Prince William County

Base Realignment and Closure Transportation Impact Analysis

Final Report

BRAC

Prepared For:

Prince William County Planning Office
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Prince William, Virginia 22192

Prepared By:

URS Corporation

December 2009

FINAL REPORT

BASE REALIGNMENT AND CLOSURE (BRAC) TRANSPORTATION IMPACT STUDY

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I. INTRODUCTION

I.1. Background

In 2005, the Base Realignment and Closure (BRAC) Commission recommended a number realignment and closure actions for military installations located in the District of Columbia, Maryland and Virginia, with the majority of the relocations internal to the National Capital Region (NCR). BRAC recommendations for Northern Virginia call for the movement of nearly 19,300 jobs to Fort Belvoir and approximately 3,000 jobs to Marine Corps Base Quantico (MCBQ). Fort Belvoir is located approximately 5 miles north of the Potomac Communities in Fairfax County and the City of Alexandria. Marine Corps Base Quantico is located in Prince William, Fauquier and Stafford counties. All relocations are to be complete by September, 2011.

The Final Environmental Impact Statements (FEIS) prepared by each of the military installations were released in June 2007 for Fort Belvoir and in April 2008 for MCBQ. From a regional perspective, both reports conclude that the overall net effects of BRAC would have minor beneficial and negative impacts due to a "robust" regional economy and to an existing employee base already residing in the NCR. The reports note that existing transportation networks are constrained as a result of rapid development and the degradation of the level of service on roadways would occur with or without BRAC.

Realignments associated with Fort Belvoir are expected to add an additional 4,300 new residents to Prince William County beginning by 2030. An analysis of current employee distribution by zip code indicates that 22 percent of the employees associated with Fort Belvoir already live in Prince William County and nine percent are from Stafford County. Population growth associated with MCBQ is expected to add approximately 7,000 new residents to the region of influence (ROI) but this figure is not broken down in the FEIS at the County level. The ROI for MCBQ includes the counties of Prince William, Stafford, Fauquier, Caroline, King George, and Spotsylvania. Residential distribution for existing employees at MCBQ, broken down by zip code for the ROI, identifies 33 percent of employees as living north of the facility and 67 percent living to the south.

The EIS for each of the military installations identity and provide recommendations to mitigate on-post impacts; however, neither report specifically addresses the off-post effects of BRAC to Prince William County. At the local level, the realignment of jobs and commute patterns is expected to have a significant short and long-term effect on population, housing and transportation.

This report presents an assessment of the impacts BRAC 2005 will have on Prince William County and specifically on the Potomac Communities. In anticipation of the need to identify and address issues related to BRAC growth, Prince William County applied to the Metropolitan Washington Council of Governments (MWCOG) for a technical assistance grant to prepare a scope of work to study BRAC related impacts. In 2008, the County received a grant from the Department of Defense/Office of Economic Adjustment to conduct this BRAC Impact Study.

I.2. Purpose of this Study

A major goal of this BRAC Impact Analysis is to provide recommendation that will assist the County in identifying strategies to develop new land use and transportation policies to protect and enhance the health and livability of the Potomac Communities. This report presents a snapshot for the year 2005 of important socioeconomic and transportation variables and uses a travel demand model to project impacts for 2015 and 2030 based on alternative scenarios identified to guide future growth and development.

I.3. Study Area

The Study Area, known as the Potomac Communities, is an approximately 37-square mile corridor of land located between I-95 and the Potomac River from Stafford County to Fairfax County. Please see **Figure 1** located in the Appendix (all figures referred to hereafter can be found in the Appendix to this report). Included in this area are the towns of Dumfries and Quantico, the communities of Woodbridge and the Triangle, and neighborhoods such as Belmont, Marumsco, Featherstone, Rippon Landing, Newport, and Graham Park. The area is served by two north-south transportation facilities, US 1 (Route 1) and I-95.

Route 1, known as the Jefferson Davis Highway, dates to colonial times and for nearly a century it served as the major north-south corridor linking Maine to Florida. Over the decades, Route 1 has evolved into a continuous ribbon of low density development characterized by highway service commercial uses created to meet the needs of the surrounding residential areas. In the 1960's, I-95 was constructed to serve as the new the major north, south highway connecting the eastern seaboard. Bypassed by the new interstate highway, Route 1 began to decline as a shopping and business destination.

More recently, regional growth pressures, increased traffic congestion and construction along I-95 have forced motorists in large numbers back on to Route 1 changing its character, for at least part of the day, to a commuter corridor. To alleviate congestion along Route 1 caused by increased traffic volumes, the Virginia Department of Transportation (VDOT) plans to widen the road to six-lanes with a boulevard. One of the challenges of the widening is to effectively mitigate future congestion through the identification of nodes for smart growth development to strengthen east-west transportation linkages.

I.4. Overview of the Study Methodology

The study team began by conducting research of using the following documents:

- Existing Community and County Plans
- Current zoning and Capital Improvement Plan (CIP) documents
- Transit plans
- BRAC FEIS documentation for both Fort Belvoir and MCBQ

Using the data resources and input from Prince William County staff, the study team developed quantitative and qualitative descriptions of existing conditions in the Study Area, including population and employment data, existing roadway facilities, and park-and-ride lots. Ridership

data and operational capacities were obtained from Virginia Railway Express (VRE) to estimate the available capacity on each segment of the Fredericksburg service line through the county. Similarly, available ridership data and operational capacities for *OmniRide* and *OmniLink* service routes were obtained from Potomac and Rappahannock Transportation Commission (PRTC) to estimate the available capacity on each segment in the Study Area.

To understand the future baseline conditions, the effect of BRAC growth in the Study Area, and the benefits and costs of various improvements, the study team conducted an evaluation of existing (2005) conditions and three future year scenarios:

- Scenario 1: Baseline – Future Conditions without BRAC Impacts (2015 and 2030)
- Scenario 2: Future Conditions with BRAC Impacts and No Transportation or Zoning Changes (2015 and 2030)
- Scenario 3: Future Conditions with BRAC Impacts and Recommended Transportation and Land Use Improvements (2015 and 2030).

Using the results of the analyses of Scenarios 3a, 3b, and 3c, the study team developed a Preferred Alternative comprised of the most viable and feasible elements of each scenario. Details of each analyses are described in the following sections.

II. EXISTING CONDITIONS

The study team researched several documents and resources to define the existing conditions in the Study Area. These documents included various community and county plans, current land use and zoning documents, roadway and transit plans as well as the Environmental Documents prepared by Fort Belvoir and MCBQ. The results of this research are presented below and serve as a basis for comparison with forecasted with BRAC and without BRAC scenarios discussed later in this report.

II.1. Land Use and Zoning

The analysis of land use and growth trends in the Study Area included a review the ***2008 Prince William County Comprehensive Plan***, the ***Potomac Communities Revitalization Plan***, the ***County Zoning Ordinance*** and relevant documents provided by the County or obtained from other sources including County land use and transportation planners.

Overall, the ***Comprehensive Plan*** and ***County Zoning Ordinance*** are supportive of well planned and managed growth. The *Comprehensive Plan* provides a set of goals, policies and actions to promote efficient and fiscally responsible development through linking various implementation plans, policy documents and operating plans. In addition to providing general land use guidance, the *Comprehensive Plan* contains a series of sector plans to address growth in specific areas of the County and two general land use categories; the Development Area and the Rural Area. All but two locations within the boundaries of the Potomac Community have the Development Area designation.

The focus of the ***Potomac Communities Revitalization Plan*** *(Potomac Communities Plan)* is the redevelopment of commercial and residential uses along Route 1 to create a community that provides a sustainable balance of jobs, housing and community amenities The Plan contains specific strategies designed to reduce potential impacts from the proposed widening of Route 1. These strategies address community design, physical infrastructure, and environmental and cultural resource areas. One of the elements included in the Transportation section of the 2003 Sector Plan, proposes the development of a future VRE station as part of an overall mixed use plan that provided for low to medium density, rural and suburban residential; a commercial and regional employment center; and recreational and cultural resource elements. Since adoption of the original plan, a portion of the property has been developed as the Southbridge subdivision. In 2006, the Sector Plan was amended to provide a modified configuration for developing 979 acres for higher residential densities and a more urban form of mixed use supporting a town centered plan with a conference facility.

To promote revitalization within the Potomac Communities, the Plan identifies four flexible incentives that provide opportunities to increase density for redevelopment of Residential, Neighborhood Commercial, Office and Urban Mixed Use properties. The 2008 Comprehensive Plan Long Range Land Use Map (**Figure 2**) shows the distribution of these land use designations within the Potomac Communities.

The *Potomac Communities Plan* identifies three study areas for the initial phase of implementing the land use, community design, housing, and transportation recommendations contained within the Plan. All three study areas; North Woodbridge, Neabsco Mills and the Triangle provide for a combination of Urban Mixed Use and medium to high density residential land use designations. Individually, the plans for these study areas identify opportunities to build upon existing strengths to achieve distinct identities.

- The North Woodbridge Study Area plan proposes to capitalize on its access to Route 1 and the Woodbridge VRE station by implementing a mix of higher density residential and offices uses. The plan identifies the opportunity to create a waterfront community, employ a grid street pattern with pedestrian oriented architecture, and promote recreational and heritage trails.

- The Neabsco Mills Study Area plan identifies opportunities to revitalize existing commercial nodes and develop linkages with civic facilities and residential communities. The plan proposes the use of Urban Mixed Use development guidelines to enhance the existing street pattern and a façade improvement program to regenerate the areas appearance.

- The Triangle Study Area plan addresses the opportunity to build upon its location just north of MCB-Q. The plan proposes the development of new neighborhoods with medium to low density urban residential and Village Mixed Uses with offices at nodes along Route 1 to support defense industry contractors.

The County's Zoning Ordinance contains 24 zoning districts that regulate the form and function of land use categories identified in the *Comprehensive Plan*. In an effort to protect and enhance specific lands and structures, the County has created five Overlay Zones. Two of the Overlay Zones located in the Study Area have relevance to this BRAC analysis – the Redevelopment Overlay and the Highway Corridor Overlay. As its name implies, the Redevelopment Overlay provides guidance to promote the renewal of areas experiencing economic decline. The Potomac Communities contains two redevelopment areas; the Triangle and Woodbridge. The Highway Corridor Overlay is intended to mitigate the adverse visual and functional impacts that can occur along major arterials. Within the Study Area, three roadways have an Urban Arterial overlay designation; State Route 234, Dale Boulevard, and Gordon Boulevard. Route 1 from Route 234 to Dale Boulevard, also has an overlay designation. The Prince William County Zoning Classification Map (**Figure 3**) shows the location of Zoning districts and Overlay Zones.

One of the measures the County has taken to ensure compatibility between land use designations and zoning districts is the inclusion of two compatibility matrices as part of the latest Land Use Update.

II.2. Population and Employment

According to Census 2000, the population of Prince William County grew during the 1990's by over 65,000 people making it the third largest County by population in the State of Virginia. The 2005 population statistic used in this study put the combined (including Manassas and Manassas Park) County population at 399,871 reflecting a 22 percent increase from 2000. The population

density for the County is approximately 1,100 persons per square mile with a total number of dwelling units of 138,979.

A summary of demographic information contained in the ***Potomac Communities Revitalization Plan*** put the 2000 population of the Study Area at 22 percent of the County's population or approximately 62,000 people. While the Potomac Communities experienced an increase in population between 2000 and 2005 the population as a percentage of the County total dropped to 18 percent indicating a slower rate of population growth than for the County as a whole. Overall, the Study Area has a population density per square mile of slightly more than one unit per acre which is nearly two and one half times greater than the Countywide residential density...

According to the Prince William County Demographic Fact Sheet, Fourth Quarter 2005, the County has experienced a substantial increase in jobs, nearly doubling the At-Place Employment from 1990. Currently, employment within the Study Area represents 26 percent of the County total. Based on a review of employment-related data reported by the Bureau of Economic Analysis (BEA), government and government enterprises comprise the single largest employer in the County. This sector employed nearly 18 percent of the total workforce from 2005 to 2007. Employment in the Military sector, which is of importance to this study, is reported between 3.5 percent and 3.7 percent during the same time period. **Table 1** provides a summary of socioeconomic data used in support of this study.

Table 1
Selected Socioeconomic Summary for 2005

Socioeconomic Characteristic	Prince William County*	Study Area – Potomac Communities	Percent of County
Total Population	399,871	73,976	18
Total Land Area Sq. Miles	360	37	10
Population Density Per Sq. Mile	1,111	1,999	180
Dwelling Unit			
Single-Family	77,704	11,579	15
Townhouse	35,074	7,145	20
Multi-Family	26,201	8,101	31
Total Dwelling Units	138,979	26,825	19
Total Acres	230,594	23,913	10
Dwelling Units Per Acre	0.49	1.12	-
Employment			
Industrial	34,927	6,779	19
Retail	39,770	10,080	25
Office	41,232	10,247	25
Other	21,951	8,623	39
Total Employment	136,880	35,729	26

*Combined data for Prince William County, including Manassas and Manassas Park

II.3. Highway Network

II.3.1. TransAction 2030

TransAction 2030 is the long range transportation plan for northern Virginia which was approved in 2006 by the Northern Virginia Transportation Authority (NVTA). Of the eight multi-modal corridors identified in the plan, one of the corridors, the Prince William Parkway has its eastern terminus at Route 1. The Plan prioritized improvements in the Study Area and includes the US 1 Interchange at Dale and Rippon Boulevards and an expansion of the Fredericksburg Line VRE parking spaces at stations within the Study Area.

One improvement not associated with a multi-modal corridor but potentially included in the BRAC Study Area is the Eastern Potomac Crossing connecting Maryland Route 301 with an unidentified area of either Prince William or Stafford County (5^{th} Priority – $1.215 billion).

None of the projects in ***TransAction 2030*** have been programmed in either the current Prince William County Capital Improvement Program or the VDOT Six-Year Transportation Improvement Program.

II.3.2. Prince William County CIP (FY 2010 – 2015)

The ***Prince William County Capital Improvement Program: FY 2010 – 2015*** includes several projects in and near the BRAC Study Area. These include:

- **Minnieville Road (Old Bridge Road to Canton Hill Road)**
  With a cost of $33.4 million, this project was financed through the 2002 Road Improvement Bond Referendum and provides for the widening to four lanes. Construction was substantially completed in FY 2009.

- **Route 1 Improvements (Dale Boulevard to Featherstone Road)**
  With a cost of $6.0 million, this project was financed through a combination of the 2002 and 2006 Road Improvement Bond Referenda and provides for the widening to six lanes.

- **Route 1 Improvements (Joplin Road to Bradys Hill Road)**
  With a cost of $66.2 million, this project was financed through a combination of the 2002 and 2006 Road Improvement Bond Referenda and provides for the widening to six lanes. Construction was scheduled to start in FY 2009.

II.3.3. VDOT Six-Year Transportation Improvement Program

The current ***Fiscal Year 2010 VDOT Six Year Transportation Improvement Program (FY 2010 SYIP)*** includes improvements programmed with federal, state and local funds through the period FY 2010 – FY 2015. Reviewed on the VDOT website, the program includes numerous program emphasis areas that will provide funds for improvements, the location and type of which are not specifically identified. For example, funds have been programmed for Highway Safety Improvement Program (HSIP) projects on a Northern Virginia District-wide basis. Another example is district-wide traffic signal coordination. These may include improvements in the

Study Area, but the improvements are not specified. Moreover, improvements programmed under these types of allocations tend to be of a relatively low cost.

The ***FY 2010 SYIP*** includes the improvements located in the Study Area as listed in **Table 2**. This list shows the degree to which VDOT's transportation funding for improvements has been curtailed. With the exception of the Neabsco Creek Bridge Widening and Replacement, all of the projects that are funded through construction are relatively small. The projects that will be included in development of the BRAC Impact Study are shown in italics.

Table 2
Programmed Improvements in BRAC Study Area
FY 2010-FY 2015

Project	Funding Source	Cost (x $1,000)	Additional Funds Required (x $1,000)	Start of Construction
Route 234: Partial Intersection Reconstruction at Route 1	*HSIP*	*597*	*205*	*FY 2013*
Prince William Pkwy: Install Sidewalk & Ped Crossing to Horner Corner Lot	HSIP	450	0	FY 2011
Replace and Widen Bridge & Approach at Neabsco Creek	Bridge Replacement	37,480	0	Underway
Route 1: Fuller Heights Road Relocation	Primary	1,785	0	FY 2011
Route 1 @ 123: Construct Interchange	Primary	55,532 (PE & ROW Only)	N/A	N/A
Route 234 Park & Ride Lot Expansion	*Primary*	*8,515*	*0*	*Underway*
Woodbridge VRE Parking Lot Expansion	*Public Trans*	*821*	*164*	*N/A*
Route 1 Widening (Town of Dumfries)	Urban	500	125	N/A

II.3.4. VDOT Park and Ride Lots

VDOT maintains park and ride lots in the vicinity of the Study Area. Shown in **Figure 4**, the lots are located to provide quick access to I-95 and its HOV lanes. The demand for park and ride spaces for the years 2007 and 2008 are shown in **Table 3.** The table shows that surpluses exist at seven of the ten lots. However, with the exception of Lot #1 at I-95 and Route 123, the surpluses are marginal. The largest deficit in supply exists at Lot #9, located at Route 1 and Route 234, where overflow commuters have been parking illegally. However, a project to expand the lot

capacity to 852 spaces is underway with completion expected in November 2009. The addition of 501 spaces will provide more than adequate capacity for the existing overflow parking demand.

Table 3
VDOT Park and Ride Lots
2007-2008 Space Demand and Supply

Lot #	Park & Ride Lot Name	Capacity	2007 Usage	2008 Usage	2008 Surplus (Deficit)	Location
1	I-95/123 Loop Interchange	580	123	157	423	Intersection I-95 and Rte 123, Exit 160
2	Hechinger's - Old Bridge	580	539	576	4	Intersection Rte 123 and Old Bridge Road
3	Church of the Brethren	31	0	0	31	Intersection Horner Rd and Millwood Dr. Woodbridge
4	Prince William Parkway Lot	2363	2300	2366	(3)	Prince William Parkway at I-95
5	Potomac Mills Mall	936	1123	980	(44)	Potomac Mills Mall across from Pier I Imports
6	PRTC Transit Center	200	157	107	93	Potomac Mills Road at Telegraph Road
7	Prince William Square	45	0	0	45	Smoketown Road and Gideon Drive
8	K-Mart, Dale City	90	146	76	14	Intersection Dale Blvd & Gideon Dr.
9	US1/VA 234	351	413	459	(108)	VA 234 & US 1
10	Triangle	31	22	28	3	VA 619 and US 1

II.4. Transit Service

The BRAC Study Area is served by two principal transit providers: the Potomac & Rappahannock Transportation Commission (PRTC) and the Virginia Railway Express (VRE).

II.4.1. PRTC Service & Ridership

The BRAC Study area is served by both peak period commuter and daily fixed-route bus service operated by PRTC. The overall service area for PRTC includes a population of 326,238 within an area of 361 square miles. The current rolling stock provides for a maximum of 69 vehicles in service during peak periods.

In 2005, the fixed-route service, OmniLink, included two routes:

1. Quantico – PRTC Transit Center (west of I-95 at Dale Boulevard): The route generally follows Route 1 on its north-south movements. Average daily ridership for the second half of 2005 was 558.

2. Woodbridge/Lake Ridge/PRTC Transit Center: The circular route includes both clockwise and counterclockwise service. On the east side of I-95, service is provided on Occoquan Road, Route 1, and Optiz Boulevard. In 2005 the average daily ridership was 869.

Since 2005, PRT service in the BRAC Study Area has been modified and expanded. The route to the PRTC Transit Center now starts at Fuller Heights Road. A route between Quantico and the Woodbridge VRE station has been added to the service. The Woodbridge/Lake Ridge/PRTC Transit Center circular route remains unchanged. As an indicator of demand, PRTC provided route ridership data for peak periods. Summarized in **Table 4**, the results show that peak hour ridership is not consistent with peak commuter patterns in the PM peak hour. Heavier ridership occurs in the mid-afternoon hours. In contrast, morning peak demand is consistent with commuter patterns.

According to PRTC, seating capacity on vehicles used for *OmniLink* service in the BRAC Study area is sufficient for demand. Increases in ridership could easily be accommodated by the existing service.

