plantation site

Site 44YO0301 is identified as an historic plantation site. Martha McCartney first identified the site in December 1983 when she map projected the site using J. F. Gilmer's 1860s *Vicinity of Richmond and Part of the Peninsula* map. At the time, she conducted no fieldwork to verify the location of the site and did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.7 Site 44YO0506, Indeterminate site

Site 44YO0506 is identified as an indeterminate site. The William and Mary Center for Archaeological Research (WMCAR) first identified the site in August 1989 during a survey of the Williamsburg Pottery property. They discovered the site was examining a modern road cut and noted that the site contained a small number of lithic artifacts found on the surface and through shovel testing. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.8 Site 44YO0507, Indeterminate site

Site 44YO0507 is identified as an 18th and 19th century indeterminate site. WMCAR first identified the site in August 1989 during a survey of the Williamsburg Pottery property. They discovered the site was examining a modern road cut and noted that the site contained a small scatter of artifacts found in the road bed. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places.

According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.9 Site 44YO1038, Laurel Springs

Site 44YO1038 is identified as a Middle Archaic and Early Woodland temporary camp and an 18th, 19th, and 20th century farmstead. In 2002, the owner of the property, Patrick Pettitt, wanted to excavate the property prior to him selling his family farm. As part of the sale of the property, and by court order, prior to the sale of the property Pettitt also had an adjacent family cemetery moved from the property. Pettitt hired MAAR to conduct the excavations and in October 2002 they conducted an archaeological data recovery of the property. They noted several features including a house foundation, one well with a cover, one filled well, one concrete pad, and three privies. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.10 Site 047-0070, House site

Site 047-0070 is identified as a circa 1925 house site that includes two houses, one barn, and two shed. R. Perry first identified the site in October 1971 during a Phase I survey. At the time, he did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In April 2011, the site was reported as demolished. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.11 Site 047-0077, Lutheran Parish House

Site 047-0077 is identified as the circa 1870 Lutheran Parish House. Ed Chappell first identified the site in 1971 during a Phase I survey. At the time, he did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.12 Site 047-5151, Bethany Parish Lutheran Residence

Site 047-5151 is identified as the circa 1908 Bethany Parish Lutheran Residence. MAAR first identified the site in 2000 during a cost share survey of resources in James City County. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In March 2007, the Ottery Group, Inc. surveyed the site during a Phase I survey. They also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.13 Site 047-5152, House

Site 047-5152 is identified as a circa 1927 house that includes two houses, one animal shelter, and one garage. MAAR first identified the site in 2000 during a cost share survey of resources in James City County. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In December 2006, the Ottery Group, Inc. surveyed the site during a Phase I survey. They also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. Sarah Clarke surveyed the site in July 2010 for a Virginia Department of

Transportation (VDOT) I-64 corridor study. She recommended that the site was not eligible for listing on the National Register of Historic Places. VDHR concurred with her recommendation in July 2011.

1.14 Site 047-5157, Hill Pleasant Farm

Site 047-5157 is identified as the circa 1904 Hill Pleasant Farm that includes two houses, four outbuildings, two barns, one shed, and one silo. MAAR first identified the site in 2000 during a cost share survey of resources in James City County. At the time, they did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In March 2007, the Ottery Group, Inc. surveyed the site during a Phase I survey. They also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.15 Site 047-5301, Norge Depot

Site 047-5301 is identified as the circa 1908 Norge Depot. Roberta Reid first identified the site in 1990 during a Phase I survey. At the time, she did not make any recommendation as to the site's eligibility for listing on the National Register of Historic Places. In September 2005, at the request of James City County Office of Development Management, WMCAR conducted a Phase II survey of the site. They recommended that the site was eligible for listing on the National Register of Historic Places. VDHR noted that the site was potentially eligible for listing on the National Register of Historic Places in July 2005. Two years later, in 2007, WMCAR drafted a National Register of Historic Places nomination for the site. That same year the site was listed on the VLR. However, in April 2008, a federal

determination was made that the site is not eligible for listing on the National Register of Historic Places.

1.16 Site 099-0003, Cherry Hall

Site 099-0003 is identified as the circa 1820 Cherry Hall that includes one house and one smokehouse. Robert Wiggins first identified the site in September 1958 during a HABS survey. At the time, he did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. In June 1970, Calder Loth updated the HABS survey and also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. In July 2007, Lyle Browning conducted a volunteer survey of the site. At the time, he also did not make any recommendations as to the site's eligibility for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.17 Site 099-5105, Levorsen House

Site 099-5105 is identified as the circa 1875 Levorsen House that includes one house, two barns, one corn crib, two sheds, one well, one blacksmith shop, and one post office. MAAR first identified the site in May 1999 during a Phase II survey. At the time, they recommended that the site was not eligible for listing on the National Register of Historic Places. VDHR concurred with their recommendation in February 2000.

1.18 Site 099-5107, House

Site 099-5107 is identified as a circa 1920 house. The site was first identified during a Phase I survey in April 1999. However, V-CRIS listed no information

on the surveyor, although it did note that the site was recommended as not eligible for listing on the National Register of Historic Places. According to V-CRIS, to date no further survey work has occurred and no formal determination of eligibility has been made.

1.19 Site 099-5108, House

Site 099-5108 is identified as a circa 1935 house that includes one house and one shed. Sarah Clarke first identified the site in July 2010 for a VDOT I-64 corridor study. She recommended that the site was not eligible for listing on the National Register of Historic Places. VDHR concurred with her recommendation in July 2011.

1.20 Site 099-5291, House

Site 099-5291 is identified as a circa 1950 house that includes one house and one shed. Sarah Clarke first identified the site in July 2010 for a VDOT I-64 corridor study. She recommended that the site was not eligible for listing on the National Register of Historic Places. VDHR concurred with her recommendation in July 2011.

2.0 Historic Mapping

Maps of the area drawn during the Civil War era show the project area primarily wooded with minor development along Old Stage Road (now Route 60).

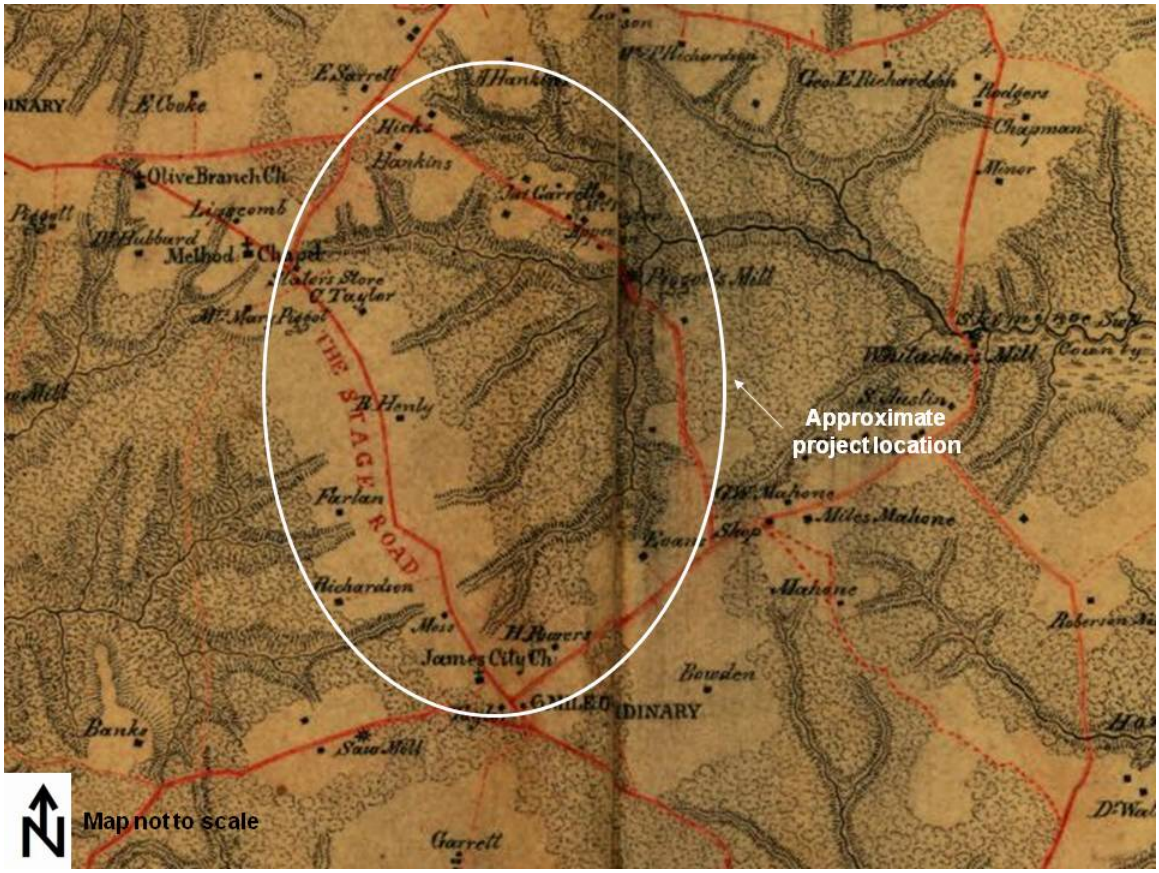


Figure 1-1

Detail of *Map of New Kent, Charles City, James City and York counties*. Map from the Confederate Engineer Bureau in Richmond, Va. General J.F. Gilmer, Chief Engineer 1863.

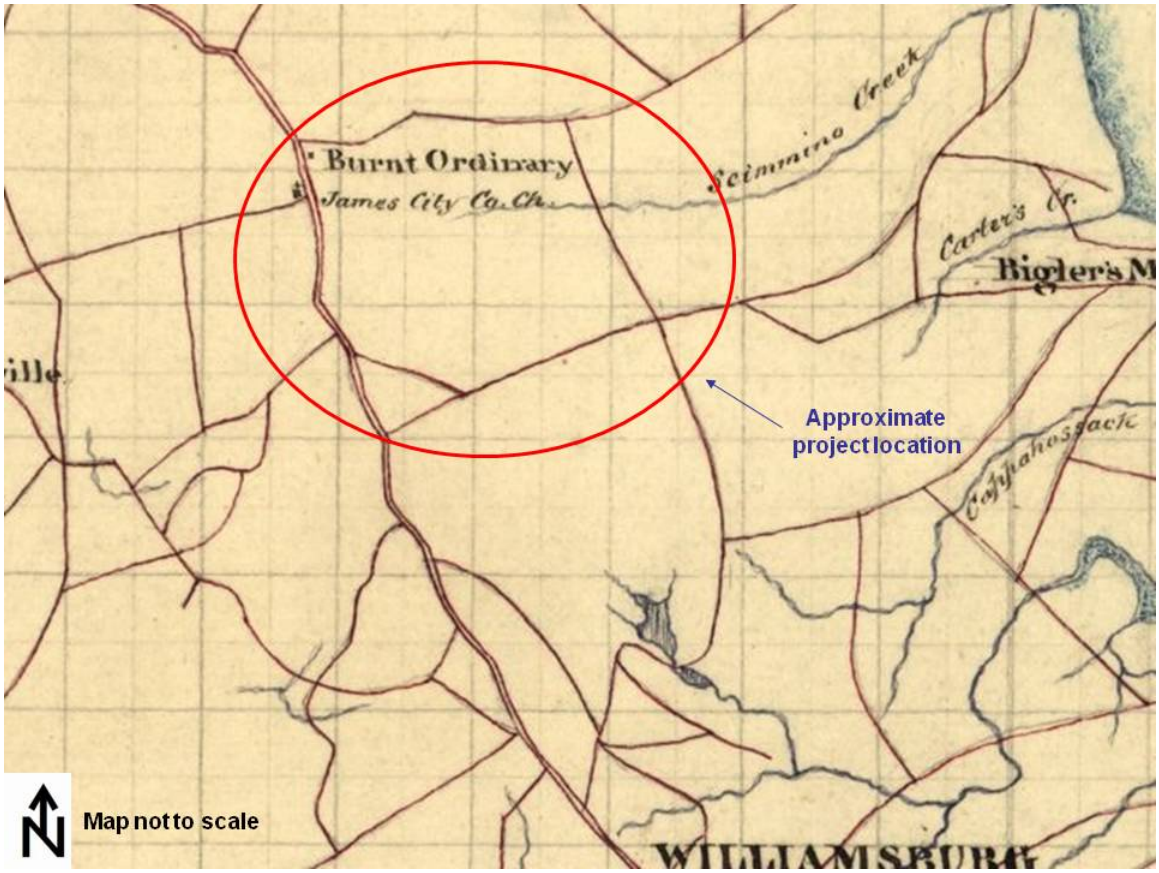


Figure 1-2

Detail of *James City, York, Warwick, and Elizabeth City counties, Virginia* by Jed. Hotchkiss, Top. Eng., Staunton, Va., 1867.

APPENDIX D
Market Analysis Report

Mooretown Road Extension Corridor Study
Market Analysis
James City County, Virginia

July 2015

Prepared by:

RKG Associates Inc.

1 EXECUTIVE SUMMARY

A. DEMOGRAPHIC TRENDS

Population & Households — James City County has experienced extremely robust population growth since 1990, growing from approximately 34,800 in 1990 to 70,000 in 2013. York County's population grew rapidly as well, from approximately 42,400 in 1990 to 66,500 in 2013. However, the rate of population growth in York County has been declining faster than James City County, due in large measure to the dwindling supply of land that can be developed to residential uses. In 2013, the number of households in James City County surpassed York County, at 28,100 to 24,400, respectively.

Household Income — In 2013, the median household income in James City and York were $80,200 and $80,322, respectively, compared to $63,146 in Virginia. An examination of the counties' economic base shows growth trends in most industry sectors, including higher paying sectors such as health care, professional, services, management of companies, and finance.

B. ECONOMIC BASE ANALYSIS

At-Place Employment — James City County added 1,474 new jobs from 2002 through 2013, for a total of 23,337. York County added 9,235 new jobs during the same period, for a total of 21,344, and Williamsburg City added 1,116 jobs to its 2013 total of 16,224. Among the three jurisdictions, notable increases in employment occurred in the following industry sectors from 2002 to 2013: professional services, 74% (1,480 jobs); arts, entertainment & recreation, 65% (4,000 jobs); finance & insurance, 59% (390 jobs); retail, 47% (2,740 jobs); other services, 46% (695 jobs); and, health care, 36% (1,857 jobs).

Labor Force & Unemployment — The combined labor force of James City County, York County, and Williamsburg increased in size considerably over the past decade (2004-2013), from just over 64,400 in 2004 to 77,235 in 2013, in spite of a decline in 2009. Unemployment rates in the combined jurisdictions have remained between 0.2% and 0.5% lower than Virginia's since 2004, indicating a relatively stable economic base in the region.

C. RESIDENTIAL MARKET TRENDS

Development Trends — In James City County, 932 average annual single family units were added to the inventory from 2003 through 2007, followed by apartments at 39, timeshares at 33, and condos at 20. In the six year period from 2008 through 2013, the average annual single family units declined to 466, while the average annual apartments increased from 39 to 105 following a national trend of apartment construction in response to tightened credit and lower demand from potential home buyers.

In York County, 342 average annual units were added to the inventory in the five-year period from 2003 through 2007. During the same period, and average of 43 apartments were added annually, followed by timeshare units at 29, condos at 27, and duplexes at 12. From 2008 to 2013, average annual single family units were 175. Average apartments increased slightly to 45. Timeshare units

decreased to 14 average annual, followed by an average of six condos per year, and zero duplexes.

Housing Characteristics — In 2013, median owner occupied dwelling unit values were as follows: James City County, $324,200; York County, $336,600; Williamsburg City, $326,200. Median cash rents in James City and York Counties are relatively close, at $1,066 and $1,110 respectively, compared to $910 for Williamsburg City.

Pipeline Development — The James City County Planning Division estimated a pipeline of approximately 9,400 residential units in approved residential subdivisions as of December 2013. If residential construction continues to proceed at the 2008-2013 rate of 576 units per year average, it will take just over sixteen years to build 9,400 units. If the rate of residential construction proceeds at the 2003-2007 pace of 1,024 new units per year average, 9,400 units could be built in just over nine years, with a midpoint between twelve and thirteen years.

The York County Department of Environmental and Development Services estimated that approximately 1,570 residential units were within approved planned developments in September 2012. At the 2008-2013 rate of 453 new annual units average, it would take just three years to build 1,570 units, and between six and seven years at the 2008-2013 rate of 240 new units per year average. According to the County of York 2012-2013 Comprehensive Plan, residential development in York County is projected to add approximately 5,700 new housing units by 2035.

Implications — The Virginia Employment Commission projects that James City and York Counties combined will add an additional 20,000 to 25,000 households by 2030. At the current rates of absorption, James City County will consume its current residential development pipeline in 12 to 13 years, and York County will consume its pipeline units in just three years. Of course, rezonings and development approvals will continually add to the pipeline in both jurisdictions. (in James City County' case, it is anticipated it could be enough for 19-38 years of growth). The consensus among real estate professionals interviewed for this analysis is that viable development tracts are becoming scarcer as the inventory is consumed. If household growth continues as projected, demand for new housing should remain steady ten to fifteen years in the future. The locational characteristics of the Mooretown Road Corridor will make it attractive for developers and residents with its easy access to I-64 and the employment centers of Richmond and Hampton Roads.

D. NON-RESIDENTIAL MARKET TRENDS

Inventory — In James City County, industrial uses account for the largest amount of improved space at 5.3 million square feet, approximately 3.2 million square feet of which is owned and operated by a single user, the Anheuser-Busch brewery. Warehouse space comprises the second largest land use at approximately 25% or 4.7 million square feet followed by retail/service at 23% or 4.3 million square feet, and office at 10% or 1.8 million square feet.

In York County, retail/services comprises the largest amount of improved space at 3.9 million square feet or 42%, followed by restaurant/lodging at 1.8 million square feet or 20%, industrial at 1.4 million square feet or 15%, and office space at 705,000 square feet or 8%.

Retail — James City County added 136,000 square feet of retail 2008-2013, York County added 446,000 square feet during the same period. Except for grocery stores, the greater Williamsburg area is over retailed due to the preponderance of stores and shopping centers that cater to visitors, such as Williamsburg Pottery and Premium Outlets. For community and neighborhood shopping centers which are generally locally serving, there was a 15% vacancy rate, which is reflected by the empty storefronts in the area. Nonetheless, the high visibility and access of the Mooretown Road Corridor

offers a very attractive site for developers and retail tenants who might overlook market trends to be in a more advantageous location.

Office — Since 2003, James City County has seen an average of 60,000 square feet of office delivered annually, compared to about 8,000 square feet in York County. This rate of absorption would support low density, suburban campus style development such as that which already characterized much of the local marketplace, and office space as an element of mixed use development, such as that in New Town.

Industrial — Although warehousing/distribution operations prefer proximity to highway interchanges, the demand from other land uses in the Mooretown Road Corridor could likely price them out of the market. In James City County, industrial development has slowed down in the past five years to one-tenth of what it was the previous five years, so the demand can be absorbed into existing industrial parks into the foreseeable future. If the market for flex space picks up in the next decade, it could be a land use that want to reside in the Corridor.

Visitation Attractions — The owners of the Williamsburg Pottery are currently (Fall 2014) in the process of assessing the potential for "an international, family-focused entertainment and education complex" on 720 acres of land in the Mooretown Road Corridor. About 80% of the land is in York County with the remainder in James City County. If the project moves forward to fruition, it could represent the dominant use in the Corridor.

Lodging — One of the proposed uses in the aforementioned Williamsburg Pottery concept is lodging. Even in an over supplied market, a well-positioned, unique product could garner enough of the market share to thrive, at other's expense of course. A strategically sited product in the corridor could have the distinct competitive advantage of easy access and maximum visibility.

Based on the findings of the work program, RKG concluded that the study area could support mixed used development that integrates a range of land uses that is most appropriately represented by the 365-acre New Town community.

2 INTRODUCTION

RKG Associates, Inc. (RKG) was engaged by the firm Vanasse Hangen Brustlin, Inc. (VHB) to conduct assessments of demographics, economics and real estate market sectors that will influence future development in the Mooretown Road Extension Corridor. The objective of the market assessment is to inform the provision of planning services for the Mooretown Road Extension Corridor Study through the identification of potential land uses in the context of market support ten or fifteen years in the future.

In the course of the work program, RKG professionals reviewed relevant plans and documents, and interacted with key stakeholders including municipal staff, local real estate professionals and developers, business leaders, economic development practitioners, and others. Stakeholder input provided local context for analyzing factors that will impact land uses in James City and York Counties in general, and the study area in particular. The RKG project manager also conducted physical reconnaissance of the study area and surrounding geographies.

Key sources of data analyzed in the course of the work program included:

- James City County Tax Assessors Database
- York County Tax Assessors Database
- Old Dominion University Center for Real Estate and Economic Development Real Estate Market Reviews, 2004-2014
- CoStar, First Quarter 2014 Reports, Hampton Roads Markets for Retail, Office and Industrial
- Demographics Now and Esri Business Services, census data reporting services

The real estate market analysis work program was conducted with several objectives in mind: (1) develop an understanding of the study area's context relative to the real estate market dynamics at play in the James City County/York County/Williamsburg marketplace; (2) prioritize real estate sectors to be assessed based on appropriateness for the study area; (3) assess the ability of tourism and visitation to generate support for new land uses in the study area.
The report includes the following chapters:

- Chapter 1 – Executive Summary
- Chapter 2 – Introduction
- Chapter 3 – Socioeconomic Analysis
- Chapter 4 – Real Estate Market Analysis

3 SOCIOECONOMIC ANALYSIS

A. INTRODUCTION

The following chapter analyzes demographic trends and projections in areas such as population, households, income, education attainment, and employment data. The analysis focuses on trends and conditions within James City County, York County, Williamsburg City, and includes comparative data for the Commonwealth of Virginia. The data provides insight into local and regional growth trends as well as projected future growth patterns. These factors provide the framework for understanding the factors that will influence future development. The consultant utilized several public and private data sources to complete the analysis including the U.S. Census Bureau, ESRI (Site To Do Business)[1], Demographics Now, and the Virginia Employment Commission.

Population, household, and income trend data provided by ESRI includes decennial data from the U.S. Census Bureau summarized for users in the real estate industry. ESRI incorporates projection data developed by their proprietary approach. RKG Associates uses this data unless otherwise noted. Data in tables is generally categorized by geographic area, with subject jurisdictions listed separately for comparison purposes.

B. DEMOGRAPHIC TRENDS

1. Population Trends and Projections

Information from the U.S. Census indicates that James City County has experienced extremely robust population growth since 1990, growing from approximately 34,800 in 1990 to 70,000 in 2013. York County's population grew rapidly as well, from approximately 42,400 in 1990 to 66,500 in 2013. However, the rate of population growth in York County has been declining faster than James City County, due in large measure to the dwindling supply of land that can be developed to residential uses. A review of the York County zoning map graphically illustrates the preponderance of military reservations in the county which cannot be developed, and the diminishing acreage of developable land (Table 3-1).

Table 3-1
Population Trends
1990-2018

	1990	2000	2013	2018
POPULATION COUNT				
James City Co.	34,779	47,953	69,987	77,761
York Co.	42,434	56,349	66,505	70,845
Williamsburg City	11,600	12,150	15,495	16,618
State	6,189,197	8,049,313	9,759,332	10,365,298
PERCENT CHANGE IN POPULATION				
James City Co.	—	37.9%	45.9%	11.1%
York Co.	—	32.8%	18.0%	6.5%
Williamsburg City	—	4.7%	27.5%	7.2%
State	—	30.1%	21.2%	6.2%
ANNUAL PERCENT CHANGE IN POPULATION				
James City Co.	—	3.8%	3.5%	2.2%
York Co.	—	3.3%	1.4%	1.3%
Williamsburg City	—	0.5%	2.1%	1.4%
State	—	3.0%	1.6%	1.2%

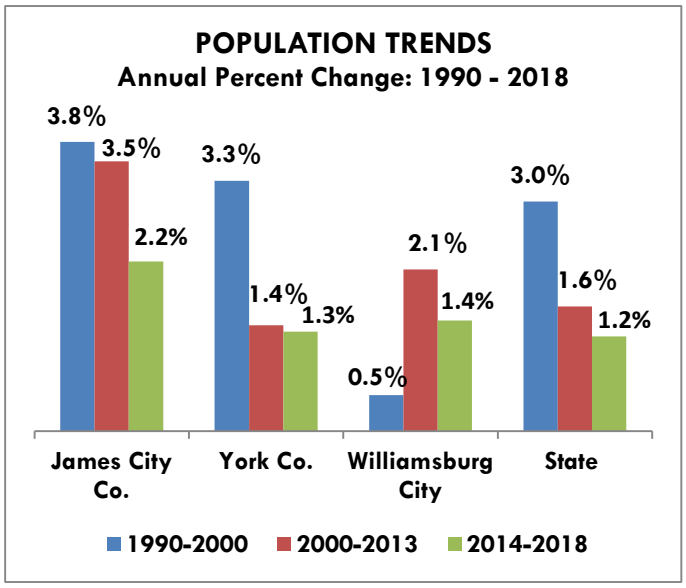
Source: Demofraphics Now; RKG Associates 2014

[1] ESRI is an internationally renowned data vendor of socioeconomic and market data.

The City of Williamsburg experienced a surge of growth of 27.5% from 2000 to 2013, compared to just 4.7% between 1990 and 2000. The City has added over 500 residential units since 2000 and enjoyed a net increase of over 1,470 jobs from 2002 to 2011, from 21,860 to 23,340.

Like many southern and sunbelt States, Virginia experienced strong population growth in recent decades. Both James City and York Counties have added jobs in the last decade (discussed in more detail in the Economic Base Analysis section in this report), and have also become popular destinations for empty nesters and retiring Baby Boomers to reside. Figure 3-1 graphically illustrates how population trends have shifted in the four comparative geographies. Population growth in James City County, supported by local and regional job growth as well as ample residential development, is growing at the fastest rate. York's population growth rate has slowed down as the county approaches residential build-out. Williamsburg surged from 2000 to 2013, and is projected to maintain a growth rate higher than both York County and the state through 2018.

Figure 3-1



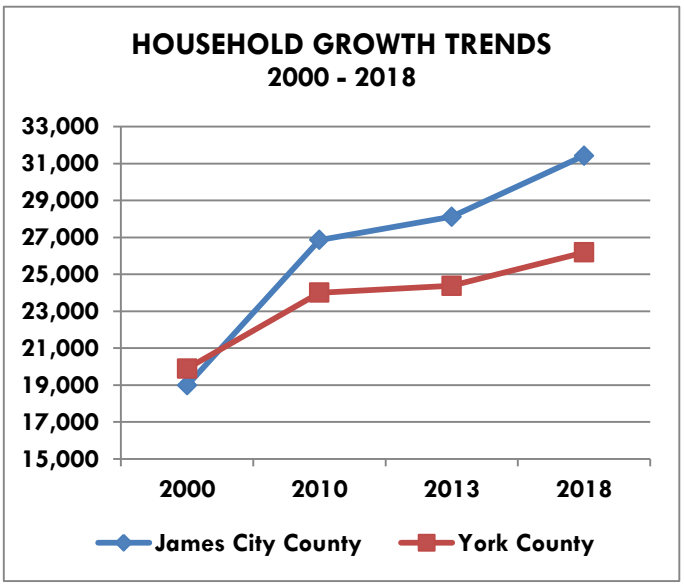
Source: ESRI and RKG Associates, Inc., 2014

2. Household Trends

Household growth trends typically parallel population trends. In 2000, York County had approximately 19,890 total households to James City County's 18,980, a difference of only 900. In 2013, the number of households in James City County surpassed York County, at 28,100 to 24,400, respectively. In Williamsburg, the number of households increased from approximately 3,640 in 2000 to 5,150 in 2013.

Decreases in the average size of households are a contributing factor in the acceleration of household growth at a faster rate than population. Average household sizes in James City County were 2.53 in 2000 compared to 2.49 in 2013. In York County, average household sizes shrunk from 2.83 in 2000 to 2.73 in 2013.

Figure 3-2



Source: ESRI and RKG Associates, Inc., 2014

A general decline in average household size has been observed nationally, as there are increasing numbers of single-adult households, one-parent households, and generally lower fertility rates than in

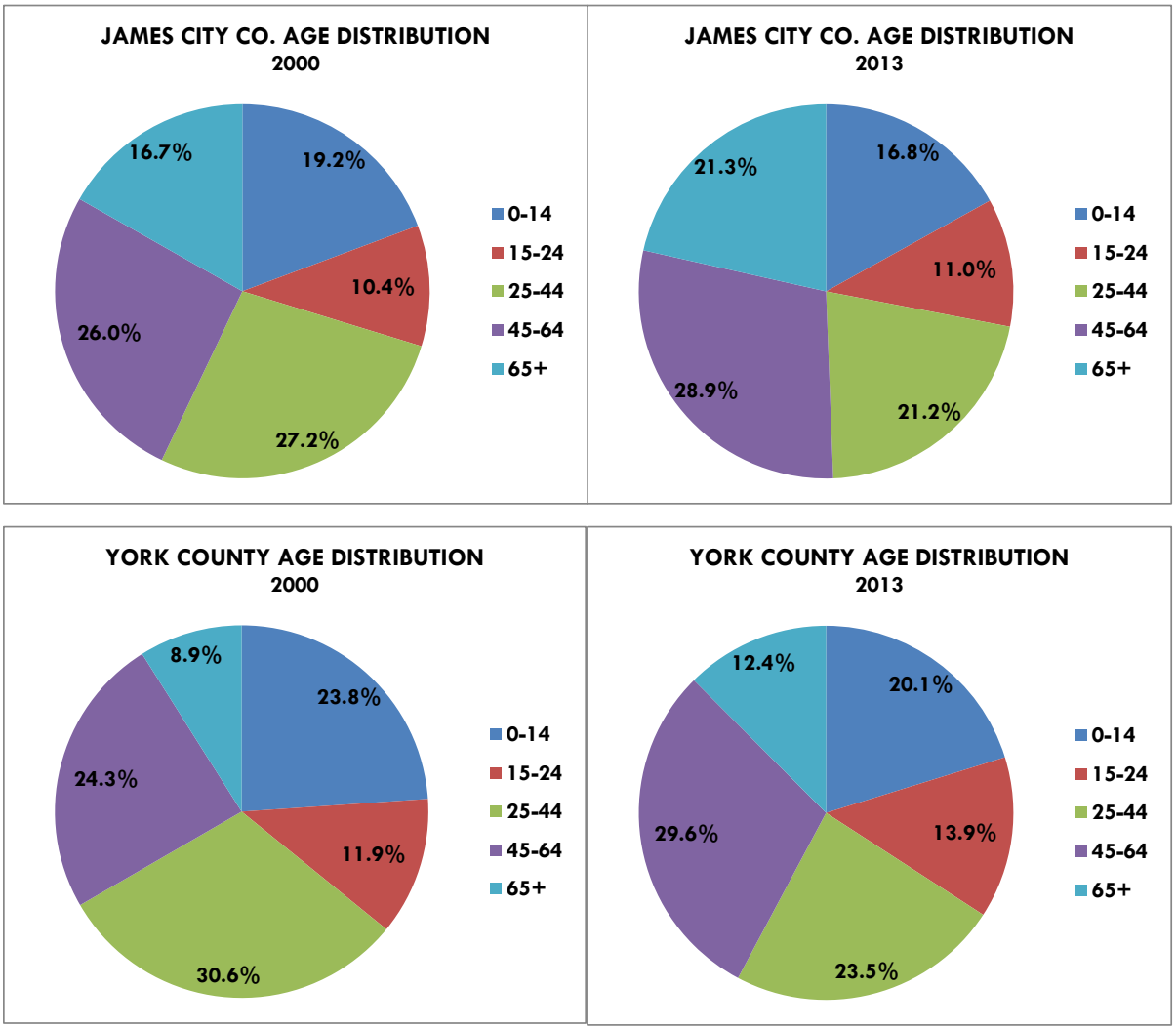
the past. Smaller household size could also be the result of an increase in the "empty-nest" retirement age population consisting largely of couples who no longer have children living with them.