Table 4
Peak Hour Ridership: *OmniLink* Service in BRAC Study Area

No.	Route	AM				PM			
		Start	Start Point	End Point	Ridership	Start	Start Point	End Point	Ridership
L2	Dumfries	5:31 AM	Fuller Heights	Transit Center	191	2:00 PM	Transit Center	Quantico Terrace Apts.	169
L5 A	Woodbridge / Lake Ridge	5:40 AM	Tacketts Mall	Transit Center	174	2:00 PM	Transit Center	Transit Center	142
L5 B	Woodbridge / Lake Ridge	5:40 AM	Tacketts Mall	Transit Center	154	1:15 PM	Transit Center	Transit Center	145
L6	Route 1	6:36 AM	Quantico	Woodbridge VRE	93	2:45 PM	Woodbridge VRE	Quantico	115

PRTC also provides commuter service, *OmniRide*, in the BRAC Study Area. In 2005, three routes were provided:

1. Triangle-Washington (I-95/Route 123 Commuter Lot): The service is provided once per day in each direction at 5:49 AM and 5:08 PM. Average ridership was 22 in the AM peak period and 14 in the PM peak period.
2. Dumfries-Washington (Fox Lair Drive & Route 234/Route 1 Commuter Lot): The service is provided four times per day in the AM period with 40 minute headways beginning at 5:19 AM An additional route was added in April 2005 at 6:10 AM Five afternoon routes with 40 minute headways are provided beginning at 3:14 PM. A mid-day route at 1:04 PM was added in March 2005, but ridership is very low at 2-3 passengers. Average ridership was 133 in the AM peak period and 143 in the PM peak period. Peak ridership per trip was 38 in the AM peak and 33 in the PM peak.

3. PRTC Transit Center-Franconia/Springfield Metro Station (Serves Route 1 between Route 123 and Opitz Boulevard southbound in the AM, northbound in the PM): The number of routes and headways varied over the year. Service is provided all day, and generally, routes were run approximately 52 times per day. Average ridership was 333 in the AM peak period and 453 in the PM peak period. Peak ridership per trip was 26 in the AM peak and 24 in the PM peak.

Since 2005, additional *OmniRide* route service has been provided between Cardinal Drive and Washington, serving the Route 1 corridor between Dale Boulevard and Prince William Parkway. Most of the boardings occurred at the Horner Road commuter lot. Three daily routes with 56 minute headways at 5:02 AM and 3:50 PM are provided. Average ridership during January-March 2008 was 141 total passengers. The AM peak route (5:02 AM) carried an average of 47 passengers while the PM peak route (4:55 PM) carried an average of 21 passengers. The service was discontinued on May 11, 2009.

2008 average ridership for the three *OmniRide* routes serving the Route 1 corridor are summarized in **Table 5**. The results show that ridership has increased by 13 percent on the Dumfries – Washington service and by 27 percent on the PRTC – Metro Station connector service. Ridership has shown a 9 percent decrease on the Triangle – Washington service.

Table 5
Average *OmniRide* Ridership: 2005 & 2008

Service	Triangle – Washington	Dumfries – Washington	PRTC Transit Ctr – Franconia/Springfield Metro Station
2005 Daily Ridership	36	276	786
2005 Peak Trip Ridership (AM/PM)	22/14	38/33	26/24
2008 Daily Ridership*	33	311	1,001
2008 Peak Trip Ridership (AM/PM)*	20/13	45/46	40/36

*Average of data collected January-March 2008.

The PRTC Strategic Plan focuses on overall system service and performance. It identifies areas where service additions or extensions should be considered to meet identified needs and identifies estimated costs for such improvements.

The following improvements are identified in the BRAC Study Area:

1. New *OmniRide* service to Fort Belvoir from Dumfries along Route 1, to be implemented once planned improvements to Route 1 in Fairfax County have been completed (page 31)
2. New and Expanded Route 1 *OmniLink* service (page 36)
3. New *OmniLink* Route 1 Fort Belvoir Extension (page 38)

The plan does not include a schedule for implementing the *OmniRide* service to Fort Belvoir, indicating it would be "Beyond FY 2012" (page 9). The expanded Route 1 *OmniLink* service was scheduled to be implemented in 2006. The *OmniLink* extension service was forecast to carry only 48 passengers per day and was dropped from the plan (page 9).

The ***PRTC Bus Plan*** is intended to "…properly plan for major facility needs having 25-30 year lives…" (page 1-1). The document develops and evaluates alternative service policies to meet identified needs. The recommended service policy (Service Policy 4) provides for the following service improvements in the BRAC Study Area:

1. New *OmniRide* service between Woodbridge and the Engineer Proving Grounds; and,
2. Expansion of *OmniRide* Route 1 service with more frequent headways and expanded hours

To provide this service, the *PRTC Bus Plan* develops a schedule, identifying the year and number of buses needed to provide the service. *OmniRide* service between Woodbridge and the Engineer Proving Grounds requires three buses to start service in 2015. Expansion of *OmniRide* Route 1 service with more frequent headways and expanded hours requires two buses beginning in 2010 (page 3-67). After initiation, if the service demand meets certain defined thresholds, additional vehicles supporting service expansions will be provided.

II.4.2. Virginia Railway Express (VRE)

Virginia Railway Express (VRE) provides fixed-route heavy rail commuter service to Washington on two routes in Prince William County: one originating in Manassas and the other originating in Fredericksburg. The Fredericksburg service runs along the CSX-owned rail line through the BRAC Study Area with stations at Quantico, Rippon Landing, and Woodbridge.

Service schedules for the stations in the Study Area are shown in **Table 6**, and the 2005 annual ridership and demand capacity is shown in **Table 7**. It should be noted in both **Tables 6 and 7** that the AMTRAK service does not stop at each station served by VRE. The AMTRAK Train #84 stops at Quantico and Woodbridge, with no stop at Rippon Landing. Trains #86 and #94 stop only at Quantico and are not scheduled during the commuter peak period.

The results in **Table 7** show that in the earlier months of 2005, several VRE trains were servicing ridership at levels beyond capacity. Later in the year, while the ridership remained at the same levels, the capacity utilization improved as more seats were added to the trains in service.

On November 28, 2008, VRE conducted a ridership survey to determine station use. The survey consisted of providing riders with a brief questionnaire. On the Fredericksburg line, 3,804 riders were counted from which 2,361 (62 percent) valid responses were obtained. The results indicated ridership by station in Prince William County as follows:

Station	Ridership	Percent of Total
Quantico	269	7.1
Rippon Landing	457	12.0
Woodbridge	481	12.6

Table 6
VRE and AMTRAK Schedule: BRAC Study Area

Days of Operation	M-F	M-F	M-F	M-F	M-F	M-F	M-F	M-F	M-F
	Northbound Trains (AM)								
Station	**300**	**302**	**304**	**306**	**AMT 84**	**308**	**310**	**AMT 86**	**AMT 94**
Quantico	5:40	6:10	6:35	7:00	7:19	7:40	8:15	9:17	12:19
Rippon	5 49	6 19	6 44	7 09	--	7 49	8 24	--	--
Woodbridge	5:56	6:26	6:51	7:16	7:30	7:56	8 30	--	--
	Southbound Trains (PM)								
Station	**301**	**AMT 95**	**303**	**305**	**307**	**309**	**AMT 93/83**	**311**	**313**
Woodbridge	1:40	3:03	4:23	4:52	5:34	6:03	--	6:47	7:25
Rippon	1:45	-	4:28	4:57	5:40	6:09	--	6:52	7:30
Quantico	1:54	3:17	4:38	5:07	5:50	6:19	6:36	7:02	7:39

The most heavily used station on the Fredericksburg Line is at Fredericksburg, with a ridership boarding of 1,274 passengers accounting for 33.5 percent of the total line passenger boardings.

VRE published its report on system performance measures on July 22, 2009, covering data through June 30, 2009. Three items in the report relate to issues to be addressed in the BRAC Impact Study: 1) ridership growth; 2) parking lot utilization; and, 3) line capacity.
VRE system ridership growth (including ridership on both the Manassas and Fredericksburg lines) was robust until 2004. Since then, the growth in total ridership has moderated. However, more recent data shown in Table 8 indicates that on the Fredericksburg line, ridership growth rates may be increasing. When compared with 2008 total, FY 2009 ridership was an average of 6.64 percent higher.

Table 9 shows capacity utilization by train on the Fredericksburg line for FY 2009 ridership levels. Only one train (#303 – southbound arriving at Woodbridge at 4:23 PM) exhibits demand beyond rated capacity.

Utilization at the Quantico (QAN) station is 79 percent of the 258 space capacity and 56 percent of capacity at both the Woodbridge Station (WDB) with 758 spaces and at Rippon Landing Station (RIP) with 600 spaces.

Table 7
Year 2005 Ridership: VRE and AMTRAK by Train
Mid-Week Average Ridership (Tuesday – Thursday)

Northbound

2005	Train #300		Train #302		Train #304		Train #306		Amtrak #84		Train #308		Train #310		Amtrak #86		Amtrak #94			Days	Average
Month	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	**Totals**	**Included**	**per day**
January	10,107	107.5%	8,136	100.6%	9,077	96.5%	6,887	79.4%	1,727	n/a	5,467	87.0%	3,145	67.0%	381	n/a	42	n/a	**44,969**	11	4,088
February	10,640	103.7%	9,130	103.5%	9,509	92.7%	7,447	78.7%	2,149	n/a	5,635	82.2%	3,554	69.4%	261	n/a	30	n/a	**48,355**	12	4,030
March	13,595	106.0%	11,590	105.1%	10,762	83.9%	9,378	79.2%	1,978	n/a	7,482	87.4%	4,967	77.5%	272	n/a	4	n/a	**60,028**	15	4,002
April	10,329	100.7%	8,867	100.5%	8,657	84.4%	7,900	83.4%	2,843	n/a	5,396	78.8%	3,810	74.4%	308	n/a	57	n/a	**48,167**	13	3,705
May	11,258	101.3%	9,398	98.4%	11,161	100.4%	7,997	78.0%	3,018	n/a	6,365	85.7%	4,653	83.8%	305	n/a	50	n/a	**54,205**	13	4,170
June	12,403	103.6%	9,796	95.2%	11,549	96.5%	8,644	78.3%	2,749	n/a	7,510	93.9%	4,291	71.8%	308	n/a	49	n/a	**57,299**	14	4,093
July	11,114	80.5%	8,276	80.7%	9,415	92.3%	7,820	88.7%	1,780	n/a	6,403	97.0%	3,855	75.2%	269	n/a	47	n/a	**48,979**	12	4,082
August	13,319	82.7%	10,143	84.7%	7,579	63.7%	7,343	71.4%	844	n/a	5,939	77.1%	5,022	84.0%	121	n/a	21	n/a	**50,331**	14	3,595
September	12,477	83.5%	9,526	85.7%	9,135	82.7%	6,825	71.4%	647	n/a	6,986	97.7%	3,707	66.8%	140	n/a	8	n/a	**49,451**	13	3,804
October	10,981	79.6%	8,186	79.8%	8,566	84.0%	6,999	79.4%	603	n/a	5,927	89.8%	3,130	61.1%	127	n/a	9	n/a	**44,528**	12	3,711
November	12,527	90.6%	8,978	94.0%	9,835	88.5%	8,185	89.9%	85	n/a	6,097	67.0%	3,928	70.8%	170	n/a	7	n/a	**49,812**	13	3,832
December	10,115	73.1%	7,066	74.0%	8,263	74.3%	6,237	68.5%	630	n/a	5,530	60.8%	3,947	71.1%	190	n/a	3	n/a	**41,981**	13	3,229
Total	**138,865**		**109,092**		**113,508**		**91,662**		**19,053**		**74,737**		**48,009**		**2,852**		**327**		**598,105**	155	
Average	**11,572**	**92.7%**	**9,091**	**91.8%**	**9,459**	**86.7%**	**7,639**	**78.8%**	**1,588**	**N/A**	**6,228**	**83.7%**	**4,001**	**72.7%**	**238**	**N/A**	**27**	**N/A**	**49,842**		**3,859**

Southbound

2005	Amtrak #77		Amtrak #95		Train #301		Train #303		Train #305		Train #307		Train #309		Train #311		Train #313			Days	Average
Month	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	Passengers	% Cap.	**Totals**	**Included**	**per day**
January	27	n/a	360	n/a	2,311	24.6%	9,171	105.7%	6,437	79.6%	10,154	108.0%	8,390	108.7%	5,649	89.9%	3,116	66.3%	**45,615**	11	4,147
February	0	n/a	175	n/a	2,036	19.8%	9,277	98.0%	7,700	87.3%	11,586	112.9%	8,617	84.0%	5,916	86.3%	2,930	57.2%	**48,237**	12	4,020
March	0	n/a	86	n/a	2,077	16.2%	10,237	86.5%	9,864	89.5%	14,484	112.9%	11,073	86.3%	7,868	91.9%	4,079	63.7%	**59,768**	15	3,985
April	11	n/a	145	n/a	1,747	17.0%	8,898	94.0%	7,649	86.7%	11,348	110.6%	7,950	77.5%	5,364	78.3%	3,282	64.1%	**46,394**	13	3,569
May	24	n/a	254	n/a	1,982	17.8%	9,212	89.8%	9,443	98.8%	13,024	117.2%	9,727	87.5%	6,850	92.3%	3,761	67.8%	**54,277**	13	4,175
June	19	n/a	251	n/a	2,576	21.5%	9,929	89.9%	9,115	88.6%	14,147	118.2%	10,568	88.3%	7,333	91.7%	3,866	64.7%	**57,804**	14	4,129
July	9	n/a	202	n/a	1,868	13.5%	7,773	76.2%	7,666	86.9%	12,128	87.9%	8,901	86.8%	5,905	89.5%	3,208	62.6%	**47,660**	12	3,972
August	12	n/a	67	n/a	1,889	11.7%	9,753	82.0%	8,631	83.9%	13,505	83.9%	9,406	78.6%	6,710	87.1%	2,905	48.6%	**52,878**	14	3,777
September	15	n/a	219	n/a	1,764	11.8%	9,104	82.4%	7,838	82.0%	12,683	84.8%	9,412	84.7%	6,259	87.5%	2,806	50.5%	**50,100**	13	3,854
October	11	n/a	194	n/a	1,641	11.9%	8,108	79.5%	7,174	81.3%	11,949	86.6%	9,296	90.6%	6,249	94.7%	722	14.1%	**45,344**	12	3,779
November	6	n/a	231	n/a	2,770	24.9%	9,624	100.7%	7,924	87.1%	12,020	86.9%	8,882	79.9%	6,493	71.4%	2,412	43.5%	**50,362**	13	3,874
December	8	n/a	187	n/a	2,323	20.9%	7,758	81.2%	7,894	86.7%	10,235	74.0%	8,094	72.8%	5482	60.2%	2,360	42.5%	**44,341**	13	3,411
Total	**142**		**2,371**		**24,984**		**108,844**		**97,335**		**147,263**		**110,316**		**76,078**		**35,447**		**602,780**	155	
Average	**12**	**N/A**	**198**	**N/A**	**2,082**	**17.6%**	**9,070**	**88.8%**	**8,111**	**86.5%**	**12,272**	**98.7%**	**9,193**	**85.5%**	**6,340**	**85.1%**	**2,954**	**53.8%**	**50,232**		**3,889**

Table 8
VRE Fredericksburg Line Average Daily Ridership (FY 2008-2009)

Month	Average Daily Ridership		% Change
	FY2008	FY2009	
July	7,393	8,388	13.46
August	7,379	8,316	12.70
September	7,652	8,720	13.96
October	7,754	8,538	10.11
November	7,707	8,439	9.50
December	7,235	8,584	18.65
January	8,148	8,501	4.33
February	8,018	8,375	4.45
March	8,050	8,194	1.79
April	8,324	8,196	-1.54
May	8,094	8,015	-0.98
June	8,504	8,254	-3.05
Total	**94,258**	**100,520**	**6.64**

Table 9
VRE Fredericksburg Line Capacity Utilization by Train (FY 2009)

Train #	# of Seats	Daily Average (Mon - Fri)	% Use	Mid Week (Tues-Thurs)	% Use
300	1,110	883	80	911	82
307	1,110	937	84	957	86
302	774	703	91	729	94
305	774	685	89	675	87
304	873	691	79	715	82
301	873	157	18	138	16
309	873	759	87	796	91
306	774	657	85	727	94
303	774	810	105	794	103
308	698	619	89	649	93
311	698	582	83	635	91
310	531	411	77	423	80
313	531	282	53	308	58

In May 2004, VRE adopted the ***Virginia Railway Express Strategic Plan 2004-2025*** to guide the future growth and development of the VRE system. The ***VRE Strategic Plan*** evaluates both core service needs and potential expansions in the system service. Since the BRAC Study Area is served by existing VRE service, improvements related to service in the Study Area are viewed as core service improvements.

For the most part, core service improvements focus on the expansion of capacity to the existing rolling stock, providing the opportunity for more frequent service.

The ***VRE Strategic Plan*** does provide for a new station at Cherry Hill, between the Quantico and Rippon Landing stations in the BRAC Study Area. Initially, the station is forecast to produce 300-400 morning boardings, and a parking lot of 400 spaces would be sufficient. By 2025, morning boardings are forecast to increase to 600-800, and parking inventory should be increased to 600 spaces (page 46). The ***VRE Strategic Plan*** recommends that the Cherry Hill Station be in service with Phase 1 improvements by 2010 (page 98). Improvements to system capacity on the Fredericksburg Line include the following (page 99):

Phase (Implementation Period)	**Train Sets**	**Coaches**
2005	6	26
Phase 1 (2007-10)	7	49
Phase 2 (2010-15)	8	55
Phase 3 (2015-2025)	9	70

In addition to adding service capacity with rolling stock, the *VRE Strategic Plan* recommends increasing station parking inventory, with the demand at both Woodbridge and at Rippon Landing doubling by 2025 (page 36). No specific schedule for station by station parking improvements was developed.

III. SCENARIO 1: FUTURE CONDITIONS WITHOUT BRAC IMPACTS

The study team developed forecasts of year 2015 and 2030 socioeconomic data to project transportation demand in the Study Area. Using the updated model developed for existing conditions, year 2015 and 2030 TAZ socioeconomic forecasts were updated. The study team modified the roadway and transit network to include improvements identified in the constrained long range transportation plan and transit plans and the model was run to identify congested roadway conditions. The team forecasted land use and zoning changes and cost estimates were created to improve roadway segments in the Study Area to LOS D or better. This scenario served as a base case for comparison with the other future "with BRAC" scenarios discussed later in this report.

III.1. Travel Demand Forecasting Methodology

Forecasts of year 2030 conditions without BRAC developed were based on the forecasts for each TAZ developed through the regional transportation planning process. The basis for the forecasts was documented in the publications, ***Round 7.1 Cooperative Forecasting: Population and Households Forecasts to 2030 by Traffic Analysis Zone*** and ***Route 7.1 Cooperative Forecasting: Employment Forecasts to 2030 by Traffic Analysis Zone.***[1]

There are fewer TAZs in the Metropolitan Washington Council of Governments (MWCOG) travel demand model than in the Prince William County travel demand model. Consequently, Prince William County staff developed a TAZ data set of population, household and employment estimates and forecasts for use with the County's model. For example, in the MWCOG model, TAZ 1920 covers an area located generally between Route 1 and I-95, south of the Occoquan River and north of Prince William Parkway. In the County's travel demand model, TAZ 1920 has been further divided into nine smaller TAZs. However, the combined population and employment estimates and forecasts within these nine TAZs equal the number in the MWCOG estimates and forecasts for TAZ 1920. The allocation of estimates and forecasts from the larger MWCOG TAZs to the smaller County model TAZs were provided by County staff.

In addition, both the MWCOG and County travel demand model TAZ estimates and forecasts include estimates and forecasts for the separate jurisdictions of Manassas, Manassas Park and the Town of Dumfries. Consequently, the total forecasts and estimates used in the analysis of all the alternatives include data from these three jurisdictions in the overall County totals. The year 2005 estimates and year 2015 and 2030 forecasts for the socioeconomic variables used in the travel demand modeling process are shown in **Table 10** (population & housing) and in **Table 11** (employment).

It should be noted that forecasts of year 2015 socioeconomic variables were developed for the County model TAZs by extrapolating between the 2005 estimates and the 2030 forecasts. The extrapolation assumes a straight line growth pattern between 2005 and 2030. Specifically, 40

[1] Department of Human Services, Planning and Public Safety, Metropolitan Washington Council of Governments. 2008.

percent of the change for each variable between 2005 and 2030 has been forecasted to occur by 2015.

Table 10
Forecasts and Estimates: 2005, 2015 and 2030 Population and Housing

Year	Single-Family Units	Townhouse Units	Multi-Family Units	Group Qtrs.	Total Population
2005	77,694	35,074	26,201	4,235	399,840
2015	91,268	39,169	38,090	5,273	485,203
2030	111,615	45,331	55,920	6,827	613,209

Table 11
Forecasts and Estimates: 2005, 2015 and 2030 Employment

Year	Industrial Employment	Retail Employment	Office Employment	Other Employment	Total Employment
2005	34,927	39,770	41,232	21,951	137,880
2015	38,895	49,837	57,175	23,862	169,769
2030	44,832	64,932	81,067	26,747	217,578

III.2. Year 2015 and Year 2030 Forecasts

Using the forecasted socioeconomic data by TAZ for the year 2030 and then for year 2015, the study team ran the County's travel demand model. Assignments were developed for daily and peak hour conditions, with levels of service determined on the basis of peak hour directional volume. Roadway segments with a forecasted service level of E or F were considered deficient.

In developing the year 2015 travel demand model network, several improvements were added to the existing network to reflect currently programmed and funded transportation improvements. These were:

- University Boulevard from Route 234 Bypass to Sudley Manor Drive
- Prince William Parkway from Hoadly Road to Old Bridge Road
- US 1 from Joplin Road to Brady's Hill Road
- Purcell Road from Dumfries Road to Running Deer Road
- Minnieville Road from Cardinal Drive to Spriggs Lane
- Route 15 from I-66 to Sudley Road
- Old Carolina from Route 15 to Heathcote Boulevard

In developing the year 2030 network, several planned improvements (those in the transportation element of the *Comprehensive Plan* had been previously incorporated as part of the planned network. For example, the transportation element recommends that Route 1 be improved to six lanes for its entire length by 2030. For the year 2030 network, all of these recommended improvements have been added to the model network. Cost estimates for these transportation

element improvements have not been included in the estimates for each alternative, and this should be considered when comparing the year 2015 deficiencies with those identified for the year 2030. Specifically, the forecasted year 2015 deficiencies were not based on the assumption that the deficient segments of Route 1 would have been improved. In contrast, the forecasted year 2030 deficiencies were based on the assumption that the deficient segments (along with all other segments) of Route 1 would have been improved. Thus, the year 2015 cost estimates include costs for widening Route 1 to six lanes along the deficient segments, and the year 2030 cost estimates include costs for widening the deficient segments of Route 1 beyond six lanes where appropriate.

The deficient roadways produced by model runs are presented graphically in **Figure 5 (**2015 No BRAC Proposed Improvements Key Map) and in **Figure 6** (2030 No BRAC Proposed Improvements Key Map). The results show that most of the improvements are clustered in the North Woodbridge area (north of Opitz Boulevard and east of Route 1) and in the Triangle area.

III.3. Development of Improvements and Cost Estimates

For each link within the Study Area that was forecasted to operate at LOS E or F, the study team performed further analyses to determine the number of additional through lanes that would be required for this roadway segment to operate at LOS D or better under the future conditions. In some instances, the improvements also included an upgrade in the roadway's functional classification. For example, a Major Collector may need to be upgraded to the operational parameters of a Minor Arterial in order to operate at LOS D or better with the forecasted traffic volumes.

The needs of a roadway segment may vary by time of day. For example, on a particular segment, the northbound lanes may experience much more traffic than the southbound lanes during the morning peak. In this instance, the morning peak may require two northbound lanes, but only one southbound lane, to operate at an acceptable LOS. However, the reverse is likely to be true during the evening peak. Therefore, when determining the recommended capacity improvements for each link, the same number of additional lanes was recommended in each direction.

Once the list of roadway segments with LOS E or F was developed using peak hour data and the improvements were determined for 2015 and 2030, the study team prepared planning level cost estimates for each improvement needed to achieve LOS D or better. Roadway segments were first separated into two categories – those included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan and all remaining segments. For year 2015, a list of the roadway segments that are LOS E or F in 2015, but are improved to LOS D or better in the 2030 model was identified, but not included in the set of improvements.

The improvements with a number designation of "CP" are included in some form in the *Comprehensive Plan.* However, the extent of improvement needed to address the specific deficiency along the respective segments may exceed that provided in the *Comprehensive Plan.* For example, Route 1 is identified as recommended for improvement to six lanes in the *Comprehensive Plan*, but in several instances, the improvement needed to address deficiencies in this study indicate more than six lanes will be needed. The list segments included in the *Comprehensive Plan* has been provided for information. Improvements and their respective costs

have been provided without consideration of the limits in the *Comprehensive Plan* recommendations.

The study team developed cost per lane mile unit costs for construction cost and right-of-way and utilities cost. These unit costs were based on the Route 1 South (widening from Joplin Road to Bradys Hill Road) project cost estimate recently completed by the Virginia Department of Transportation (VDOT). Using the Route 1 project as a guide, the construction cost per lane mile was calculated as $9.5 million. The right-of-way and utilities costs per mile were calculated as $80 million.

In addition, the study team developed right-of-way and utilities costs for residential and mixed use areas based on the Route 1 cost estimate. Factors for right-of-way and utilities costs were taken from VDOT Transportation and Mobility Planning Division Statewide Planning Level Cost Estimates (NOVA/Hampton Roads) and were based on predominant land uses. The land use factors are as follows: commercial (1.00), residential (0.56), and mixed use (0.76). By applying these factors to the commercial right-of-way and utilities cost per mile of $80 million, residential land use was calculated to cost $44.8 million per mile, and mixed use land use was calculated to cost $60.8 million per mile.

For each roadway segment, the improvement cost of $9.5 million per lane mile was applied, along with the applicable right-of-way and utilities cost, based on the predominant land use along the segment. The sum of these costs is the total project cost for the roadway segment.

Cost estimates for Scenario 1 (2015 and 2030) are shown in **Tables 12 and 14**. **Table 13** shows the roadway segments that are deficient in 2015, but improved to LOS D or better in the 2030 model. **Figures 5 and 6** show the geographic location of the roadway segments that required improvement. The cost estimates show that to improve the road network to LOS D or better in 2015, the total cost is $598.1 million. To improve the road network to LOS D or better in 2030, the total cost is $733.0 million.

The improvements in the Triangle area (Roadway sections 7-17) account for $244.9 million, or 41 percent of the total year 2015 improvement costs and $240.2 million, or 33 percent of the total year 2030 improvement costs. These improvements are associated with traffic demand both with the Town of Quantico and with MCBQ.

In Woodbridge to the north, the cost of widening Route 1 to six lanes by 2015 is estimated at $126.3 million, or 21 percent of the total improvement costs, and $147.2 million, or 20 percent of the total year 2030 improvement costs. It should be noted again that the year 2030 costs do not include the cost of widening Route 1 to six lanes whereas the year 2015 estimates do include the costs of widening Route 1 to six lanes along the deficient segments.

Table 12
Cost Estimate – Scenario 1 (2015 Without BRAC)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build Level of Service	Length of Improvement (miles)	Improvement Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	8-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	4	6-lane divided Commercial	2	F	0.29	9.50	5.51	80.0	23.2	28.7
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	4	6-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	8-lane divided Commercial	2	E	0.24	9.50	4.56	80.0	19.2	23.8
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	4	6-lane divided Commercial	2	F	0.21	9.50	3.99	80.0	16.8	20.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane divided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-9[4]	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	E	0.25	9.50	4.75	44.8	11.2	16.0
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	E	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	E	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles E	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Directional Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	4-lane divided Commercial	2	F	0.11	9.50	2.09	80.0	8.8	10.9
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.39	9.50	7.41	80.0	31.2	38.6
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.05	9.50	1.90	80.0	4.0	5.9
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	4-lane divided Mixed Use	2	F	0.09	9.50	1.71	60.8	5.5	7.2
18	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	2	4-lane divided Residential	2	E	0.45	9.50	8.55	44.8	20.2	28.7
													$598.1

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-9 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan

Table 13
Scenario 1 – LOS E or F in 2015, Improved in 2030 Model

Roadway Section No. (See Key Map)	Road	From	To	Length of Section (miles)
CP-13	US 1	1/2 way to Mt. Pleasant Dr	Mt. Pleasant Dr	0.27
CP-14	US 1	Mt. Pleasant Dr	Long View Dr	0.33
CP-16	VA 639 - Summerland Dr	VA 639 - Horner Road	Prince William Pkwy	0.20
CP-20	VA 253 - Occoquan Road	Deerfield Lane	Hylton Ave	0.10
CP-21	VA 253 - Occoquan Road	Hylton Ave	VA 639 - Horner Road	0.38
CP-22	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	0.21
CP-23	VA 639 - Horner Road	VA 253 - Occoquan Rd	Millwood Dr (E)	0.54
CP-24	VA 639 - Horner Road	Millwood Dr (E)	Millwood Dr (W)	0.45
CP-25	VA 639 - Horner Road	Millwood Dr (W)	Botts Ave	0.29
CP-26	VA 639 - Horner Road	Botts Ave	VA 639 - Summerland Dr	0.06
CP-27	Express Dr	Dawson Beach Road	VRE Woodbridge Station	0.20
CP-28	Express Dr	VRE Woodbridge Station	Ospreys View Place	0.43
CP-29	Belmont Bay Dr	Ospreys View Place	Course View Way	0.55
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	0.25
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	0.94
CP-32	Neabsco Road	US 1	1.16 miles E	1.16
CP-33	US 1 - SB	Possum Point Road	Mine Road	0.47
CP-34	US 1 - SB	Mine Road	Graham Park Road	0.40
CP-35	US 1 - SB	0.27 miles N	Bradys Hill Rd	0.27
21	Dawson Beach Road	US 1	Express Dr	0.09
22	Delaware Dr	Blackburn Road	0.15 miles E	0.15

Notes:
Segments CP-13 to CP-35 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

Table 14
Cost Estimate – Scenario 1 (2030 Without BRAC)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvement (miles)	Improvement Cost Per Lane Mile ($ million)[2]	Constr. Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	6	8-lane divided Commercial	2	E	0.24	9.50	4.56	80.0	19.2	23.8
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	6	8-lane divided Commercial	2	E	0.29	9.50	5.51	80.0	23.2	28.7
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	6	8-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	6	10-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane divided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-9[4]	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	E	0.25	9.50	4.75	44.8	11.2	16.0
CP-10[4,5]	US 1	Featherstone Rd	Reddy Dr	6	8-lane divided Commercial	2	E	0.23	9.50	4.37	80.0	18.4	22.8
CP-11[4]	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-12[4]	Neabsco Mills Rd	Dale Blvd	0.28 miles N	4	6-lane divided Mixed Use	2	E	0.28	9.50	5.32	60.8	17.0	22.3
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	E	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
5	Mine Road	US 1 SB	Van Buren Road	2	4-lane undivided Residential	2	F	0.47	9.50	8.93	44.8	21.1	30.0
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	E	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	E	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles E	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Directional Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	4-lane divided Commercial	2	F	0.11	9.50	2.09	80.0	8.8	10.9
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.35	9.50	6.65	80.0	28.0	34.7
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.03	9.50	1.14	80.0	2.4	3.5
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	6-lane divided Mixed Use	4	F	0.09	9.50	3.42	60.8	5.5	8.9
18	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	2	4-lane divided Residential	2	E	0.45	9.50	8.55	44.8	20.2	28.7
19	Possum Point Road	US 1	Leonard St	2	4-lane undivided Residential	2	E	0.41	9.50	7.79	44.8	18.4	26.2
20[6]	Graham Park Road	Woodland Dr	Vanetta Ct	2	4-lane undivided Residential	2	E	0.34	9.50	3.23	44.8	15.2	18.5
TOTAL													**$733.0**

Table 14 (continued)
Cost Estimate – Scenario 1 (2030 Without BRAC)

Notes:
[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2030.
[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area
[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area
[4] Segments CP-1 to CP-12 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan
- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Neabsco Mills Road is recommended to remain a four-lane roadway in the Comprehensive Plan

[5] Road Section No. CP-10 (US 1 between Featherstone Road and Reddy Drive) is recommended as a six-lane roadway in the CIP. However, with projected 2030 No BRAC conditions, an eight-lane section is necessary at this location.
[6] Road Section No. 20 (Graham Park Road between Woodland Drive and Vanetta Court) is recommended as a 4-lane roadway. This section of roadway currently varies from 2-4 lanes. The cost estimate reflects improving the entire segment to contain 4 lanes.

IV. SCENARIO 2: BRAC IMPACTS AND NO TRANSPORTATION OR ZONING CHANGES

Using forecasts developed in ***Final Environmental Impact Statement for Implementation of 2005 Base Realignment and Closure (BRAC) Recommendations and Related Army Actions at Fort Belvoir, Virginia*** (June 2007) and ***Final Environmental Impact Statement: Development of the Westside of Marine Corps Base Quantico, Including the 2005 Base Realignment and Closure Action*** (April 2008), as a basis for this study, the study team developed BRAC related growth forecasts for the Study Area. Using the "with BRAC" forecasts by TAZ for 2015 and 2030, the study team ran the County's travel demand model to develop a set of forecasts that include BRAC impacts to the transportation network. The network for this model includes only those roadway and transit improvements that are included in the current constrained long range plan (CLRP). The study team then forecasted the land use and zoning changes and developed recommendations for improvements to roadway segments in the Study Area that would achieve LOS D or better by 2015 and by 2030. The study team developed planning level costs estimates for each roadway improvement.

IV.1. Year 2030 and Year 2015 Forecasts

The process of developing forecasts of the socioeconomic variables used in the travel demand model involved three steps:

1. ***Estimate BRAC related population, households and employment in Prince William County***: Using the findings in the Final Environmental Impact Statements (FEIS) for Fort Belvoir and for MCBQ, estimates of BRAC related County residents were developed. For Fort Belvoir, the FEIS forecasted distribution of 22.2 percent of BRAC employees residing in Prince William County resulted in a forecast of 4,284 residents by 2030 and 3,118 residents by 2015. For MCBQ, the number of BRAC residents in Prince William County was forecasted at 982 for both 2015 and 2030.The number of BRAC related households was estimated at one per BRAC employee. The number of added employees in Prince William County as a result of BRAC related population growth was based on the number of employees per person for the without BRAC alternative. On average, the forecasted number of added employees from BRAC related growth is estimate at 0.35 employees per person, for an increase in employment of 3,882 in 2015 and 4,041 in 2030. It should be noted that this employment growth is forecast in addition to the BRAC growth at either Fort Belvoir or at MCBQ.

2. ***Distribute BRAC related population and households in Prince William County:*** The distribution of BRAC related households was developed using the findings in the Fort Belvoir FEIS as a guide. The place of residence for BRAC related employees will tend to increase with frequency as the distance from the facility is reduced. To estimate this dispersion of employees' places of residence, three areas were defined for each BRAC facility. **Figure 7** shows the areas associated with Fort Belvoir and **Figure 8** shows the areas associated with MCBQ. In Area 1, it has been estimated that 60 percent of BRAC related employees will reside; in Area 2, it has been

estimated that 30 percent of BRAC related employees will reside; and, in the remaining areas of the County it has been estimated that 10 percent of BRAC related employees will reside.

The distribution of BRAC residences within each area was based on the proportion of households by type within individual TAZs to the total number of households within the overall Area. For example, for the year 2030 forecasts, if 1.1 percent of the households in Fort Belvoir Area 1 were to be located TAZ 566 and 40 percent of those were single-family detached units, 30 percent in townhouse units and 30 percent in multi-family units then number of the Fort Belvoir BRAC households in TAZ 566 was forecasted at 11 single-family households (4,284 x 60 percent x 1.1 percent x 40 percent), 9 townhouse households and 9 multi-family households (4,284 x 60 percent x 1.1 percent x 30 percent). The same process was used to forecast BRAC residences in each TAZ for both Fort Belvoir and MCBQ.

3. ***Distribute employment associated with increases in BRAC related population:*** While the distribution of BRAC employees' residences can be related to the distance from the respective facility, the same cannot be assumed for the growth in County employment related to increases in BRAC population. Consequently, the distribution of added employment was calculated based on the distribution of employment by TAZ countywide.

Graphic depictions of the growth in population, households and total employment by TAZ in the BRAC Study Area for the years 2005, 2015 and 2030 have been developed and shown in **Figures 9, 10 and 11**, respectively. It should be noted that these figures depict growth from both forecasted development without BRAC and BRAC related growth. As **Figures 9 and 10** show, forecasted growth in population and households is not evenly distributed within the BRAC Study Area. Several TAZs exhibit substantial growth over the 25 year period, while others exhibit only modest increases. With the planned revitalization of the Potomac Communities as recommended in the ***Comprehensive Plan***, the TAZs in the North Woodbridge, Neabsco Mills and Triangle area all show considerable forecasted growth.

For employment, **Figure 11** shows growth in the Potomac Communities revitalization areas, but also on the Harbor Station site (TAZs located generally between Powells Creek and Quantico Creek). The total socioeconomic forecasts for years 2015 and 2030 with BRAC are shown in **Table 15** for households and population and **Table 16** for employment.

Table 15
Forecasts and Estimates: 2005, 2015 and 2030
Population and Housing with BRAC

Year	Single-Family Units	Townhouse Units	Multi-Family Units	Group Qtrs.	Total Population
2005	77,694	35,074	26,201	4,235	399,840
2015	93,006	40,256	39,346	5,273	496,315
2030	113,407	46,178	58,542	6,827	626,872

Table 16
Forecasts and Estimates: 2005, 2015 and 2030
Employment with BRAC

Year	Industrial Employment	Retail Employment	Office Employment	Other Employment	Total Employment
2005	34,927	39,770	41,232	21,951	137,880
2015	39,370	50,791	58,435	24,380	173,516
2030	45,733	66,327	82,785	27,310	222,195

IV.2. Scenario 2: Travel Demand Modeling Results

The results of the travel demand modeling analysis of the with BRAC impacts for the years 2015 and 2030 are shown in **Figures 12 and 13**, respectively. When compared to the deficiencies identified in the without BRAC Scenario 1, most of the added deficiencies are forecast to occur in the North Woodbridge area. Most of the roadway deficiencies added as a result of BRAC impacts are in the transportation element of the ***Comprehensive Plan***.

The projected increases in deficient roadway segments are likely a result of the increase in trips associated with growth in population and employment associated with Fort Belvoir. The addition of approximately 60 percent of the BRAC related residences in the immediate area of North Woodbridge and in the Occoquan area increases peak hour directional volume along several facilities to a point where the service levels deteriorate to LOS E or F.

IV.3. Development of Improvements and Cost Estimates

Using the methodology described for Scenario 1 above, the study team identified the roadway segments forecasted to operate at LOS E or F and the improvements (i.e. number of new lanes needed) needed by 2015 and 2030 to achieve LOS D or better,. Next, the study team developed cost estimates for each improvement using the unit costs generated for Scenario 1. Roadway segments were separated into two categories – those included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan and all remaining segments. For year 2015, a list of the roadway segments that are LOS E or F in 2015, but are improved to LOS D or better in the 2030 model was identified, but not included in the set of improvements.

Cost estimates for Scenario 2 (2015 and 2030) are shown in **Tables 17 and 19**. **Table 18** shows the roadway segments that are deficient in 2015, but improved to LOS D or better in the 2030 model. **Figures 12 and 13** graphically show the roadway improvements included in the tables. The cost estimates show that to improve the road network to LOS D or better in 2015, the total cost is $683.8 million. To improve the road network to LOS D or better in 2030, the total cost is $845.6 million.

When compared with the cost of addressing roadway deficiencies forecasted to occur without BRAC impacts, the cost of addressing deficiencies with BRAC impacts is forecast in 2015 to be $85.7 million higher (at $683.8 million) and in 2030 to be $112.6 million higher (at $845.6 million).