3. Population by Age

Although the populations within most age groups have been on the rise in both James City and York Counties, those 65 years of age and over have seen the highest proportional increases, which reinforces the notion that the area is a popular retirement destination.

In 2000, the 65 and over age cohort of James City County comprised about 17% of the population compared to 21% in 2013. In this period, the 65 and over age cohort grew in real numbers by almost 87%. The second fastest growing age cohort was the 45-64 age group, which increased by approximately 63% to a proportion of 29% of the population. This age group is generally considered to be of working age and in their prime earning years. The younger working-age 25-44 cohort had the lowest rate of growth at 14%, and accounted for about 21% of the population compared to 27% in 2000. In York County, this age cohort actually decreased in population by 9%, and the 0-14 age cohort remained static. Otherwise, the "population by age" dynamics are similar to James City County (Figure 3-3).

Figure 3-3



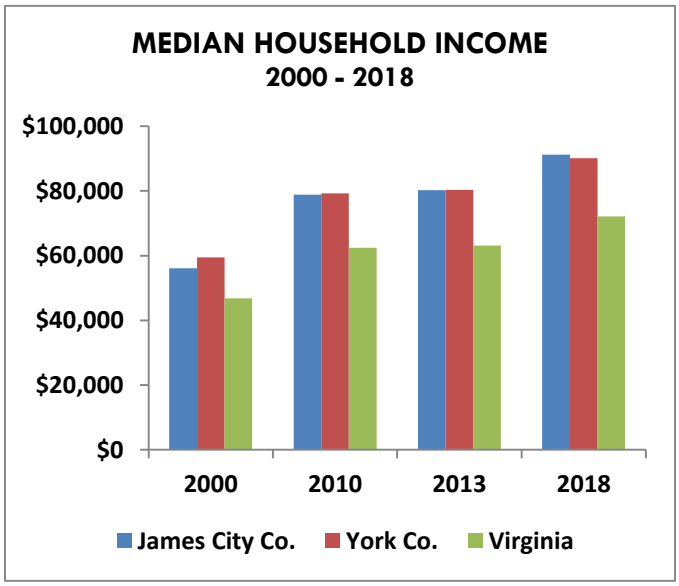
Source: ESRI and RKG Associates, Inc., 2014

4. Household Income

Household income data indicates a level of relative prosperity and much similarity in James City and York Counties with regard to household incomes. Both counties' median incomes have consistently exceeded the state since 2000. In 2013, the median household income in James City and York were $80,200 and $80,322, respectively, compared to $63,146 in Virginia.

An examination of the counties' economic base shows growth trends in most industry sectors, including higher paying sectors such as health care, professional, services, management of companies, and finance. Of course retail, restaurants, entertainment and recreation, and hotels comprise the key sectors of the area's visitation based economy, and have grown as well. Employment is analyzed in more detail in the Economic Base Analysis.

Figure 3-4

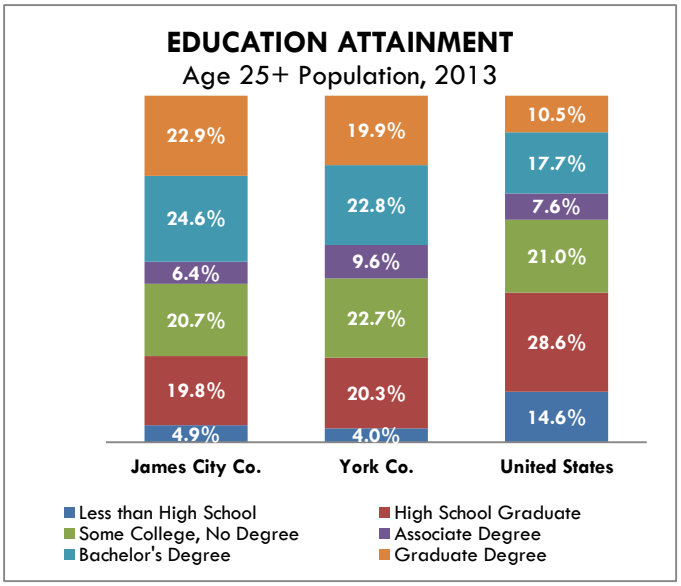


Source: ESRI and RKG Associates, 2014

5. Education Attainment

The education attainment of the local and regional labor force is a significant factor in supporting efforts to expand economic development and attract new employers. Figure 3-5 illustrates the educational attainment levels of the population 25 years and older for James City and York Counties and nation as of 2013. James City County has the largest proportions of population with bachelors and graduate degrees among the three comparative areas. James City's 25% and York's 23% proportion of bachelors degrees is significantly higher than the nation at 18%. Likewise, the proportion of graduate degrees was 23%, and 20% in James City and York Counties, respectively, compared to 11% in the nation. This finding is a positive, when considering expanding economic development recruitment for industries requiring highly skilled workers.

Figure 3-5



Source: ESRI and RKG Associates, 2014

C. ECONOMIC BASE ANALYSIS

The economic base analysis examines changes in the labor force and business characteristics of the greater study area in an effort to understand and frame the non-residential development potential in the Mooretown Road Extension Corridor. This analysis includes data on employment, major employers, labor force and unemployment trends, occupational skills and commuting patterns, which will help to establish a context for evaluating the non-residential development potential.

1. Employment Trends

At-place employment measures the number of workers within a specific geography, without regard to place of residence. For example, in 2011 James City County had approximately 23,300 people who worked in the county, which included 15,850 in-commuters and 7,490 residents who also worked in the county. At-place employment does not include working residents who commute to jobs outside of their county or city of residence.

James City County added 1,474 new jobs from 2002 through 2013, for a total of 23,337. York County added 9,235 new jobs during the same period, for a total of 21,344, and Williamsburg City added 1,116 jobs to its 2013 total of 16,224.

Employment by major industry sectors are shown for James City and York Counties as well as Williamsburg City in order to provide the most accurate depiction of industry characteristics that may impact future development in the study area. The top five industries in all of the subject jurisdictions include hotels & restaurants and retail, which reflect the preponderance of the major destination attractions in the area and associated visitation. However, each jurisdiction has its own unique employment characteristics as described in more detail below (Figure 3-6 and Table 3-2).

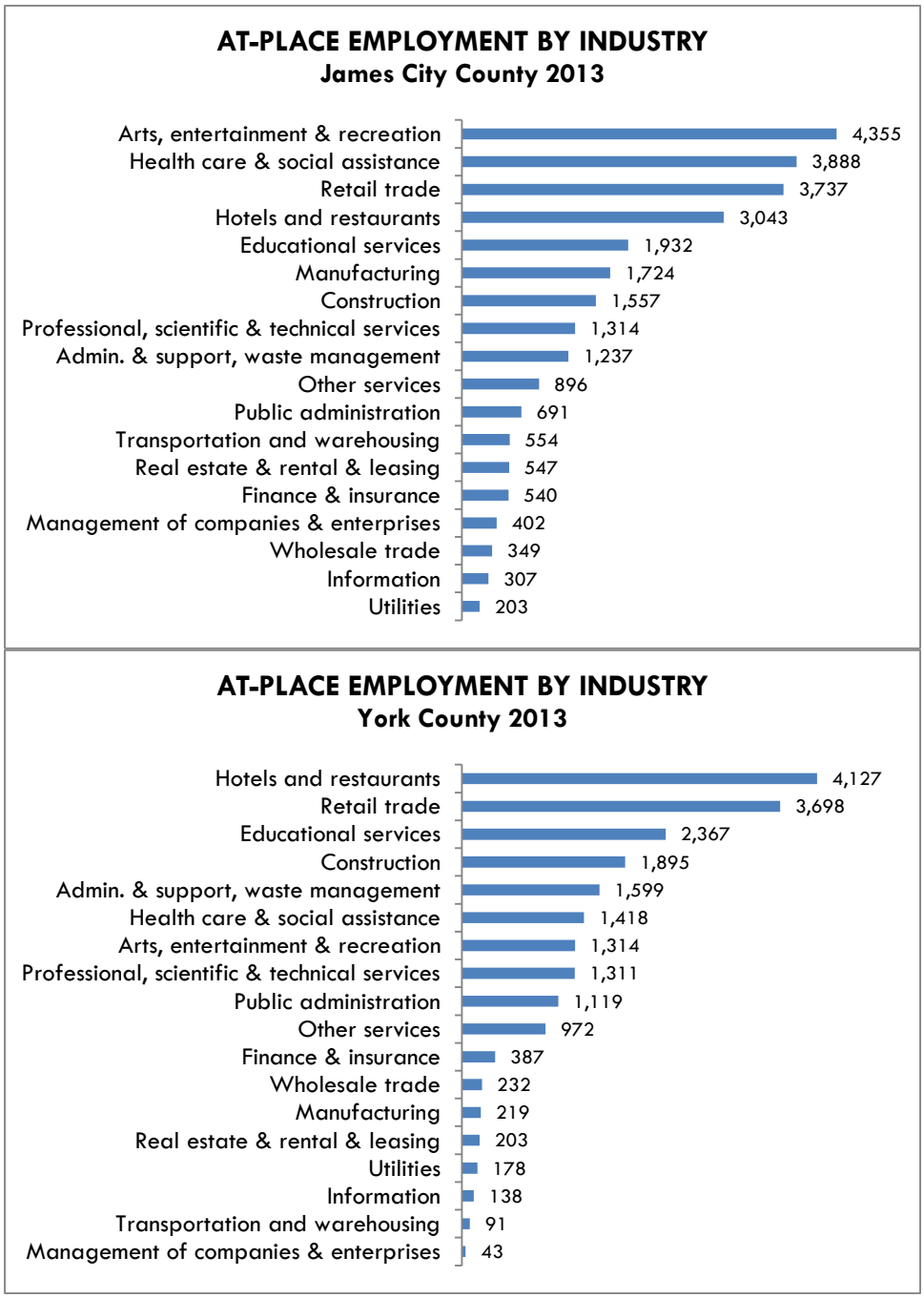
James City County — The presence of the Busch Gardens amusement park accounts for the high employment in the arts, recreation and entertainment sector which also heavily supports hotels, restaurants, and retail. The county is also home to Eastern State Hospital and several nursing homes which employ persons in the health care industry. The county has nearly 30 manufacturing establishments employing over 1,700, despite having declined in employment by 38% since 2002. White collar sectors including information, finance & insurance, professional services, management of companies, and administration account for over 3,000 jobs in the county, and have all seen increases in employment since 2002. These sectors typically occupy office buildings.

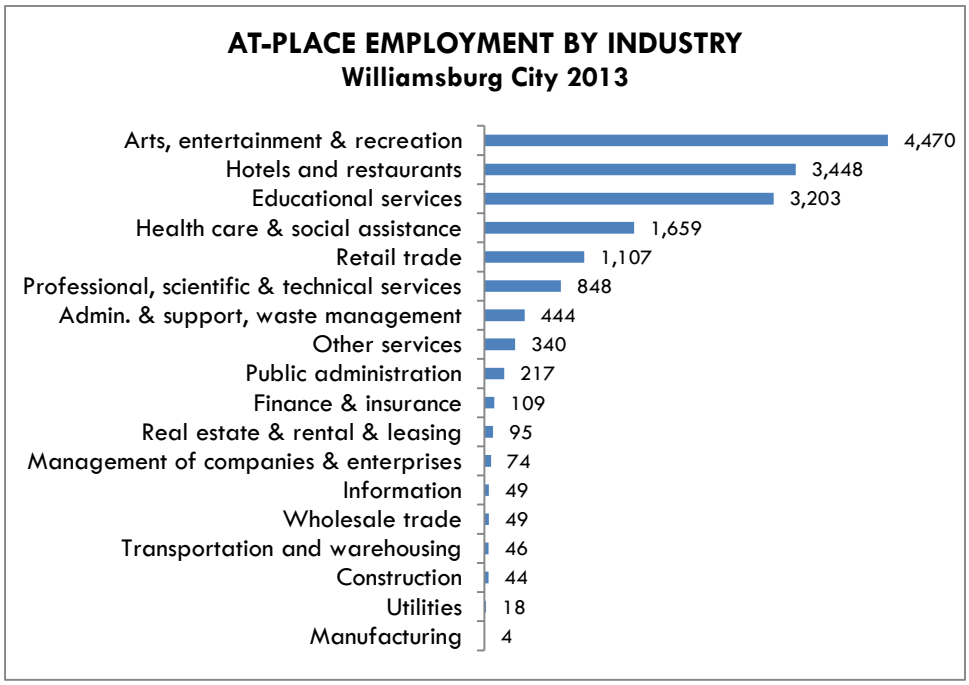
York County — Home to Water Country USA, historic Yorktown, and Williamsburg Pottery, York County also has strong hotel, restaurant and retail sectors, albeit the arts, entertainment and recreation sector is the smallest of the subject jurisdictions at just over 1,300. York County's information, finance & insurance, professional services, management of companies, and administration sectors account for nearly 3,500 jobs in the county, and similar to James City County, have added new jobs since 2002.

Williamsburg City — Williamsburg's top five industry sectors by employment are arts, entertainment and recreation (Colonial Williamsburg), hotels and restaurants, education (College of William & Mary), health care and retail.

Among the three jurisdictions, notable increases in employment occurred in the following industry sectors from 2002 to 2013: professional services, 74% (1,480 jobs); arts, entertainment & recreation, 65% (4,000 jobs); finance & insurance, 59% (390 jobs); retail, 47% (2,740 jobs); other services, 46% (695 jobs); and, health care, 36% (1,857 jobs).