Table 17
Cost Estimate – Scenario 2 (2015 With BRAC)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build Level of Service	Length of Improvement (miles)	Improvement Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	8-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	4	8-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	4	6-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	8-lane divided Commercial	2	F	0.24	9.50	4.56	80.0	19.2	23.8
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	4	8-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane undivided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-11[4]	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	4	6-lane divided Commercial	2	F	0.27	9.50	5.13	80.0	21.6	26.7
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	4	6-lane divided Commercial	2	F	0.33	9.50	6.27	80.0	26.4	32.7
CP-15[4]	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	6-lane divided Commercial	2	F	0.21	9.50	3.99	80.0	16.8	20.8
CP-16[4]	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	4	6-lane divided Mixed Use	2	F	0.20	9.50	3.80	60.8	12.2	16.0
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	F	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
5	Mine Road	US 1 SB	Fairfax St	2	4-lane undivided Residential	2	E	0.14	9.50	2.66	44.8	6.3	8.9
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	F	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles E	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Dir. Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	4-lane divided Commercial	2	F	0.11	9.50	2.09	80.0	8.8	10.9
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.39	9.50	7.41	80.0	31.2	38.6
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.05	9.50	1.90	80.0	4.0	5.9
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	4-lane divided Mixed Use	2	F	0.09	9.50	1.71	60.8	5.5	7.2
TOTAL													**$683.8**

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-16 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Horner Road/Summerland Drive is recommended to remain a four-lane roadway in the Comprehensive Plan

Table 18
Scenario 2 – LOS E or F in 2015, Improved in 2030 Model

Roadway Section No. (See Key Map)	Road	From	To	Length of Section (miles)
CP-20	VA 253 - Occoquan Road	Deerfield Lane	Hylton Ave	0.10
CP-21	VA 253 - Occoquan Road	Hylton Ave	VA 639 - Horner Road	0.38
CP-23	VA 639 - Horner Road	VA 253 - Occoquan Rd	Millwood Dr (E)	0.54
CP-24	VA 639 - Horner Road	Millwood Dr (E)	Millwood Dr (W)	0.45
CP-25	VA 639 - Horner Road	Millwood Dr (W)	Botts Ave	0.29
CP-26	VA 639 - Horner Road	Botts Ave	VA 639 - Summerland Dr	0.06
CP-27	Express Dr	Dawson Beach Road	VRE Woodbridge Station	0.20
CP-28	Express Dr	VRE Woodbridge Station	Ospreys View Place	0.43
CP-29	Belmont Bay Dr	Ospreys View Place	Course View Way	0.55
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	0.25
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	0.94
CP-32	Neabsco Road	US 1	1.16 miles E	1.16
CP-33	US 1 - SB	Possum Point Road	Mine Road	0.47
CP-34	US 1 - SB	Mine Road	Graham Park Road	0.40
CP-35	US 1 - SB	0.27 miles N	Bradys Hill Rd	0.27
CP-36	VA 123 - Gordon Blvd	NB I-95 Directional Ramps	Annapolis Way	0.17
CP-37	VA 253 - Occoquan Road	VA 639 - Horner Road	US 1	0.35
CP-38	Horner Road	VA 639 - Summerland Dr	Forest Glen Road	0.09
CP-39	US 1	Long View Dr	Wigglesworth Way	0.13
CP-40	Opitz Blvd	I-95 Ramps	VA 638 - Neabsco Mills Rd	0.26
CP-41	Blackburn Road	Maryland Ave	Delaware Dr	0.25
21	Dawson Beach Road	US 1	Express Dr	0.09
22	Delaware Dr	Blackburn Road	0.15 miles E	0.15
23	Mt. Pleasant Dr	Thompson Dr	Fisher Ave	0.32
24	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	0.45

Notes:
Segments CP-20 to CP-41 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

Table 19
Cost Estimate – Scenario 2 (2030 With BRAC)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvement (miles)	Imprmnt. Cost Per Lane Mile ($ million)[2]	Const. Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	6	10-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	6	8-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	6	10-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane divided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-10[4,5]	US 1	Featherstone Rd	Reddy Dr	6	8-lane divided Commercial	2	E	0.23	9.50	4.37	80.0	18.4	22.8
CP-11[4]	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-12[4]	Neabsco Mills Rd	Dale Blvd	0.28 miles N	4	6-lane divided Mixed Use	2	E	0.28	9.50	5.32	60.8	17.0	22.3
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	6	10-lane divided Commercial	4	F	0.27	9.50	10.26	80.0	21.6	31.9
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	6	8-lane divided Commercial	2	E	0.33	9.50	6.27	80.0	26.4	32.7
CP-15[4]	VA 639 - Horner Rd	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	6-lane divided Commercial	2	E	0.21	9.50	3.99	80.0	16.8	20.8
CP-16[4]	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	4	6-lane divided Mixed Use	2	F	0.20	9.50	3.80	60.8	12.2	16.0
CP-17[4]	US 1	Maryland Ave	Delaware Dr	6	8-lane divided Commercial	2	E	0.12	9.50	2.28	80.0	9.6	11.9
CP-18[4]	VA 3000 - Prince William Parkway	I-95 Ramps	Summerland Dr	4	6-lane divided Mixed Use	2	E	0.22	9.50	4.18	60.8	13.4	17.6
CP-19[4]	Dale Blvd	I-95	Neabsco Mills Rd	4	6-lane divided Mixed Use	2	E	0.18	9.50	3.42	60.8	10.9	14.4
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	F	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
5	Mine Road	US 1 SB	Fairfax St	2	4-lane undivided Residential	2	E	0.14	9.50	2.66	44.8	6.3	8.9
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	E	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles E	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Dir. Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	6-lane divided Commercial	4	F	0.11	9.50	4.18	80.0	8.8	13.0
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.35	9.50	6.65	80.0	28.0	34.7
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.03	9.50	1.14	80.0	2.4	3.5
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	F	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	6-lane divided Mixed Use	4	F	0.09	9.50	3.42	60.8	5.5	8.9
19	Possum Point Road	US 1	Leonard St	2	4-lane undivided Residential	2	E	0.41	9.50	7.79	44.8	18.4	26.2
20[6]	Graham Park Road	Woodland Dr	Vanetta Ct	2	4-lane undivided Residential	2	E	0.34	9.50	3.23	44.8	15.2	18.5
25	Mine Road	Fairfax St	Van Buren Rd	2	4-lane undivided Residential	2	E	0.33	9.50	6.27	44.8	14.8	21.1
TOTAL													**$845.6**

Table 19 (continued)
Cost Estimate – Scenario 2 (2030 With BRAC)

Notes:
[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2030.
[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area
[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area
[4] Segments CP-1 to CP-19 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan
- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Horner Road/Summerland Drive is recommended to remain a four-lane roadway in the Comprehensive Plan
- Neabsco Mills Road is recommended to remain a four-lane roadway in the Comprehensive Plan
- Prince William Parkway is recommended to remain a four-lane roadway in the Comprehensive Plan
- Dale Boulevard is recommended to remain a four-lane roadway in the Comprehensive Plan

[5] Road Section No. CP-10 (US 1 between Featherstone Road and Reddy Drive) is recommended as a six-lane roadway in the CIP. However, with projected 2030 No BRAC conditions, an eight-lane section is necessary at this location.
[6] Road Section No. 20 (Graham Park Road between Woodland Drive and Vanetta Court) is recommended as a 4-lane roadway. This section of roadway currently varies from 2-4 lanes. The cost estimate reflects improving the entire segment to contain 4 lanes.

V. SCENARIO 3: BRAC WITH IMPROVEMENTS

Scenario 3 is comprised of three components that were analyzed for 2015 and 2030:

- Scenario 3a: Roadway Improvements Alternative
- Scenario 3b: Transit Oriented Development (TOD) Alternative
- Scenario 3c: Mixed Use Development Alternative.

For Scenario 3a, the recommended roadway improvements that were found to be needed under Scenario 2 were programmed into the model to determine which roadway segments in the Study Area would operate at LOS E or F in 2015 and 2030. The study team then developed planning level cost estimates for the roadway segments that were recommended to be improved to LOS D or better under this scenario.

For Scenario 3b, TOD improvements were programmed into the model to determine how the traffic would decrease in the Study Area in 2015 and 2030. The study team also evaluated the roadway segments that would operate at LOS E or F in those years and developed cost estimates for the roadway segments that were recommended to be improved to LOS D or better under this scenario.

For Scenario 3c, mixed use development improvements were programmed into the model to determine how the traffic would decrease in the Study Area in 2015 and 2030. The study team also evaluated the roadway segments that would operate at LOS E or F in those years and developed cost estimates for the roadway segments that were recommended to be improved to LOS D or better under this scenario.

V.1. Scenario 3a: Forecast Conditions with BRAC with Roadway Improvements

To evaluate the impact of an improvement alternative to address BRAC impacts that focuses exclusively on peak hour roadway travel demand, the travel demand model network was modified by adding improvements to directly address all the deficiencies identified in Scenario 2 – With BRAC. Specifically, the network was changed so that each facility in the Study Area was improved to reflect the ultimate lane width for either 2015 or 2030 as shown in the previous section.

Using the same socioeconomic forecasts used in developing the model forecasts in Scenario 2 (With BRAC without Roadway Improvements), the results of the model indicate that more improvements will be needed, a finding which requires explanation.

With the improvements to the Route 1 corridor (widening up to eight lanes), the model is able to provide the heavy north-south traffic flow an alternative path to the I-95 corridor. The results indicate that with its added capacity and higher speeds under congested conditions, the assignment process is shifting more trips to Route 1, and consequently, even though it has been widened, the service level is still viewed as deficient – LOS E or worse. The other added projects are likely a result of the enhance attractiveness of Route 1 as a path to the employment centers to

the north. In reality, if Route 1 were to be widened, congestion would tend to exhibit a level of equilibrium between the Route 1 and I-95 corridors. Scenario 3a builds on Scenario 2 by incorporating the recommended roadway improvements into the model for 2015 and 2030.

Once the recommended roadway improvements from Scenario 2 were incorporated into the model, the roadway segments forecasted to operate at LOS E or F were identified using peak hour data. The study team then developed improvements (i.e. number of new lanes needed) needed by 2015 and 2030 to achieve LOS D or better for deficient roadway segments. The study team then developed planning level cost estimate for each improvement using the same cost per lane mile and right-of-way and utility cost per mile as described in Scenarios 1 and 2. Roadway segments were separated into two categories – those included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan and all remaining segments. For year 2015, a list of the roadway segments that are LOS E or F in 2015, but are improved to LOS D or better in the 2030 model was identified, but not included in the set of improvements.

Cost estimates for Scenario 3a (2015 and 2030) are shown in **Tables 20 and 22**, respectively. **Table 21** shows the roadway segments that are deficient in 2015, but improved to LOS D or better in the 2030 model. **Figures 14 and 15,** located in the Appendix, graphically show the roadway segments included in the tables. The cost estimates show that to improve the road network to LOS D or better in 2015, the total cost would be $177.3 million. To improve the road network to LOS D or better in 2030, the total cost would be $250.6 million.

V.2. Scenario 3b: Future Conditions with BRAC and Transit Oriented Development

To reduce overall travel demand, a strategy of encouraging transit oriented development has been included as an alternative for the analysis of a with BRAC impacts scenario. A recent study of transit oriented development (TOD) trip generation rates was published by the Transportation Research Board. The findings of the study, *Effects of TOD on Housing, Parking and Travel* (conducted by the Transit Cooperative Research Program) found that residential developments served by high quality transit with a mix of modes. While most of the 17 sites evaluated were exclusively residential, six had incidental retail uses.[2]

Although the findings indicated that total daily and peak hour trips are up to 44 percent lower than the number of trips forecasted using rates developed in the ITE publication, Trip Generation, only two of the studied sites were in a suburban setting and served by a rail commuter line similar to the service provided by the Virginia Railway Express (VRE). On average, the TOD uses in suburban Philadelphia and suburban New Jersey areas generated daily trip volumes that were 25 percent less than those indicated by using the rates in Trip Generation.

To reflect the impacts on mode choice documented in studies of transit oriented developments located near suburban commuter rail station, a reduction of 25 percent of the peak hour trips has been applied to the total trips in the TAZs in which TOD has been forecasted in this scenario.

[2] Arrington, G.B. and Cevero, Robert. *Effects of TOD on Housing, Parking and Travel.* TCRP Report 128, Transportation Research Board, Washington, D.C. 2008. pp. 29-54.

Table 20
Cost Estimate – Scenario 3a (2015 Roadway Improvements Alternative)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvement (miles)	Imprmnt. Cost Per Lane Mile ($ million)[2]	Const. Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	2	4-lane undivided Residential	2	F	0.25	9.50	4.75	44.8	11.2	16.0
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	4	6-lane divided Commercial	2	F	0.94	9.50	17.86	80.0	75.2	93.1
CP-34	US 1 - SB	Mine Road	Graham Park Road	2	4-lane Commercial	2	F	0.40	9.50	7.60	80.0	32.0	39.6
CP-41	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	F	0.25	9.50	4.75	44.8	11.2	16.0
CP-42	Blackburn Road	Featherstone Rd	Reddy Dr	2	4-lane undivided Residential	2	E	0.20	9.50	3.80	44.8	9.0	12.8
													$177.3

Notes:
[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.
[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area
[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area
[4] Segments CP-30 to CP-42 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan
- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan

Table 21
Scenario 3a – LOS E or F in 2015: Improved in 2030 Model

Roadway Section No. (See Key Map)	Road	From	To	Length of Section (miles)
CP-20	VA 253 - Occoquan Road	Deerfield Lane	Hylton Ave	0.10
CP-21	VA 253 - Occoquan Road	Hylton Ave	VA 639 - Horner Road	0.38
CP-23	VA 639 - Horner Road	VA 253 - Occoquan Rd	Millwood Dr (E)	0.54
CP-24	VA 639 - Horner Road	Millwood Dr (E)	Millwood Dr (W)	0.45
CP-25	VA 639 - Horner Road	Millwood Dr (W)	Botts Ave	0.29
CP-26	VA 639 - Horner Road	Botts Ave	VA 639 - Summerland Dr	0.06
CP-27	Express Dr	Dawson Beach Road	VRE Woodbridge Station	0.20
CP-28	Express Dr	VRE Woodbridge Station	Ospreys View Place	0.43
CP-29	Belmont Bay Dr	Ospreys View Place	Course View Way	0.55
CP-32	Neabsco Road	US 1	1.16 miles E	1.16
CP-33	US 1 - SB	Possum Point Road	Mine Road	0.47
CP-35	US 1 - SB	0.27 miles N	Bradys Hill Rd	0.27
CP-36	VA 123 - Gordon Blvd	NB I-95 Directional Ramps	Annapolis Way	0.17
CP-39	US 1	Long View Dr	Wigglesworth Way	0.13
CP-40	Opitz Blvd	I-95 Ramps	VA 638 - Neabsco Mills Rd	0.26
CP-43	Neabsco Mills Road	S College Dr	US 1	0.47
21	Dawson Beach Road	US 1	Express Dr	0.09
22	Delaware Dr	Blackburn Road	0.15 miles E	0.15
24	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	0.45

Notes:
Segments CP-20 to CP-43 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

The proposed TOD developments in Prince William County would exhibit similar characteristics to those in suburban Philadelphia and New Jersey on which the 25 percent trip-making reduction has been based. Specifically, the developments are within walking distance of the commuter stations, service frequency is similar to that planned along the VRE, and the distance in travel time from the core urban area is similar. While there are similarities between TOD and mixed use development in that both provided for a the combination of residential, retail commercial and Office uses, only TOD claims that auto trips are reduced as a result of the availability of transit service.

Table 22
Cost Estimate – Scenario 3a (2030 Roadway Improvements Alternative)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvement (miles)	Imprmnt. Cost Per Lane Mile ($ million)[2]	Const. Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-14	US 1	Mt. Pleasant Dr	East Longview Dr	8	12-lane divided Commercial	4	F	0.33	9.50	12.54	80.0	26.4	38.9
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	2	4-lane undivided Residential	2	E	0.25	9.50	4.75	44.8	11.2	16.0
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	6	8-lane divided Commercial	2	E	0.94	9.50	17.86	80.0	75.2	93.1
CP-34	US 1 - SB	Mine Road	Graham Park Road	2	4-lane Commercial	2	E	0.40	9.50	7.60	80.0	32.0	39.6
CP-41	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	F	0.25	9.50	4.75	44.8	11.2	16.0
CP-42	Blackburn Road	Featherstone Rd	Reddy Dr	2	4-lane undivided Residential	2	E	0.20	9.50	3.80	44.8	9.0	12.8
CP-44	Neabsco Mills Rd	Opitz Blvd	Potomac Branch Dr	4	6-lane divided Mixed Use	2	E	0.13	9.50	2.47	60.8	7.9	10.4
CP-45	Neabsco Mills Rd	Potomac Branch Dr	Sheffield Way	4	6-lane divided Mixed Use	2	E	0.30	9.50	5.70	60.8	18.2	23.9
													$250.6

Notes:
[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.
[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area
[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area
[4] Segments CP-14 to CP-45 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan
- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan
- Neabsco Mills Road is recommended to remain a four-lane roadway in the Comprehensive Plan

One characteristic of TOD identified in TCRP Report 128 that limits the location in which TOD may be proposed in the BRAC Study Area is transit station proximity. The two sites in suburban Philadelphia and suburban New Jersey area were within 990 feet of walking distance to the nearest commuter line. In the BRAC Study Area, two areas exhibit the potential for extensive TOD development within either an existing or a proposed VRE station. First, in North Woodbridge the area within TAZ 566 has been evaluated for TOD potential, and has been included Comprehensive Plan as appropriate for Urban Mixed Use. To reflect this revitalization to TOD potential, the 2030 forecasted housing in the TAZ was set at 3,500 multi-family units. Employment was expanded to reflect 500,000 square feet of retail floor area and 700,000 square feet of office floor area.

Next, the six TAZs in the vicinity of the proposed Harbor Station VRE Station were reconfigured based on forecasts of TOD development. These six TAZs are generally within walking distance of the potential VRE station site, and are relatively undeveloped. They are both part of and adjacent to the proposed Harbor Station development that has been zoned but no development has been initiated. The proposed TOD development forecasts for the year 2030 includes approximately 10,000 multi-family units and a mix of retail and office development with approximately 1,127 employees. Totals for the TOD household and population forecasts are presented in **Table 23** and employment forecasts are presented in **Table 24**. Graphics of the growth by TAZ in the Study Area are shown in **Figure 16** – Households**, Figure 17** – Population, and **Figure 18** – Employment.

Table 23
Forecasts and Estimates: 2005, 2015 and 2030 - Population and Housing with BRAC TOD

Year	Single-Family Units	Townhouse Units	Multi-Family Units	Group Qtrs.	Total Population
2005	77,694	35,074	26,201	4,235	399,840
2015	91,950	40,146	40,538	5,272	496,606
2030	111,016	46,354	60,758	6,827	628,071

Table 24
Forecasts and Estimates: 2005, 2015 and 2030 - Employment with BRAC TOD

Year	Industrial Employment	Retail Employment	Office Employment	Other Employment	Total Employment
2005	34,927	39,770	41,232	21,951	137,880
2015	39,771	50,965	58,433	24,408	173,586
2030	45,769	66,182	82,425	27,189	221,566

To reflect the impact of TOD development on the assignment process, the model was modified by reducing by 25 percent the total trips associated with the TAZs in which TOD development is forecasted. This is consistent with the findings of TCRP Report 128 as previously discussed. It

has been assumed that the number of auto trips will be lower because of the easy availability of the VRE commuter service and enhanced PRTC service. With more transit options, fewer auto trips will be generated.

Once the recommended TOD impacts were incorporated into the model, the roadway segments forecasted to operate at LOS E or F were identified using peak hour data. The study team then developed improvements (i.e. number of new lanes needed) needed by 2015 and 2030 to achieve LOS D or better for deficient roadway segments. The study team then developed planning level cost estimate for each improvement using the same cost per lane mile and right-of-way and utility cost per mile as described in the previous scenarios. Roadway segments were separated into two categories – those included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan and all remaining segments. For year 2015, a list of the roadway segments that are LOS E or F in 2015, but are improved to LOS D or better in the 2030 model was identified, but not included in the set of improvements.

Cost estimates for Scenario 3b (2015 and 2030) are shown in **Tables 25 and 27**. **Table 26** shows the roadway segments that are deficient in 2015, but improved to LOS D or better in the 2030 model. **Figures 19 and 20** graphically show the roadway segments included in the tables. The cost estimates show that to improve the road network to LOS D or better in 2015, the total cost would be $605.1 million. To improve the road network to LOS D or better in 2030, the total cost would be $748.7 million.

The forecasted impacts from the travel demand model indicate that the inclusion of TOD development in the North Woodbridge and Harbor Station areas results in a reduction in the estimated cost of addressing deficient roadways in the BRAC Study Area. The forecasted cost of addressing deficiencies for Scenario 1 – without BRAC is $598.1 million in 2015 and $733.0 million in 2030. For Scenario 3b, With BRAC and TOD, the costs are $605.1 million in 2015 and $748.7 million in 2030 – $7.0 million higher in 2015 and $15.7 million higher in 2030 than the costs for Scenario 1.

The location of the roadways forecasted to be deficient follow the pattern set with the initial study scenario. Most of the deficiencies are forecast to occur in the North Woodbridge and Triangle areas. Most of the roadways to be improved in North Woodbridge are in the transportation element of the *Comprehensive Plan*, and most of those in the Triangle area are not.

Referring to **Figures 12 and 20**, it should be noted that although the TOD development has been forecasted for the Harbor Station area (TAZs number 662, 663, 665, 668, 669 and 670), none of the roadways in the vicinity of the transit oriented development exhibit deficiencies. By reducing the number of zonal trips by 25 percent and providing a mix of uses in the immediate vicinity, fewer commuter trips (usually the longest auto trip of all trip purposes) will be generated by the development within the TAZs.

Table 25
Cost Estimate – Scenario 3b (2015 TOD Alternative)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvement.(miles)	Impromnt. Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	8-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	4	8-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	4	6-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	8-lane divided Commercial	2	F	0.24	9.50	4.56	80.0	19.2	23.8
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	4	8-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	4	6-lane divided Commercial	2	F	0.27	9.50	5.13	80.0	21.6	26.7
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	4	6-lane divided Commercial	2	F	0.33	9.50	6.27	80.0	26.4	32.7
CP-41[4]	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	F	0.25	9.50	4.74	44.8	11.2	15.9
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	F	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	F	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles East	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Dir. Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	4-lane divided Commercial	2	F	0.11	9.50	2.09	80.0	8.8	10.9
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.39	9.50	7.41	80.0	31.2	38.6
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.05	9.50	1.90	80.0	4.0	5.9
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	4-lane divided Mixed Use	2	F	0.09	9.50	1.71	60.8	5.5	7.2
TOTAL													**$605.1**

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-41 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan

Table 26
Scenario 3b – LOS E or F in 2015, Improved in 2030 Model

Roadway Section No. (See Key Map)	Road	From	To	Length of Section (miles)
CP-6	West Longview Dr	Matthews Dr	Prince William Pkwy	0.52
CP-15	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	0.21
CP-16	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	0.20
CP-20	VA 253 - Occoquan Road	Deerfield Lane	Hylton Ave	0.10
CP-21	VA 253 - Occoquan Road	Hylton Ave	VA 639 - Horner Road	0.38
CP-23	VA 639 - Horner Road	VA 253 - Occoquan Rd	Millwood Dr (E)	0.54
CP-24	VA 639 - Horner Road	Millwood Dr (E)	Millwood Dr (W)	0.45
CP-25	VA 639 - Horner Road	Millwood Dr (W)	Botts Ave	0.29
CP-26	VA 639 - Horner Road	Botts Ave	VA 639 - Summerland Dr	0.06
CP-27	Express Dr	Dawson Beach Road	VRE Woodbridge Station	0.20
CP-28	Express Dr	VRE Woodbridge Station	Ospreys View Place	0.43
CP-29	Belmont Bay Dr	Ospreys View Place	Course View Way	0.55
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	0.25
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	0.94
CP-32	Neabsco Road	US 1	East	1.16
CP-33	US 1 - SB	Possum Point Road	Mine Road	0.47
CP-34	US 1 - SB	Mine Road	Graham Park Road	0.40
CP-35	US 1 - SB	North	Bradys Hill Rd	0.27
CP-39	US 1	Long View Dr	Wigglesworth Way	0.13
21	Dawson Beach Road	US 1	Express Dr	0.09
22	Delaware Dr	Blackburn Road	East	0.15
24	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	0.45

Notes:
Segments CP-6 to CP-39 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

V.3. Scenario 3c: Future Conditions with BRAC and Mixed Use Development

As with transit oriented development, mixed use development offers the potential to reduce the amount of auto trips generated by a site either by linking trips within different uses with the mixed use development of by providing more attractive non-auto modes, such as walking and bicycling, in addition to transit. Mixing uses within several larger sites within various TAZs has the potential to offset a portion of the added trips forecasted to be generated by BRAC associated growth. To reduce overall travel demand, a strategy of encouraging mixed use development has been included as an alternative for the analysis of a with BRAC impacts scenario**.**

Table 27
Cost Estimate – Scenario 3b (2030 TOD Alternative)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvmnt. (miles)	Improvmnt Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	6	8-lane divided Commercial	2	F	0.29	9.50	5.51	80.0	23.2	28.7
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	6	8-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	6	10-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-10[4,5]	US 1	Featherstone Rd	Reddy Dr	6	8-lane divided Commercial	2	E	0.23	9.50	4.37	80.0	18.4	22.8
CP-11[4]	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-12[4]	Neabsco Mills Rd	Dale Blvd	0.28 miles N	4	6-lane divided Mixed Use	2	F	0.28	9.50	5.32	60.8	17.0	22.3
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	6	10-lane divided Commercial	4	F	0.27	9.50	10.26	80.0	21.6	31.9
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	6	8-lane divided Commercial	2	E	0.33	9.50	6.27	80.0	26.4	32.7
CP-41[4]	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	E	0.25	9.50	4.74	44.8	11.2	15.9
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	F	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
5	Mine Road	US 1 SB	Fairfax St	2	4-lane undivided Residential	2	F	0.14	9.50	2.66	44.8	6.3	8.9
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	E	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	E	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles East	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Dir. Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	6-lane divided Commercial	4	F	0.11	9.50	4.18	80.0	8.8	13.0
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.35	9.50	6.65	80.0	28.0	34.7
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.03	9.50	1.14	80.0	2.4	3.5
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	6-lane divided Mixed Use	4	F	0.09	9.50	3.42	60.8	5.5	8.9
19	Possum Point Road	US 1	Leonard St	2	4-lane undivided Residential	2	E	0.41	9.50	7.79	44.8	18.4	26.2
20[6]	Graham Park Road	Woodland Dr	Vanetta Ct	2	4-lane undivided Residential	2	E	0.34	9.50	3.23	44.8	15.2	18.5
25	Mine Road	Fairfax St	Van Buren Rd	2	4-lane undivided Residential	2	F	0.33	9.50	6.27	44.8	14.8	21.1
26	Delaware Dr	US 1	East	2	4-lane divided Mixed Use	2	E	0.08	9.50	1.52	60.8	4.9	6.4
TOTAL													**$748.7**

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2030.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-41 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- East Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Neabsco Mills Road is recommended to remain a four-lane roadway in the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan

[5] Road Section No. CP-10 (US 1 between Featherstone Road and Reddy Drive) is recommended as a six-lane roadway in the CIP. However, with projected 2030 No BRAC conditions, an eight-lane section is necessary at this location.

[6] Road Section No. 20 (Graham Park Road between Woodland Drive and Vanetta Court) is recommended as a 4-lane roadway. This section of roadway currently varies from 2-4 lanes. The cost estimate reflects improving the entire segment to contain 4 lanes.

While numerous studies have been performed on various mixed use developments, no defined methodology to compute valid and reliable estimates of the number of trips that would remain within the development – also known as estimates of internal capture – has been recognized by the profession. The National Cooperative Highway Research Program (NCHRP) is currently developing a method for classifying mixed use development and a guide for data collection efforts, all with the intent of better estimating the potential for internal trip capture. However, the report is not expected until December 2009 (NCHRP #08-51).

Until the publishing of the report for HCHRP #08-51, the only recognized method for estimating the reduction in traffic from mixed use development is detailed in the ITE publication, Trip Generation Handbook[4]. The method defined in the Trip Generation Handbook estimates the number of internal trips in a mixed use development that includes office, residential and retail uses. Using estimated capture rates between trips entering and exiting each use with each other use, estimates of the total number of captured trip are computed. However, the rates used for trip capture estimation between office and residential and between office and retail are relatively low – two to three percent between retail and office, and two percent between office and residential. For a substantial proportion of total trips to be captured within a mixed use development, a significant number of the site trips must be related to retail activities.

To evaluate the impact of mixed use developments on the forecasted roadway system in the BRAC Study Area, a series of mixed use develop forecasts were developed within several TAZs. The mixed use development included office, residential and retail. Residential densities were moderate to high, with most units forecasted to be multi-family. None were forecasted to be single-family detached units. Commercial development was split among office, retail and other uses. The retail component was as high as 50 percent on several TAZs in the Neabsco Mills area, and as low as 30 percent in the eastern Harbor Station area. In general, densities of both residential and commercial increased with proximity to the Route 1 corridor.

The distributions of household, population and employment growth for Scenario 3c – with BRAC Mixed Use are shown in **Figures 21, 22, and 23**, respectively. The figures show how the distribution of mixed use development has been dispersed throughout the BRAC Study Area. The total forecasts for the 2015 and 2030 socioeconomic variables for Scenario 3c: with BRAC and Mixed Use Development are presented in **Table 28** for households and population and **Table 29** for employment. Using the method for computing internal trip capture as detailed in Trip Generation Handbook, estimates of the proportion of captured trips were calculated. On average 7 percent of the total trips were estimated to be captured within the development. As previously stated, TOD and mixed use developments can be similar in terms of land uses. Only the former is forecast to generate lower external auto trip rates due to the availability of transit service, whereas the latter is forecast to generate lower external trip rates due to the internal capture of trips. Although this analysis methodology could have reduced the mixed use external trip rates by 25 percent in those TAZ in North Woodbridge and Harbor Station because of the proximity of the VRE stations, the results would not have presented a clear distinction between the different land use management strategies. If external trips had been reduced to reflect transit service in the Alternative 3c analysis, the results may have interpreted to indicate that pursuing a mixed use development strategy would be as effective as pursuing a TOD strategy in achieving the offset of BRAC transportation impacts. To avoid the potential for mis-

[4] *Trip Generation Handbook*. Institute of Transportation Engineers, Washington, D.C. 2004.

interpretation of the alternatives analysis results, no external trip reductions associated with transit service have been applied to the mixed-use development trip generation volumes.

Table 28
Forecasts and Estimates: 2005, 2015 and 2030
Population and Housing with BRAC Mixed Use

Year	Single-Family Units	Townhouse Units	Multi-Family Units	Group Qtrs.	Total Population
2005	77,694	35,074	26,201	4,235	399,840
2015	91,950	40,146	40,538	5,272	496,215
2030	111,027	46,772	60,101	6,827	627,126

Table 29
Forecasts and Estimates: 2005, 2015 and 2030
Employment with BRAC Mixed Use

Year	Industrial Employment	Retail Employment	Office Employment	Other Employment	Total Employment
2005	34,927	39,770	41,232	21,951	137,880
2015	40,154	51,721	59,265	24,591	175,731
2030	45,769	66,781	83,030	27,189	221,566

Considering the low proportion of trips that have been forecast to be captured within each mixed use development, the findings that Scenario 3c would produce a collection of roadway deficiencies that would be the most expensive of all the alternatives to address should not come as a surprise. The cost of addressing deficiencies in 2015 and 2030 is addressed in the following section. The high number of units and employees in the Neabsco Mills and the Harbor Station area are generating traffic volumes that exceed those in the other alternatives, and consequently, the number of deficient roadway segments in these areas is also greater.

Once the mixed use development was incorporated into the model, the roadway segments forecasted to operate at LOS E or F were identified using peak hour data. the study team then developed improvements (i.e. number of new lanes needed) needed by 2015 and 2030 to achieve LOS D or better for deficient roadway segments. the study team then developed planning level cost estimate for each improvement using the same cost per lane mile and right-of-way and utility cost per mile as described in the previous scenarios. Roadway segments were separated into two categories – those included in the Transportation Plan element of the 2008 *Comprehensive Plan* and all remaining segments. For year 2015, a list of the roadway segments that are LOS E or F in 2015, but are improved to LOS D or better in the 2030 model was identified, but not included in the set of improvements.

Cost estimates for Scenario 3c (2015 and 2030) are shown in **Tables 30 and 32**. **Table 31** shows the roadway segments that are deficient in 2015, but improved to LOS D or better in the 2030 model. **Figures 24 and 25,** located in the Appendix, graphically show the roadway segments included in the tables. The cost estimates show that to improve the road network to LOS D or better in 2015, the total cost would be $751.5 million. To improve the road network to LOS D or better in 2030, the total cost would be $1.02 billion.

Table 30
Cost Estimate – Scenario 3c (2015 Mixed Use Alternative)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvmnt (miles)	Improvmnt Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	8-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	4	8-lane divided Commercial	4	F	0.29	9.50	11.02	80.0	23.2	34.2
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	4	6-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	4	8-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane undivided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	4	6-lane divided Commercial	2	F	0.27	9.50	5.13	80.0	21.6	26.7
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	4	6-lane divided Commercial	2	F	0.33	9.50	6.27	80.0	26.4	32.7
CP-30[4]	Blackburn Road	Reddy Dr	Maryland Ave	2	4-lane undivided Residential	2	E	0.25	9.50	4.78	44.8	11.3	16.1
CP-31[4]	US 1	Port Potomac Ave	Powells Creek Blvd	4	6-lane divided Commercial	2	F	0.94	9.50	17.77	80.0	74.8	92.6
CP-41[4]	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	F	0.25	9.50	4.74	44.8	11.2	15.9
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	F	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	F	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles East	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 - Joplin Rd	I-95 SB Dir. Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	4-lane divided Commercial	2	F	0.11	9.50	2.09	80.0	8.8	10.9
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.39	9.50	7.41	80.0	31.2	38.6
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.05	9.50	1.90	80.0	4.0	5.9
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	4-lane divided Mixed Use	2	F	0.09	9.50	1.71	60.8	5.5	7.2
TOTAL													**$751.5**

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-41 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan

Table 31
Scenario 3c – LOS E or F in 2015, Improved in 2030 Model

Roadway Section No. (See Key Map)	Road	From	To	Length of Section (miles)
CP-15	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	0.21
CP-16	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	0.20
CP-20	VA 253 - Occoquan Road	Deerfield Lane	Hylton Ave	0.10
CP-21	VA 253 - Occoquan Road	Hylton Ave	VA 639 - Horner Road	0.38
CP-23	VA 639 - Horner Road	VA 253 - Occoquan Rd	Millwood Dr (E)	0.54
CP-24	VA 639 - Horner Road	Millwood Dr (E)	Millwood Dr (W)	0.45
CP-25	VA 639 - Horner Road	Millwood Dr (W)	Botts Ave	0.29
CP-26	VA 639 - Horner Road	Botts Ave	VA 639 - Summerland Dr	0.06
CP-27	Express Dr	Dawson Beach Road	VRE Woodbridge Station	0.20
CP-28	Express Dr	VRE Woodbridge Station	Ospreys View Place	0.43
CP-29	Belmont Bay Dr	Ospreys View Place	Course View Way	0.55
CP-32	Neabsco Road	US 1	East	1.16
CP-33	US 1 - SB	Possum Point Road	Mine Road	0.47
CP-34	US 1 - SB	Mine Road	Graham Park Road	0.40
CP-35	US 1 - SB	North	Bradys Hill Rd	0.27
CP-36	VA 123 - Gordon Blvd	NB I-95 Directional Ramps	Annapolis Way	0.17
CP-39	US 1	Long View Dr	Wigglesworth Way	0.13
CP-46	US 1	River Ridge Blvd	River Heritage Blvd	0.33
21	Dawson Beach Road	US 1	Express Dr	0.09
22	Delaware Dr	Blackburn Road	East	0.15
24	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	0.45

Notes:
Segments CP-15 to CP-46 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

Table 32
Cost Estimate – Scenario 3c (2030 Mixed Use Alternative)

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvmnt (miles)	Improvmnt Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	6	8-lane divided Commercial	2	F	0.29	9.50	5.51	80.0	23.2	28.7
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	6	8-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-4[4]	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	6	10-lane divided Commercial	4	F	0.24	9.50	9.12	80.0	19.2	28.3
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	6	10-lane divided Commercial	4	F	0.21	9.50	7.98	80.0	16.8	24.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane divided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-10[4,5]	US 1	Featherstone Rd	Reddy Dr	6	8-lane divided Commercial	2	E	0.23	9.50	4.37	80.0	18.4	22.8
CP-11[4]	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-12[4]	Neabsco Mills Rd	Dale Blvd	0.28 miles N	4	6-lane divided Mixed Use	2	F	0.28	9.50	5.32	60.8	17.0	22.3
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	6	8-lane divided Commercial	2	F	0.27	9.50	5.13	80.0	21.6	26.7
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	6	8-lane divided Commercial	2	E	0.33	9.50	6.27	80.0	26.4	32.7
CP-19[4]	Dale Blvd	I-95	Neabsco Mills Rd	4	6-lane divided Mixed Use	2	E	0.18	9.50	3.42	60.8	10.9	14.4
CP-30[4]	Blackburn Road	Reddy Dr	Maryland Ave	2	4-lane undivided Residential	2	E	0.25	9.50	4.78	44.8	11.3	16.1
CP-31[4]	US 1	Port Potomac Ave	Powells Creek Blvd	6	8-lane divided Commercial	2	E	0.94	9.50	17.77	80.0	74.8	92.6
CP-41[4]	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	E	0.25	9.50	4.74	44.8	11.2	15.9
CP-42[4]	Blackburn Road	Featherstone Rd	Reddy Dr	2	4-lane undivided Residential	2	E	0.20	9.50	3.80	44.8	9.0	12.8
1	East Longview Dr	US 1	Bayside Ave	2	4-lane undivided Residential	2	E	0.19	9.50	3.61	44.8	8.5	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2	4-lane undivided Residential	2	F	0.42	9.50	7.98	44.8	18.8	26.8
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	F	0.27	9.50	5.13	80.0	21.6	26.7
4	Maryland Ave	US 1	Winding Loop	2	4-lane undivided Mixed Use	2	F	0.13	9.50	2.47	60.8	7.9	10.4
5	Mine Road	US 1 SB	Fairfax St	2	4-lane undivided Residential	2	F	0.14	9.50	2.66	44.8	6.3	8.9
6	Graham Park Road	US 1 SB	US 1 NB	2	4-lane divided Commercial	2	E	0.06	9.50	1.14	80.0	4.8	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	E	0.05	9.50	0.95	44.8	2.2	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles East	2	4-lane undivided Residential	2	F	0.06	9.50	1.14	44.8	2.7	3.8
10	VA 619 -	I-95 SB Directional	I-95 SB Loop	2	4-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvmnt (miles)	Improvmnt Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
	Joplin Rd	Ramps	Ramp										
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	6-lane divided Commercial	4	F	0.11	9.50	4.18	80.0	8.8	13.0
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.35	9.50	6.65	80.0	28.0	34.7
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.03	9.50	1.14	80.0	2.4	3.5
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2	6-lane divided Mixed Use	4	F	0.09	9.50	3.42	60.8	5.5	8.9
19	Possum Point Road	US 1	Leonard St	2	4-lane undivided Residential	2	F	0.41	9.50	7.79	44.8	18.4	26.2
20[6]	Graham Park Road	Woodland Dr	Vanetta Ct	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
25	Mine Road	Fairfax St	Van Buren Rd	2	4-lane undivided Residential	2	F	0.33	9.50	6.27	44.8	14.8	21.1
26	Delaware Dr	US 1	East	2	4-lane divided Mixed Use	2	E	0.08	9.50	1.52	60.8	4.9	6.4
27	Possum Point Road	Leonard St	East	2	4-lane undivided Residential	2	E	1.33	9.50	25.27	44.8	59.6	84.9
28	Possum Point Road	1.74 miles E of US 1	East	2	4-lane undivided Residential	2	E	0.24	9.50	4.56	44.8	10.8	15.3
TOTAL													**$1,015.9**

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2030.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-42 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Neabsco Mills Road is recommended to remain a four-lane roadway in the Comprehensive Plan
- Dale Boulevard is recommended to remain a four-lane roadway in the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan

[5] Road Section No. CP-10 (US 1 between Featherstone Road and Reddy Drive) is recommended as a six-lane roadway in the CIP. However, with projected 2030 No BRAC conditions, an eight-lane section is necessary at this location.

[6] Road Section No. 20 (Graham Park Road between Woodland Drive and Vanetta Court) is recommended as a 4-lane roadway. This section of roadway currently varies from 2-4 lanes. The cost estimate reflects improving the entire segment to contain 4 lanes.

VI. PREFERRED ALTERNATIVE

The findings of the Analysis of Alternatives highlights that the most effective way for offsetting the transportation impacts of forecasted added traffic volumes from BRAC activities involves a combination actions including modifying land use plans and policies, enhancing transit service and improving roadways.

When considering an overall strategy, it must be recognized that each of the three actions (or tactics) has limitations that would compromise its ability by itself to achieve an offset of impacts. For example, in the analysis of encouraging mixed-use development along certain sections of the Route 1 corridor, it was evident that enhancing the retail component of the mixed-use equation would increase the rate of internal trip capture. However, the location of the Route 1 corridor in relation to the regional retail commercial complex (featuring Potomac Mills) on the west side of I-95 that extends from Dale Boulevard to Prince William Parkway makes the likelihood of extensive regional retail development relatively low beyond that already approved Stonebridge and Potomac Town Center.. Consequently, the limited retail potential along the Route 1 corridor limits the effectiveness of offsetting BRAC transportation impacts by implementing a mixed-use development land use management approach without highly specific orientation to enhanced transit.