Figure 3-6


AT-PLACE EMPLOYMENT BY INDUSTRY
James City County 2013
Arts, entertainment & recreation 4,355
Health care & social assistance 3,888
Retail trade 3,737
Hotels and restaurants 3,043
Educational services 1,932
Manufacturing 1,724
Construction 1,557
Professional, scientific & technical services 1,314
Admin. & support, waste management 1,237
Other services 896
Public administration 691
Transportation and warehousing 554
Real estate & rental & leasing 547
Finance & insurance 540
Management of companies & enterprises 402
Wholesale trade 349
Information 307
Utilities 203
AT-PLACE EMPLOYMENT BY INDUSTRY
York County 2013
Hotels and restaurants 4,127
Retail trade 3,698
Educational services 2,367
Construction 1,895
Admin. & support, waste management 1,599
Health care & social assistance 1,418
Arts, entertainment & recreation 1,314
Professional, scientific & technical services 1,311
Public administration 1,119
Other services 972
Finance & insurance 387
Wholesale trade 232
Manufacturing 219
Real estate & rental & leasing 203
Utilities 178
Information 138
Transportation and warehousing 91
Management of companies & enterprises 43



Source: U.S. Census County Business Patterns, Virginia Employment Commission; RKG Associates, 2014

Table 3-2
At-Place Employment by Industry 2002-2013 Trends
James City and York Counties, Williamsburg City

		JAMES CITY CO.		YORK CO.		WILLIAMSBURG		TOTAL ALL		
NAICS*	DESCRIPTION	2013	Δ 2002 to 2013	2013	Δ 2002 to 2013	2013	Δ 2002 to 2013	2013	Δ 2002 to 2013	Percent Change
	TOTAL ALL JOBS	**23,337**	**1,474**	**21,344**	**9,235**	**16,224**	**1,116**	**60,905**	**11,825**	**24%**
11	Agriculture, forestry, fishing & hunting	34	1	29	1	0	(2)	63	0	—
21	Mining, oil and gas extraction	4	4	4	4	0	0	8	8	—
22	Utilities	203	20	178	36	18	(1)	399	55	16%
23	Construction	1,557	145	1,895	(221)	44	(79)	3,496	(155)	-4%
31-32	Manufacturing	1,724	(1,043)	219	(256)	4	(28)	1,947	(1,327)	-41%
42	Wholesale trade	349	(111)	232	(46)	49	(28)	630	(185)	-23%
44-45	Retail trade	3,737	990	3,698	2,081	1,107	(328)	8,542	2,743	47%
48-49	Transportation and warehousing	554	86	91	(67)	46	19	691	38	6%
51	Information	307	140	138	38	49	(158)	494	20	4%
52	Finance & insurance	540	291	387	168	109	(73)	1,036	386	59%
53	Real estate & rental & leasing	547	(45)	203	(571)	95	(372)	845	(988)	-54%
54	Professional, scientific & technical services	1,314	400	1,311	611	848	466	3,473	1,477	74%
55	Management of companies & enterprises	402	185	43	5	74	(13)	519	177	52%
56	Admin. & support, waste management	1,237	257	1,599	131	444	228	3,280	616	23%
61	Educational services	1,932	331	2,367	260	3,203	875	7,502	1,466	24%
62	Health care & social assistance	3,888	2,439	1,418	714	1,659	(1,296)	6,965	1,857	36%
71	Arts, entertainment & recreation	4,355	482	1,314	819	4,470	2,687	10,139	3,988	65%
72	Accomodation & food services	3,043	443	4,127	2,086	3,448	(800)	10,618	1,729	19%
81	Other services	896	396	972	306	340	(7)	2,208	695	46%
92	Public administration	691	62	1,119	62	217	62	2,027	186	21%

[1]North American Industry Classification System Code

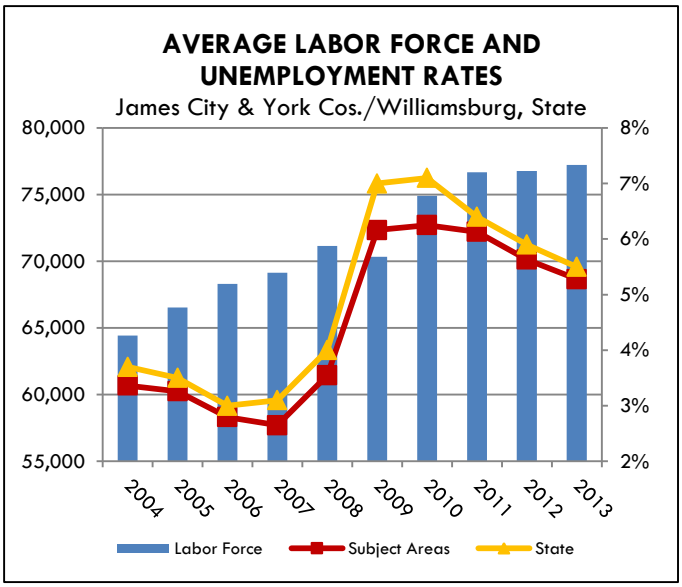
Source: US Census County Business Patterns; Virginia Employment Commission; RKG Associates

3. Labor Force and Unemployment Trends

The labor force and unemployment rate are measures of the size of a region's active, resident worker base, as well as their current employment status. The labor force includes workers who are currently employed, unemployed, or actively looking for work. The combined labor force of James City County, York County, and Williamsburg increased in size considerably over the past decade (2004-2013), from just over 64,400 in 2004 to 77,235 in 2013, in spite of a decline in 2009.

Unemployment rates in the combined jurisdictions have remained between 0.2% and 0.5% lower than Virginia's since 2004, indicating a relatively stable economic base in the region.

Figure 3-7

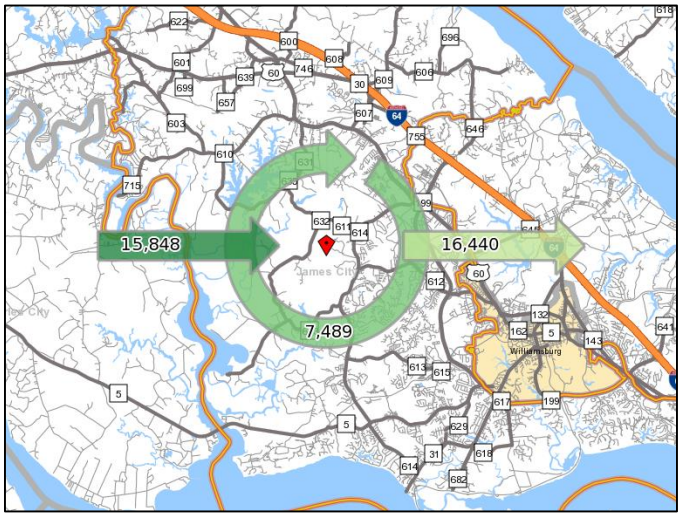


Source: U.S. Bureau of Labor Statistics; RKG Associates, 2014

5. Commuting Patterns

Understanding commuting patterns can provide useful insight into evaluating potential actions with regard to creating and retaining jobs, which will impact future residential and non-residential development. Commuting patterns highlight the flow of workers into and out of a given labor market area and as such, can help to indicate where there may be potential to capture additional jobs that are "leaking" from the local economic base.

Figure 3-7: James City County Commuting Pattern



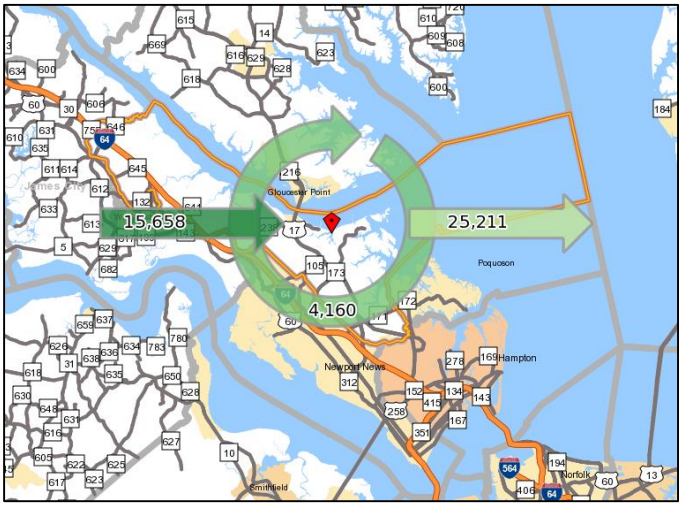
Source: US Census; RKG Associates, 2014

Figures 3-7 and 3-8 illustrate 2011 commuting patterns for at-place workers and residents of James City and York Counties. Of the 23,340 persons employed in James City County in that year, 7,490 (32%) are county residents, and 15,850 (68%) live outside the county. Commuters who leave the county to work elsewhere numbered 16,440. Of this number, 22% commute into Williamsburg, 13% commute to Newport News, and the remainder commute elsewhere.

Of the 23,340 persons employed in York County in 2011, 7,490 (21%) are county residents, and 15,660 (79%) live outside the county. Commuters who leave the county to work elsewhere numbered 25,200. Of this number, 19% commute to Newport News, 8% commute to Hampton, and the remaindercommute elsewhere.

Williamsburg City is a strong net importer of workers. In 2011 there were 16,220 at-place jobs in the city, 93% of which employed non-resident commuters. Only 1,200 at-place workers both lived and worked in Williamsburg, and 3,700 commuted to work outside the city, most to jobs in Newport News.

Figure 3-8: York County Commuting Pattern



Source: US Census; RKG Associates, 2014

D. IMPLICATIONS

The area's economy has supported robust population and household growth over the past decade. James City County, York County, and Williamsburg combined to add almost 12,000 new jobs from 2002 to 2013. The population in James City County alone grew by 46% from 2000 to 2013, and Williamsburg City saw a surge in population as well. As long as the area's economy continues to expand beyond the entertainment and hospitality industries, the demand for land to accommodate both residential and non-residential uses will continue.

4 REAL ESTATE MARKET ANALYSIS

A. INTRODUCTION

This chapter examines recent real estate trends within the region, with a focus on non-residential and residential market forces that are shaping the study area's development environment. The analysis includes factors such as existing inventory of buildings and units, development trends within selected time frames, vacancy and absorption rates, and sales values/lease rates. In addition, RKG Associates conducted a number of interviews with local development and real estate professionals in order to understand the nuances of the market and to gain an "in-the-field" perspective on the potential demand and speculative investment climate.

Data was gathered from a number of sources, both public and private, which include: James City and York Counties; the Old Dominion University Center for Real Estate and Economic Development, Coldwell Banker Traditions, ESRI Business Solutions, CoStar, and Demographics Now.

B. GENERAL LAND USES

The first step in a sector based real estate market analysis is to determine a market area that is reasonably assumed to impact development in the subject geography, the Mooretown Road Extension Corridor. For the purposes of this analysis, James City County and York County comprise the primary market area that which will exert the greatest influence on the future development potential in the study area. Data for ratable, general land uses were obtained from the tax assessor's databases for both James City County, and York County. Market data is also included for Williamsburg City for the analysis of certain real estate sectors.

Table 4-1
General Land Uses
James City & York Counties 2013

Land Use	James City County	York County	Total
RESIDENTIAL			
Single-Family	24,814	19,219	44,033
Apartments	3,295	1,663	4,958
Timeshares	1,104	1,145	2,249
Condominiums	927	891	1,818
Duplex	174	660	834
NON-RESIDENTIAL			
Retail/Service	4,327,779	3,869,782	8,197,561
Industrial	5,326,597	1,385,304	6,711,901
Warehouse	4,690,704	1,832,983	6,523,687
Restaurant/Lodging	1,155,343	1,832,983	2,988,326
Office	1,804,427	705,305	2,509,732
Entertainment	1,027,183	87,041	1,114,224
Automotive	101,811	362,518	464,329

Source: James City Co.; York Co.; RKG Associates 2014

Single family homes dominate the residential sector with an estimated total of 44,000 units, followed by apartments at nearly 5,000. As a vacation destination the area supports timeshare units, of which there are approximately 2,250. Condominiums number just over 1,800, and duplexes number just over 830.

In the total non-residential sector retail/service sector for both counties accounts for the highest amount of square footage at approximately 8.2 million square feet. The industrial sector comprises 6.7 million square feet, over 3 million of which belongs to Anheuser-Busch in James City County, followed by warehouses at 6.5 million. Restaurants and lodging comprise nearly 3.0 million square feet, and are heavily supported by tourism to the area. Office comprises 2.5 million square feet of space, and is characterized by low rise, campus type inventory. The entertainment industry is a key employer in the area, and accounts for over 1.1 million square feet of building space under roof along with a myriad of open air uses. Automotive uses such as gas stations and garages account for less than 500,000 square feet (Table 4-1).

C. RESIDENTIAL MARKET TRENDS

1. Development Trends

An examination of residential development trends over time is useful for projecting future absorption, even ten or fifteen years into the future. For the purpose of this analysis, the five years prior to 2008 are examined separately from 2008 through 2013, in order to assess the impact of the economic downturn on the market.

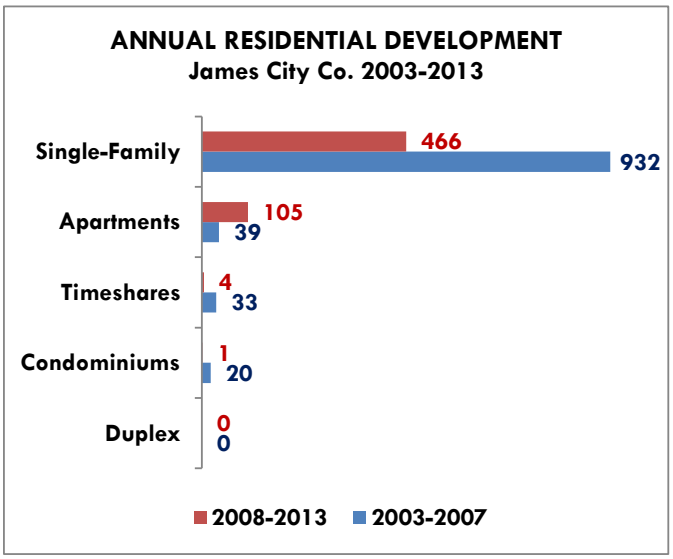
In James City County, 932 average annual single family units were added to the inventory from 2003 through 2007, followed by apartments at 39, timeshares at 33, and condos at 20.

In the six year period from 2008 through 2013, the average annual single family units declined to 466, while the average annual apartments increased from 39 to 105 following a national trend of apartment construction in response to tightened credit and lower demand from potential home buyers. Annual timeshare and condominium units dropped to four and one, respectively, likely holdovers from 2007.

In York County, 342 average annual units were added to the inventory in the five-year period from 2003 through 2007. During the same period, an average of 43 apartments were added annually, followed by timeshare units at 29, condos at 27, and duplexes at 12.

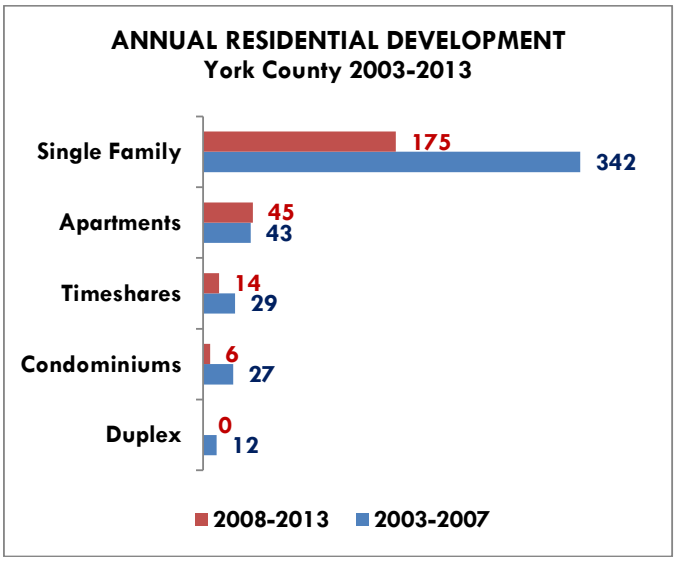
From 2008 to 2013, new single family units were added at an average of 175 annually. Annual average apartments

Figure 4-1



Source: James City Co.; York Co.; RKG Associates 2014

Figure 4-2



Source: James City Co.; York Co.; RKG Associates 2014

increased slightly to 45. Timeshare units decreased to 14 average annual, followed by an average of six condos per year, and zero duplexes.

2. Housing Characteristics

In 2013, median owner occupied dwelling unit values were as follows: James City County, $324,200; York County, $336,600; and, Williamsburg City, $326,200. Based on discussions with real estate professionals, York County has a significant number of waterfront homes, which tends to drive up value. Williamsburg City has a large proportion of units in the over $500,000 category, which also drives up the median value.

Median cash rents in James City and York Counties are relatively close, at $1,066 and $1,110 respectively, compared to $910 for Williamsburg City. In James City County, 53% of monthly cash rents exceed $1,000, compared to 59% in York County and 45% in Williamsburg City (Figure 4-4).

The size of single family dwelling units trended upward from 2003 to 2007, and generally decreased in average size after 2007. The average James City County single family dwelling unit size prior to 2003 was 2,132 square feet. Single family dwelling units constructed from 2003 through 2007 averaged 2,641 square feet in size, and units constructed from 2008 through 2013 were somewhat smaller again, averaging 2,410 square feet. In York County, single family dwelling unit size prior to 2003 was 2,102 square feet. Single family dwelling units constructed from 2003 through 2007 averaged 2,943 square feet, and units constructed from 2008 through 2013 averaged 2,573 square feet. The trend to smaller sized units from 2003-2007 to 2008-2014 reflects the tightening of the market and a market shift to more affordable product.

Figure 4-3

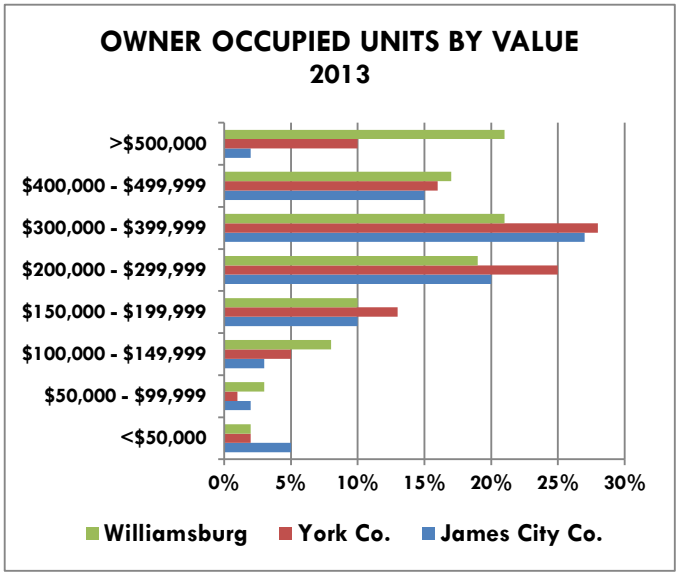
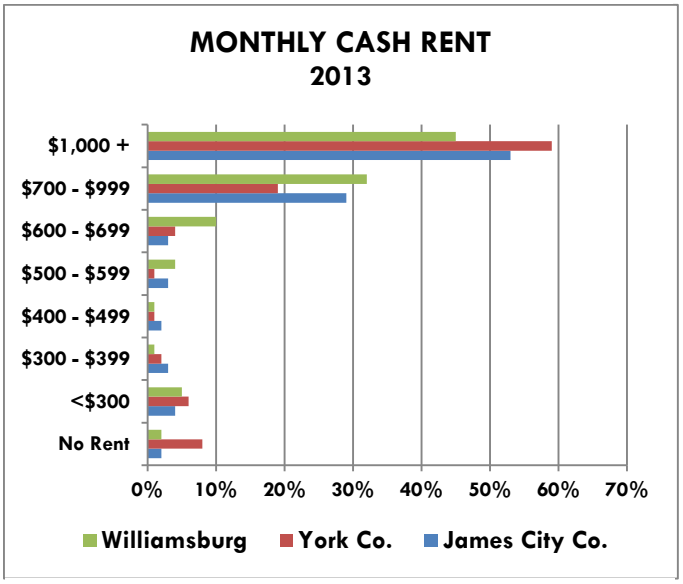


Figure 4-4



Source: James City Co.; York Co.; RKG Associates 2014

James City and York Counties have demonstrated relatively low proportions of renter occupied housing compared to owner occupied housing since 2000, although the proportion has increased slightly from 2000 to 2013. Nationally, renter occupied units accounted for approximately 30% of all occupied units in 2013, compared to approximately 25% in James City and York Counties. In Williamsburg City, the proportion of renter occupied housing exceed both the comparative counties and the nation, at approximately 56% in 2013, up from 50% in 2000.

The number of vacant units has increased in all jurisdictions since 2000, most dramatically in York County, which rose from 3.5% of total units in 2000 to 10.3% in 2013. Vacancies decreased dramatically in Williamsburg City, from 7% in 2000 to 1.4% in 2013 (Table 4-2).

Table 4-2
Housing Occupancy Trends
James City County, York County, Williamsburg City

	James City County	York County	W'burg City
2000			
Housing Units	20,745	20,582	3,475
Total Occupied Units	18,979	19,871	3,483
Owner Occupied Housing Units	77.0%	75.8%	42.5%
Renter Occupied Housing Units	23.0%	24.2%	50.4%
Vacant Housing Units	8.5%	3.4%	7.0%
2010			
Housing Units	29,797	26,849	5,176
Total Occupied Units	26,860	24,006	4,571
Owner Occupied Housing Units	76.1%	75.1%	38.6%
Renter Occupied Housing Units	23.9%	24.8%	49.7%
Vacant Housing Units	9.8%	10.5%	11.6%
2013			
Housing Units	31,106	27,194	5,250
Total Occupied Units	28,113	24,374	5,172
Owner Occupied Housing Units	75.5%	74.7%	42.8%
Renter Occupied Housing Units	24.5%	25.3%	55.6%
Vacant Housing Units	9.6%	10.3%	1.4%

Source: Site to do Business; RKG Associates 2014

3. Pipeline Development

Pipeline development usually refers to projects that are in the predevelopment approval phases, such as site plan or subdivision approval, which constitute an inventory of future residential dwelling units. Since taking projects to these stages typically involves considerable investments in time and money, it can be reasonably assumed that these units will be constructed in the relative near term, the pace of which is influenced by market conditions. Developers and investors maintain a close watch on the development pipeline to help inform their go/no-go decisions on new, speculative projects. As with any commodity, the housing market is subject to the laws of supply and demand.

The James City County Planning Division estimated a pipeline of approximately 9,400 residential units in approved residential subdivisions as of December 2013. If residential construction continues to proceed at the 2008-2013 rate of 576 units per year average, it will take just over sixteen years to build 9,400 units. If the rate of residential construction proceeds at the 2003-2007 pace of 1,024 new units per year average, 9,400 units could be built in just over nine years, with a midpoint between twelve and thirteen years.

The York County Department of Environmental and Development Services estimated that approximately 1,570 residential units were within approved planned developments in September 2012. At the 2008-2013 rate of 453 new annual units average, it would take just three years to build 1,570 units, and between six and seven years at the 2008-2013 rate of 240 new units per year average.

Discussions with planners and developers in both counties revealed that the rate of development will abate as the availability of developable land diminishes. In York County, Environmental and Development Services has projected an additional 10,400 units as the maximum build-out scenario assuming each parcel will be developed to the maximum extent allowed under the existing zoning. However, they concede that is unlikely due to fact that remaining sites will be increasingly encumbered by environmental and other constraints that will reduce allowable lot yields. According to the County

of York 2012 – 2013 Comprehensive Plan, residential development in York County is projected to add approximately 5,700 new housing units by 2035.

4. Implications

Although significant development opportunities in the Mooretown Road Extension Corridor may be fifteen years or more off into the future, they should present themselves at an opportune time from a supply perspective. There is a general consensus in the planning and real estate communities in both James City and York Counties that the best development sites have been taken, and developers are already facing the prospect of considering less desirable sites. Of course, the access that an extended Mooretown Road will provide to new opportunity sites will make them extremely desirable.

The area will also be desirable from the perspective of potential residents for a number of reasons: its easy access to I-64; its reasonable driving distance to Hampton Roads' urban employment centers to the south and Richmond to the east; and, the abundance of desirable amenities within close proximity.

D. NON-RESIDENTIAL MARKET TRENDS

This section details the recent and historical real estate trends in the industrial and office markets that encompass and influence the study area's development environment. This nonresidential analysis reflects the most current market conditions and includes information such as building, development trends, and lease and vacancy rates. The purpose of this analysis is to identify the existing competitive supply of real estate and provide estimates of potential future demand within the Mooretown Road Extension Corridor area.

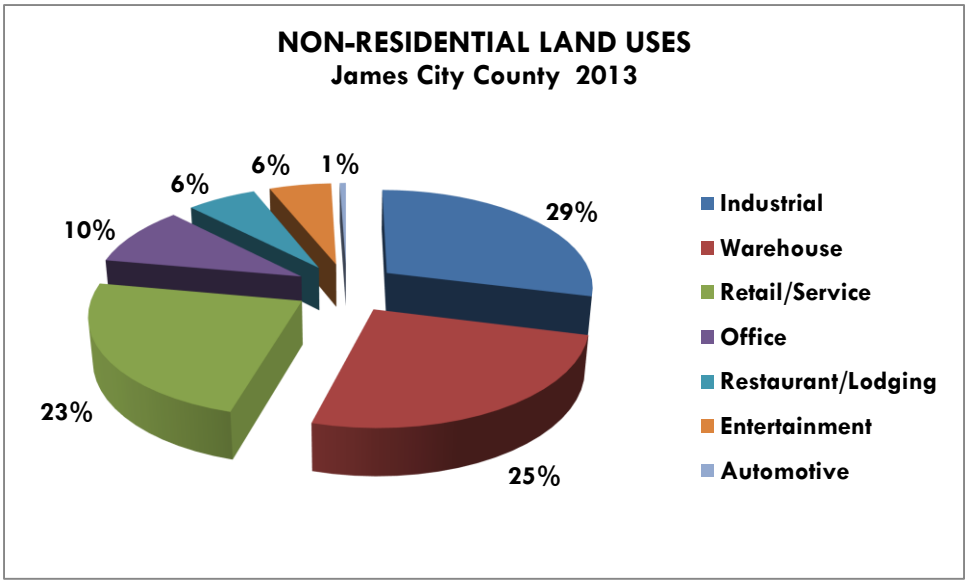
1. Nonresidential Building Inventory

Based on a review of tax assessment records, a summary inventory has been compiled that illustrates the total building square footage for nonresidential buildings in the study area. The building uses presented in Figure 4-5 and 4-6 are generalized categories of the actual use types listed in the databases.

Automotive uses include auto dealerships, gas stations and garages. Entertainment is shown as its own category to reflect its prevalence in the greater Williamsburg area, although many of the entertainment attractions are open space oriented (amusement park rides) and are not documented on a square foot basis. Restaurant and lodging includes fast food and full service restaurants, as well as hotels and motels. Office includes conventional office space not associated with warehouse or industrial uses, and medical office space. Retail and service comprises food, pharmacy, and merchandise stores as well as shopping centers and malls. Services such as drive in banking, gyms and spas and daycare are included under retail/service. The warehouses category is limited to storage and distribution, and the industrial category encompasses production facilities. Non-taxable uses such as government facilities and public schools are not shown in this analysis.

In James City County, industrial uses account for the largest amount of improved space at 5.3 million square feet, approximately 3.2 million square feet of which is owned and operated by a single user, the Anheuser-Busch brewery. Warehouse space comprises the second largest land use at approximately 25% or 4.7 million square feet followed by retail/service at 23% or 4.3 million square feet, and office at 10% or 1.8 million square feet (Figure 4-5).

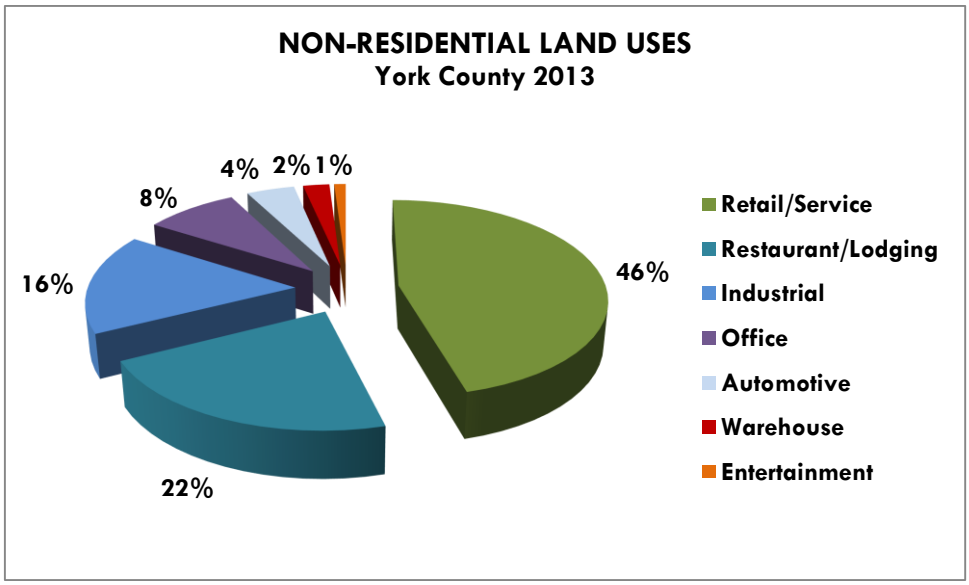
Figure 4-5



Source: James City Co.; RKG Associates 2014

York County's non-residential land use characteristics are somewhat different than James City County, with retail/services comprising the largest amount of improved space at 3.9 million square feet or 42%, followed by restaurant/lodging at 1.8 million square feet or 20%, industrial at 1.4 million square feet or 15%, and office space at 8% or 705,000 square feet (Figure 4-6).

Figure 4-6

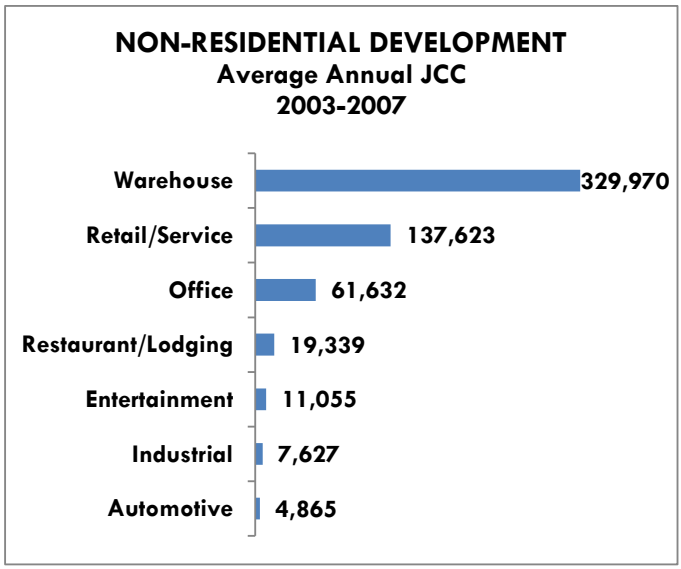


Source: York Co.; RKG Associates 2014

1. Non-Residential Development Trends

An examination of non-residential development trends since 2003 is useful for projecting how certain land use types may develop in the future. In James City County, 1.6 million square feet of warehouse space was developed from 2003 through 2007, approximately 1 million square feet of which was a single Walmart warehouse. Otherwise, warehouse development would be roughly equivalent to retail/service development at approximately 650,000-700,000 square feet over this period. Whereas warehouse development dropped to just about 110,000 total square feet in the 2008 to 2013 period, retail/service development stayed steady at 136,000 square feet *annually*, totaling 678,000 square feet over the period.