In the analysis of enhancing transit service to support transit oriented development the two points of focus of the transit service development (TOD) was the VRE stations at Woodbridge and at Harbor Station (proposed station). While the Fredericksburg line has two other stations that are located within the County (Rippon Landing and Quantico), neither was considered a viable candidate for redevelopment to TOD. Rippon Landing is next to the Featherstone National Wildlife Refuge and has single-family and multi-family housing in the station vicinity. Supporting access to the station with PRTC fixed-route service would create a lengthy transit route through relatively low-density single-family development. The impact on auto trip generation would likely be minimal and comparatively costly. The Quantico VRE station is in a developed area and also near environmentally sensitive areas. Its surroundings exhibit very limited potential for redevelopment into TOD. Consequently, there are only two VRE station locations (one existing and one planned) where the surrounding land can be planned to accommodate transit oriented development – Woodbridge and Harbor Station.

The third tactic – improving roadways – can by itself effectively offset the transportation impacts of BRAC activities. However, pursuit of this tactic as the exclusive component of the overall strategy would bring it into conflict with two major limitations, cost and right of way impacts. As detailed in the analysis of Scenario 3a (BRAC with Roadway Improvements) the cost of over $770 million to address all identified roadway needs through the year 2030 substantially outstrips even the most optimistic estimates of available transportation funds. Moreover, the analysis also showed that widening Route 1 may attract motorists who divert from the I-95 corridor, a change in route selection that will have the effect of reducing service levels on the widened Route 1 roadway.

In summary, the analysis of alternatives shows that the transportation impacts of BRAC can be offset in whole or in part by individual tactics, but that the greatest offset of impacts would be produced by a coordinated strategy using all three tactics. As a result, the overall strategy of the Preferred Alternative builds on the findings of studies of the trip making characteristics of transit oriented development, incorporates the general findings of the Alternative Analysis, and expands the application of both findings to produce a more efficient land use and transportation system in the Study Area. The forecasted efficiencies gained with implementation of this strategy will more than offset the transportation impacts of BRAC activities.

VI.1. Preferred Alternative Defined

VI.1.1. Preferred Alternative Land Use

The proposed land use policies for the Preferred Alternative focus on promoting transit oriented development in three locations in the Study Area. The first two are similar with those TOD areas used in the analysis of Scenario 3B – Transit Oriented Development – while the third (Neabsco Mills) has been developed based on adopted recommendations in the *Potomac Communities Revitalization Plan.* The locations of the specific TAZs recommended for TOD development and redevelopment are shown in **Figures 27 and 28**, and are described below:

1. **North Woodbridge (TAZ# 566, 572 & 573):** As part of the *Potomac Communities Revitalization Plan* all of TAZ 566 and 572 and part of TAZ 573 have been recommended for redevelopment to Urban Mixed Use (UMU). With the location of the VRE Woodbridge station within walking distance, planned redevelopment should include densities and mixes of use sufficient to become transit oriented. As proposed, the TOD development area would accommodate 4,310 multi-family units and 2,395 total employees. The FAR for non-residential uses is recommended at 0.5, and 40% of the non-residential floor area is in retail use.
2. **Harbor Station (TAZ# 662, 663, 665, 668-670):** Generally within walking distance of the planned Cherry Hill VRE station, these TAZs have been recommended for redevelopment to Urban Mixed Use (UMU). While situated in a more remote location from the Route 1 corridor, the planned development should be denser than that proposed for any of the adjacent undeveloped TAZs to the west. As proposed, the TOD development area would accommodate 7,386 multi-family units and 1,551 total employees. Recognizing that the remote location diminishes the potential for densities equivalent with those in Woodbridge, the FAR for non-residential uses is recommended at 0.3. Recognizing also that the distance from the Route 1 corridor diminishes the potential for major retail use, 25% of the non-residential floor area is in retail use.
3. **Neabsco Mills: (TAZ# 578, 581, 584, 585 & 588):** As part of the ***Potomac Communities Revitalization Plan***, parts of these TAZs have been recommended for redevelopment to Urban Mixed Use (UMU). Unlike the North Woodbridge TOD area, Neabsco Mills does not have access to a VRE station within walking distance. To address this access need, it is being proposed as part of the land use recommendation that PRTC service between the PRTC transfer station and VRE Woodbridge station along Route 1 be enhanced to 15-minute headways from 5:30 AM to 7:00 PM.

Planned development and redevelopment should include densities and mixes of use sufficient to become transit oriented. As proposed, the TOD development area would accommodate 1,746 multi-family units and 1,386 total employees. The FAR for non-residential uses is recommended at 0.4, and with access to the Route 1 and Optiz Boulevard corridors 65% of the non-residential floor area is in retail use.

The forecasted socioeconomic variables used by the travel demand model are presented for population and housing in **Table 33** and for employment in **Table 34**.

Table 33
Estimates: 2005, 2015 and 2030
Population and Housing

Year	Single-Family Units	Townhouse Units	Multi-Family Units	Group Qtrs.	Total Population
2005	77,694	35,074	26,201	4,235	399,840
2015	92775	39,913	41,719	5,272	499,883
2030	113,088	457,85	63,688	6,827	636,270

Table 34
Forecasts and Estimates: 2005, 2015 and 2030
Employment

Year	Industrial Employment	Retail Employment	Office Employment	Other Employment	Total Employment
2005	34,927	39,770	41,232	21,951	137,880
2015	39,765	50,903	58,331	24,400	173,399
2030	45,769	66,049	82,174	27,178	221,171

VI.1.2. Preferred Alternative Network Modifications

For the 2015 analysis of the Preferred Alternative, several improvements were added to the existing network. These were the same improvements added to the 2015 travel demand model network in the Analysis of Alternatives, and include:

- University Boulevard from Route 234 Bypass to Sudley Manor Drive
- Prince William Parkway from Hoadly Road to Old Bridge Road.
- US 1 from Joplin Road to Bradys Hill Road
- Purcell Road from Dumfries Road to Running Deer Road
- Minnieville Road from Cardinal Drive to Spriggs Lane
- Route 15 from I-66 to Sudley Road
- Old Carolina from Route 15 to Heathcote Boulevard

In addition, the 2030 travel demand model network included the widening of Route 1 to six lanes. In the Analysis of Alternatives section, the cost of improvements to Route 1 reflected only those needed to address deficiencies exhibited by the six lane facility. For example, where the

deficiency on Route 1 indicated that eight lanes would be needed, the cost of adding only two lanes was included in the improvement cost, since the widening to six lanes had been included in the network as part of the ***Comprehensive Plan***. In contrast, for the forecast of improvements to address 2015 deficiencies, the costs of all improvements to Route 1 (widening beyond the existing four lanes) were included, since widening of Route 1 had not been specified in the list of 2015 network improvements listed above.

In conducting the alternatives analysis for the With BRAC and Without BRAC scenarios described in the preceding sections, deficiencies were addressed regardless of the status of the related improvements. The tables of projects showed that some improvements were included in the ***Comprehensive Plan*** while others were not. This provided a basis on which to compare the extent of the impacts among the various alternatives.

In contrast, development of the Preferred Alternative roadway improvements were developed to be more consistent with the transportation element of the ***Comprehensive Plan***. After review of the list of projects in the Analysis of Alternatives section, there was concern expressed for the potential for unacceptable impacts to development along adjacent rights of way. There were exceptions to this approach which were generally located in the vicinity of MCB Quantico to the south within the Study Area. Specifically, improvements to Brady's Hill Road, Old Triangle Road, Joplin Road, Fuller Heights Road and Possum Point Road have been included.

In addition to modification to the travel demand model network, the assignment of trips to and from the TAZs in which TOD development or redevelopment has been included has been reduced by 25 percent. The basis for this trip reduction was discussed in the analysis of the Scenario 3b, With BRAC and Transit Oriented Development. For the Woodbridge and Harbor Station areas, the presence of the VRE service within walking distance and the mix of uses meet the definition of transit oriented development. For the Neabsco Mills area, the addition of PRTC service with 15-minute headways and the mix of uses meet the definition of transit oriented development.

VI.1.3. Transit Service Enhancements

As previously stated, to provide transit service sufficient to maintain a substantial shift in the proportion of daily and peak hour trips to the transit mode, frequent and reliable transit service must be available. While the proximity of the VRE station to North Woodbridge and the planned station at Harbor Station sustain the definition of the proposed urban mixed use development in these two areas as transit oriented, there is no current frequent and reliable transit service in the vicinity of Neabsco Mills. To address this deficiency, the Preferred Alternative includes establishment of a transit route between the PRTC Transfer Station at Potomac Mills Road to the Woodbridge VRE station. With 15- minute headways provided between 5:30 AM and 7:00 PM on weekdays and 30-minute headways provided during off-peak periods on weekdays, weekends, and holidays, the recommended service enhancement would enable reclassifying all urban mixed uses developed or redeveloped along the service corridor as transit oriented.

Current *OnmiLink* service along Route 1 connects the Town of Quantico in the south with Woodbridge to the north. Headways generally are one hour. With the establishment of the recommended service enhancement along the Route 1 corridor to the north, the existing Route 1 service could be re-routed to terminate at the PRTC Transfer Station. From there, riders would pick up the more frequent service to the north on Route 1.

In addition, PRTC offers a route diversion service, permitting riders to call in for pick-up off the main route. Although this service assists riders, it compromises the ability to keep service on schedule – a requirement for maintaining both frequent and reliable service to TOD developments. An examination of providing route diversion for the recommended service to evaluate the impacts on ridership and reliability would be appropriate prior to providing the service.

The costs for providing the recommended service are estimated as follows:

Capital Cost (Four (4) *OmniLink* vehicles at $353,336 each): **$1,413,344**
Annual Operating Costs (13,770 revenue hours @ $103.00/hr): **$1,418,310**

The proposed enhanced service would likely result in reductions in service from route modifications on the existing Woodbridge/Lake Ridge and Route 1 *OmniLink* routes. Potential cost savings from these service modifications have not been considered in this analysis, but would be defined in the detailed transit service study included in the recommendations listed below.

Based on fare box recovery factors estimated by PRTC, fares would cover approximately 13% of annual operating costs, leaving a deficit of approximately $1,233,548. A simple accrual of the annual operating deficit from 2010 through the year 2030 would equal $24,671,000. However, the enhanced transit service would not start until the proposed transit oriented development had advanced to the development stage and forecasts of actual occupancy could be predicted. Leading up to that time, the County should coordinate with PRTC to modify existing routes and facilities to provide for the eventual enhancement. Additional implementation measures will be discussed in the next section of this report.

VI.2. Preferred Alternative Analysis Results

The results of the travel demand model analysis and the 2015 and 2030 Preferred Alternative cost estimates are shown in **Tables 35 and 36**. **Figures 26** and **27** graphically show the roadway segments included in the cost estimates. The estimated cost of the 2015 Preferred Alternative is $570.8 million and the estimated cost of the 2030 Preferred Alternative is $913.3 million.

Although improvements are recommended for the 2030 Preferred Alternative, there will still be deficiencies in the network. **Table 37** shows the road segments that are LOS E or F in 2015, including the segments that are improved to LOS D or better in the 2030 model. **Table 38** shows the road segments that are LOS E or F in 2030 with all recommended roadway improvements in-place. The aforementioned **Figures 26** and **27** also show these deficient segments in addition to the roadway improvements included in the 2030 Preferred Alternative cost estimate.

The 2030 costs for the Preferred Alternative roadway improvements are lower that those for any of the alternatives previously analyzed. By reducing the number of auto trips generated by areas recommended for TOD development and by eliminating major roadway improvements that would produce unacceptable impacts to adjacent rights of way, the overall cost is reduced.

Table 39 provides a summary of all scenarios that were examined and the network deficiencies in each scenario.

Table 35
Cost Estimate – 2015 Preferred Alternative

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvemnt (miles)	Improvemnt Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-1[4]	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	6-lane divided Commercial	2	F	0.24	9.50	4.56	80.0	19.2	23.8
CP-2[4]	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	4	6-lane divided Commercial	2	F	0.29	9.50	5.51	80.0	23.2	28.7
CP-3[4]	US 1	Rosedale Ct	Featherstone Rd	4	6-lane divided Commercial	2	E	0.19	9.50	3.61	80.0	15.2	18.8
CP-5[4]	US 1	Cardinal Dr	Port Potomac Ave	4	6-lane divided Commercial	2	F	0.21	9.50	3.99	80.0	16.8	20.8
CP-6[4]	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane undivided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7[4]	West Longview Dr	Montgomery Ave	0.39 miles N	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8[4]	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-11[4]	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-13[4]	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	4	6-lane divided Commercial	2	F	0.27	9.50	5.13	80.0	21.6	26.7
CP-14[4]	US 1	Mt. Pleasant Dr	East Longview Dr	4	6-lane divided Commercial	2	F	0.33	9.50	6.27	80.0	26.4	32.7
CP-15[4]	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	6-lane divided Commercial	2	F	0.21	9.50	3.99	80.0	16.8	20.8
CP-16[4]	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	4	6-lane divided Mixed Use	2	F	0.20	9.50	3.80	60.8	12.2	16.0
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
10	VA 619 - Joplin Rd	I-95 SB Directional Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	4-lane divided Commercial	2	F	0.11	9.50	2.09	80.0	8.8	10.9
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.39	9.50	7.41	80.0	31.2	38.6
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.05	9.50	1.90	80.0	4.0	5.9
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	E	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
TOTAL													**$570.8**

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2015.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-1 to CP-16 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- US 1 is recommended as a six-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Horner Road/Summerland Drive is recommended to remain a four-lane roadway in the Comprehensive Plan

Table 36
Cost Estimate – 2030 Preferred Alternative

Roadway Section No. (See Key Map)	Road	From	To	No-Build No. of Lanes[1]	Proposed Improvement to Achieve LOS D or Better & Prevalent Land Use	No. of New lanes	No-Build LOS	Length of Improvemnt (miles)	Improvemnt Cost Per Lane Mile ($ million)[2]	Construction Cost ($ million)	Right-of-Way & Utilities Cost Per Mile ($ million)[3]	Right-of-Way & Utilities Cost ($ million)	Total Cost ($ million)
CP-6	West Longview Dr	Matthews Dr	Prince William Pkwy	2	4-lane divided Residential	2	E	0.52	9.50	9.88	44.8	23.3	33.2
CP-7	West Longview Dr	Montgomery Ave	North	2	4-lane undivided Residential	2	E	0.39	9.50	7.41	44.8	17.5	24.9
CP-8	Montgomery Ave	West Longview Dr	Opitz Blvd	2	4-lane divided Mixed Use	2	E	0.53	9.50	10.07	60.8	32.2	42.3
CP-11	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	2	4-lane undivided Residential	2	E	0.34	9.50	6.46	44.8	15.2	21.7
CP-12	Neabsco Mills Rd	Dale Blvd	North	4	6-lane divided Mixed Use	2	E	0.28	9.50	5.32	60.8	17.0	22.3
CP-15	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	4	6-lane divided Commercial	2	E	0.21	9.50	3.99	80.0	16.8	20.8
CP-16	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	4	6-lane divided Mixed Use	2	F	0.20	9.50	3.80	60.8	12.2	16.0
CP-18	VA 3000 - Prince William Parkway	I-95 Ramps	Summerland Dr	4	6-lane divided Mixed Use	2	E	0.22	9.50	4.18	60.8	13.4	17.6
CP-19	Dale Blvd	I-95	Neabsco Mills Rd	4	6-lane divided Mixed Use	2	E	0.18	9.50	3.42	60.8	10.9	14.4
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	2	4-lane undivided Residential	2	E	0.25	9.50	4.75	44.8	11.2	16.0
CP-41	Blackburn Road	Maryland Ave	Delaware Dr	2	4-lane undivided Residential	2	F	0.25	9.50	4.75	44.8	11.2	16.0
CP-42	Blackburn Road	Featherstone Rd	Reddy Dr	2	4-lane undivided Residential	2	E	0.20	9.50	3.80	44.8	9.0	12.8
CP-44	Neabsco Mills Rd	Opitz Blvd	Potomac Branch Dr	4	6-lane divided Mixed Use	2	E	0.13	9.50	2.47	60.8	7.9	10.4
CP-45	Neabsco Mills Rd	Potomac Branch Dr	Sheffield Way	4	6-lane divided Mixed Use	2	E	0.30	9.50	5.70	60.8	18.2	23.9
3	Reddy Dr	US 1	Blackburn Rd	2	4-lane divided Commercial	2	E	0.27	9.50	5.13	80.0	21.6	26.7
7	Bradys Hill Rd	US 1	Old Triangle Rd	2	4-lane undivided Residential	2	F	0.19	9.50	3.61	44.8	8.5	12.1
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	2	4-lane undivided Residential	2	F	0.05	9.50	0.95	44.8	2.2	3.2
10	VA 619 - Joplin Rd	I-95 SB Directional Ramps	I-95 SB Loop Ramp	2	4-lane divided Commercial	2	F	0.19	9.50	3.61	80.0	15.2	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2	6-lane divided Commercial	4	F	0.11	9.50	4.18	80.0	8.8	13.0
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	4	6-lane divided Commercial	2	F	0.35	9.50	6.65	80.0	28.0	34.7
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	2	6-lane divided Commercial	4	F	0.03	9.50	1.14	80.0	2.4	3.5
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2	4-lane divided Commercial	2	E	0.16	9.50	3.04	80.0	12.8	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2	4-lane undivided Mixed Use	2	F	1.20	9.50	22.80	60.8	73.0	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2	4-lane undivided Mixed Use	2	E	0.41	9.50	7.79	60.8	24.9	32.7
19	Possum Point Road	US 1	Leonard St	2	4-lane undivided Residential	2	E	0.41	9.50	7.79	44.8	18.4	26.2
													$574.5

Notes:

[1] No-Build No. of Lanes: Number of total lanes in the travel demand model based on the facilities in the CLRP for 2030.

[2] Improvement Cost Per Lane Mile: Based on recent project cost estimates in the vicinity of the Study Area

[3] Right-of-Way and Utilities Cost Per Mile: Based on recent project cost estimates in the vicinity of the Study Area

[4] Segments CP-6 to CP-45 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

- West Longview Dr/Montgomery Ave is recommended to remain a two-lane roadway in the Comprehensive Plan; Conventional road widening is not feasible according to the Comprehensive Plan
- Neabsco Road is recommended as a four-lane roadway in the Comprehensive Plan
- Horner Road/Summerland Drive is recommended to remain a four-lane roadway in the Comprehensive Plan
- Neabsco Mills Road is recommended to remain a four-lane roadway in the Comprehensive Plan
- Prince William Parkway is recommended to remain a four-lane roadway in the Comprehensive Plan
- Dale Boulevard is recommended to remain a four-lane roadway in the Comprehensive Plan
- Blackburn Road is recommended to remain a two-lane roadway in the Comprehensive Plan

Table 37
Preferred Alternative (2015) - LOS E or F

Road Segment	Road	From	To	LOS
CP-1	US 1	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	F
CP-2	US 1	VA 253 - Occoquan Rd	1/2 way to Mt. Pleasant Dr	F
CP-3	US 1	Rosedale Ct	Featherstone Rd	F
CP-4	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	F
CP-5	US 1	Cardinal Dr	Port Potomac Ave	F
CP-8	Montgomery Ave	West Longview Dr	Opitz Blvd	E
CP-9	Blackburn Road	Maryland Ave	Delaware Dr	E
CP-13	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	F
CP-14	US 1	Mt. Pleasant Dr	Long View Dr	E
CP-16	VA 639 - Summerland Dr	VA 639 - Horner Road	Prince William Pkwy	E
CP-20	VA 253 - Occoquan Road	Deerfield Lane	Hylton Ave	E
CP-21	VA 253 - Occoquan Road	Hylton Ave	VA 639 - Horner Road	E
CP-22	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	F
CP-23	VA 639 - Horner Road	VA 253 - Occoquan Rd	Millwood Dr (E)	F
CP-24	VA 639 - Horner Road	Millwood Dr (E)	Millwood Dr (W)	F
CP-25	VA 639 - Horner Road	Millwood Dr (W)	Botts Ave	F
CP-26	VA 639 - Horner Road	Botts Ave	VA 639 - Summerland Dr	F
CP-27	Express Dr	Dawson Beach Road	VRE Woodbridge Station	F
CP-28	Express Dr	VRE Woodbridge Station	Ospreys View Place	E
CP-29	Belmont Bay Dr	Ospreys View Place	Course View Way	E
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	E
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	F
CP-32	Neabsco Road	US 1	1.16 miles E	E
CP-33	US 1 - SB	Possum Point Road	Mine Road	F
CP-34	US 1 - SB	Mine Road	Graham Park Road	F
CP-35	US 1 - SB	0.27 miles N	Bradys Hill Rd	F
1	Long View Dr	US 1	Bayside Ave	E
2	Long View Dr	Bayside Ave	Colchester Rd	F
3	Reddy Dr	US 1	Blackburn Rd	E
4	Maryland Ave	US 1	Winding Loop	F
6	Graham Park Road	US 1 SB	US 1 NB	F
7	Bradys Hill Rd	US 1	Old Triangle Rd	F
8	Old Triangle Rd	Bradys Hill Rd	Woodland Dr	F
9	Woodland Dr	Old Triangle Rd	0.06 miles E	F
10	VA 619 - Joplin Rd	I-95 SB Directional Ramps	I-95 SB Loop Ramp	F
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	F
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	F
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	F
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	E
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	E
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	E
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	F
18	Botts Ave	Prince William Pkwy	VA 639 - Horner Rd	F
21	Dawson Beach Road	US 1	Express Dr	E
22	Delaware Dr	Blackburn Road	0.15 miles E	E