Figure 4-7

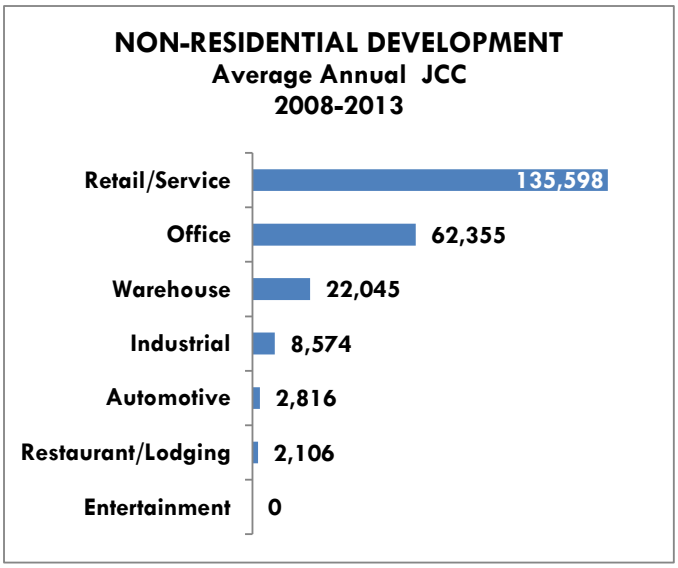


Source: James City Co.; RKG Associates 2014

Office development has stayed very consistent on an annual basis since 2003, averaging approximately 61,600 square feet in the 2003-2007 period and 62,400 in the 2008-2013 period. Restaurant/lodging development totaled nearly 97,000 square feet in the 2003-2007 period, dropping to a total of just over 10,500 square feet from 2003 through 2013. Industrial development in the 2003-2007 period totaled approximately 38,000 square feet, compared to 43,000 from 2008 through 2013. The entertainment category added just over 55,000 square feet from 2003 through 2007, with no building activity in the subsequent period (with the possible exception of amusement park rides). For illustration purposes, non-residential development is shown as average annual square feet in Figures 4-7 and 4-8.

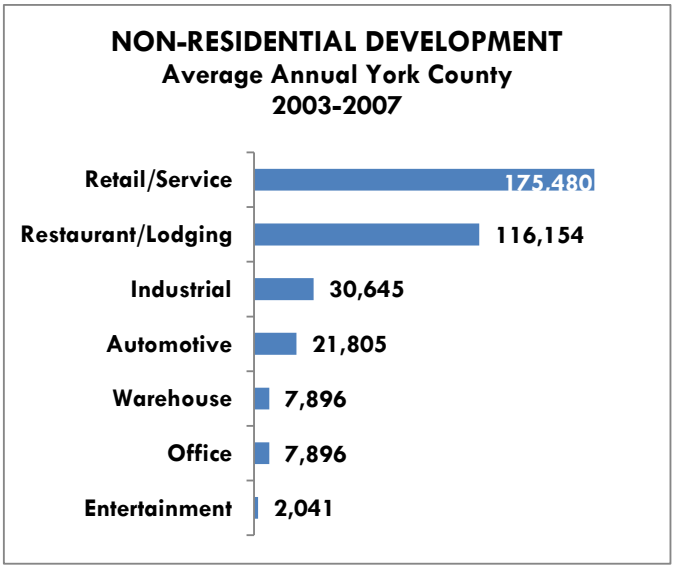
The retail/ service and restaurant / lodging categories have remained consistent leaders in non-residential development trends in York County from 2003 through 2013, although the pace of development has declined since 2007. In the 2003-2007 period, the retail /service sector added approximately 877,000 square feet, compared to 446,000 square feet in 2008-2013, but still remained the leader in development. Restaurant/lodging development declined from approximately 581,000 square feet in 2003-2007 to 196,000 square feet in 2008-2013, but still remained second in new development.

Figure 4-8



Source: James City Co.; RKG Associates 2014

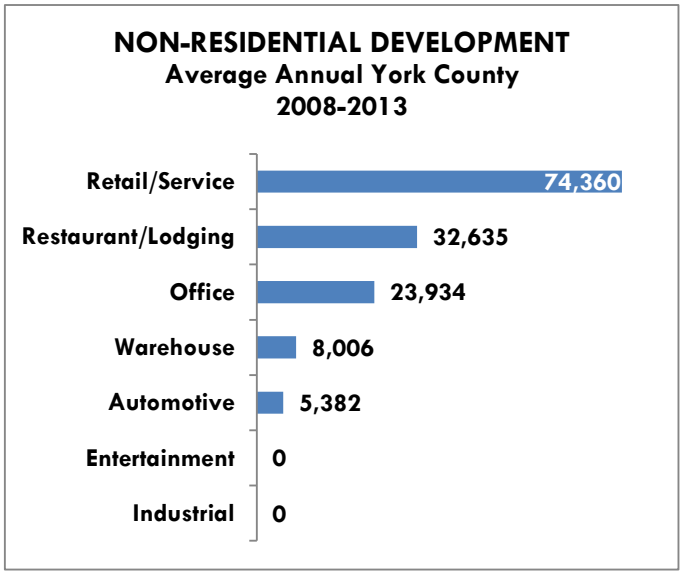
Figure 4-9



Source: York Co.; RKG Associates 2014

York County actually experienced an upsurge in office development, from approximately 109,000 square feet in 2003-2007 to 196,000 square feet in 2008-2013. Warehouse development also saw an increase in the pace of development, from approximately 39,500 square feet in 2003-2007 to 48,000 square feet in 2008-2013. The entertainment and industrial sectors saw no development activity from 2008 through 2013 (Figures 4-9 and 4-10).

Figure 4-10



Source: York Co.; RKG Associates 2014

2. Retail Market Characteristics

The term "retail" generally refers to operations involved in the sale of goods, merchandise, or services from a fixed location, such as a shopping center or freestanding store. Information on the local and regional retail marketplace is derived from CoStar, a national real estate data reporting service. CoStar generally classifies retail into five major categories by building configuration: **general retail**, which is typically single tenant freestanding general purpose commercial buildings with parking; **malls**, regional or super regional centers ranging in size from 250,000 square feet to 1.5 million square feet built around two or more full-line department stores; **power centers**, typically consisting of several freestanding anchors and a minimum amount of small specialty tenants; **shopping centers**, neighborhood or community centers ranging in size from 50,000 to 250,000 square feet built around a junior department store, variety store, super drugstore, or discount department store as the major tenant, in addition to a supermarket; and, **specialty centers**, usually located in tourist areas and include outlet centers and theme centers (e.g., Williamsburg Pottery, Premium Outlets).

CoStar recognizes 47 submarkets in the greater Hampton Roads retail marketplace. The two most relevant to the Mooretown Road Extension Corridor are the Lightfoot and Williamsburg submarkets (Figures 4-11 and 4-12). Although the Lightfoot submarket completely contains the Corridor area, the Williamsburg submarket is significant due to its close proximity and size of its inventory. Whereas the Lightfoot submarket contains 87 buildings comprising 2.7 million square feet, the Williamsburg submarket has 254 buildings comprising 4.6 million square feet. In the regional context, the greater Hampton Roads market contains over 100 million square feet of retail (Table 4-4).

Table 4-3
Retail Market Characteristics
Lightfoot & Williamsburg Submarkets Q1 2014

	Existing Inventory		Vacancy	
Submarket	**Buildings**	**Square Feet**	**Square Feet**	**Percent**
LIGHTFOOT				
General Retail	73	792,775	5,293	0.7%
Power Center	1	384,141	5,240	1.4%
Shopping Center	10	529,623	111,902	21.1%
Specialty Center	3	970,528	0	4.6%
Subtotal	87	2,677,067	122,435	4.6%
WILLIAMSBURG				
General Retail	219	1,358,457	110,869	8.2%
Mall	2	537,160	51,497	9.6%
Power Center	1	379,322	0	0.0%
Shopping Center	32	2,348,900	321,582	13.7%
Subtotal	254	4,623,839	483,948	10.5%
TOTAL	341	7,300,906	606,383	8.3%
Hampton Roads	7,646	100,107,388	6,553,987	6.5%

Source: CoStar; RKG Associates 2014

Figure 4-11

Lightfoot Retail Submarket

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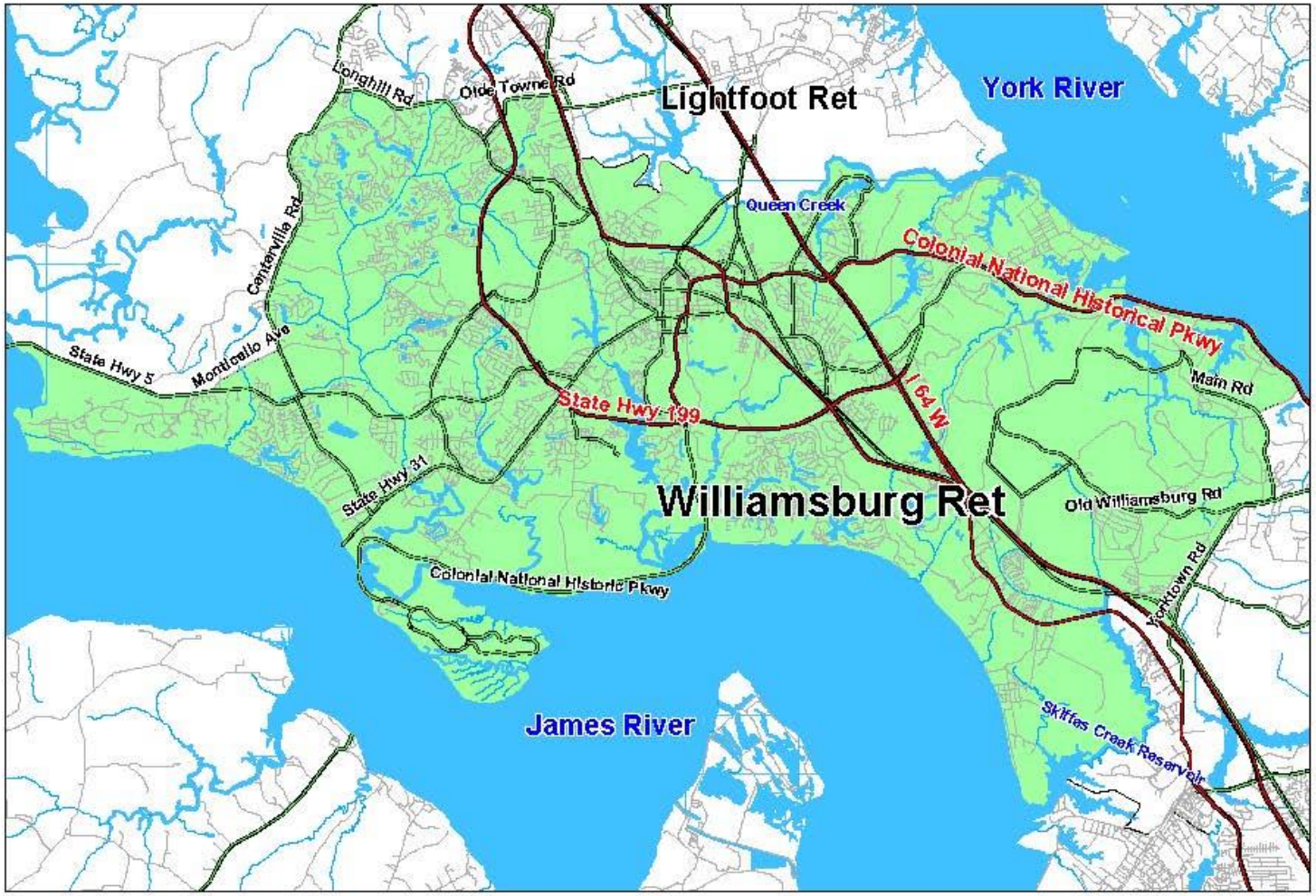
Figure 4-12



Williamsburg Retail Submarket

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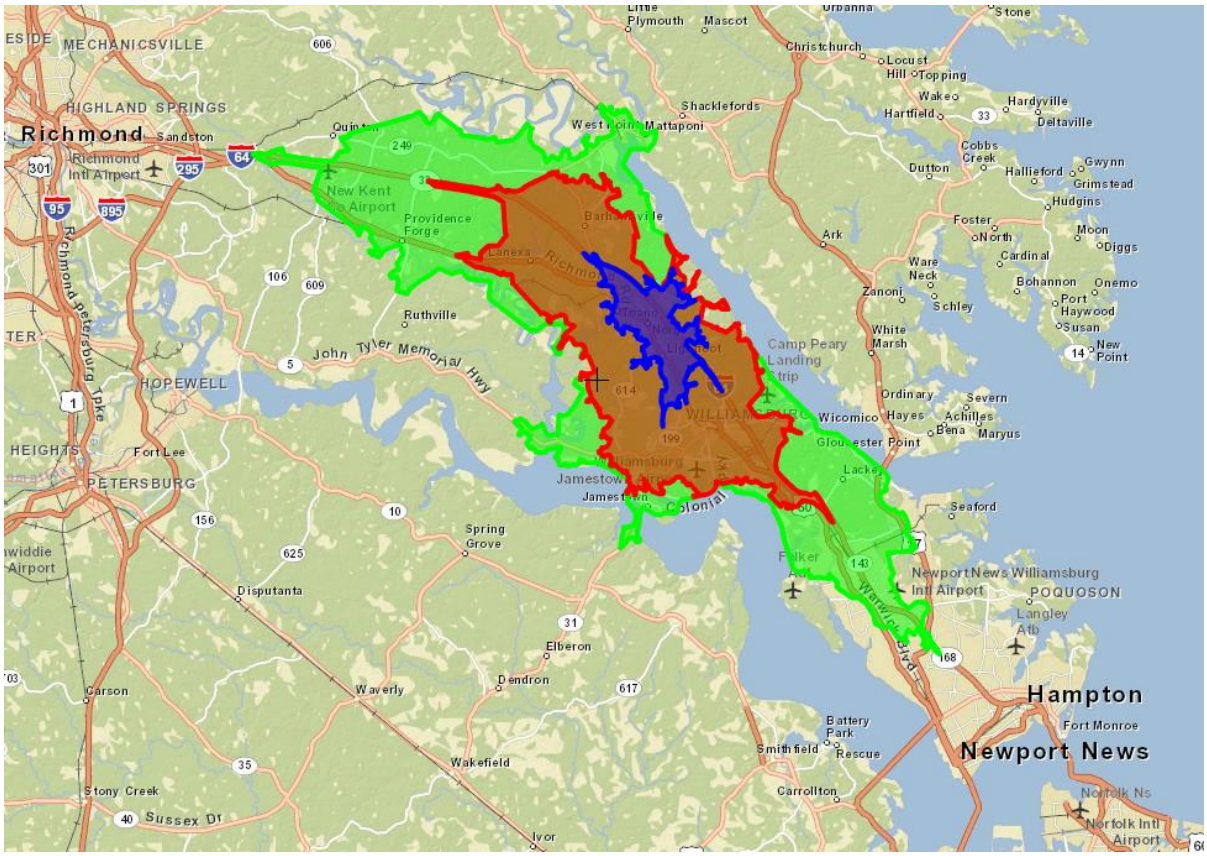
A widely accepted measure of retail characteristics is the *Retail Market Potential*, a comparison of supply and demand to determine potential sources of revenue growth at any standard or user defined geographic level. An **opportunity gap**, otherwise referred to as leakage, appears when household expenditure levels for a specific geography are higher than the corresponding retail sales estimates. This difference signifies that resident households are meeting the available supply and supplementing their additional demand potential by going outside of their own geography. The opposite is true in the event of an **opportunity surplus**. That is, when the levels of household expenditures are lower than the retail sales estimates. In this case, local retailers are attracting residents of other areas into their stores.

Three trade areas were assessed as part of the retail market potential analysis conducted for the Mooretown Road Extension Corridor: ten-, twenty- and thirty-minute drive times. Figure 4-13 illustrates the three drivesheds, indicating ten minutes in blue, twenty minutes in red, and thirty minutes in green. The ten-minute driveshed encompasses the entire Corridor area and comprises a population of 28,476. The twenty-minute driveshed encompasses all of Williamsburg City, and most of the Lightfoot and Williamsburg retail submarkets. The thirty-minute driveshed stretches from well into Newport News to the south, up into New Kent County, ending east of the I-295 Richmond bypass.

Figure 4-13



Source: Demographics Now; RKG Associates 2014

The retail market potential for each driveshed is based on household characteristics and retail inventory in each specific area and does not take into account visitation and tourism, which supports a significant portion of the area's retail inventory. Indeed, the large opportunity surpluses (in black type) in clothing and furniture and home furnishings are most likely due to the preponderance of stores catering to tourists, as are full-service restaurants. Notable opportunity gaps (in red type) are evident in grocery stores, general merchandise (within the 20-minute driveshed) and building materials, garden equipment and supplies stores (Table 4-4).

Table 4-4
Retail Market Potential by Drive Times
Mooretown Road Extension Corridor 2013

Category	10 Minutes	20 Minutes	30 Minutes
DEMOGRAPHICS			
2013 Population	28,476	101,519	255,953
2013 Households	11,424	38,841	99,234
2013 Median Disposable Income	$50,944	$55,564	$49,822
2013 Per Capita Income	$30,882	$35,541	$30,873
DAILY NEEDS			
Grocery Store	$19,089,015	$100,028,536	$169,858,943
Specialty food stores	$1,567,040	$131,215	$1,908,833
Pharmacies & drug stores	$33,464,340	$22,753,872	$16,908,678
GENERAL MERCHANDISE, APPAREL, FURNITURE, OFFICE (GAFO)			
General Merchandise	$1,340,099	$85,359,832	$54,882,809
Clothing and clothing accessories	$244,700,128	$177,291,064	$193,448,555
Furniture and home furnishing stores	$13,503,547	$10,999,525	$30,534,495
Electronic and appliance stores	$1,885,742	$12,044,179	$25,501,542
Sporting goods, hobby, book, and music stores	$2,514,292	$3,120,252	$27,701
Office supplies, stationary, gift stores	$5,418	$37,309	$5,707,154
Bldg materials, garden equip & supply stores	$10,340,438	$7,113,972	$19,633,494
FOOD SERVICE			
Full-service restaurants	$22,799,274	$12,864,045	$29,732,423
Limited service eating places	$8,939,392	$10,860,875	$35,292,755

Source: ESRI Business Information Solutions; RKG Asociates

The retail marketplace is currently experiencing adjustment as evidenced by the high shopping center vacancy rates in the Lightfoot (21%) and Williamsburg (14%) submarkets. The addition of over 1 million square feet of retail in James City and York Counties, combined, from 2008 through 2013 has almost certainly contributed to an oversupply of locally serving shopping centers. Going forward, the key to success for retail will be visibility and access such as that enjoyed by the power center (Walmart Super Center, Lowes, Home Depot) at Mooretown Road and East Rochambeau, just to the east of the Corridor. It is anticipated that the retail marketplace will continue to remain very competitive over the next ten to fifteen years, but centers with the best visibility and access, particularly from I-64, will enjoy a competitive advantage.

3. Office

The data provided in this section are derived from CoStar. Costar typically categorizes office buildings under three classifications:

- Class A is used to describe buildings that generally qualify as extremely desirable investment-grade properties and command the highest rents or sale prices compared to other buildings in the same market.
- Class B is use to describe buildings that generally qualify as a more speculative investment, and as such, command lower rents or sale prices compared to Class A properties.
- Class C is used to describe buildings as no-frills, older buildings that offer basic space and command lower rents or sale prices compared to other buildings in the same market.

The two relevant CoStar geographical submarkets for the office sector correspond to the geographies of James City County/Williamsburg and York County, and are referred to as such. Costar only documents office space that is leased or available for lease. Of the two submarkets, James City County/ Williamsburg has the much larger inventory at approximately 2.2 million square feet compared to York County at 860,000 square feet. The total inventory for the Hampton Roads market is 48.7 million square feet. Vacancy rates for both submarkets run slightly less than the market, which was 11.4% in the first quarter of 2014.

Future office development will depend on the area's ability to continue to attract and retain employers. From 2003 through 2013, James City County/Williamsburg has added approximately 620,000 square feet to its office inventory, compared to just over 250,000 square feet in York County. This office development corresponds to employment increases in white collar industry sectors, including finance & insurance, professional and technical services, management of companies, and administrative support services.

Table 4-5
Office Market Characteristics
Williamsburg/JCC and York Co. Submarkets Q1 2014

	Existing Inventory		Vacancy	
Submarket	**Buildings**	**Square Feet**	**Square Feet**	**Percent**
WILLIAMSBURG / JAMES CITY COUNTY				
Class A	2	89,898	6,483	7.2%
Class B	183	1,712,454	205,385	12.0%
Class C	88	416,650	38,356	9.2%
Subtotal	273	2,219,002	250,224	11.3%
YORK COUNTY				
Class A	1	64,992	7,460	11.5%
Class B	74	616,771	59,698	9.7%
Class C	36	178,194	47,168	26.5%
Subtotal	111	859,957	114,326	10.50%
TOTAL	384	3,078,959	364,550	
Hampton Roads	3,301	48,717,844	5,547,132	11.4%

Source: CoStar; RKG Associates 2014

4. Industrial

CoStar classifies industrial space into two categories by use type: **flex** is a type of building designed to be versatile, which may be used in combination with office, research and development, quasi-retail sales, and including, but not limited to production, warehouse, and distribution uses; **warehouse** is primarily used for storing and/or distributing product, and typically includes a small office component.

CoStar recognizes 22 industrial submarkets in the greater Hampton Roads market. The submarket that is relevant to the Mooretown Road Extension Corridor is Williamsburg Extended, which extends from Yorktown to the south to an area north of Croaker Road, as shown in Figure 4-14.

Figure 4-14

Williamsburg Extended Industrial Submarket

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Flex space for lease in the Williamsburg extended submarket amounts to approximately 247,000 square feet in ten buildings, and has a vacancy rate of nearly 20%. Warehouse space totals 8.3 million square feet with a 4.7% vacancy rate. The greater Hampton Roads market contains 14.3 million square feet of flex space with an 11.4% vacancy rate and 95.6 million square feet of warehouse with a 7.9% vacancy rate.

Table 4-6
Industrial Market Characteristics
Williamsburg Extended Submarket Q1 2014

	Existing Inventory		Vacancy	
Submarket	Buildings	Square Feet	Square Feet	Percent
WILLAMSBURG EXTENDED				
Flex	10	246,598	48,717	19.8%
Warehouse	111	8,316,507	391,188	4.7%
HAMPTON ROADS				
Flex	821	14,349,809	1,628,913	11.4%
Warehouse	2,822	95,556,358	7,556,762	7.9%

Source: CoStar; RKG Associates 2014

Industrial and warehouse land uses total just over 10 million square feet in James City County/Williamsburg compared to 1.6 million square feet in York County. New industrial development in James City County/Williamsburg amounted to just over 38,000 square feet in 2003-2007 and nearly 43,000 square feet in 2008-2013. New warehouse space totaled over 1.6 million square feet in 2003-2007 and 110,000 square feet in 2008-2013.

In York County, approximately 153,000 square feet of industrial space was added in 2003-2007 and no industrial space was added in 2007-2013. New warehouse space totaled just under 40,000 square feet in 2003-2007 and just over 48,000 square feet in 2008-2013.

5. Visitation Attractions

The greater Williamsburg area is unique with regard to its cluster of tourist and visitor attractions, which includes historic sites, amusement and theme parks, golf courses, and destination shopping centers. Some of the key attractions are as follows:

- **The Historic Triangle** is an arrangement of three historic colonial communities on the Virginia Peninsula stretching from **Jamestown** through **Colonial Williamsburg** on to **Yorktown**. In 2013, paid attendance at Colonial Williamsburg was 651,000, down from its peak of 1.1 million in 1985, but up 10% from its lowest attendance year, 2004.
- The area's amusement parks include **Busch Gardens**, an "Old Europe" themed amusement park near Williamsburg, and **Water Country USA**, the Mid-Atlantic's largest water park. Busch Gardens had a paid attendance of 2.7 million in 2013, down from 3.1 million in 2008. These two amusement parks have certainly contributed to Virginia's ranking of 7th among states in amusement and theme park revenues of $268 million in 2013 (by comparison, Florida was ranked number one with $7.4 billion in revenues).
- **Williamsburg Pottery** is a specialty retail center encompassing 160,000 square feet of enclosed space on 19 acres. It was estimated that 3 million people visited Williamsburg Pottery on an annual basis in the 1980s and early 1990s. As of 2010, visitors had dropped to 500,000 annually, presumably due to new competition such as **Williamsburg Premium Outlets**, which was built in 1988 and has an estimated 135 stores.

Market research of the amusement park industry revealed that larger companies are currently focused on expanding internationally in order to boost profitability and revenue. Domestically, amusement parks are expanding and replacing attractions in existing parks. Resorts along the lines of Great Wolf Lodge are still being developed, which integrate a unique lodging theme with indoor amusements, such as a water park. For example, there are plans currently underway to develop a $215 million resort which includes an indoor snow ski facility and Hard Rock International Hotel between Dallas and Fort Worth, Texas.

6. Lodging

Naturally, a tourism and visitors destination area supports a significant hospitality sector, and the greater Williamsburg area is a case in point. Analysis of the greater Williamsburg lodging market, which includes properties in James City and York Counties, as well as the City of Williamsburg, show 73 lodging properties comprising 8,508 guest rooms in 2013, up from 69 with 8,447 rooms in 2008.

Hotel occupancies are a measure of the proportion of rooms rented to rooms available, and is a key metric that potential lodging investors use when evaluating the potential for new development within a specific market area. Since the Williamsburg area is a seasonal destination, lodging occupancies are at their highest from June through August, and lowest from January through March. In the summer of 2013, lodging occupancies ranged from 60.1% to 67.4%. The lowest occupancy winter months in 2013 ranged from 18.5% to 34.7%. Annual occupancy averages for the greater Williamsburg lodging market were 43.7% in 2013, and have generally been in the low forty percent range in the past six years. PKF Hospitality Research projects a national occupancy level of 63.8% in 2014, which is nearly 20 points higher than Williamsburg.

Other key metrics for lodging investors are the trends in average room rates (ADR) and Revenue per Available Room (RevPAR). If these metrics are static or in decline, investors may hold off development decisions until there is a consistent, positive trend. Analysis indicates that the marketplace is oversupplied relative to recent and current visitation levels.

Table 4-7
Greater Willamsburg Market Hotel Operating Characteristics

	2008	2009	2010	2011	2012	2013
Properties	69	70	71	71	71	72
Rooms	8,447	8,535	8,612	8,545	8,537	8,508
Occupancy	44.7%	42.5%	42.2%	42.1%	43.8%	43.7%
Avg. Room Rate	$92.03	$99.31	$95.96	$89.28	$85.82	$90.18
RevPAR	$41.13	$42.21	$40.50	$37.61	$37.60	$39.44

Source: Smith Travel Research; RKG Associates 2014

7. Summary Conclusions

Residential — The Virginia Employment Commission projects that James City and York Counties combined will add an additional 20,000 to 25,000 households by 2030. At the current rates of absorption, James City County will consume its current residential development pipeline in 12 to 13 years, and York County will consume its pipeline units in just three years. Of course, new units will come into the pipeline, but the consensus among real estate professionals interviewed for this analysis is that viable development tracts are becoming scarce as the inventory is consumed. If household growth continues as projected, demand for new housing should remain steady ten to fifteen years in the future. The locational characteristics of the Mooretown Road Corridor will make it attractive for developers and residents with its easy access to I-64 and the employment centers of Richmond and Hampton Roads.

Retail — The retail analysis shows local, community and regional trade areas as generally over supplied, which is consistent with a destination location that draws from well outside of its marketplace. However, a closer look at occupancies show relatively high vacancies in neighborhood and community serving shopping centers (Table 4-3), which indicate a local oversupply as well. Nonetheless, the high visibility and access of the Mooretown Road Corridor offers a very attractive site for developers and retail tenants who might overlook market trends to be in a more advantageous location.

Office — Since 2003, James City County has seen an average of 60,000 square feet of office delivered annually, compared to about 8,000 square feet in York County. This rate of absorption would support low density, suburban campus style development such as that which already characterized much of the local marketplace, and office space as an element of mixed use development, such as that in New Town.

Industrial — Although warehousing/distribution operations prefer proximity to highway interchanges, the demand from other land uses in the Mooretown Road Corridor could likely price them out of the market. In James City County, industrial development has slowed down in the past five years to one-tenth of what it was the previous five years, so the demand can be absorbed into existing industrial parks into the foreseeable future. If the market for flex space picks up in the next decade, it could be a land use that wants to reside in the Corridor.

Visitation Attractions — The owners of the Williamsburg Pottery are currently (Fall 2014) in the process of assessing the potential for "an international, family-focused entertainment and education complex" on 720 acres of land in the Mooretown Road Corridor. About 80% of the land is in York County with the remainder in James City County. If the project moves forward to fruition, it could represent the dominant use in the Corridor.

Lodging — One of the proposed uses in the aforementioned Williamsburg Pottery concept is lodging. Even in an over supplied market, a clever product could garner enough of the market share to thrive, at other's expense of course. A strategically sited product in the corridor could have the distinct competitive advantage of easy access and maximum visibility.

APPENDIX E
Public Involvement Summaries

Planning | Transportation | Land Development | Environmental

Vanasse Hangen Brustlin, Inc.
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Memorandum

To: Jason Purse, James City County

Date: May 13, 2014

Project No.: 33843.00

From: Keith Lewis, Paul Moyer

Re: Mooretown Road Extension Public Meeting #1

The following document provides a summary of the comments received during the April 29, 2014 Public Meeting held at the Croaker Road Library in James City County.

Written Comments

1. In your opinion, what are the major considerations/issues that should be addressed by this study?

- Storm water, RPA, PSA, York County Property, width of road including breakdown lanes and turn lanes.
- Diverting traffic off Rochambeau between Croaker Road and Cloverleaf Lane or widen and repair to accommodate current heavy traffic. All of Rochambeau Drive is in good repair except this section.
- Reconnecting Rochambeau at 199. Why pay taxes to construct a new road when you have one going to that same point on Croaker Road? Waste of taxes.
- Money would be better spent upgrading existing roads and not building new ones. Will require extensive condemnation.
- Cost versus benefit: Too many bridges and environmental damage. Mooretown Road in York County is 2-lane residential which limits its use as an alternative route.

2. In your opinion, what are the potential benefits or impacts of constructing the Mooretown Road extension?

- No benefits, only impacts
- Benefits service to hospital and local businesses
- Benefits to a few (Hunt, Maloney, & JCC). Destroying quality of life for current landowners in AG-1.
- Few benefits—many adverse impacts.
- Benefit accrues mostly to these large landowners: Stevens Estate, Hunt, and Pottery—let these owners pay for a road to service their land.

3. Any additional comments?

- Repair current roads effecting approach to Croaker Road.
- We don't want this road. Our land is potentially right in the path. We'd be forced to move at retirement age. Our lives as we planned it would be ruined.
- Allow development of 3 large areas without a connection to Croaker Road.

Comments from Easel Pads

Traffic

- Look at Rochambeau Rd as an alternative alignment
- Add Grade separation of Rochambeau over / under 199?
- Will new development require traffic signals?
- Make sure Croaker Rd is not a bottleneck
- There are already 4 roads – can they be expanded to support the needs?