Segments that are LOS E or F in 2015, but are improved to LOS D or better in the 2030 model

Note: Segments CP-1 to CP-35 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

Table 38
Preferred Alternative (2030) - LOS E or F

Road Segment	Road	From	To	LOS
CP-4	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	F
CP-5	US 1	Cardinal Dr	Port Potomac Ave	F
CP-42	Blackburn Road	Featherstone Road	Reddy Drive	E
1	Long View Dr	US 1	Bayside Ave	E
2	Long View Dr	Bayside Ave	Colchester Rd	F
4	Maryland Ave	US 1	Winding Loop	E
5	Mine Road	US 1 SB	Van Buren Road	E
9	Woodland Dr	Old Triangle Rd	0.06 miles E	E
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	F

Note: Segments CP-4 to CP-42 are also included in the Transportation Plan element of the 2008 Prince William County Comprehensive Plan

Table 39
Scenario Comparison

				Scenario 1 2015 No BRAC		Scenario 1 2030 No BRAC		Scenario 2 2015 With BRAC		Scenario 2 2030 With BRAC		Scenario 3a 2015 Roadway Improvements Alternative		Scenario 3a 2030 Roadway Improvements Alternative		Scenario 3b 2015 TOD Alternative		Scenario 3b 2030 TOD Alternative		Scenario 3c 2015 Mixed Use Development Alternative		Scenario 3c 2030 Mixed Use Development Alternative	
Roadway Section No.	Road	From	To	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($ Mil)	New Lanes / Total Lanes	Total Project Cost ($ Mil)
CP-1	US 1	VA 123 Gordon Blvd	VA 253 Occoquan Rd	4 / 8	34.2	2 / 8	23.8	4 / 8	28.3	4 / 10	28.3	-	-	-	-	4 / 8	34.2	4 / 10	28.3	4 / 8	34.2	4 / 10	28.3
CP-2	US 1	VA 253 Occoquan Rd	1/2 way to Mt. Pleasant Dr	2 / 6	28.7	2 / 8	28.7	4 / 8	34.2	4 / 10	34.2	-	-	-	-	4 / 8	34.2	2 / 8	28.7	4 / 8	34.2	2 / 8	28.7
CP-3	US 1	Rosedale Ct	Feather-stone Rd	2 / 6	18.8	2 / 8	18.8	2 / 6	18.8	2 / 8	18.8	-	-	-	-	2 / 6	18.8	2 / 8	18.8	2 / 6	18.8	2 / 8	18.8
CP-4	US 1	VA 638 - Neabsco Mills Rd	Cardinal Dr	2 / 8	23.8	4 / 10	28.3	2 / 8	23.8	4 / 10	28.3	-	-	-	-	2 / 8	23.8	4 / 10	28.3	4 / 10	28.3	4 / 10	28.3
CP-5	US 1	Cardinal Dr	Port Potomac Ave	2 / 6	20.8	4 / 10	24.8	4 / 8	24.8	4 / 10	24.8	-	-	-	-	4 / 8	24.8	4 / 10	24.8	4 / 8	24.8	4 / 10	24.8
CP-6	West Longview Dr	Matthews Dr	Prince William Pkwy	2 / 4	33.2	2 / 4	33.2	2 / 4	33.2	2 / 4	33.2	-	-	-	-	-	-	-	-	2 / 4	33.2	2 / 4	33.2
CP-7	West Longview Dr	Montgom-ery Ave	0.39 miles N	2 / 4	24.9	2 / 4	24.9	2 / 4	24.9	2 / 4	24.9	-	-	-	-	2 / 4	24.9	2 / 4	24.9	2 / 4	24.9	2 / 4	24.9
CP-8	Montgomery Ave	West Longview Dr	Opitz Blvd	2 / 4	42.3	2 / 4	42.3	2 / 4	42.3	2 / 4	42.3	-	-	-	-	2 / 4	42.3	2 / 4	42.3	2 / 4	42.3	2 / 4	42.3
CP-9	Blackburn Road	Maryland Ave	Delaware Dr	2 / 4	16.0	2 / 4	16.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CP-10	US 1	Feather-stone Rd	Reddy Dr	-	-	2 / 8	22.8	-	-	2 / 8	22.8	-	-	-	-	-	-	2 / 8	22.8	-	-	2 / 8	22.8
CP-11	Neabsco Rd	1.16 miles E of US 1	Daniel K Ludwig Dr	-	-	2 / 4	21.7	2 / 4	21.7	2 / 4	21.7	-	-	-	-	-	-	2 / 4	21.7	-	-	2 / 4	21.7
CP-12	Neabsco Mills Rd	Dale Blvd	0.28 miles N	-	-	2 / 6	22.3	-	-	2 / 6	22.3	-	-	-	-	-	-	2 / 3	22.3	-	-	2 / 6	22.3
CP-13	US 1	1/2 way between Occoquan Rd and Mt. Pleasant Dr	Mt. Pleasant Dr	-	-	-	-	2 / 6	26.7	4 / 10	31.9	-	-	-	-	2 / 6	26.7	4 / 10	31.9	2 / 6	26.7	2 / 8	26.7
CP-14	US 1	Mt. Pleasant Dr	East Long-view Dr	-	-	-	-	2 / 6	32.7	2 / 8	32.7	-	-	4 / 12	38.9	2 / 6	32.7	2 / 8	32.7	2 / 6	32.7	2 / 8	32.7
CP-15	VA 639 - Horner Road	VA 123 - Gordon Blvd	VA 253 - Occoquan Rd	-	-	-	-	2 / 6	20.8	2 / 6	20.8	-	-	-	-	-	-	-	-	-	-	-	-
CP-16	Summerland Dr	VA 639 - Horner Road	VA 3000 - Prince William Pkwy	-	-	-	-	2 / 6	16.0	2 / 6	16.0	-	-	-	-	-	-	-	-	-	-	-	-

				Scenario 1 2015 No BRAC		Scenario 1 2030 No BRAC		Scenario 2 2015 With BRAC		Scenario 2 2030 With BRAC		Scenario 3a 2015 Roadway Improvements Alternative		Scenario 3a 2030 Roadway Improvements Alternative		Scenario 3b 2015 TOD Alternative		Scenario 3b 2030 TOD Alternative		Scenario 3c 2015 Mixed Use Development Alternative		Scenario 3c 2030 Mixed Use Development Alternative	
Roadway Section No.	Road	From	To	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($ Mil)	New Lanes / Total Lanes	Total Project Cost ($ Mil)
CP-17	US 1	Maryland Ave	Delaware Dr	-	-	-	-	-	-	2 / 8	11.9	-	-	-	-	-	-	-	-	-	-	-	-
CP-18	VA 3000 - Prince William Parkway	I-95 Ramps	Summer-land Dr	-	-	-	-	-	-	2 / 6	17.6	-	-	-	-	-	-	-	-	-	-	-	-
CP-19	Dale Blvd	I-95	Neabsco Mills Rd	-	-	-	-	-	-	2 / 6	14.4	-	-	-	-	-	-	-	-	-	-	2 / 6	14.4
CP-30	Blackburn Road	Reddy Dr	Maryland Ave	-	-	-	-	-	-	-	-	2 / 4	16.0	2 / 4	16.0	-	-	-	-	2 / 4	16.1	2 / 4	16.1
CP-31	US 1	Port Potomac Ave	Powells Creek Blvd	-	-	-	-	-	-	-	-	2 / 6	93.1	2 / 8	93.1	-	-	-	-	2 / 6	92.6	2 / 8	92.6
CP-34	US 1 - SB	Mine Road	Graham Park Road	-	-	-	-	-	-	-	-	2 / 4	39.6	2 / 4	39.6	-	-	-	-	-	-	-	-
CP-41	Blackburn Road	Maryland Ave	Delaware Dr	-	-	-	-	-	-	-	-	2 / 4	16.0	2 / 4	16.0	2 / 4	15.9	2 / 4	15.9	2 / 4	15.9	2 / 4	15.9
CP-42	Blackburn Road	Feather-stone Rd	Reddy Dr	-	-	-	-	-	-	-	-	2 / 4	12.8	2 / 4	12.8	-	-	-	-	-	-	2 / 4	12.8
CP-44	Neabsco Mills Rd	Opitz Blvd	Potomac Branch Dr	-	-	-	-	-	-	-	-	-	-	2 / 6	10.4	-	-	-	-	-	-	-	-
CP-45	Neabsco Mills Rd	Potomac Branch Dr	Sheffield Way	-	-	-	-	-	-	-	-	-	-	2 / 6	23.9	-	-	-	-	-	-	-	-
1	East Longview Dr	US 1	Bayside Ave	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1	-	-	-	-	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1
2	East Longview Dr	Bayside Ave	Colchester Rd	2 / 4	26.8	2 / 4	26.8	2 / 4	26.8	2 / 4	26.8	-	-	-	-	2 / 4	26.8	2 / 4	26.8	2 / 4	26.8	2 / 4	26.8
3	Reddy Dr	US 1	Black-burn Rd	2 / 4	26.7	2 / 4	26.7	2 / 4	26.7	2 / 4	26.7	-	-	-	-	2 / 4	26.7	2 / 4	26.7	2 / 4	26.7	2 / 4	26.7
4	Maryland Ave	US 1	Winding Loop	2 / 4	10.4	2 / 4	10.4	2 / 4	10.4	2 / 4	10.4	-	-	-	-	2 / 4	10.4	2 / 4	10.4	2 / 4	10.4	2 / 4	10.4
5	Mine Road	US 1 SB	Van Buren Road	-	-	2 / 4	30.0	2 / 4	8.9	2 / 4	8.9	-	-	-	-	-	-	2 / 4	8.9	-	-	2 / 4	8.9
6	Graham Park Road	US 1 SB	US 1 NB	2 / 4	5.9	2 / 4	5.9	2 / 4	5.9	2 / 4	5.9	-	-	-	-	2 / 4	5.9	2 / 4	5.9	2 / 4	5.9	2 / 4	5.9
7	Bradys Hill Rd	US 1	Old Triangle Rd	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1	-	-	-	-	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1	2 / 4	12.1
8	Old Triangle Rd	Bradys Hill Rd	Wood-land Dr	2 / 4	3.2	2 / 4	3.2	2 / 4	3.2	2 / 4	3.2	-	-	-	-	2 / 4	3.2	2 / 4	3.2	2 / 4	3.2	2 / 4	3.2
9	Woodland Dr	Old Triangle Rd	0.06 miles E	2 / 4	3.8	2 / 4	3.8	2 / 4	3.8	2 / 4	3.8	-	-	-	-	2 / 4	3.8	2 / 4	3.8	2 / 4	3.8	2 / 4	3.8
10	VA 619 - Joplin Rd	I-95 SB Directional Ramps	I-95 SB Loop Ramp	2 / 4	18.8	2 / 4	18.8	2 / 4	18.8	2 / 4	18.8	-	-	-	-	2 / 4	18.8	2 / 4	18.8	2 / 4	18.8	2 / 4	18.8
11	VA 619 - Joplin Rd	I-95 SB Loop Ramp	I-95 NB Ramps	2 / 4	10.9	2 / 4	10.9	2 / 4	10.9	4 / 6	13.0	-	-	-	-	2 / 4	10.9	4 / 6	13.0	2 / 4	10.9	4 / 6	13.0
12	VA 619 - Joplin Rd	I-95 NB Ramps	US 1	2 / 6	38.6	2 / 6	34.7	2 / 6	38.6	2 / 6	34.7	-	-	-	-	2 / 6	38.6	2 / 6	34.7	2 / 6	38.6	2 / 6	34.7
13	VA 619 - Fuller Rd	US 1	Fuller Heights Rd	4 / 6	5.9	4 / 6	3.5	4 / 6	5.9	4 / 6	3.5	-	-	-	-	4 / 6	5.9	4 / 6	3.5	4 / 6	5.9	4 / 6	3.5

				Scenario 1 2015 No BRAC		Scenario 1 2030 No BRAC		Scenario 2 2015 With BRAC		Scenario 2 2030 With BRAC		Scenario 3a 2015 Roadway Improvements Alternative		Scenario 3a 2030 Roadway Improvements Alternative		Scenario 3b 2015 TOD Alternative		Scenario 3b 2030 TOD Alternative		Scenario 3c 2015 Mixed Use Development Alternative		Scenario 3c 2030 Mixed Use Development Alternative	
Roadway Section No.	Road	From	To	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($Mil)	New Lanes / Total Lanes	Total Project Cost ($ Mil)	New Lanes / Total Lanes	Total Project Cost ($ Mil)
14	Fuller Heights Rd	VA 619 - Fuller Rd	Old Triangle Rd	2 / 4	15.8	2 / 4	15.8	2 / 4	15.8	2 / 4	15.8	-	-	-	-	2 / 4	15.8	2 / 4	15.8	2 / 4	15.8	2 / 4	15.8
15	Fuller Heights Rd	Old Triangle Rd	Belleau Woods Dr	2 / 4	95.8	2 / 4	95.8	2 / 4	95.8	2 / 4	95.8	-	-	-	-	2 / 4	95.8	2 / 4	95.8	2 / 4	95.8	2 / 4	95.8
16	Fuller Heights Rd	Belleau Woods Dr	Windsor Rd	2 / 4	32.7	2 / 4	32.7	2 / 4	32.7	2 / 4	32.7	-	-	-	-	2 / 4	32.7	2 / 4	32.7	2 / 4	32.7	2 / 4	32.7
17	Windsor Rd	Fuller Heights Rd	VA 619 - Fuller Rd	2 / 4	7.2	4 / 6	8.9	2 / 4	7.2	4 / 6	8.9	-	-	-	-	2 / 4	7.2	4 / 6	8.9	2 / 4	7.2	4 / 6	8.9
18	Botts Ave	Prince William Pkwy	VA 639 Horner Rd	2 / 4	28.7	2 / 4	28.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	Possum Point Road	US 1	Leonard St	-	-	2 / 4	26.2	-	-	2 / 4	26.2	-	-	-	-	-	-	2 / 4	26.2	-	-	2 / 4	26.2
20	Graham Park Road	Woodland Dr	Vanetta Ct	-	-	2 / 4	18.5	-	-	2 / 4	18.5	-	-	-	-	-	-	2 / 4	18.5	-	-	2 / 4	21.7
25	Mine Road	Fairfax St	Van Buren Road	-	-	-	-	-	-	2 / 4	21.1	-	-	-	-	-	-	2 / 4	21.1	-	-	2 / 4	21.1
26	Delaware Dr	US 1	0.08 miles E	-	-	-	-	-	-	2 / 4	21.1	-	-	-	-	-	-	2 / 4	6.4	-	-	2 / 4	6.4
27	Possum Point Road	Leonard St	1.33 miles E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 / 4	84.9
28	Possum Point Road	1.74 miles E of US 1	0.24 miles E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 / 4	15.3
	TOTAL				**$598.1**		**$733.0**		**$683.8**		**$845.6**		**$177.5**		**$250.7**		**$605.0**		**$748.7**		**$751.4**		**$1,016.0**

VII. SUMMARY OF FINDINGS AND CONCLUSIONS

VII.1. BRAC Activities

The analysis of the transportation impacts of the BRAC activities at Fort Belvoir and MCBQ incorporated assumptions developed in the environmental document for each facility. For Fort Belvoir, the key findings in the Final Environmental Impact Statement (FEIS, June 2007) for the expansion of the facility, the key findings were:

- Net increase in workforce of approximately 22,000 (subsequently reduced to 19,300);
- By 2030, approximately 4,284 (22.2 percent) of added workforce will reside in Prince William County, and 1,718 (8.9 percent) would reside to the south along the I-95 corridor;
- The location of the place of residence within the County for the added workforce will tend to increase in frequency as the distance from Fort Belvoir decreases; and,
- The proportion of the additional workforce that commutes to work by transit is not likely to exceed 3 percent.

For MCBQ, the key findings in the Final Environmental Impact Statement (FEIS, April 2008) for the expansion of the facility, the key findings were:

- Net increase in workforce of approximately 3,000 resulting from the BRAC action. These would be located on the Russell Road site west of I-95;
- Approximately 33 percent of the added workforce will reside either in Prince William County or north of the County; and,
- Transit use is unlikely to reduce the number of auto commuters, since transit service is not provided to the area of MCBQ where BRAC activities are to be located.

VII.2. Scenario 1: Transportation Service Without BRAC Impacts

This scenario included analysis of forecasted conditions in the BRAC Study Area without considering the impacts of BRAC activities.

Even without the added marginal transportation impacts from BRAC activities, the analysis of forecasted year 2015 and 2030 conditions show substantial roadway deficiencies in the Study Area. Using LOS D as a threshold for adequacy (LOS E and F are considered deficient), numerous roadway segments are forecast to exhibit deficient service levels. To address these deficiencies, planning level cost estimates in 2009 dollars were developed for each segment. To address the deficiencies forecasted in 2030, improvements estimated to cost $771 million would need to be constructed. It should be noted that these improvements do not included the cost of widening Route 1 to six lanes since the widening was included in the year 2030 plan. The costs of widening Route 1 beyond six lanes – where needed – have been included. Emphasizing that the deficiencies involve non-BRAC related traffic, to address the deficiencies forecasted in 2015, improvements estimated to cost $598 million would need to be constructed. In contrast with the 2030 cost estimate, the 2015 improvement costs included the cost of widening Route 1 to six lanes.

VII.3. Scenario 2: Transportation Service With BRAC Impacts

This scenario includes analysis of forecasted conditions in the BRAC Study Area with consideration the impacts of BRAC activities. Roadway deficiencies are identified and cost estimates developed, but network modifications reflecting improvements to the deficient segments were not included.

VII.3.1. Land Use

The year 2015 and 2030 forecasts of households, employment and population were modified to included forecasts of BRAC related growth. For households and population, growth was allocated to TAZs in a manner generally consistent with the forecasts developed in the FEIS of Fort Belvoir BRAC Activities. The density of BRAC employee residence locations increases as the distance from the BRAC facility (either Fort Belvoir or MCBQ) decreases. Consequently, the TAZs located closer to Fort Belvoir or MCBQ, as appropriate, exhibited more residential growth associated with BRAC activities that exhibited TAZs in more distant locations from the two respective facilities.

Forecasts of employment growth were developed in proportion to the ratio of population to employment on a countywide basis. Employment growth was also distributed to TAZs countywide on the basis of forecasted growth using year 2005 as a baseline.

Using year 2005 estimates as a baseline, total forecasted BRAC related growth for Prince William County is as follows:

Year	Households	Population	Employment
2030	5,266	13,867	4,041
2015	4,101	10,999	3,819

VII.3.2. Transportation

The added marginal transportation impacts from BRAC activities increased the forecasted number of roadway segments in the Study Area. To address the deficiencies forecasted in 2015, improvements estimated to cost $684 million (including the cost of Route 1 widening) would need to be installed. To address the deficiencies forecasted in 2030, improvements estimated to cost $846 million would need to be constructed. Here again, these improvements do not include the cost of widening Route 1 to six lanes, but do include the cost of widening it beyond six lanes.

VII.4. Scenario 3a: Transportation Service With BRAC Impacts & Roadway Improvements

This scenario includes analysis of forecasted conditions in the BRAC Study Area with consideration the impacts of BRAC activities. The travel demand model network is modified to reflect improvements to the deficient segments detailed in Scenario 2.

VII.4.1. Transportation

After modifying the travel demand model network in the BRAC Study Area by widening the deficient roadway segments identified in Scenario 2, a second trip assignment run was

completed. The results indicted that the improved Study Area roadway network would exhibit further deficiencies beyond those identified in Scenario 1. These deficiencies were a product of the model's path building process that considers the impacts of congestion on travel times in routing trips. In essence, the enhanced speeds the model computed along an improved Route 1 attracted motorists from the congested I-95 corridor, resulting in improved travel times on I-95 but a continued forecast of deficient conditions on Route 1. To provide for adequate service on all the Study Area roadways in 2030, in addition to the $846 million in improvements detailed in Scenario 2, an additional $250 million in improvements would be needed. Most of the added cost related to further widening of Route 1.

VII.5. Scenario 3b: Transportation Service With BRAC Impacts – Transit Oriented Development

This scenario included analysis of forecasted conditions in the BRAC Study Area with consideration the impacts of BRAC activities. To mitigate the roadway impacts, forecasts in certain areas were modified to reflect a reduction in auto trip generation as a result of transit oriented development.

VII.5.1. Land Use

Using the Potomac Communities Revitalization Plan recommendations as a guide, forecasts of land use redevelopment in the North Woodbridge area were modified to reflect a mix of residential, retail, and office uses. Since the area is within walking distance of the Woodbridge VRE station, a reduced adjustment of 25% of forecast trips from the TAZ was applied in the travel demand model process. Similarly, in the TAZs adjacent to and within walking distance of the proposed Harbor Station VRE station, were modified to reflect transit oriented development. The land use in these TAZs was modified to include multi-family housing at higher densities. The density was estimated at approximately 56 dwelling units per acre in North Woodbridge and at 30 dwelling units per acre at Harbor Station. In general, the forecasted number of multi-family units was increased and the number of single-family units was decreased.

A reduced adjustment of 25% was applied to the trips forecasted to be generated by the TAZs with forecasted transit oriented development in the travel demand model process.

VII.5.2. Transportation

With the conversion of forecasts to transit oriented development and the application of the 25% trip reduction, the added marginal transportation impacts from BRAC activities decreased when compared with those in Scenario 2 and 3a. To address the deficiencies forecasted in 2015, roadway improvements estimated to cost $605 million (including the cost of Route 1 widening) would need to be constructed. To address the deficiencies forecasted in 2030, roadway improvements estimated to cost $749 million would need to be constructed. Here again, these improvements do not included the cost of widening Route 1 to six lanes, but do include the cost of widening it beyond six lanes.

VII.6. Scenario 3c: Transportation Service With BRAC Impacts – Mixed-Use Development

This scenario included analysis of forecasted conditions in the BRAC Study Area with consideration of the impacts of BRAC activities. To mitigate the roadway impacts, forecasts in certain areas were modified to reflect a reduction in auto trip generation as a result of mixed-use development.

VII.6.1 Land Use

Using the *Potomac Communities Revitalization Plan* recommendations as a guide, forecasts of land use redevelopment in the North Woodbridge, Neabsco Mills and Triangle areas were modified to reflect a mix of residential, retail and office uses. In addition, in the TAZs adjacent to and within walking distance of the proposed Harbor Station VRE station were modified to reflect mixed-use development.

The land use in these TAZs was modified to include multi-family housing at higher densities. The density was estimated at 80 dwelling units per acre in North Woodbridge; at 45 dwelling units per acres in Neabsco Mills and Harbor Station; and at 18 dwelling units per acre in Triangle. In general, the forecasted numbers of townhouse and multi-family units were increased and the forecasted number of single-family units was decreased.

Using procedures developed in the Institute of Transportation Engineers publication, ***Trip Generation Handbook***, estimates of the proportion of trips that remain (or captured) within a mixed-use development was estimated at seven percent. The computation of the capture rate is heavily dependent upon the amount of retail use in the mixed-use development. For any mixed-use development in the BRAC Study Area, the potential for the development of regional retail use is constrained by the proximity of the regional retail complex centered on Potomac Mills. Consequently, the potential capture rates are relatively low. To reflect the impact of mixed-use development on auto trips, the model generated trips from TAZs with forecasted mixed-use development was reduced by seven percent.

VII.6.2. Transportation

With the conversion of forecasts to mixed-use development and the application of the seven percent trip reduction, the added marginal transportation impacts from BRAC activities increased when compared with those in both Scenarios 2 and 3a. To address the deficiencies forecasted in 2015, improvements estimated to cost $751 million (including the cost of Route 1 widening) would need to be installed. To address the deficiencies forecasted in 2030, improvements estimated to cost $1.016 million would need to be installed. Here again, these improvements do not included the cost of widening Route 1 to six lanes, but do include the cost of widening it beyond six lanes.

While the trips in the mixed-use TAZs in this Scenario 3b were reduced by seven percent this scenario still generated the most costly deficiencies. Focusing population and employment in the Route 1 corridor increases travel demand along the facility and increases volumes on several adjacent facilities.

It should be noted that if the Scenario 3-C Mixed-Use Development were to be analyzed for implementation, the 25 percent trip reduction that was applied in North Woodbridge and Harbor Station in Scenario 3-B Transit Oriented Development would also be applied here. The reduced trips provided by use of the VRE service would apply to both development scenarios. However, the purpose of developing and analyzing alternative development scenarios was to evaluate the effectiveness of each in addressing the need to mitigate or offset transportation impacts from BRAC related development. Anticipating the development of a hybrid scenario as the preferred approach, the analysis developed scenarios that emphasized different policy approaches: Scenario 3a - improving roads, Scenario 3b - encouraging transit oriented development; and, Scenario 3c - encouraging mixed-use development. If the 25 percent trip reduction had been included in both Scenario 3b and 3c; the comparative effectiveness of Scenario 3c (Mixed-Use) would not have been as clearly defined when compared with Scenario 3b (Transit Oriented). By developing and analyzing discrete alternative scenarios, the results provide more definitive guidance in the selection of the most effectiveness characteristics for inclusion in the development of the preferred alternative.

VII.7. Preferred Alternative – Expanded Transit Oriented Development

This scenario included analysis of forecasted conditions in the BRAC Study Area building on the findings in Scenario 3b – Transit Oriented Development. By adding recommendation for enhanced PRTC service between the PRTC Transfer Station and the Woodbridge VRE station, development and redevelopment in the Neabsco Mills area can be forecasted as transit oriented, and a forecasted 25 percent reduction of auto trips can be applied.

VII.7.1. Land Use

Using the *Potomac Communities Revitalization Plan* recommendations as a guide, forecasts of land use redevelopment in the North Woodbridge and Neabsco Mills area were modified to reflect a mix of residential, retail and office uses. In addition, transit service to the Woodbridge VRE station was recommended to provide 15-minute headways during peak periods on weekdays. Since the two areas are within walking distance of the frequent and reliable transit service, a reduced adjustment of 25 percent of forecast trips from the TAZ was applied in the travel demand model process. Similarly, in the TAZs adjacent to and within walking distance of the proposed Harbor Station VRE station, were modified to reflect transit oriented development.

VII.7.2. Transportation

With the conversion of forecasts to TOD, the application of the 25 percent trip reduction, and the added marginal transportation impacts from BRAC activities, the Preferred Alternative exhibited the lowest level of roadway deficiencies. To address the deficiencies forecasted in 2015, improvements estimated to cost $567 million (including the cost of Route 1 widening). To address the deficiencies forecasted in 2030, roadway improvements estimated to cost $575 million would need to be constructed. It should be noted that no improvements to Route 1 beyond the planned widening to six lanes were included in the 2030 cost estimates.

In addition to roadway improvements, providing an enhanced PRTC *OmniLink* fixed-route transit service between the PRTC Transfer Station and the Woodbridge VRE would involve increased capital and operating costs. Capital costs for added rolling stock is estimated at

$1,413,344, and net operating costs (operating costs less fare box recovery rate of 13 percent) is estimated at $1,418,318.

VII.8. Summary of Alternatives

A comparison of the population, household and employment forecasts for each scenario within the BRAC Study Area is presented in **Table 40** and **Table 41**, respectively.

Table 40
Summary of 2030 Forecasts by Scenario
Population and Housing

Scenario	Single-Family Units	Townhouse Units	Multi-Family Units	Total Population
2005 Existing	11,579	7,145	8,101	73,976
1 – 2030 Without BRAC	15,855	10,758	24,236	136,542
2 – 2030 With BRAC	16,383	11,231	26,220	143,854
3b – 2030 Transit Oriented	14,090	11,186	28,619	144,620
3c – 2030 Mixed-Use	14,098	11,602	27,961	144,346

Table 41
Summary of Forecasts by Scenario
Employment

Scenario	Industrial Employment	Retail Employment	Office Employment	Other Employment	Total Employment
2005 Existing	6,779	10,080	10,247	8,623	35,729
1 – 2030 Without BRAC	6,689	16,431	20,350	10,679	54,149
2 – 2030 With BRAC	6,834	16,790	20,795	10,909	55,328
3b – 2030 Transit Oriented	6,738	16,739	19,699	10,298	53,473
3c – 2030 Mixed-Use	6,702	17,525	17,889	10,017	52,133

VIII. RECOMMENDATIONS

Based on the findings of the study of the forecasted impacts associated with BRAC activities in the Study Area, the roadway and transit service improvements, and the land use development policies detailed in the Preferred Alternative are recommended. It offers the most effective method for applying a strategy to offset the marginal deterioration in transportation service resulting from increase traffic volumes associated with BRAC.

VIII.1. Implementation

Implementation of the recommended strategy will require a multifaceted set of actions involving land use planning, zoning, roadway and transit infrastructure analysis and capital improvement programming.

VIII.1.2. Comprehensive Plan

Harbor Station - The first implementation task will be the amendment of the *Comprehensive Plan* in the eastern area of Harbor Station to recommend transit oriented development within the area bounded by TAZs 662-663, 665 and 668-670. The appropriate balance of densities for housing units should be defined, as well as an appropriate mix of non-residential uses.

North Woodbridge – While recommended for Urban Mixed Use (UMU) in the *Comprehensive Plan*, the appropriate mix and densities for development and redevelopment in TAZs 566 and 572-573 should be defined in more detail.

Neabsco Mills - The *Comprehensive Plan* recommends UMU in Neabsco Mills, but further study needs to be completed prior to defining the area for transit oriented development. However, application of the current UMU recommendations should be pursued.

VIII.1.3. Transit Analysis

The key recommendation in the Preferred Alternative is the establishment of frequent and reliable PRTC *OmniLink* fixed-route transit service along the Route 1 corridor connecting the PRTC Transfer Station with the VRE Woodbridge Station. This service would likely reduce auto generated trips not only in Neabsco Mills but also along the Route 1 corridor. This recommendation was based on the findings developed in the TCRP Report 128, *Effects of TOD on Housing, Parking and Travel.* In summarizing the review of previous studies, the authors list several key conclusions:

- *Factors that most influence transit ridership are station proximity, transit quality and parking policies (page 3).*
- *TOD commuters typically use transit two to five times more than other commuters in the region.*
- *Similar to findings for non-work trips, transit share is two to five times higher, although mode shares are typically lower than commute trips.*

- *The primary reason…is that transit use is heavily influenced by relative travel times with automobile and extensiveness of transit service… As the transit network links to more job centers, educational opportunities, and cultural facilities, transit use increases (Page 6).*

While this analysis has not addressed parking policies, it has addressed both station proximity and transit quality. By providing frequent transit service along the Route 1 corridor (and adjacent to Neabsco Mills) between the Woodbridge VRE Station and the PRTC Transit Center, the fixed-route transit system provides direct connections to VRE commuter rail (for commuters destined for the CBD) and to the VRTC *OmniRide* all-day circular service (Metro Direct) provided between the PRTC Transit Center and the. The range of destinations is expanded by the service provided by the linked transit systems.

The authors also cite previous studies that indicate appropriate service frequencies:

> *A generally accepted service level threshold for TODs is headways of 15 minutes or less during most of the day (Dittmar and Ohland, 2004). It makes little sense to build TOD in places that receive only hourly bus service, as service is not frequent enough to make transit use convenient (page 14).*

In reviewing the service provided and route performance of transit services in the study area (as previously documented in Existing Conditions section of this report), the most frequent route services exhibit 40 minute headways during peak periods and 60 minute or more headways during off-peak periods. In addition, the reliability of existing transit service on Route 1 between the PRTC Transit Center and the Woodbridge VRE is compromised by on-demand services. In certain locations (generally within 0.75 miles of Route 1) rides may arrange to have transit vehicles divert from the fixed-route to a specific pick-up point. While this service flexibility may be suitable for route with headways of 40 minutes or more, it would not be compatible with the more rigorous schedule adherence expectations of riders using a route with 15 minute headways.

With peak hour headways planned at 15 minutes and off-peak at 30 minutes, PRTC recognizes the need for more frequent service in it improvement plans. However, neither existing nor planned service exhibits the 15 minute headway threshold identified in literature as providing adequate service for transit oriented development.

To evaluate the service benefits and costs of providing 15-minute headways on weekdays along this route, a detailed transit ridership study should be conducted. The study should identify potential ridership with consideration to land use development alternatives. If the study determines that the recommended service is feasible, the County should subsequently endorse the service for funding.

With the support of the County, PRTC should determine the appropriate timing and phasing strategy for implementing the enhanced transit service. Concurrently, the County should amend the *Comprehensive Plan* to provide for transit oriented development in the Neabsco Mills TAZs currently recommended for UMU development. These included TAZs 578, 581, 584-585 and 588.

VIII.1.4. Proffer Guidelines

Guidance for the development of cash proffers associated with rezoning applications is detailed in the document, *A Policy Guide for Monetary Contributions* (Prince William County Office of Planning, July 1, 2006). The overall approach provides guidance for applicants based on computed capital costs for schools, fire and rescue, libraries, parks, open space and transportation improvements included in the *Comprehensive Plan*. Proffer amounts are "requested" based on the type of residential unit: single-family, townhouse or multi-family. The amount for each is based on forecasted growth and the forecasted amount of unfunded roadway needs.

While the proffer policy guide is exclusively based on computations of roadway needs, it is clear from this analysis that the *Comprehensive Plan* policies do not anticipate that all needs will be met. Specifically, Route 1 is planned to be widened to 6 lanes from 4 lanes, but forecasted volumes indicated more than 6 lanes will be needed to provide adequate service. Furthermore, once Route 1 has been widened (not scheduled during the next 6 years), proffered monetary contributions as part of rezoning actions on properties within the study area may well be expended on improvements outside the study area.

To add flexibility in responding to existing and forecasted mobility needs, the County should expand the guidelines for rezoning applications located in the areas recommended for TOD development. Specifically, after computation of the monetary amount according to current policy, the applicant may proffer and the County may accept use of the funds for capital facilities associated with planned transit service improvements.

While this approach has been practiced (the Harbor Station proffers include the VRE planned station), it is not explicitly documented in either the proffer guidelines or in the *Comprehensive Plan.* To provide for transportation proffer flexibility, the following planning actions should be completed:

1. Identify planned transit improvements in the three TOD areas as part of the amendments to the *Comprehensive Plan* (see VIII.1.2. Comprehensive Plan);
2. Amend the document, *A Policy Guide for Monetary Contributions*, to provide for use of monetary proffers for transit capital improvement costs; and,
3. Develop a separate set of proffer guidelines for each of the three transit oriented development areas.

It should be noted that proffered monetary contributions based either residential or non-residential development should be available for use to fund transit capital improvements.

VIII.1.5. Modal Connectivity Guidelines

The County should develop guidelines to be applied to development proposals in the three transit oriented development areas that provide for ease of connection between uses and modes. These guidelines should encourage site development plans that accommodate easy pedestrian and bicyclist access between land uses and transit service. Provision of off-road trails, bicycle lockers and racks, and covered transit stops are examples of measures that encourage such connective activities.

VIII.2. Funding Opportunities for Implementation

Developing a connected multi-modal transportation system takes cooperation from state, local and national leaders. While the BRAC action will create transportation needs, Congress has not specifically dedicated any money to fund the needed transportation improvements. Funding for the Prince William County BRAC improvements will likely include a mix of federal, state, local and possibly private (developer) sources. Even though the mechanisms for financing transportation improvements have increased and changed in the last decade, federal funds remain the backbone of transportation financing for State projects. As such, it is often best to maximize federal funding opportunities. In addition, there are a growing number of localities and states securing funding earmarks from Congress and state legislatures, using local bond measures to generate funds, and using a variety of creative financing methods to provide funds for transportation projects.

Major transportation projects are rarely funded from a single source. Rather, a funding program is developed to take advantage of directed funding sources that may exist at a local, state or federal level. The most promising sources of funding available at this time are described below:

VIII.2.1. Surface Transportation Authorization Act of 2009 (STAA)

The initial version of the STAA proposes $340 billion for highway construction investment, including at least $100 billion for Capital Asset Investment to begin to restore the National Highway System (including the Interstate System) and the nation's bridges to a state of good repair. At this time it is unclear how long SAFETLU will be extended before Congress passes a new bill. For more information, please see http://transportation.house.gov/

VIII.2.2. American Recovery and Reinvestment Act (ARRA)

There are a variety of opportunities for funding with economic stimulus funds available through the ARRA. The Department of Transportation TIGER (Grants for Transportation Investment Generating Economic Recovery) program will provide $1.5 billion of discretionary funds. The guidance for TIGER funds specifically identifies highway and bridge projects including interstate rehabilitation, improvements to the rural collector road system, reconstruction of overpasses and interchanges, bridge replacements and road realignments as projects that are eligible for funding. For more information, please see www.recovery.gov

VIII.2.3. Department of Defense Office of Economic Adjustment (OEA)

The OEA is the Department of Defense's primary source for assisting communities that are adversely impacted by Defense program changes, including Base Realignment and Closure (BRAC) actions. To assist affected communities, OEA manages and directs the Defense Economic Adjustment Program, and coordinates the involvement of other Federal Agencies. The Commonwealth of Virginia and its counties and jurisdictions have been the beneficiary of several OEA grants to date. Maryland and other states that will have BRAC impacts have also received OEA funds. These grants have been used to conduct studies through the planning and 30 percent design phase. For more information, please see http://www.oea.gov/OEAWeb.nsf/Home?OpenForm

VIII.2.4. Defense Access Road (DAR) Program

Roads providing access to military installations are usually not owned by the Department of Defense. Military installations are not responsible (nor may they provide funding) for the maintenance of any public highway. The DAR Program provides a legal vehicle by which the Department of Defense can indirectly help to pay for a portion of improvements to certain public highways which are necessary to mitigate an unusual impact of a defense activity. Thoroughfares designated as "defense access roads" may have all of part of the cost of their construction and maintenance paid for by funds appropriated for that purpose.

When a garrison commander believes that highway improvements are needed to provide adequate access to his installation that cannot be provided by a state or local agency, he submits a report detailing the access road needs to the commander of the Military Surface Deployment and Distribution Command (SDDC). The SDDC commander may then ask the Federal Highway Administration (FHWA) to evaluate the local highway facilities and provide improvement recommendations, if warranted, and a cost estimate. If required, SDDC will then initiate a military construction program request through the appropriate military service.

There are specific traffic-related benchmarks that trigger the initiation of a DAR project. Projects results from the assessment of the on-site commander that road improvements are required and that the associated state or local transportation agency does not have the resources to implement them. It is the responsibility of SDDC to determine the eligibility of proposed improvements for financing through the use of DAR funds.

For more information, please see http://flh.fhwa.dot.gov/programs/dar/

VIII.2.5. Tax Increment Financing and Special Taxing Districts

When a public project such as a roadway improvement is carried out, there is often an increase in the value of surrounding real estate, and the potential for new investment in the area. This increased value and investment sometimes generates increased tax revenues, which are known as a tax increment. Tax Increment Financing dedicates tax increments within a certain defined district to finance debt issued to pay for the project. Municipalities can also form special taxing districts to support public infrastructure investments.

As an example, the State of Maryland has established the BRAC Revitalization and Incentive Zone Program to focus growth in areas that are already designated for growth, provide local governments with financial assistance for public infrastructure and align other state resources and programs to local governments and businesses located in the BRAC zones for a coordinated State effort on making the zones the focus of BRAC growth. Funds provided under this program must be used for infrastructure improvements in the designated Zone. Each year, the amount to be paid to all local jurisdictions is the amount appropriated in the State budget up to $5,000,000. If the total amount applied for exceeds the cap, each jurisdiction receives its pro rata share.

Under this program, each local jurisdiction receives:

- Payment of 100 percent of state real property tax increment on qualified properties.
- Payment equal to 50 percent of the local jurisdiction's real property tax increment on qualified properties.

Funds can be used to pay back bonds, including Tax Increment Financing bonds, issues for infrastructure improvement in the Zone. In addition, local jurisdiction and business entities receive priority consideration for financing assistance for projects or operations from various state agencies and benefits are available for the 10-year life of the Zone.

For more information on Maryland's program, please see
http://www.choosemaryland.org/businessservices/taxincentives/BRACRevitalizationZone.html

VIII.2.6. Public-Private Partnership

Public-Private partnerships are an increasingly important means of getting transportation infrastructure developed. The private sector sees value in getting additional transportation infrastructure constructed and in participating in the project upside. This includes public-private joint developments between revenue generating private sector space (e.g. commercial/retail) and public sector space which provides revenue or transportation infrastructure improvements to the public sector. Joint development can provide capital/operating cost saving/sharing.

For more information, please see http://www.fhwa.dot.gov/PPP/defined_default.htm

Appendix