Environmental

- Should road use bridges or culverts?
- Are there other unique species other than federal or state listed plants and animals on site?
- Is it feasible to construct a road through an area such as this with a large amount of streams and wetlands?
- Is the project worth the potential impact?
- Seems like other improvements should be done before constructing a road.
- Pineridge has opted out of the Economic Opportunity area, are they still exempt from this project?

General Comments

- Why not keep going with extension all the way to Route 60?
- Need to take into account the planned growth at Stonehouse
- Why build a new road when existing roads are in poor shape such as Rochambeau
- There are concerns about the existing wells being impacted by new development.

Mooretown Road Extension Corridor Study Public Meeting #2 Summary
Norge Elementary School
October 20, 2014
7:00 pm-8:30 pm

On October 20, 2014, James City County and Vanasse Hangen Brustlin, Inc. held the second Mooretown Road Extension Corridor Study public meeting. The meeting was held at Norge Elementary School in Williamsburg and attended by 49 citizens. The following report provides a summary of the meeting presentation, feedback of the activities, and themes of the comments received.

1. Meeting Agenda

   7:00pm Presentation by Project Staff
   - Introduction
   - Alternatives
   - Market Analysis
   - Land Use
   - Traffic Forecasts and Capacity Analysis
   - Roadway Typical Section Considerations

   7:30pm Work Session/Open House
   8:30pm Adjourn

   During the presentation, project staff updated the public on the progress of the project, introduced the alternatives developed, and provided a review of the technical analyses. At the conclusion of the presentation, attendees were invited to provide input and participate in four activities.

2. Summary of Feedback on the Activities

   Activity 1
   The first activity asked citizens to identify their top choice of Typical Section Concepts. A board with renderings illustrating five section concepts was on display. The public was provided with a sticker to place on their preferred choice. The options and voting results are represented in the following table:

Typical Section Concept	**Total Votes Received**
Shoulder and Ditch with Bike Lanes	5
Shoulder and Ditch with Bike Lanes and Sidewalks	1
Shoulder and Ditch with Shared Use Path	1
Curb and Gutter with Bike Lanes and Sidewalks	
Curb and Gutter with Shared Use Path	10
Two Lane Country Road with Bike Path*	4
None of the Above*	12

*Reflects choice added by citizens.

Activity 2

The second activity asked citizens to identify their preferred corridor alternative. Three boards, each of which illustrated a different alternative (central, western, eastern) were on display. The public was provided with a sticker to place on their preferred choice. The options and voting results are represented in the following table.

Proposed Alternative	**Total Votes Received**
#1: Central	12
#2: Western	3
#3: Eastern	5

Activity 3

The third activity asked citizens to rank their top three priorities for the Mooretown Road Extension Project. The public was provided with a handout and asked to rank their top three preferred choices. Once all of the votes were collected, they were displayed on a board. The priorities and voting results are represented in the following table.

Priorities	**Total Votes Received by Ranking**		
	Ranked #1	Ranked #2	Ranked #3
A. Protecting natural resources	20	1	7
B. Relieving future traffic congestion on adjacent road network	5	11	3
C. Improving safety	1	6	6
D. Providing an attractive and safe pedestrian and bicycle network		5	3
E. Creating new road access to the area	3	4	5
F. Encouraging development within the area	6	3	4
Write ins: None of the above I cannot answer or rank any of these. None are any of my choices at all in any way shape or form.	 2 1		

Activity 4

The fourth activity asked citizens to identify what kind of development they preferred for the Mooretown area. The public was provided with a handout and asked to identify their top preferred choice. Once all of the votes were collected, they were displayed on a board. The types of development and voting results are represented in the following table.

Kind of Development	**Total Votes Received**
A mix of uses including commercial and residential, medium scale of buildings, such as in New Town	10
B. A mix of uses including adjacent industrial/manufacturing, and a larger scale of buildings, such as in City Center in the Oyster Pint section of Newport News	3
Primarily an office park, such as Innsbruck in Hanover County	1
Primarily a light industrial area, such as Stonehouse Commerce Park	5
Write Ins: None of these No development Retain rural residential Park area and athletic fields Tourism related	 11 2 1 1 1

3. Summary of Comments

   The public was provided with a comment form to complete at the meeting or submit by mail. There were 12 comments received. The themes of the comments included:

   - "Do not build" had a majority of the support, with 9 citizens sharing their opposition to the extension.
   - Keep development to the East portion of the EOZ.
   - A suggestion was received to create a historic triangle international trade zone and intermodal distribution center.
   - A suggestion was received to extend 4 lanes on Rochambeau across from Croaker Road until it meets up the 4-lane road at Faith Baptists Church.

Mooretown Road Extension Corridor Study Public Meeting Summary
Toano Middle School
March 12, 2015
7:00 pm-8:30 pm

On March 12, 2015, James City County and Vanasse Hangen Brustlin, Inc. held the third Mooretown Road Extension Corridor Study public meeting. The meeting was held at Toano Middle School in Toano and attended by 27 citizens. The following report provides a summary of the meeting presentation, feedback of the activities, and themes of the comments received.

1. Meeting Agenda

   7:00pm Presentation by Project Staff
   7:30pm Work Session/Open House
   8:30pm Adjourn

   During the presentation, project staff updated the public on the history and progress of the project, reviewed the alternatives developed, provided a review of the technical analyses, and introduced the recommended alternative. At the conclusion of the presentation, attendees were invited to provide input by speaking with project staff or completing comment forms.

2. Activity:

   Maps of the corridor that identified the recommended alternative were posted in the space and the public was invited to write comments. The comments received included:

   - How much acreage is ROW for 2 and 4 lanes?
   - Drinkwater Equestrian Center would be effectively destroyed by the proposed route.
   - Industrial – use railroad access.
   - Road should be double loaded.
   - Eliminates at grade railroad crossings.
   - Preferred alignment eliminates new business.
   - General group prefers central alignment.
   - If proposed, (can) road run parallel to railroad longer until after crossing Peach Street.

3. Summary of Comments

   The public was provided with a comment form to complete at the meeting or submit by mail. Summary of the comments received included:

   - Liked the alignment recommended and that it allows the at grade railroad crossings to be eliminated, improving safety and improves the rail corridor. Liked typical section with shoulders with ditch and bike lane.

- Can you provide a segmental approach to construction? Two lanes first and improve Croaker & Mooretown intersection.
- Using less environmental impact as a reason for the “recommended alternative” is disingenuous as the stated purpose of the road is to encourage development in this area, which will ultimately obliterate the existing environmental assets. Instead of facilitating green businesses, such as the campground and a horse farm, this alternative will force them out of business and turn their acreage into more mixed-use development or worse. The center route may be more expensive, but bridging over the wetland areas will actually preserve them better than turning them into drainage ditches for more shopping centers and business parks. Locating the extension adjacent to the railroad and existing Route 60 creates a chokepoint in emergencies with 3 routes of transport co-located and vulnerable. This alternative impacts more lives and livelihood in favor of an illusion of protecting the environment. The center route makes more sense.
- If alternative #2 as displayed tonight will be the selected route, I recommend pulling the new Mooretown Road off of the railroad tracks 700’ to 1000’ to allow for development of industrial land between the road and the railroad tracks with potential railway access.
- Route 2 Alternative is preferred to other more environmental impact routes
- Government funds should not be used to construct the road. Rather the developer(s) should be required to pay for the work.
- This will have a devastating effect on several residents in the Peach St. neighborhood. Do not recommend.

PLANNING DIRECTOR'S REPORT
November 2015

This report summarizes the status of selected Planning Division activities during the past month.

- **New Town.** The Design Review Board did not meet in October. They electronically reviewed subdivision plans for the end of Discovery Park Blvd., final plans for outdoor seating at Blaze Pizza, and interpretive signage for the Roper-Homestead Park. The DRB's next meeting is November 12.

- **Historical Commission.** Over the summer, the Historical Commission, in conjunction with the James River Institute for Archaeology (JRIA), completed a phase II intensive architectural survey for the Jerusalem Baptist Church located on Brick Bat Road. The final report was recently reviewed by the Virginia Department of Historic Resources, which concurred with JRIA's findings that the building is eligible for listing on the National Register of Historic Places. The Commission also purchased and mounted two signs for the Ambler House, which is located on the Jamestown Beach Campground property, to celebrate its listing to the Virginia Landmarks Register and National Register of Historic Places.

- **Training.** In early October, Planning Division staff had the opportunity to attend Manufacturing Day tours of several existing County industries including Owens-Illinois, Core Six Glass, the Brewery and Ball Metal. The tours were valuable to get a better understanding of current trends in industrial development and potential external impacts of similar facilities. Staff also attended the Rural Planning Caucus and participated in sessions about agricultural economic development, adaptive reuse of buildings, changes in permitting telecommunications facilities, historic register nominations, cross-border communications and data sharing and legislative updates.

- **Capital Improvements Program (CIP).** Applications to request FY17-21 CIP funding were sent to County departments and WJCC Schools in late September and are due on November 13th. After staff processes the applications, the Policy Committee will be evaluating the requests beginning in January 2016.

- **Monthly Case Report.** For a list of all cases received in the last month, please see the attached documents.

- **Board Action Results:**
  - September 22, 2015
    - Historic Preservation Awards
  - October 13, 2015
    - ZO-0001-2015, Article VI. Division 3 – Floodplain Area Regulations - **Approved 5-0**
    - ZO-0005-2015, Article VIII-Appeals – **Approved, 5-0**

New Cases for November

Case Type	Case Number	Case Title	Address	Description	Planner	District
Conceptual Plan	C-0066-2015	Hasbrouck Farms	9003 DIASCUND ROAD	Possible horse and pony farm with boarding and riding lessons	Ellen Cook	02-Powhatan
	C-0067-2015	Lightfoot Marketplace-CHKD Parcel	6401 RICHMOND ROAD	Master plan consistency review for building and park placement	Ellen Cook	01-Stonehouse
	C-0068-2015	5800 Centerville Road Subdivision	5800 CENTERVILLE RD	Concept for parcel line adjustments and subdivision of lots	Ellen Cook	02-Powhatan
	C-0069-2015	6300 Old Mooretown Rd. (York County Courtesy Review)	6300 OLD MOORETOWN RD.	Courtesy review of an application submitted to York County requesting a Special Use Permit to authorize the establishment of a senior housing-independent living facility on a 10.2 acre parcel of land in their Economic Opportunity zoning district	Leanne Pollock	York County
	C-0070-2015	110 Depot Street	110 DEPOT STREET	Request to add additional residential dwelling units on property zoned industrial	Leanne Pollock	01-Stonehouse
	C-0071-2015	8636 Pocahontas Trail Subdivision/BLA	8636 POCAHONTAS TR	Boundry line adjustment for 8636 Pocahontas Trail	Roberta Sulouff	05-Roberts
	C-0072-2015	2015 DEQ, Programmatic Environmental Assessment	800 Blow Flats Road	Joint Base Langley-Eustis environmental analysis of operations	Ellen Cook	None
	C-0073-2015	Cottages at Stonehaven Subdivision of Parcel 3 and Lot 47	215 and 205 Neck-O-Land Road	Proposed subdivsion of lot 47 into three parcels and lot 3 into two	Jose Ribeiro	03-Berkeley
Master Plan	MP-0001-2015	Greensprings Plantation Master Sign Plan Amendment	3790 PHILIP LUDWELL	Amendment of the BOS adopted Master Sign Plan to allow two additional signs on brick columns to identify the Governor's Ridge section of Greensprings Plantation	Chris Johnson	03-Berkeley
Subdivision	S-0037-2015	Windsor Ridge Sec. 2A Driveway Amend.	8068 FAIRMONT DRIVE	Amendment to approved construction plans to remove a shared driveway and BMP access and allow for individual driveways to serve residential lots	Leanne Pollock	01-Stonehouse
	S-0038-2015	Jacobs Industrial Center Parcels 8A and 8B	263 INDUSTRIAL BLVD	Subdivision of Parcel 8 in Jacob's Industrial Park to create one additional lot	Savannah Pietrowski	01-Stonehouse
	S-0039-2015	Colonial Heritage Ph.6 Sec. 1 Amend	499 JOLLY POND ROAD	Amendment to approved construction plans reducing the number of lots from 116 to 111 lots	Jose Ribeiro	01-Stonehouse
	S-0040-2015	Promenade at John Tyler BLE	5304 JOHN TYLER HGWY	Subdivisionextinguishing internal property lines in The Promenade at John Tyler and designating drainage easements, JCSA utility easements, and sight distance easements	Savannah Pietrowski	03-Berkeley
	S-0041-2015	Wellington, Sec. 2 Lot 171	8455 BECKENHAM COURT	Amendment to allow a lot previously identified for "future development" to be platted as a residential lot	Leanne Pollock	01-Stonehouse
	S-0042-2015	New Town Sec. 3&6 Block 21 Parcel C1	5501 DISCOVERY PARK BLVD	Subdivision to create a park/common area parcel out of the larger assisted living facility parcel so the park can be transferred to the commercial owner's association	Leanne Pollock	04-Jamestown
Site Plan	SP-0089-2015	Jacobs Industrial Park, Parcels 8A and 8B	263 INDUSTRIAL BLVD	Construction of four buildings (totalling approx. 7600 SF of office space and 18600 SF of warehouse space) and associated gravel access road, parking lots, and storage yards	Savannah Pietrowski	01-Stonehouse
	SP-0090-2015	152 Tewning Road Office/Warehouse	152 TEWNING ROAD	Project is for the proposed construction of 15,000 square feet of warehouse space and associated parking	Roberta Sulouff	04-Jamestown
	SP-0091-2015	HRSD Industrial Blvd. Co-location Tower	185 INDUSTRIAL BLVD	Installation of 2 microwave dishes and supporting equipment (including new equipment cabinet), and expansion of existing compound for the addition of a generator and propane tank	Savannah Pietrowski	01-Stonehouse
	SP-0092-2015	1950 Two River Rd. Pole Barn SP Amend.	1950 TWO RIVERS ROAD	Custruct pole barn using like materials as existing pole barn	Roberta Sulouff	03-Berkeley
	SP-0093-2015	Lightfoot Marketplace - Building 5	6401 RICHMOND ROAD	Proposed 22,100 square foot medical office building	Ellen Cook	01-Stonehouse
	SP-0094-2015	Williamsburg Crossing - Colonial Eye Care Addition	5273 JOHN TYLER HGWY	Convert prior Old Point National Bank outparcel to an optometrist on the first floor and general office on the second floor and to enclose the drive-thru teller area	Leanne Pollock	03-Berkeley
	SP-0095-2015	4037 Ironbound Road Parking Improvements	4037 IRONBOUND ROAD	Improvements to an existing parking lot area to accomdate a new use of the property (medical clinic)	Jose Ribeiro	04-Jamestown
	SP-0096-2015	314 Stonehouse Rd. Horse Barn	314 STONEHOUSE ROAD	Proposed 3 sheds 16 x 16 each. Purpose is to shelter horses	Jose Ribeiro	01-Stonehouse
	SP-0097-2015	Chambrel at Williamsburg- Assisted Living Facility	3800 TREYBURN DRIVE	Additional assisted living facility at Chambrell (65,000 square feet)	Ellen Cook	04-Jamestown
	SP-0098-2015	101 Lakeview Dr. Barn	101 LAKEVIEW DRIVE	Construction of a 4056 SF horse barn	Savannah Pietrowski	01-Stonehouse
Special Use Permit	SUP-0005-2015	Clara Byrd Baker Elementary Additional Parking	3131 IRONBOUND ROAD	ordianances and to allow for the construction of new parking spaces and	Jose Ribeiro	03-Berkeley